UT-BATTELLE

Water Tests of Hg System

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Muon Collaboration Friday Meeting

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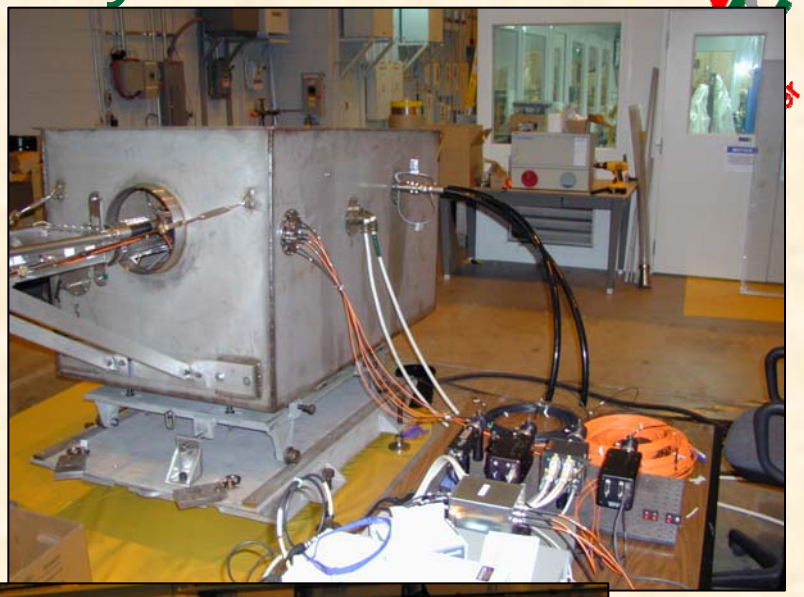
OAK RIDGE NATIONAL LABORATORY
U. S. DEPARTMENT OF ENERGY

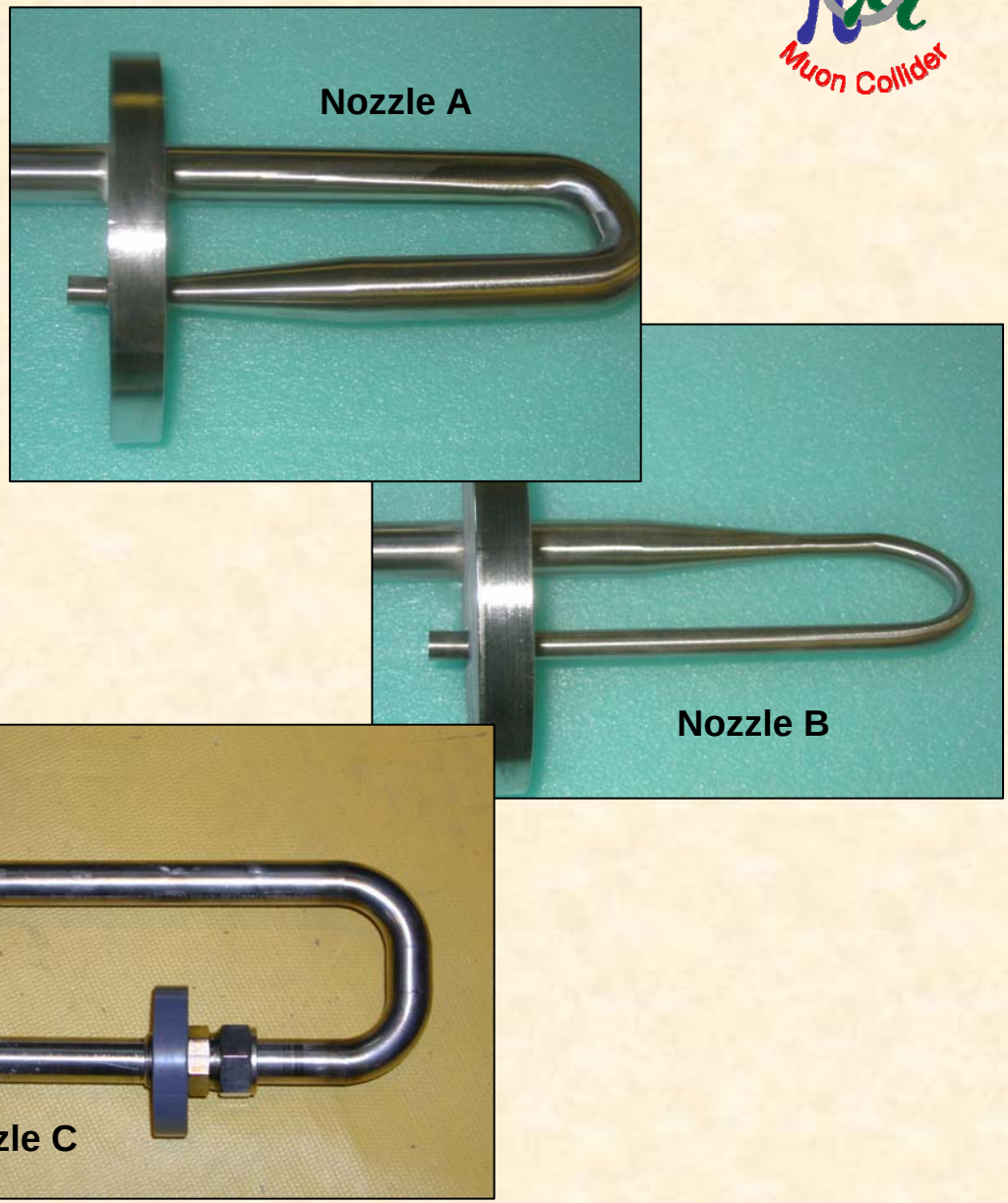
System Assembly Nearly Complete

- **Primary containment completed**
  - **Issues with piping resolved, final fit-up completed**
- **All sensors and optical diagnostics installed and operational**
- **Final steps to assemble secondary containment underway**



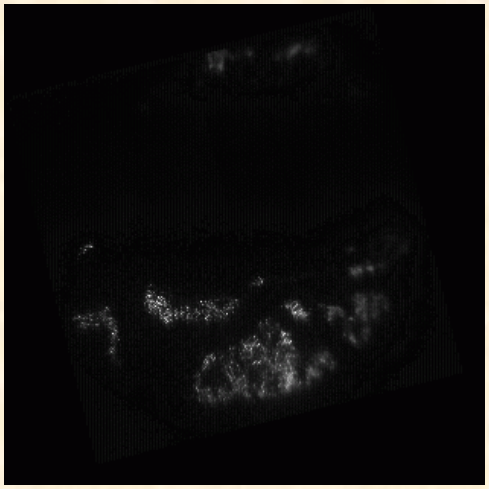
SS Water Test Nozzles

- **Nozzle A – diameter reduction after bend, 2.5° nozzle angle**
- **Nozzle B – reduction before bend, 2.5° nozzle angle**
- **Nozzle C – test nozzle with reduction after bend, straight nozzle tip, internally similar to nozzle A**
- **Nozzle D – nozzle A after reaming out the tip**

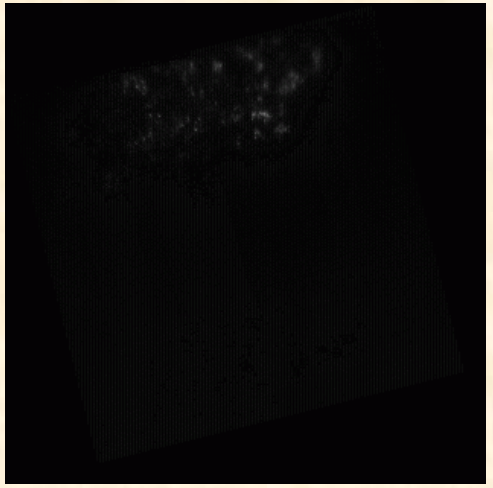


Results

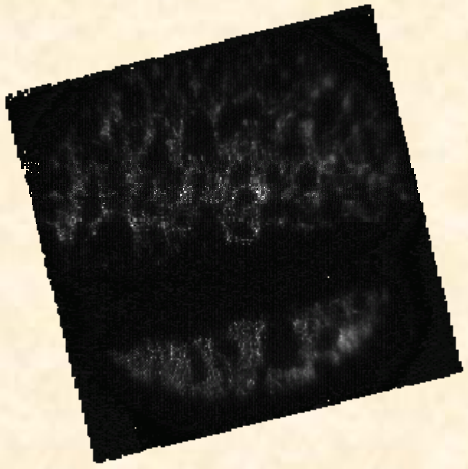
- **Nozzle B spray worse than Nozzle A**
  - **Neither jet was acceptable**
- **Definite increase in jet diameter at higher velocities**
- **Nozzle C gave best results**
- **Water droplets on windows was a problem**



Nozzle A, 20m/s



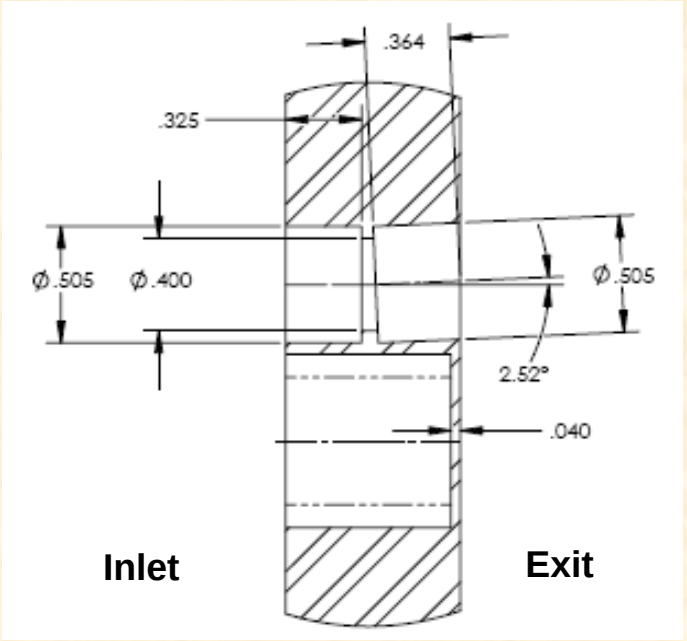
Nozzle B, 20m/s



Nozzle C, 20m/s

Nozzle Issues

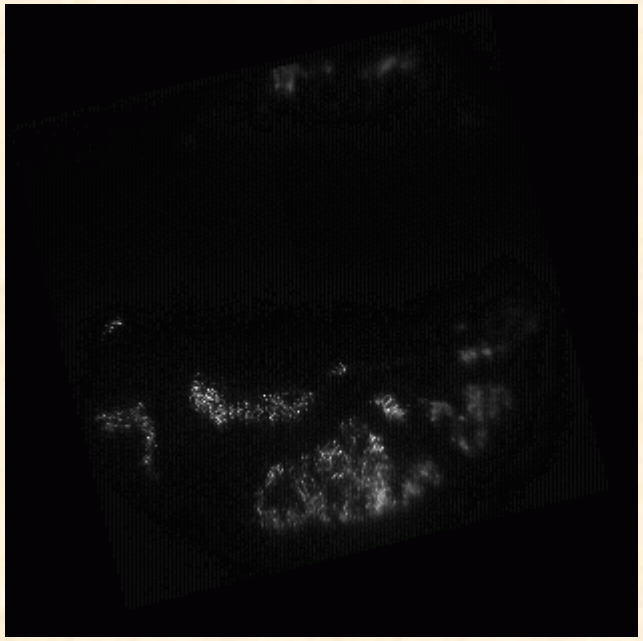
- **Flow path is a three-piece weldment**
  - **Inlet tube**
  - **Nozzle flange**
  - **Short angled nozzle tip**
- **Change in direction required for beam to miss piping geometry**
- **Smooth path requires constant ID**
- **Investigation revealed SS nozzles had step in flow path (flange thru hole smaller than tube IDs)**



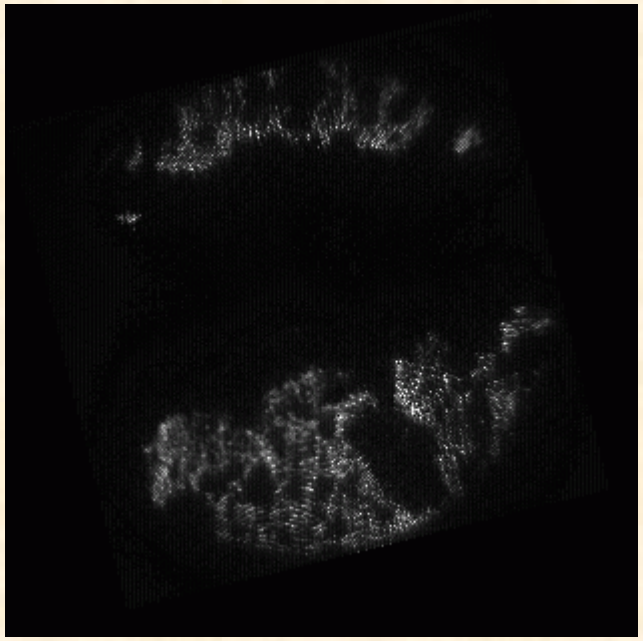
Dimensions in inches

Nozzle D Tested

- **Nozzle A was manually modified using drill bits to provide nearly constant ID from flange to tip**
- **Tests showed definite improvement, but still not satisfactory**
  - **Field of view 5.5cm, so Nozzle D generates ~2cm jet**



Nozzle A, 20m/s



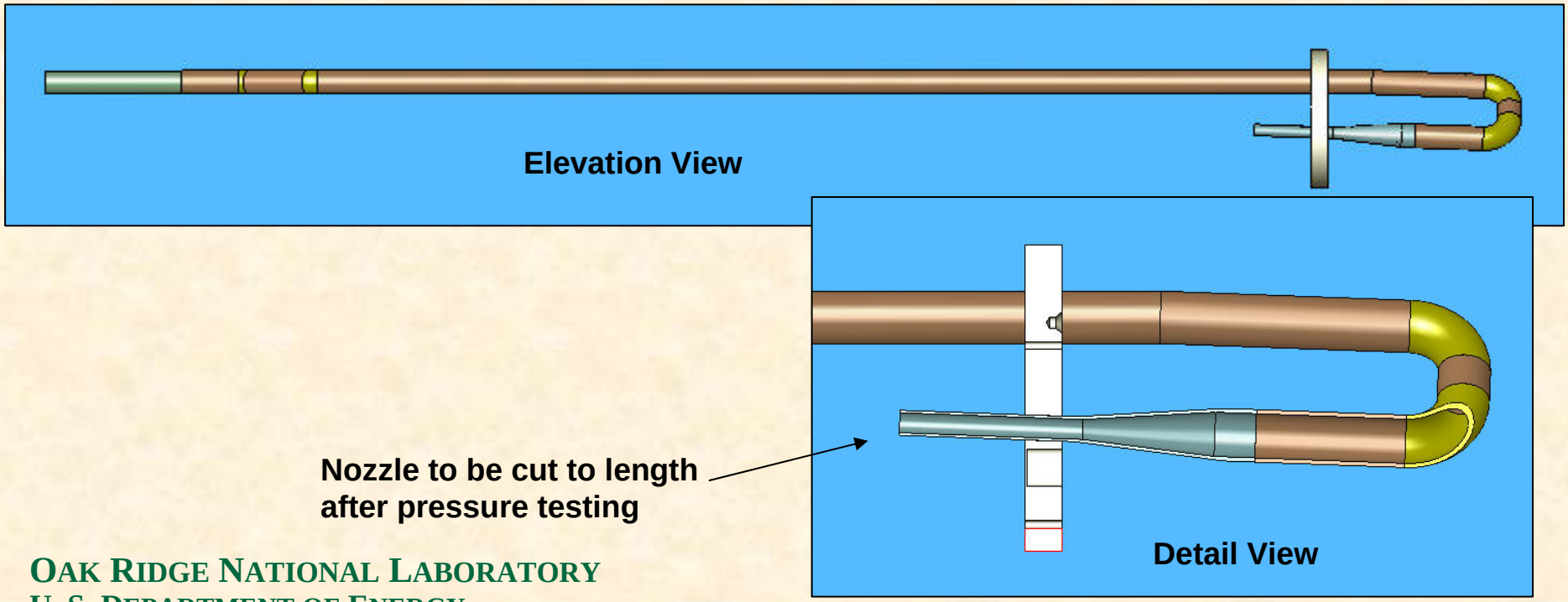
Nozzle D, 20m/s

Path Forward

- **Water test results discussed among MERIT collaboration**
- **Best chance of success is to reproduce straight nozzle C**
  - **Changing direction just before nozzle exit has not proven to provide satisfactory results**
  - **Piping still requires "kink" to avoid beam, but new design will move kink in front of 180deg bend**
- **New nozzles will be fabricated with Ti, the actual design material**
  - **Enough Ti on hand to produce two configurations**
  - **Machining and drawings ready for a Ti nozzle A**
  - **Developing models and drawings for a new nozzle E**

Nozzle E configuration

- **Straight flow path after 180deg bend**
- **"Kink" made prior to bend**
- **Nozzle angle and elevation being finalized**
- **Proceed with fabrication ASAP**



ORNL Readiness Review

- **Internal ORNL review held to determine if necessary steps are in place for mercury operations**
- **No issues noted as long as safety equipment is in place and operating procedures are followed**
- **MERIT collaboration discussing when to start Hg tests**
  - **Use existing nozzles or wait for Ti versions**
  - **Syringe has never been Hg tested**
  - **Cannot switch back to water after Hg introduced**
  - **Have to consider waste issues**

Current Status / Next Steps

- **Fabricate Ti nozzle(s) immediately**
- **Complete secondary containment**
  - **Assemble and check for air leaks**
  - **Install Hg vapor filters**
- **Clean inside of viewports before introduction of Hg**
- **Conduct Hg tests**
- **Working on equipment transport issues**
  - **Equipment crating is being fabricated**