LLNL-TR-869526

TEX-Cl: Integral Experiment Execution of Thermal/Epithermal eXperiments using Highly Enriched Uranium with Polyethylene and Chloride Absorbers

IER-499 CED-3b Report

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External (Unlimited)

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Disclaimer

Acknowledgements

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Executive Summary

This report documents the experimental configurations and measurements performed for IER-499, TEX with chlorine (TEX-Cl). TEX-Cl is a variant of the TEX-HEU campaign and utilizes highly enriched uranium fuel, high-density polyethylene (HDPE) moderators and reflectors, and interstitial NaCl salt absorbers. These experiments probe the chlorine (from the sodium chloride) absorption cross section in the thermal and intermediate neutron energy regimes, with a small portion in the fast neutron energy regime. Three configurations were selected by maximizing the sensitivity in k_{eff} to the needs of Y-12 for their electrorefining operations.

The experiments were performed over three weeks between July 16, 2024, and August 5, 2024 (FY24Q4). The experiments were performed on the Comet General Purpose Critical Assembly Machine at the National Criticality Experiments Research Center (NCERC) at the Nevada National Security Site (NNSS) by the following members of the Advanced Nuclear Technology Group at Los Alamos National Laboratory: Theresa Cutler, Peter Brain, Travis Grove, Rene Sanchez, Alex McSpaden, Kristin Stolte, Zach Lemke, Kenny Valdez, and Charlie Kiehne. The campaign included three benchmark measurements, two reproducibility measurements, and an array of physical measurements including coordinate measuring machine (CMM) stack height measurements, all of which will be used in the benchmark evaluation of these experiments. The final configurations as well as the estimated excess reactivities are shown in Table 1.

Table 1: Summary of the TEX-Cl experimental configurations.

Configuration	Benchmark Date	HEU Mass (g)	NaCl Mass (g)	Moderator Thickness (in)	Upper Reflector Thickness (in)	Fission Fractions[ξ]	Excess Reactivity (¢)
8-Layer Standard	July 22, 2024	48617.0	4870.5	0.750	0.250	63/26/12	8.13(31)
8-Layer Sandwich	July 29, 2024	48617.0	4870.5	1.750	0.500	58/30/12	8.60(3)
18-Layer Standard	August 1, 2024	109166.4	8712.6	0.125	0.0625	14/52/35	16.29(5)

[ξ]**Estimated fission fractions from the CED-2 models.**

The TEX-Cl campaign used many of the same parts procured for the TEX-HEU and TEX-Hf campaigns with the notable addition of interstitial moderator plates and the NaCl absorber plates. Both the TEX-HEU and TEX-Hf benchmarks will serve as a baseline and template for the benchmark evaluation of this campaign.

These experiments were funded by the U.S. Department of Energy's Nuclear Criticality Safety Program.

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Section 1

Introduction

This experimental campaign (TEX-Cl) utilized the Thermal Epithermal eXperiments (TEX) highly enriched uranium (TEX-HEU; HEU-MET-MIXED-021) template with sodium chloride (NaCl) absorber plates. Parts from the TEX-HEU and TEX-Hf (HEU-MET-INTER-013) were utilized in the TEX-Cl with the inclusion of new moderator plates and NaCl absorber plates. The goal of this experiment was to provide chlorine validation for Y-12 electrorefining operations. However, the need for chlorine validation is much broader so the cases were chosen to provide both thermal/intermediate and intermediate/fast neutron fission energy validation.

Three total configurations were executed, two 8-layer configurations and an 18-layer configuration. The two 8-layer configurations varied by moderator plate orientation. Standard implies moderator between one side of the fuel and absorber plates and sandwich implies moderator plates on both sides of the absorber plates, creating a flux trap. The 18-layer configuration maximized the fast fission component of the spectrum. Tuning of the neutron fission energies was done by varying the moderator thickness and fine reactivity control was done with upper reflector thickness and HEU plate masses. The final configurations, as well as the estimated fission fractions are shown in Table 2.

Table 2: Summary of the TEX-Cl experimental configurations.

Configuration	HEU Mass (g)	NaCl Mass (g)	Moderator Thickness (in)	Upper Reflector Thickness (in)	Fission Fractions[ξ]		
					Thermal (<0.625 eV)	Intermediate (0.625 eV – 100 keV)	Fast (>100 keV)
8-Layer Standard	48617.0	4870.5	0.750	0.250	62.93	25.78	11.55
8-Layer Sandwich	48617.0	4870.5	1.750	0.500	58.05	30.19	11.76
18-Layer Standard	109166.4	8712.6	0.125	0.0625	13.66	51.78	34.56

[ξ]Estimated fission fractions from the CED-2 models.

The experiments were performed between July 16, 2024, and August 5, 2024 (FY24Q4) at NCERC at the NNSS. The experiments were executed as a collaborative effort between Lawrence Livermore National Laboratory's (LLNL) Nuclear Criticality Safety Division and Los Alamos National Laboratory's (LANL) Advanced Nuclear Technology Group (NEN-2) with facility support from NCERC-FO and Mission Support and Test Services (MSTS).

The HEU plates used in this experiment have a long history in many critical experiments executed by LANL. The earliest usage of similar HEU plates is in the "extension of the earlier Jemima experiments" in 1956, which used 3 mm thick U(93.4) plates with a 15 in outer diameter (IEU-MET-FAST-002). Since then, these same HEU plates have been used in the Big Ten experiments in the 1970s (IEU-MET-FAST-007), the first three Zeus experiments in 1999-2002 (HEU-MET-INTER-006, HEU-MET-FASTER-073, and HEU-MET-FAST-072), and the Nb-1Zr experiment in 2004 (HEU-MET-FAST-047). More recently, these HEU plates have been in the Curie (HEU-MET-INTER-011), TEX-HEU (HEU-MET-MIXED-021), TEX-Hf (HEU-MET-INTER-013) and Zeus-Pb (HEU-MET-FAST-102) experiments.

Section 2

Experimental Description

2.1 Experimental Description

Parts of this section have been taken and adapted from [1,2].

2.1.1 Assembly

The design of the assembly was based on the TEX-HEU template with layers of HEU, polyethylene, and absorber material. Figure 1 shows a rendering of the TEX-HEU assembly as a reference. The fission neutron energy spectra were tuned by adjusting the interstitial moderator thickness and reactivity was controlled by varying the number of fuel layers, the HEU fuel masses, and the upper reflector thickness. Coarse reactivity control was done by adding or removing fuel layers or swapping out HEU plates with other HEU plates with smaller or larger inner annuli, effectively adding to or removing mass from the assembly. The upper reflector was the main fine reactivity control during the experiment and could be adjusted in 1/32 in (0.079375 cm) increments. The HDPE ring reflector height was adjusted to match the HEU and polyethylene stack to the nearest 1/32 in (0.079375 cm). Similar to TEX-Hf, the absorber material of interest, in this case NaCl plates, was placed in each layer with the moderator and fuel plates.

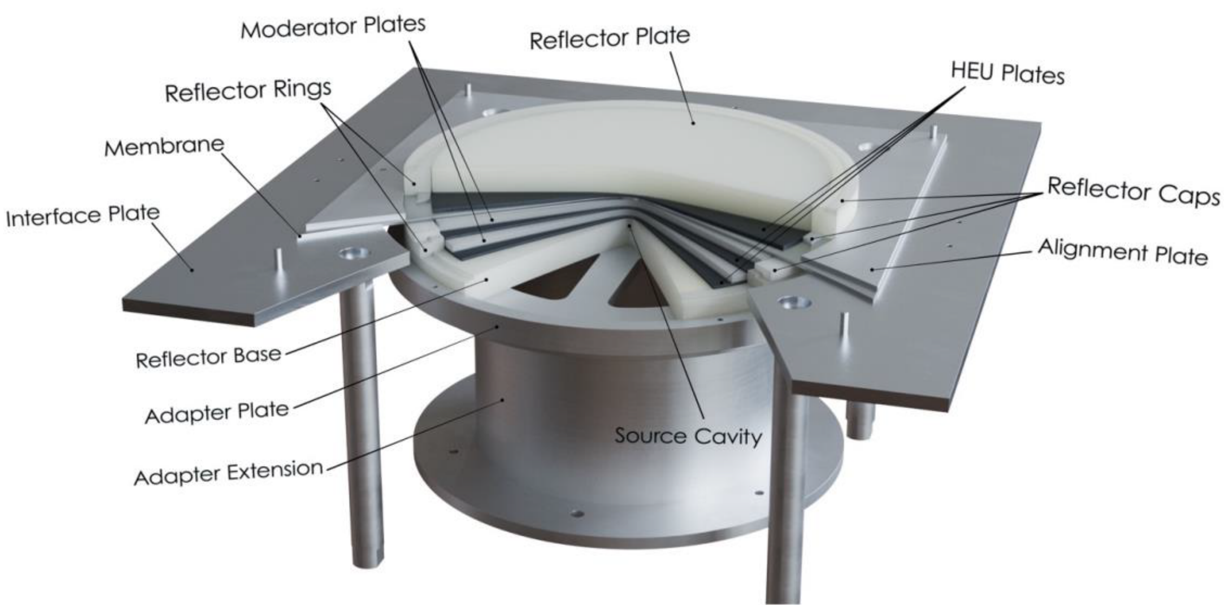

Figure 1: TEX-HEU experiment design and components.

Two different moderator configurations were used: sandwich and standard. Examples of the two configurations are shown in Figure 2 and Figure 3. The standard stacking model is made up of a repeating pattern of one HEU plate, one polyethylene moderator plate, and one absorber plate. The sandwich stacking method has two half layers of polyethylene sandwiching an absorber plate between the HEU plates. The dark gray plates are the HEU plates, the light gray plates are the NaCl plates which are enclosed in aluminum, the white plates are the HDPE moderators or reflectors. Figure 2 shows the top half of the 8-layer sandwich stack on Comet prior to the installation of the ring reflector and while the two halves of the assembly are fully separated. Figure 3 shows the top half of the 8-layer standard stack on the granite table for CMM measurements and also does not show the ring reflector installed.

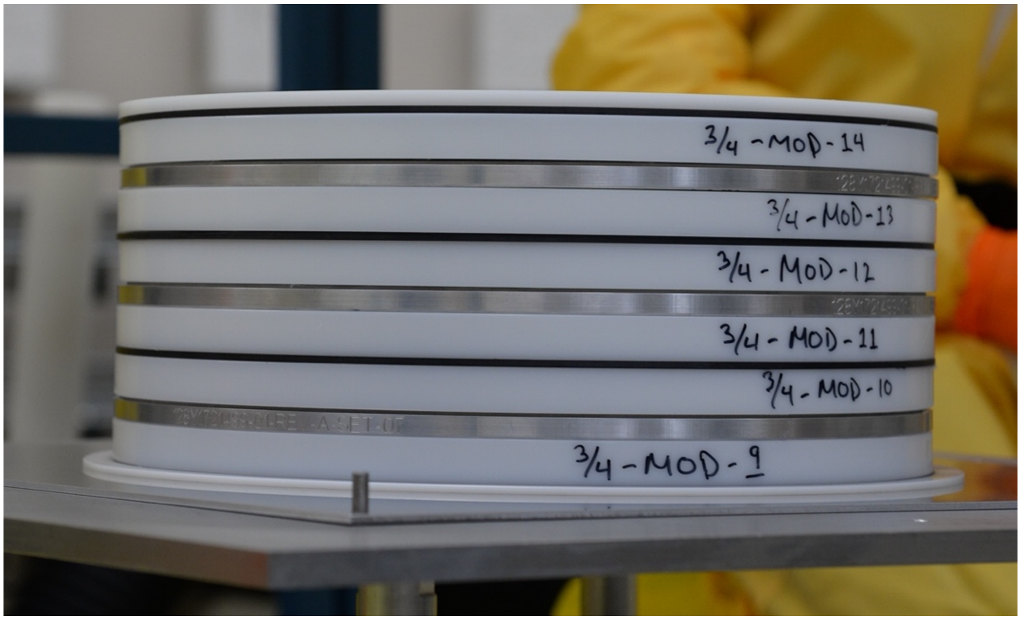

Figure 2: Top stack of the TEX-Cl 8-layer sandwich configuration.

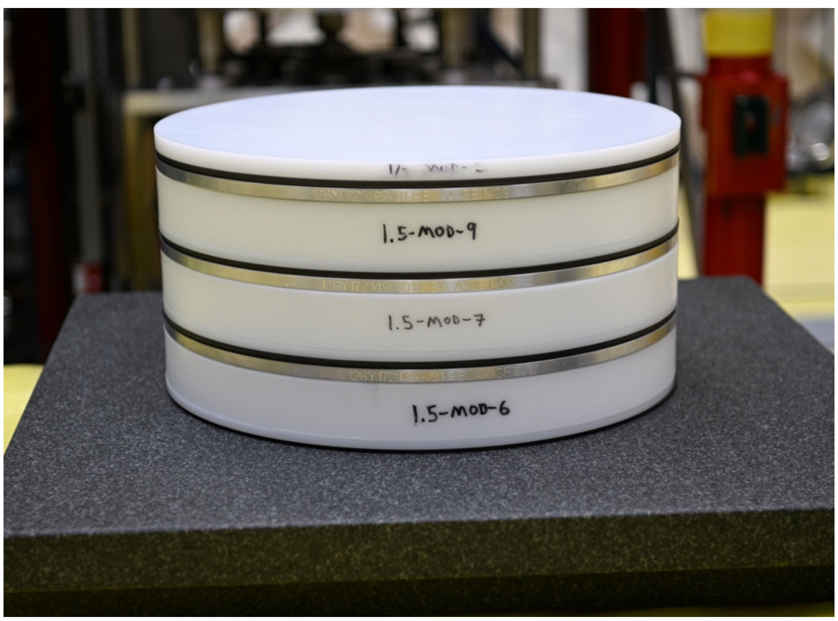

Figure 3: Top stack of the TEX-Cl 8-layer standard configuration.

2.1.2 Comet General Purpose Critical Assembly Machine

The Comet General Purpose Critical Assembly Machine is a vertical lift machine used to remotely assemble a critical mass. As shown in Figure 4, Comet consists of the surrounding structure, stationary platform, and movable platen. For TEX-HEU, TEX-Hf, and TEX-Cl, additional parts were affixed to Comet: an experiment platform, affixed to the stationary platform, and a lower adapter, extending the movable platen.

During assembly, roughly half of the experiment is built on the upper experiment platform with the other half on the lower adapter. During operation, the movable platen is extended vertically to bring the two halves of the experiment into contact. Once fully assembled, the two halves are only separated by a thin aluminum membrane.

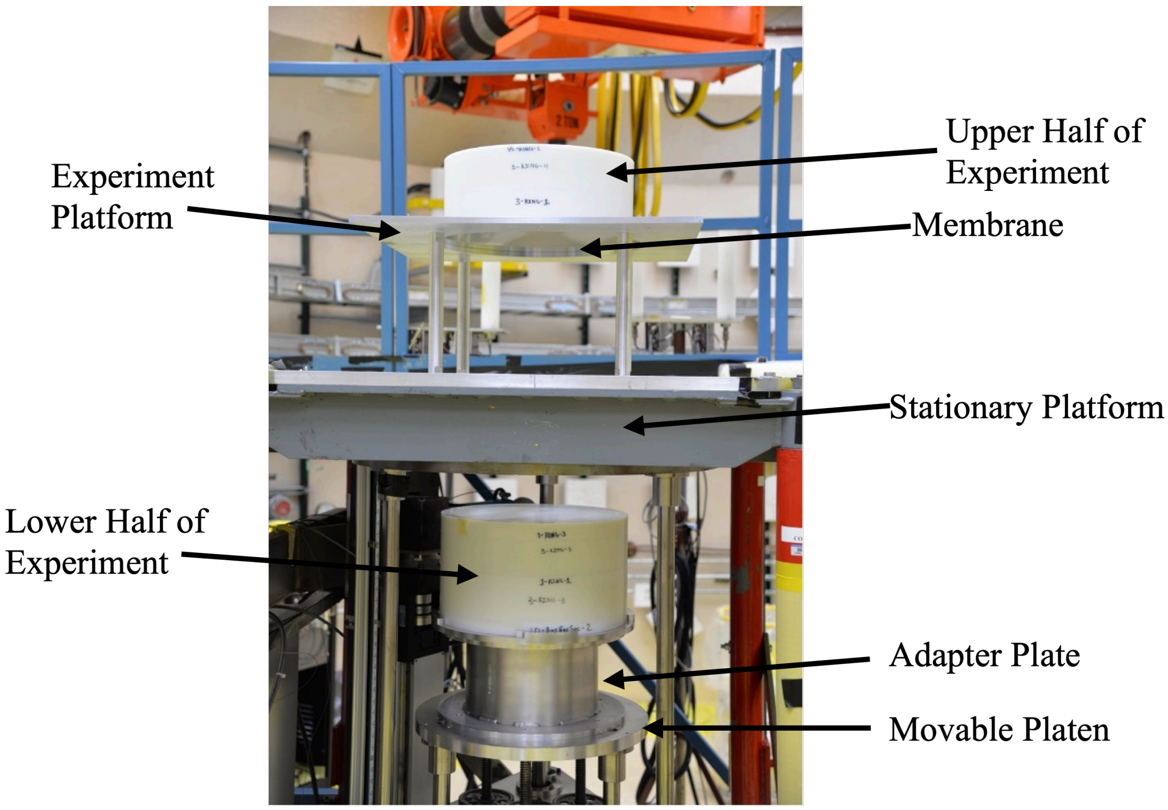

Figure 4: The Comet General Purpose Critical Assembly Machine.

2.1.2.1 Stationary Platform

The experiment platform holds the upper half of the experiment, shown in Figure 5. The platform consists of an interface plate and four standoffs, which connect the interface plate to the stationary platform. The membrane is placed on top of the hole in the interface plate, allowing the movable platen to lift the lower half of the experiment as it meets the upper half of the experiment through the membrane. The interface plate includes four pegs to hold the membrane and alignment plate in place while still allowing vertical movement.

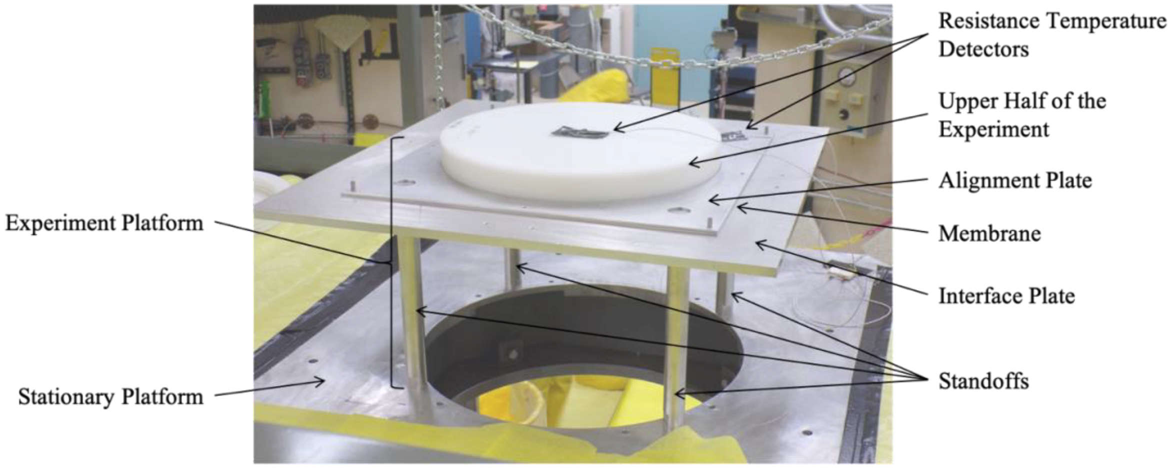

Figure 5: Upper stationary platform of Comet, with the experiment platform.

The interface plate is a 28 in x 28 in x 0.5 in (71.12 cm x 71.12 cm x 1.27 cm) Al 6061-T6 plate with a 19 in (48.26 cm) diameter hole through its center. The standoffs are 12 in (30.48 cm) long Al 6061-T6 cylinders with a 1.25 in (3.175 cm) diameter. The membrane is a 21 in x 21 in (53.34 cm x 53.34 cm) Al 6061-T6 plate with a thickness of 0.125 in (0.3175 cm). The membrane features four holes, one in each corner, ensuring consistent alignment when placed onto the interface plate using the four pegs. The design allows the membrane to be lifted via 0.75 in (1.905 cm) of travel on the pegs.

2.1.2.2 Movable Platen

The lower adapter holds the lower half of the experiment, shown in Figure 6. This lower adapter consists of an adapter plate and an adapter extension, which affixes the lower adapter to the movable platen. An updated adapter plate was designed to allow for access to the source holder of the new bottom reflector plates. The adapter plate has an outer diameter of 18.5 in (46.99 cm) and a thickness of 0.53 in (1.3462 cm). This plate features a 17.150 in (43.561 cm) inner diameter with an additional 0.47 in (1.1938 cm) lip height to hold the bottom polyethylene reflector plate. The difference between the old and new design is that the new design minimizes the lip surface area, reducing the size of the lips to provide easier access to the bottom reflector plate. The adapter extension is an 8 in (20.32 cm) tall annular cylinder with a wall thickness of 0.25 in (0.635 cm) and a 12 in (30.48 cm) outer diameter. This extension includes a 2.5 in (6.35 cm) wide and 0.5 in (1.27 cm) thick top and bottom lip to affix it to the adapter plate and the platen. Both components of the lower adapter are Al 6061-T6. Figure 6 shows the movable platen with the old adapter plate, Figure 7 shows the new adapter plate design, and Figure 8 shows a drawing of the updated lower adapter design.

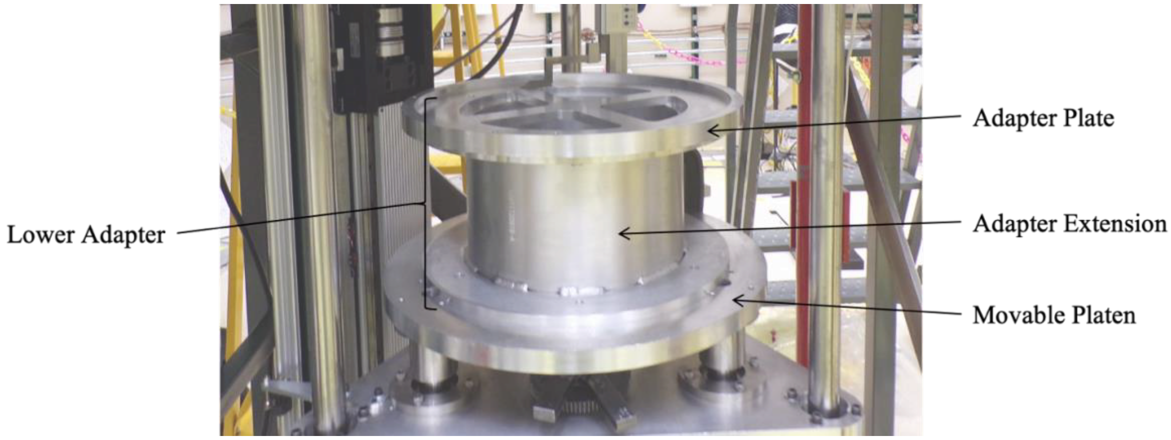

Figure 6: Lower movable platen of Comet, with the lower adapter from TEX-Hf.

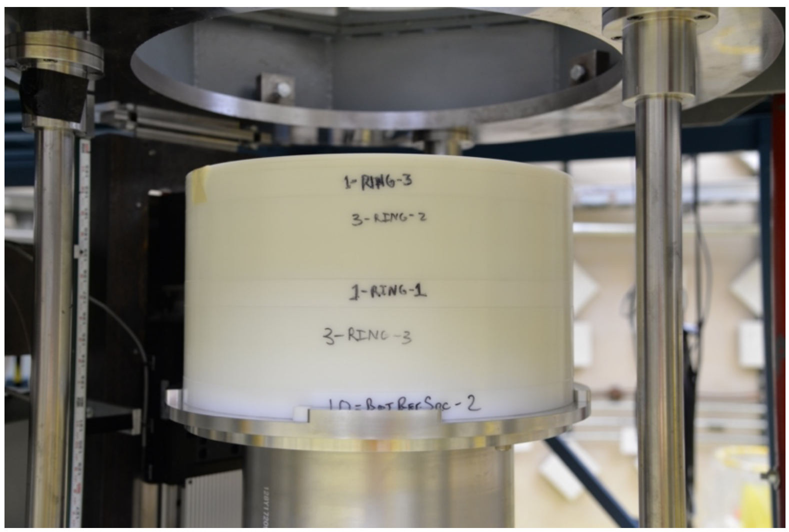

Figure 7: Lower platen with the new adapter plate, which highlights the difference between the lip design of the new and old design.

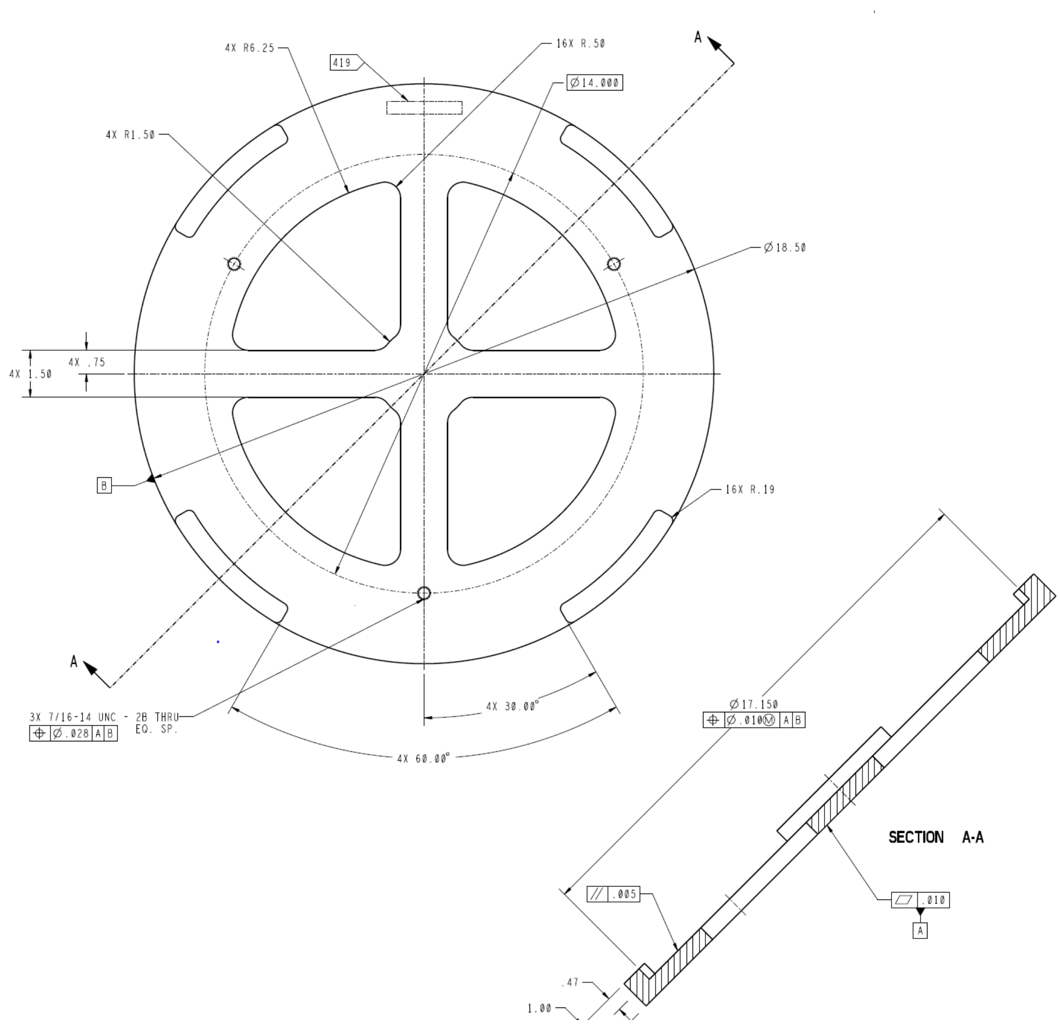

Figure 8: Drawing of the updated lower adapter plate.

2.1.3 Highly Enriched Uranium Plates

The HEU plates are nominally 0.118 in (0.29972 cm) thick, 15 in (38.1 cm) outer diameter U(93+) plates, collectively known as the “Jemima” plates. These plates are either full or annular cylinders with an inner annulus of 2.5 in (6.35 cm), 6 in (15.24 cm), or 10 in (25.4 cm). The annulus removes some of the HEU mass resulting in lower and higher mass plate variants. The plates are identified in this, and previous evaluations, based on their annulus: 15/0-HEU (Full, HEU1), 15/2.5-HEU (2.5”, HEU2, Id. No. 403), 15/6-HEU (6”, HEU4, “Six Inch”, Id. No. 401), and 15/10-HEU (10”, HEU5, “Ten Inch”, Id. No. 402). Each of these four variants are shown in Figure 9.

Table 3 reports the nominal dimensions of the HEU plates and the mass measurement performed during the TEX-Hf experiment campaign. Previous measurements are also shown in Table 3. The mass measurements during the TEX-Hf experiment campaign were performed using a Mettler Toledo Electronic Scale (Cal No. 012708, valid through May 17, 2023). The manufacturer reports a maximum capacity of 16,200 grams, precision of 0.1 grams, and linearity of 0.2 grams. The measurement procedure involved the HEU plates being weighed in a plastic bag to contain any contamination. Each bag was weighed before placing the HEU plate in the bag. Then the weight of the HEU plate in the bag was measured. After performing this measurement, the balance was checked to ensure the measurement returned to zero with the HEU plate and bag removed. The plate mass is calculated by subtracting the bag mass. Table 4 also includes the mass measurement of the plates involved in the TEX-HEU experiment campaign. It also includes the HEU plate thickness measurements that are part of MIX-MET-FAST-016, taken in 2019. These were performed using an IP67 Mitutoyo caliper (CD-24"C) with a resolution of ±0.02 in.

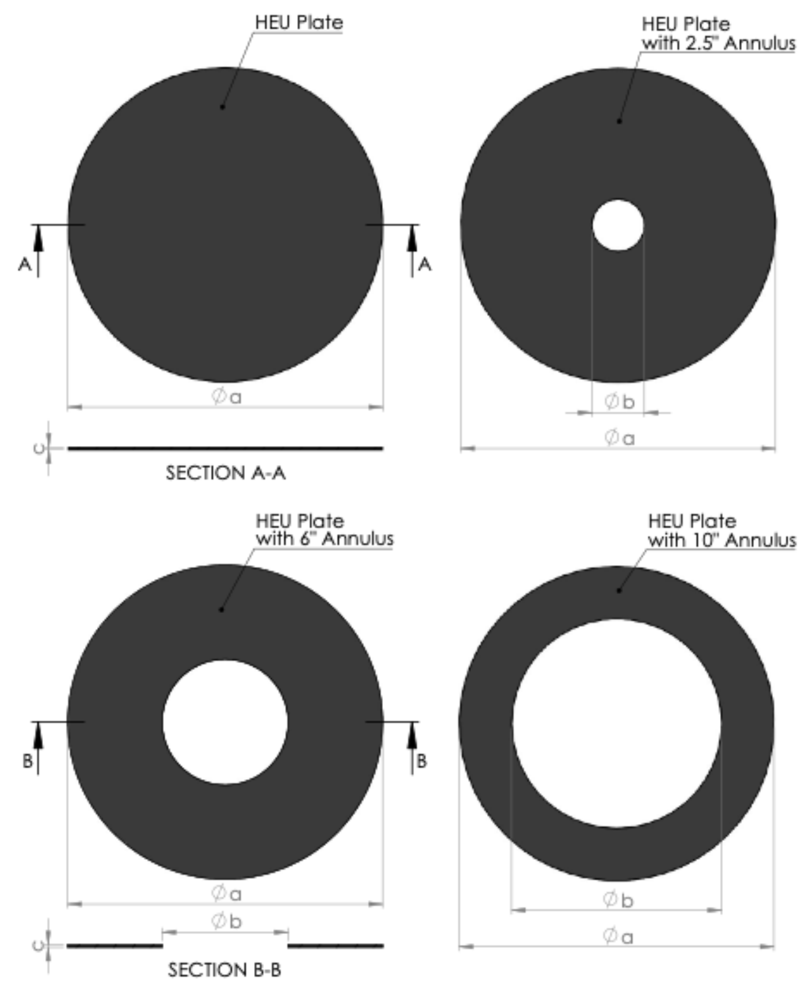

Figure 9: Drawings of the HEU plates, showing the 15/0-HEU (upper left), 15/2.5-HEU (upper right), 15/6-HEU (lower left), and 15/10-HEU (lower right).

Table 3: HEU plate dimensions and tolerances (see Figure 9).

Part Type	Inner Diameter, b [in (cm)]	Outer Diameter, a [in (cm)]	Thickness, c [in (cm)]
15/0-HEU	-	15 +0.000/-0.005 (38.1 +0.000/-0.0127)	0.118 (0.29972)
15/2.5-HEU	2.510 +0.005/-0.000 (6.3754 +0.0127/-0.0000)		
15/6-HEU	6.005 +0.005/-0.000 (15.2527 +0.0127/-0.0000)		
15/10-HEU	10.005 +0.005/-0.000 (25.4127 +0.0127/-0.0000)		
6/0-HEU	-	6 +0.000/-0.005 (15.24 +0.0000/-0.0127)	

Table 4: HEU plate mass and dimension measurements (see Figure 9).

Part Type	Part ID	Thickness[1], c [in (cm)]	Mass (g)		
			2022[3]	2020[2]	2005[1]
15/0-HEU	11150	0.1218 (0.3095)	6404.7	6410.3	6415.4
	11149	0.1222 (0.3103)	6382.2	6383.6	6409.2
	11147	0.1195 (0.3035)	6512.4	6517.3	6526.2
	11019	0.1190 (0.3023)	6469.2	6470.0	6476.9
	11017	0.1208 (0.3069)	6497.8	6501.6	6518.6
15/2.5-HEU	10491	0.1238 (0.3145)	6391.6	6392.4	6292.8
	10489	0.1232 (0.3128)	6343.7	6343.8	6345.0
	10487	0.1203 (0.3056)	6275.4	6274.9	6276.4
	10475	0.1285 (0.3264)	6228.5	6230.0	6236.2
	10470	0.1227 (0.3116)	6278.6	6279.0	6261.0
	10467	0.1245 (0.3162)	6335.6	6335.8	6336.6
	10464	0.1195 (0.3035)	6258.4	6258.5	6259.3
15/6-HEU	11018	0.1192 (0.3027)	5369.6	5369.9	5375.4
	10935	-	5434.9	-	5435.9
	10933	-	5437.4	-	5439.9
	10932	0.1250 (0.3175)	5432.9	-	5436.5
	10477	0.1235 (0.3137)	5498.9	5499.2	5498.6
	10457	0.1255 (0.3188)	5573.9	5574.1	5574.0
15/10-HEU	10485	-	3604.3	-	3605.5
	10481	0.1205 (0.3061)	3594.3	-	3593.6
	10479	0.1198 (0.3044)	3564.6	3564.7	3565.4
	10473	-	3606.9	-	3607.3
	10472	0.1220 (0.3099)	3586.4	3585.7	3587.2
	10463	0.1233 (0.3133)	3631.7	3631.7	3627.0

Part Type	Part ID	Thickness[1], c [in (cm)]	Mass (g)		
			2022[3]	2020[2]	2005[1]
	10458	-	3617.9	-	3618.3
6/0-HEU	Q2-16	0.1252 (0.3179)	1075.6	-	1077.8

[1]J. M. Goda. HEU Data Jemima Plates 2019. Technical Report LA-UR-19-24229, Los Alamos National Laboratory, 2019
[2]J. D. Norris, et. al. TEX-HEU: Integral Experiments with Highly Enriched Uranium and Polyethylene. Technical Report LLNL-TR-817959, Lawrence Livermore National Laboratory, 2020
[3]HEU-MET-INTER-013

2.1.4 NaCl Plates

The NaCl absorber, which is composed of NaCl salt, is encapsulated with an aluminum container. Two types of NaCl absorber plates were designed for this experiment: 0.250 in-thick (0.635 cm) and 0.1875 in-thick (0.47625 cm) active absorption regions. The diameter of the salt containing cavity for both variations was 12 in (30.48 cm). The base of the vessel features the cavity as well as an interface surface for the lid, which is surrounded by a retaining lip. The lip has a nominal thickness of 0.23 in (0.5842 cm) and height of 0.03 in (0.0762 cm), along the edge at a diameter of 14.77 in (37.5158 cm). The base has an outer diameter of 15 in (38.1 cm). Figure 10 shows a drawing of the NaCl plate bases. Figure 11 shows a drawing of the NaCl plate covers. Figure 12 shows a drawing of the screws used in the NaCl plates. The screws, 16 in total for each plate, are used to affix the cover to the base.

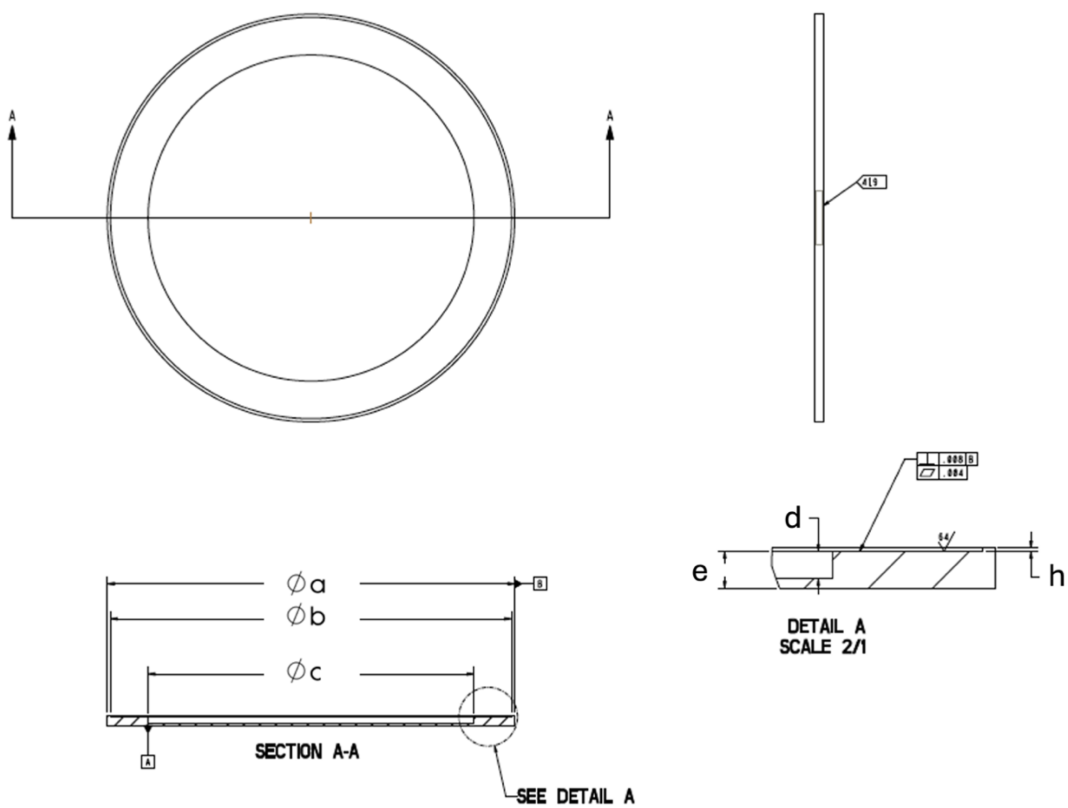

Figure 10: Drawing of the NaCl plate base.

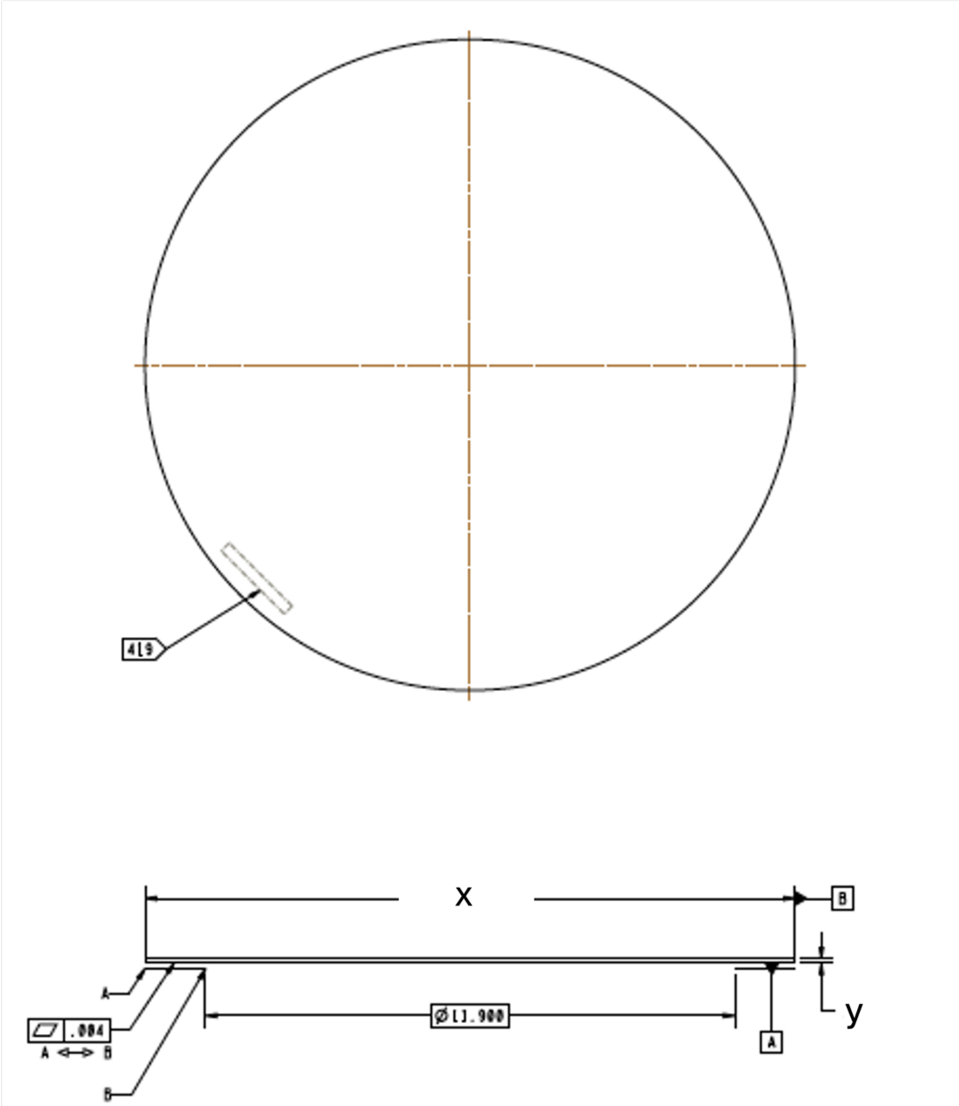

Figure 11: Drawing of the NaCl plate cover.

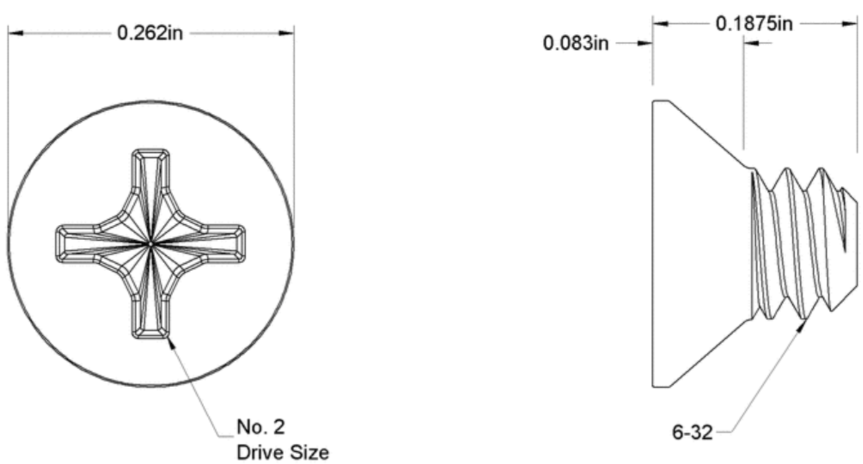

Figure 12: Drawing of the aluminum screws used in the NaCl salt plates.

The NaCl plates were procured by LANL and shipped to LLNL for filling. The filling procedure can be found in [5]. After filling the plates were shipped to NNSS to prepare for experimental execution. Acceptance measurements were performed by LANL after receiving them from the manufacturer and prior to sending them to LLNL. Initial mass measurements were also performed. At LLNL mass measurements of the filled plates were performed. After the experiment, at NNSS, a final weight was taken for the plates that were used in the experiments.

Mass measurements performed at LLNL were accompanied by calibrated check weight measurements to create a calibration curve to adjust the measured values. The adjustment due to this calibration curve was found to be insignificant.

2.1.4.1 3/16" NaCl Plates

Twenty-three 3/16" NaCl salt plates were procured for this experiment. Upon receipt from the manufacturer LANL performed acceptance measurements using 6" digital calipers (calibration number: A23151184), 24" digital calipers (calibration number: 74337), outside micrometer 0-1" (calibration number: 9298165), and CMM. Masses of the plates were determined at LANL with a balance with the calibration number C032910287, at LLNL with an Ohaus PX4202/E (calibration number: 19-E8S6X-20-1), and at the DAF by LANL with a Mettler Toledo 017285 (calibration number: 012239). Table 5 and Table 6 tabulate the mass data for the empty NaCl plates and their components during acceptance from the manufacturer by LANL. Table 7 gives the masses of the filled NaCl plates immediately after filling. Table 8 gives the masses of the filled NaCl plates prior to shipping to NNSS for experimental execution. Table 9 gives the masses of the filled NaCl plates immediately following the execution of the experiments.

Dimensions of the NaCl plate bases determined via CMM measurements are shown in Table 10. Dimensions of the NaCl plate bases determined via other measurements techniques are shown in Table 11, Table 12, and Table 13. It should be noted that average values reported for CMM measurements are not the average of the individual reported measurements, but the average of all CMM data points in the data set.

Dimensions of the NaCl plate covers determined via CMM measurements are shown in Table 14. Dimensions of the NaCl plate covers determined via other measurement techniques are shown in Table 15 and Table 16.

The thicknesses of the assembled NaCl plate determined by CMM and hand measurements are shown in Table 17 and Table 18, respectively.

Table 5: Absorber plate component weights via acceptance measurements performed by LANL.

Part ID	Mass (g)			
	Base	Cover	Assembled (No Salt)	Screws (Difference)
SaltPlate3/16-1	1197.9	721.4	1920.9	1.60
SaltPlate3/16-2	1209.0	721.3	1932.3	2.00
SaltPlate3/16-3	1218.1	720.0	1940.5	2.40

SaltPlate3/16-4	1207.8	721.6	1931.7	2.30
SaltPlate3/16-5	1205.5	721.0	1928.8	2.30
SaltPlate3/16-6	1210.5	720.2	1932.3	1.60
SaltPlate3/16-7	1213.0	719.8	1935.1	2.30
SaltPlate3/16-8	1209.5	722.5	1934.2	2.20
SaltPlate3/16-9	1201.6	720.7	1924.4	2.10
SaltPlate3/16-10	1204.0	720.9	1926.8	1.90
SaltPlate3/16-11	1215.0	720.3	1937.5	2.20
SaltPlate3/16-12	1218.0	720.9	1941.1	2.20
SaltPlate3/16-13	1211.8	721.5	1935.5	2.20
SaltPlate3/16-14	1204.3	720.1	1926.7	2.30
SaltPlate3/16-15	1211.6	718.3	1932.1	2.20
SaltPlate3/16-16	1210.9	719.9	1932.9	2.10
SaltPlate3/16-17	1197.2	719.3	1918.7	2.20
SaltPlate3/16-18	1214.6	722.6	1939.6	2.40
SaltPlate3/16-19	1203.5	718.9	1924.6	2.20
SaltPlate3/16-20	1207.1	718.9	1928.2	2.20
SaltPlate3/16-21	1209.6	719.5	1931.3	2.20
SaltPlate3/16-22	1206.3	720.8	1929.3	2.20
SaltPlate3/16-23	1211.9	720.7	1934.6	2.00

Table 6: Absorber plate weights without salt via acceptance measurements performed by LANL.

Part ID	Mass of Empty Vessel (g)			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate3/16-1	1922.1	1922.1	1922.1	1922.10
SaltPlate3/16-2	1933.1	1933.1	1933.1	1933.10
SaltPlate3/16-3	1941.2	1941.2	1941.1	1941.15
SaltPlate3/16-4	1932.1	1932.1	1932.1	1932.09
SaltPlate3/16-5	1929.3	1929.3	1929.3	1929.30
SaltPlate3/16-6	1933.6	1933.6	1933.6	1933.57
SaltPlate3/16-7	1935.6	1935.6	1935.6	1935.57
SaltPlate3/16-8	1934.8	1934.8	1934.8	1934.79
SaltPlate3/16-9	1924.9	1924.9	1924.9	1924.93
SaltPlate3/16-10	1927.3	1927.3	1927.3	1927.33
SaltPlate3/16-11	1938.2	1938.1	1938.1	1938.14
SaltPlate3/16-12	1941.6	1941.6	1941.6	1941.64
SaltPlate3/16-13	1935.9	1936.0	1935.9	1935.94
SaltPlate3/16-14	1927.2	1927.2	1927.2	1927.20
SaltPlate3/16-15	1932.6	1932.6	1932.7	1932.63

SaltPlate3/16-16	1933.5	1933.5	1933.5	1933.46
SaltPlate3/16-17	1919.3	1919.2	1919.3	1919.25
SaltPlate3/16-18	1940.1	1940.1	1940.1	1940.08
SaltPlate3/16-19	1925.1	1925.1	1925.1	1925.12
SaltPlate3/16-20	1928.1	1928.1	1928.1	1928.13
SaltPlate3/16-21	1931.9	1931.9	1931.9	1931.87
SaltPlate3/16-22	1929.9	1929.9	1929.9	1929.86
SaltPlate3/16-23	1935.1	1935.1	1935.1	1935.06

Table 7: Absorber plate weights with salt immediately after being filled.

Part ID	Initial Filled Mass (g)				
	Date	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate3/16-1	May 1, 2024	2464.6	2464.6	2464.6	2464.64
SaltPlate3/16-2	May 2, 2024	2454.2	2454.2	2454.2	2454.15
SaltPlate3/16-3	May 2, 2024	2456.0	2456.0	2456.0	2455.95
SaltPlate3/16-4	May 7, 2024	2447.8	2447.8	2447.8	2447.75
SaltPlate3/16-5	May 7, 2024	2446.1	2446.1	2446.1	2446.10
SaltPlate3/16-6	May 7, 2024	2456.5	2456.5	2456.5	2456.46
SaltPlate3/16-7	May 8, 2024	2445.6	2445.6	2445.6	2445.63
SaltPlate3/16-8	May 8, 2024	2449.8	2449.8	2449.8	2449.80
SaltPlate3/16-9	May 8, 2024	2433.3	2433.3	2433.3	2433.30
SaltPlate3/16-10	May 9, 2024	2425.4	2425.4	2425.4	2425.37
SaltPlate3/16-11	May 9, 2024	2449.6	2449.6	2449.6	2449.62
SaltPlate3/16-12	May 9, 2024	2457.6	2457.6	2457.6	2457.58
SaltPlate3/16-13	May 10, 2024	2446.6	2446.6	2446.6	2446.58
SaltPlate3/16-14	May 10, 2024	2437.8	2437.8	2437.8	2437.76
SaltPlate3/16-15	May 13, 2024	2445.6	2445.6	2445.6	2445.55
SaltPlate3/16-16	May 13, 2024	2448.5	2448.4	2448.5	2448.44
SaltPlate3/16-17	May 13, 2024	2425.1	2425.1	2425.1	2425.11
SaltPlate3/16-18	May 14, 2024	2442.0	2442.0	2442.0	2442.00
SaltPlate3/16-19	May 14, 2024	2430.9	2430.9	2430.9	2430.86
SaltPlate3/16-20	May 15, 2024	2424.4	2424.4	2424.4	2424.41
SaltPlate3/16-21	May 15, 2024	2432.3	2432.3	2432.3	2432.34
SaltPlate3/16-22	May 20, 2024	2425.4	2425.4	2425.4	2425.43
SaltPlate3/16-23	May 21, 2024	2451.1	2451.1	2451.1	2451.10

Table 8: Absorber plate weights with salt prior to being shipped to NNSS.

Part ID	Pre-Shipment Mass (g)				
	Date	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate3/16-1	May 31, 2024	2464.7	2464.7	2464.7	2464.67
SaltPlate3/16-2	May 31, 2024	2454.2	2454.2	2454.2	2454.16
SaltPlate3/16-3	May 31, 2024	2456.0	2456.0	2456.0	2455.99
SaltPlate3/16-4	May 31, 2024	2447.8	2447.8	2447.7	2447.77
SaltPlate3/16-5	May 31, 2024	2446.2	2446.2	2446.2	2446.17
SaltPlate3/16-6	May 31, 2024	2456.0	2455.7	2455.8	2455.85
SaltPlate3/16-7	May 31, 2024	2455.6	2455.6	2455.6	2455.60
SaltPlate3/16-8	May 31, 2024	2449.8	2449.9	2449.9	2449.85
SaltPlate3/16-9	May 31, 2024	2433.3	2433.3	2433.3	2433.33
SaltPlate3/16-10	May 31, 2024	2425.5	2425.4	2425.4	2425.44
SaltPlate3/16-11	May 31, 2024	2449.6	2449.6	2449.7	2449.62
SaltPlate3/16-12	May 31, 2024	2457.5	2457.5	2457.6	2457.54
SaltPlate3/16-13	May 31, 2024	2446.6	2446.5	2446.6	2446.56
SaltPlate3/16-14	May 31, 2024	2437.7	2437.7	2437.7	2437.68
SaltPlate3/16-15	May 31, 2024	2445.6	2445.6	2445.5	2445.55
SaltPlate3/16-16	May 31, 2024	2448.3	2448.4	2448.4	2448.37
SaltPlate3/16-17	May 31, 2024	2425.3	2425.3	2425.3	2425.29
SaltPlate3/16-18	May 31, 2024	2442.1	2442.2	2442.1	2442.10
SaltPlate3/16-19	May 31, 2024	2431.0	2430.9	2431.0	2430.95
SaltPlate3/16-20	May 31, 2024	2424.5	2424.6	2424.6	2424.54
SaltPlate3/16-21	May 31, 2024	2432.5	2432.5	2432.4	2432.44
SaltPlate3/16-22	May 31, 2024	2425.7	2425.5	2425.5	2425.56
SaltPlate3/16-23	May 31, 2024	2451.1	2451.1	2451.1	2451.09

Table 9: Absorber plate weights with salt immediately after execution of the experiment.

Part ID	Post Experiment Mass (g)	
	Date	Measurement
SaltPlate3/16-1	August 5, 2024	-
SaltPlate3/16-2	August 5, 2024	2453.5
SaltPlate3/16-3	August 5, 2024	2455.1
SaltPlate3/16-4	August 5, 2024	2446.9
SaltPlate3/16-5	August 5, 2024	2445.3
SaltPlate3/16-6	August 5, 2024	2454.9
SaltPlate3/16-7	August 5, 2024	-
SaltPlate3/16-8	August 5, 2024	2448.9

SaltPlate3/16-9	August 5, 2024	2432.5
SaltPlate3/16-10	August 5, 2024	2424.5
SaltPlate3/16-11	August 5, 2024	2448.8
SaltPlate3/16-12	August 5, 2024	2456.7
SaltPlate3/16-13	August 5, 2024	2445.8
SaltPlate3/16-14	August 5, 2024	2436.7
SaltPlate3/16-15	August 5, 2024	2444.4
SaltPlate3/16-16	August 5, 2024	2447.1
SaltPlate3/16-17	August 5, 2024	2423.9
SaltPlate3/16-18	August 5, 2024	2440.8
SaltPlate3/16-19	August 5, 2024	2429.6
SaltPlate3/16-20	August 5, 2024	-
SaltPlate3/16-21	August 5, 2024	-
SaltPlate3/16-22	August 5, 2024	-
SaltPlate3/16-23	August 5, 2024	-

Table 10: Absorber plate base dimensions via acceptance measurements with a CMM performed by LANL (see Figure 10).

Part ID	Inner Diameter, c [in (cm)]	Outer Diameter, a [in (cm)]	Pocket Depth, d [in (cm)]				Bottom Thickness, e-d [in (cm)]
			Measurement 1	Measurement 2	Measurement 3	Average	
SaltPlate3/16-1	12.0010 (30.4825)	14.9990 (38.0975)	.1870 (.4750)	.1850 (.4699)	.1830 (.4648)	.1930 (.4902)	.0960 (.2438)
SaltPlate3/16-2	12.0000 (30.4800)	14.9960 (38.0898)	.1870 (.4750)	.1880 (.4775)	.1840 (.4674)	.1920 (.4877)	.0950 (.2413)
SaltPlate3/16-3	11.9990 (30.4775)	14.9960 (38.0898)	.1860 (.4724)	.1850 (.4699)	.1860 (.4724)	.1910 (.4851)	.1000 (.2540)
SaltPlate3/16-4	11.9980 (30.4749)	14.9960 (38.0898)	.1870 (.4750)	.1870 (.4750)	.1840 (.4674)	.1930 (.4902)	.1010 (.2565)
SaltPlate3/16-5	11.9990 (30.4775)	14.9960 (38.0898)	.1850 (.4699)	.1850 (.4699)	.1870 (.4750)	.1930 (.4902)	.0940 (.2388)
SaltPlate3/16-6	11.9990 (30.4775)	14.9970 (38.0924)	.1860 (.4724)	.1850 (.4699)	.1850 (.4699)	.1930 (.4902)	.1000 (.2540)
SaltPlate3/16-7	12.0000 (30.4800)	14.9970 (38.0924)	.1860 (.4724)	.1870 (.4750)	.1860 (.4724)	.1900 (.4826)	.0920 (.2337)
SaltPlate3/16-8	12.0000 (30.4800)	14.9970 (38.0924)	.1870 (.4750)	.1870 (.4750)	.1870 (.4750)	.1930 (.4902)	.0980 (.2489)
SaltPlate3/16-9	12.0000 (30.4800)	14.9970 (38.0924)	.1870 (.4750)	.1850 (.4699)	.1870 (.4750)	.1940 (.4928)	.0940 (.2388)
SaltPlate3/16-10	12.0000 (30.4800)	14.9960 (38.0898)	.1870 (.4750)	.1880 (.4775)	.1860 (.4724)	.1930 (.4902)	.0970 (.2464)
SaltPlate3/16-11	11.9990 (30.4775)	14.9960 (38.0898)	.1850 (.4699)	.1850 (.4699)	.1890 (.4801)	.1930 (.4902)	.0940 (.2388)
SaltPlate3/16-12	11.9980 (30.4749)	14.9990 (38.0975)	.1860 (.4724)	.1850 (.4699)	.1870 (.4750)	.1920 (.4877)	.0990 (.2515)
SaltPlate3/16-13	12.0000 (30.4800)	14.9970 (38.0924)	.1870 (.4750)	.1870 (.4750)	.1890 (.4801)	.1930 (.4902)	.0980 (.2489)
SaltPlate3/16-14	12.0020 (30.4851)	14.9970 (38.0924)	.1870 (.4750)	.1870 (.4750)	.1860 (.4724)	.1880 (.4775)	.0910 (.2311)

SaltPlate3/16-15	12.0000 (30.4800)	14.9960 (38.0898)	.1870 (.4750)	.1860 (.4724)	.1860 (.4724)	.1930 (.4902)	.0980 (.2489)
SaltPlate3/16-16	12.0000 (30.4800)	14.9970 (38.0924)	.1880 (.4775)	.1850 (.4699)	.1870 (.4750)	.1960 (.4978)	.0930 (.2362)
SaltPlate3/16-17	11.9990 (30.4775)	14.9960 (38.0898)	.1850 (.4699)	.1880 (.4775)	.1870 (.4750)	.1920 (.4877)	.0950 (.2413)
SaltPlate3/16-18	12.0000 (30.4800)	14.9950 (38.0873)	.1870 (.4750)	.1850 (.4699)	.1850 (.4699)	.1910 (.4851)	.0970 (.2464)
SaltPlate3/16-19	11.9990 (30.4775)	14.9960 (38.0898)	.1840 (.4674)	.1850 (.4699)	.1810 (.4597)	.1950 (.4953)	.0930 (.2362)
SaltPlate3/16-20	11.9990 (30.4775)	14.9950 (38.0873)	.1860 (.4724)	.1870 (.4750)	.1860 (.4724)	.1930 (.4902)	.0930 (.2362)
SaltPlate3/16-21	11.9990 (30.4775)	14.9960 (38.0898)	.1860 (.4724)	.1870 (.4750)	.1860 (.4724)	.1920 (.4877)	.0950 (.2413)
SaltPlate3/16-22	12.0000 (30.4800)	14.9960 (38.0898)	.1870 (.4750)	.1900 (.4826)	.1860 (.4724)	.1960 (.4978)	.0960 (.2438)
SaltPlate3/16-23	12.0000 (30.4800)	14.9960 (38.0898)	.1880 (.4775)	.1870 (.4750)	.1850 (.4699)	.1950 (.4953)	.0970 (.2464)

Table 11: Absorber plate base dimensions via acceptance measurements performed by LANL (see Figure 10).

Part ID	Lip Inner Diameter, b [in (cm)]			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate3/16-1	14.7680 (37.5107)	14.7655 (37.5044)	17.7680 (45.1307)	15.7672 (40.0486)
SaltPlate3/16-2	14.7645 (37.5018)	17.7645 (45.1218)	14.7665 (37.5069)	15.7652 (40.0435)
SaltPlate3/16-3	14.7675 (37.5095)	14.7675 (37.5095)	14.7690 (37.5133)	14.7680 (37.5107)
SaltPlate3/16-4	14.7650 (37.5031)	14.7705 (37.5171)	14.7680 (37.5107)	14.7678 (37.5103)
SaltPlate3/16-5	14.7650 (37.5031)	14.7665 (37.5069)	14.7650 (37.5031)	14.7655 (37.5044)
SaltPlate3/16-6	14.7655 (37.5044)	14.7720 (37.5209)	14.7655 (37.5044)	14.7677 (37.5099)
SaltPlate3/16-7	14.7655 (37.5044)	14.7660 (37.5056)	14.7685 (37.5120)	14.7667 (37.5073)
SaltPlate3/16-8	14.7625 (37.4968)	14.7705 (37.5171)	14.7635 (37.4993)	14.7655 (37.5044)
SaltPlate3/16-9	14.7660 (37.5056)	14.7705 (37.5171)	14.7695 (37.5145)	14.7687 (37.5124)
SaltPlate3/16-10	14.7670 (37.5082)	14.7680 (37.5107)	14.7660 (37.5056)	14.7670 (37.5082)
SaltPlate3/16-11	14.7670 (37.5082)	14.7650 (37.5031)	14.7695 (37.5145)	14.7672 (37.5086)
SaltPlate3/16-12	14.7695 (37.5145)	14.7655 (37.5044)	14.7715 (37.5196)	14.7688 (37.5128)
SaltPlate3/16-13	14.7685 (37.5120)	14.7715 (37.5196)	14.7530 (37.4726)	14.7643 (37.5014)
SaltPlate3/16-14	14.7185 (37.3850)	14.7435 (37.4485)	14.7545 (37.4764)	14.7388 (37.4366)
SaltPlate3/16-15	14.7705 (37.5171)	14.7685 (37.5120)	14.7710 (37.5183)	14.7700 (37.5158)
SaltPlate3/16-16	14.7690 (37.5133)	14.7690 (37.5133)	14.7675 (37.5095)	14.7685 (37.5120)
SaltPlate3/16-17	14.7705 (37.5171)	14.7665 (37.5069)	14.7690 (37.5133)	14.7687 (37.5124)
SaltPlate3/16-18	14.7735 (37.5247)	14.7660 (37.5056)	14.7705 (37.5171)	14.7700 (37.5158)
SaltPlate3/16-19	14.7695 (37.5145)	14.7670 (37.5082)	14.7680 (37.5107)	14.7682 (37.5111)
SaltPlate3/16-20	14.7630 (37.4980)	14.7660 (37.5056)	14.7700 (37.5158)	14.7663 (37.5065)
SaltPlate3/16-21	14.7655 (37.5044)	14.7705 (37.5171)	14.7685 (37.5120)	14.7682 (37.5111)
SaltPlate3/16-22	14.7700 (37.5158)	14.7655 (37.5044)	14.7700 (37.5158)	14.7685 (37.5120)
SaltPlate3/16-23	14.7635 (37.4993)	14.7695 (37.5145)	14.7630 (37.4980)	14.7653 (37.5039)

Table 12: Absorber plate base dimensions via acceptance measurements performed by LANL (see Figure 10).

Part ID	Bottom Thickness, e-d [in (cm)]			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate3/16-1	.2717 (.6901)	.2743 (.6967)	.2749 (.6982)	.2736 (.6950)
SaltPlate3/16-2	.2755 (.6998)	.2733 (.6942)	.2729 (.6932)	.2739 (.6957)
SaltPlate3/16-3	.2741 (.6962)	.2742 (.6965)	.2742 (.6965)	.2742 (.6964)
SaltPlate3/16-4	.2751 (.6988)	.2730 (.6934)	.2725 (.6922)	.2735 (.6948)
SaltPlate3/16-5	.2751 (.6988)	.2725 (.6922)	.2728 (.6929)	.2735 (.6946)
SaltPlate3/16-6	.2742 (.6965)	.2727 (.6927)	.2744 (.6970)	.2738 (.6954)
SaltPlate3/16-7	.2750 (.6985)	.2765 (.7023)	.2717 (.6901)	.2744 (.6970)
SaltPlate3/16-8	.2739 (.6957)	.2736 (.6949)	.2764 (.7021)	.2746 (.6976)
SaltPlate3/16-9	.2748 (.6980)	.2718 (.6904)	.2728 (.6929)	.2731 (.6938)
SaltPlate3/16-10	.2717 (.6901)	.2722 (.6914)	.2760 (.7010)	.2733 (.6942)
SaltPlate3/16-11	.2746 (.6975)	.2773 (.7043)	.2731 (.6937)	.2750 (.6985)
SaltPlate3/16-12	.2751 (.6988)	.2751 (.6988)	.2726 (.6924)	.2743 (.6966)
SaltPlate3/16-13	.2739 (.6957)	.2759 (.7008)	.2731 (.6937)	.2743 (.6967)
SaltPlate3/16-14	.2741 (.6962)	.2750 (.6985)	.2731 (.6937)	.2741 (.6961)
SaltPlate3/16-15	.2764 (.7021)	.2758 (.7005)	.2722 (.6914)	.2748 (.6980)
SaltPlate3/16-16	.2744 (.6970)	.2761 (.7013)	.2730 (.6934)	.2745 (.6972)
SaltPlate3/16-17	.2737 (.6952)	.2734 (.6944)	.2723 (.6916)	.2731 (.6938)
SaltPlate3/16-18	.2753 (.6993)	.2733 (.6942)	.2762 (.7015)	.2749 (.6983)
SaltPlate3/16-19	.2761 (.7013)	.2473 (.6282)	.2725 (.6922)	.2653 (.6739)
SaltPlate3/16-20	.2746 (.6975)	.2736 (.6949)	.2726 (.6924)	.2736 (.6949)
SaltPlate3/16-21	.2754 (.6995)	.2739 (.6957)	.2720 (.6909)	.2738 (.6954)
SaltPlate3/16-22	.2729 (.6932)	.2760 (.7010)	.2743 (.6967)	.2744 (.6970)
SaltPlate3/16-23	.2732 (.6939)	.2763 (.7018)	.2734 (.6944)	.2743 (.6967)

Table 13: Absorber plate base dimensions via acceptance measurements performed by LANL (see Figure 10).

Part ID	Pocket Depth, d [in (cm)]			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate3/16-1	.1845 (.4686)	.1865 (.4737)	.1875 (.4763)	.1862 (.4729)
SaltPlate3/16-2	.1900 (.4826)	.1875 (.4763)	.1855 (.4712)	.1877 (.4767)
SaltPlate3/16-3	.1875 (.4763)	.1875 (.4763)	.1885 (.4788)	.1878 (.4771)
SaltPlate3/16-4	.2840 (.7214)	.1845 (.4686)	.1885 (.4788)	.2190 (.5563)
SaltPlate3/16-5	.1865 (.4737)	.1875 (.4763)	.1875 (.4763)	.1872 (.4754)
SaltPlate3/16-6	.1855 (.4712)	.1865 (.4737)	.1895 (.4813)	.1872 (.4754)
SaltPlate3/16-7	.1900 (.4826)	.1905 (.4839)	.1895 (.4813)	.1900 (.4826)
SaltPlate3/16-8	.1900 (.4826)	.1900 (.4826)	.1865 (.4737)	.1888 (.4796)
SaltPlate3/16-9	.1875 (.4763)	.1885 (.4788)	.1875 (.4763)	.1878 (.4771)

SaltPlate3/16-10	.1875 (.4763)	.1885 (.4788)	.1915 (.4864)	.1892 (.4805)
SaltPlate3/16-11	.1890 (.4801)	.1880 (.4775)	.1860 (.4724)	.1877 (.4767)
SaltPlate3/16-12	.1865 (.4737)	.1880 (.4775)	.1885 (.4788)	.1877 (.4767)
SaltPlate3/16-13	.1825 (.4636)	.1835 (.4661)	.1830 (.4648)	.1830 (.4648)
SaltPlate3/16-14	.1850 (.4699)	.1860 (.4724)	.1860 (.4724)	.1857 (.4716)
SaltPlate3/16-15	.1865 (.4737)	.1860 (.4724)	.1860 (.4724)	.1862 (.4729)
SaltPlate3/16-16	.1850 (.4699)	.1850 (.4699)	.1870 (.4750)	.1857 (.4716)
SaltPlate3/16-17	.1860 (.4724)	.1865 (.4737)	.1905 (.4839)	.1877 (.4767)
SaltPlate3/16-18	.1875 (.4763)	.1855 (.4712)	.1910 (.4851)	.1880 (.4775)
SaltPlate3/16-19	.1905 (.4839)	.1870 (.4750)	.1905 (.4839)	.1893 (.4809)
SaltPlate3/16-20	.1925 (.4890)	.1905 (.4839)	.1925 (.4890)	.1918 (.4873)
SaltPlate3/16-21	.1865 (.4737)	.1875 (.4763)	.1850 (.4699)	.1863 (.4733)
SaltPlate3/16-22	.1875 (.4763)	.1875 (.4763)	.1870 (.4750)	.1873 (.4758)
SaltPlate3/16-23	.1880 (.4775)	.1850 (.4699)	.1870 (.4750)	.1867 (.4741)

Table 14: Absorber plate cover dimensions via CMM measurements performed by LANL (see Figure 11).

Part ID	Diameter, x [in (cm)]	Thickness, y [in (cm)]			
		Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate3/16-1	14.6490 (37.2085)	.0990 (.2515)	.0990 (.2515)	.0980 (.2489)	.0990 (.2515)
SaltPlate3/16-2	14.6470 (37.2034)	.0980 (.2489)	.1010 (.2565)	.0980 (.2489)	.0990 (.2515)
SaltPlate3/16-3	14.6500 (37.2110)	.0990 (.2515)	.0990 (.2515)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-4	14.6490 (37.2085)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-5	14.6500 (37.2110)	.0980 (.2489)	.0980 (.2489)	.0990 (.2515)	.0980 (.2489)
SaltPlate3/16-6	14.6480 (37.2059)	.0990 (.2515)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-7	14.6500 (37.2110)	.0980 (.2489)	.0980 (.2489)	.0990 (.2515)	.0980 (.2489)
SaltPlate3/16-8	14.6490 (37.2085)	.0980 (.2489)	.0990 (.2515)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-9	14.6440 (37.1958)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-10	14.6460 (37.2008)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-11	14.6430 (37.1932)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-12	14.6430 (37.1932)	.0980 (.2489)	.0990 (.2515)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-13	14.6460 (37.2008)	.0990 (.2515)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-14	14.6470 (37.2034)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-15	14.6500 (37.2110)	.0990 (.2515)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-16	14.6500 (37.2110)	.0980 (.2489)	.0980 (.2489)	.0970 (.2464)	.0980 (.2489)
SaltPlate3/16-17	14.6480 (37.2059)	.0990 (.2515)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-18	14.6460 (37.2008)	.0990 (.2515)	.1010 (.2565)	.0980 (.2489)	.0990 (.2515)
SaltPlate3/16-19	14.6480 (37.2059)	.0980 (.2489)	.0970 (.2464)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-20	14.6500 (37.2110)	.0980 (.2489)	.0970 (.2464)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-21	14.6490 (37.2085)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)

SaltPlate3/16-22	14.6450 (37.1983)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)	.0980 (.2489)
SaltPlate3/16-23	14.6450 (37.1983)	.0980 (.2489)	.0970 (.2464)	.0980 (.2489)	.0980 (.2489)

Table 15: Absorber plate cover dimensions via acceptance measurements performed by LANL (see Figure 11).

Part ID	Diameter, x [in (cm)]			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate3/16-1	14.6465 (37.2021)	14.6505 (37.2123)	14.6408 (37.1876)	14.6459 (37.2007)
SaltPlate3/16-2	14.6445 (37.1970)	14.6475 (37.2047)	14.6470 (37.2034)	14.6463 (37.2017)
SaltPlate3/16-3	14.6540 (37.2212)	14.6485 (37.2072)	14.6540 (37.2212)	14.6522 (37.2165)
SaltPlate3/16-4	14.6500 (37.2110)	14.6535 (37.2199)	14.6465 (37.2021)	14.6500 (37.2110)
SaltPlate3/16-5	14.6500 (37.2110)	14.6550 (37.2237)	14.6480 (37.2059)	14.6510 (37.2135)
SaltPlate3/16-6	14.6470 (37.2034)	14.6540 (37.2212)	14.6505 (37.2123)	14.6505 (37.2123)
SaltPlate3/16-7	14.6480 (37.2059)	14.6490 (37.2085)	14.6505 (37.2123)	14.6492 (37.2089)
SaltPlate3/16-8	14.6480 (37.2059)	14.6500 (37.2110)	14.6480 (37.2059)	14.6487 (37.2076)
SaltPlate3/16-9	14.6455 (37.1996)	14.6410 (37.1881)	14.6440 (37.1958)	14.6435 (37.1945)
SaltPlate3/16-10	14.6495 (37.2097)	17.6450 (44.8183)	14.6490 (37.2085)	15.6478 (39.7455)
SaltPlate3/16-11	14.7665 (37.5069)	14.6440 (37.1958)	14.6475 (37.2047)	14.6860 (37.3024)
SaltPlate3/16-12	14.6395 (37.1843)	14.6480 (37.2059)	14.6400 (37.1856)	14.6425 (37.1920)
SaltPlate3/16-13	14.6455 (37.1996)	14.6525 (37.2174)	14.6450 (37.1983)	14.6477 (37.2051)
SaltPlate3/16-14	14.6495 (37.2097)	14.6480 (37.2059)	14.6455 (37.1996)	14.6477 (37.2051)
SaltPlate3/16-15	14.6510 (37.2135)	14.6510 (37.2135)	14.6490 (37.2085)	14.6503 (37.2118)
SaltPlate3/16-16	14.6515 (37.2148)	14.6495 (37.2097)	14.6505 (37.2123)	14.6505 (37.2123)
SaltPlate3/16-17	14.6525 (37.2174)	14.6490 (37.2085)	14.6485 (37.2072)	14.6500 (37.2110)
SaltPlate3/16-18	14.6485 (37.2072)	14.6450 (37.1983)	14.6455 (37.1996)	14.6463 (37.2017)
SaltPlate3/16-19	14.6530 (37.2186)	14.6480 (37.2059)	14.6520 (37.2161)	14.6510 (37.2135)
SaltPlate3/16-20	14.6450 (37.1983)	14.6495 (37.2097)	14.6530 (37.2186)	14.6492 (37.2089)
SaltPlate3/16-21	14.6540 (37.2212)	14.6480 (37.2059)	14.6535 (37.2199)	14.6518 (37.2157)
SaltPlate3/16-22	14.6480 (37.2059)	14.6425 (37.1920)	14.6465 (37.2021)	14.6457 (37.2000)
SaltPlate3/16-23	14.6460 (37.2008)	14.6465 (37.2021)	14.6500 (37.2110)	14.6475 (37.2047)

Table 16: Absorber plate cover dimensions via acceptance measurements performed by LANL (see Figure 11).

Part ID	Thickness, y [in (cm)]			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate3/16-1	.0971 (.2465)	.0977 (.2482)	.0975 (.2475)	.0974 (.2474)
SaltPlate3/16-2	.0972 (.2469)	.0973 (.2471)	.0976 (.2479)	.0974 (.2473)
SaltPlate3/16-3	.0974 (.2473)	.0970 (.2464)	.0973 (.2471)	.0972 (.2469)
SaltPlate3/16-4	.0972 (.2469)	.0973 (.2471)	.0971 (.2466)	.0972 (.2469)
SaltPlate3/16-5	.0974 (.2473)	.0973 (.2471)	.0972 (.2469)	.0973 (.2471)
SaltPlate3/16-6	.0977 (.2480)	.0973 (.2470)	.0974 (.2473)	.0974 (.2474)
SaltPlate3/16-7	.0972 (.2468)	.0974 (.2474)	.0976 (.2479)	.0974 (.2474)
SaltPlate3/16-8	.0977 (.2482)	.0977 (.2482)	.0977 (.2482)	.0977 (.2482)
SaltPlate3/16-9	.0973 (.2471)	.0973 (.2471)	.0970 (.2464)	.0972 (.2469)
SaltPlate3/16-10	.0972 (.2468)	.0975 (.2477)	.0973 (.2471)	.0973 (.2472)
SaltPlate3/16-11	.0972 (.2468)	.0972 (.2468)	.0970 (.2464)	.0971 (.2466)
SaltPlate3/16-12	.0974 (.2474)	.0972 (.2468)	.0974 (.2473)	.0973 (.2471)
SaltPlate3/16-13	.0974 (.2473)	.0975 (.2475)	.0974 (.2473)	.0974 (.2474)
SaltPlate3/16-14	.0977 (.2482)	.0977 (.2482)	.0971 (.2466)	.0975 (.2477)
SaltPlate3/16-15	.0968 (.2459)	.0970 (.2464)	.0969 (.2461)	.0969 (.2461)
SaltPlate3/16-16	.0973 (.2470)	.0972 (.2468)	.0976 (.2479)	.0973 (.2472)
SaltPlate3/16-17	.0971 (.2466)	.0974 (.2473)	.0972 (.2469)	.0972 (.2469)
SaltPlate3/16-18	.0978 (.2484)	.0978 (.2484)	.0978 (.2484)	.0978 (.2484)
SaltPlate3/16-19	.0971 (.2465)	.0971 (.2465)	.0971 (.2466)	.0971 (.2465)
SaltPlate3/16-20	.0973 (.2471)	.0993 (.2522)	.0967 (.2456)	.0978 (.2483)
SaltPlate3/16-21	.0972 (.2468)	.0969 (.2460)	.0971 (.2466)	.0970 (.2465)
SaltPlate3/16-22	.0975 (.2475)	.0976 (.2479)	.0972 (.2469)	.0974 (.2474)
SaltPlate3/16-23	.0974 (.2473)	.0972 (.2469)	.0972 (.2469)	.0973 (.2470)

Table 17: Assembled absorber plate thicknesses via CMM measurements performed by LANL.

Part ID	Assembled Thickness [in (cm)]			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate3/16-1	.3860 (.9804)	.3720 (.9449)	.3800 (.9652)	.3800 (.9652)
SaltPlate3/16-2	.3840 (.9754)	.3750 (.9525)	.3800 (.9652)	.3810 (.9677)
SaltPlate3/16-3	.3740 (.9500)	.3900 (.9906)	.3840 (.9754)	.3850 (.9779)
SaltPlate3/16-4	.3740 (.9500)	.3800 (.9652)	.3820 (.9703)	.3820 (.9703)
SaltPlate3/16-5	.3840 (.9754)	.3730 (.9474)	.3800 (.9652)	.3770 (.9576)
SaltPlate3/16-6	.3750 (.9525)	.3870 (.9830)	.3820 (.9703)	.3830 (.9728)
SaltPlate3/16-7	.3870 (.9830)	.3750 (.9525)	.3770 (.9576)	.3780 (.9601)
SaltPlate3/16-8	.3790 (.9627)	.3990 (1.0135)	.3820 (.9703)	.3820 (.9703)

SaltPlate3/16-9	.3890 (.9881)	.3730 (.9474)	.3850 (.9779)	.3790 (.9627)
SaltPlate3/16-10	.3730 (.9474)	.3890 (.9881)	.3790 (.9627)	.3830 (.9728)
SaltPlate3/16-11	.3890 (.9881)	.3730 (.9474)	.3820 (.9703)	.3800 (.9652)
SaltPlate3/16-12	.3740 (.9500)	.3820 (.9703)	.3840 (.9754)	.3820 (.9703)
SaltPlate3/16-13	.4000 (1.0160)	.3770 (.9576)	.3930 (.9982)	.3890 (.9881)
SaltPlate3/16-14	.3710 (.9423)	.3850 (.9779)	.3740 (.9500)	.3760 (.9550)
SaltPlate3/16-15	.3880 (.9855)	.3770 (.9576)	.3960 (1.0058)	.3850 (.9779)
SaltPlate3/16-16	.3900 (.9906)	.3740 (.9500)	.3820 (.9703)	.3820 (.9703)
SaltPlate3/16-17	.3820 (.9703)	.3910 (.9931)	.3720 (.9449)	.3800 (.9652)
SaltPlate3/16-18	.3950 (1.0033)	.3770 (.9576)	.3760 (.9550)	.3830 (.9728)
SaltPlate3/16-19	.3780 (.9601)	.3720 (.9449)	.3970 (1.0084)	.3790 (.9627)
SaltPlate3/16-20	.3890 (.9881)	.3860 (.9804)	.3720 (.9449)	.3770 (.9576)
SaltPlate3/16-21	.3800 (.9652)	.3790 (.9627)	.3840 (.9754)	.3770 (.9576)
SaltPlate3/16-22	.3810 (.9677)	.3970 (1.0084)	.3730 (.9474)	.3810 (.9677)
SaltPlate3/16-23	.3840 (.9754)	.3820 (.9703)	.3920 (.9957)	.3820 (.9703)

Table 18: Assembled absorber plate thicknesses via hand measurements performed by LANL.

Part ID	Assembled Thickness [in (cm)]		
	Measurement 1	Measurement 2	Measurement 3
SaltPlate3/16-1	.3690 (.9373)	.3720 (.9449)	.3710 (.9423)
SaltPlate3/16-2	.3710 (.9423)	.3710 (.9423)	.3730 (.9474)
SaltPlate3/16-3	.3720 (.9449)	.3700 (.9398)	.3740 (.9500)
SaltPlate3/16-4	.3710 (.9423)	.3710 (.9423)	.3710 (.9423)
SaltPlate3/16-5	.3700 (.9398)	.3700 (.9398)	.3740 (.9500)
SaltPlate3/16-6	.3720 (.9449)	.3720 (.9449)	.3730 (.9474)
SaltPlate3/16-7	.3710 (.9423)	.3730 (.9474)	.3690 (.9373)
SaltPlate3/16-8	.3730 (.9474)	.3710 (.9423)	.3720 (.9449)
SaltPlate3/16-9	.3730 (.9474)	.3700 (.9398)	.3720 (.9449)
SaltPlate3/16-10	.3730 (.9474)	.3690 (.9373)	.3730 (.9474)
SaltPlate3/16-11	.3750 (.9525)	.3710 (.9423)	.3730 (.9474)
SaltPlate3/16-12	.3730 (.9474)	.3710 (.9423)	.3740 (.9500)
SaltPlate3/16-13	.3730 (.9474)	.3710 (.9423)	.3720 (.9449)
SaltPlate3/16-14	.3700 (.9398)	.3710 (.9423)	.3700 (.9398)
SaltPlate3/16-15	.3730 (.9474)	.3700 (.9398)	.3710 (.9423)
SaltPlate3/16-16	.3730 (.9474)	.3720 (.9449)	.3710 (.9423)
SaltPlate3/16-17	.3710 (.9423)	.3710 (.9423)	.3710 (.9423)
SaltPlate3/16-18	.3740 (.9500)	.3710 (.9423)	.3720 (.9449)
SaltPlate3/16-19	.3730 (.9474)	.3710 (.9423)	.3720 (.9449)
SaltPlate3/16-20	.3730 (.9474)	.3710 (.9423)	.3720 (.9449)

SaltPlate3/16-21	.3730 (.9474)	.3720 (.9449)	.3710 (.9423)
SaltPlate3/16-22	.3720 (.9449)	.3690 (.9373)	.3730 (.9474)
SaltPlate3/16-23	.3730 (.9474)	.3700 (.9398)	.3730 (.9474)

2.1.4.2 1/4" NaCl Plates

Thirteen 1/4" NaCl salt plates were procured for this experiment. Upon receipt from the manufacturer LANL performed acceptance measurements using 6" digital calipers (calibration number: A23151184), 24" digital calipers (calibration number: 74337), outside micrometer 0-1" (calibration number: 9298165), and CMM. Masses of the plates were determined at LANL with a balance with the calibration number C032910287, at LLNL with an Ohaus PX4202/E (calibration number: 19-E8S6X-20-1), and at the DAF by LANL with a Mettler Toledo 017285 (calibration number: 012239). Table 19 and Table 20 tabulate the mass data for the empty NaCl plates and their components during acceptance from the manufacturer by LANL. Table 21 gives the masses of the filled NaCl plates immediately after filling. Table 22 gives the masses of the filled NaCl plates prior to shipping to NNSS for experimental execution. Table 23 gives the masses of the filled NaCl plates immediately following the execution of the experiments.

Dimensions of the NaCl plates determined via CMM measurements are shown in Table 24. Dimensions of the NaCl plates determined via other measurements techniques are shown in Table 25, Table 26, and Table 27. It should be noted that average values reported for CMM measurements are not the average of the individual reported measurements, but the average of all CMM data points in the data set.

Dimensions of the NaCl plate covers determined via CMM measurements are shown in Table 28. Dimensions of the NaCl plate covers determined via other measurement techniques are shown in Table 29.

The thicknesses of the assembled NaCl plate determined by CMM and hand measurements are shown in Table 30 and Table 31, respectively.

Table 19: Absorber plate component weights via acceptance measurements performed by LANL.

Part ID	Mass (g)			
	Base	Cover	Assembled (No Salt)	Screws (Difference)
SaltPlate1/4-1	1373.0	719.0	2094.3	2.30
SaltPlate1/4-2	1374.4	721.5	2098.4	2.50
SaltPlate1/4-3	1388.3	722.0	2112.5	2.20
SaltPlate1/4-4	1383.9	722.1	2107.9	1.90
SaltPlate1/4-5	1390.1	722.0	2114.4	2.30
SaltPlate1/4-6	1384.6	721.7	2108.5	2.20
SaltPlate1/4-7	1402.0	722.7	2126.8	2.10
SaltPlate1/4-8	1385.6	721.0	2108.8	2.20
SaltPlate1/4-9	1392.9	722.7	2118.0	2.40

SaltPlate1/4-10	1390.9	722.6	2115.9	2.40
SaltPlate1/4-11	1383.1	722.0	2107.3	2.20
SaltPlate1/4-12	1386.7	720.9	2109.7	2.10
SaltPlate1/4-13	1385.1	721.4	2108.9	2.40

Table 20: Absorber plate weights without salt via acceptance measurements performed by LANL.

Part ID	Mass of Empty Vessel (g)			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate1/4-1	2094.8	2094.8	2094.8	2094.81
SaltPlate1/4-2	2098.9	2098.9	2098.9	2098.91
SaltPlate1/4-3	2113.1	2113.1	2113.1	2113.12
SaltPlate1/4-4	2108.8	2108.8	2108.8	2108.76
SaltPlate1/4-5	2115.1	2115.1	2115.1	2115.12
SaltPlate1/4-6	2109.1	2109.1	2109.1	2109.10
SaltPlate1/4-7	2127.4	2127.4	2127.4	2127.43
SaltPlate1/4-8	2109.3	2109.3	2109.3	2109.29
SaltPlate1/4-9	2118.5	2118.5	2118.5	2118.51
SaltPlate1/4-10	2116.3	2116.3	2116.3	2116.31
SaltPlate1/4-11	2107.8	2107.8	2107.8	2107.79
SaltPlate1/4-12	2110.3	2110.2	2110.3	2110.25
SaltPlate1/4-13	2109.4	2109.4	2109.4	2109.44

Table 21: Absorber plate weights with salt immediately after being filled.

Part ID	Initial Filled Mass (g)				
	Date	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate1/4-1	May 21, 2024	2751.3	2751.3	2751.3	2751.26
SaltPlate1/4-2	May 21, 2024	2761.0	2760.9	2760.9	2760.94
SaltPlate1/4-3	May 21, 2024	2773.5	2773.5	2773.4	2773.45
SaltPlate1/4-4	May 21, 2024	2764.8	2764.8	2764.8	2764.83
SaltPlate1/4-5	May 21, 2024	2761.7	2761.7	2761.7	2761.72
SaltPlate1/4-6	May 22, 2024	2764.8	2764.8	2764.8	2764.80
SaltPlate1/4-7	May 22, 2024	2781.2	2781.2	2781.2	2781.18
SaltPlate1/4-8	May 23, 2024	2762.1	2762.1	2762.1	2762.13
SaltPlate1/4-9	May 23, 2024	2777.9	2777.9	2777.9	2777.86
SaltPlate1/4-10	May 23, 2024	2793.2	2793.2	2793.2	2793.19
SaltPlate1/4-11	May 23, 2024	2774.5	2774.5	2774.5	2774.52
SaltPlate1/4-12	May 23, 2024	2790.1	2790.1	2790.1	2790.07
SaltPlate1/4-13	May 24, 2024	2783.2	2783.2	2783.2	2783.22

Table 22: Absorber plate weights with salt prior to being shipped to NNSS.

Part ID	Pre-Shipment Mass (g)				
	Date	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate1/4-1	May 31, 2024	2751.3	2751.2	2751.3	2751.28
SaltPlate1/4-2	May 31, 2024	2760.9	2761.0	2761.0	2760.94
SaltPlate1/4-3	May 31, 2024	2773.4	2773.3	2773.4	2773.37
SaltPlate1/4-4	May 31, 2024	2764.9	2764.9	2764.8	2764.84
SaltPlate1/4-5	May 31, 2024	2761.5	2761.6	2761.8	2761.62
SaltPlate1/4-6	May 31, 2024	2763.9	2763.9	2763.8	2763.83
SaltPlate1/4-7	May 31, 2024	2781.3	2781.3	2781.3	2781.29
SaltPlate1/4-8	May 31, 2024	2762.2	2762.2	2762.2	2762.20
SaltPlate1/4-9	May 31, 2024	2778.0	2778.0	2777.9	2777.97
SaltPlate1/4-10	May 31, 2024	2793.2	2793.2	2793.1	2793.17
SaltPlate1/4-11	May 31, 2024	2774.6	2774.6	2774.7	2774.60
SaltPlate1/4-12	May 31, 2024	2790.2	2790.2	2790.2	2790.16
SaltPlate1/4-13	May 31, 2024	2783.5	2783.4	2783.3	2783.39

Table 23: Absorber plate weights with salt immediately after execution of the experiment.

Part ID	Post Experiment Mass (g)	
	Date	Measurement
SaltPlate1/4-1	August 5, 2024	-
SaltPlate1/4-2	August 5, 2024	2760.1
SaltPlate1/4-3	August 5, 2024	2772.6
SaltPlate1/4-4	August 5, 2024	2764.0
SaltPlate1/4-5	August 5, 2024	2760.8
SaltPlate1/4-6	August 5, 2024	-
SaltPlate1/4-7	August 5, 2024	2780.3
SaltPlate1/4-8	August 5, 2024	2761.3
SaltPlate1/4-9	August 5, 2024	2777.0
SaltPlate1/4-10	August 5, 2024	-
SaltPlate1/4-11	August 5, 2024	-
SaltPlate1/4-12	August 5, 2024	-
SaltPlate1/4-13	August 5, 2024	-

Table 24: Absorber plate base dimensions via acceptance measurements with a CMM performed by LANL (see Figure 10).

Part ID	Inner Diameter, c [in (cm)]	Outer Diameter, a [in (cm)]	Pocket Depth, d [in (cm)]				Bottom Thickness, e-d [in (cm)]
			Measurement 1	Measurement 2	Measurement 3	Average	
SaltPlate1/4-1	11.9970 (30.4724)	15.0040 (38.1102)	.2480 (.6299)	.2460 (.6248)	.2460 (.6248)	.2440 (.6198)	.1000 (.2540)
SaltPlate1/4-2	11.9960 (30.4698)	15.0000 (38.1000)	.2470 (.6274)	.2460 (.6248)	.2460 (.6248)	.2540 (.6452)	.0910 (.2311)
SaltPlate1/4-3	12.0000 (30.4800)	14.9970 (38.0924)	.2480 (.6299)	.2480 (.6299)	.2480 (.6299)	.2570 (.6528)	.0920 (.2337)
SaltPlate1/4-4	12.0000 (30.4800)	14.9980 (38.0949)	.2480 (.6299)	.2470 (.6274)	.2460 (.6248)	.2550 (.6477)	.0930 (.2362)
SaltPlate1/4-5	12.0000 (30.4800)	14.9960 (38.0898)	.2480 (.6299)	.2480 (.6299)	.2460 (.6248)	.2510 (.6375)	.0910 (.2311)
SaltPlate1/4-6	12.0000 (30.4800)	14.9960 (38.0898)	.2470 (.6274)	.2470 (.6274)	.2470 (.6274)	.2540 (.6452)	.0930 (.2362)
SaltPlate1/4-7	12.0000 (30.4800)	14.9970 (38.0924)	.2480 (.6299)	.2460 (.6248)	.2470 (.6274)	.2510 (.6375)	.0910 (.2311)
SaltPlate1/4-8	12.0000 (30.4800)	14.9970 (38.0924)	.2480 (.6299)	.2470 (.6274)	.2480 (.6299)	.2530 (.6426)	.0920 (.2337)
SaltPlate1/4-9	12.0000 (30.4800)	14.9970 (38.0924)	.2480 (.6299)	.2490 (.6325)	.2480 (.6299)	.2560 (.6502)	.0930 (.2362)
SaltPlate1/4-10	12.0000 (30.4800)	14.9980 (38.0949)	.2490 (.6325)	.2480 (.6299)	.2480 (.6299)	.2560 (.6502)	.0930 (.2362)
SaltPlate1/4-11	12.0000 (30.4800)	14.9980 (38.0949)	.2480 (.6299)	.2480 (.6299)	.2480 (.6299)	.2520 (.6401)	.0910 (.2311)
SaltPlate1/4-12	12.0000 (30.4800)	14.9980 (38.0949)	.2480 (.6299)	.2480 (.6299)	.2490 (.6325)	.2550 (.6477)	.0940 (.2388)
SaltPlate1/4-13	11.9990 (30.4775)	14.9990 (38.0975)	.2490 (.6325)	.2490 (.6325)	.2480 (.6299)	.2520 (.6401)	.0950 (.2413)

Table 25: Absorber plate base dimensions via acceptance measurements performed by LANL (see Figure 10).

Part ID	Lip Inner Diameter, b [in (cm)]			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate1/4-1	14.7655 (37.5044)	14.7650 (37.5031)	14.7670 (37.5082)	14.7658 (37.5052)
SaltPlate1/4-2	14.7665 (37.5069)	14.7665 (37.5069)	14.7665 (37.5069)	14.7665 (37.5069)
SaltPlate1/4-3	14.7690 (37.5133)	14.7720 (37.5209)	14.7670 (37.5082)	14.7693 (37.5141)
SaltPlate1/4-4	14.7675 (37.5095)	14.7665 (37.5069)	14.7720 (37.5209)	14.7687 (37.5124)
SaltPlate1/4-5	14.7630 (37.4980)	14.7470 (37.4574)	14.7705 (37.5171)	14.7602 (37.4908)
SaltPlate1/4-6	14.7670 (37.5082)	14.7700 (37.5158)	14.7675 (37.5095)	14.7682 (37.5111)
SaltPlate1/4-7	14.7655 (37.5044)	14.7685 (37.5120)	14.7655 (37.5044)	14.7665 (37.5069)
SaltPlate1/4-8	14.7630 (37.4980)	14.7685 (37.5120)	14.7665 (37.5069)	14.7660 (37.5056)
SaltPlate1/4-9	14.7650 (37.5031)	14.7645 (37.5018)	14.7660 (37.5056)	14.7652 (37.5035)
SaltPlate1/4-10	14.7605 (37.4917)	14.7705 (37.5171)	14.7690 (37.5133)	14.7667 (37.5073)
SaltPlate1/4-11	14.7695 (37.5145)	14.7685 (37.5120)	14.7630 (37.4980)	14.7670 (37.5082)

SaltPlate1/4-12	14.7665 (37.5069)	14.7620 (37.4955)	14.7585 (37.4866)	14.7623 (37.4963)
SaltPlate1/4-13	14.7620 (37.4955)	14.7608 (37.4924)	14.7645 (37.5018)	14.7624 (37.4966)

Table 26: Absorber plate base dimensions via acceptance measurements performed by LANL (see Figure 10).

Part ID	Bottom Thickness, e-d [in (cm)]			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate1/4-1	.3350 (.8509)	.3362 (.8539)	.3344 (.8494)	.3352 (.8514)
SaltPlate1/4-2	.3366 (.8548)	.3345 (.8496)	.3341 (.8485)	.3350 (.8510)
SaltPlate1/4-3	.3338 (.8477)	.3365 (.8547)	.3397 (.8628)	.3367 (.8551)
SaltPlate1/4-4	.3372 (.8564)	.3375 (.8573)	.3365 (.8546)	.3370 (.8561)
SaltPlate1/4-5	.3370 (.8560)	.3388 (.8606)	.3380 (.8585)	.3379 (.8584)
SaltPlate1/4-6	.3355 (.8522)	.3376 (.8575)	.3367 (.8551)	.3366 (.8549)
SaltPlate1/4-7	.3369 (.8557)	.3364 (.8545)	.3397 (.8628)	.3377 (.8577)
SaltPlate1/4-8	.3354 (.8519)	.3385 (.8598)	.3370 (.8560)	.3370 (.8559)
SaltPlate1/4-9	.3372 (.8565)	.3364 (.8545)	.3383 (.8593)	.3373 (.8567)
SaltPlate1/4-10	.3388 (.8606)	.3355 (.8522)	.3360 (.8534)	.3368 (.8554)
SaltPlate1/4-11	.3345 (.8496)	.3351 (.8512)	.3360 (.8534)	.3352 (.8514)
SaltPlate1/4-12	.3334 (.8468)	.3368 (.8555)	.3379 (.8583)	.3360 (.8535)
SaltPlate1/4-13	.3358 (.8529)	.3355 (.8522)	.3367 (.8552)	.3360 (.8534)

Table 27: Absorber plate base dimensions via acceptance measurements performed by LANL (see Figure 10).

Part ID	Pocket Depth, d [in (cm)]			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate1/4-1	.2460 (.6248)	.2555 (.6490)	.2480 (.6299)	.2498 (.6346)
SaltPlate1/4-2	.2475 (.6287)	.2470 (.6274)	.2500 (.6350)	.2482 (.6303)
SaltPlate1/4-3	.2505 (.6363)	.2495 (.6337)	.2520 (.6401)	.2507 (.6367)
SaltPlate1/4-4	.2530 (.6426)	.2505 (.6363)	.2520 (.6401)	.2518 (.6397)
SaltPlate1/4-5	.2505 (.6363)	.2490 (.6325)	.2500 (.6350)	.2498 (.6346)
SaltPlate1/4-6	.2470 (.6274)	.2470 (.6274)	.2540 (.6452)	.2493 (.6333)
SaltPlate1/4-7	.2445 (.6210)	.2495 (.6337)	.2510 (.6375)	.2483 (.6308)
SaltPlate1/4-8	.2455 (.6236)	.2490 (.6325)	.2475 (.6287)	.2473 (.6282)
SaltPlate1/4-9	.2490 (.6325)	.2500 (.6350)	.2485 (.6312)	.2492 (.6329)
SaltPlate1/4-10	.2540 (.6452)	.2500 (.6350)	.2505 (.6363)	.2515 (.6388)
SaltPlate1/4-11	.2490 (.6325)	.2490 (.6325)	.2495 (.6337)	.2492 (.6329)
SaltPlate1/4-12	.2505 (.6363)	.2500 (.6350)	.2500 (.6350)	.2502 (.6354)
SaltPlate1/4-13	.2480 (.6299)	.2485 (.6312)	.2490 (.6325)	.2485 (.6312)

Table 28: Absorber plate cover dimensions via CMM measurements performed by LANL (see Figure 11).

Part ID	Diameter, x [in (cm)]	Average Thickness, y [in (cm)]
SaltPlate3/16-1	14.6510 (37.2135)	.0980 (.2489)
SaltPlate3/16-2	14.6470 (37.2034)	.0980 (.2489)
SaltPlate3/16-3	14.6480 (37.2059)	.0980 (.2489)
SaltPlate3/16-4	14.6480 (37.2059)	.0980 (.2489)
SaltPlate3/16-5	14.6470 (37.2034)	.0990 (.2515)
SaltPlate3/16-6	14.6430 (37.1932)	.0990 (.2515)
SaltPlate3/16-7	14.6460 (37.2008)	.1000 (.2540)
SaltPlate3/16-8	14.6410 (37.1881)	.1000 (.2540)
SaltPlate3/16-9	14.6470 (37.2034)	.0990 (.2515)
SaltPlate3/16-10	14.6480 (37.2059)	.0990 (.2515)
SaltPlate3/16-11	14.6470 (37.2034)	.0990 (.2515)
SaltPlate3/16-12	14.6420 (37.1907)	.0990 (.2515)
SaltPlate3/16-13	14.6470 (37.2034)	.0990 (.2515)

Table 29: Absorber plate cover dimensions via acceptance measurements performed by LANL (see Figure 11).

Part ID	Diameter, x [in (cm)]			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate3/16-1	14.6415 (37.1894)	14.6535 (37.2199)	14.6480 (37.2059)	14.6477 (37.2051)
SaltPlate3/16-2	14.6500 (37.2110)	14.6435 (37.1945)	14.6485 (37.2072)	14.6473 (37.2042)
SaltPlate3/16-3	14.6500 (37.2110)	14.6495 (37.2097)	14.6480 (37.2059)	14.6492 (37.2089)
SaltPlate3/16-4	14.6490 (37.2085)	14.6495 (37.2097)	14.6445 (37.1970)	14.6477 (37.2051)
SaltPlate3/16-5	14.6425 (37.1920)	14.6465 (37.2021)	14.6500 (37.2110)	14.6463 (37.2017)
SaltPlate3/16-6	14.6480 (37.2059)	14.6430 (37.1932)	14.6470 (37.2034)	14.6460 (37.2008)
SaltPlate3/16-7	14.6470 (37.2034)	14.6485 (37.2072)	14.6445 (37.1970)	14.6467 (37.2025)
SaltPlate3/16-8	14.6425 (37.1920)	14.6405 (37.1869)	14.6390 (37.1831)	14.6407 (37.1873)
SaltPlate3/16-9	14.6440 (37.1958)	14.6530 (37.2186)	14.6450 (37.1983)	14.6473 (37.2042)
SaltPlate3/16-10	14.6400 (37.1856)	14.6440 (37.1958)	14.6435 (37.1945)	14.6425 (37.1920)
SaltPlate3/16-11	14.6780 (37.2821)	14.6445 (37.1970)	16.6475 (42.2847)	15.3233 (38.9213)
SaltPlate3/16-12	14.6350 (37.1729)	14.6385 (37.1818)	14.6460 (37.2008)	14.6398 (37.1852)
SaltPlate3/16-13	14.6450 (37.1983)	14.6435 (37.1945)	14.6500 (37.2110)	14.6462 (37.2013)

Table 30: Assembled absorber plate thicknesses via CMM measurements performed by LANL.

Part ID	Assembled Thickness [in (cm)]			
	Measurement 1	Measurement 2	Measurement 3	Average
SaltPlate1/4-1	.4320 (1.0973)	.4540 (1.1532)	.4420 (1.1227)	.4420 (1.1227)
SaltPlate1/4-2	.4320 (1.0973)	.4510 (1.1455)	.4460 (1.1328)	.4400 (1.1176)
SaltPlate1/4-3	.4340 (1.1024)	.4510 (1.1455)	.4480 (1.1379)	.4420 (1.1227)
SaltPlate1/4-4	.4330 (1.0998)	.4510 (1.1455)	.4520 (1.1481)	.4430 (1.1252)
SaltPlate1/4-5	.4340 (1.1024)	.4430 (1.1252)	.4450 (1.1303)	.4380 (1.1125)
SaltPlate1/4-6	.4400 (1.1176)	.4470 (1.1354)	.4500 (1.1430)	.4400 (1.1176)
SaltPlate1/4-7	.4390 (1.1151)	.4360 (1.1074)	.4400 (1.1176)	.4390 (1.1151)
SaltPlate1/4-8	.4480 (1.1379)	.4360 (1.1074)	.4460 (1.1328)	.4400 (1.1176)
SaltPlate1/4-9	.4510 (1.1455)	.4360 (1.1074)	.4430 (1.1252)	.4420 (1.1227)
SaltPlate1/4-10	.4470 (1.1354)	.4410 (1.1201)	.4530 (1.1506)	.4430 (1.1252)
SaltPlate1/4-11	.4460 (1.1328)	.4340 (1.1024)	.4390 (1.1151)	.4380 (1.1125)
SaltPlate1/4-12	.4520 (1.1481)	.4350 (1.1049)	.4440 (1.1278)	.4420 (1.1227)
SaltPlate1/4-13	.4340 (1.1024)	.4560 (1.1582)	.4500 (1.1430)	.4450 (1.1303)

Table 31: Assembled absorber plate thicknesses via hand measurements performed by LANL.

Part ID	Assembled Thickness [in (cm)]		
	Measurement 1	Measurement 2	Measurement 3
SaltPlate1/4-1	.4320 (1.0973)	.4290 (1.0897)	.4320 (1.0973)
SaltPlate1/4-2	.4330 (1.0998)	.4290 (1.0897)	.4350 (1.1049)
SaltPlate1/4-3	.4350 (1.1049)	.4330 (1.0998)	.4330 (1.0998)
SaltPlate1/4-4	.4340 (1.1024)	.4300 (1.0922)	.4330 (1.0998)
SaltPlate1/4-5	.4350 (1.1049)	.4320 (1.0973)	.4340 (1.1024)
SaltPlate1/4-6	.4350 (1.1049)	.4330 (1.0998)	.4330 (1.0998)
SaltPlate1/4-7	.4350 (1.1049)	.4360 (1.1074)	.4330 (1.0998)
SaltPlate1/4-8	.4360 (1.1074)	.4340 (1.1024)	.4300 (1.0922)
SaltPlate1/4-9	.4360 (1.1074)	.4340 (1.1024)	.4330 (1.0998)
SaltPlate1/4-10	.4360 (1.1074)	.4350 (1.1049)	.4330 (1.0998)
SaltPlate1/4-11	.4330 (1.0998)	.4350 (1.1049)	.4350 (1.1049)
SaltPlate1/4-12	.4360 (1.1074)	.4320 (1.0973)	.4330 (1.0998)
SaltPlate1/4-13	.4360 (1.1074)	.4340 (1.1024)	.4330 (1.0998)

2.1.5 High-Density Polyethylene Parts

The HDPE parts include moderator (MOD) plates, reflector (REF) plates, a bottom reflector (BOTREF), reflector rings (RING) and caps (CAP,BOTCAP). Figure 13 shows a diagram of how these parts fit together. The moderator plates are interstitial to the core stack while all other parts are used to create a nominal 1-inch (2.54 cm) reflector surrounding the core stack. The bottom reflector, reflector rings, and reflector caps include step joints, allowing the parts to easily mate while also reducing neutron streaming paths. As shown in the figure, the BOTCAP and 0-CAP parts are used to fill in the step joints to complete the reflectors.

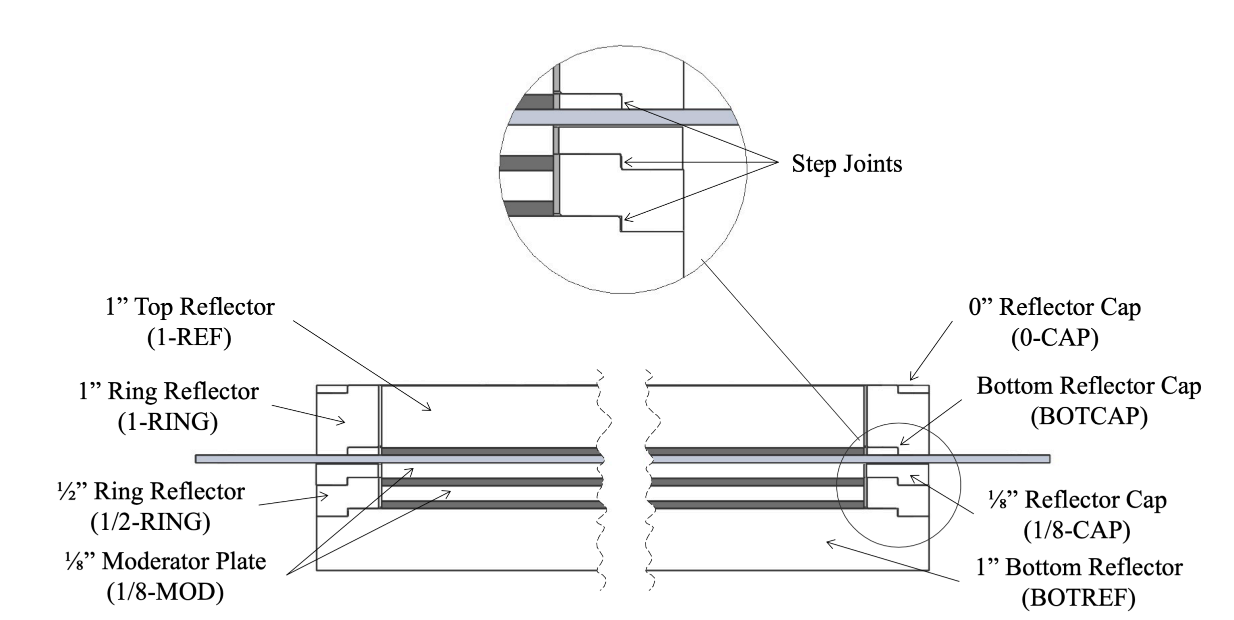

Figure 13: Diagram of the HDPE parts.

All parts from the TEX-HEU or TEX-Hf campaigns were weighed and measured, using a CMM, by LLNL’s dimensional inspection laboratory prior to the experiment. The dimensional measurements performed by the CMM report minimum, maximum, and average values for the diameter and a single value for the thicknesses. Similar measurements were performed by LANL for all parts procured for this experiment.

2.1.5.1 Moderator and Reflector Plates

The HDPE moderator and reflector plates are cylindrical with varying thicknesses and a nominal diameter of 15 in (38.1 cm). Figure 14 shows a drawing of the nominal moderator and reflector plate dimensions and Table 32 tabulates the nominal dimensions of the reflector and moderator plates used in the experiment.

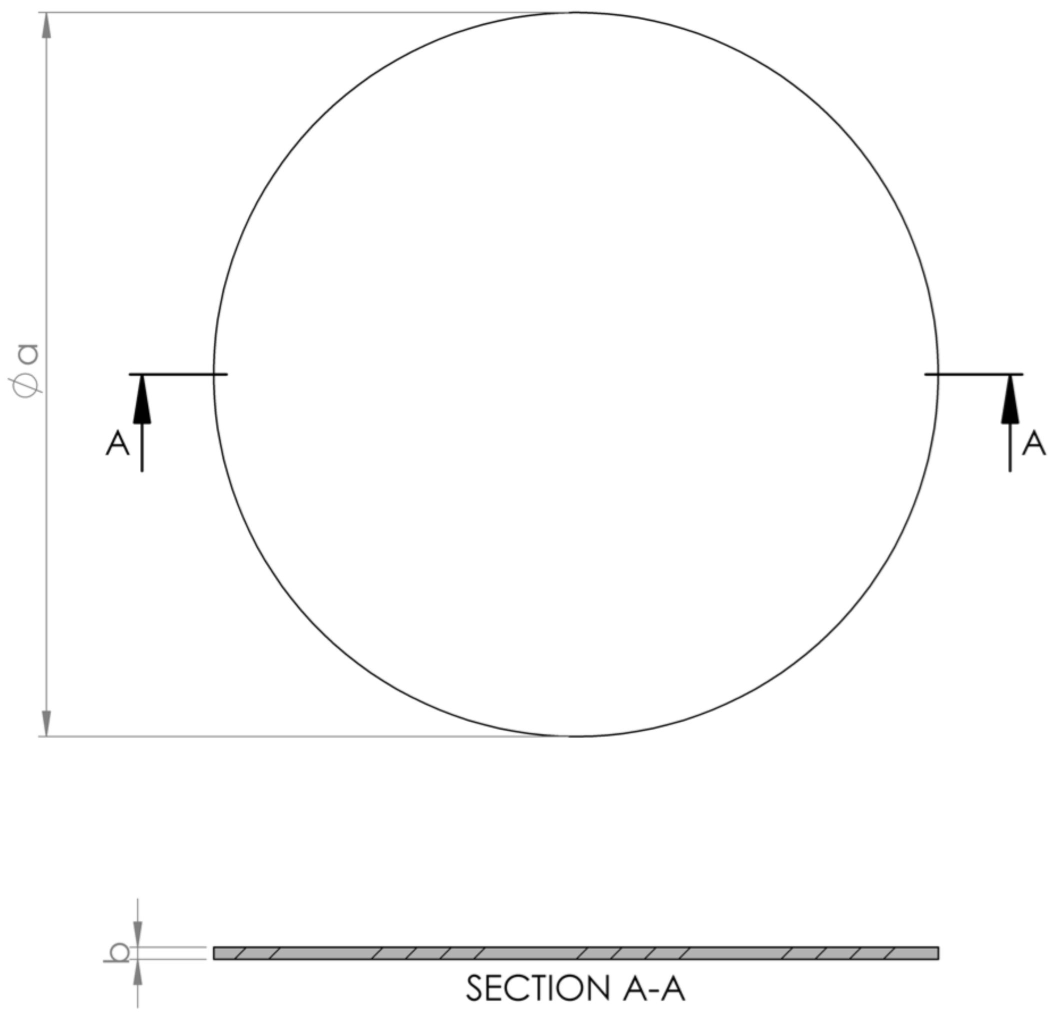

Figure 14: Drawing of the polyethylene moderator and reflector plates.

Table 32: Polyethylene moderator and reflector plate nominal dimension (see Figure 14).

Part Type	Thickness, b [in (cm)]	Diameter, a [in (cm)]
1/8-MOD	0.125 ± 0.005 (0.3175 ± 0.0127)	15.000 ± 0.010 (38.1000 ± 0.0254)
1/4-MOD	0.250 ± 0.005 (0.6350 ± 0.0127)	
1/2-MOD	0.500 ± 0.005 (1.2700 ± 0.0127)	
3/4-MOD	0.750 ± 0.005 (1.9050 ± 0.0127)	15.000 ± 0.005 (38.1000 ± 0.0127)
1.5-MOD	1.500 ± 0.005	15.000 ± 0.010

Part Type	Thickness, b [in (cm)]	Diameter, a [in (cm)]
	(3.8100 ± 0.0127)	(38.1000 ± 0.0254)
1/16-REF	0.0625 ± 0.005 (0.15875 ± 0.0127)	
1-REF	1.000 ± 0.005 (2.54 ± 0.0127)	

A set of new moderator plates, with the same diameter as those of TEX-HEU (15 in OD), were procured for this experiment with thicknesses of 1 in, 7/8 in, 3/4 in, and 1/2 in, however only the 3/4-inch plates were utilized.

Tables Table 33, Table 34, Table 35, Table 36, Table 37 and Table 38 report the mass and dimension measurements taken for all of the moderator and reflector plates. The 3/4-MOD parts were procured specifically for the TEX-Cl experiment and were measured by LANL using a CMM and have values reported in a different format, namely that the diameter is directly measured instead of a min and max.

Table 33: Mass and dimension measurements of the 1/8-MOD parts (see Figure 14).

Part ID	Mass (g)	Thickness, b [in (cm)]	Diameter, a [in (cm)]		
			Min	Max	Average
1/8-MOD-1	343.0	0.1249 (.3172)	14.9894	14.9979	14.9948 (38.0868)
1/8-MOD-2	342.1	0.1259 (.3198)	14.9895	14.9991	14.9947 (38.0865)
1/8-MOD-3	344.0	0.1253 (.3183)	14.9894	14.9993	14.995 (38.0873)
1/8-MOD-4	344.3	0.1251 (.3178)	14.9878	14.9999	14.9944 (38.0858)
1/8-MOD-5	343.0	0.1246 (.3165)	14.9913	14.9995	14.9955 (38.0886)
1/8-MOD-6	344.7	0.1255 (.3188)	14.9934	15.0018	14.9965 (38.0911)
1/8-MOD-7	345.0	0.1248 (.3170)	14.9908	15.0017	14.9959 (38.0896)
1/8-MOD-8	345.2	0.1251 (.3178)	14.9901	15.0003	14.9956 (38.0888)
1/8-MOD-9	343.4	0.1248 (.3170)	14.9885	14.9969	14.994 (38.0848)
1/8-MOD-10	343.5	0.1266 (.3216)	14.9904	15.0004	14.9962 (38.0903)
1/8-MOD-11	343.2	0.1249 (.3172)	14.9901	14.9998	14.9954 (38.0883)
1/8-MOD-12	344.6	0.1264 (.3211)	14.9876	15.0001	14.9951 (38.0876)
1/8-MOD-13	343.9	0.125 (.3175)	14.9895	15.0002	14.9945 (38.0860)
1/8-MOD-14	345.4	0.1259 (.3198)	14.9908	15.0006	14.9964 (38.0909)
1/8-MOD-15	345.3	0.1256 (.3190)	14.9927	14.9986	14.9961 (38.0901)
1/8-MOD-16	343.8	0.1247 (.3167)	14.9931	15.0005	14.9972 (38.0929)
1/8-MOD-17	344.0	0.1253 (.3183)	14.9921	14.9991	14.9957 (38.0891)
1/8-MOD-18	344.7	0.1255 (.3188)	14.9917	15.0000	14.9964 (38.0909)
1/8-MOD-19	350.8	0.1275 (.3239)	14.9917	15.0013	14.9967 (38.0916)

1/8-MOD-20	350.2	0.128 (.3251)	14.9888	14.9980	14.9943 (38.0855)
1/8-MOD-21	350.6	0.1285 (.3264)	14.9893	14.9995	14.9953 (38.0881)
1/8-MOD-22	351.0	0.1274 (.3236)	14.9905	15.0001	14.9961 (38.0901)
1/8-MOD-23	351.4	0.1274 (.3236)	14.9899	14.9998	14.9955 (38.0886)
1/8-MOD-24	351.4	0.1271 (.3228)	14.9916	14.9987	14.9958 (38.0893)
1/8-MOD-25	349.4	0.1268 (.3221)	14.9903	14.9995	14.9951 (38.0876)
1/8-MOD-26	351.9	0.1269 (.3223)	14.9919	15.0000	14.9957 (38.0891)
1/8-MOD-27	349.3	0.1263 (.3208)	14.9937	15.0004	14.9965 (38.0911)
1/8-MOD-28	349.3	0.1272 (.3231)	14.9922	15.0015	14.9974 (38.0934)
1/8-MOD-29	347.9	0.1314 (.3338)	14.9894	14.9999	14.9957 (38.0891)
1/8-MOD-30	348.3	0.1283 (.3259)	14.9908	15.0003	14.995 (38.0873)
1/8-MOD-31	351.1	0.1268 (.3221)	14.9886	14.9990	14.9953 (38.0881)
1/8-MOD-32	348.8	0.127 (.3226)	14.9890	14.9992	14.9952 (38.0878)
1/8-MOD-33	350.0	0.1271 (.3228)	14.9892	14.9990	14.9948 (38.0868)
1/8-MOD-34	351.3	0.1277 (.3244)	14.9880	14.9979	14.9942 (38.0853)
1/8-MOD-35	351.2	0.1288 (.3272)	14.9909	14.9984	14.9957 (38.0891)
1/8-MOD-36	348.3	0.1306 (.3317)	14.9908	15.0015	14.9965 (38.0911)
1/8-MOD-37	347.3	0.1293 (.3284)	14.9922	15.0009	14.9963 (38.0906)
1/8-MOD-38	351.1	0.1321 (.3355)	14.9923	15.0008	14.9973 (38.0931)
1/8-MOD-39	350.5	0.1276 (.3241)	14.9864	15.0007	14.9946 (38.0863)

Table 34: Mass and dimension measurements of the 1/4-MOD parts (see Figure 14).

Part ID	Mass (g)	Thickness, b [in (cm)]	Diameter, a [in (cm)]		
			Min	Max	Average
1/4-MOD-1	690.2	0.2512 (.6380)	14.9835	14.9910	14.9879 (38.0693)
1/4-MOD-2	689.1	0.2532 (.6431)	14.9821	14.9912	14.9866 (38.0660)
1/4-MOD-3	688.0	0.2497 (.6342)	14.9804	14.9915	14.9853 (38.0627)
1/4-MOD-4	689.7	0.2558 (.6497)	14.9824	14.9903	14.9868 (38.0665)
1/4-MOD-5	689.2	0.2555 (.6490)	14.9822	14.9923	14.9869 (38.0667)
1/4-MOD-6	687.5	0.2539 (.6449)	14.9806	14.9909	14.9862 (38.0649)
1/4-MOD-7	688.4	0.2531 (.6429)	14.9792	14.9872	14.9843 (38.0601)
1/4-MOD-8	689.2	0.2524 (.6411)	14.9786	14.9903	14.9855 (38.0632)
1/4-MOD-9	688.8	0.254 (.6452)	14.9850	14.9913	14.9883 (38.0703)
1/4-MOD-10	689.5	0.2514 (.6386)	14.9792	14.9887	14.9844 (38.0604)
1/4-MOD-11	688.1	0.2499 (.6347)	14.9790	14.9885	14.9849 (38.0616)
1/4-MOD-12	688.5	0.2516 (.6391)	14.9842	14.9909	14.9872 (38.0675)
1/4-MOD-13	689.4	0.2511 (.6378)	14.9806	14.9899	14.9864 (38.0655)
1/4-MOD-14	689.5	0.2507 (.6368)	14.9803	14.9897	14.9858 (38.0639)

1/4-MOD-15	689.1	0.2515 (.6388)	14.9806	14.9893	14.9858 (38.0639)
1/4-MOD-16	688.2	0.2532 (.6431)	14.9815	14.9924	14.9872 (38.0675)
1/4-MOD-17	687.6	0.2605 (.6617)	14.9796	14.9899	14.9851 (38.0622)
1/4-MOD-18	688.9	0.253 (.6426)	14.9812	14.9898	14.9859 (38.0642)
1/4-MOD-19	688.2	0.2547 (.6469)	14.9769	14.9887	14.9838 (38.0589)
1/4-MOD-20	688.7	0.2599 (.6601)	14.9814	14.9890	14.986 (38.0644)
1/4-MOD-21	686.9	0.26 (.6604)	14.9804	14.9877	14.984 (38.0594)
1/4-MOD-22	688.2	0.2605 (.6617)	14.9817	14.9889	14.9851 (38.0622)
1/4-MOD-23	688.0	0.2499 (.6347)	14.9775	14.9879	14.9841 (38.0596)
1/4-MOD-24	688.3	0.2528 (.6421)	14.9810	14.9878	14.9854 (38.0629)
1/4-MOD-25	687.6	0.2525 (.6414)	14.9800	14.9903	14.9849 (38.0616)
1/4-MOD-26	688.4	0.2542 (.6457)	14.9812	14.9907	14.986 (38.0644)
1/4-MOD-27	687.9	0.2574 (.6538)	14.9803	14.9881	14.9849 (38.0616)
1/4-MOD-28	687.9	0.2595 (.6591)	14.9820	14.9887	14.9857 (38.0637)
1/4-MOD-29	688.0	0.2621 (.6657)	14.9830	14.9924	14.9864 (38.0655)
1/4-MOD-30	688.3	0.2594 (.6589)	14.9837	14.9914	14.987 (38.0670)
1/4-MOD-31	688.2	0.2515 (.6388)	14.9821	14.9892	14.9861 (38.0647)
1/4-MOD-32	688.2	0.2509 (.6373)	14.9807	14.9910	14.9859 (38.0642)
1/4-MOD-33	688.3	0.2511 (.6378)	14.9815	14.9922	14.9871 (38.0672)
1/4-MOD-34	687.7	0.2581 (.6556)	14.9810	14.9887	14.9849 (38.0616)
1/4-MOD-35	688.2	0.2583 (.6561)	14.9830	14.9918	14.9879 (38.0693)
1/4-MOD-36	688.1	0.2576 (.6543)	14.9833	14.9900	14.9875 (38.0683)

Table 35: Mass and dimension measurements of the 1/2-MOD parts (see Figure 14).

Part ID	Mass (g)	Thickness, b [in (cm)]	Diameter, a [in (cm)]		
			Min	Max	Average
1/2-MOD-1	1377.9	0.5079 (1.2901)	14.9884	14.9953	14.9925 (38.0810)
1/2-MOD-2	1377.8	0.5047 (1.2819)	14.9866	14.9957	14.9909 (38.0769)
1/2-MOD-3	1385.0	0.5095 (1.2941)	14.9880	14.9951	14.9914 (38.0782)
1/2-MOD-4	1378.1	0.5044 (1.2812)	14.9877	14.9974	14.9926 (38.0812)
1/2-MOD-5	1380.2	0.5033 (1.2784)	14.9882	14.9950	14.9913 (38.0779)
1/2-MOD-6	1378.2	0.5003 (1.2708)	14.9870	14.9955	14.991 (38.0771)
1/2-MOD-7	1383.7	0.5068 (1.2873)	14.9882	14.9963	14.9917 (38.0789)
1/2-MOD-8	1386.3	0.5047 (1.2819)	14.9854	14.9925	14.9888 (38.0716)
1/2-MOD-9	1385.4	0.5035 (1.2789)	14.9867	14.9912	14.9888 (38.0716)
1/2-MOD-10	1379.6	0.5045 (1.2814)	14.9861	14.9939	14.989 (38.0721)
1/2-MOD-11	1384.5	0.5068 (1.2873)	14.9849	14.9937	14.9889 (38.0718)
1/2-MOD-12	1376.8	0.5005 (1.2713)	14.9867	14.9937	14.9901 (38.0749)

1/2-MOD-13	1385.5	0.5061 (1.2855)	14.9900	14.9961	14.9923 (38.0804)
1/2-MOD-14	1378.1	0.5079 (1.2901)	14.9841	14.9947	14.9884 (38.0705)
1/2-MOD-15	1381.5	0.506 (1.2852)	14.9839	14.9936	14.9896 (38.0736)
1/2-MOD-16	1378.8	0.5063 (1.2860)	14.9848	14.9943	14.9891 (38.0723)
1/2-MOD-17	1378.8	0.5075 (1.2891)	14.9856	14.9942	14.9886 (38.0710)
1/2-MOD-18	1384.9	0.5127 (1.3023)	14.9840	14.9949	14.9892 (38.0726)
1/2-MOD-19	1380.5	0.5105 (1.2967)	14.9825	14.9922	14.9871 (38.0672)
1/2-MOD-20	1378.2	0.5016 (1.2741)	14.9862	14.9924	14.9893 (38.0728)
1/2-MOD-21	1379.3	0.5005 (1.2713)	14.9867	14.9921	14.9896 (38.0736)
1/2-MOD-22	1377.0	0.503 (1.2776)	14.9858	14.9925	14.9888 (38.0716)
1/2-MOD-23	1385.3	0.5104 (1.2964)	14.9858	14.9934	14.9896 (38.0736)
1/2-MOD-24	1378.2	0.5092 (1.2934)	14.9854	14.9937	14.9887 (38.0713)
1/2-MOD-25	1385.6	0.5109 (1.2977)	14.9842	14.9920	14.989 (38.0721)
1/2-MOD-26	1377.8	0.5066 (1.2868)	14.9837	14.9928	14.987 (38.0670)
1/2-MOD-27	1385.1	0.5082 (1.2908)	14.9833	14.9934	14.9886 (38.0710)
1/2-MOD-28	1377.3	0.4996 (1.2690)	14.9855	14.9931	14.9889 (38.0718)
1/2-MOD-29	1376.3	0.5041 (1.2804)	14.9874	14.9942	14.9901 (38.0749)
1/2-MOD-30	1377.5	0.5084 (1.2913)	14.9857	14.9935	14.99 (38.0746)
1/2-MOD-31	1377.8	0.5051 (1.2830)	14.9878	14.9952	14.9915 (38.0784)
1/2-MOD-32	1381.2	0.5073 (1.2885)	14.9862	14.9937	14.9889 (38.0718)

Table 36: Mass and dimension measurements of the 3/4-MOD parts (see Figure 14).

Part ID	Mass (g)	Thickness, b [in (cm)]	Diameter, a [in (cm)]
3/4-MOD-1	2117.4	0.776 (1.9710)	14.990 (38.0746)
3/4-MOD-2	2117.2	0.772 (1.9609)	14.997 (45.7124)
3/4-MOD-3	2116.9	0.777 (1.9736)	14.992 (38.0797)
3/4-MOD-4	2116.6	0.771 (1.9583)	14.996 (38.0898)
3/4-MOD-5	2107.7	0.776 (1.9710)	14.996 (38.0898)
3/4-MOD-6	2115.7	0.773 (1.9634)	14.994 (38.0848)
3/4-MOD-7	2116.7	0.764 (1.9406)	14.994 (38.0848)
3/4-MOD-8	2116.2	0.758 (1.9253)	14.997 (38.0924)
3/4-MOD-9	2116.9	0.76 (1.9304)	14.996 (38.0898)
3/4-MOD-10	2112.5	0.763 (1.9380)	14.997 (38.0924)
3/4-MOD-11	2111.8	0.756 (1.9202)	14.996 (38.0898)
3/4-MOD-12	2112.3	0.757 (1.9228)	14.997 (38.0924)
3/4-MOD-13	2116.3	0.761 (1.9329)	14.992 (38.0797)

3/4-MOD-14	2118.1	0.764 (1.9406)	14.994 (38.0848)
3/4-MOD-15	2117.0	0.769 (1.9533)	14.998 (38.0949)
3/4-MOD-16	2109.6	0.757 (1.9228)	14.995 (38.0873)
3/4-MOD-17	2112.5	0.759 (1.9279)	14.998 (38.0949)
3/4-MOD-18	2117.1	0.767 (1.9482)	14.996 (38.0898)
3/4-MOD-19	2117.1	0.77 (1.9558)	14.996 (38.0898)
3/4-MOD-20	2119.2	0.767 (1.9482)	14.998 (38.0949)
3/4-MOD-21	2117.7	0.771 (1.9583)	14.998 (38.0949)
3/4-MOD-22	2118.0	0.766 (1.9456)	14.997 (38.0924)

Table 37: Mass and dimension measurements of the 1.5-MOD parts (see Figure 14).

Part ID	Mass (g)	Thickness, b [in (cm)]	Diameter, a [in (cm)]		
			Min	Max	Average
1.5-MOD-1	4150.8	1.4998 (3.8095)	14.9962	15.0107	15.0035 (38.1089)
1.5-MOD-2	4132.6	1.51 (3.8354)	14.9968	14.9977	14.9933 (38.0830)
1.5-MOD-3	4125.6	1.5087 (3.8321)	14.9846	14.9962	14.9988 (38.0970)
1.5-MOD-4	4136.2	1.5146 (3.8471)	14.9879	15.0005	14.9946 (38.0863)
1.5-MOD-5	4147.2	1.4945 (3.7960)	14.9967	15.0075	15.0038 (38.1097)
1.5-MOD-6	4173.6	1.5086 (3.8318)	14.9811	14.9896	14.9859 (38.0642)
1.5-MOD-7	4167.4	1.5241 (3.8712)	14.9851	14.9984	14.9913 (38.0779)
1.5-MOD-8	4175.3	1.5105 (3.8367)	14.9803	14.9896	14.9856 (38.0634)
1.5-MOD-9	4135.6	1.5027 (3.8169)	14.9879	14.9949	14.9917 (38.0789)
1.5-MOD-10	4168.4	1.5103 (3.8362)	14.9784	14.9898	14.9841 (38.0596)
1.5-MOD-11	4171.2	1.5263 (3.8768)	14.9827	14.9948	14.9887 (38.0713)
1.5-MOD-12	4146.4	1.5188 (3.8578)	14.9915	15.0022	14.9965 (38.0911)

Table 38: Mass and dimension measurements of the reflector plates (see Figure 14).

Part ID	Mass (g)	Thickness, b [in (cm)]	Diameter, a [in (cm)]		
			Min	Max	Average
1/16-REF-1	182.4	0.0728 (.1849)	14.9831	14.9890	14.9858 (38.0639)
1/16-REF-2	182.9	0.0671 (.1704)	14.9829	14.9884	14.9856 (38.0634)
1-REF-1	2766.9	0.9995 (2.5387)	14.9860	14.9934	14.9902 (38.0751)
1-REF-2	2767.2	1.0015 (2.5438)	14.9844	14.9922	14.9883 (38.0703)

2.1.5.2 Reflector Rings

The polyethylene reflector rings are annular cylinders with varying thicknesses and a nominal inner and outer diameter of 15.1 in (38.354 cm) and 17.1 in (43.434 cm), respectively. Figure 15 shows a drawing of a reflector ring part. New annular reflector pieces were procured with nominal thicknesses of 1.125 in and 3.125 in, however the new parts were not used. In all, the reflector rings have six nominal thicknesses: 0.25 in (0.635 cm), 0.5 in (1.27 cm), 1 in (2.54 cm), 1.125 in (2.8575 cm), 3 in (7.62 cm), and 3.125 in (7.9375 cm). The reflector rings stack around the core stack to provide a nominal 1 in (2.54 cm) reflector. They are designed to interlock, using step joints, which keep the rings in alignment as they are stacked and reduce neutron streaming paths. The step joints have a nominal height of 0.125 in (0.3175 cm). On the lower half of the experiment, the reflector rings sit on the bottom reflector (BOTREF). On the upper half of the experiment, the reflector rings sit on the bottom reflector cap (BOTCAP).

Table 39 tabulates the mass and dimensional measurements performed on the reflector ring types used in the experiment.

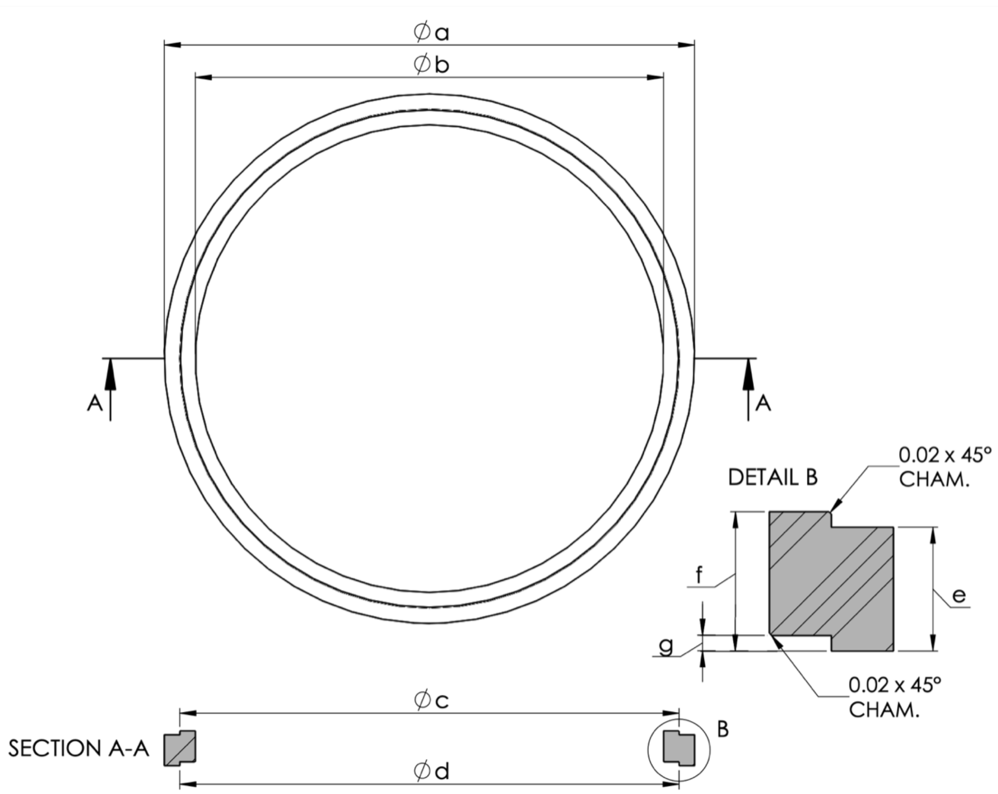

Figure 15: Drawing of the polyethylene reflector ring (in inches).

Table 39: Mass and dimensions of the reflector ring parts (see Figure 15).

Part ID	Mass (g)	Outer Diameter, a [in (cm)]			Inner Diameter, b [in (cm)]		
		Min	Max	Average	Min	Max	Average
1/4-RING-1	199.1	17.0822	17.1050	17.0933 (43.4170)	15.0657	15.0912	15.0789 (38.3004)
1/4-RING-2	198.9	17.0821	17.1019	17.0927 (43.4155)	15.0690	15.0925	15.0813 (38.3065)

1/4-RING-3	198.7	17.0816	17.1060	17.0939 (43.4185)	15.0699	15.0912	15.0811 (38.3060)
1/4-RING-4	199.4	17.0838	17.1047	17.0937 (43.4180)	15.0681	15.0897	15.0792 (38.3012)
1/2-RING-1	394.1	17.0770	17.0870	17.0818 (43.3878)	15.0620	15.0728	15.0670 (38.2702)
1/2-RING-2	394.4	17.0802	17.0854	17.0830 (43.3908)	15.0660	15.0729	15.0682 (38.2732)
1/2-RING-3	392.9	17.0806	17.0855	17.0828 (43.3903)	15.0652	15.0721	15.0680 (38.2727)
1/2-RING-4	393.3	17.0793	17.0865	17.0822 (43.3888)	15.0650	15.0703	15.0676 (38.2717)
1-RING-1	805.8	17.0787	17.0852	17.0824 (43.3893)	15.0605	15.0691	15.0660 (38.2676)
1-RING-2	805.8	17.0745	17.0781	17.0767 (43.3748)	15.0572	15.0629	15.0609 (38.2547)
1-RING-3	805.8	17.0808	17.0888	17.0837 (43.3926)	15.0622	15.0700	15.0666 (38.2692)
1-RING-4	804.9	17.0696	17.0766	17.0729 (43.3652)	15.0509	15.0606	15.0560 (38.2422)
1-RING-5	804.8	17.0812	17.0868	17.0839 (43.3931)	15.0671	15.0714	15.0691 (38.2755)
1-RING-6	805.8	17.0775	17.0810	17.0788 (43.3802)	15.0595	15.0647	15.0624 (38.2585)
3-RING-1	2384.7	17.0879	17.0916	17.0898 (43.4081)	15.0875	15.0912	15.0896 (38.3276)
3-RING-2	2387.0	17.0877	17.0923	17.0896 (43.4076)	15.0891	15.0932	15.0910 (38.3311)
3-RING-3	2388.8	17.0872	17.0938	17.0915 (43.4124)	15.0880	15.0913	15.0898 (38.3281)
3-RING-4	2388.1	17.0887	17.0928	17.0912 (43.4116)	15.0873	15.0922	15.0905 (38.3299)
3-RING-5	2384.2	17.0855	17.0915	17.0888 (43.4056)	15.0894	15.0928	15.0913 (38.3319)
3-RING-6	2384.7	17.0861	17.0933	17.0892 (43.4066)	15.0877	15.0933	15.0909 (38.3309)

Table 12 (*cont.*): Mass and dimensions of the reflector ring parts (see Figure 15).

Part ID	Top Step Diameter, c [in (cm)]			Bottom Step Diameter, d [in (cm)]		
	Min	Max	Average	Min	Max	Average
1/4-RING-1	16.0527	16.0778	16.0654 (40.8061)	16.0876	16.1120	16.0990 (40.8915)
1/4-RING-2	16.0532	16.0787	16.0654 (40.8061)	16.0906	16.1096	16.1003 (40.8948)
1/4-RING-3	16.0491	16.0743	16.0630 (40.8000)	16.0896	16.1120	16.1010 (40.8965)
1/4-RING-4	16.0509	16.0746	16.0634 (40.8010)	16.0895	16.1082	16.0993 (40.8922)
1/2-RING-1	16.0480	16.0596	16.0537 (40.7764)	16.0836	16.0956	16.0895 (40.8673)
1/2-RING-2	16.0507	16.0575	16.0533 (40.7754)	16.0871	16.0919	16.0894 (40.8671)
1/2-RING-3	16.0471	16.0528	16.0496 (40.7660)	16.0894	16.0965	16.0922 (40.8742)
1/2-RING-4	16.0495	16.0543	16.0515 (40.7708)	16.0880	16.0938	16.0904 (40.8696)
1-RING-1	16.0564	16.0653	16.0615 (40.7962)	16.0800	16.0845	16.0824 (40.8493)
1-RING-2	16.0517	16.0575	16.0550 (40.7797)	16.0897	16.0939	16.0923 (40.8744)
1-RING-3	16.0590	16.0661	16.0628 (40.7995)	16.0799	16.0862	16.0823 (40.8490)
1-RING-4	16.0420	16.0531	16.0485 (40.7632)	16.0989	16.1075	16.1037 (40.9034)
1-RING-5	16.0624	16.0693	16.0653 (40.8059)	16.0850	16.0906	16.0880 (40.8635)
1-RING-6	16.0554	16.0604	16.0581 (40.7876)	16.0915	16.0967	16.0934 (40.8772)
3-RING-1	16.0726	16.0780	16.0742 (40.8285)	16.0975	16.1006	16.0993 (40.8922)
3-RING-2	16.0713	16.0748	16.0729 (40.8252)	16.0982	16.1025	16.1000 (40.8940)
3-RING-3	16.0685	16.0751	16.0713 (40.8211)	16.0970	16.1014	16.0994 (40.8925)

3-RING-4	16.0714	16.0751	16.0738 (40.8275)	16.0981	16.1035	16.1007 (40.8958)
3-RING-5	16.0710	16.0733	16.0720 (40.8229)	16.0994	16.1029	16.1014 (40.8976)
3-RING-6	16.0710	16.0736	16.0722 (40.8234)	16.1022	16.1048	16.1033 (40.9024)

Table 12 (*cont.*): Mass and dimensions of the reflector ring parts (see Figure 15).

Part ID	Outer Edge Height, e [in (cm)]	Inner Edge Height, f [in (cm)]	Bottom Step Height, g [in (cm)]
1/4-RING-1	.2568 (.6523)	.3727 (.9467)	.1205 (.3061)
1/4-RING-2	.2585 (.6566)	.3748 (.9520)	.1209 (.3071)
1/4-RING-3	.2575 (.6541)	.3721 (.9451)	.1205 (.3061)
1/4-RING-4	.2566 (.6518)	.3711 (.9426)	.1199 (.3045)
1/2-RING-1	.5027 (1.2769)	.6140 (1.5596)	.1198 (.3043)
1/2-RING-2	.5042 (1.2807)	.6156 (1.5636)	.1205 (.3061)
1/2-RING-3	.5053 (1.2835)	.6166 (1.5662)	.1179 (.2995)
1/2-RING-4	.5050 (1.2827)	.6156 (1.5636)	.1184 (.3007)
1-RING-1	1.0016 (2.5441)	1.1275 (2.8639)	.1219 (.3096)
1-RING-2	1.0036 (2.5491)	1.1256 (2.8590)	.1196 (.3038)
1-RING-3	1.0014 (2.5436)	1.1268 (2.8621)	.1219 (.3096)
1-RING-4	1.0052 (2.5532)	1.1232 (2.8529)	.1161 (.2949)
1-RING-5	.9991 (2.5377)	1.1252 (2.8580)	.1205 (.3061)
1-RING-6	1.0036 (2.5491)	1.1255 (2.8588)	.1190 (.3023)
3-RING-1	2.9952 (7.6078)	3.1229 (7.9322)	.1231 (.3127)
3-RING-2	2.9957 (7.6091)	3.1223 (7.9306)	.1230 (.3124)
3-RING-3	2.9974 (7.6134)	3.1235 (7.9337)	.1232 (.3129)
3-RING-4	2.9953 (7.6081)	3.1223 (7.9306)	.1225 (.3112)
3-RING-5	2.9961 (7.6101)	3.1243 (7.9357)	.1231 (.3127)
3-RING-6	2.9951 (7.6076)	3.1226 (7.9314)	.1224 (.3109)

2.1.5.3 Reflector Caps

The polyethylene reflector caps are rings with varying thicknesses and a nominal inner and outer diameter of 15.1 in (38.354 cm) and 17.1 in (43.434 cm), respectively. The polyethylene bottom reflector caps (BOTCAP) are rings with a nominal thickness of 0.125 in (0.3175 cm) and inner and outer diameter of 15.1 in (38.354 cm) and 16.08 in (40.8432 cm), respectively. Figure 16 and Figure 17 show drawings of the reflector cap part types. The reflector caps provide fine height adjustment on the top of the reflector rings while the bottom reflector caps serve as the base for the first reflector ring in the upper half of the experiment on the membrane. The reflector caps allow the ring reflector to be brought to within 0.03125 in (0.079375 cm) of the top reflector height. Like the polyethylene reflector rings, the step joints have a nominal height of 0.125 in (0.3175 cm). There is also a zero-height reflector cap (0-CAP) with a nominal thickness of 0.125 in (0.3175 cm) and inner and outer diameter of 16.08 in (40.8432 cm) and 17.1 in (43.434 cm), respectively. The zero-height reflector cap finished the top of the reflector rings without adding any additional height.

Table 40 and Table 41 report the mass and dimensional measurements of the polyethylene reflector caps.

Table 40: Mass and dimensions of the 0-BOTCAP and 0-CAP parts (see Figure 16).

Part ID	Mass (g)	Outer Edge Height, d [in (cm)]	Inner Edge Height, e [in (cm)]	Bottom Step Height, d-e [in (cm)]
0-BOTCAP-1	48.2	16.0530 (40.7746)	15.0660 (38.2676)	.1310 (.3327)
0-BOTCAP-2	48	16.0530 (40.7746)	15.0650 (38.2651)	.1250 (.3175)
0-CAP-1	50.7	17.0465 (43.2981)	16.0785 (40.8394)	.1260 (.3200)
0-CAP-2	50.8	17.0460 (43.2968)	16.0770 (40.8356)	.1255 (.3188)
0-CAP-3	50.9	17.0470 (43.2994)	16.0710 (40.8203)	.1250 (.3175)

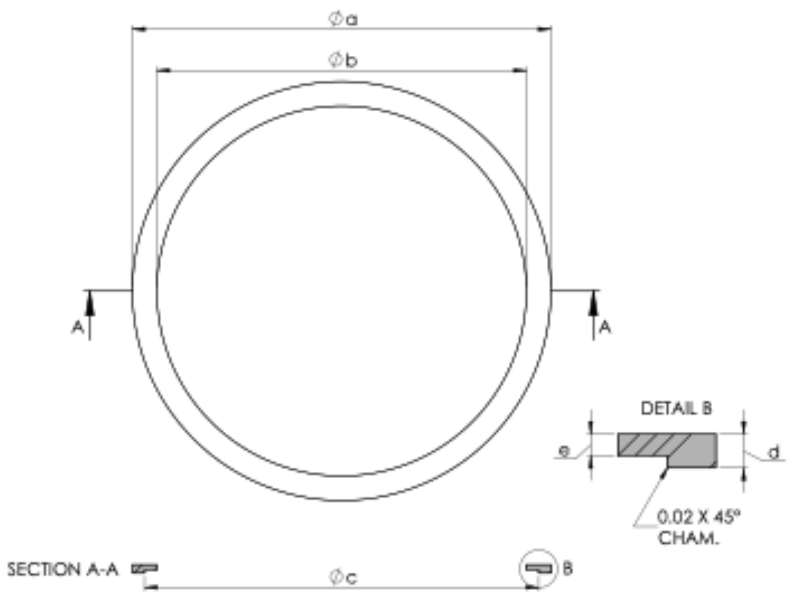

Figure 16: Drawing of the reflector cap (in inches).

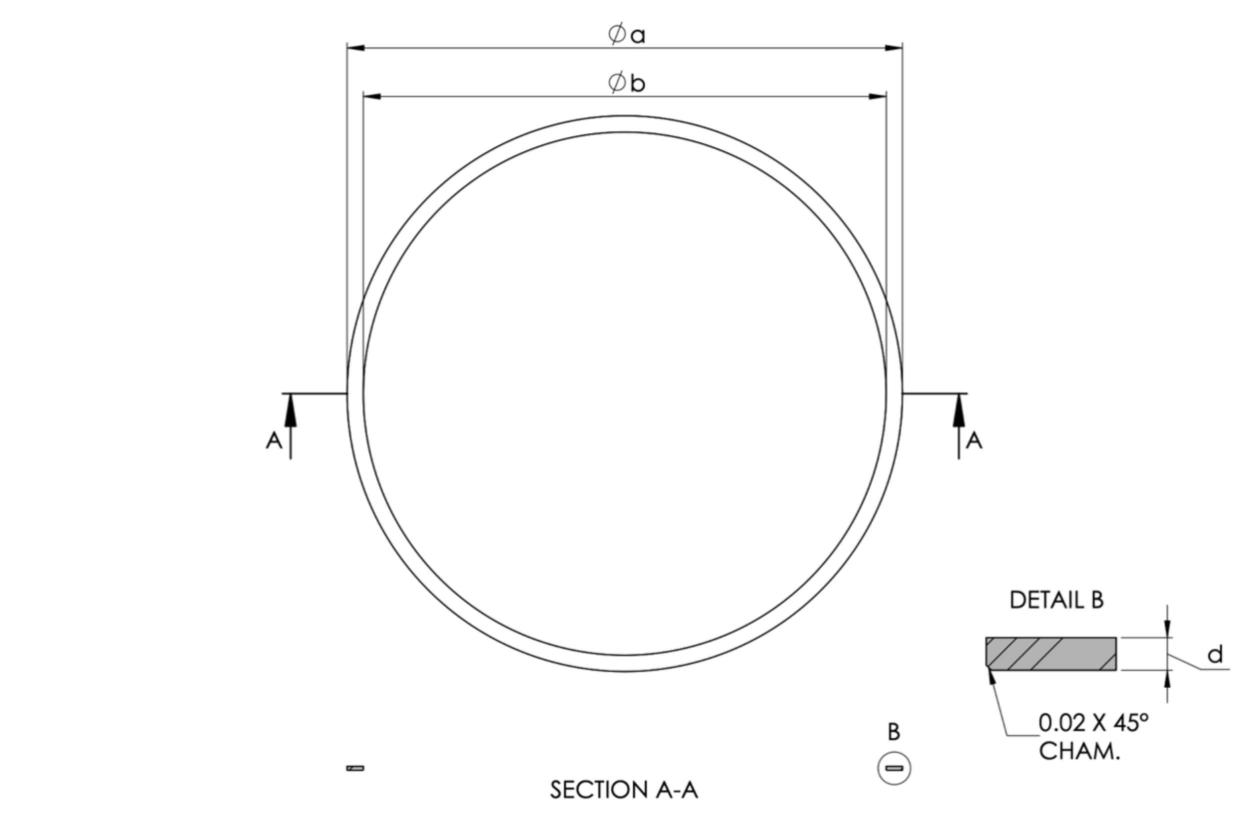

Figure 17: Drawing of the 0-BOTCAP and 0-CAP parts (in inches).

Table 41: Mass and dimensions of the reflector cap parts (see Figure 16).

Part ID	Mass (g)	Outer Diameter, a [in (cm)]			Inner Diameter, b [in (cm)]		
		Min	Max	Average	Min	Max	Average
1/32-CAP-1	76.8	17.0612	17.0763	17.0689 (43.3550)	15.0604	15.0828	15.0738 (38.2875)
1/32-CAP-2	76.8	17.0620	17.0804	17.0711 (43.3606)	15.0645	15.0875	15.0769 (38.2953)
1/32-CAP-3	76.9	17.0651	17.0758	17.0710 (43.3603)	15.0731	15.0847	15.0773 (38.2963)
1/16-CAP-1	101.5	17.0457	17.1074	17.0794 (43.3817)	15.0554	15.1168	15.0842 (38.3139)
1/16-CAP-2	101.2	17.0690	17.0906	17.0803 (43.3840)	15.0741	15.0933	15.0850 (38.3159)
1/16-CAP-3	101.0	17.0496	17.1070	17.0765 (43.3743)	15.0456	15.1037	15.0773 (38.2963)
3/32-CAP-1	127.9	17.0414	17.1020	17.0725 (43.3642)	15.0511	15.1100	15.0807 (38.3050)
3/32-CAP-2	126.7	17.0687	17.0734	17.0713 (43.3611)	15.0821	15.0893	15.0850 (38.3159)
3/32-CAP-3	127.5	17.0620	17.0836	17.0728 (43.3649)	15.0676	15.0920	15.0796 (38.3022)
1/8-CAP-1	149.0	17.0753	17.0845	17.0788 (43.3802)	15.0748	15.0873	15.0824 (38.3093)
1/8-CAP-2	148.9	17.0692	17.0909	17.0791 (43.3809)	15.0748	15.0921	15.0817 (38.3075)
1/8-CAP-3	149.0	17.0582	17.0977	17.0781 (43.3784)	15.0652	15.1004	15.0815 (38.3070)
5/32-CAP-1	173.7	17.0691	17.0927	17.0788 (43.3802)	15.0714	15.0913	15.0836 (38.3123)

5/32-CAP-2	173.7	17.0668	17.0892	17.0775 (43.3769)	15.0752	15.0944	15.0847 (38.3151)
5/32-CAP-3	172.9	17.0664	17.0908	17.0787 (43.3799)	15.0733	15.0934	15.0848 (38.3154)
3/16-CAP-1	198.2	17.0697	17.0946	17.0797 (43.3824)	15.0708	15.0966	15.0851 (38.3162)
3/16-CAP-2	194.1	17.0714	17.0906	17.0806 (43.3847)	15.0781	15.0972	15.0867 (38.3202)
3/16-CAP-3	193.9	17.0754	17.0867	17.0808 (43.3852)	15.0828	15.0950	15.0876 (38.3225)
7/32-CAP-1	225.4	17.0781	17.0919	17.0860 (43.3984)	15.0790	15.0933	15.0861 (38.3187)
7/32-CAP-2	225.2	17.0662	17.0774	17.0706 (43.3593)	15.0692	15.0857	15.0780 (38.2981)
7/32-CAP-3	225.6	17.0548	17.0841	17.0686 (43.3542)	15.0602	15.0909	15.0774 (38.2966)

Table 14 (*continued*): Mass and dimensions of the reflector cap parts (see Figure 16).

Part ID	Top Step Diameter, c [in (cm)]			Outer Edge Height, d [in (cm)]	Inner Edge Height, e [in (cm)]
	Min	Max	Average		
1/32-CAP-1	16.0833	16.1000	16.0930 (40.8762)	.1647 (.4183)	.0344 (.0874)
1/32-CAP-2	16.0874	16.1030	16.0950 (40.8813)	.1649 (.4188)	.0351 (.0892)
1/32-CAP-3	16.0906	16.0989	16.0943 (40.8795)	.1664 (.4227)	.0350 (.0889)
1/16-CAP-1	16.0727	16.1328	16.1012 (40.8970)	.1953 (.4961)	.0681 (.1730)
1/16-CAP-2	16.0898	16.1123	16.1025 (40.9004)	.1912 (.4856)	.0673 (.1709)
1/16-CAP-3	16.0673	16.1258	16.0999 (40.8937)	.1904 (.4836)	.0729 (.1852)
3/32-CAP-1	16.0645	16.1234	16.0946 (40.8803)	.2431 (.6175)	.1006 (.2555)
3/32-CAP-2	16.0948	16.1025	16.0978 (40.8884)	.2443 (.6205)	.1000 (.2540)
3/32-CAP-3	16.0813	16.1057	16.0930 (40.8762)	.2451 (.6226)	.1005 (.2553)
1/8-CAP-1	16.0928	16.1036	16.0993 (40.8922)	.2531 (.6429)	.1292 (.3282)
1/8-CAP-2	16.0913	16.1076	16.0981 (40.8892)	.2540 (.6452)	.1290 (.3277)
1/8-CAP-3	16.0838	16.1214	16.1011 (40.8968)	.2535 (.6439)	.1281 (.3254)
5/32-CAP-1	16.0874	16.1091	16.0999 (40.8937)	.2832 (.7193)	.1618 (.4110)
5/32-CAP-2	16.0905	16.1128	16.1009 (40.8963)	.2836 (.7203)	.1620 (.4115)
5/32-CAP-3	16.0889	16.1098	16.1009 (40.8963)	.2824 (.7173)	.1606 (.4079)
3/16-CAP-1	16.0891	16.1102	16.1020 (40.8991)	.3147 (.7993)	.1935 (.4915)
3/16-CAP-2	16.0982	16.1164	16.1070 (40.9118)	.3116 (.7915)	.1866 (.4740)
3/16-CAP-3	16.1019	16.1163	16.1086 (40.9158)	.3116 (.7915)	.1856 (.4714)
7/32-CAP-1	16.0990	16.1155	16.1073 (40.9125)	.3444 (.8748)	.2290 (.5817)
7/32-CAP-2	16.0823	16.0973	16.0904 (40.8696)	.3517 (.8933)	.2242 (.5695)
7/32-CAP-3	16.0723	16.1012	16.0887 (40.8653)	.3531 (.8969)	.2251 (.5718)

2.1.5.4 Bottom Reflector

A set of new bottom reflector pieces were designed and procured which include a source cavity (Figure 18) and matching source insert (Figure 19) so that the source is easily accessible from the side of the reflector piece. Bottom reflector pieces were procured with nominal thicknesses of 1.000 in (2.54 cm) and 1.500 in (3.81 cm) and outer diameters of 17.100 in (43.434 cm). Each bottom reflector has a lip that protrudes from the top surface with a thickness of 0.125 in (0.3175 cm) and outer diameter of 16.080 in (40.8432 cm). On the bottom of each part is a channel which may be filled with the source insert piece. The channel has a nominal width of 0.563 in (1.43002 cm) and depth of 0.500 in (1.27 cm). Measurements of the mass and select features were performed with a CMM by LANL and are tabulated in Table 42. Inspection of the parts using calipers, depth gauges, and gauge pins were performed by the manufacturer and are tabulated in Table 43.

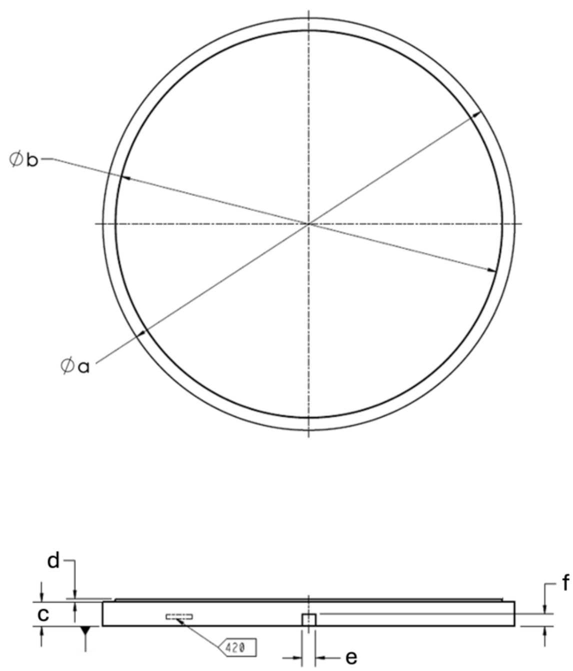

Figure 18: Drawing of the new bottom reflector with a source cavity.

Table 42: Mass and dimensions of the bottom reflector parts via CMM measurements performed by LANL (see Figure 18).

Part ID	Mass (g)	Outer Diameter, a [in (cm)]	Thickness, c [in (cm)]		
			Measurement 1	Measurement 2	Average
1.0-BOTREFSRC-1	3976.0	17.0780 (43.3781)	1.0015	1.0015	1.0015 (2.5438)
1.0-BOTREFSRC-2	3976.7	17.0840 (43.3934)	1.0000	1.0030	1.0015 (2.5438)
1.5-BOTREFSRC-1	5783.6	17.0785 (43.3794)	1.4995	1.4990	1.4993 (3.8081)
1.5-BOTREFSRC-2	5784.7	17.0890 (43.4061)	1.5005	1.4965	1.4985 (3.8062)

Table 43: Dimensions of the bottom reflector parts via inspection performed by the manufacturer (see Figure 18).

Part ID	Outer Diameter, a [in (cm)]	Thickness, c [in (cm)]	Lip Diameter, b [in (cm)]	Lip Thickness, d [in (cm)]	Slot Width, e [in (cm)]	Slot Thickness, f [in (cm)]
1.0-BOTREFSRC-1	17.0950 (43.4213)	1.0020 (2.5451)	16.0750 (40.8305)	.1260 (.3200)	.5580 (1.4173)	.5000 (1.2700)
1.0-BOTREFSRC-2	17.0960 (43.4238)	1.0015 (2.5438)	16.0775 (40.8369)	.1275 (.3239)	.5590 (1.4199)	.4970 (1.2624)
1.5-BOTREFSRC-1	17.1000 (43.4340)	1.4970 (3.8024)	16.0840 (40.8534)	.1270 (.3226)	.5640 (1.4326)	.5040 (1.2802)
1.5-BOTREFSRC-2	17.0990 (43.4315)	1.4970 (3.8024)	16.0850 (40.8559)	.1270 (.3226)	.5640 (1.4326)	.5010 (1.2725)

Two variations of the source insert parts were fabricated: one with a hole at the end for the source and one that was a solid piece. CMM measurements of select features of the inserts were performed by LANL and are tabulated in Table 44. Inspection of the parts were performed by the manufacturer using calipers, height gauges, depth gauges, and go/no-go gauges. The inspection results are tabulated in Table 45 and Table 46.

Figure 19: Drawing of the matching source insert.

Table 44: Mass and dimensions of the source insert parts via CMM measurements performed by LANL (see Figure 19).

Part ID	Mass (g)	Hole Diameter, g [in (cm)]	Hole Depth, h [in (cm)]	Hole Distance or Length, i [in (cm)]	Width, j [in (cm)]	Thickness, k [in (cm)]
SRCINSRT-1	39.5	.2850 (.7239)	.4385 (1.1138)	9.0120 (22.8905)	.5540 (1.4072)	.4920 (1.2497)
SRCINSRT-2	39.4	.2840 (.7214)	.4375 (1.1113)	8.9990 (22.8575)	.5540 (1.4072)	.4915 (1.2484)
SRCINSRT-3	39.3	.2850 (.7239)	.4360 (1.1074)	9.0050 (22.8727)	.5545 (1.4084)	.4920 (1.2497)
SRCINSRT-4	39.3	.2830 (.7188)	.4395 (1.1163)	9.0090 (22.8829)	.5540 (1.4072)	.4920 (1.2497)
BLNKINSRT-1	38.6	-	-	9.0000 (22.8600)	.5540 (1.4072)	.4920 (1.2497)
BLNKINSRT-2	39.5	-	-	8.9980 (22.8549)	.5560 (1.4122)	.4920 (1.2497)
BLNKINSRT-3	39.8	-	-	9.0055 (22.8740)	.5540 (1.4072)	.4920 (1.2497)
BLNKINSRT-4	39.9	-	-	9.0028 (22.8671)	.5545 (1.4084)	.4920 (1.2497)

Table 45: Width and thicknesses of the source insert parts via inspection performed by the manufacturer (see Figure 19).

Part Type	Width, j [in (cm)]			Thickness, k [in (cm)]		
	Sample 1	Sample 2	Average	Sample 1	Sample 2	Average
SRCINSRT	.5560 (1.4122)	.5550 (1.4097)	.5555 (1.4110)	.4910 (1.2471)	.4915 (1.2484)	.4913 (1.2478)
BLNKINSRT	.5550 (1.4097)	.5550 (1.4097)	.5550 (1.4097)	.4915 (1.2484)	.4910 (1.2471)	.4913 (1.2478)

Table 46: Hole dimensions of the source insert parts via inspection performed by the manufacturer (see Figure 19).

Part Type	Hole Diameter, g (Go/No-Go Guage)	Hole Depth, h [in (cm)]			Hole Distance, i [in (cm)]		
		Sample 1	Sample 2	Average	Sample 1	Sample 2	Average
SRCINSRT	Pass	.4350 (1.0875)	.4370 (1.1100)	.4360 (1.1074)	9.0040 (22.8702)	9.0060 (22.8752)	9.0050 (22.8727)

2.2 Description of Material Data

The following material descriptions originate from the TEX-HEU and TEX-Hf experiment description and benchmark evaluations, documented in [1-4]. The relevant descriptions from those documents are reproduced in the following sections.

2.2.1 Comet General Purpose Critical Assembly Machine

The additional parts for TEX-HEU affixed to Comet were weighed prior to installation on Comet. The weights are reported in Table 47 and were measured during the TEX-HEU experiment campaign with a Mettler Toledo SB16001 High-Capacity Precision Balance under the NCERC calibration Program (Cal No. 012708). The calibration for this balance was certified on May 2, 2019, and was valid through May 2, 2020. These measurements were taken on February 24, 2020. The manufacturer of the SB16001 reports a maximum capacity of 16,100 grams, precision of 0.1 grams, and linearity of 0.3 grams.

Table 47: Additional TEX-HEU parts used on Comet.

Part ID		Mass (g)
Membrane		2396.1
Experiment Platform	Interface Plate	11242.5
	Standoffs	633.8
		634.4
		634.0
		635.0
Lower Adapter	Adapter Plate	5014.7
	Adapter Extensions	8365.3

2.2.2 Highly Enriched Uranium

The following sections summarize and reproduce relevant material information from previous ICSBEP benchmark evaluations that use the same HEU plates. These benchmark evaluations include IEU-MET-FAST-007 and HEU-MET-FAST-072. The IEU-MET-FAST-007 experiments and benchmark evaluation use the 15/2.5-HEU, 15/6-HEU, and 15/10-HEU plate types, identified as ID No. 403, 401, and 402, respectively. The HEU-MET-FAST-072 experiments and benchmark evaluation use the 15/0-HEU and 15/2.5-HEU plates.

Mass measurements of the HEU plates were performed using a Mettler Toledo SB16001 High-Capacity Precision Balance under the NCERC Calibration Program (Cal No. 012708). The calibration for this balance was certified on May 17, 2022, and was valid through May 17, 2023. These measurements were taken on October 17, 2022. The manufacturer of the SB16001 reports a maximum capacity of 16,100 grams, precision of ±0.1 grams, and linearity of ±0.3 grams. The measurement procedure required the HEU plated be weighed in a plastic bag to contain any contamination. Each bag was weighed before placing the HEU plate in it. Then the weight of the HEU plate inside the bag was measured. After performing this measurement, the balance was checked to ensure the measurement returned to zero with the HEU plate and bag removed.

Prior to performing the HEU plate mass measurements, two known check weights were measured on the balance. Table 48 summarizes these measurements. These check weights were chosen to bound the HEU plate masses.

Table 48: Check weight measurements used to generate the calibration curve.

Mass (g)			Notes
Check Weight	Measured	Difference[(a)]	
2000.0	2000.2	0.2	2 kg weight
7000.0	7000.8	0.8	2kg + 5 kg weights

[(a)](Measured) - (Check Weight)

Based on these measurements, the following calibration curve was generated

$$f(m) = 0.00012m - 0.04, \tag{1}$$

where m is the mass, in grams, and $f(m)$ is the calibration curve, as a function of mass, used to correct the mass measurement, valid between 2kg and 7kg. This calibration curve is used to correct the HEU plate masses reported in Table 49.

Table 49: HEU plate mass measurements and mass corrections.

Part Type	Part ID	Mass (g)			Corrected Mass (g)[b]
		Bag	Plate & Bag	Plate[a]	
15/10-HEU	10485	100.0	6359.1	6259.1	6258.4
	10481	100.7	5470.9	5370.2	5369.6
	10479	97.6	5533.1	5435.5	5434.9
	10473	95.6	5533.6	5438.0	5437.4
	10472	101.2	5534.7	5433.5	5432.9
	10463	95.9	5595.4	5499.5	5498.9
	10458	100.8	5675.3	5574.5	5573.9
15/6-HEU	11018	101.4	6493.7	6392.3	6391.6
	10935	100.5	6444.9	6344.4	6343.7
	10933	97.1	6373.2	6276.1	6275.4
	10932	96.7	6325.9	6229.2	6228.5
	10477	95.9	6375.2	6279.3	6278.6
	10457	98.2	6434.5	6336.3	6335.6
15/2.5-HEU	10491	98.6	3703.3	3604.7	3604.3
	10489	99.6	3694.3	3594.7	3594.3
	10487	103.2	3668.2	3565.0	3564.6
	10475	98.0	3705.3	3607.3	3606.9
	10470	95.2	3682.0	3586.8	3586.4
	10467	98.2	3730.3	3632.1	3631.7
	10464	95.8	3714.1	3618.3	3617.9
15/0-HEU	11150	96.4	6501.8	6405.4	6404.7
	11149	100.8	6483.7	6382.9	6382.2
	11147	95.9	6609.0	6513.1	6512.4
	11019	95.9	6565.8	6469.9	6469.2
	11017	100.5	6599.0	6498.5	6497.8
6/0-HEU	Q2-16	102.7	1178.4	1075.7	1075.6

[a](Plate & Bag Mass) - (Bag Mass) = (Plate Mass)

[b]Corrected using the calibration curve reported in Eq. 1

2.2.2.1 ^{235}U Enrichment

Table 50 reproduces the relevant HEU plate enrichments from IEU-MET-FAST-007 and HEU-MET-FAST-072. As noted in those benchmark evaluations, the enrichment values were obtained from the LANL MASS systems for the plates used in the Big Ten assembly and a letter from Dixon Callihan (ORNL) to Hugh Paxton (LANL) dated May 20, 1960.

The IEU-MET-FAST-007 benchmark evaluation, using the HEU4 and HEU5 plates, does not report the individual plate ^{235}U enrichments, instead it lists individual enrichment values grouped by part type. Therefore, the ^{235}U enrichments for these HEU plate types are represent as an average and standard deviation of the values from the corresponding plate type in IEU-MET-FAST-007. The HEU-MET-FAST-072 benchmark evaluation reports ^{235}U enrichment values for each individual plate. Some of the HEU plate Part IDs in HEU-MET-FAST-072 are prefaced with "B10" which has been removed in favor of the ending 5-digit identifier.

Table 50: HEU Plate ^{235}U enrichment.

Part Type	Part ID	Enrichment
15/10-HEU	10458	93.40
	10463	-
	10472	-
	10473	-
	10479	-
	10481	93.23
	10485	93.24
15/6-HEU	10457	93.44
	10477	93.35
	10932	93.15
	10933	93.16
	10935	93.18
	11018	93.19
15/2.5-HEU	10464	93.38
	10467	93.41
	10470	93.41
	10475	93.40
	10487	93.26
	10489	93.39
	10491	93.37
15/0-HEU	11017	93.31
	11019	93.18
	11147	93.17
	11149	93.24
	11150	93.17
6/0-HEU	Q2-16	-

In addition to the 235U enrichment values reported in IEU-MET-FAST-007 and HEU-MET-FAST-072, the benchmark evaluations present mass spectrometry measurements performed at

LANL for HEU isotopic content of the plate, reproduced in Table 51. The measurements are reported as atomic ratios relative to ^{235}U and the uncertainties are at the 95% confidence level (2σ).

Table 51: HEU plate uranium isotopic content measurements.

Part Type	Part ID	Uranium Isotope (Atom Ratio Relative to 235U)			
		234U	235U	236U	238U
15/10-HEU	10458	0.0111 ± 0.0002	1.00	<2E-5	0.0577 ± 0.0012
15/6-HEU	10493	0.0115 ± 0.0001	1.00	(8.40 ± 0.42)E-4	0.0592 ± 0.0002
	10932	0.0108 ± 0.0001	1.00	(3.50 ± 0.04)E-3	0.0586 ± 0.0002
	11018	0.0110 ± 0.0001	1.00	(5.56 ± 0.06)E-3	0.0555 ± 0.0002

2.2.2.2 *Uranium Impurities*

Table 52 reproduces the HEU plate impurity measurements from IEU-MET-FAST-007 and HEU-MET-FAST-072. Per IEU-MET-FAST-007, the analysis reports did not distinguish whether the impurities were atomic fractions or mass fractions. Therefore, the reported impurities are assumed to be by weight, as is done in IEU-MET-FAST-007.

Table 52: Measured HEU plate impurities.

Impurity (ppm U)	15/0-HEU			15/6-HEU	
	11147	11149	11150	10932	10933
Li	<0.1	<0.1	<0.1	<0.1	<0.1
Be	<0.1	<0.1	<0.1	<0.1	<0.1
B	0.6	0.6	0.30	0.2	<0.1
C	1100	270.0	320.00	170	170
Na	<1	<1	<1	<1	<1
Mg	<1	<1	<1	<1	1
Al	50	40.0	20.00	150	100
Si	300	400.0	210.00	80	130
Ca	<2	<2	<2	<2	<2
V	<20	<20	<20	<20	<20
Cr	5	15.0	5.00	2	3
Mn	4	7.0	6.00	7	6
Fe	100	190.0	90.00	70	30
Co	<5	<5	<5	<5	<5
Ni	20	30.0	20.00	15	15
Cu	6	5.0	4.00	4	3

Mo	50	<25	<25	-	-
Sn	<1	<1	<1	-	-
Pb	5	<1	<1	-	-

2.2.3 NaCl Plates

The following subsections report impurity analysis and moisture content of the NaCl salt. These measurements were performed by Eurofins prior to the experiment. For each of the measurements a random sample of 16 plates were combined to a total of four samples: 01-08, 01-10, 01-11, and 01-13. Each of the samples were testing independently. Table 53 displays which samples corresponded to which plate.

Table 53: NaCl salt plate identification numbers with their respective sample identifiers.

Plate ID	Original NaCl Sample ID	Final NaCl Sample ID
SaltPlate3/16-1	001	-
SaltPlate3/16-2	002	-
SaltPlate3/16-3	003	-
SaltPlate3/16-4	004	-
SaltPlate3/16-5	005	-
SaltPlate3/16-6	006	-
SaltPlate3/16-7	007	-
SaltPlate3/16-8	008	-
SaltPlate3/16-9	009	-
SaltPlate3/16-10	010	01-13
SaltPlate3/16-11	011	-
SaltPlate3/16-12	012	-
SaltPlate3/16-13	013	-
SaltPlate3/16-14	014	-
SaltPlate3/16-15	015	-
SaltPlate3/16-16	016	-
SaltPlate3/16-17	017	-
SaltPlate3/16-18	018	-
SaltPlate3/16-19	019	-
SaltPlate3/16-20	020	01-11
SaltPlate3/16-21	021	01-10
SaltPlate3/16-22	022	01-11
SaltPlate3/16-23	023	01-08

SaltPlate1/4-1	01-01	01-08
SaltPlate1/4-2	01-02	01-13
SaltPlate1/4-3	01-03	-
SaltPlate1/4-4	01-04	01-10
SaltPlate1/4-5	01-05	-
SaltPlate1/4-6	01-06	-
SaltPlate1/4-7	01-07	-
SaltPlate1/4-8	01-08	01-08
SaltPlate1/4-9	01-09	-
SaltPlate1/4-10	01-10	01-10
SaltPlate1/4-11	01-11	01-11
SaltPlate1/4-12	01-12	-
SaltPlate1/4-13	01-13	01-13

The salt containers were made of aluminum and are discussed in Section 2.2.5.

2.2.3.1 NaCl Salt Impurities

Salt impurities were checked against 77 elements through Glow-Discharge Mass Spectrometry (GDMS) at Eurofins (EAG Laboratories); however, the test was insensitive to C, N, and O. Additionally, Na and Cl were not reported as they are the main constituents of the salt. Arsenic (As) was marked as interference due to spectral interference and was not reported. The electrode used was made of Ta and so it was not measured. The impurities are reported in ppm weight and reported values less than the value given implies that the element was not detected above the lower threshold of the measurement. Table 54 tabulates the measured impurities of the NaCl salt.

Table 54: Measured NaCl impurities.

Element	Concentration [ppm wt]			
	01-08	01-10	01-11	01-13
Li	0.01	<0.01	<0.01	<0.01
Be	<0.01	<0.01	<0.01	<0.01
B	<0.05	<0.05	<0.05	<0.05
C	-	-	-	-
N	-	-	-	-
O	-	-	-	-
F	<1	<1	<1	<1
Na	Matrix	Matrix	Matrix	Matrix
Mg	0.86	0.47	0.39	0.47
Al	0.05	0.18	<0.05	0.07
Si	0.07	0.33	<0.05	0.12

P	<0.1	<0.1	<0.1	<0.1
S	1.2	5.1	3.4	3.1
Cl	Matrix	Matrix	Matrix	Matrix
K	4.3	7.8	14	17
Ca	0.9	2.1	2	1.6
Sc	<0.01	<0.01	<0.01	<0.01
Ti	<0.05	<0.05	<0.05	<0.05
V	<0.05	<0.05	<0.05	<0.05
Cr	<0.05	<0.05	<0.05	<0.05
Mn	<0.05	<0.05	<0.05	<0.05
Fe	<0.1	<0.1	<0.1	<0.1
Co	<0.05	<0.05	<0.05	<0.05
Ni	<0.1	<0.1	<0.1	<0.1
Cu	<1	<1	<1	<1
Zn	<0.1	<0.1	<0.1	<0.1
Ga	<0.05	<0.05	<0.05	<0.05
Ge	<0.5	<0.5	<0.5	<0.5
As	Interference	Interference	Interference	Interference
Se	<0.5	<0.5	<0.5	<0.5
Br	2.7	12	16	13
Rb	<0.01	<0.01	<0.01	<0.01
Sr	<0.12	<0.19	<0.11	<0.23
Y	<0.01	<0.01	<0.01	<0.01
Zr	<0.05	<0.05	<0.05	<0.05
Nb	<50	<50	<50	<50
Mo	<20	<20	<20	<20
Ru	<0.05	<0.05	<0.05	<0.05
Rh	<5	<5	<5	<5
Pd	<0.05	<0.05	<0.05	<0.05
Ag	<0.1	<0.1	<0.1	<0.1
Cd	<0.1	<0.1	<0.1	<0.1
In	<1	<1	<1	<1
Sn	<0.1	<0.1	<0.1	<0.1
Sb	<0.05	<0.05	<0.05	<0.05
Te	<0.05	<0.05	<0.05	<0.05
I	<0.05	<0.05	<0.05	<0.05
Cs	<0.5	<0.5	<0.5	<0.5
Ba	<0.05	<0.05	<0.05	<0.05
La	<0.05	<0.05	<0.05	<0.05

Ce	<0.05	<0.05	<0.05	<0.05
Pr	<0.05	<0.05	<0.05	<0.05
Nd	<0.05	<0.05	<0.05	<0.05
Sm	<0.05	<0.05	<0.05	<0.05
Eu	<0.05	<0.05	<0.05	<0.05
Gd	<0.05	<0.05	<0.05	<0.05
Tb	<0.05	<0.05	<0.05	<0.05
Dy	<0.05	<0.05	<0.05	<0.05
Ho	<0.05	<0.05	<0.05	<0.05
Er	<0.05	<0.05	<0.05	<0.05
Tm	<0.05	<0.05	<0.05	<0.05
Yb	<0.05	<0.05	<0.05	<0.05
Lu	<0.05	<0.05	<0.05	<0.05
Hf	<0.5	<0.5	<0.5	<0.5
Ta	Electrode	Electrode	Electrode	Electrode
W	<5	<5	<5	<5
Re	<0.1	<0.1	<0.1	<0.1
Os	<0.01	<0.01	<0.01	<0.01
Ir	<0.01	<0.01	<0.01	<0.01
Pt	<0.05	<0.05	<0.05	<0.05
Au	<5	<5	<5	<5
Hg	<0.1	<0.1	<0.1	<0.1
Tl	<0.01	<0.01	<0.01	<0.01
Pb	<0.05	<0.05	<0.05	<0.05
Bi	<0.01	<0.01	<0.01	<0.01
Th	<0.005	<0.005	<0.005	<0.005
U	<0.005	<0.005	<0.005	<0.005

2.2.3.2 NaCl Salt Moisture

A major concern of the salt is that it is hygroscopic, meaning that it will accumulate water over time when exposed to a source of water, such as the air. While NaCl is lowly hygroscopic compared to many other salts, an accurate quantification of the moisture content is important. Mass measurements of the plates, described in Section 2.1.4, were performed to measure any water retention that occurred before the experiment took place. Samples of the NaCl salt were taken during the plate filling procedure and were sent for moisture analysis through Instrumental Gas Analysis (IGA) Multiphase Analysis by Eurofins (EAG Laboratories). Table 55 tabulates the measured moisture concentrations for the NaCl samples.

Table 55: Measured NaCl water concentrations.

Water Concentration [ppm wt]			
01-08	01-10	01-11	01-13
120	160	120	130

2.2.4 Polyethylene

2.2.4.1 Polyethylene Density Measurements

The density of the polyethylene was analyzed at LLNL by performing high-precision volume and mass measurements of small samples taken from seven different polyethylene parts. The volume measurements were performed using a Micromeritics AccuPyc II gas displacement pycnometry system. The system used a 100 cm^3 sample chamber and was calibrated using a 51.08755 cm^3 calibration ball prior to each series of sample measurements. Each volume measurement was performed 10 times per sample. The mass measurements were performed on a balance with a precision of 10 µg. Each sample was weighed three times.

Table 56 reports the results of the density measurements performed on the seven polyethylene samples. The uncertainty in the mass and volume measurements is reported as the standard deviation of the three mass measurements and 10 volume measurements. These uncertainties are then propagated in quadrature to determine the standard deviation of the calculated density.

Table 56: Polyethylene part density measurements.

Part ID	Mass (g)	Volume (cm3)	Density (g/cm3)
0-CAP-3	39.92816±0.00003	41.1483±0.0047	0.9703±0.0001
3/32-CAP-3	48.90154±0.00004	50.4268±0.0033	0.9698±0.0001
1-RING-6	44.30622±0.00001	45.6667±0.0063	0.9702±0.0001
1/8-MOD-38	46.37212±0.00007	48.1521±0.0047	0.963±0.0001
1/4-MOD-36	58.59803±0.00001	61.2725±0.0043	0.9564±0.0001
1/2-MOD-32	57.58423±0.00007	60.1526±0.0022	0.9573±0.0000
1.5-MOD-12	42.35975±0.00002	44.2152±0.0059	0.9580±0.0001

2.2.4.2 Polyethylene Impurity Analysis

Elemental analysis by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) was performed on a 246.97 µg sample of the polyethylene. This process involved adding the sample to a digestion pressure vessel with 10 mL of 6M nitric acid (HNO_3) and then digesting it in a MARS6 Microwave Digestion System (Model 910900) following the CEM “Polyethylene” procedure in the semi-quantitative, MS/MS mode. The measured elemental impurities are reported in Table 57. The selection criteria required >5000 counts per second, elements included in the analysis were as follows: Mg, V, Mn, Ni, Cu, Zn, Ga, Zr, Mo, Sn, La, and Pb.

Table 57: Polyethylene impurity analysis results. Elements not meeting the selection criteria are not reported.

Element	Unit	Average	Standard Deviation
Na	µgg-1	14.38	1.82
Al	µgg-1	23.92	1.74
Si	mgg-1	1.17	0.06
Cr	ngg-1	921.35	7.08

2.2.5 Aluminum

Nearly all the aluminum parts in the experimental configuration are Aluminum Alloy 6061 (Al-6061). The only aluminum that is not Al-6061 are the screws used in the NaCl salt plates, which were made of Al-2024. Table 58 presents handbook data for Al-6061[1]. Table 59 presents handbook data for Al-2024[1].

Table 58: Elemental composition limits for Aluminum Alloy 6061.

Element	Unit
Al(a)	95.8-98.6
Mg	0.8-1.2
Si	0.4-0.8
Cu	0.15-0.4
Cr	0.04-0.35
Fe	Max 0.7
Zn	Max 0.25
Mn	Max 0.15
Ti	Max 0.15
Other, each	Max 0.05
Other, total	Max 0.15

[a]Aluminum Content reported is calculated as the remainder.

[1] ASTM B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric), ASTM International, West Conshohocken, PA, https://doi.org/10.1520/b0209m-14.

Table 59: Elemental composition limits for Aluminum Alloy 2024.

Element	Unit
Al(a)	90.7-94.7
Mg	1.2-1,8
Si	Max 0.5
Cu	3.8-4.9
Cr	Max 0.1
Fe	Max 0.5
Zn	Max 0.25
Mn	0.3-0.9
Ti	Max 0.15
Other, each	Max 0.05
Other, total	Max 0.15

2.3 Temperature Data

The temperature of each experimental configuration was measured with resistance temperature detectors (RTDs). During the approach to critical an RTD was placed on the upper reflector and other was placed to measure the rooms ambient temperature. During the benchmark measurements the RTD on the upper reflector was removed.

2.4 Supplemental Experimental Measurements

No additional experimental measurements were performed.

Section 3

Experimental Measurements and Configurations

3.1 Experimental Measurements

3.1.1 Period Measurements

Period measurements were performed using three compensated ion chambers, referred to as linear channels (LC), and four ^{3}He proportional counters, referred to as start-up (SU) detectors, for all experimental configurations. Experiment information as well as *in-situ* (via the Comet control system) period measurements are shown in Table 60. Estimated excess reactivities corresponding to the period measurements are shown in Table 61. Excess reactivities were estimated using the standard HEU Keepin delayed neutron parameters [6].

Reproducibility measurements were performed for the two standard configurations. The reproducibility measurements involved unstacking and restacking in the same orientation and with the same parts. The system was then taken critical again to determine how reproducible the measured period of the benchmark measurements was.

Table 60: Period measurements for each experiment.

Configuration	Date	Time	Measured Period (s)					Notes
			SU	LC1	LC2	LC3	LC_{avg}	
8-Layer Sandwich	July 22, 2024	13:34	216.76	206.03	205.69	205.65	205.79	Benchmark Measurement
8-Layer Standard	July 29, 2024	13:31	127.54	118.86	119.72	118.91	119.16	Benchmark Measurement
	July 30, 2024	11:56	173.34	160.39	158.90	162.66	160.65	Reproducibility Measurement
18-Layer Standard	August 1, 2024	9:35	49.92	47.71	47.77	48.08	47.85	Benchmark Measurement
	August 5, 2024	9:47	60.18	57.01	57.20	56.72	56.98	Reproducibility Measurement

Table 61: Estimated excess reactivities for each experiment.

Configuration	Excess Reactivity Estimate, ρ (¢)					Notes
	SU	LC1	LC2	LC3	LC_{avg}	
8-Layer Sandwich	5.21	5.44	5.45	5.45	5.45	Benchmark Measurement
8-Layer Standard	8.15	8.62	8.57	8.62	8.60	Benchmark Measurement
	6.31	6.74	6.66	6.31	6.57	Reproducibility Measurement
	15.83	16.33	16.31	16.24	16.29	Benchmark Measurement

18-Layer Standard	13.91	14.45	14.42	14.50	14.46	Reproducibility Measurement

3.1.2 Temperature Measurements

Resistance temperature detectors (RTDs) were used during the experiment to measure the temperature of the stack and the room. Ambient measurements were performed during each experiment, including the approach to critical and benchmark measurements. Stack temperature measurements were only performed during the approach to critical to avoid adding additional reflector and for the ease of modeling. Table 62 reports the temperature readings taken during each experiments approach to critical and benchmark measurement.

Table 62: RTD temperature readings for each experiment.

Configuration	Date	Time	Approach		Benchmark	Notes
			UR	Ambient	Ambient	
8-Layer Sandwich	July 22, 2024	13:34	15.4	14.9	14.9	Benchmark Measurement
8-Layer Standard	July 29, 2024	13:31	-	14.7	14.9	Benchmark Measurement
	July 30, 2024	11:56	-	-	14.8	Reproducibility Measurement
18-Layer Standard	August 1, 2024	9:35	13.9	14.5	14.6	Benchmark Measurement
	August 5, 2024	9:47	-	-	15.1	Reproducibility Measurement

3.1.3 Height Measurements

In past experiments, namely TEX-HEU and TEX-Hf, height gauges were used to perform stack height measurements. For this experiment only the first configuration was measured using the stack height gauge. A 24-inch Westward Electronic Height Gauge (model number: 2YND5; calibration number: 018643) was used to measure the top and bottom stack heights. Articulated Arm CMM (calibration number: 240116-14017-UC) stack height measurements were performed with a Hexagon Absolute Arm 8525-7. The measurements were performed in place and after restacking on a granite plate. Stack height measurements were performed using both the height gauge and the CMM for the 8-layer sandwich configuration in order to validate the method, since this is the first instance of utilizing the CMM to perform in-place stack height measurements on Comet.

A new adapter plate was designed (Section 2.1.2.2) to allow the height gauge to zero at the bottom of the lower reflector. In the past, the lip of the adapter plate created an offset in the measurement. Figure 20 shows the measurement locations on Comet using the height gauge.

CMM measurements were performed on Comet by placing the CMM on a tripod which stood either next to Comet or on the Comet platform. Figure 21 shows the measurement locations on

Comet and on the granite plate after restacking for the 8-layer sandwich configuration. The "X" in Figure 21 denotes the location of the CMM in relation to Comet. The three measurements locations, H_1 through H_3, were not single measurements, but rather a set of measurements that were averaged to obtain a single value for each region. The reflector rings were measured using an average value to represent the total height. CMM measurements for the 8-layer and 18-layer standard configurations adopted a cardinal measurement scheme here the center of the plate and the points in the cardinal N/S/E/W directions were measured, shown in Figure 22.

CMM measurements were directly compared to the height gauge measurements and agreed during the first set of measurements. However, in the following data sets the values were offset from the height gauge measurements by a common factor. This is due to the orientation of the CMM tip within the software that analyzes the data. In some instances the CMM tip would become *flipped* in the software and needed to be manually corrected so that the correct heights were reported.

Table 63 reports core stack and reflector height measurements for the 8-layer sandwich configuration using the height gauge. Table 64 reports core stack and reflector height measurements for the 8-layer sandwich configuration using the CMM. Table 65 reports core stack and reflector height measurements for the 8-layer standard configuration using the CMM. Table 66 reports core stack and reflector height measurements for the 18-layer standard configuration using the CMM. Table 67 summarizes the average core stack height measurements for all three configurations.

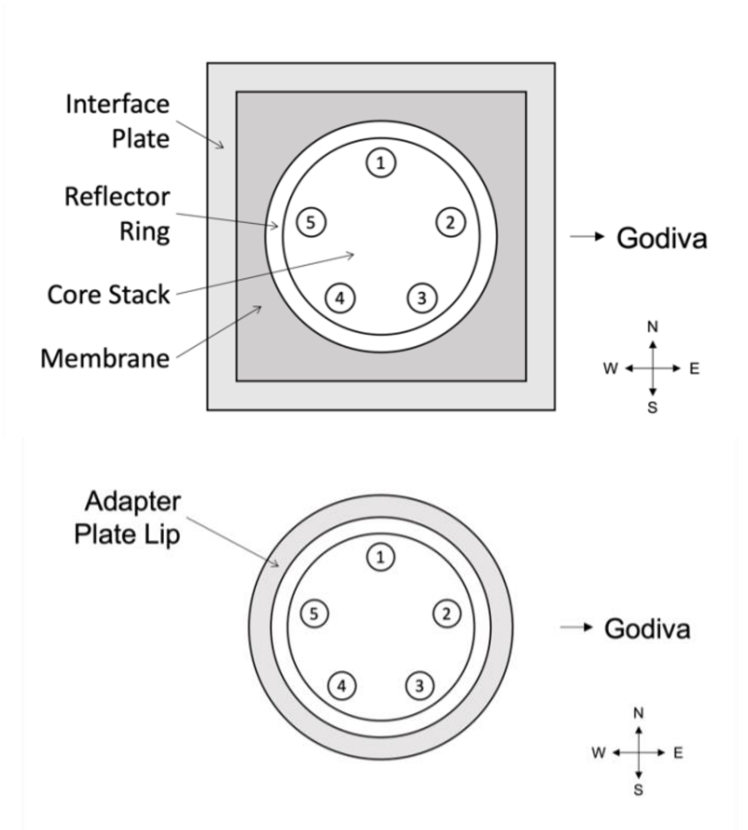

Figure 20: Upper (top) and lower (bottom) stack height measurement locations using the height gauge.

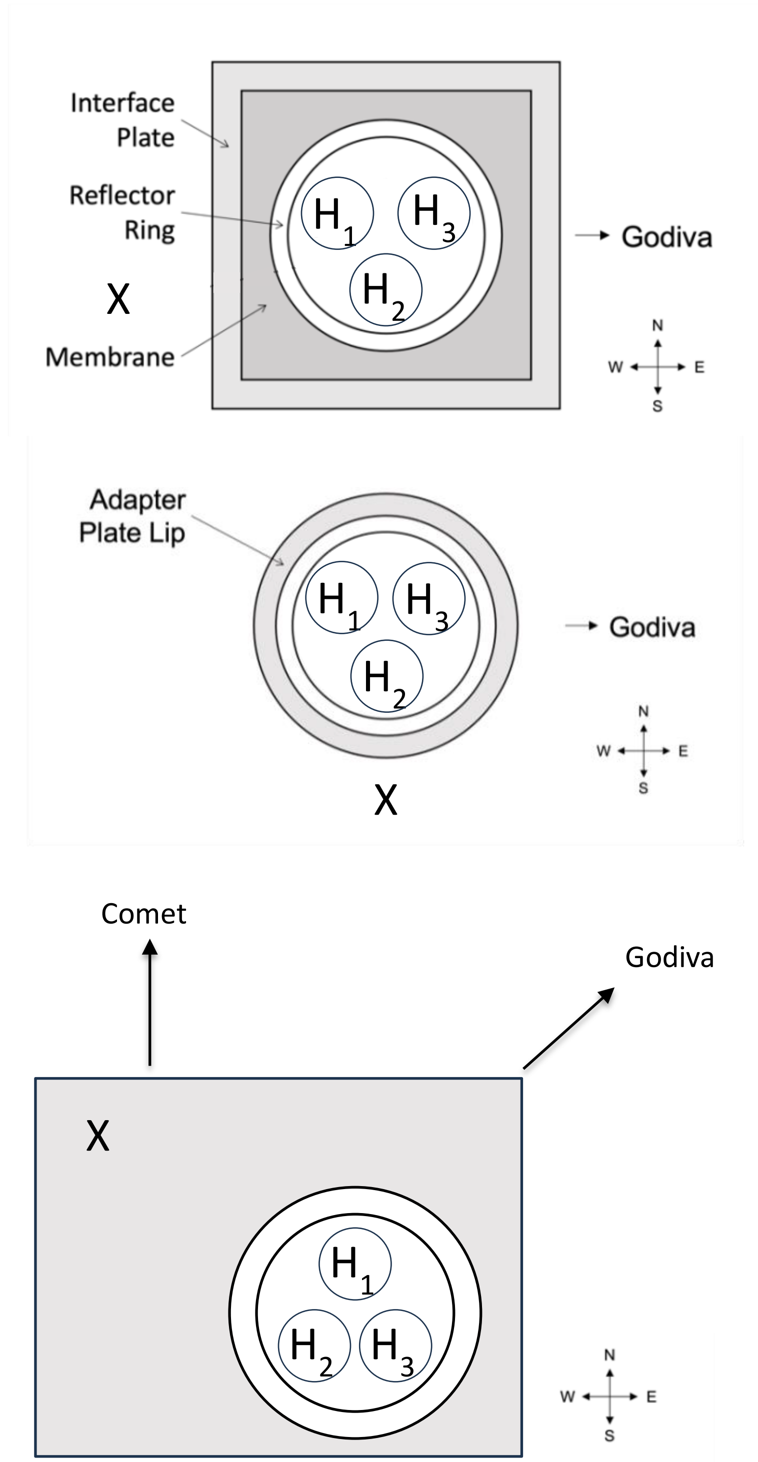

Figure 21: Upper (top), lower (middle), and granite plate (bottom) stack height measurement locations using the CMM. X denotes the location of the CMM.

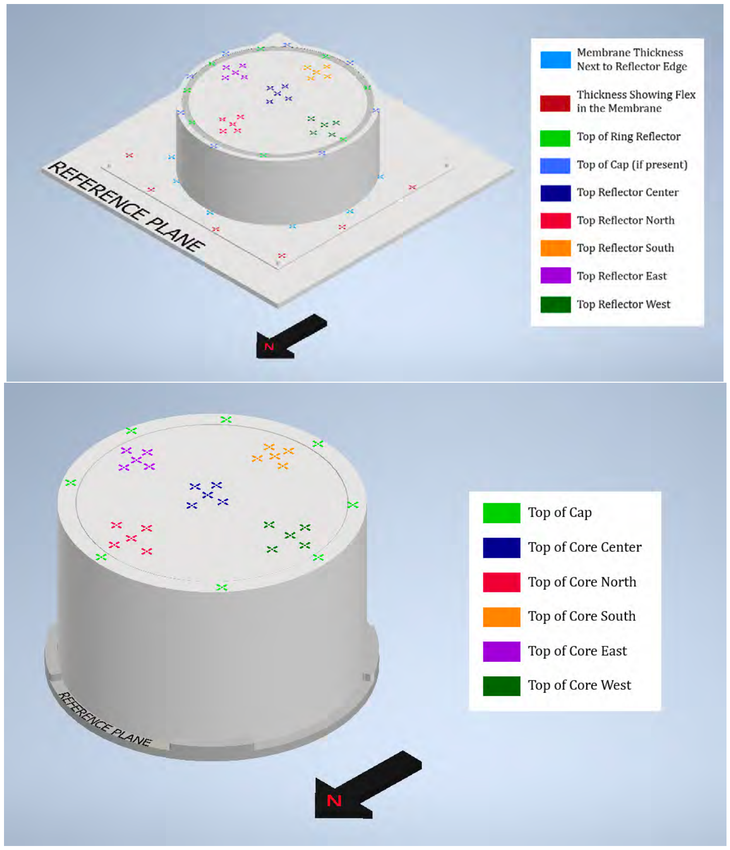

Figure 22: Upper (top) and lower (bottom) stack height measurement locations using the CMM for the N/S/E/W/Center positions.

Table 63: Core stack and reflector height measurements for the 8-layer sandwich configuration using the height gauge.

Location	Upper		Lower	
	Measurement	Re-Zero	Measurement	Re-Zero
1	167.52	0.01	-	-
2	167.34	0.00	-	-
3	166.59	0.15	-	-
4	167.88	0.05	-	-
5	167.32	0.56	-	-
Reflector Ring	168.65	0.23	-	-

Table 64: Core stack and reflector height measurements for the 8-layer sandwich configuration using the CMM.

CMM (On Comet)		
Location	Upper	Lower
H_1	167.312	240.510
H_2	167.610	240.544
H_3	167.150	240.692
Average	167.384	240.540
Reflector Ring	167.697	240.410
Retaining Ring	168.145	-

CMM (On Table)		
Location	Upper	Lower
H_1	168.285	240.971
H_2	168.006	240.464
H_3	168.060	240.676
Average	168.190	240.667
Reflector Ring	168.219	240.789
Retaining Ring	168.659	-

Table 65: Core stack and reflector height measurements for the 8-layer standard configuration using the CMM.

CMM (On Comet)		
Location	Upper	Lower
Center	195.554	263.960
North	196.254	264.115
South	195.361	263.922
East	195.392	263.698
West	195.791	263.990
Average	195.702	264.048
1/2-RING-2	196.292	-
0-CAP-1	196.819	-
1/32-CAP-1	-	264.549

CMM (On Table)		
Location	Upper	Lower
Center	194.036	264.117
North	194.178	264.031
South	193.364	264.106
East	193.148	264.064
West	193.618	264.408
Average	193.791	264.188
1/2-RING-2	193.680	-
0-CAP-1	194.148	-
1/32-CAP-1	-	264.815

Table 66: Core stack and reflector height measurements for the 18-layer standard configuration using the CMM.

CMM (On Comet)		
Location	Upper	Lower
Center	127.335	203.707
North	127.272	203.304
South	128.210	203.553
East	127.943	203.844
West	127.792	203.438
Average	127.634	203.610
1/32-CAP-2	127.551	-
1/8-CAP-2	-	203.351

CMM (On Table)		
Location	Upper	Lower
Center	125.806	204.140
North	125.972	203.579
South	125.479	204.651
East	126.310	203.873
West	126.039	203.740
Average	126.131	204.068
1/32-CAP-2	125.095	-
1/8-CAP-2	-	203.645

Table 67: Summary of the average core stack heigh measurements for all three configurations.

Average Core Stack Height (mm)					
Configuration	Upper			Lower	
	Height Gauge	CMM on Comet	CMM On Table	CMM on Comet	CMM On Table
8-Layer Sandwich	167.33	167.384	168.190	240.540	240.667
8-Layer Standard	-	195.702	193.791	264.048	264.188
18-Layer Standard	-	127.634	126.131	203.610	204.068

3.1.4 Levelness

Levelness measurements of the top and bottom stacks while on Comet were performed using a 2PM TOOLS digital level (calibration number: 019209). The measurements were performed in two directions: North/South and East West. Figure 23 shows how the levelness measurements were performed. Table 68 reports the levelness measurements of the top and bottom stacks of each of the three experimental configurations.

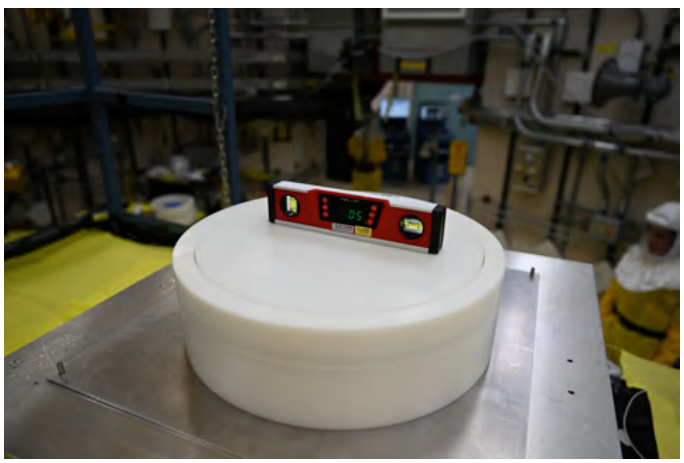

Figure 23: Levelness measurements being performed for the top stack.

Table 68: Levelness measurements of the top and bottom stack while on Comet.

	Level Measurement (°)			
Configuration	Top Stack		Bottom Stack	
	North/South	East/West	North/South	East/West
8-Layer Sandwich	0.20	0.15	0.10	0.05
8-Layer Standard	0.00	0.00	0.05	0.00
18-Layer Standard	0.30	0.05	0.15	0.00

3.1.5 Room and Comet Measurements

Table 69 reports additional measurements performed to characterize the location of the experimental configurations within the experiment room and on Comet. The measurements between the interface plate and the ceiling or wall were performed using a laser distance sensor. The other measurements were performed by hand using a tape measure. All measurements besides the distance to the start-up detectors were taken from the TEX-Hf evaluation.

Table 69: Measurements of the experiment room and Comet.

Location	Measurements
Top of Interface Plate to the Ceiling	2.329 m
West side of Interface Plate to the Wall	3.128 m
East side of Interface Plate to the Start-Up Detectors	2.794 m
Top of Comet Stationary Platform to the Floor	207 cm
Top of Interface Plate to Top of Comet Stationary Platform	31.8 cm

3.2 Experimental Configurations

3.2.1 8-Layer Sandwich Configuration

The 8-layer sandwich configuration included 8 HEU plates, 7 1/4-inch NaCl salt plates, 12 3/4-inch moderator plates, and a nominal 0.250-inch upper reflector. The 8 HEU plates consisted of five 15/0-HEU, one 15/2.5-HEU, one 15/6-HEU, and one 15/10-HEU plates, for a total HEU mass of 48.6 kg. This configuration used the Sandwich stacking method described in Section 2.1.1.

Table 70 reports the height measurements of the upper and lower core stacks and reflector rings. The measurement locations are described in Section 3.1.3. Table 71 reports the benchmark period measurement. Table 72, Table 73, and Figure 24 list the parts used in this configuration.

Table 70: Height measurements of the core stacks (left) and reflector rings (right) for the 8-layer sandwich configuration.

Location	Core Stack Height (mm)	
	Upper	Lower
H_1	168.285	240.510
H_2	168.006	240.544
H_3	168.060	240.692
Average	168.190	240.540

Location	Reflector Ring Height (mm)	
	Upper	Lower
Top of 1/16-CAP-3	-	240.410
Top of 1/2-RING-1	168.219	-
Top of 0-CAP-1	168.659	-

Table 71: Benchmark period measurements for the 8-layer sandwich configuration.

Detector	Benchmark Configuration		
	Period (s)	ρ (¢)	Scale
SU	216.76	5.21	10,000
LC1	206.03	5.44	10^{-10}
LC2	205.69	5.45	10^{-10}
LC3	205.65	5.45	10^{-10}
LC_{avg}	205.79	5.45	
$\sigma(LC_{avg})$	0.21	0.01	

Table 72: Parts used in the upper (left) and lower (right) core stacks of the 8-layer sandwich configuration.

Layer	Upper Core Stack	
	Primary	Secondary
14	1/4-MOD-1	(Upper Reflector)
13	10458	10-DISK-2
12	3/4-MOD-14	-
11	Salt Plate 1/4-9	-
10	3/4-MOD-13	-
9	10487	2.5-DISK-1
8	3/4-MOD-12	-
7	Salt Plate 1/4-8	-
6	3/4-MOD-11	-
5	11018	Q2-16
4	3/4-MOD-10	-
3	Salt Plate 1/4-7	-
2	3/4-MOD-9	-
1	11147	-

Layer	Lower Core Stack
	Primary
17	3/4-MOD-8
16	Salt Plate 1/4-5
15	3/4-MOD-7
14	11149
13	3/4-MOD-6
12	Salt Plate 1/4-4
11	3/4-MOD-5
10	11019
9	3/4-MOD-4
8	Salt Plate 1/4-3
7	3/4-MOD-3
6	11017
5	3/4-MOD-2
4	Salt Plate 1/4-2
3	3/4-MOD-1
2	11150
1	1.0-BOTREFSRC-2

Table 73: Parts used in the upper (left) and lower (right) reflector rings of the 8-layer sandwich configuration.

Upper Reflector Rings	
Layer	Primary
5	0-CAP-1
4	1/2-RING-1
3	3-RING-4
2	3-RING-1
1	0-BOTCAP-1

Lower Reflector Rings	
Layer	Primary
6	1/16-CAP-3
5	1/4-RING-1
4	1-RING-3
3	3-RING-2
2	1-RING-1
1	3-RING-3

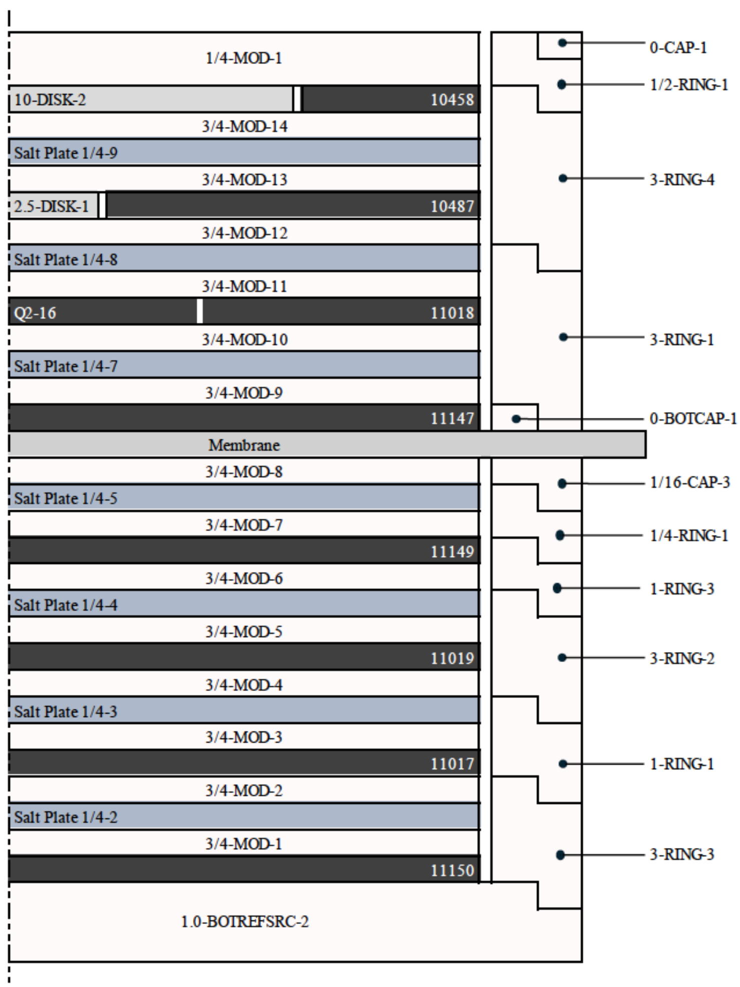

Figure 24: Axisymmetric diagram of the 8-layer sandwich configuration (not to scale).

3.2.2 8-Layer Standard Configuration

The 8-layer standard configuration included 8 HEU plates, 7 1/4-inch NaCl salt plates, 7 1.5-inch moderator plates, 7 1/4-inch moderator plates, and a nominal 0.500-inch upper reflector. The 8 HEU plates consisted of five 15/0-HEU, one 15/2.5-HEU, one 15/6-HEU, and one 15/10-HEU plates, for a total HEU mass of 48.6 kg. This configuration used the Standard stacking method described in Section 2.1.1.

Table 74 reports the height measurements of the upper and lower core stacks and reflector rings. The measurement locations are described in Section 3.1.3. Table 75 reports the benchmark period measurement. Table 76, Table 77, and Figure 25 list the parts used in this configuration.

Table 74: Height measurements of the core stacks (left) and reflector rings (right) for the 8-layer standard configuration.

Location	Core Stack Height (mm)	
	Upper	Lower
Center	195.554	263.960
North	196.254	264.115
South	195.361	263.922
East	195.392	263.698
West	195.791	263.990
Average	195.702	264.048

Location	Reflector Ring Height (mm)	
	Upper	Lower
Top of 1/32-CAP-1	-	264.549
Top of 1/2-RING-1	196.292	-
Top of 0-CAP-1	196.819	-

Table 75: Benchmark and reproducibility period measurements for the 8-layer standard configuration.

Detector	Benchmark Configuration		
	Period (s)	ρ (¢)	Scale
SU	127.54	8.15	10,000
LC1	118.86	8.62	10^{-10}
LC2	119.72	8.57	10^{-10}
LC3	118.91	8.62	10^{-10}
LC_{avg}	119.16	8.60	
$\sigma(LC_{avg})$	0.48	0.03	

Detector	Reproducibility Measurement		
	Period (s)	ρ (¢)	Scale
SU	173.34	6.31	10,000
LC1	160.39	6.74	10^{-10}
LC2	158.90	6.66	10^{-10}
LC3	162.66	6.31	10^{-10}
LC_{avg}	160.65	6.57	
$\sigma(LC_{avg})$	1.89	0.23	

Table 76: Parts used in the upper (left) and lower (right) core stacks of the 8-layer standard configuration.

Layer	Upper Core Stack	
	Primary	Secondary
14	1/2-MOD-1	(Upper Reflector)
13	10458	10-DISK-2
12	Salt Plate 1/4-09	-
11	1.5-MOD-8	-
10	1/4-MOD-7	-
9	10487	2.5-DISK-1
8	Salt Plate 1/4-08	-
7	1.5-MOD-7	-
6	1/4-MOD-6	-
5	11018	Q2-16
4	Salt Plate-1/4-07	-
3	1.5-MOD-6	-
2	1/4-MOD-5	-
1	11147	-

Layer	Lower Core Stack
	Primary
17	Salt Plate 1/4-05
16	1.5-MOD-5
15	1/4-MOD-4
14	11149
13	Salt Plate 1/4-04
12	1.5-MOD-4
11	1/4-MOD-3
10	11019
9	Salt Plate 1/4-03
8	1.5-MOD-3
7	1/4-MOD-2
6	11017
5	Salt Plate 1/4-02
4	1.5-MOD-1
3	1/4-MOD-1
2	11150
1	1-BOTREFSRC-2

Table 77: Parts used in the upper (left) and lower (right) reflector rings of the 8-layer standard configuration.

Upper Reflector Rings	
Layer	Primary
5	1/2-RING-2
4	3-RING-5
3	3-RING-4
2	1-RING-5
1	0-BOTCAP-1

Lower Reflector Rings	
Layer	Primary
5	1/32-CAP-1
4	1/4-RING-2
3	3-RING-2
2	3-RING-3
1	3-RING-1

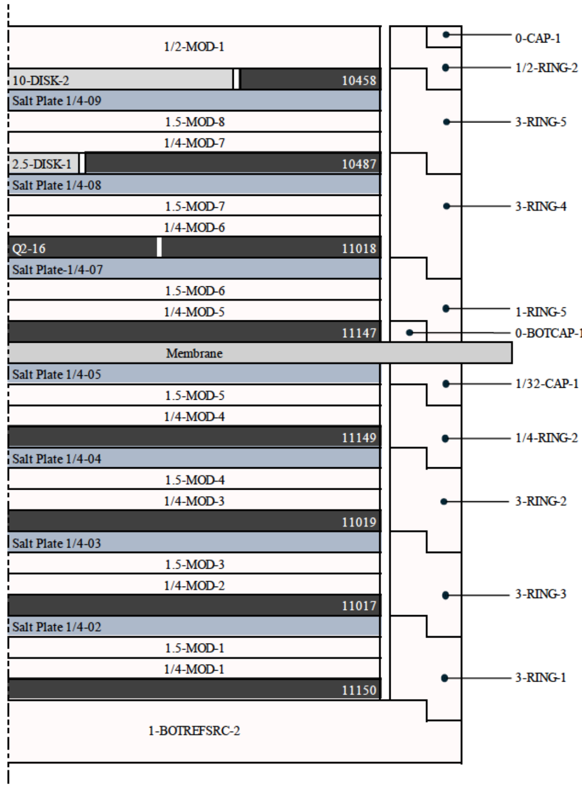

Figure 25: Axisymmetric diagram of the 8-layer standard configuration (not to scale).

3.2.3 18-Layer Standard Configuration

The 18-layer standard configuration included 18 HEU plates, 17 3/16-inch NaCl salt plates, 17 1/8-inch moderator plates, and a nominal 17/16-inch upper reflector. The 8 HEU plates consisted of five 15/0-HEU, seven 15/2.5-HEU, and six 15/6-HEU, for a total HEU mass of 109.2 kg. This configuration used the Standard stacking method described in Section 2.1.1.

Table 78 reports the height measurements of the upper and lower core stacks and reflector rings. The measurement locations are described in Section 3.1.3. Table 79 reports the benchmark period measurement. Table 80, Table 81, and Figure 26 list the parts used in this configuration.

Table 78: Height measurements of the core stacks (left) and reflector rings (right) for the 18-layer standard configuration.

Location	Core Stack Height (mm)	
	Upper	Lower
Center	127.335	203.707
North	127.272	203.304
South	128.210	103.553
East	127.943	203.844
West	127.792	203.438
Average	127.634	203.610

Location	Reflector Ring Height (mm)	
	Upper	Lower
Top of 1/8-CAP-2	-	203.351
Top of 1/32-CAP-2	127.551	-

Table 79: Benchmark and reproducibility period measurements for the 18-layer standard configuration.

Detector	Benchmark Configuration		
	Period (s)	ρ (¢)	Scale
SU	49.92	15.83	10,000
LC1	47.71	16.33	10^{-9}
LC2	47.77	16.31	10^{-9}
LC3	48.08	16.24	10^{-9}
LC_{avg}	47.85	16.29	
$\sigma(LC_{avg})$	0.20	0.05	

Detector	Reproducibility Measurement		
	Period (s)	ρ (¢)	Scale
SU	60.18	13.91	10,000
LC1	57.01	14.45	10^{-9}
LC2	57.20	14.42	10^{-9}
LC3	56.72	14.50	10^{-9}
LC_{avg}	56.98	14.46	
$\sigma(LC_{avg})$	0.24	0.04	

Table 80: Parts used in the upper (left) and lower (right) core stacks of the 18-layer standard configuration.

Layer	Upper Core Stack	
	Primary	Secondary
20	1/16-REF-1	(Upper Reflector)
19	10935	6-DISK-5
18	Salt Plate 3/16-19	-
17	1/8-MOD-17	-
16	10933	6-DISK-4
15	Salt Plate 3/16-18	-
14	1/8-MOD-16	-
13	10570	2.5-DISK-7
12	Salt Plate 3/16-17	-
11	1/8-MOD-15	-
10	10475	2.5-DISK-6
9	Salt Plate 3/16-16	-
8	1/8-MOD-14	-
7	10489	2.5-DISK-5

Layer	Lower Core Stack
	Primary
34	Salt Plate 3/16-13
33	1/8-MOD-11
32	11150
31	Salt Plate 3/16-12
30	1/8-MOD-10
29	11019
28	Salt Plate 3/16-11
27	1/8-MOD-9
26	11147
25	Salt Plate 3/16-10
24	1/8-MOD-8
23	11149
22	Salt Plate 3/16-09
21	1/8-MOD-7
20	10467
19	Salt Plate 3/16-08
18	1/8-MOD-6

Table 81: Parts used in the upper (left) and lower (right) reflector rings of the 18-layer standard configuration.

Upper Reflector Rings	
Layer	Primary
5	1-RING-5
4	1/2-RING-2
3	1/4-RING-1
2	3-RING-3
1	0-BOTCAP-1

Lower Reflector Rings	
Layer	Primary
5	1/8-CAP-2
4	1/2-RING-3
3	1/4-RING-2
2	3-RING-2
1	3-RING-1

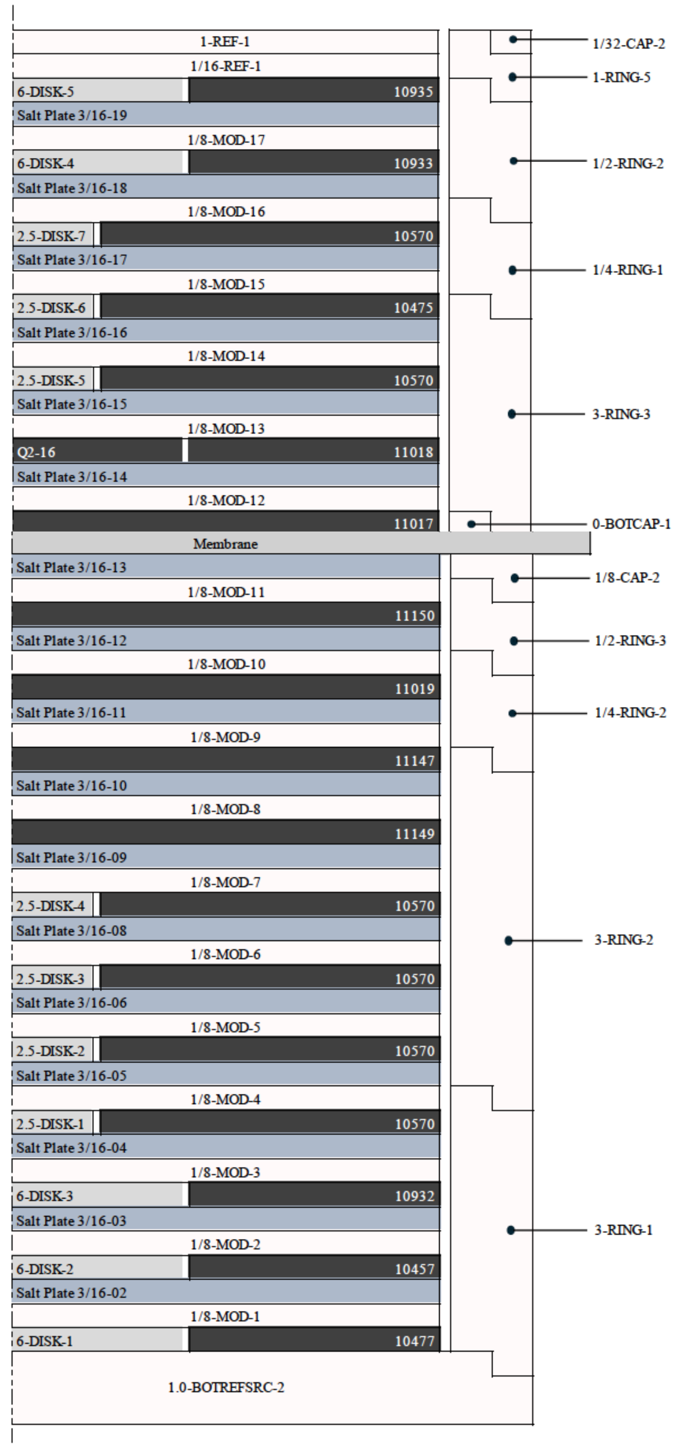

Figure 26: Axisymmetric diagram of the 18-layer standard configuration (not to scale).

Section 4

References

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5. Cutler, T. and Grove, T., *NCSP IER-499 CED-3a Documentation,* Technical Report, Los Alamos National Laboratory, July 1, 2024.
6. G.R. Keepin, Physics of Nuclear Kinetics, Addison-Wesley (1965).

Appendix A

NaCl Impurity and Moisture Analysis Reports

See attached.