LLNL-PRES-748320

ISSA Preliminary Results

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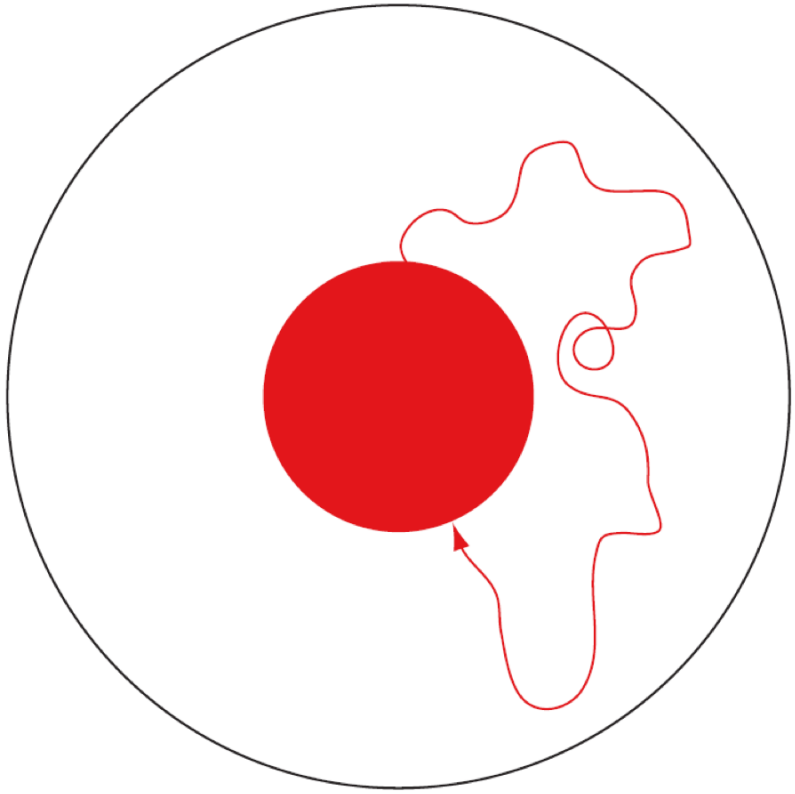
Motivation

- Fundamental physics subcritical multiplicity benchmark
- Time dependent validation through list-mode time-tagged data
- Subcritical multiplication monitoring – based on timing of neutron detection
  - Fission chains (in fast systems) ~ nanoseconds
  - Random initiation ~ milliseconds

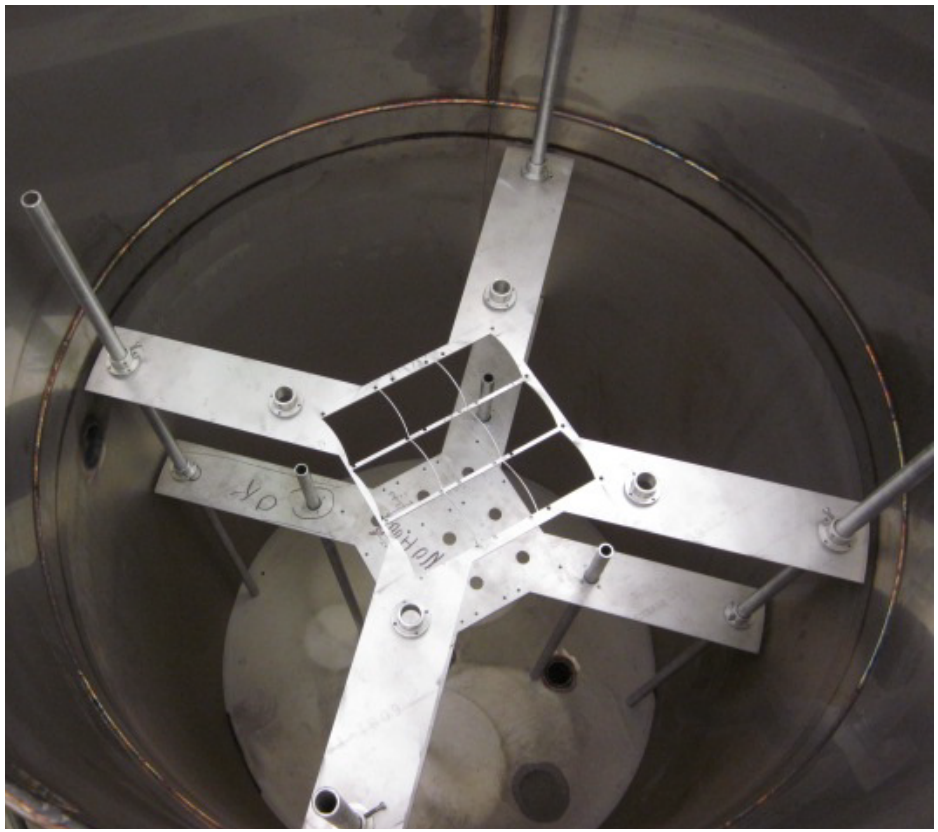
- Thermal system
- Showcase Fission Restart Theory
  - Neutron diffusion ~ microseconds

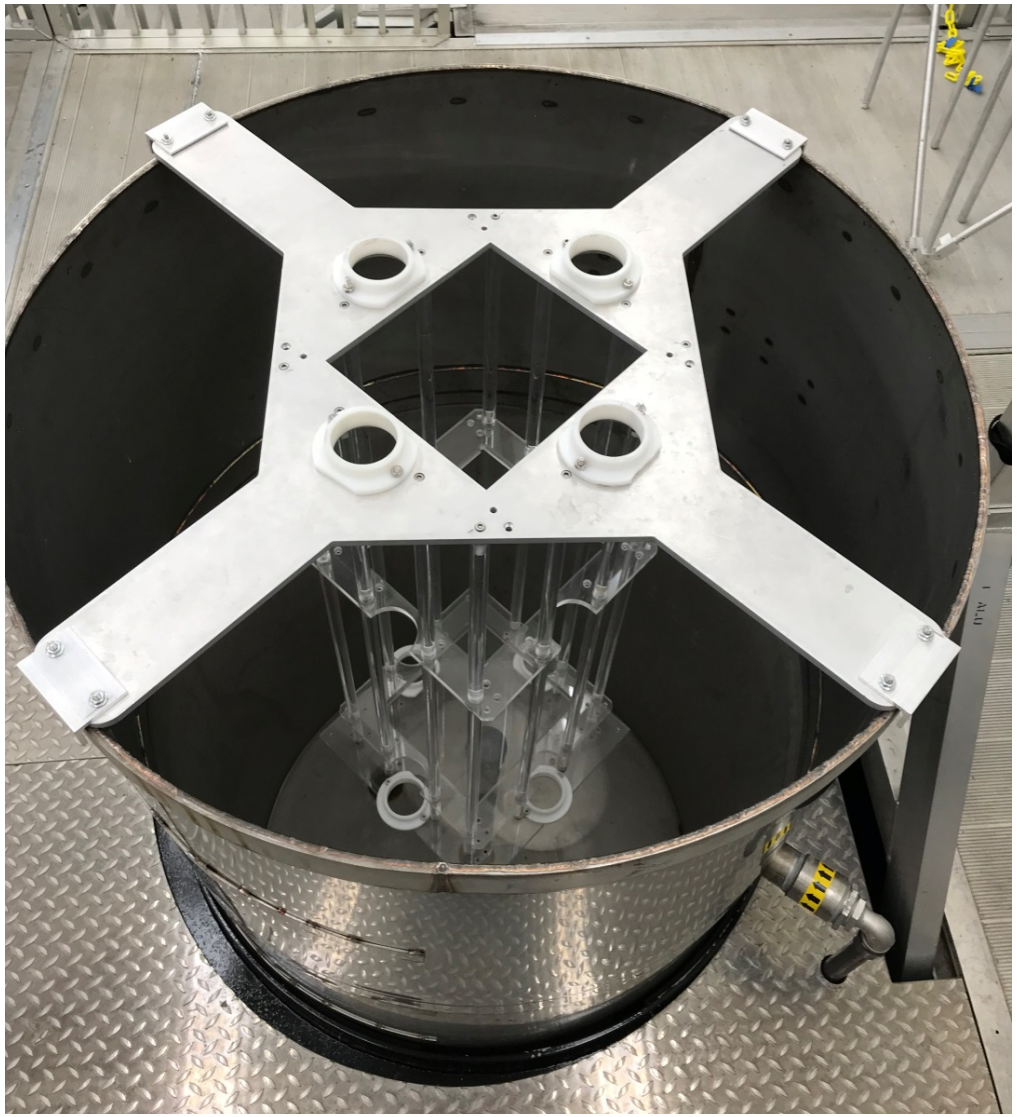


- Kim, K. S., et al. "Time evolving fission chain theory and fast neutron and gamma-ray counting distributions." *Nuclear Science and Engineering* 181.3 (2015): 225-271.
- Walston, S., et al., *Theory & Algorithms: The Fission Chain Restart Theory*. 2016, Lawrence Livermore National Laboratory: Livermore, CA.

Background

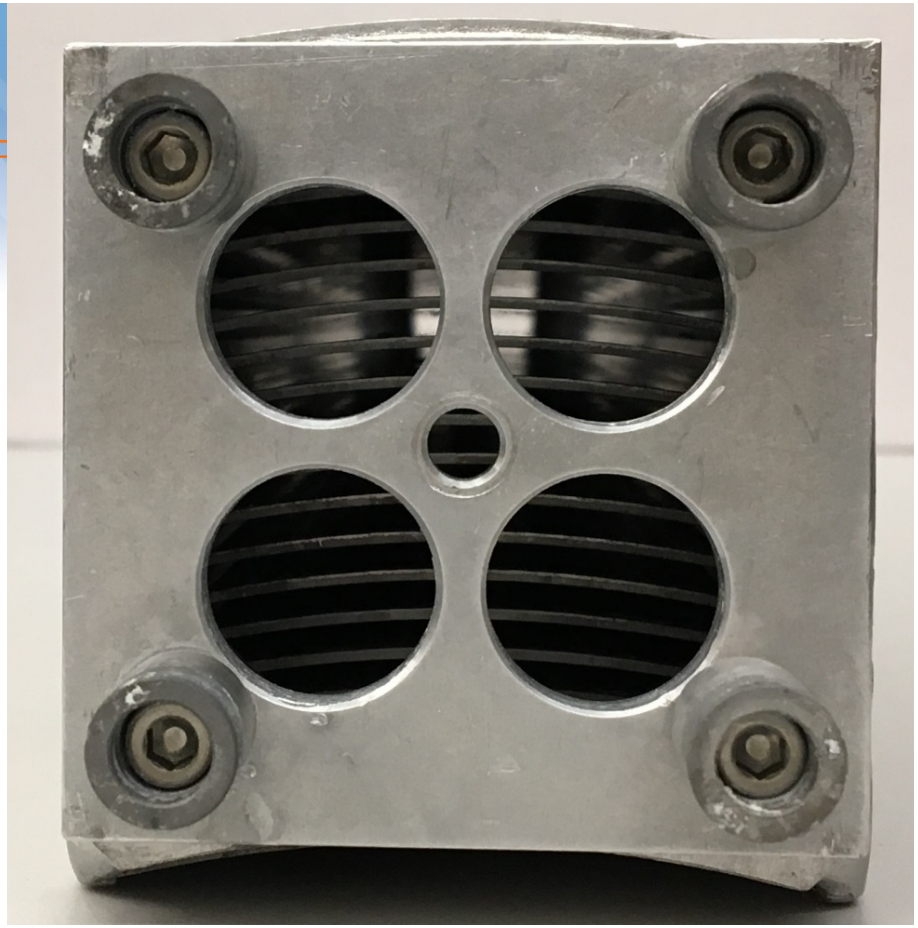
- Originally a training assembly
- Modified to reduce uncertainties
  - Replaced aluminum support with Lucite
  - Placed fuel assemblies directly in contact

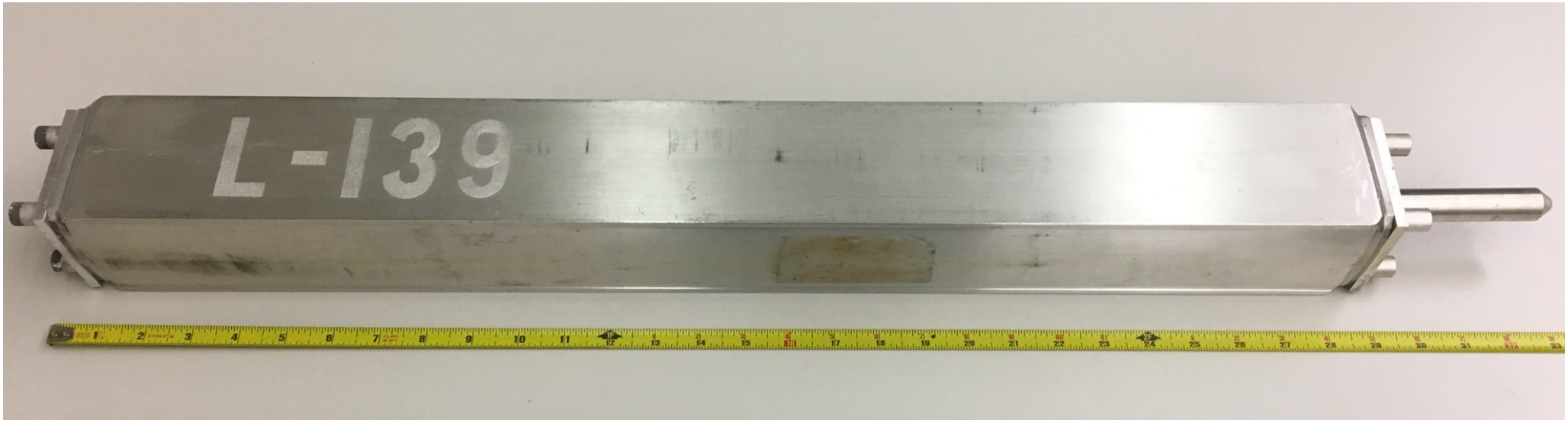




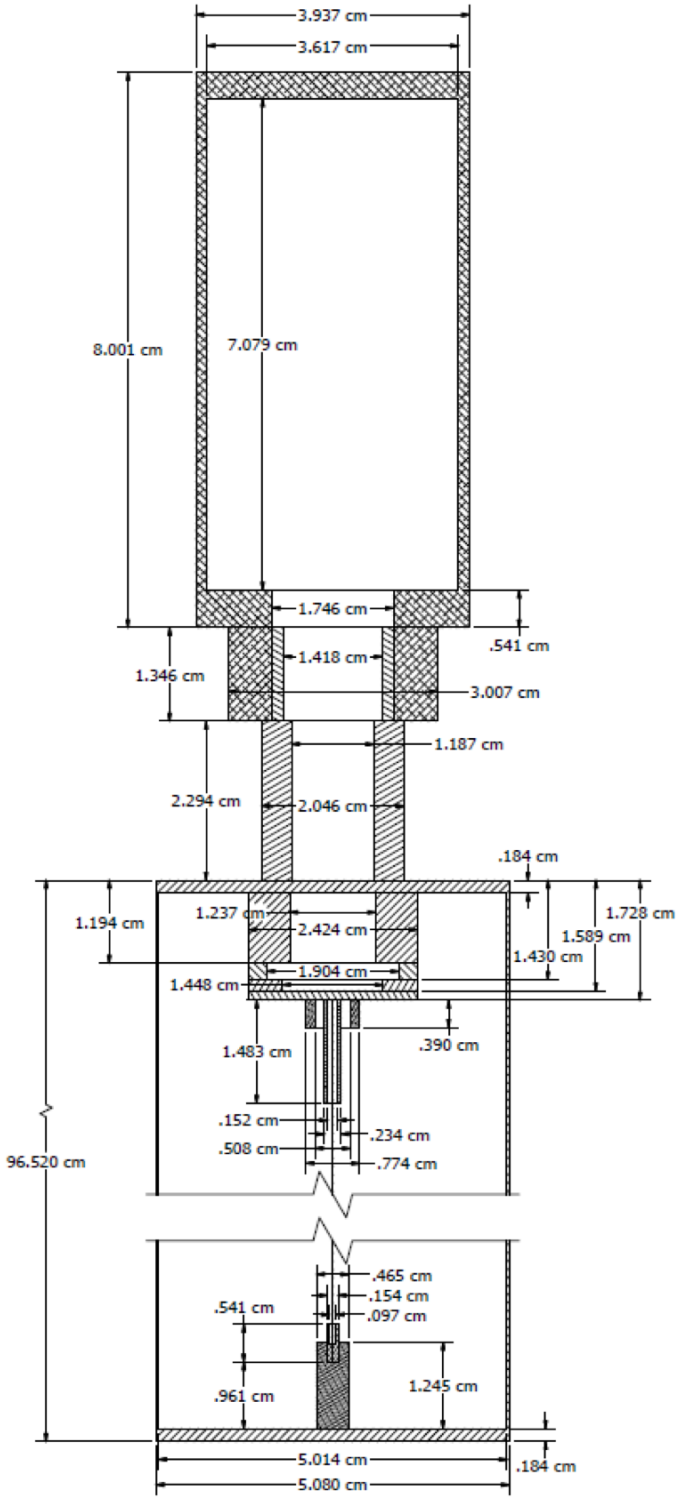
ISSA Fuel

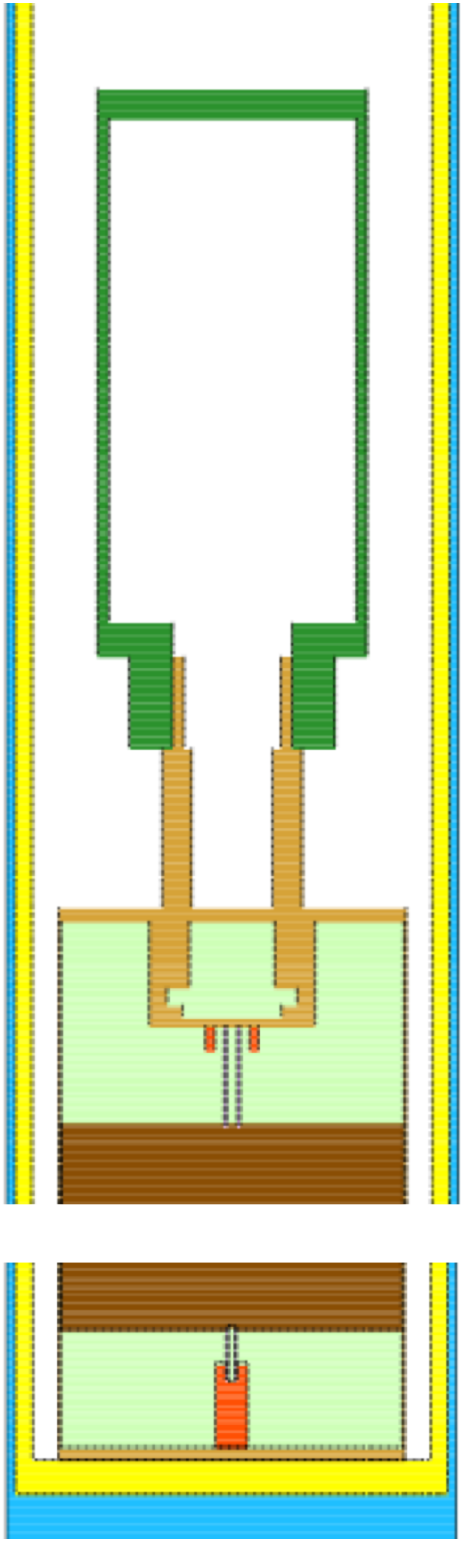
- Originally fabricated for the Omega West Reactor
- Modified at LLNL
- 93.16% ^{235}U
- U_3O_8 powder + aluminum powder
- Sandwiched between aluminum plates
- 19 curved plates per assembly
- 232 g ^{235}U per assembly





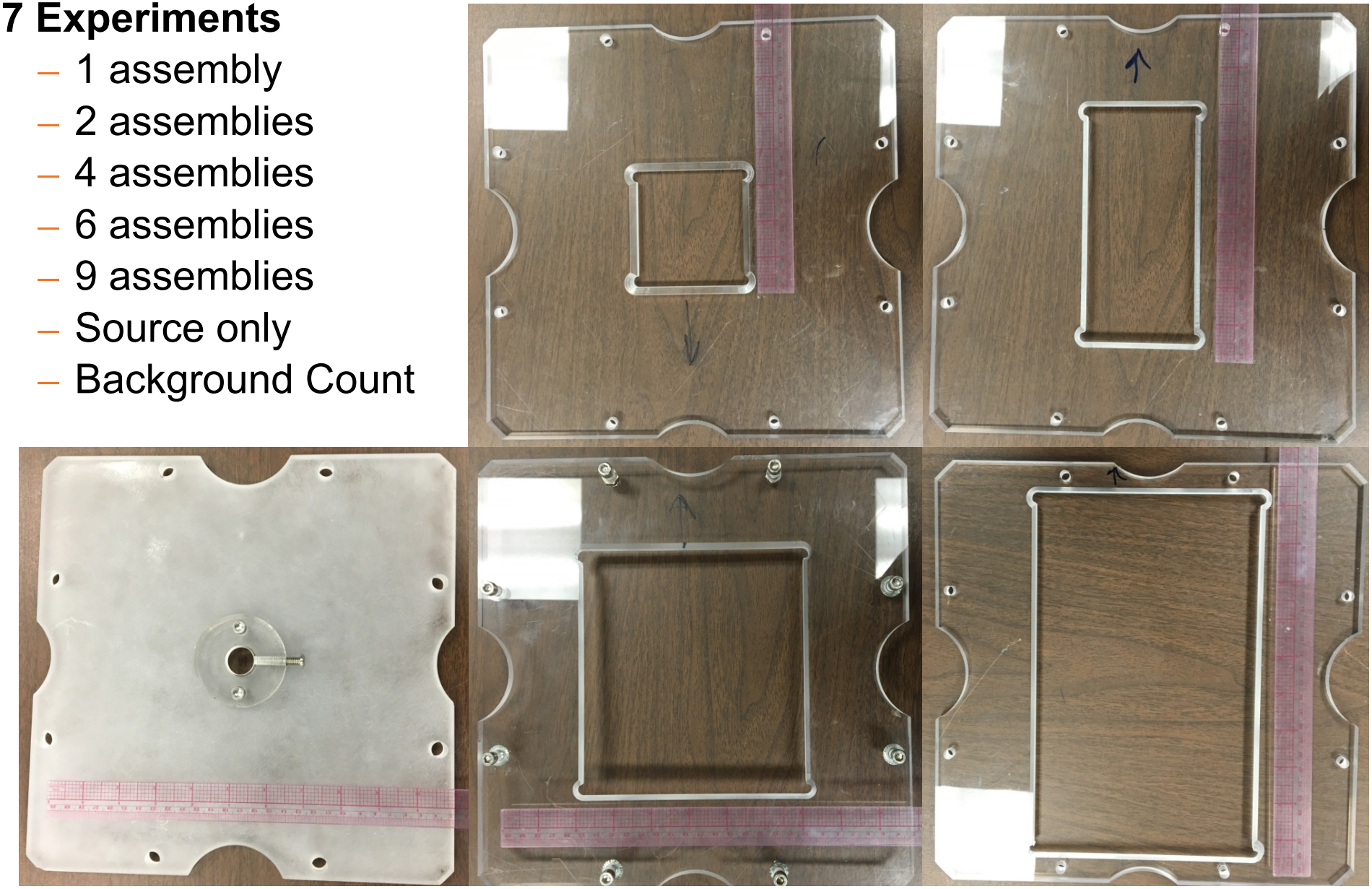

0
180
360
540
720
900

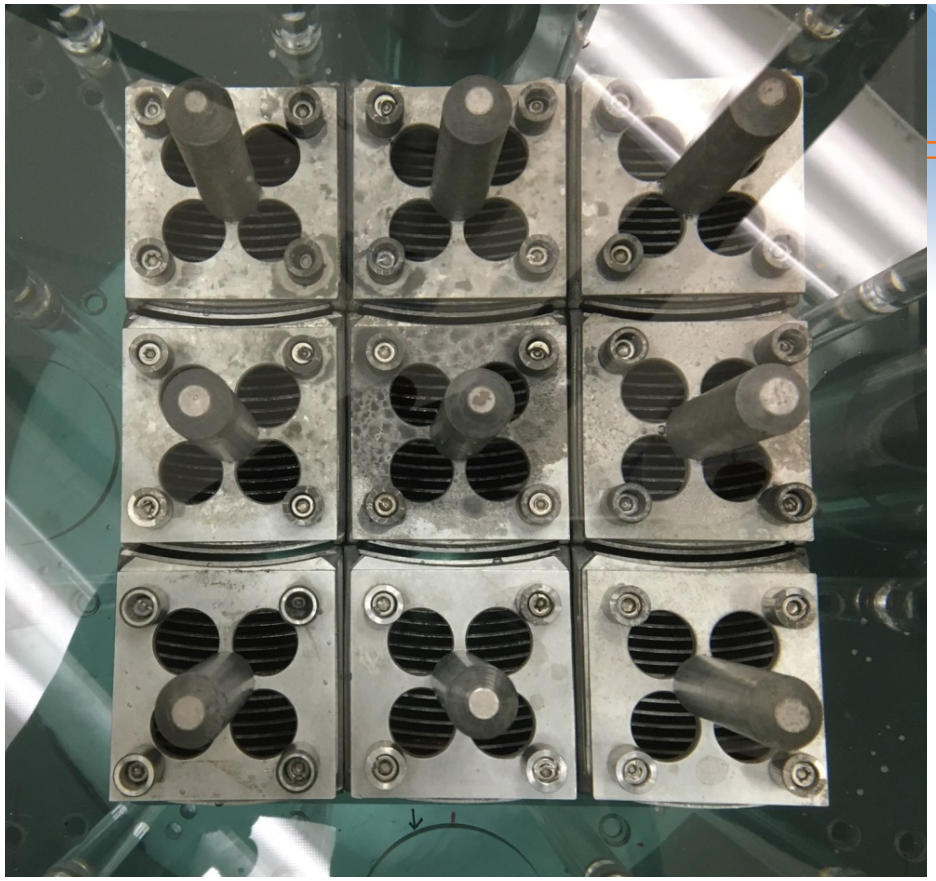

3.937 cm
3.617 cm
8.001 cm
7.079 cm
1.746 cm
.541 cm
1.346 cm
1.418 cm
3.007 cm
1.187 cm
2.294 cm
2.046 cm
.184 cm
1.194 cm
1.237 cm
2.424 cm
1.728 cm
1.589 cm
1.430 cm
1.904 cm
1.448 cm
.390 cm
1.483 cm
.152 cm
.234 cm
.508 cm
.774 cm
96.520 cm
.465 cm
.154 cm
.097 cm
.541 cm
1.245 cm
.961 cm
5.014 cm
.184 cm
5.080 cm

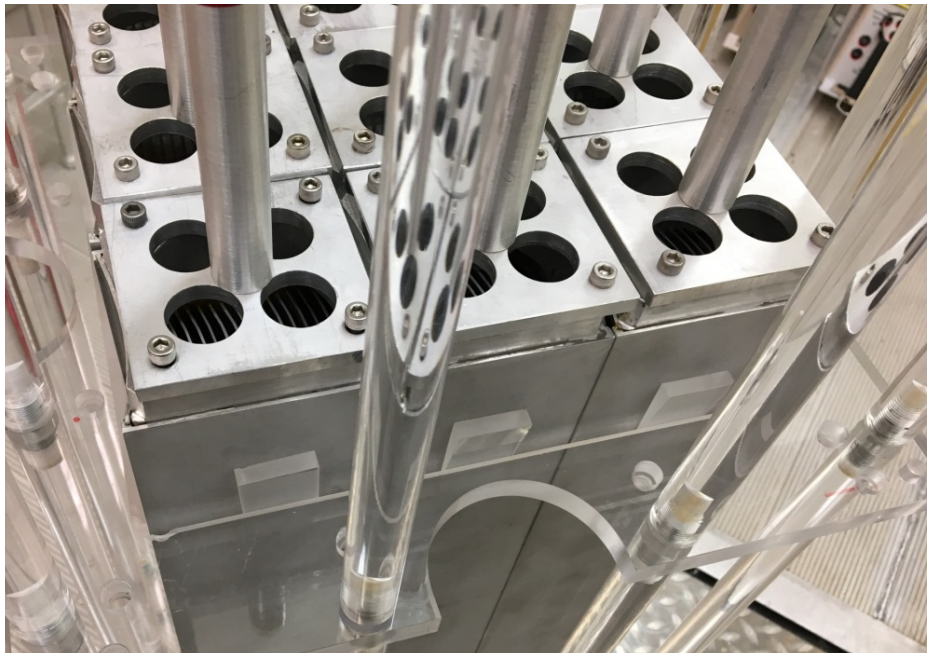


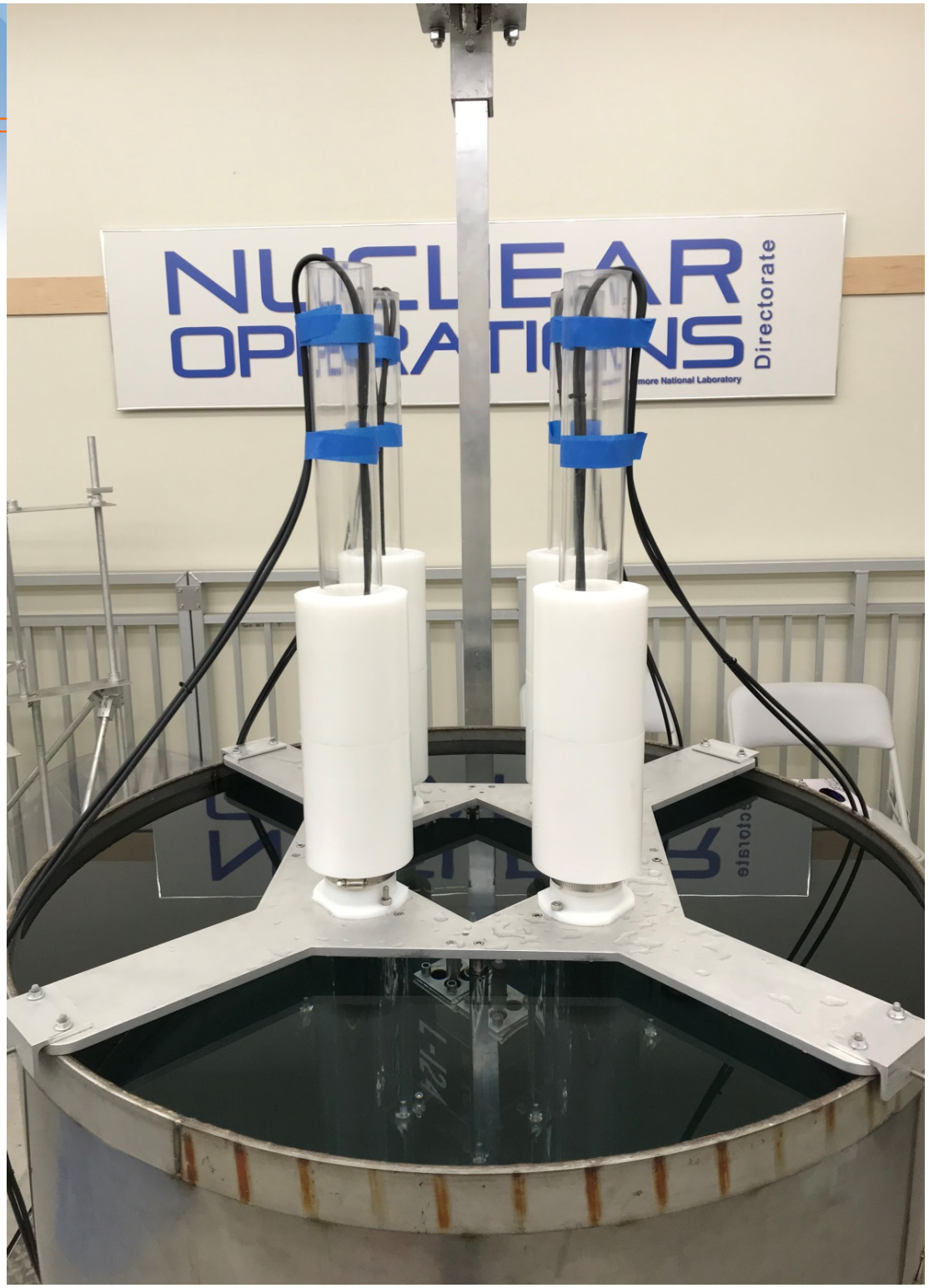
Experimental Setup

- **7 Experiments**
  - 1 assembly
  - 2 assemblies
  - 4 assemblies
  - 6 assemblies
  - 9 assemblies
  - Source only
  - Background Count



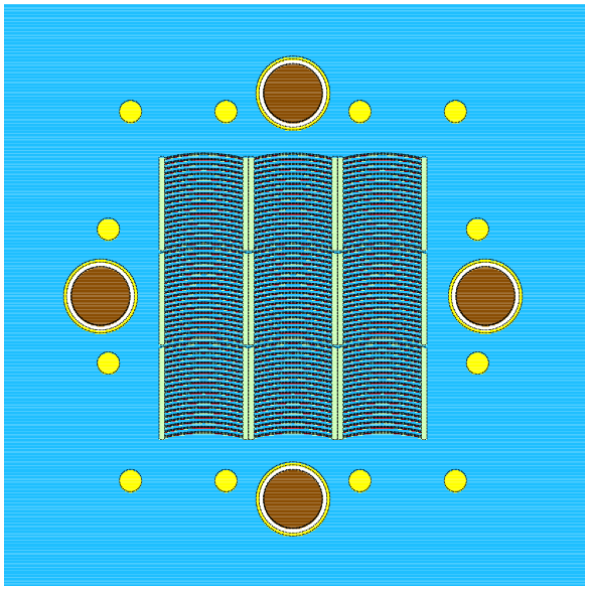


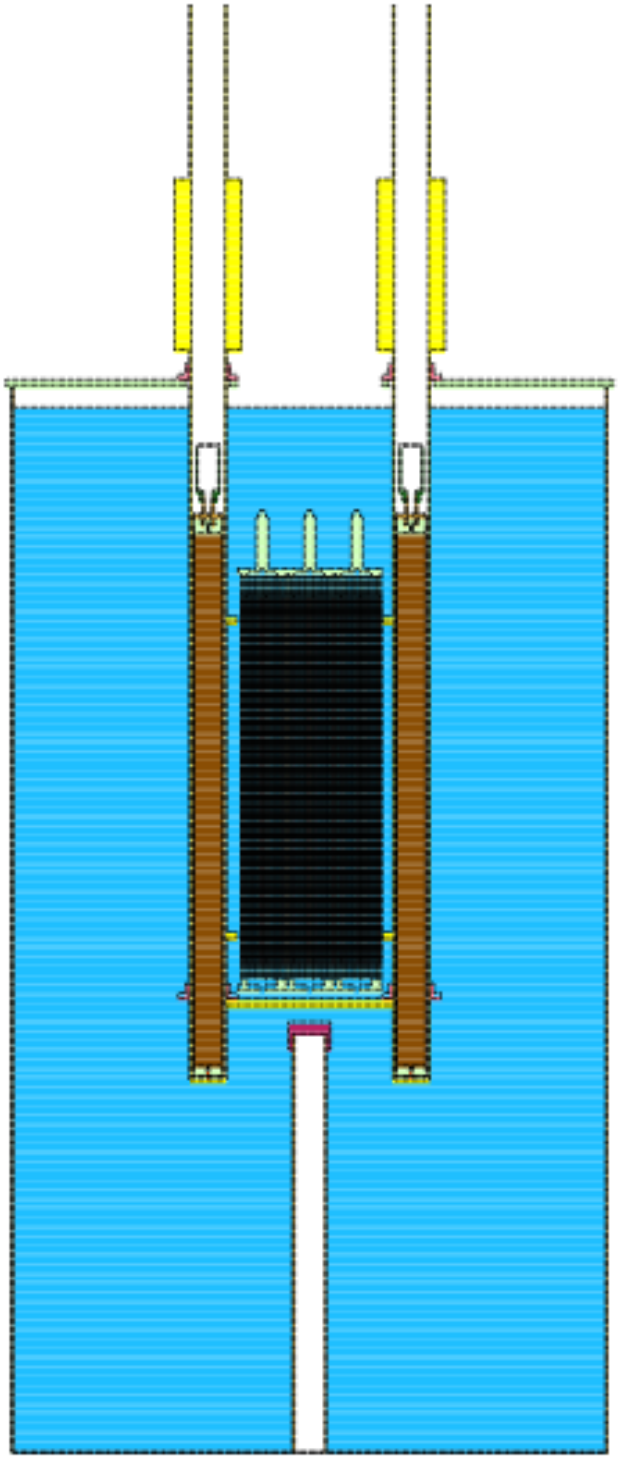



Directorate

Status

- Completed:
  - Experiments and CED-3b report
  - 6 COG models
- In Progress:
  - Data analysis
  - Experiment/model comparison
  - Uncertainty calculations
  - ICSBEP Report – October 2018





Acknowledgements

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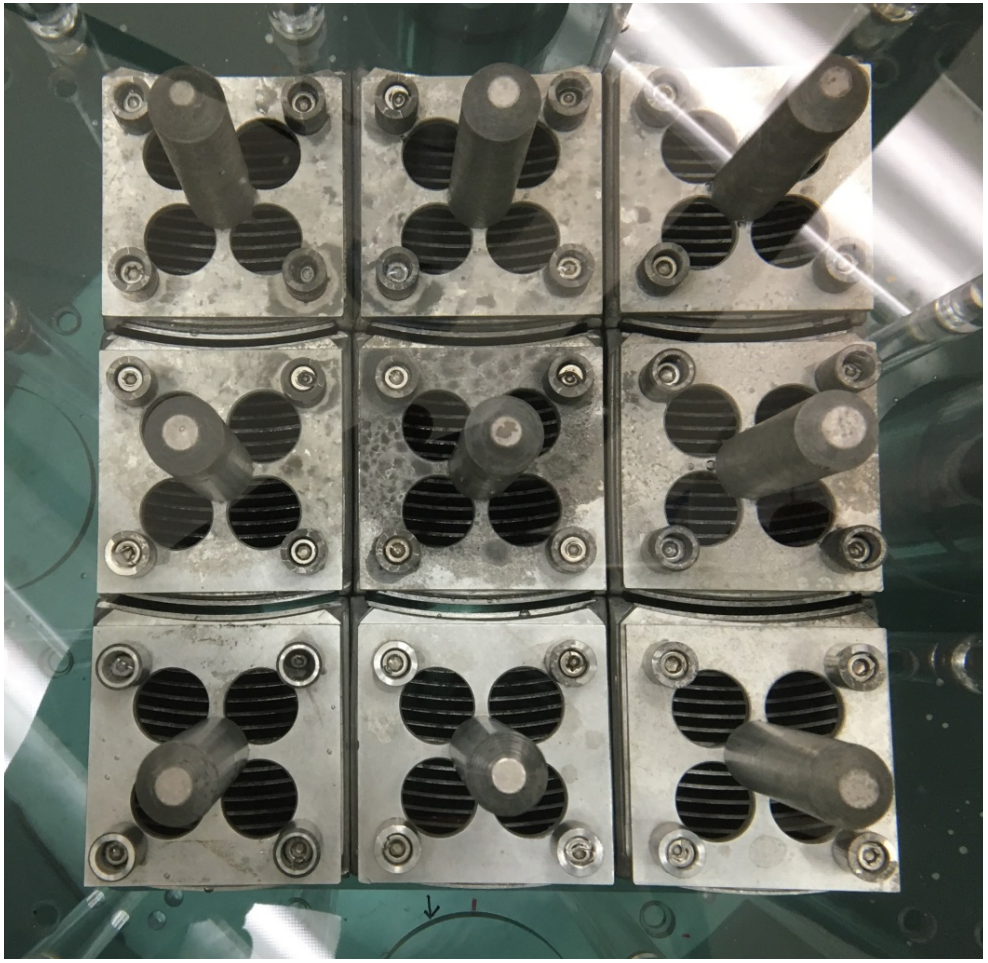
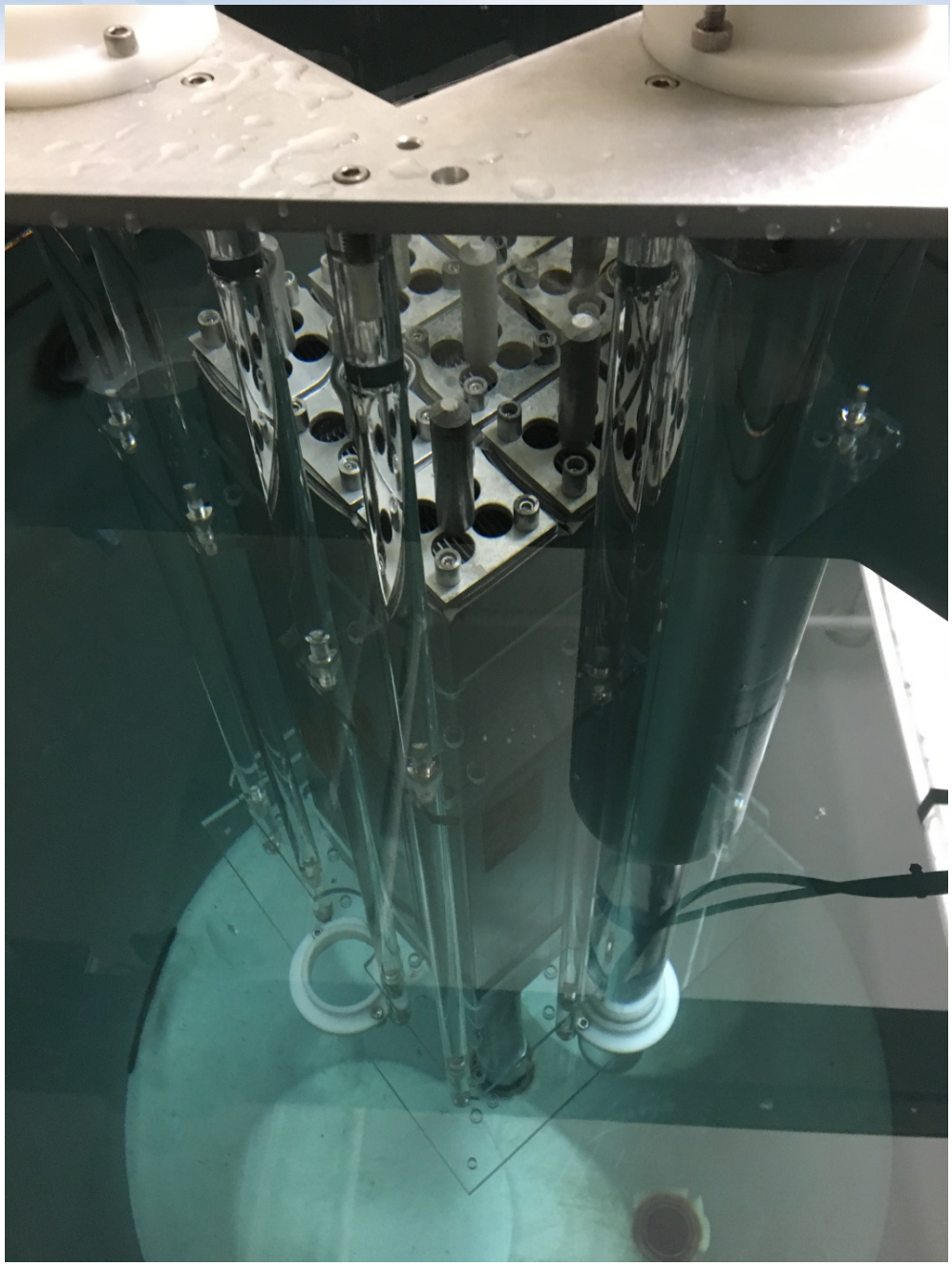
- DOE Nuclear Criticality Safety Program
- DOE Office of Fissile Materials Disposition
- DOE NNSA Livermore Field Office
- LLNL Nuclear Operations Directorate

Questions?





Questions?