University of Massachusetts Lowell

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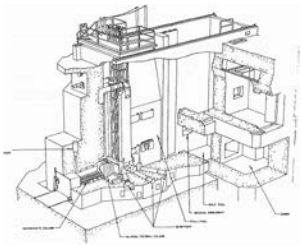
RADIATION LABORATORY



Thermal Neutron Column Description

The thermal column provides neutrons in the thermal energy range for experimental application. The thermal column is comprised of two separate assemblies. One assembly, a 4 x 4 foot square column, is embedded within the reactor pool biological shield. The other assembly, the thermal column extension, is located between the pool liner and the nuclear core, and is supported by a structural member, which is firmly attached to the pool structure.

The center line of the thermal column is aligned with the center line of the reactor core. The 4 x 4 foot square embedded column is filled with graphite. A neutron collimator for thermal neutron radiography is located in the center of the column. A lead gamma shield, located on the front end of the thermal column extension, provides shielding of reactor core gammas. 2 MeV fission neutrons travel through 4 feet of graphite and slow to thermal energies. Resulting energies correspond to wave lengths of approximately 0.9 - 6.4 Å.

A heavy, steel thermal column door is provided as a shield to protect operation personnel against gamma radiation. Four 6" diameter access ports are provided in the face of the door. Each port is fitted with four separate boral-faced plugs. Each plug is drilled and tapped to accommodate a plug removal tool, which is used to insert and remove plugs.

Thermal Column Performance Data

The thermal neutron fluence rate in the center of the column is approximately 1 E 10 n/cm^2-sec with a cadmium ratio of approximately 100. At the outside face of thermal column (access port), the cadmium ratio is approximately 7000. The resultant radiography beam has a 74 mm focal point, an L/D ratio of 140, and a fluence rate of approximately 1E6 n/cm^2-sec with a gamma component less than 2.8 mGy/sec.

Neutron imaging is available using a radiographic film method or CCD imaging method. In addition to radiography, this facility can be re-configured easily for neutron transmission measurements to determine boron densities.

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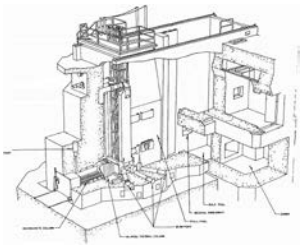

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Thermal Neutron Column Description

Fig. 1 Thermal Column with removable beam extender

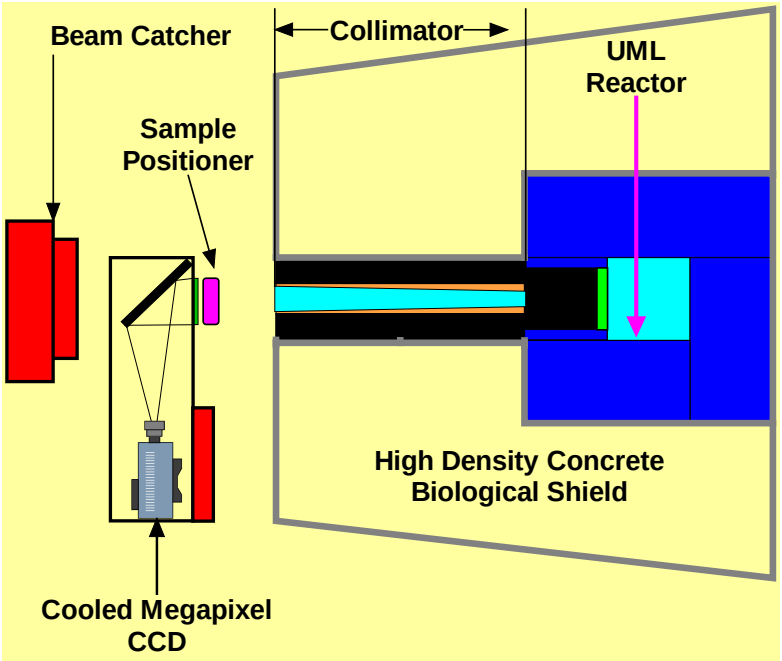

Fig. 2 Schematic of Neutron Radiography system