

RADIATION LABORATORY

Beam Port Description (6-inch)

The six-inch diameter beam port provides leakage neutrons with energies throughout the fission energy spectrum for experimental application. The beam port is an air-filled aluminum tube extending from the reactor core face nearly through the biological shield and then flange-coupled (with a non-conducting plastic gasket) to a stainless steel end fitting, which extends through the shield face and terminates at a flange for experimental access. Radiation protection is provided by a lead shutter and a removable shield plug. A shielded enclosure surrounds the beam port entrance such that the shield plug can be removed and lead shutter raised for low-power irradiations. The shield plugs are aluminum castings filled with Ferro-phosphorous concrete, lead, and steel. The plugs are fitted with a spiral-type conduit to accommodate instrument leads if it is desirable for the shield plugs to be left in place.

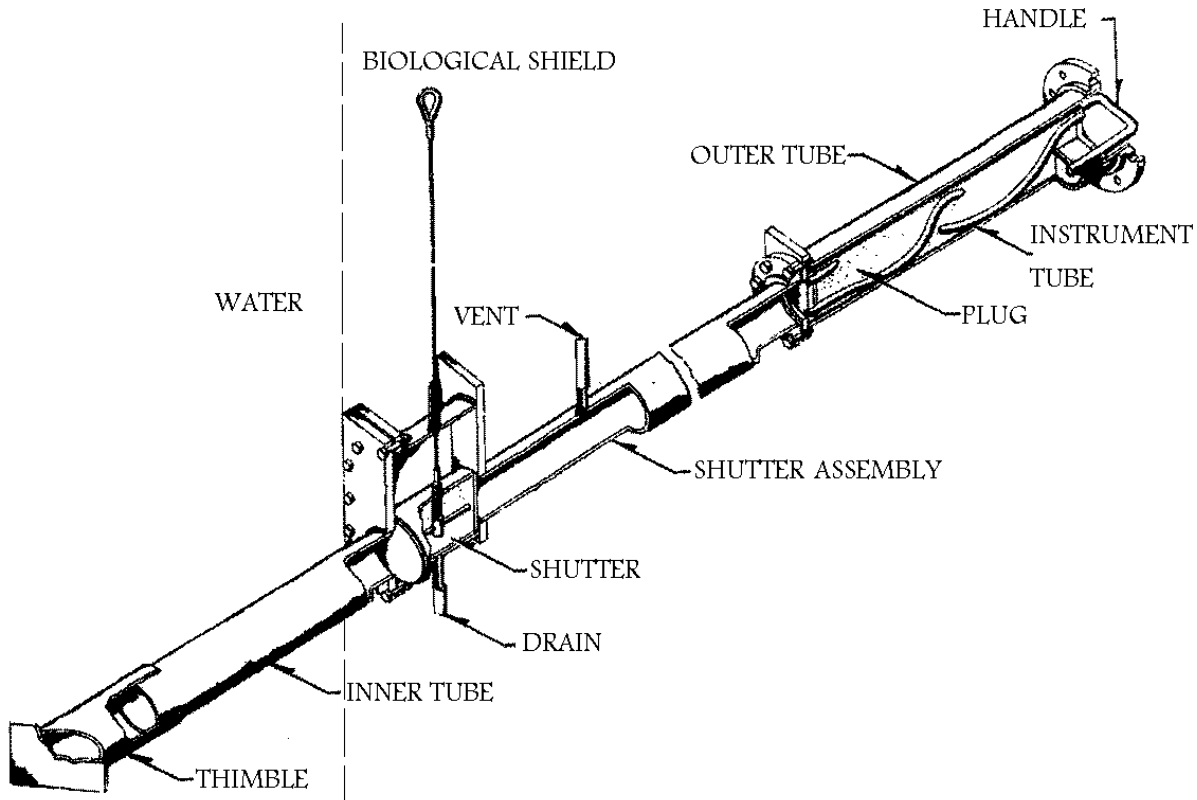
Air, gas, water or experiment lines may also be introduced to the beam ports through four conduit lines on each beam port extending from the biological shield face to a point within the shield. In addition to the conduit lines, each beam port is fitted with a separately-valved demineralized water line. The water is supplied to the beam ports through a common header which has a solenoid controlled valve interlocked to prevent opening and flooding the ports during reactor operation.

The beam port is fitted to a thimble consisting of an aluminum section extending from the reactor core face to the inner tube to which it is welded. The inner tube forms the transition between the thimble and the shutter housing. The inner tube is connected to the shutter housing by a flange-bolted connection.

The shutter housing forms the intermediate portion of the beam port between the inner and outer tubes. The 9-inch beam port shutter is contained in the flanged housing at the inner end of the shutter housing assembly. The outer tube extends from the flanged connection of the shutter housing assembly to the stainless steel end piece, which goes through the outer face of the biological shield. The tube is flange-fitted at both ends.

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Group 1:* Total Interior Length: 101"

Section	Dimensions	Reference Dwg
Outer Tube	35"LG x 8"ID	GE 107C4084
Shutter Assembly	40"LG x 6" ID	GE 107C3824
Shutter	9"LG x 8"OD	GE 693C760
Inner Tube	26"LG x 6" ID	GE 693C757
Thimble		MPL 105X939 #413

Group 2:* Total Interior Length: 98"

Section	Dimensions	Reference Dwg
Outer Tube	35"LG x 8"ID	GE 107C4084
Shutter Assembly	43"LG x 6" ID	GE 107C3824
Shutter	9"LG x 8"OD	GE 693C760
Inner Tube	20"LG x 6" ID	GE 693C757
Thimble		MPL 105X939 #413

*Two sets of two 6-inch tubes surround the reactor

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Radiation Characteristics

The following provides computational estimates for the six-inch beam port core-end location at a maximum reactor power level of 1MW¹:

Broad Group Fluxes (n/cm²-sec)

Fast Flux (>0.1MeV)	3.44 E11
Epithermal Flux	4.65 E11
Thermal Flux	3.17 E12
Total Neutron Flux	3.98 E12
Total Gamma Flux	9.97 E12

Energy Deposition (rad/hr)

Neutrons in Air	6.51 E6
Neutrons in Water	3.36 E6
Gammas in Air	9.38 E6
Gammas in Water	1.04 E7

1. J. R. White, A. Jirapongmed, and J. Byard, "Preliminary Characterization of the Irradiation Facilities Within the LEU-Fueled UMass-Lowell Research Reactor," Proceedings of Topical Meeting on Advances in Reactor Physics and Mathematics and Computation, Pittsburgh, PA (May 2000).