

Exterior Magnets Concept Blanket and Vacuum Vessel Chamber Integration and Maintenance

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Outline

- Chamber Layout
- Blanket Maintenance
- Dump Maintenance
- Design Assessment in Terms of Givens and Druthers



Chamber Cut-away

Polar Cusp
Armored Dump
Module

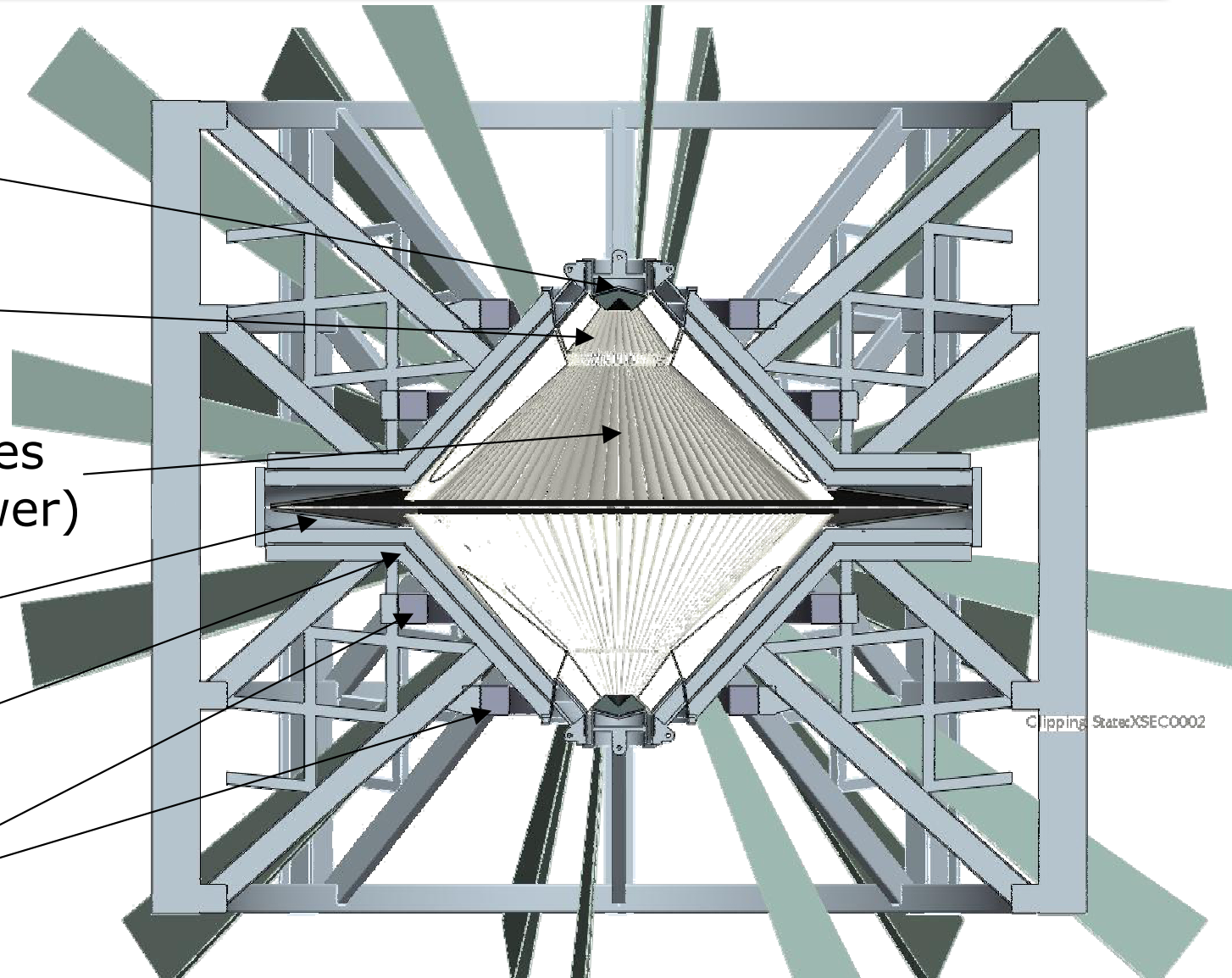
Pole Blanket
module

Mid Blanket modules
(16 upper & 16 lower)

Ring Cusp
Armored Dump

Shield/VV

Magnets



Clipping State: XSEC0002

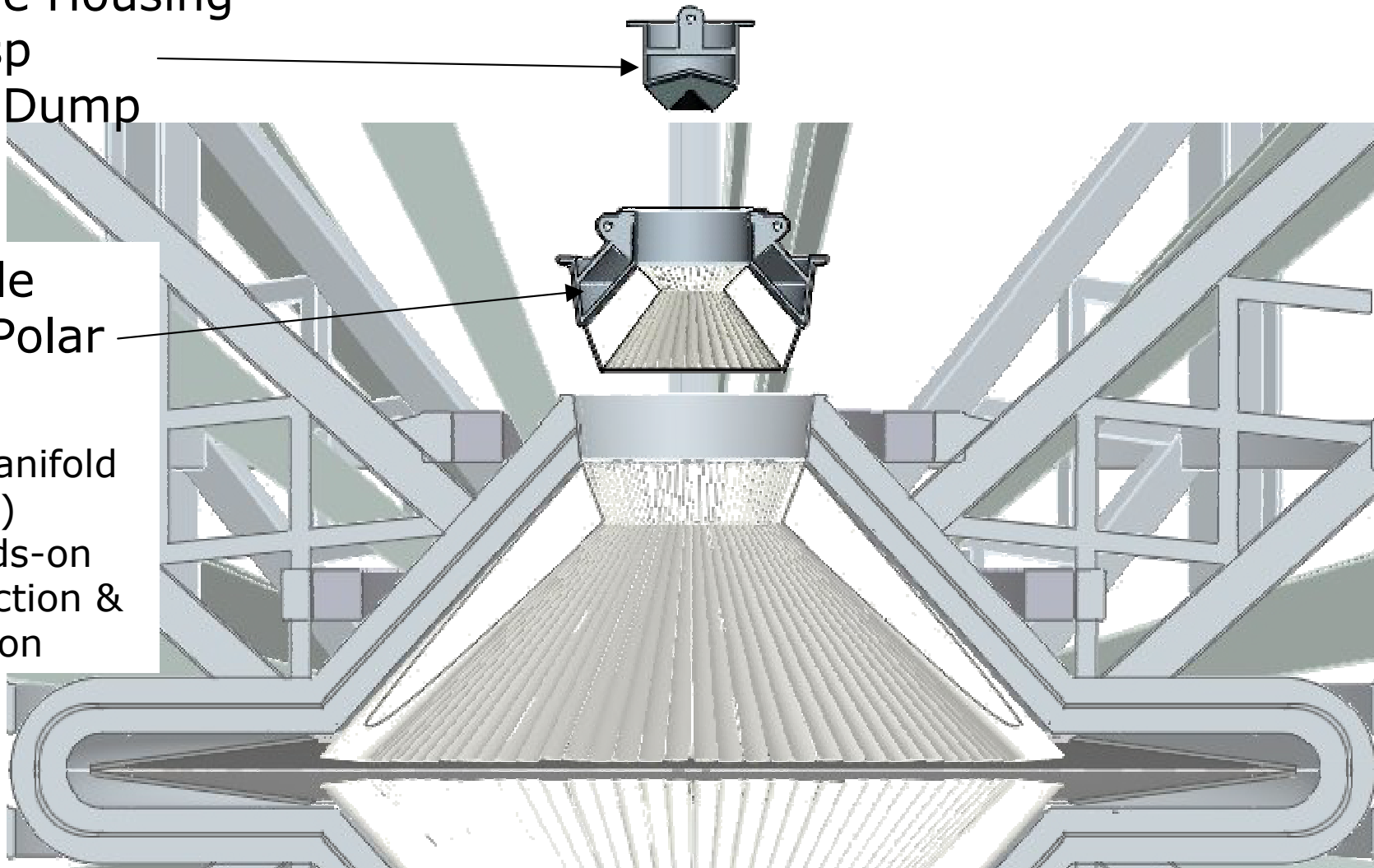


Nested polar modules allow VV access without disturbing beam ducts or magnets

VV Module Housing
Polar Cusp
Armored Dump

VV Module housing Polar
Blanket

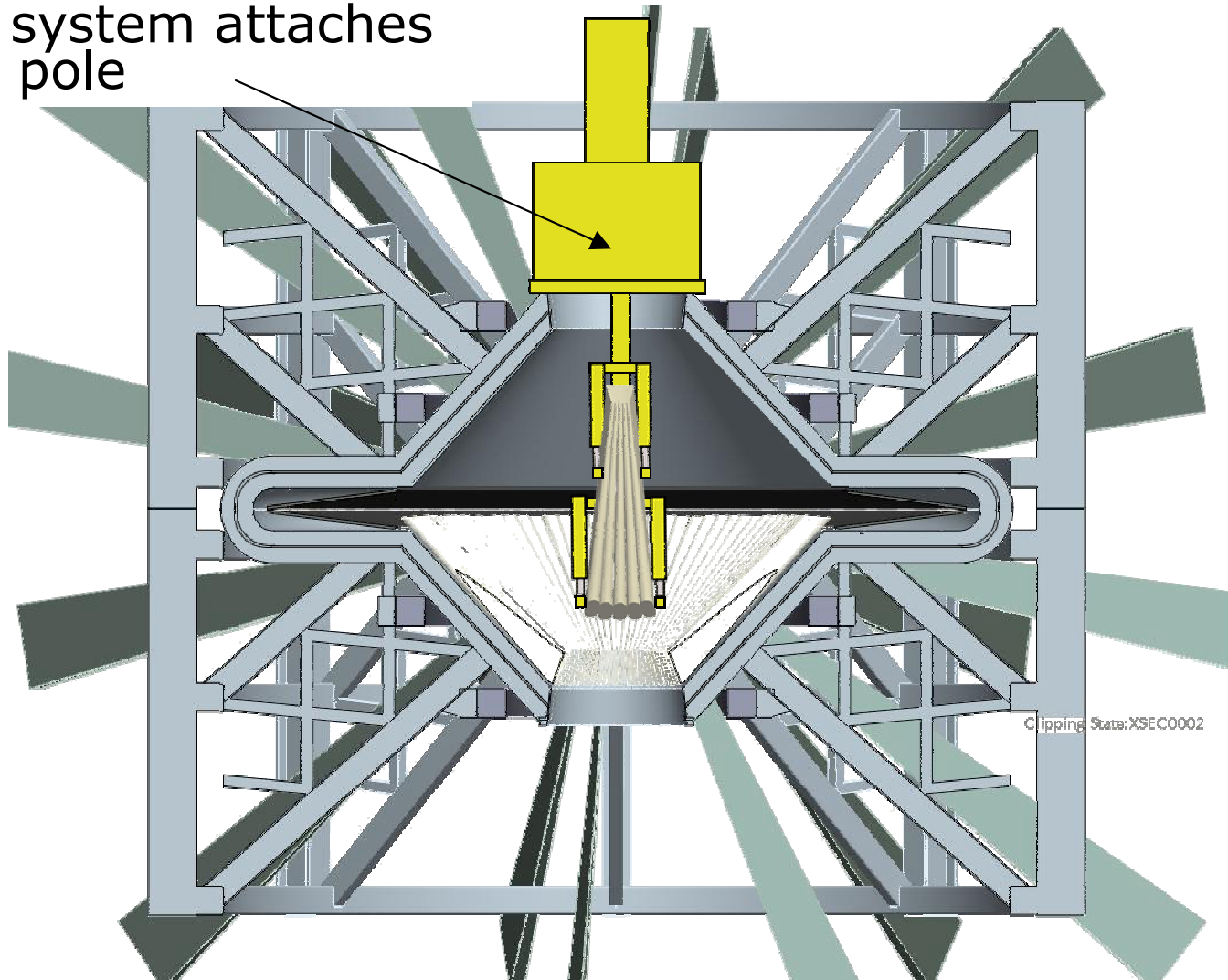
External manifold
(not shown)
allows hands-on
pipe connection &
disconnection





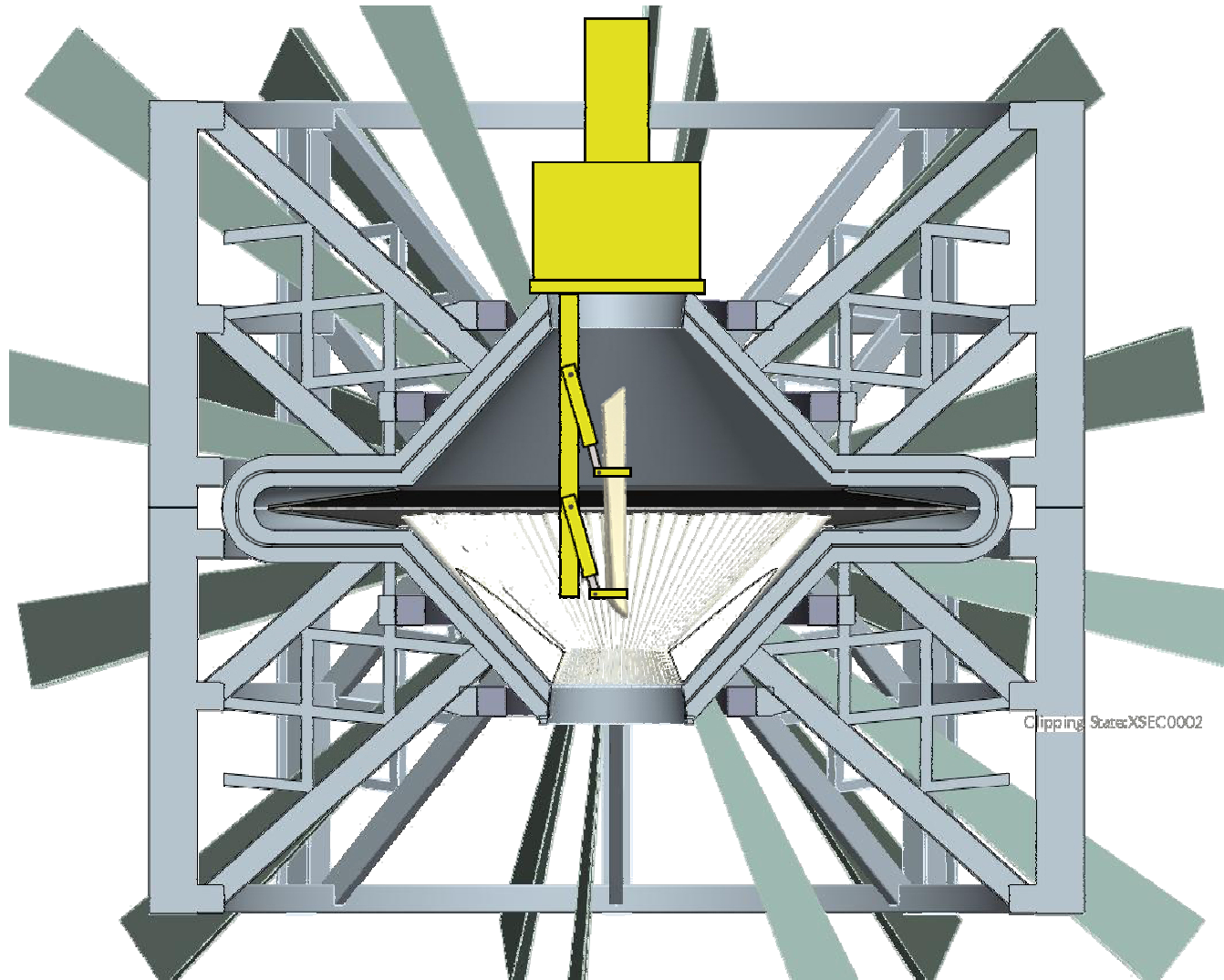
Blanket Maintenance Scheme

Self-contained remote handling system attaches vessel at pole



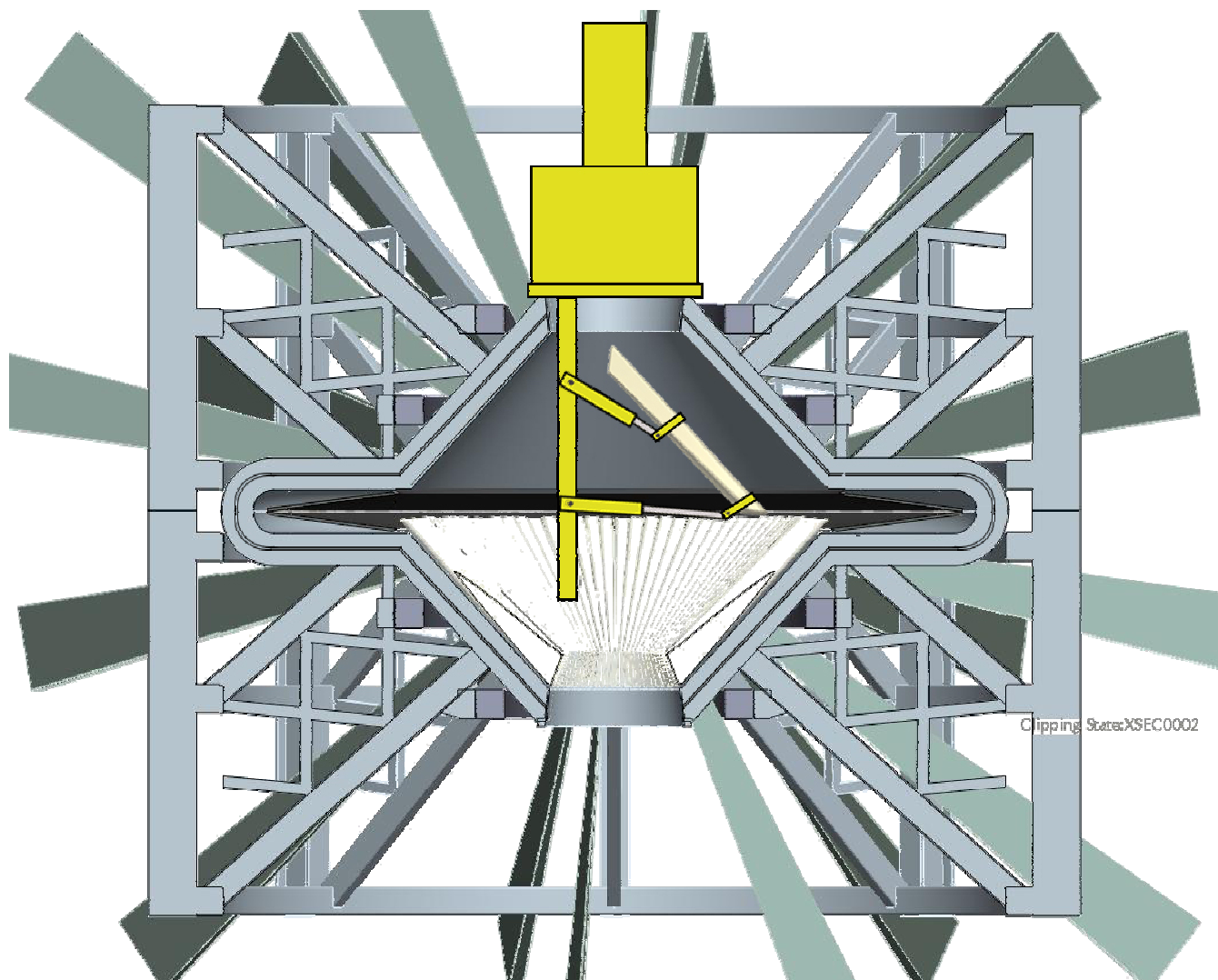


Blanket Maintenance Scheme





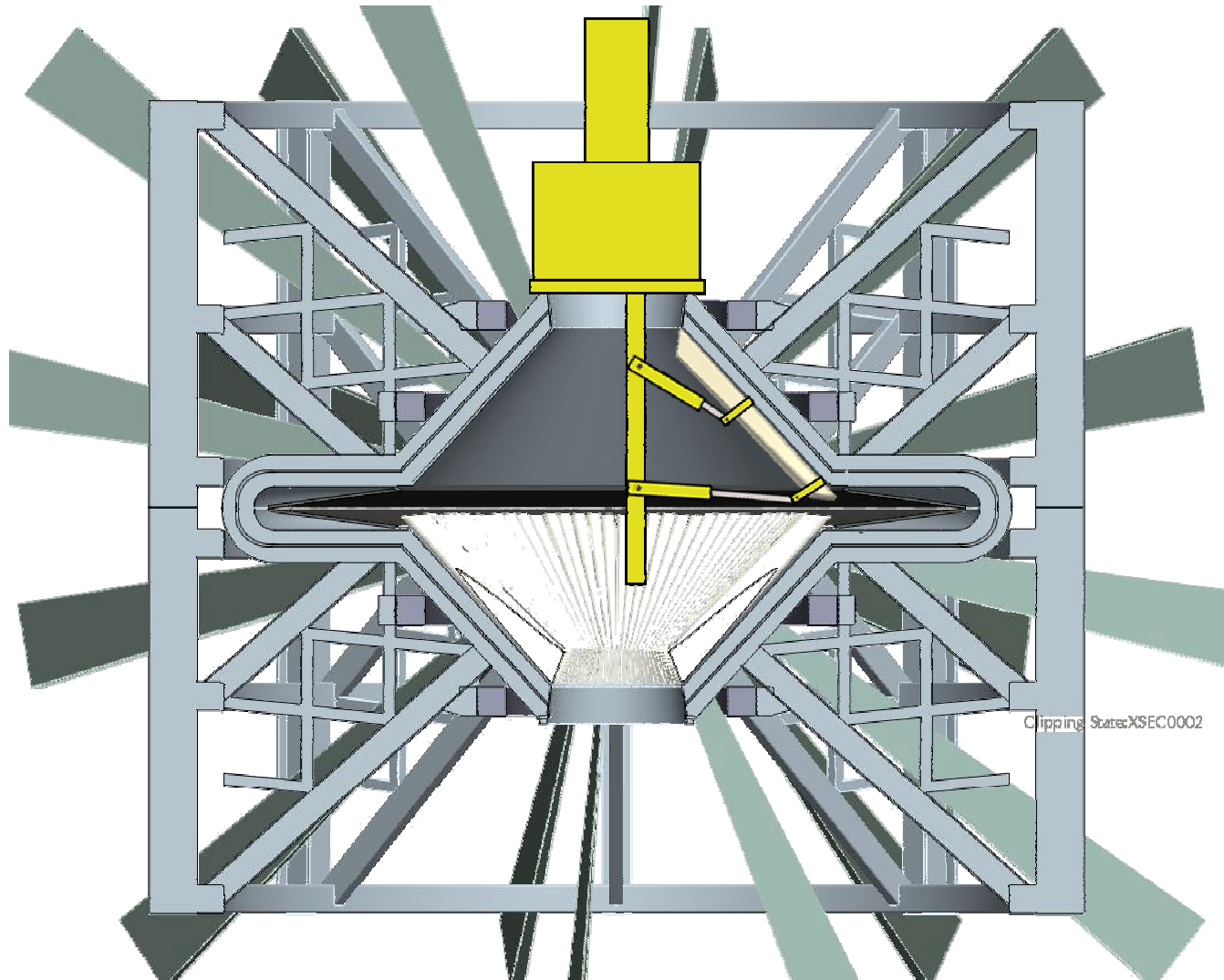
Blanket Maintenance Scheme



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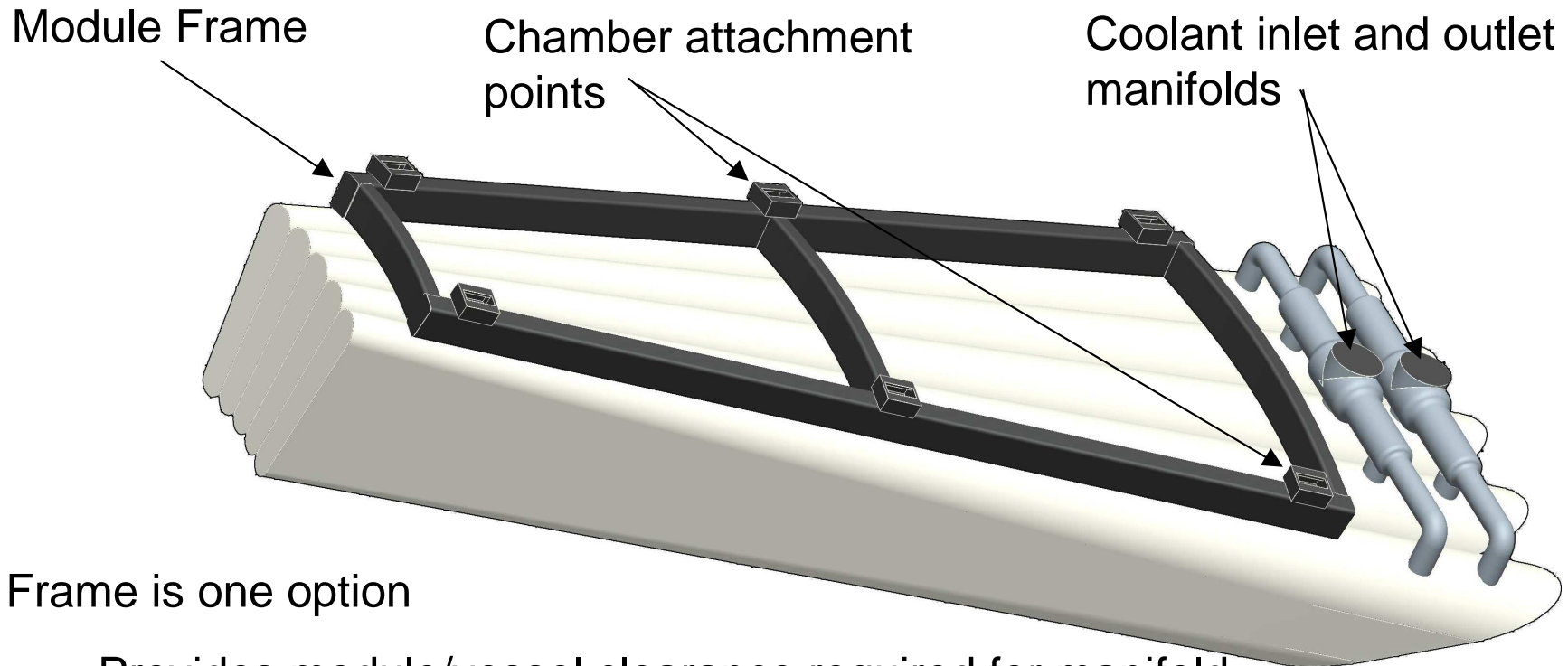


Blanket Maintenance Scheme





Blanket Module with Frame and Coolant Manifold



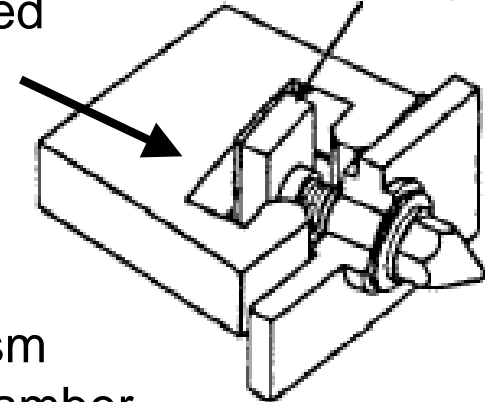
- Frame is one option
 - Provides module/vessel clearance required for manifold
 - Frame requires cooling
 - Another option: mount attachment points directly onto sub-modules
- Another manifold option is to have concentric inlet/outlet piping

Tee Nut Remote Fasteners

- Captive nut / bolt fasteners
- Utilized in TPX divertor module mounting
- Allows some lateral movement to accommodate thermal expansion
- Fastener tightened outside the chamber due to space constraints at module/chamber interface

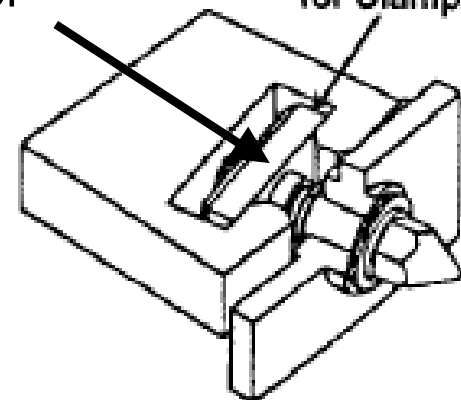
Fixed mounting receptacles mounted on module frame

Nut Bar Vertical for Installation/Removal



Nut Bar mechanism integrated into chamber and manipulated from outside of chamber

Nut Bar horizontal for Clamping

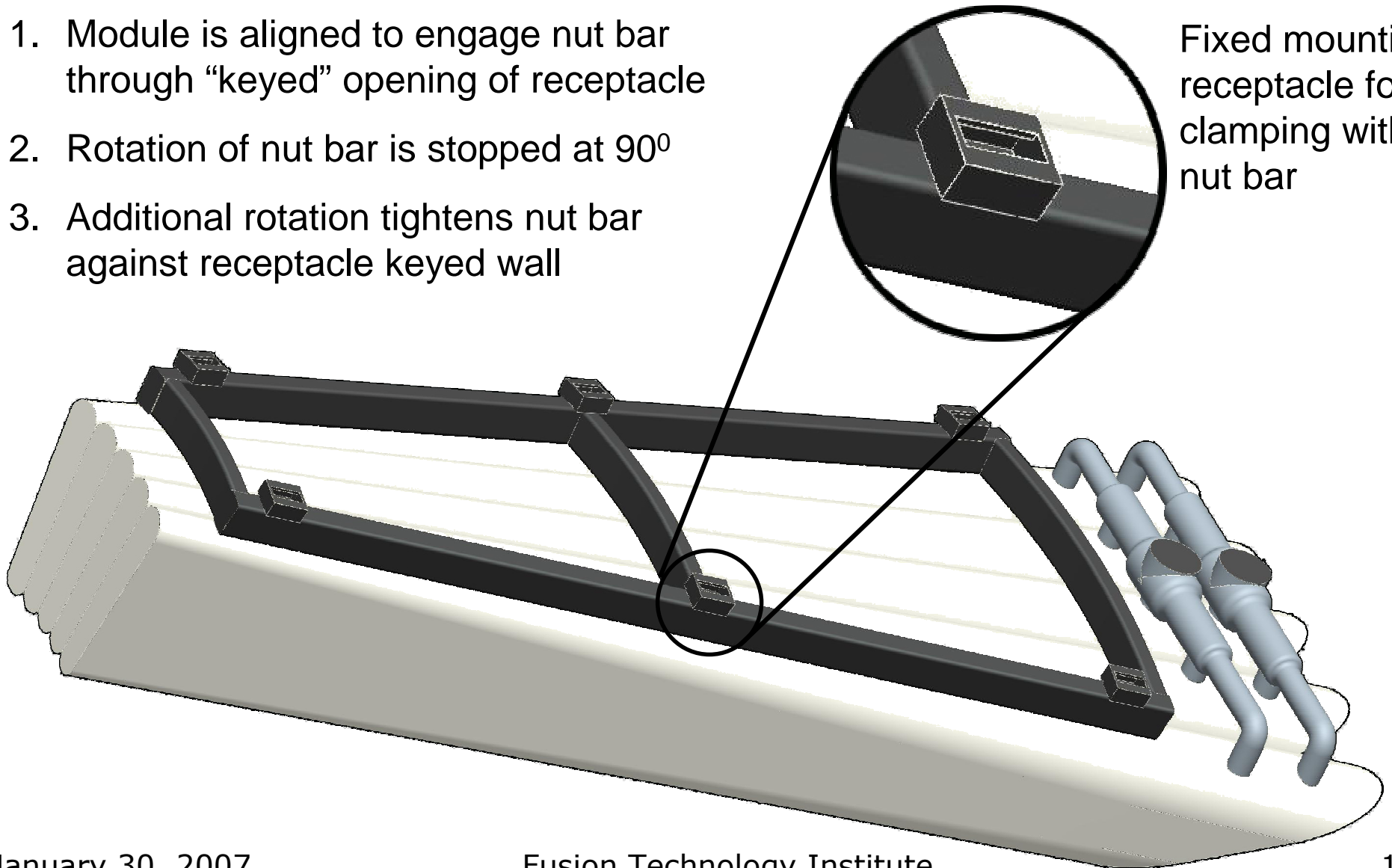




Attachment Point Detail

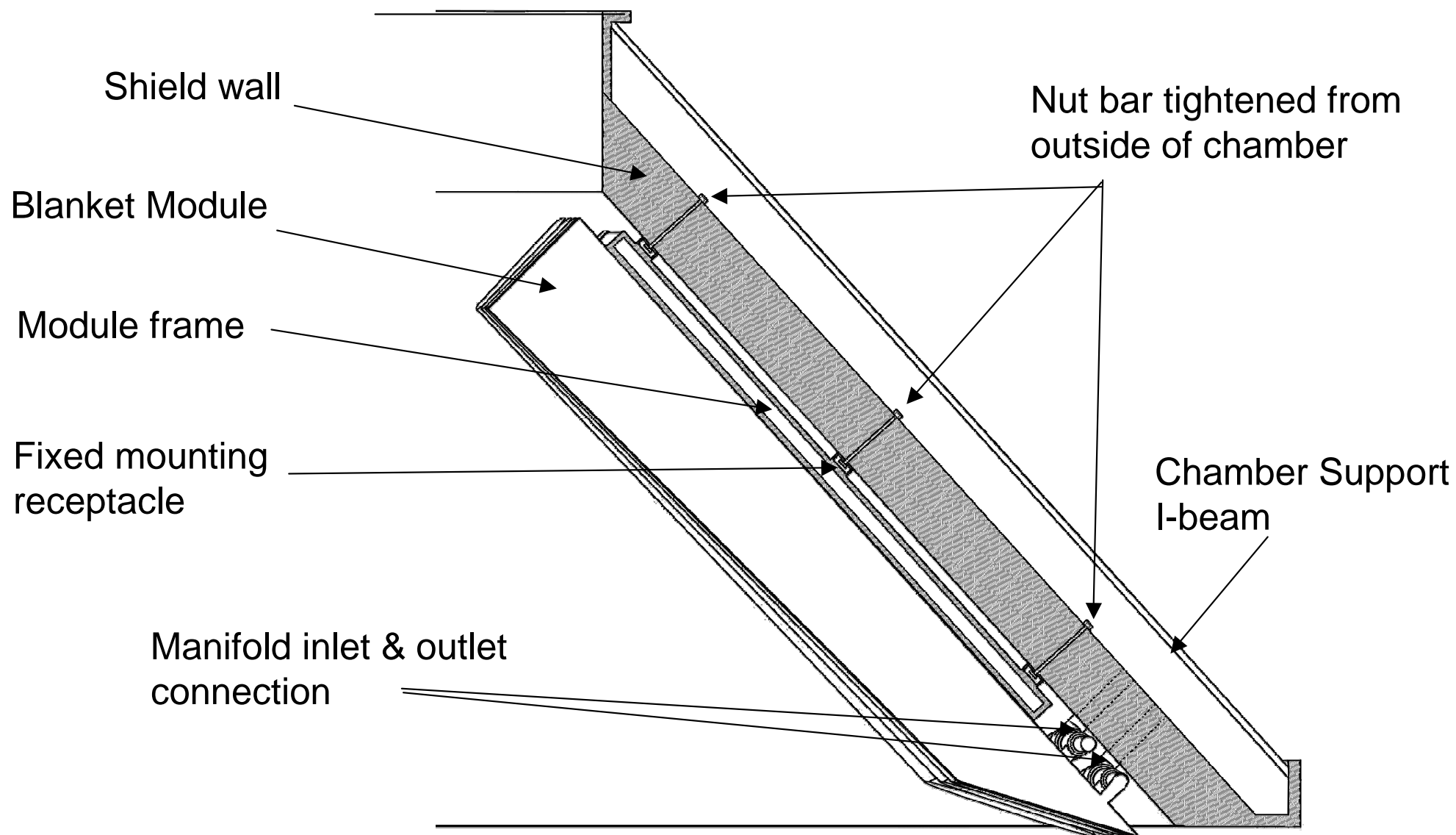
1. Module is aligned to engage nut bar through “keyed” opening of receptacle
2. Rotation of nut bar is stopped at 90°
3. Additional rotation tightens nut bar against receptacle keyed wall

Fixed mounting receptacle for clamping with nut bar



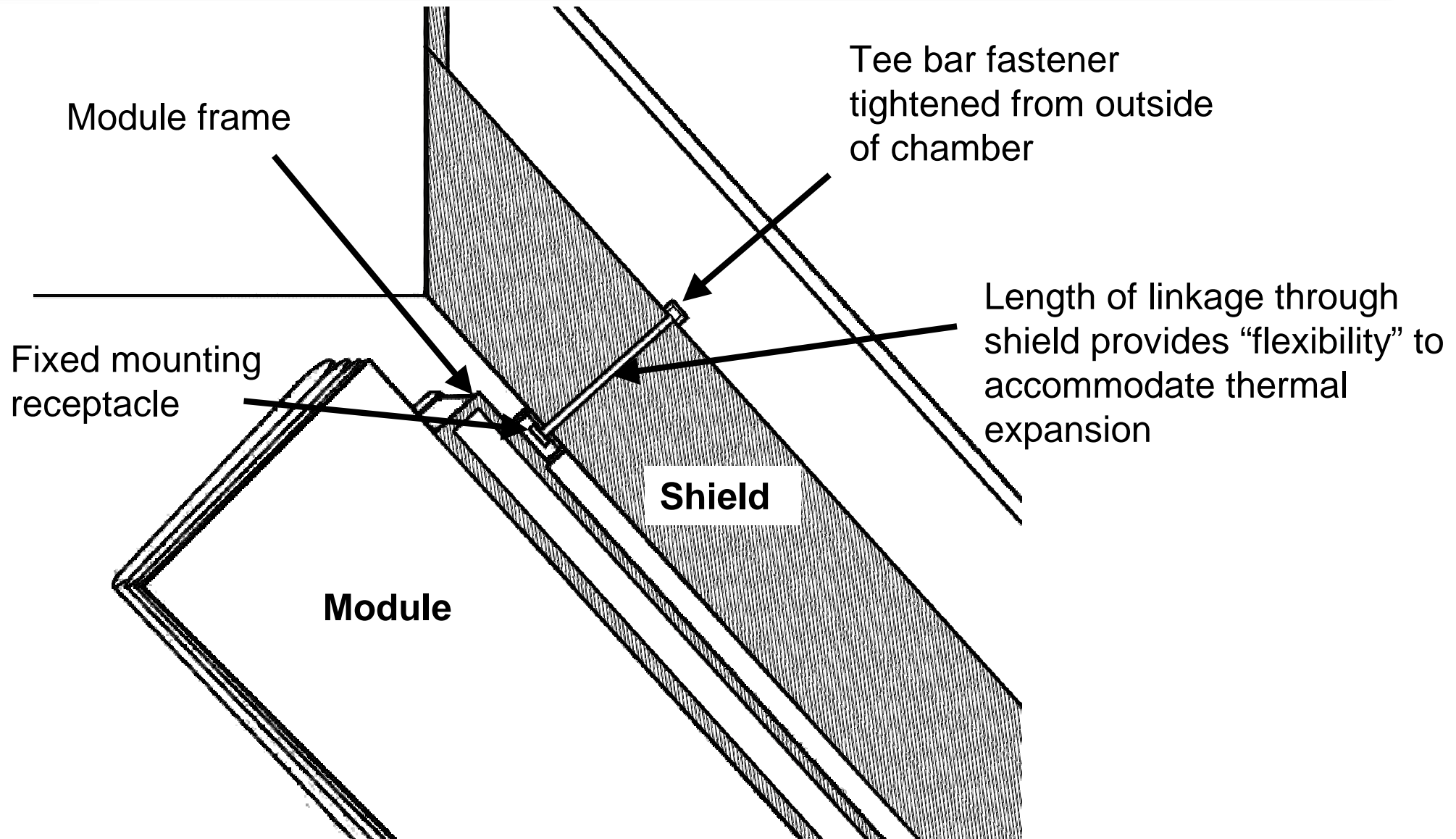


Cut-Away View of Module/Chamber Interface



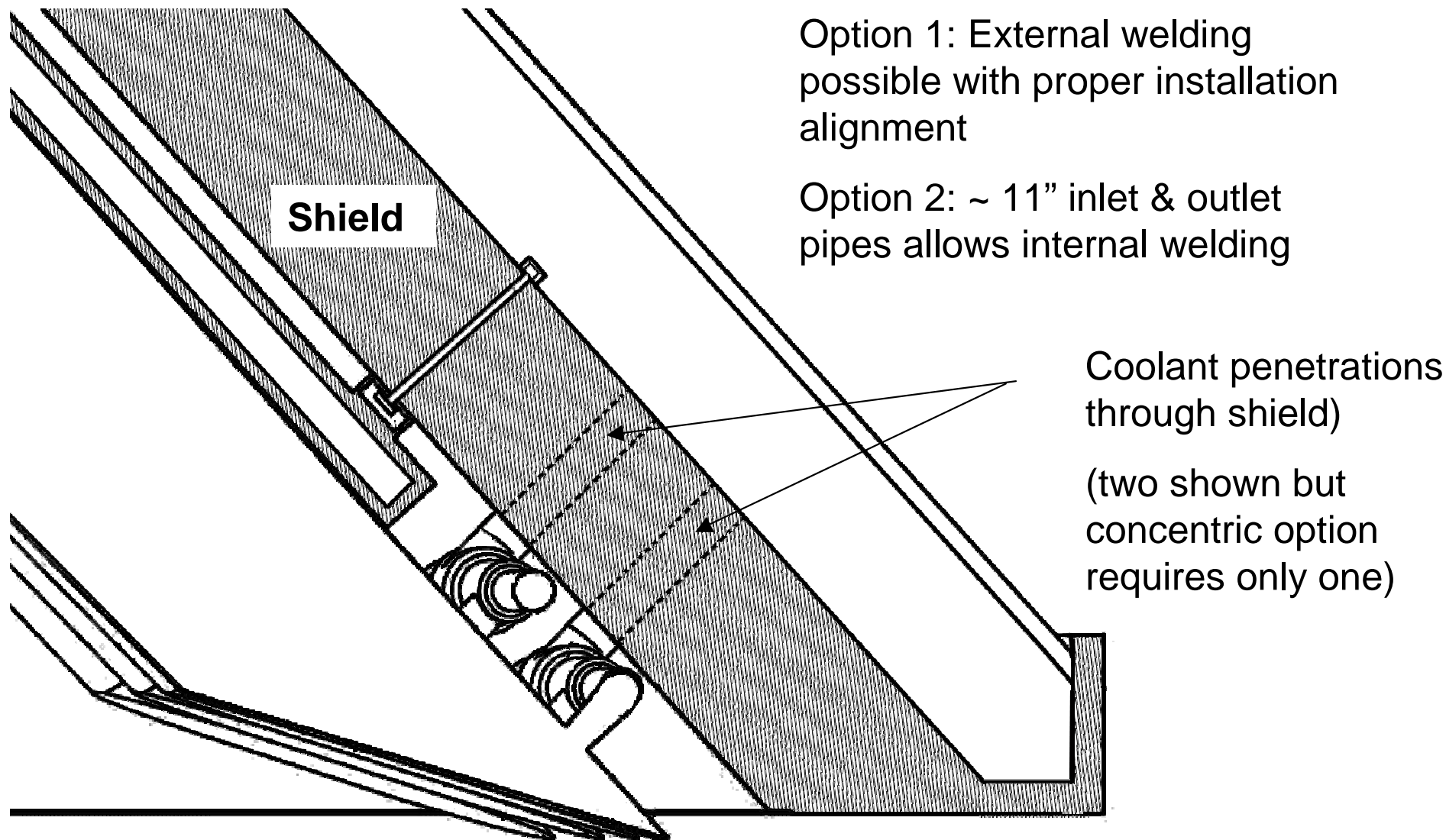


Tee Bar Fastener detail



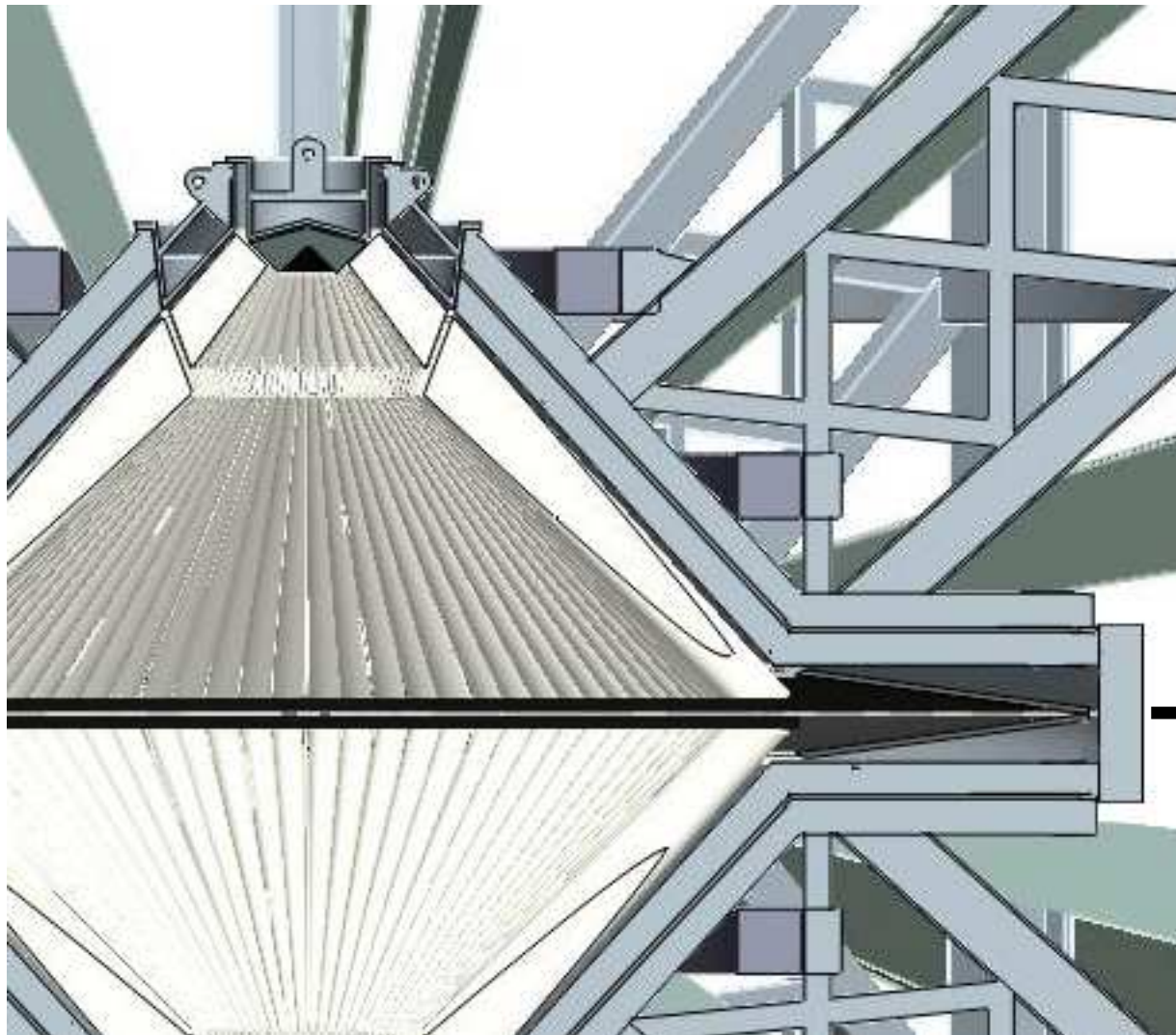


Manifold Connection Detail





Maintenance of Ring Cusp Dump



Removable “Ring Caps”
at equator

Possibly replaceable
ring cap modules with
integrated dumps plates



Givens & Druthers – All Noncompliance

- Does not allow “Straight-up” blanket removal
- Field coil radii: 4.1m & 6.9m vs. 3.4m & 6.1m
(radius measured to center of coil cross-section)
- Blanket offset from shield by only $\sim 35\text{cm}$



Givens & Druthers – Highlighted Compliance

- Blanket access does not require re-welding beam ports
- Blanket Access does not require disconnecting (or moving) beam ports
- Minimizes mass lifted for chamber access
- Minimizes height of components to be lifted
- Minimizes evacuated volume



Additional Advantages

- Blanket access does not require disturbing magnets
- Magnets accessible for hands-on maintenance