

LANSCÉ's TARGET 1 HARP BEAM DISPLAY FOR MARK IV TARGET UPGRADE

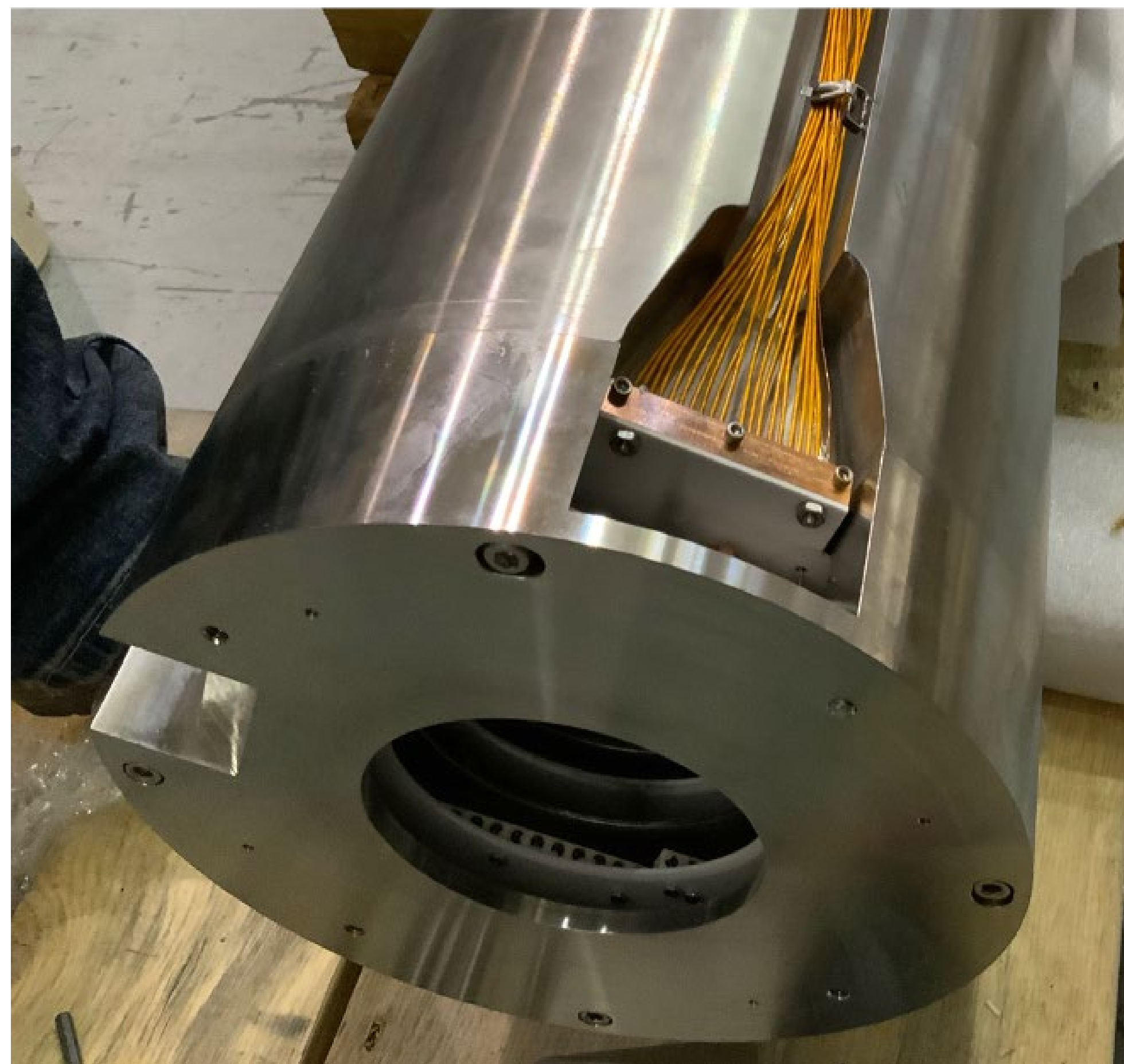
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Abstract

The Los Alamos Neutron Science Center (LANSCÉ) completed upgrades to its 1L Target Facility, which included installing the new Mark IV target assembly. This added a third tungsten target located upstream of the other two targets. Prior to Mark IV, beam centering on target was achieved by using thermocouples mounted to the quadrants and center of the upper target coolant chamber. It is slightly offset from center of the old upper target and it shadows several of the thermocouples previously used to center beam on target. This required adjustments to the diagnostic tools utilized to monitor position of the H- beam that is being delivered to the 1L target. The original display included the thermocouple readouts and displayed a visual beam profile and position taken from an upstream harp. With some of the thermocouples now being shadowed, an image overlay was added to show where the harp's measured beam position is relative to both the upper and middle targets. This gives the beam operations team an additional level of awareness when it comes to thermocouple temperatures, beam steering, and beam tuning.

1L HARP Diagnostic

The 1L (Target 1) HARP diagnostic is a set of wires spaced out in the beam line to gather a beam profile. An electrical current is induced in them proportional to beam intensity, which shows the beam profile similar to the wire scanners. The upside to the HARP is it is constantly in the beam line and due to that can provide constant updates to the beam position. The 1L HARP data can be utilized in a double-gaussian fit algorithm to provide a beam position and intensity map.

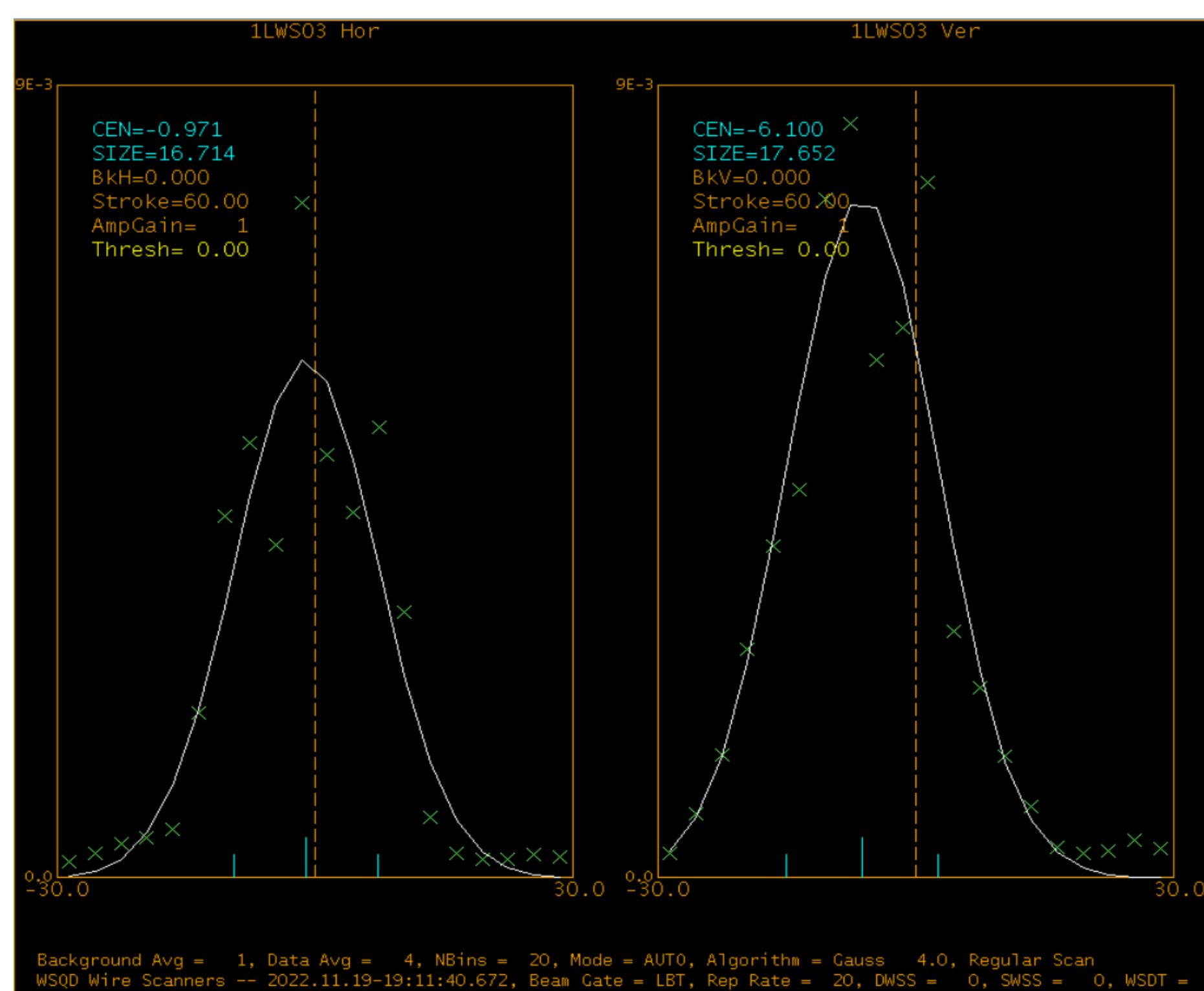


1L HARP Wires

Other Diagnostics

Wire Scanners

1L (Target 1) wire scanner 1, 2, and 3 provides a picture of the beam profile as it is being directed to the target, but don't provide a "live" status of the beam in the event of a tune change. They utilize a single wire inserted in steps in order to get a beam profile. This "live" status is extremely important, and the wire scanners cause significant beam spill making them ineffective for the information needed to visualize.

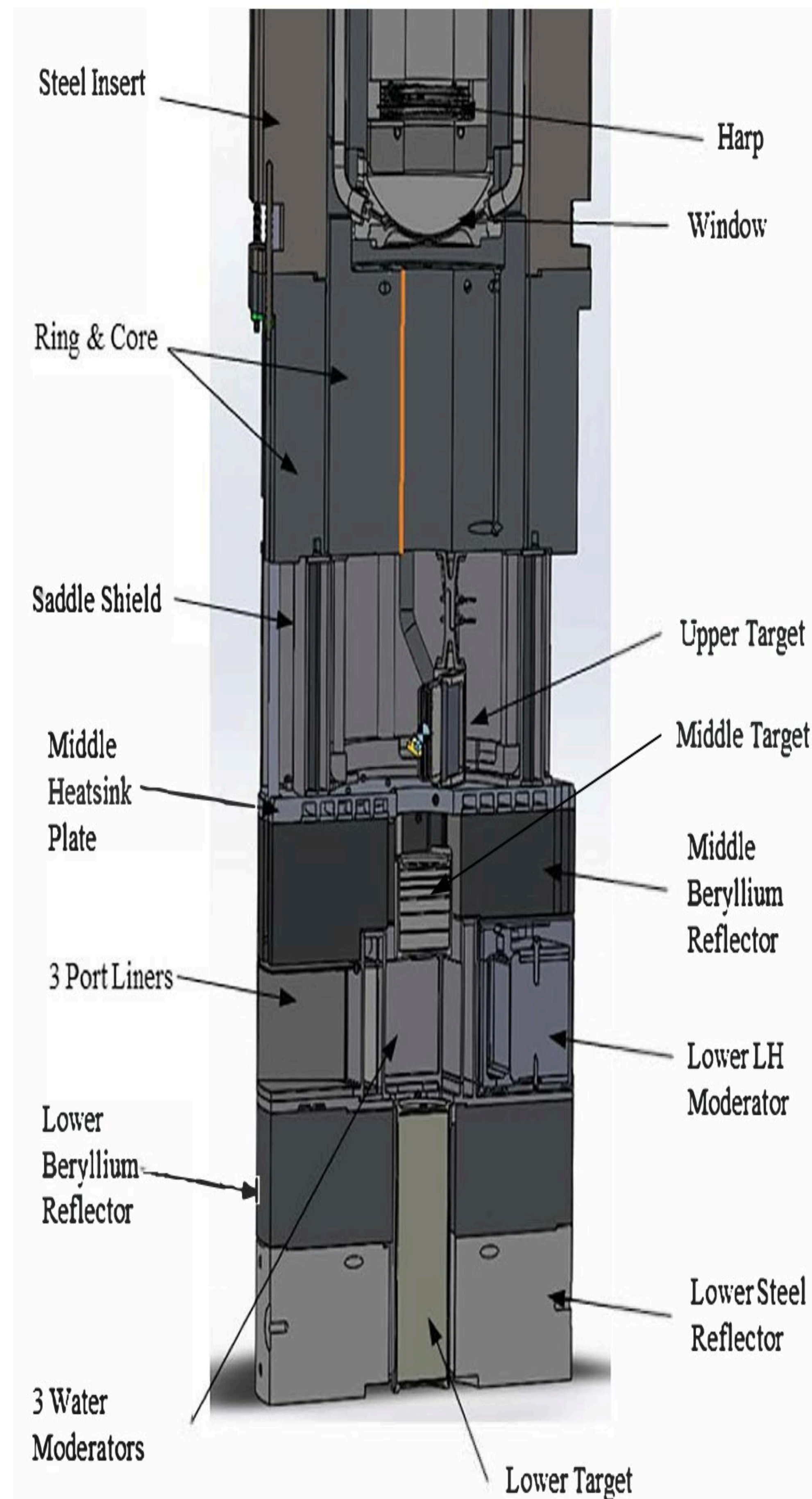


1L (Target 1) Wire Scanner 3

New Mark IV Target

Improved Opportunities For Experiments

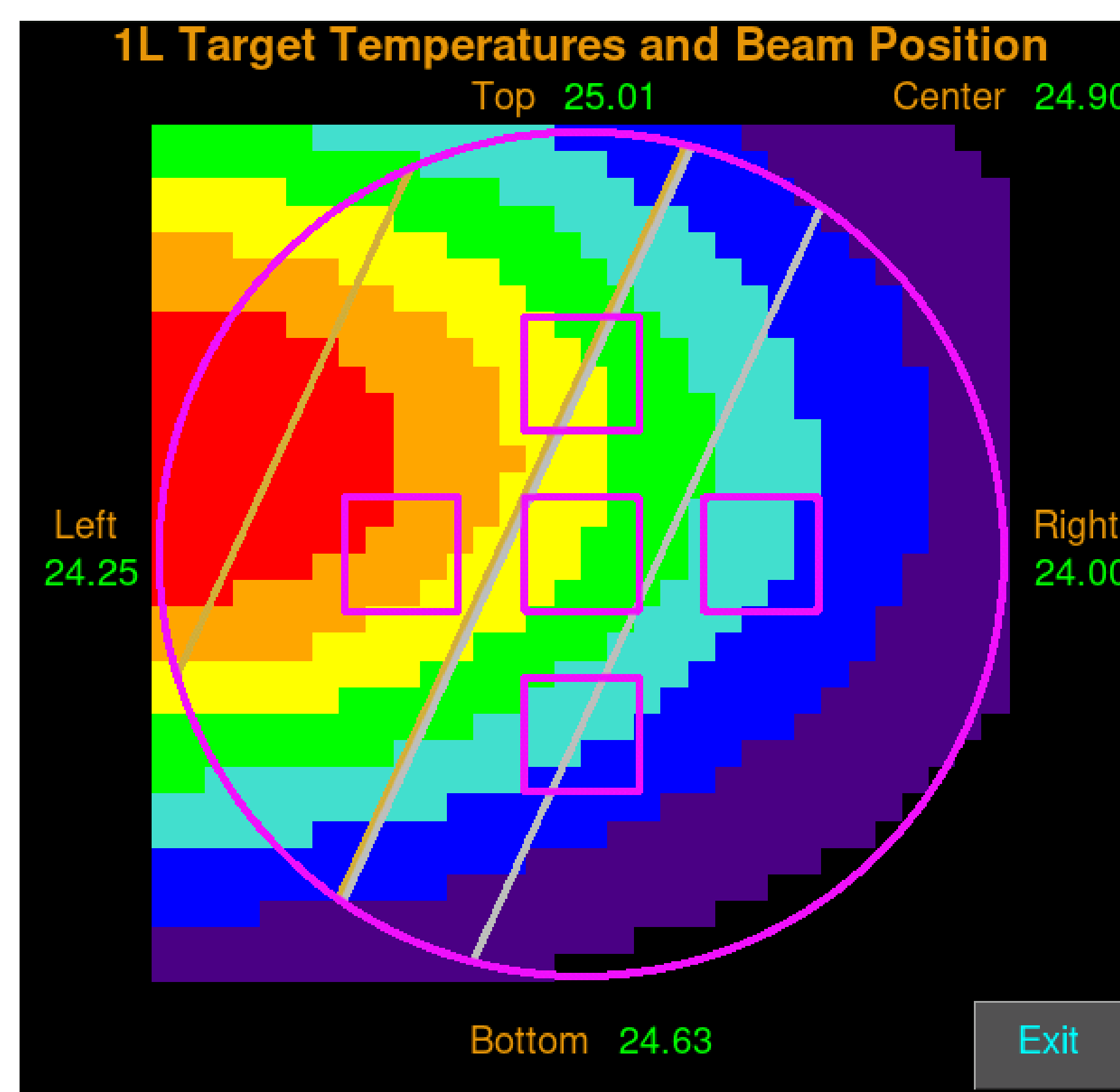
The Mark IV target was installed during the beam outage in 2022. Initial testing and commissioning was performed during the beam run cycle for 2022, and beam on target from 60 to 85 microamps. 2023 expects to see full production beam of 90+ microamps.



New Mark IV Target Assembly Installed In 2022

Simulated Beam

A simulated beam profile is shown to give an indication how the beam position is graphically represented on the screen. The intensity changes from red (most beam) to purple (least beam). Black indicates no beam in that area.

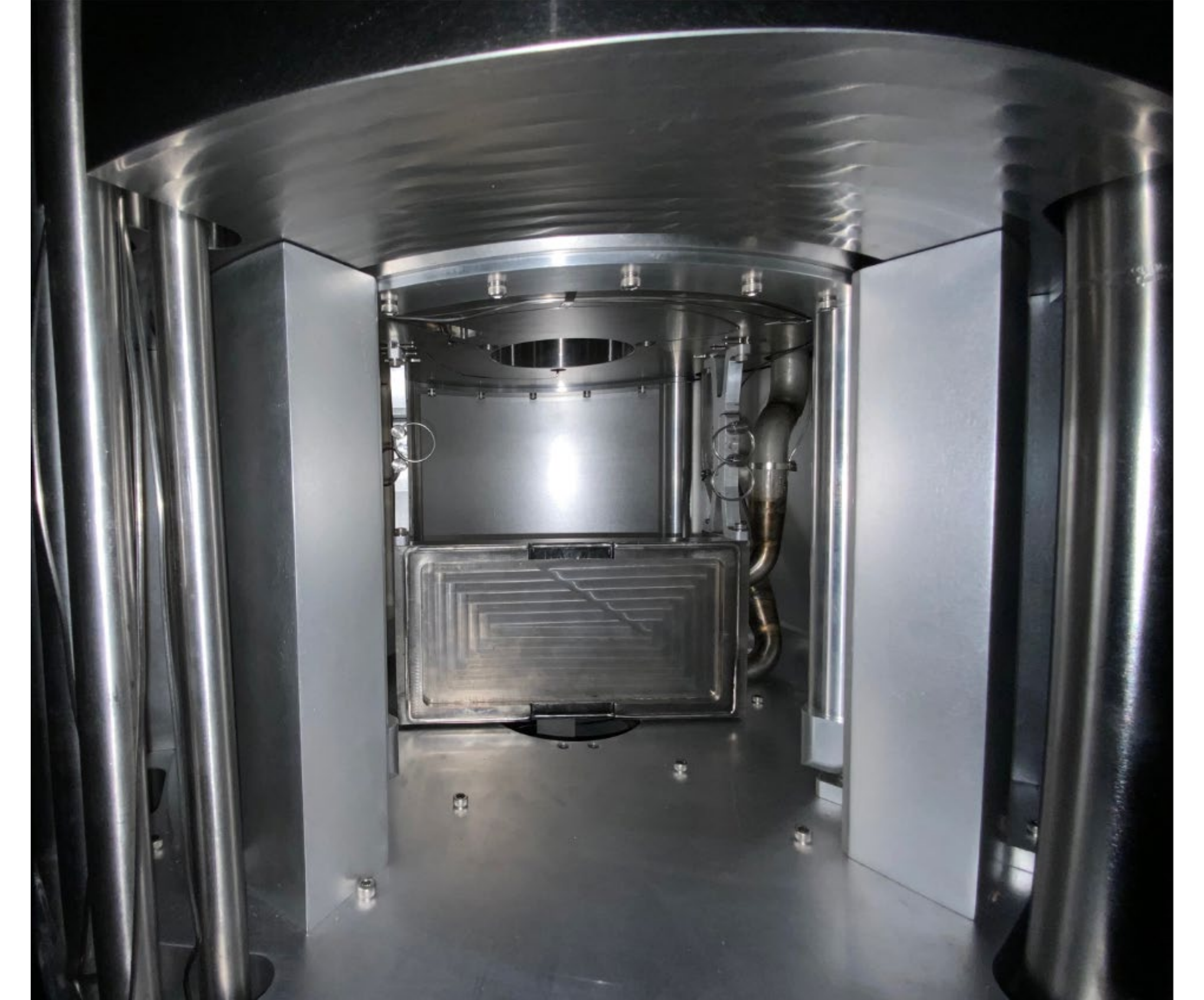


1L Target Temp. And Beam Position Screen With Simulated Beam

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Target Assembly

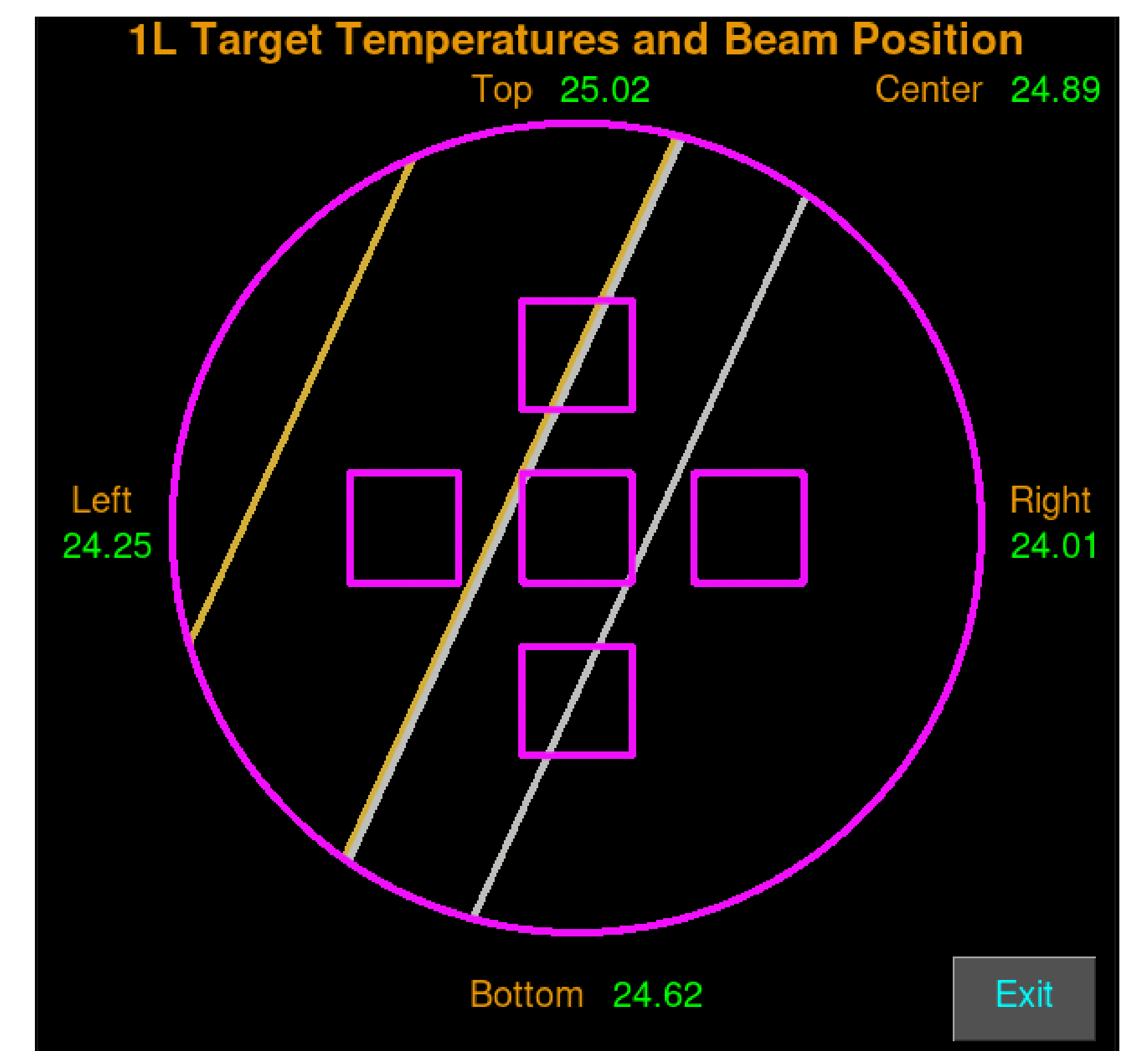
Three different target assemblies are utilized to provide neutrons to up to 15 different flight paths for experiments at varying energies. The upper target sits vertically, so getting an accurate picture of the beam profile is key due to thermocouple shadowing and neutron moderation.



Upper Target Assembly

New Target Challenges

Showing a visual representation of the beam profile is a challenging prospect. When the Mark IV target was installed, there are some thermocouples that are getting "shadowed" by the upper target and a water moderator. This shadowing causes the thermocouples to indicate lower than the beam intensity would normally lend itself to, so a graphical overlay needed to be created in order to represent the location of those moderators to indicate which thermocouples might be shadowed.



1L Target Temperatures And Beam Position Screen With New Overlay

Above is the temperature and beam position with the new overlay showing the moderators, thermocouples, temperatures, and (when on) beam position. The water moderator will moderate the neutrons differently than the tungsten target stack and the air, so differentiating between how the thermocouples might react is an important tool to utilize when determining how the beam is centered and if the beam is reacting properly to changes in the tune.

- Pink – Thermocouples (Squares) and beam pipe (Circle)
- Gold – Water moderator (Diagonal)
- Silver – Tungsten Target (Diagonal)
- Other Area Inside Circle – Air (Not Moderated)



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