UT-BATTELLE

Hg Delivery System Nozzle Discussion

Van Graves

25 Oct 2005

OAK RIDGE NATIONAL LABORATORY
U. S. DEPARTMENT OF ENERGY

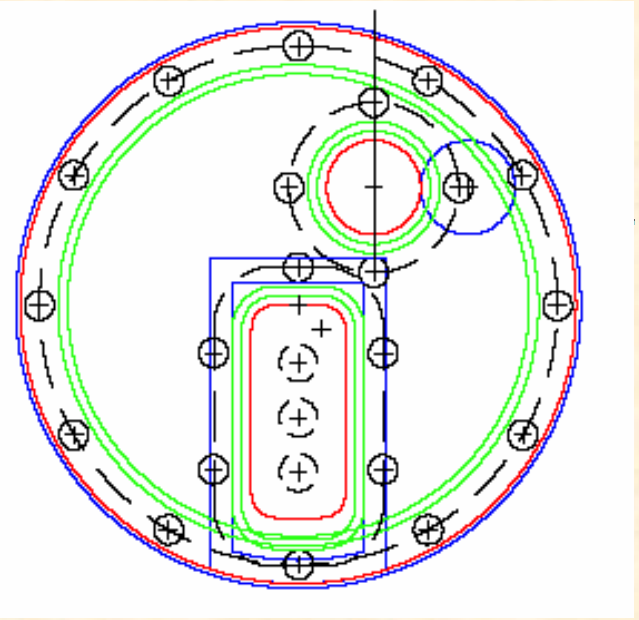
MERIT Mtg at MIT Oct 17-19

- **During Hg delivery system design review, discussion initiated concerning nozzle changeouts at MIT**
  - **Current design requires decoupling of delivery system from magnet bore to access nozzle**
  - **Operationally preferable to have access to nozzle while inserted in magnet bore**

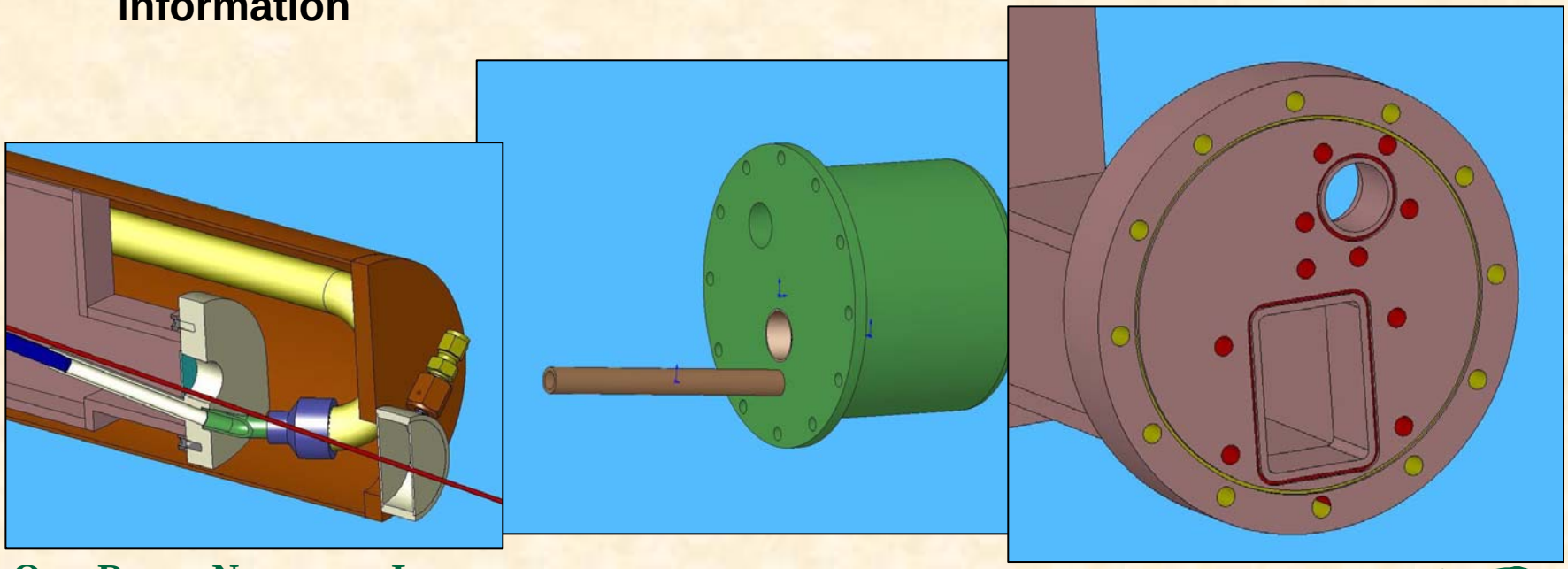
Requirements & Desirables for Up-beam Access

- **Change direction of access of mechanical fasteners**
- **Addition of a flange interface on the up-beam end of the system**
- **Removable secondary containment flange**
- **Accommodate plenum or non-plenum nozzle configurations**

McDonald Flange

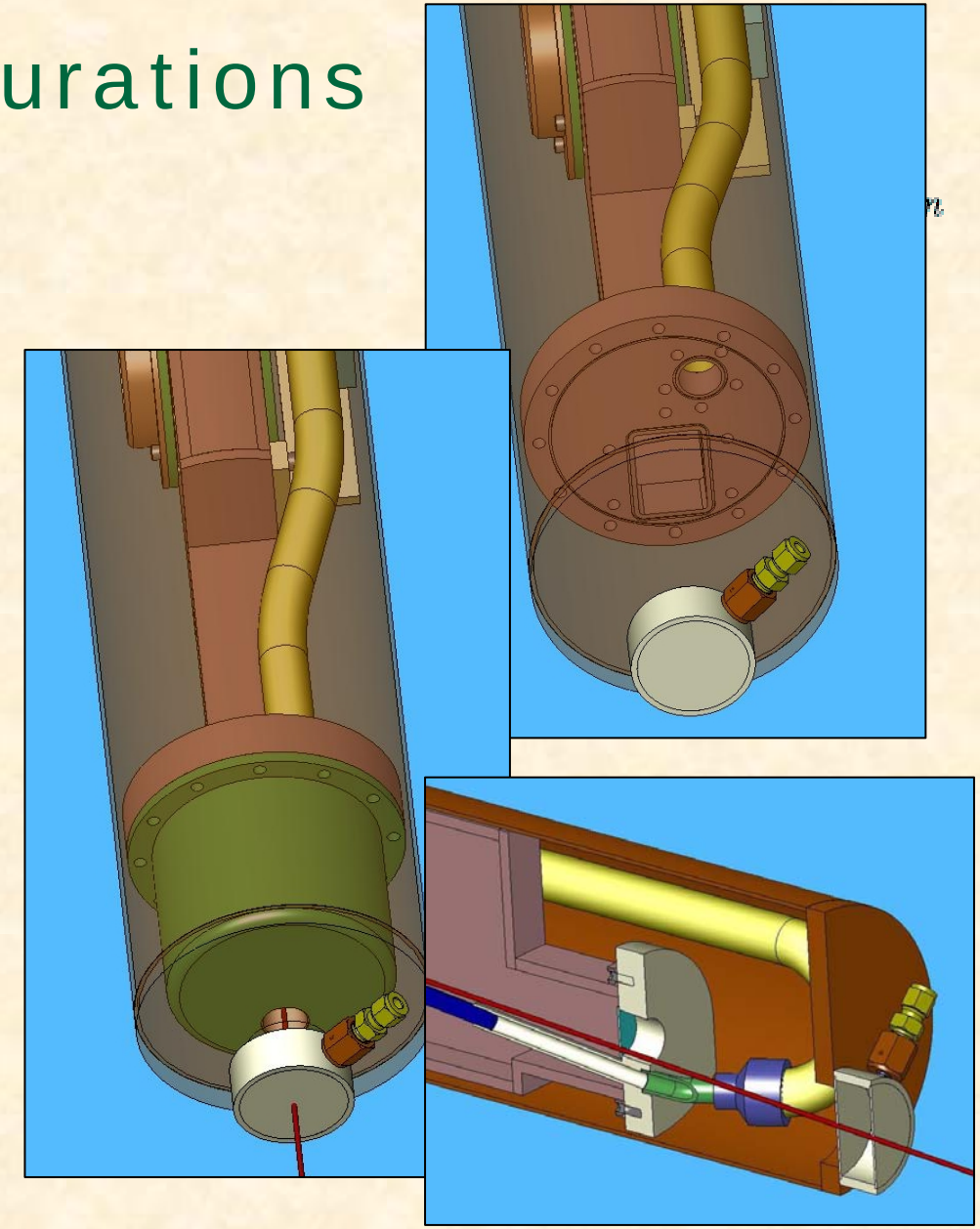


- **Kirk provided sketch of intermediate flange concept designed to accept plenum & non-plenum configurations**
  - **Incorporates o-ring seals**
- **Conceptual models developed as discussion tool**
  - **Presentation based on subjective information**



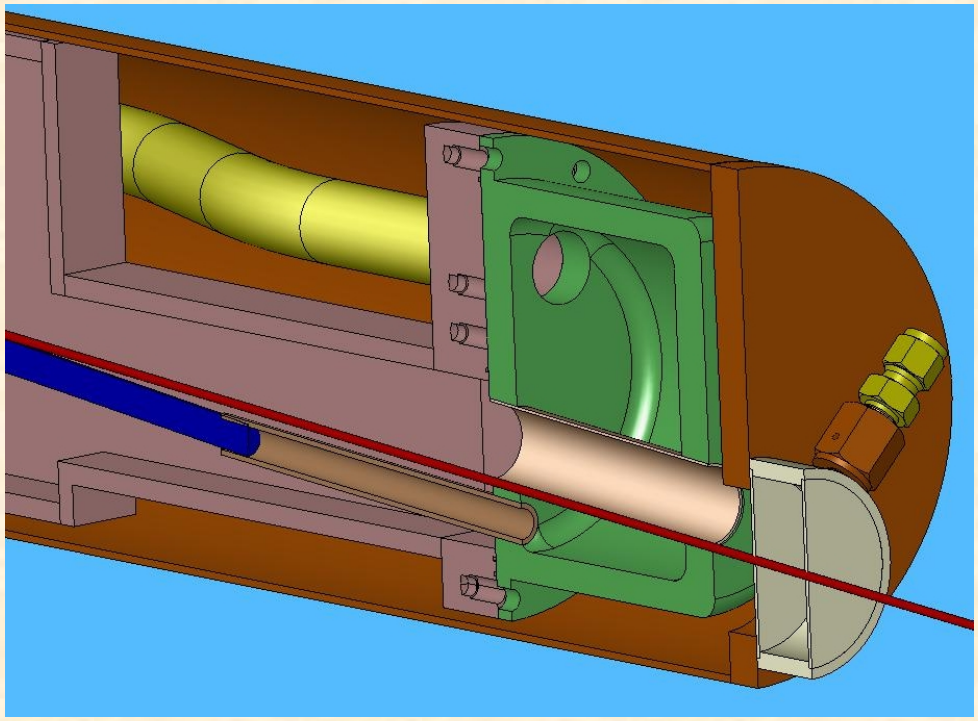
Conceptual Configurations

- **Attaching plenum from up-beam end requires smaller diameter plenum**
- **Rigid supply tubing must bend towards center to accommodate flange bolt circle**
- **Non-plenum tubing requires Hg flow to bend away from center (adds 4 bends before 180-deg turn)**



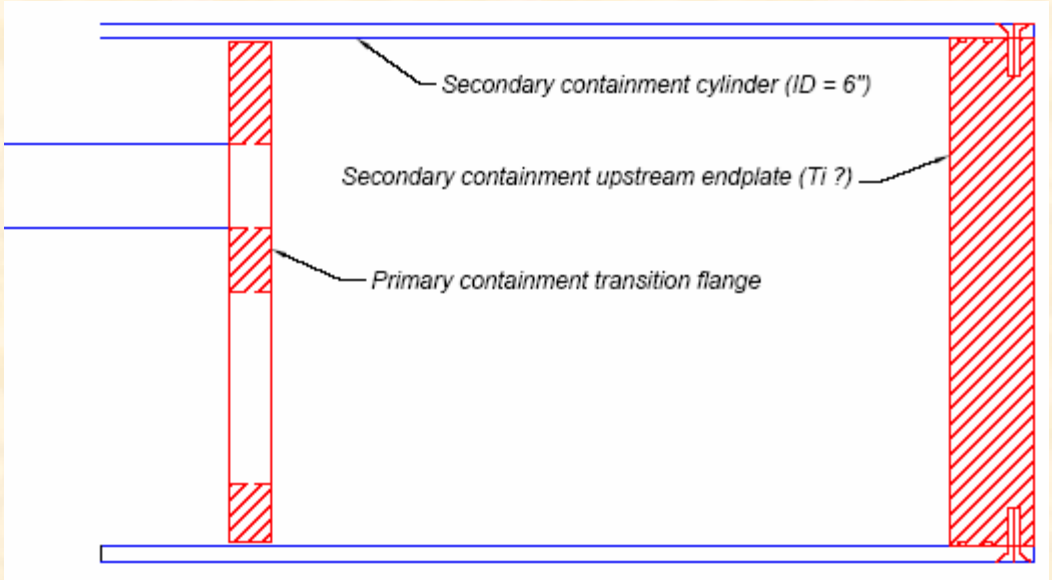
Removable Plenum Concept

- **Adding exterior bolts reduces plenum ID**
- **Beam tube positioning will be problem**
- **Plenum wall thicknesses may not be representative**



Secondary Flange

- **Radial screws provide most clearance for removal of nozzle**
- **Secondary sleeve not thick enough for flat-head screws**
  - **Adding thickness reduces clearance for removing nozzle**
- **Requires fairly precise sleeve/flange fabrication to achieve proper sealing**



My Opinions

- **Intermediate flange bolt spacing probably not realistic**
  - **High pressure will require tight spacing**
  - **Preventing o-ring groove overlap may prove difficult**
- **In-line access to all bolts not possible, especially with non-plenum configurations**
  - **Magnet bore sleeve extension makes problem worse**
  - **Other magnet connections may not allow direct hands-on access anyway**
- **Radial attachment of secondary endplate difficult without reducing ID of secondary bore**
- **Mechanics of removable plenum creates severe space limitations**
  - **Wall thicknesses of plenum may increase to accommodate Hg pressure**
  - **Inlet effects into nozzle may be affected**
- **We are increasing potential leak paths & possible failure modes**
  - **My guesstimate for nozzle changeout in current configuration is 1-2 days**
- **Selection of plenum or non-plenum should be made ASAP (with Princeton water tests if possible), not try to carry both approaches through fabrication**