OAK RIDGE National Laboratory

Moderator Reflector Assembly Topology

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March 26, 2024

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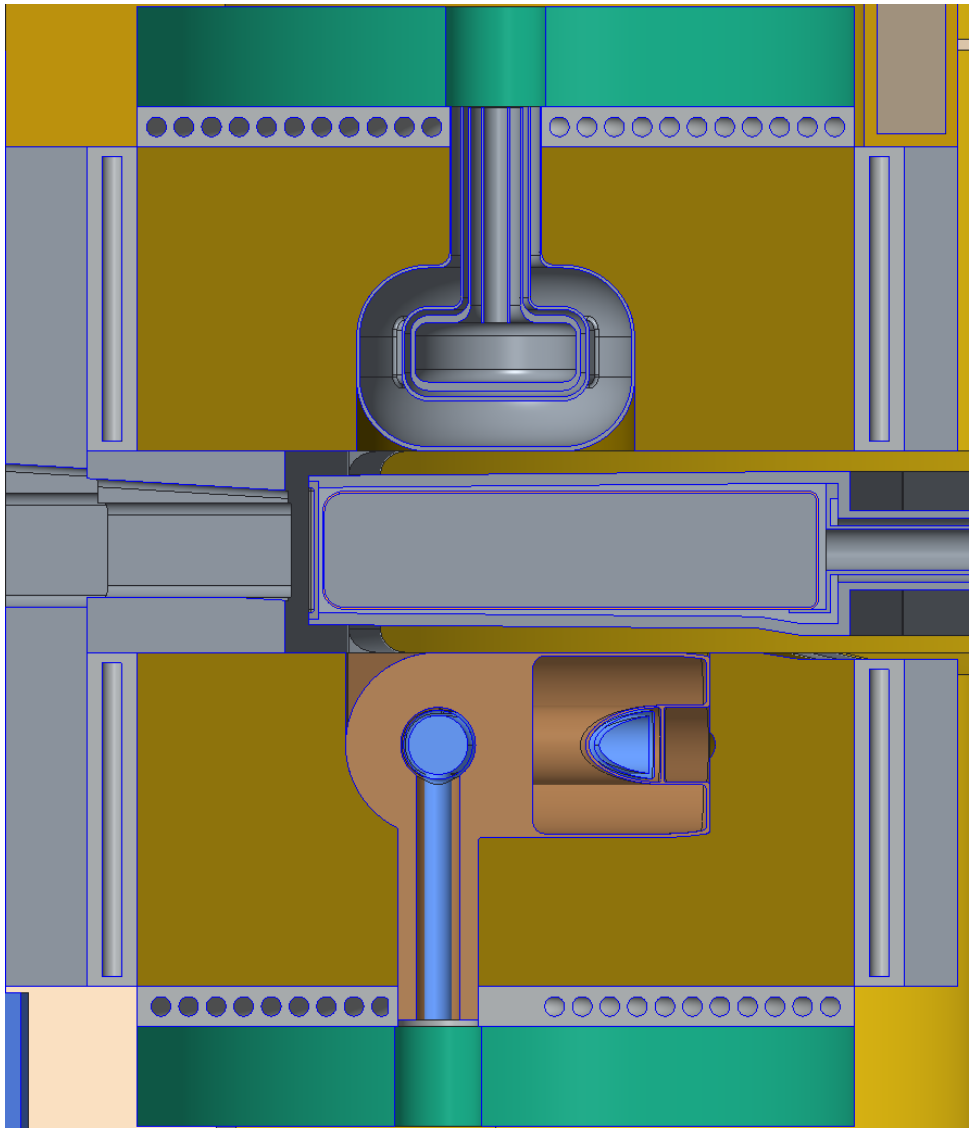
U.S. DEPARTMENT OF ENERGY

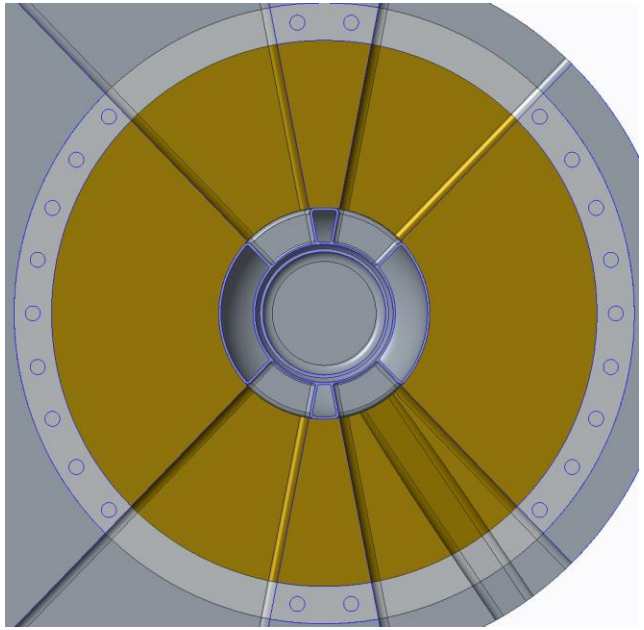
Moderator Reflector Assembly Topology at CDR

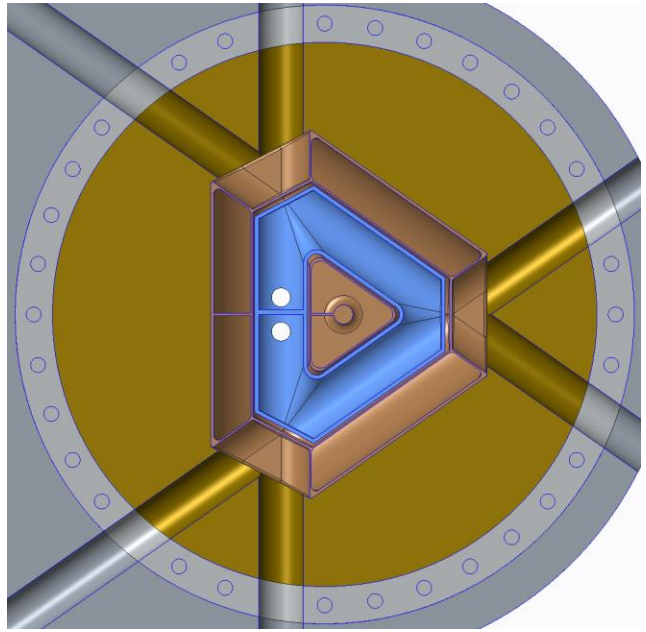
- Monolithic Top Beryllium Reflector
  - Ø364.9mm x h 155mm
  - 4 33° beam tubes
- Monolithic Bottom Be Reflector
  - Ø364.9mm x h 170mm
  - 6 Ø30mm beam tubes
- Cooling provided by external heavy water cooled aluminum plates
  - Maximizes beryllium near moderators
  - 1 flat plate and 1 annular plate per reflector



Aluminum Cooling Plates

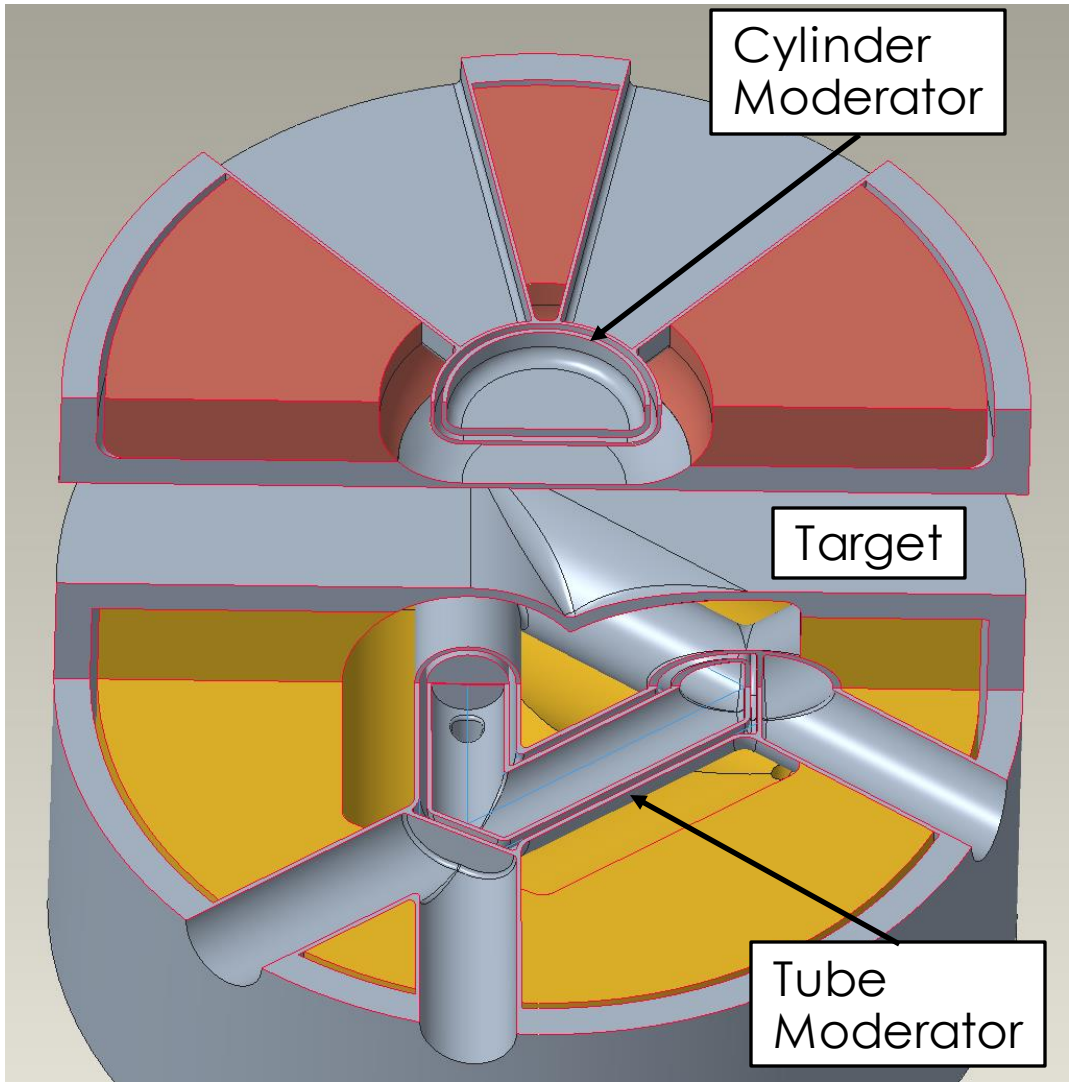
- Reflector cooling provided by flat plates top and bottom and annular plates at the outer diameter
- Contact resistance is likely too high for the amount of heat transfer required
- Braze aluminum plates to beryllium reflector for maximizing heat transfer
  - No sealing or structural requirements
  - Commercially available process
  - Will require development and testing to ensure heat transfer requirements are met
- Structural connection to reflector reinforced with bolted connections





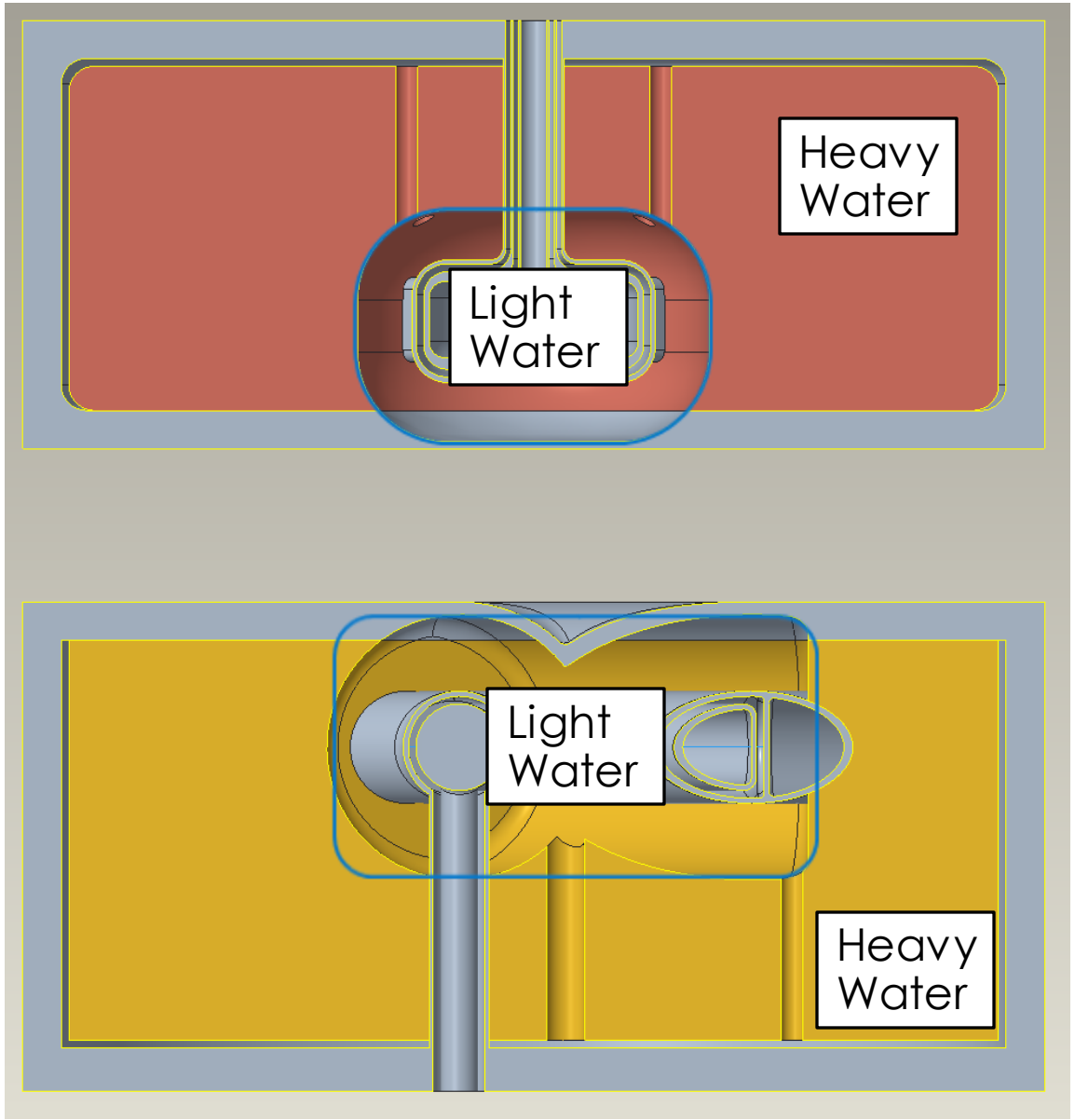
MRA Topology at PDR

- MRA designed to be simple while maximizing neutronic performance
  - Emphasis on reducing Al welding
- Light water premoderator surrounds moderators and provides reflector cooling
  - Boundary defined by Be reflector and reflector vessel
- Light water cooling surrounds outer diameter of reflectors



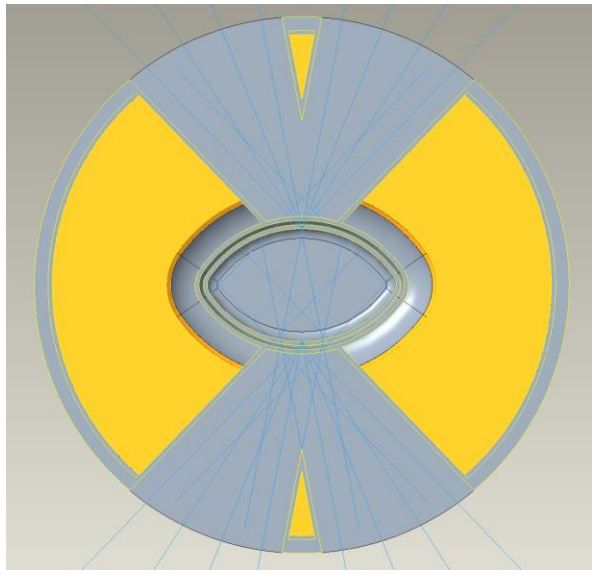
Alternative MRA Topology - Rejected

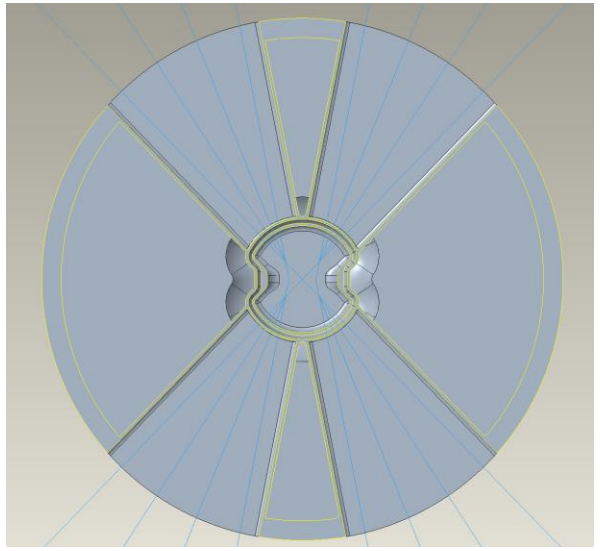
- Add extra aluminum layer around premoderator to allow for heavy water cooling of reflector
- More complicated fabrication
- More complicated reflector cooling
- No significant improvement in neutronic performance
- Rejected due to complication without increased performance



Alternative Cylinder Moderator Topologies - Rejected

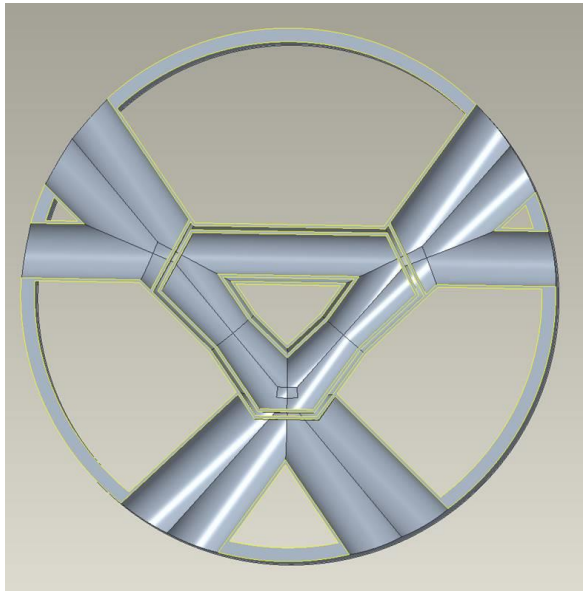
- Most focus was on the cylinder moderator as tube was considered highly optimized
- No configuration found which matched the cylinder moderator performance
  - All require thicker walls
- All configurations were more difficult to fabricate than the cylinder moderator
- Rejected due to loss of performance

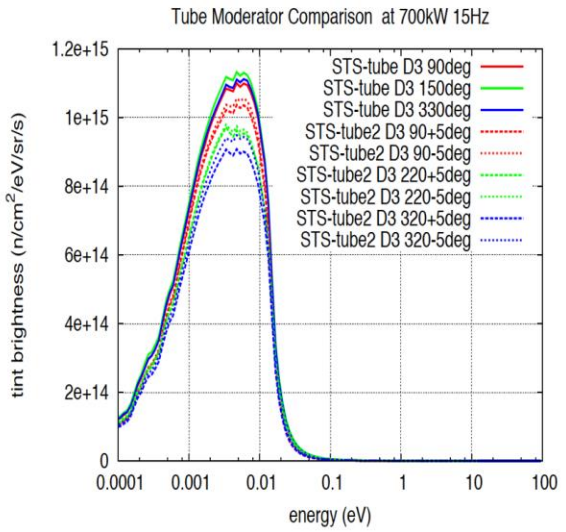




Alternative Tube Moderator Topology - Rejected

- Tube moderator alternative featured double tubes to increase number of beamlines
- Neutronics performance reduced by 5-20% depending on beamline
  - Instrument Systems was not interested in losing performance of tube moderator
- Fabrication of already complex assembly made even more complex
- Rejected due to loss of performance





Credit: Franz Gallmeier