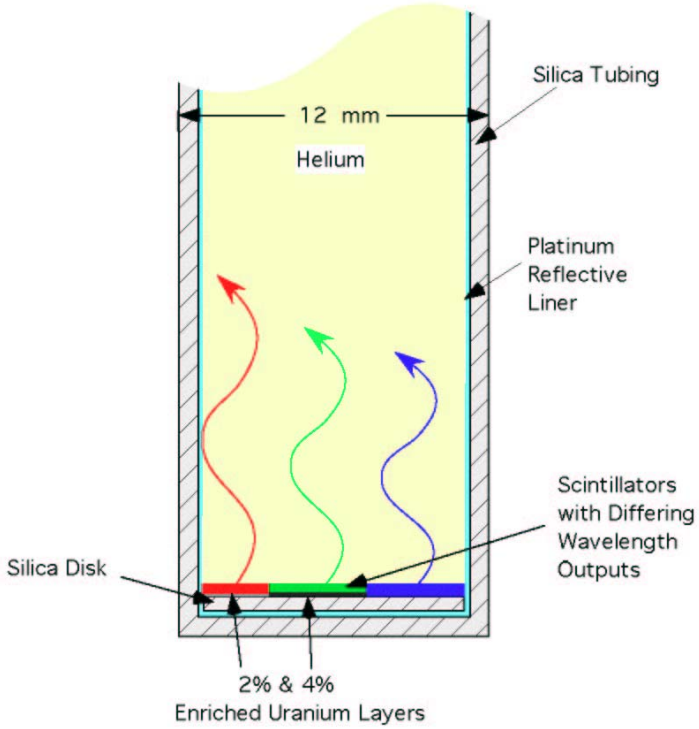
Miniature Neutron Flux/Temperature Probe

In-Core Optical Measurements

The objective of the project is to develop a miniature scintillation-based, in-core, self-powered neutron flux and temperature probe. The probe is intended to be generally applicable to any reactor technology, but is specifically designed for the higher temperatures of HTGRs. The scintillation assembly consists of a uranium layer placed against a thick film scintillator layer. The fission fragments resulting from neutron interactions in the uranium produce light in the scintillator. The light from the scintillator is guided out from the core using a hollow core optical fiber. Both the converter layer and the scintillator are segmented. A scintillator of one wavelength is collocated with a lightly ^{235}U enriched uranium layer. A scintillator with a different characteristic wavelength is placed against a higher ^{235}U enrichment uranium layer (2% and 4% for example). The scintillators produce different wavelength light allowing independent readout of the scintillation.

Features

- **Neutron flux excited scintillator films placed at distal end of hollow core optical fiber**
- **Scintillation characteristics**
  - **Pulse rate → flux**
  - **Wavelength → scintillator**
  - **Pulse shape → temperature**
- **Thin films & hollow core waveguide → high radiation tolerance**
- **Efficient blackbody light pipe for high temperature measurement**



Sensor End of Neutron Flux/Temperature Probe

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