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
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?