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Initial Neutron Imaging Alignment Plan

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Disclaimer

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

Initial Neutron Imaging Alignment Plan

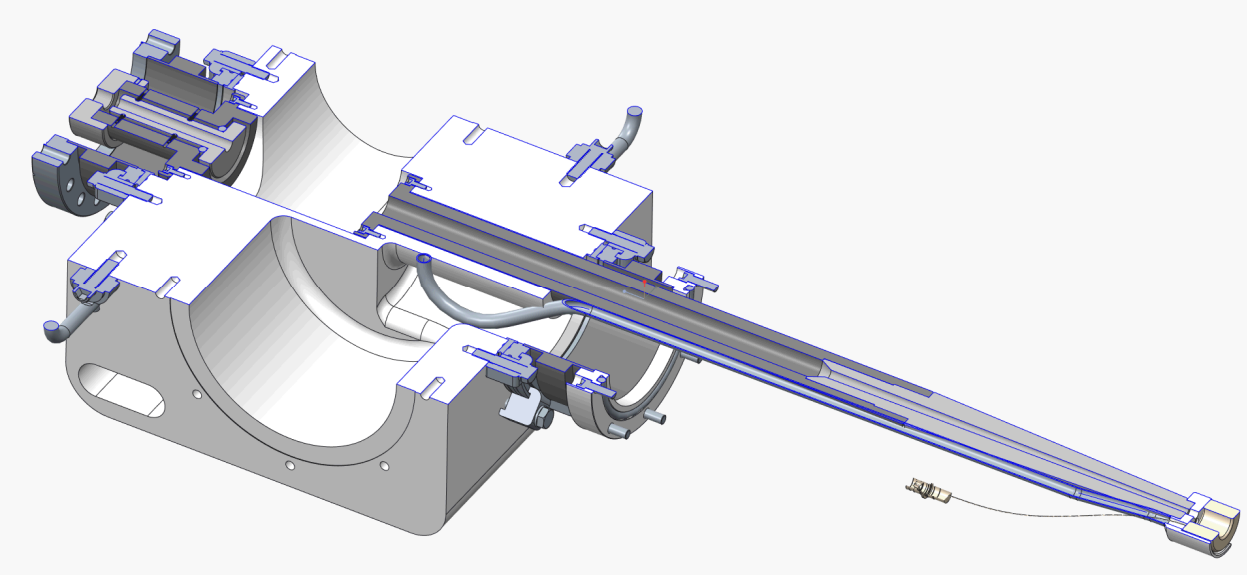
Roark Marsh

Magnet alignment

We still need final effective length measurements for the quads given we didn't have a long enough probe before. Dipole measurements are required in order to cross calibrate a probe for use as well as getting full field measurements. Magnetic center will locate quadrupoles and dipole in the end, and not their physical/flange centers so everything depends on these measurements. Magnets need power, water, klixons to test. Probes are in (18", 36", 60"), stand still functions and can be modified quickly in order to test. Measurement scans will take 30-60 minutes each, magnet setup takes about as long, especially given that dipole measurements will require quad removal, but probably not stand movement (we just set up the stage on the stands instead of using the roll around cart). Magnetic to physical center close enough? Romer-Lakeshore measurements to confirm accuracy

Rotary valve and aperture (RV and GB) alignment

There are three final target apertures of critical relevance: the rotary valve (RV) target hole, the gun barrel (GB) tungsten collimation aperture, and the upstream tungsten aperture. The physical mounting of the block sets the position of the GB. The block is mounted independently of the RV (with bellows) and they have to be aligned relative to each other. It has been determined the GB block will be adjusted using the floor stand, and thus any future apertures (such as differential pumping line apertures in upstream crosses) will need to be adjustable. The RV floor stand is also adjustable and will be used to position the RV. The upstream tungsten collimator is adjustable within its own bellows and can be aligned once the GB is placed in the GB block and machining tolerances can be accounted for in the as-built parts.



GB assembly.

Physical assembly/alignment

Much conversation with Scott Fisher developed the following plan which has been revised by conversations with Scott Anderson. George Governo may have a lead on a theodolite operator who has done this before. The skill is not difficult to learn, but the accuracy desired and the tricky implementation in our circumstance makes this a poor machine to learn for the first time on (sorry Zach/Sean).

Dipole first (Scott): set it and lock it down. Dipole pucks front/back define the zero degree line for the scope. Zach and Sean can certainly be supervised by Scott Anderson to be proficient with the scope. Scope expertise from Scott Anderson. Scott Fisher should teach a class so we can all be proficient.

Ladona/Romer team: should be used to verify final alignment when views are not available. As built verification (like with dipole tank). In situ verification of magnet probe. Turn buckle measurements? Inside to outside fiducial coordinate measurements?

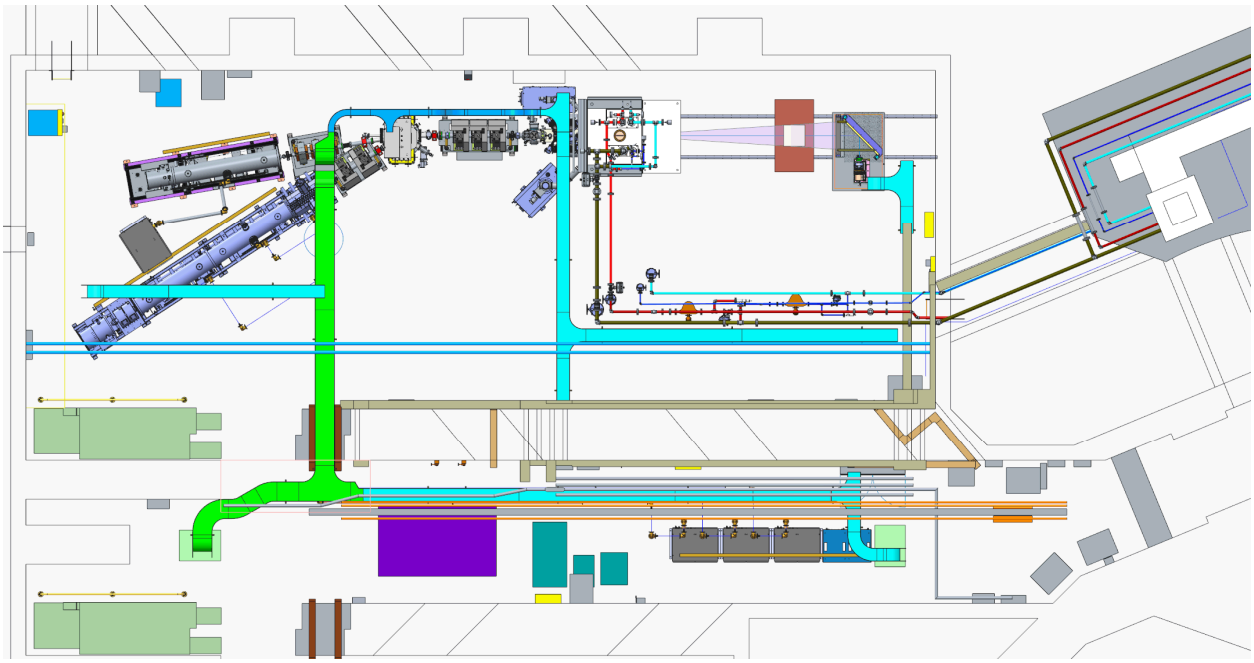
Accelerators and magnet stands need to be located in space, individual magnets will have to be shimmed to match magnetic centers as there is no adjustment for individual magnets on the stands.

Everything on the floor was planned to be aligned to sub-mm tolerance by Scott Fisher. Floor roll was identified early and surveyed (copy of this?). Quadrupole as-built measurements changed nominal beam height and led to support plates being reworked. Holes laid out and prepped by Fisher, Hall, Mclaughlin. Magnet stands in rough position currently.

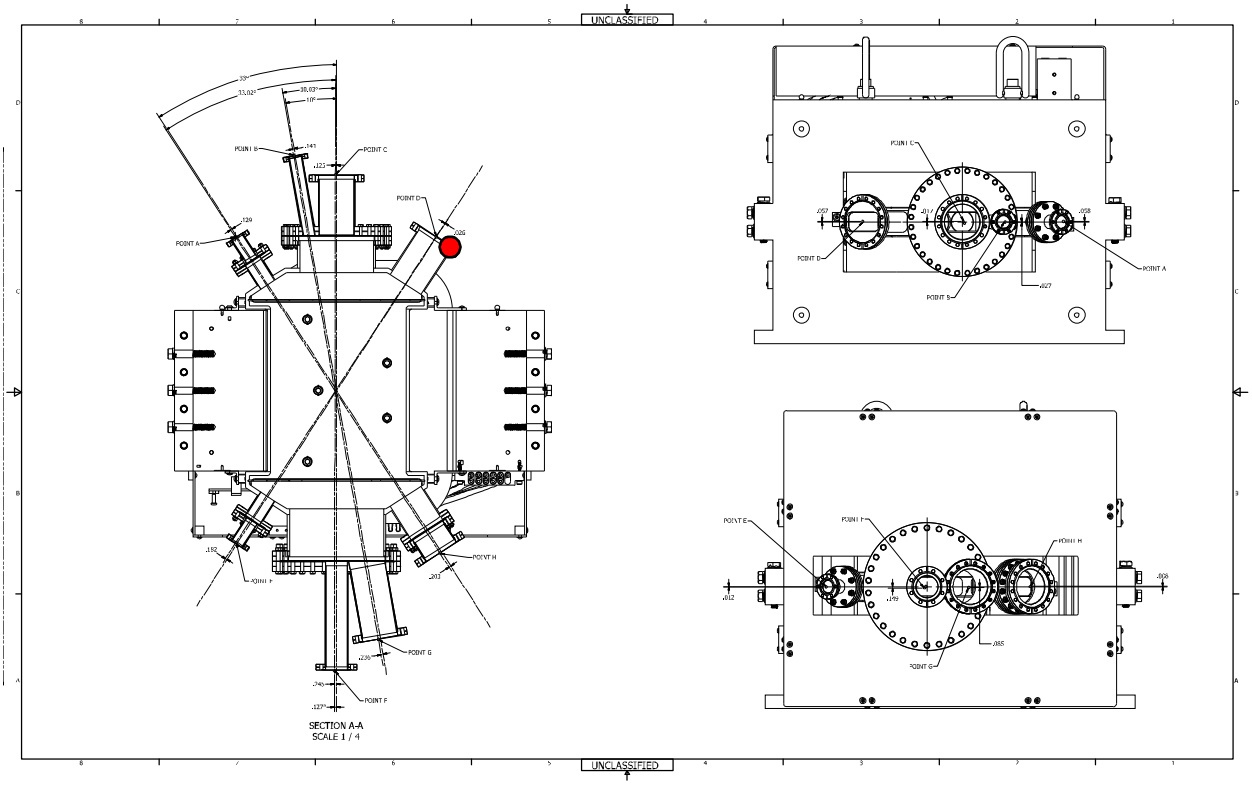
DL4 currently appears to be inches off? Placeholder position of DL4 for floor epoxy, nothing is aligned.
Scope deemed sufficient for beamline sighting? Used for a single line, zero degree line w/2 points defined by dipole stand, possibly with wall points or RV position as backup.
Extra plate needed for frame to mount to wall? Yes, in process.
Theodolite using Fisher designed mount for stand? Fine, or buy one.

Ladona Willis and Kevin Pitta. 2 man team 4weeks.
3-5/1000's accuracy possible using Romer CMM arm.
Glue in tooling balls to address concerns with slip fit.
Use 3 tooling balls on DL4 stand to leap frog it down beyond the 6' reach of the arm.
Tooling pipe preferred for quads rather than profile (but possible).
Plant survey group for theodolite, CAMS, Site 300.
Buy a shim kit for quads (under and inside)

Gerry willing to relocate rack of stuff on west wall.



Overall beamline layout of DL4 and DL7 in North cave.



Dipole chamber as built measurement with Romer arm? Chamber is 1/8” off and seems to rotate around the fixed point marked in red. 0.02-0.03 degree rotation is not a concern. Magnetic measurement will determine the effect of any offset, but currently we just plan to off-center beam by this much if necessary or make up displacement with bellows.

To do:

Purchasing: tooling balls, fixtures for quads, pucks for dipole tank, second stand for scope, theodolite tripod, shim kit for under and inside quadruple magnets.

Gerry rack plan.

Magnet measurement/alignment next.