Connection Node Workshop

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Connection Node Requirements

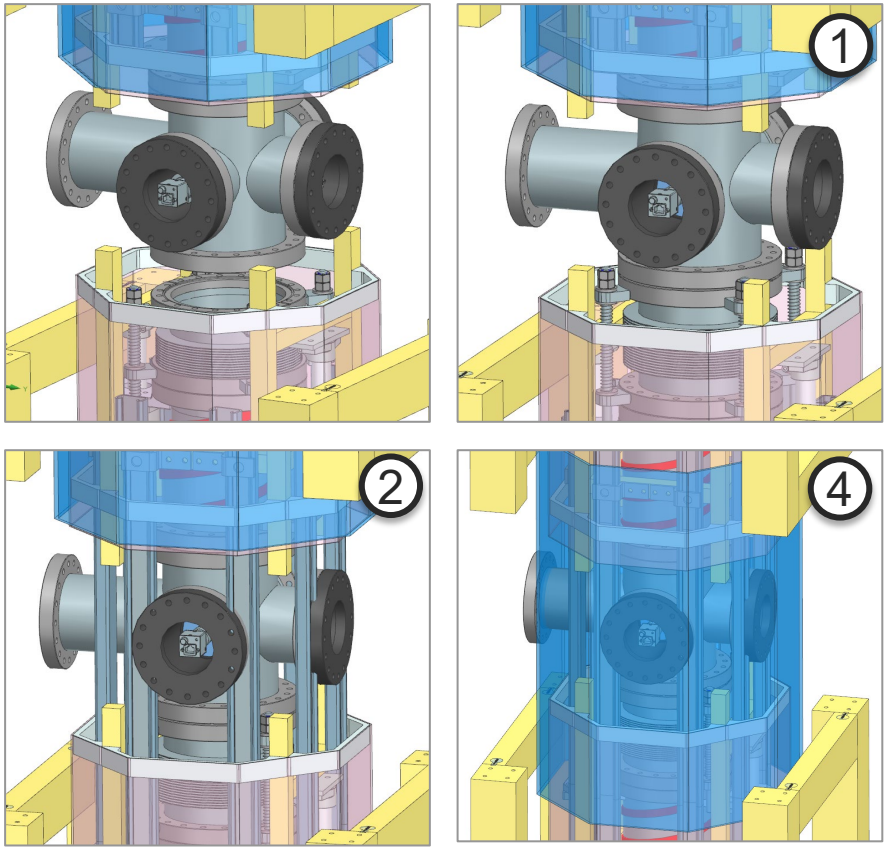
1. Provide a vacuum connection between adjacent modular sections
2. Connect and support a suitable ion pump
3. Allow for connections between adjacent bias bar coils
4. Allow for a vacuum level of 1e-10 torr or better
5. Prevent any laser light from escaping outside the connection node
6. Mount 3 cameras within ±1mm and ±1° of nominal position (locally)

- Provide a connection point for gauge(s)?
- Support and locate alignment fiducials?

Connection Node Assembly Tasks

1. Vacuum Connections
   - Rear bolt access issues
2. Bias coil connections
   - Significant interferences
3. Camera Installation (not shown)
   - Potential access issues
4. Coupler Installation
   - In development

- Connect bakeout devices?
  - Procedure outline needed
- Degaussing operations?
  - Procedure outline needed



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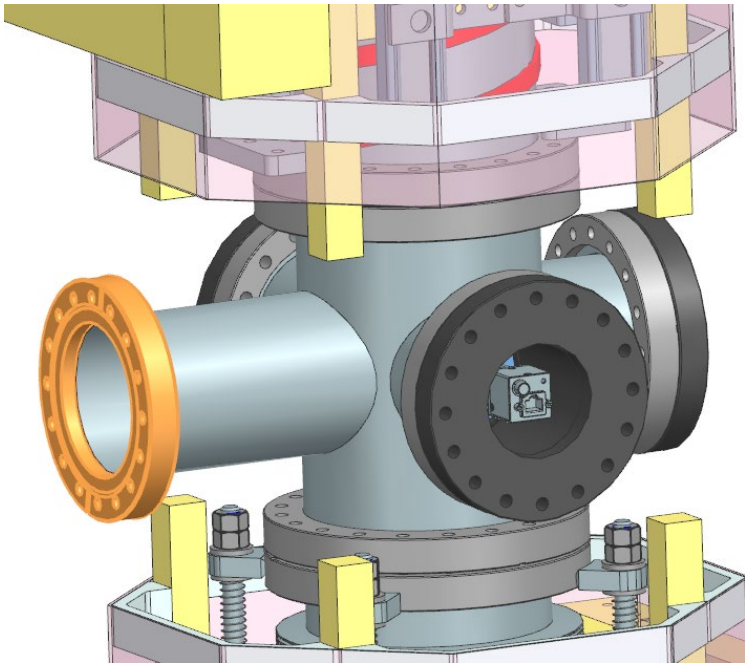
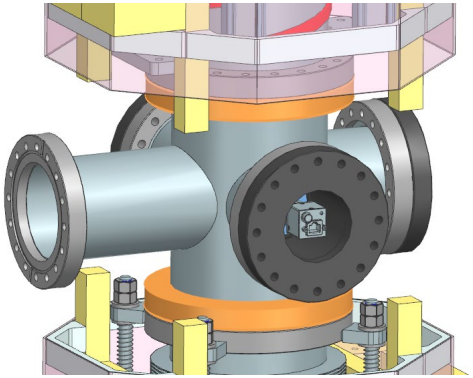
Ion Pump Port

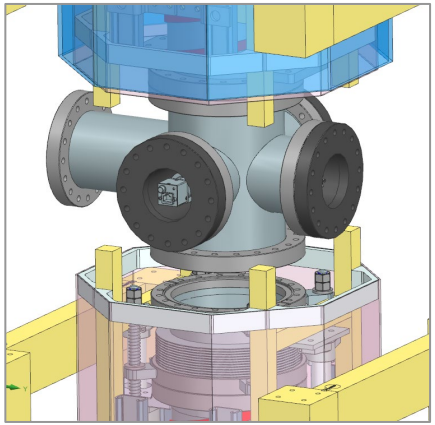
- 6” OD Flange (DN100CF)
  - Fixed or rotatable?
  - 4” tube max for bias coil interference
    - Suitable for vacuum requirements?
    - Could be elliptical tube to 8” OD flange
- Length not yet determined
  - Gauge connections?
  - Coupler size?
- Applied loads not yet confirmed
  - Ion pump weight pending
  - Support gusseting may affect assembly



Primary Vacuum Connection Ports

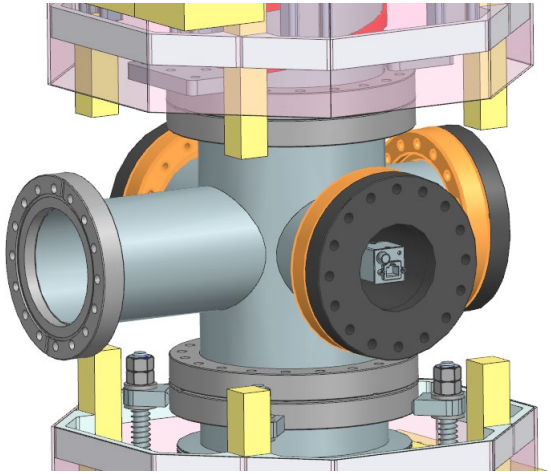
- 8” OD captive, rotatable flanges (DN160CF)
- Only lower flange made up in shaft
- Pipe length reasonably well defined
  - Sufficient clearance for fasteners
- Access issues remain for rear fasteners

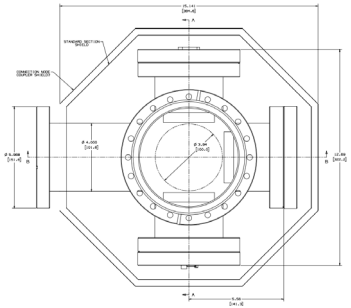


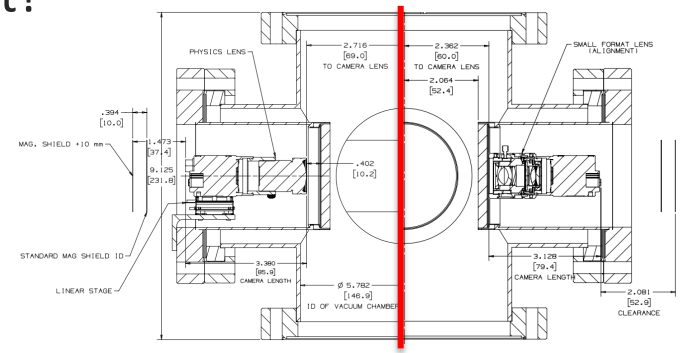


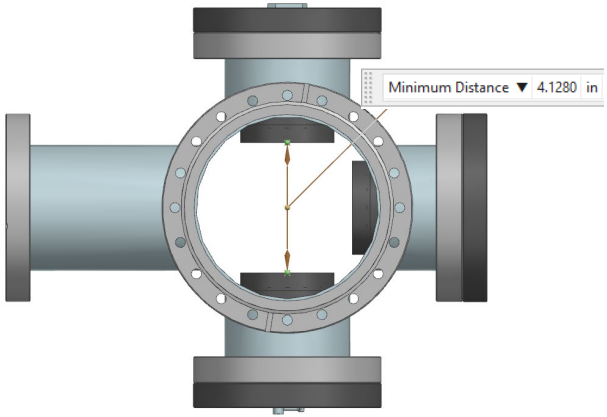
Camera Ports

- 6” OD Fixed Flanges (DN100CF)
- Re-entrant flanges create 100mm clear aperture
- Flanges well-aligned to nominal cross axes
  - ±1mm and ±1° of nominal position
- Length well defined by re-entrant flange length
- Camera lengths set?









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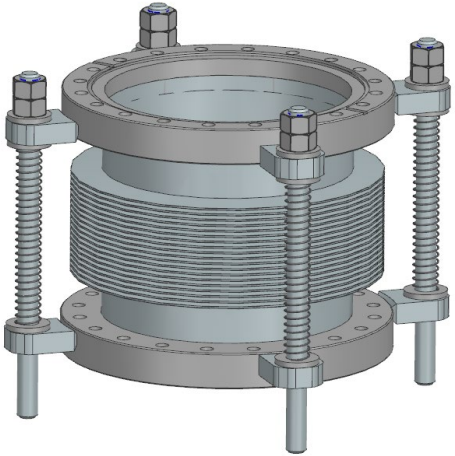
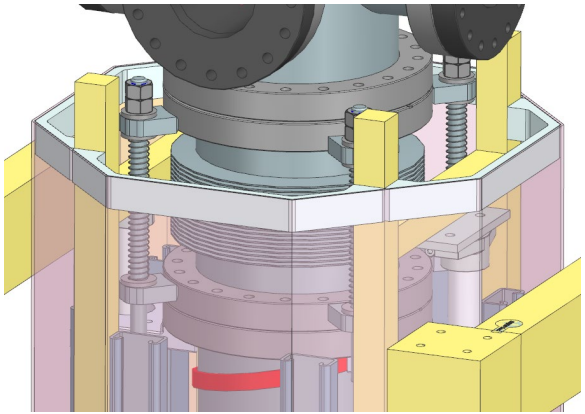
Bellows Spool

- ±2” Travel (convolution count may not be accurate)
  - Bellows must be compressed during section installation
- Clearance for 1” of insulation around bellows
- Spring loaded restraint features
  - Easy restraint disengagement from basket
  - Additional nuts added for horizontal section assembly
- Welded tab construction
  - Single piece machined construction being investigated

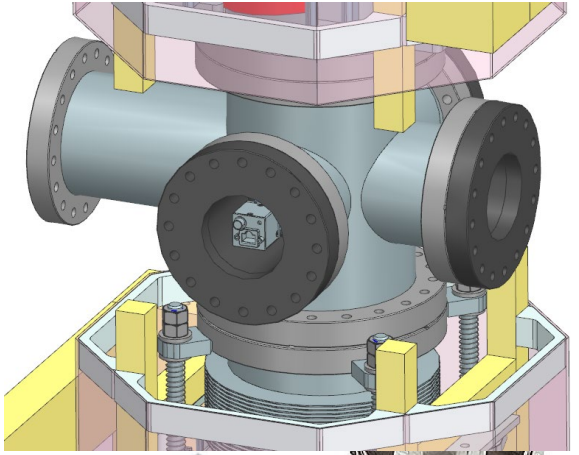




Cross Construction Methods

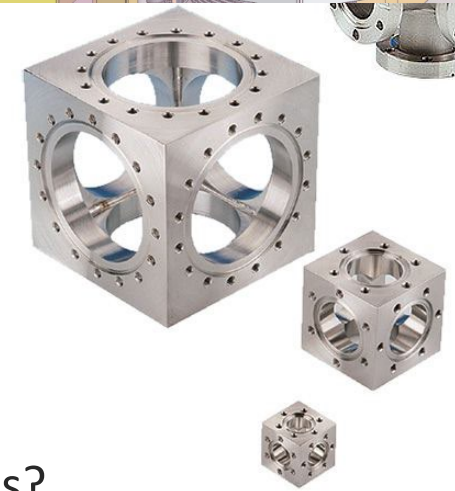
Welded Sphere/Tube Construction

- $3,750 DN160CF/ $2,120 DN100CF
- Though or tapped holes in fixed or rotatable flanges possible
- Potential bracing for ion pump needed
- Rotatable flanges or flange clocking required



Machined Cube Construction

- More accurate camera placement
- Well defined flange orientations
- Custom cubes may be heavy/expensive
- Possible bellows restraint interference
- Tapped holes only
- $6,185 DN160CF (+$40k)/ $3,250 DN100CF (+$20k)



Hybrid cube with welded upper, lower, and ion pump ports?

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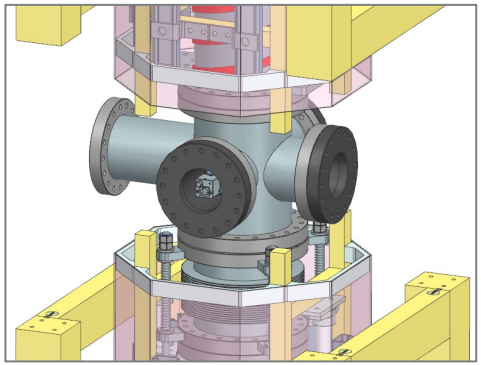
Ion Pump Orientation

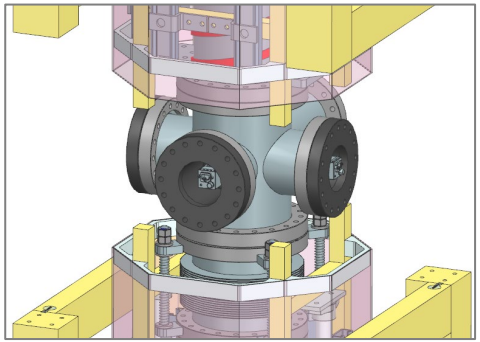
Ion pump port facing towards atom sources

- Easier access from shaft for maintenance/repair
- Significant access issues to rear camera
- Ion pump harder to install when section is horizontal



Ion pump port facing towards back wall

- Improved camera access
- Ion pump arrangement matches atom source connections
- Easier to install ion pump when section is horizontal
- No access to ion pump after section is installed



*Impact of either arrangement on installation is unclear

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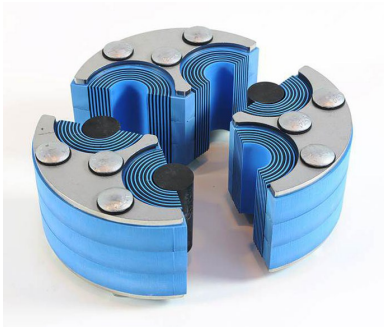
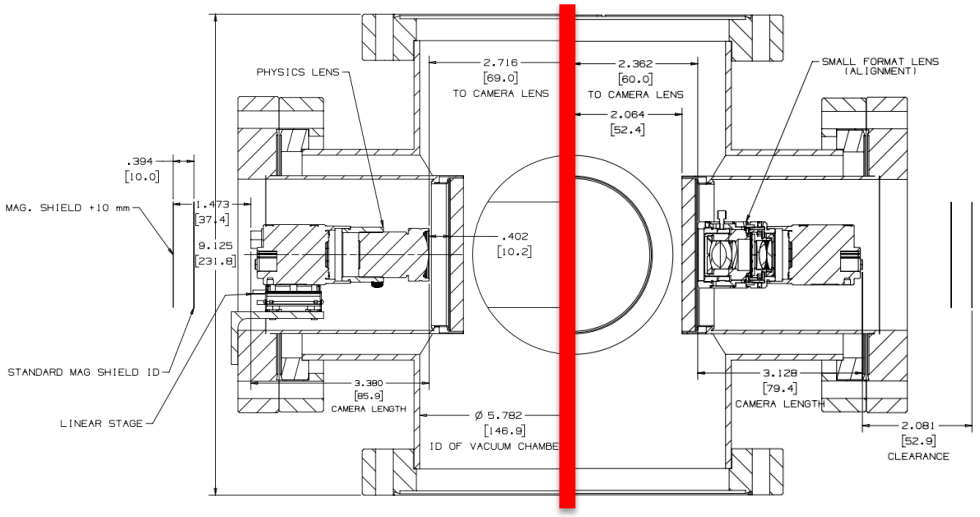
Laser Safety

- Lasers may escape through viewports
- Cross must be light-tight
  - Making shielded regions light tight not feasible
- Thin cable seal needed
  - Significant space limitations



Roxtec feedthrough



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Items to Address

1. Camera flange/Bias coil interference – Updated coil details?
2. Ion pump , pump port, and gauge specifications
3. Coupler envelope and mounting details – Pending Simulations
4. Degaussing procedure specifics – wire routing may drive designs
5. Bakeout procedure specifics
6. Laser safety design items