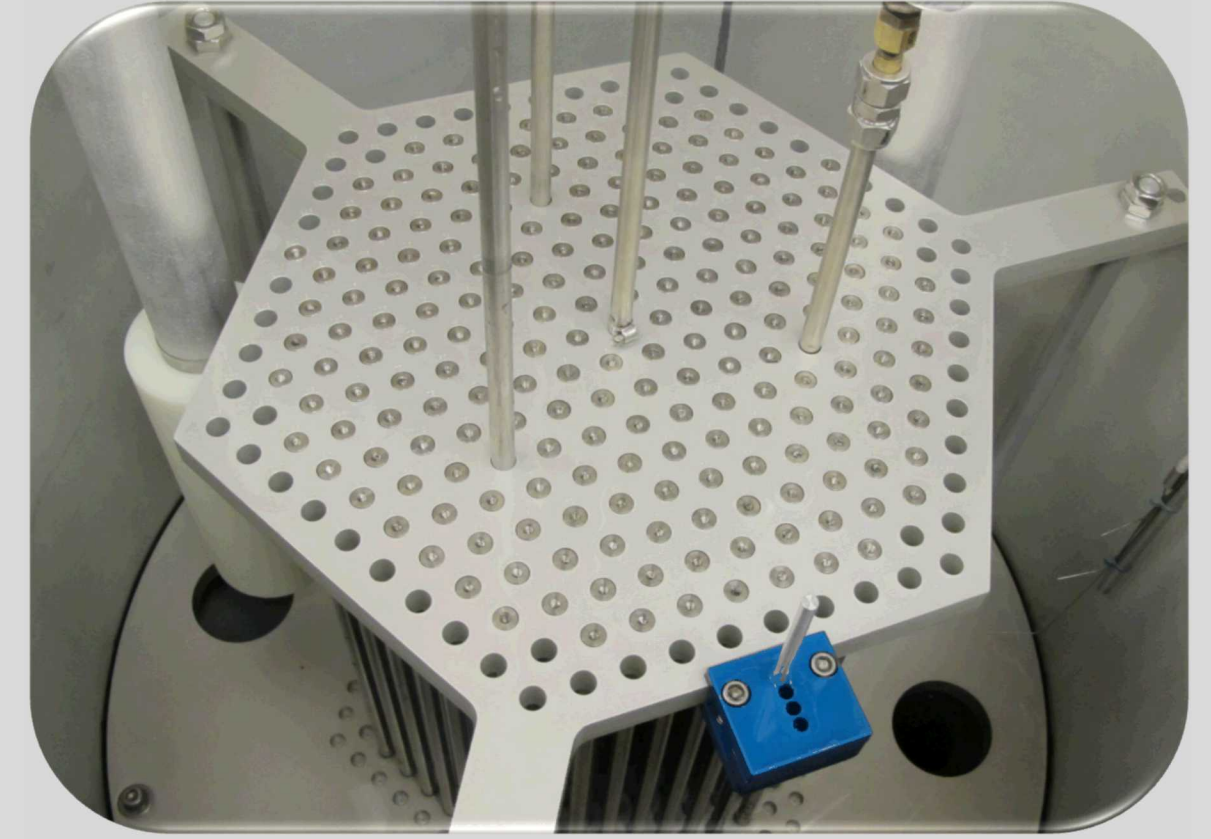




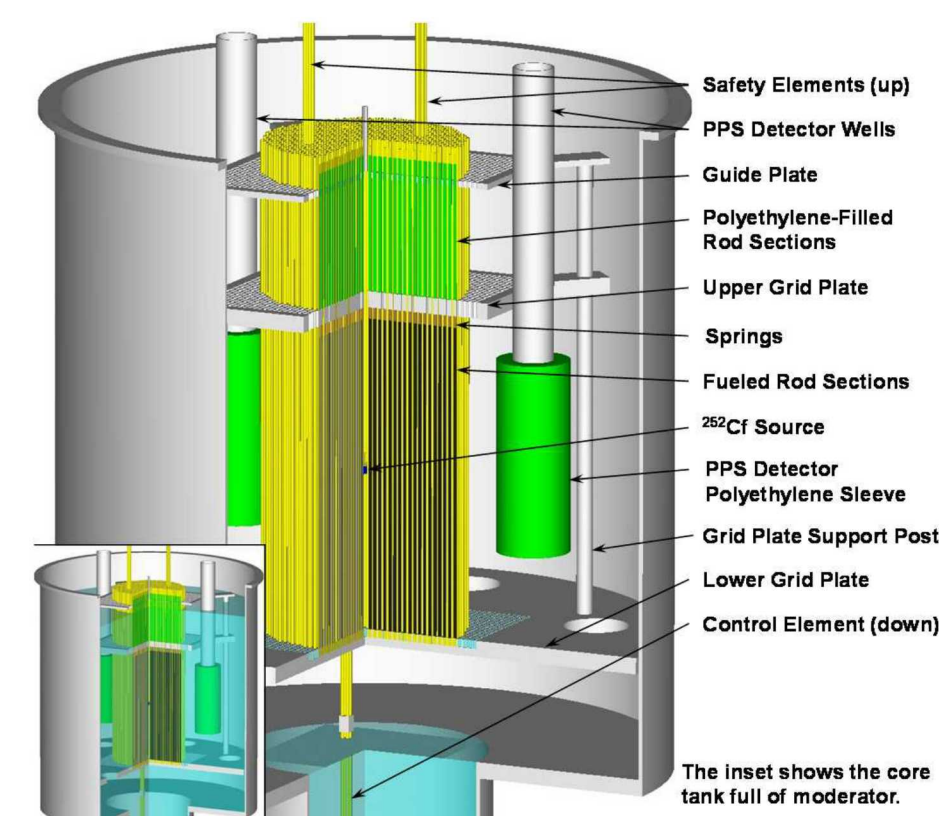
Sandia Critical Experiments Program and Nuclear Criticality Safety Program



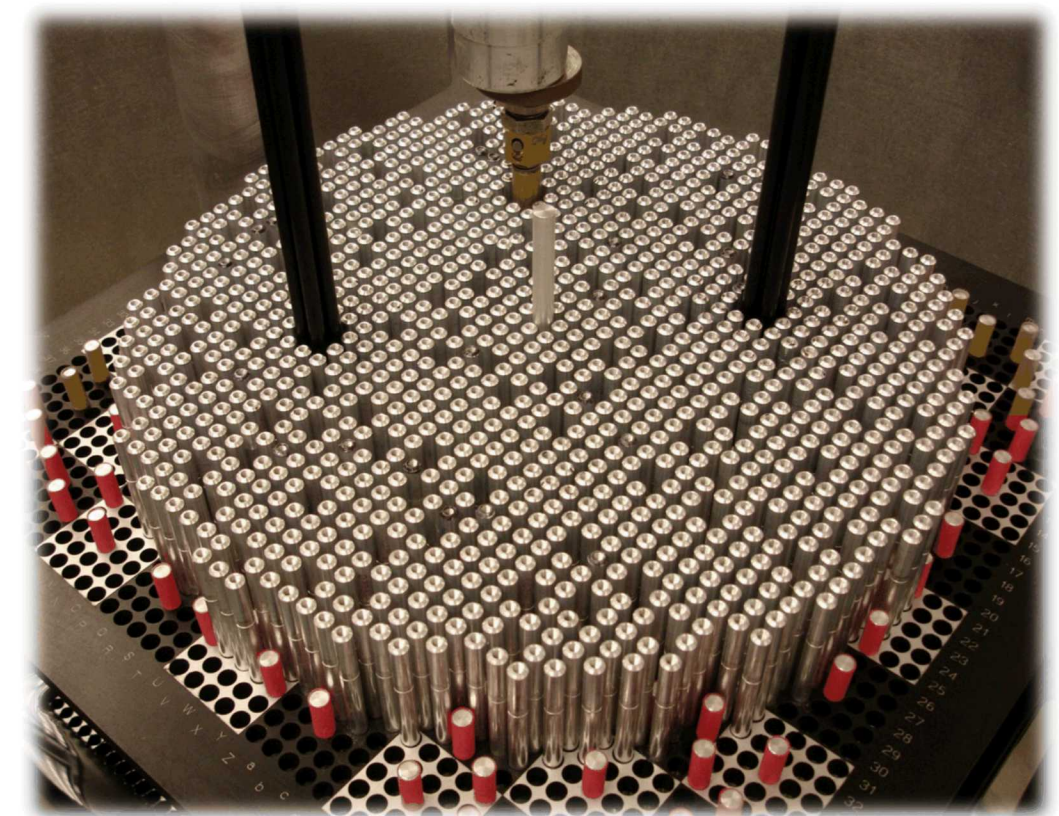
Seven Percent Critical Experiment (7uPCX)

Designed and built to perform and analyze critical benchmark experiments for validating reactor physics methods and models for fuel enrichments greater than 5% ²³⁵U. The Core is a 45x45 array of rods to simulate nine commercial fuel elements in a 3x3 array.

Multiple 7uPCX configurations for evaluating critical systems at different fuel-to-moderator ratios, fully and partially reflected cores, and with titanium/aluminum rod loadings have been performed and are documented in the International Critical Safety Benchmark Evaluation Project (ICSBEP) Handbook as LEU-COMP-THERM-078, LEU-COMP-THERM-080, LEU-COMP-THERM-096, and LEU-COMP-THERM-097.



Cut-away view of 7uPCX core tank

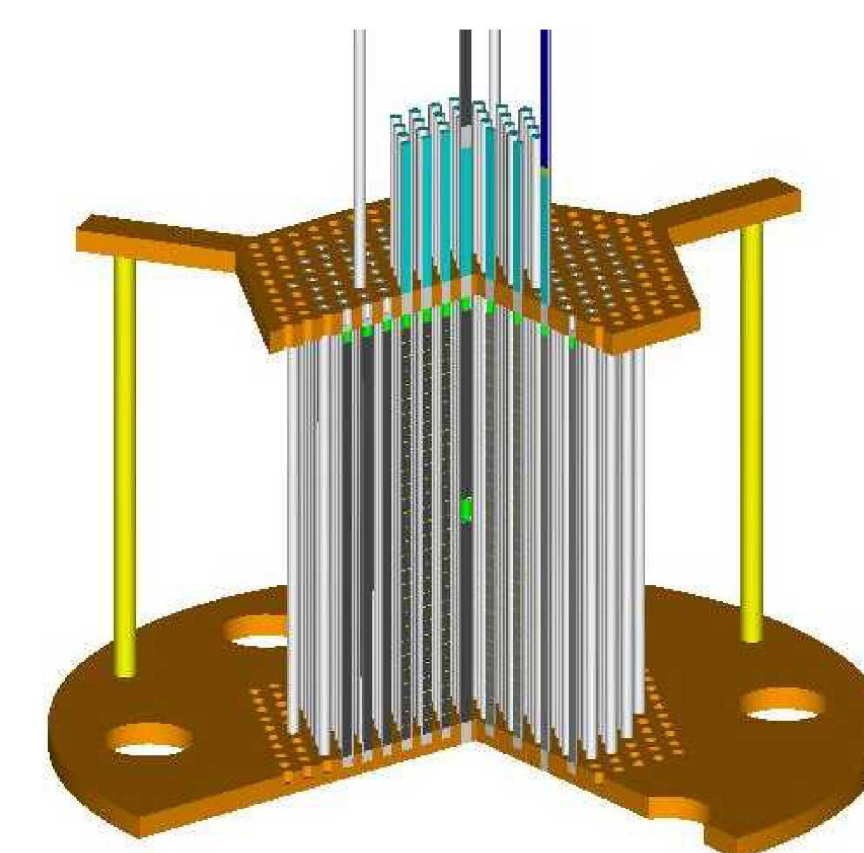


Critical fuel loading for 7uPCX

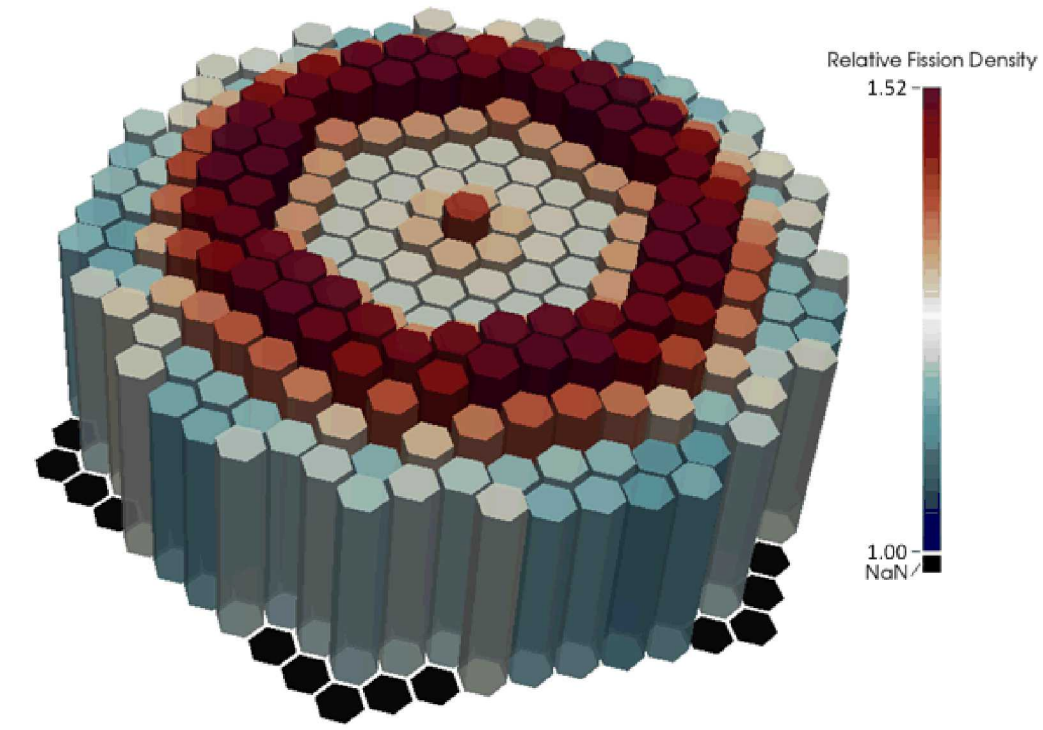
Burnup Credit Critical Experiment (BUCCX)

Designed and built for inserting fission product materials to measure reactivity effects. Experiments with rhodium were completed and documented in the ICSBEP Handbook as LEU-COMP-THERM-079.

Experiments measuring the effect of titanium on critical systems were recently performed. The series of experiments (BUCCX and 7uPCX configurations) provided the first integral test of newly-evaluated titanium nuclear data. The results will also be used by Savannah River National Laboratory to decrease waste processing costs while maintaining the required level of safety. The experiments are documented in the ICSBEP Handbook as LEU-COMP-THERM-097 and LEU-COMP-THERM-099.



Cut-away view of BUCCX core

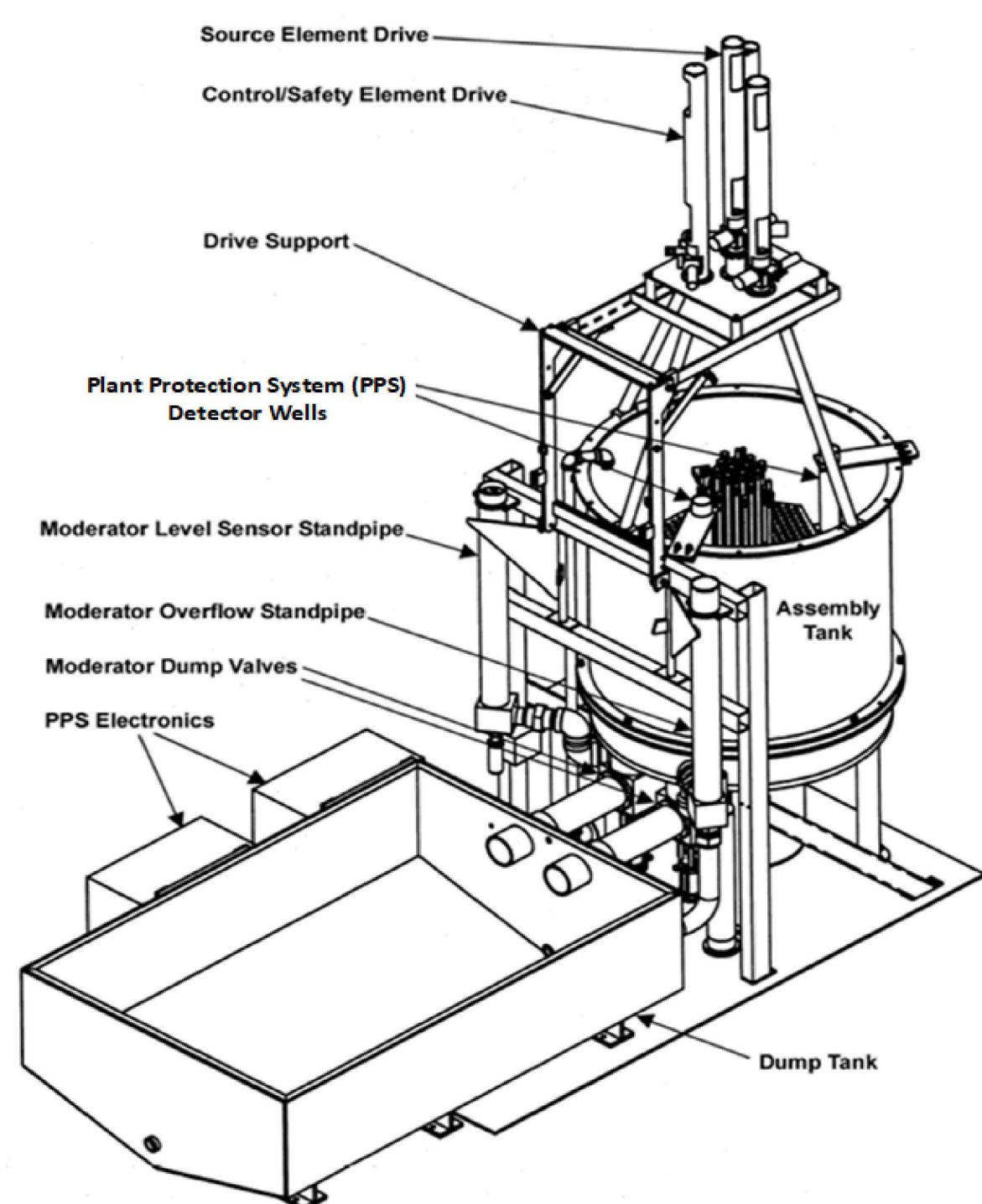


Calculated Fission Density in BUCCX with Ti-sleeves

Sandia Critical Experiments Program Capabilities

The critical experiments program is funded by the US DOE Nuclear Criticality Safety Program. Capabilities include designing, performing, and documenting high quality critical benchmark experiments that meet and exceed ICSBEP standards. Expertise and design flexibility allow for a wide range of needs to be accommodated. Upcoming and proposed experiment ideas include the following topics:

- Moderator temperature effects on reactivity
- Fuel pitch variations near optimum moderation
- Reactivity effects of molybdenum and rhodium
- Fuel configurations with water channels
- Isothermal reactivity coefficient inversion point
- Spectrum shifting towards epithermal energies
- High Assay LEU fuel configurations



Characteristics of the Sandia Critical Experiments

Critical Experiment	BUCCX		7uPCX	
Fuel	UO ₂		UO ₂	
Enrichment (%)	4.306		6.903	
Moderator	Light Water		Light Water	
Fuel OD (cm)	1.265		0.526	
Fuel Length (cm)	48.7		48.8	
Fuel Density (g/cm ³)	10.4		10.3	
Fuel Rod OD (cm)	1.382		0.635	
Array Configuration	Triangular Pitch		Square Pitch	
Pitch (cm)	2.0	2.8	0.800	0.855
Fuel to Water Volume Ratio	0.640	0.238	0.672	0.524
H to ²³⁵ U Atom Ratio	131	332	62.0	79.5
H to U Atom Ratio	4.48	12.1	4.33	5.55

Sandia Nuclear Criticality Safety Program

Established to ensure that fissionable material activities outside of nuclear reactor operations remain safely subcritical under all normal and creditable abnormal conditions. The Program is approved by the U.S. DOE in accordance with DOE Order 420.1C.

Nuclear Criticality Safety (NCS) Engineers are trained and qualified to provide technical NCS guidance to managers, supervisors, and workers at facilities with fissionable material activities.