MERIT Hg System Reconfiguration Concept

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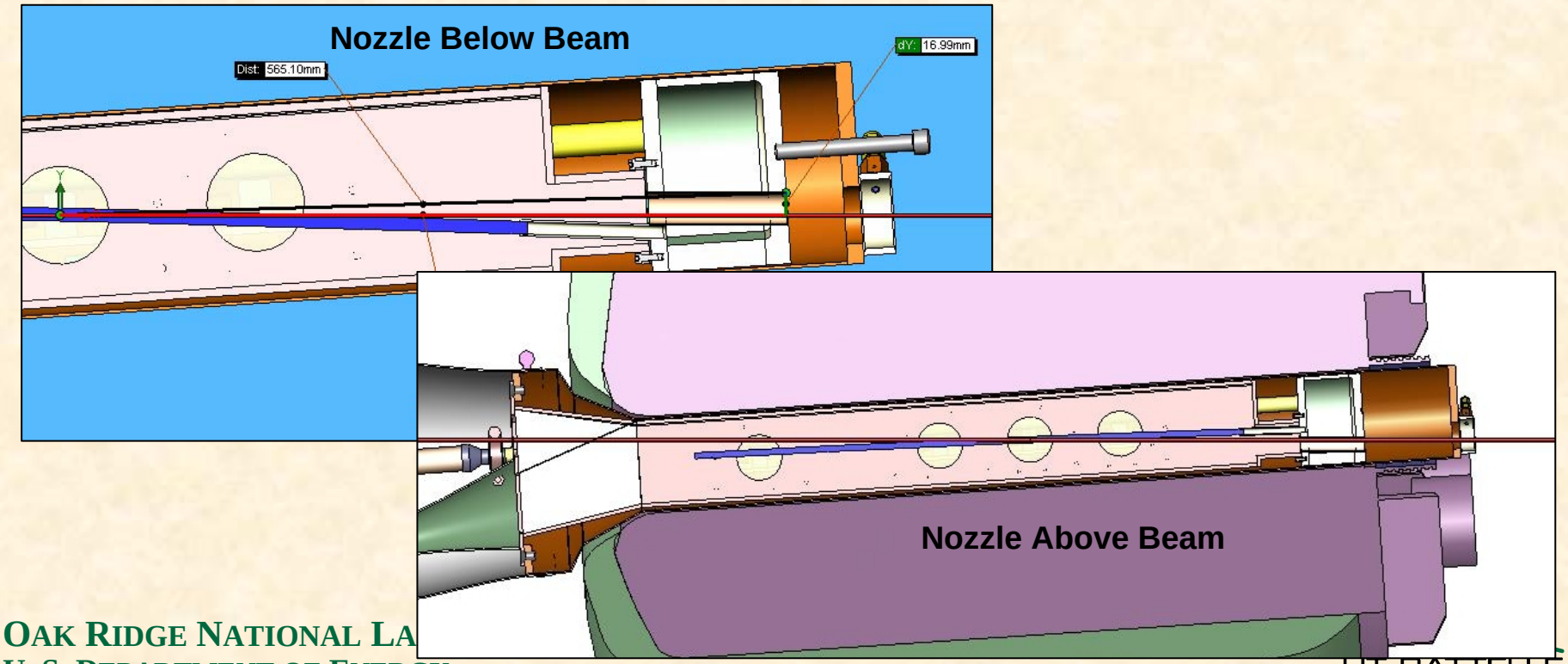
- **Two issues discussed have impact on Hg delivery system design**
  - **Hg jet distortion in field appears to be real and a significant problem**
    - **Decision made to decrease angle between Hg jet and magnet axis from 100 mrad to 33 mrad**
    - **This moves nozzle above the beam**
  - **Cost has become more of an issue as actual hardware quotations are received**

Nozzle Relocation

- **Nozzle above beam is more inline with magnet axis**
- **Magnet tilt angle cannot be decreased during experiment because nozzle would move into beam**



Design Ramifications

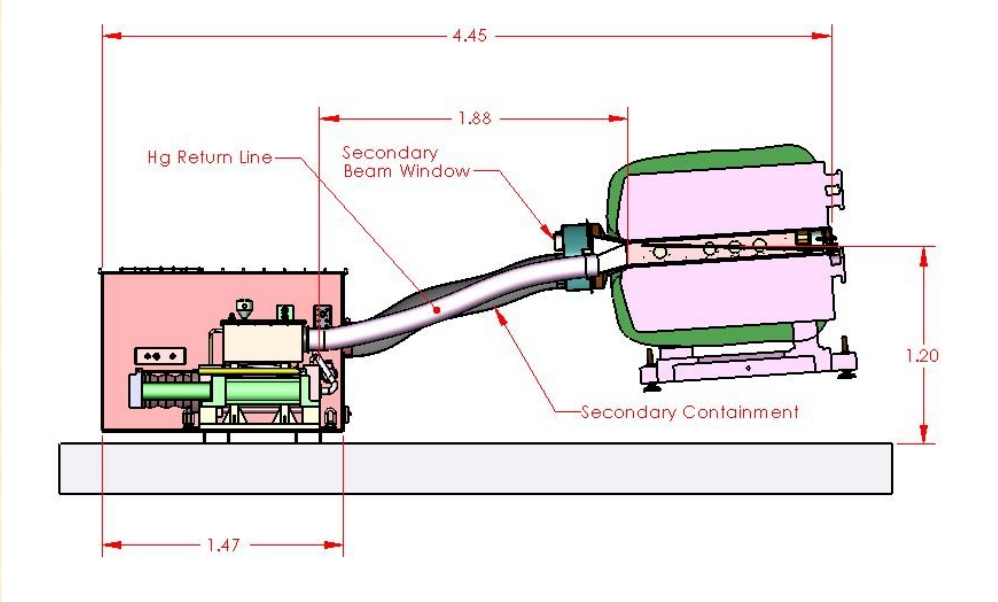
- **Need for deflector not as apparent**
  - **Might be reconfigured or eliminated**
- **Plenum no longer a preferred solution**
  - **Maneuvering Hg around beam no longer an issue**
  - **Have room to make turn at end of magnet and have long run in same direction as beam**
  - **Non-plenum approach requires increased pressure at Hg cylinder**
- **Half-plenum could be considered**
- **Still require that replaceable nozzle be incorporated**

Hg System Costs

- **Syringe ~$80K**
- **Remaining fabricated item cost estimates from ORNL fabrication expert**
  - **Common baseplate ($22K)**
  - **Target transporter ($5K)**
  - **Target cart ($3K)**
  - **Primary containment ($12K)**
  - **Secondary containment ($14K)**
- **Consideration being given to eliminate / minimize baseplate & transporter costs**

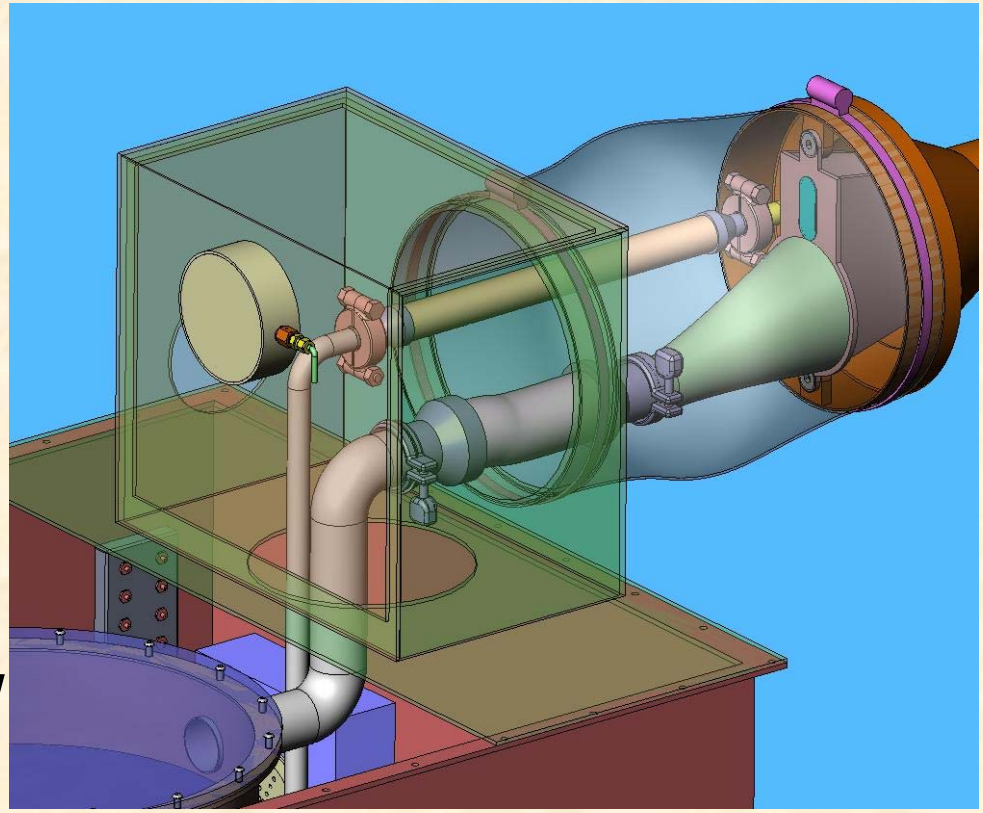
Common Baseplate Can Be Eliminated

- **Approach initially considered during analysis of attractive forces between steel cylinders and magnet**
- **Separating systems alleviated force issue but introduced other handling & transport issues**



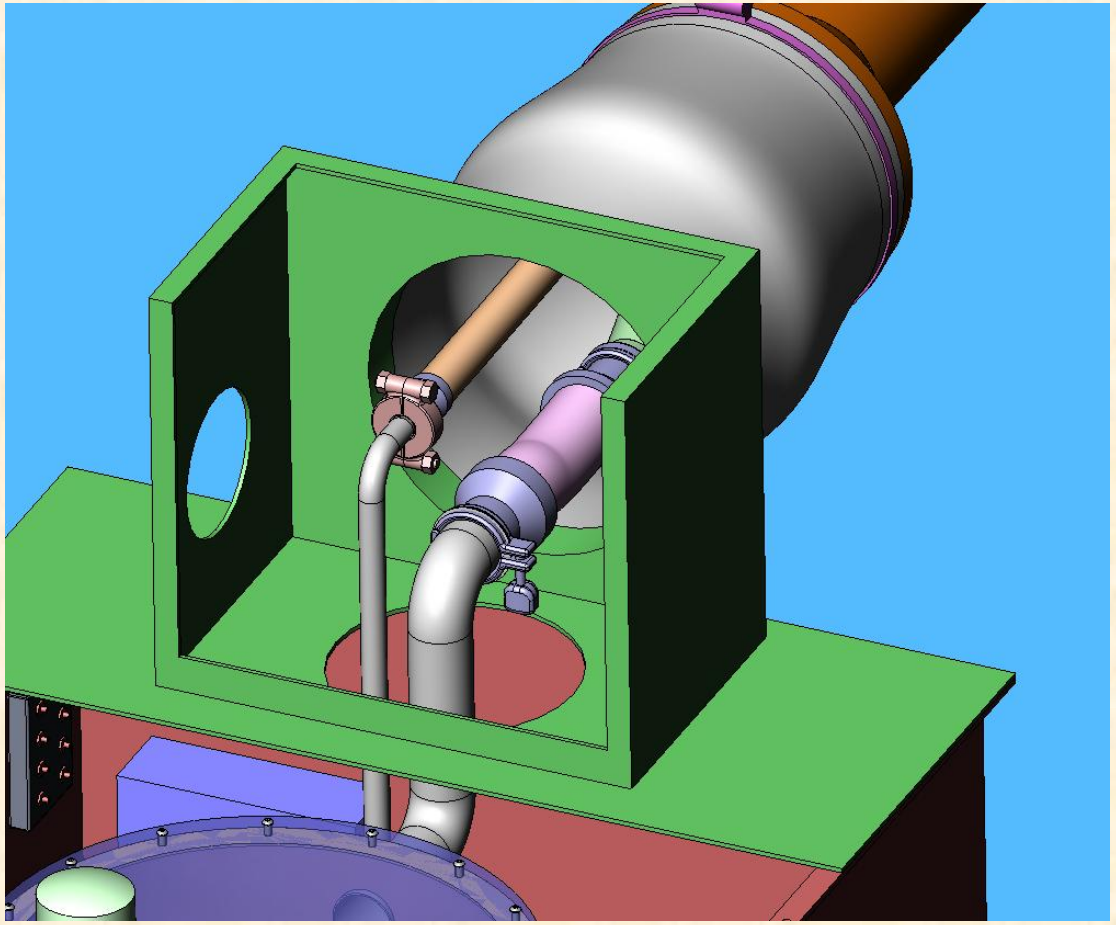
New Approach

- **Increase length of flexible tubing but minimize separation distance**
- **Reconfigure secondary containment so Hg supply & return lines exit out the top rather than the front**
- **Move secondary downstream beam window**



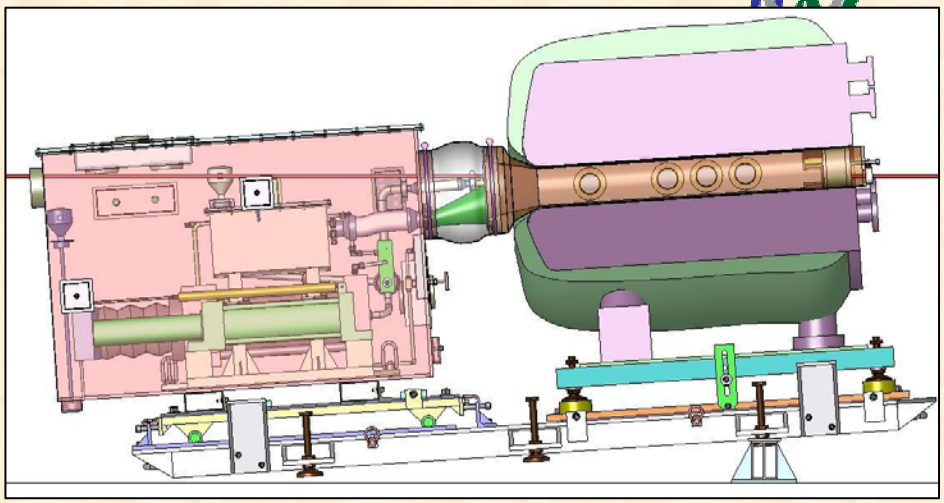
Syringe Assembly Sequence

- **Lower cylinder assembly into box**
  - **Assembly does not include flexible hoses**
- **Lower secondary cover box over cylinder discharge piping**
- **While supporting weight, attach primary containment target module (incl. flex hoses)**
- **While supporting weight, slide secondary containment sleeve over target module**
- **Pass optic fibers through side hole in cover box**
- **Install back/top of cover box (with beam window)**

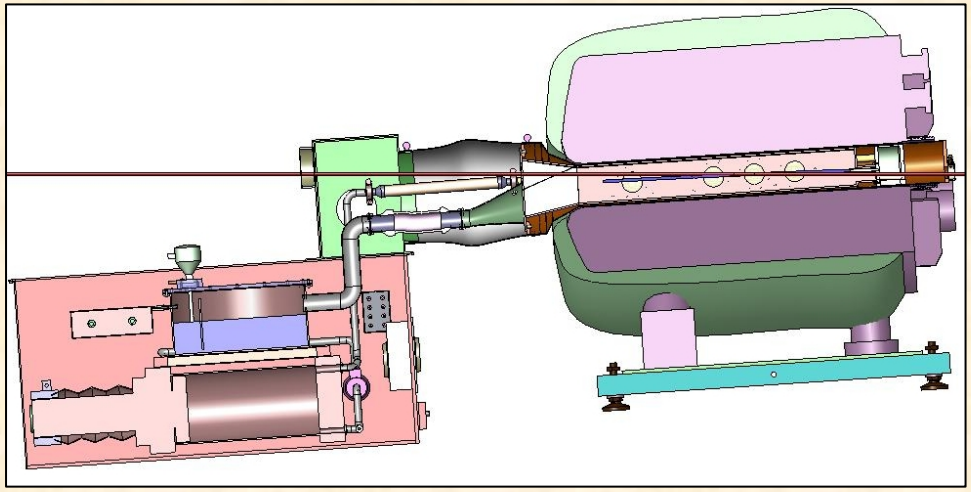


New Concept Has Its Own Issues

- **Common baseplate eliminated need for built-in tilt adjustment of Hg system**
  - **New Hg system transporter requires rolling, elevating, tilting, and locking features**
- **Support for target module will be an issue**
- **Secondary downstream beam window must be very large to accommodate non-precise tilt of Hg system**
  - **Might have to increase window thickness to withstand vacuum/pressure monitoring**
- **Slightly increased pressure drop due to longer piping**
- **Longer supply piping means slightly decreased max jet duration (<1/4sec change)**
- **Magnet will require its own transport, alignment, and support features**



Current Baseline



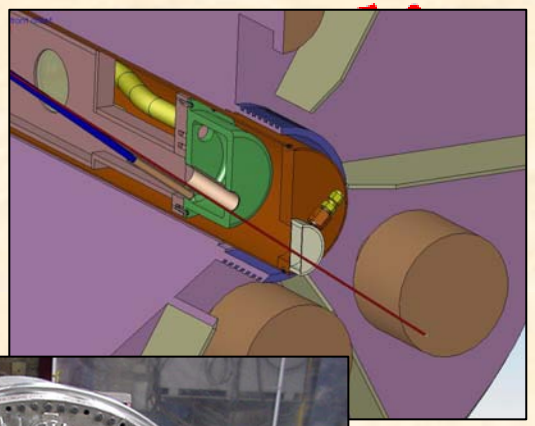
New Concept (Syringe May Be Less Tilted)

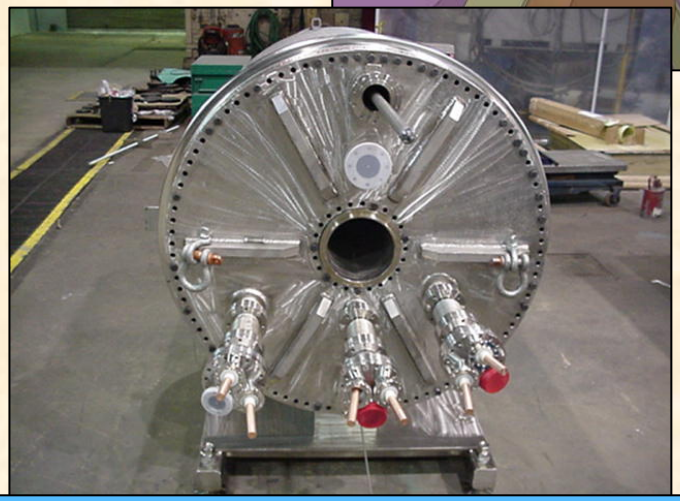
Preliminary Installation Sequence With New Concept

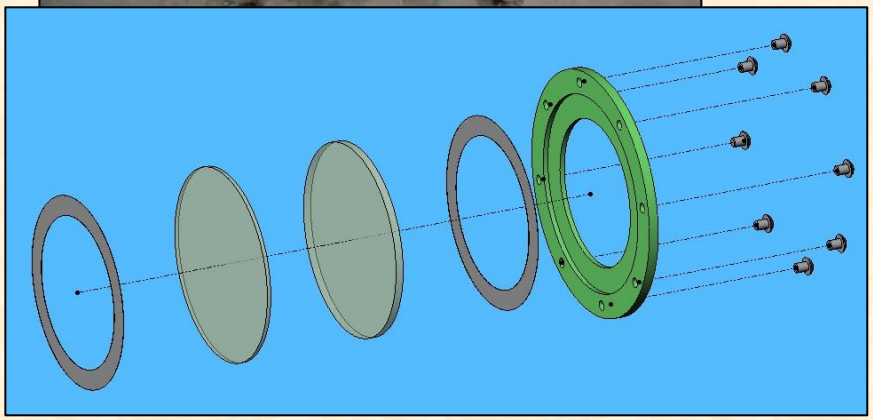
- **Grossly align magnet axis with vertical plane containing beam**
- **Elevate magnet so axis is parallel to floor and just below beam elevation**
  - **Perform fine lateral alignment of magnet**
- **Roll Hg system into position, removing support as target module enters magnet bore**
- **Raise upbeam end of magnet until Z=0 is in beamline**
  - **Must also adjust tilt/elevation of Hg system**

Other Issues Discussed

- **Decided to not pursue in-situ nozzle replacement**
  - **Proposed MIT testing**
    - **Conduct integrated tests with level baseplate until nozzle finalized**
      - **Changeouts better controlled, less risk of Hg spill if Hg system extracted from magnet**
    - **Tilt baseplate for final tests**
- **Proposing to use sapphire optical windows instead of silica/lexan**
  - **Mechanical properties of sapphire exceed those of fused silica**
  - **Princeton to conduct impact tests on sapphire disks**







Conclusions

- **Nozzle relocation will necessitate some fairly detailed design changes**
  - **Moving away from plenum concept**
- **Fabrication costs dictating further design review**
  - **New delivery system concept eliminates some major fabrication expense**
    - **More design required**
    - **Additional cost to magnet system required**
    - **Should this become baseline approach?**