Blanket and Shield Design Considerations for Magnetic Intervention

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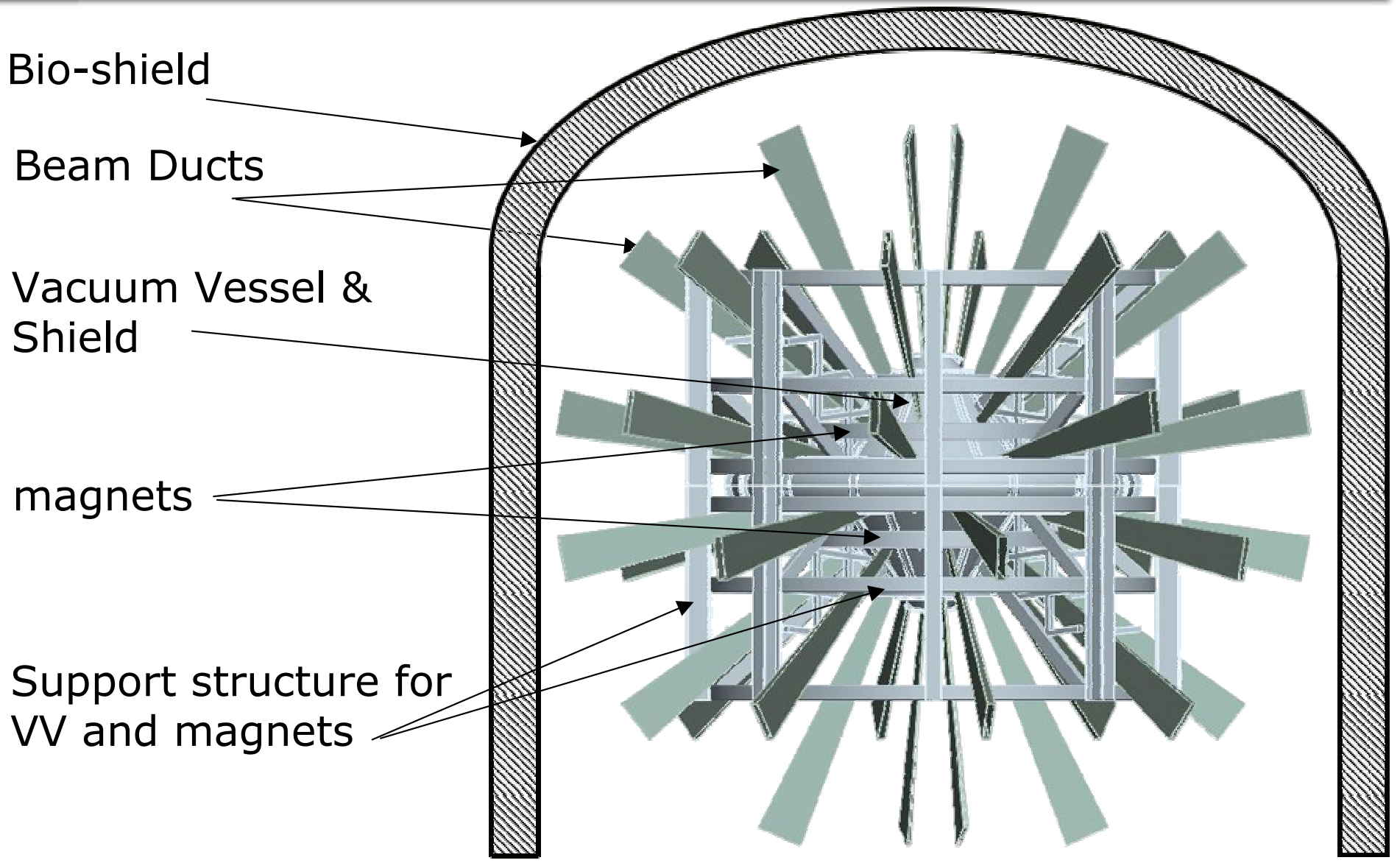
Outline

- Chamber Layout
- Shield and Vacuum Vessel (VV) Design
- Blanket Design
- Flibe Blanket Concept

Chamber General Layout



Chamber Cut-away

Polar Cusp Armored Dump Module

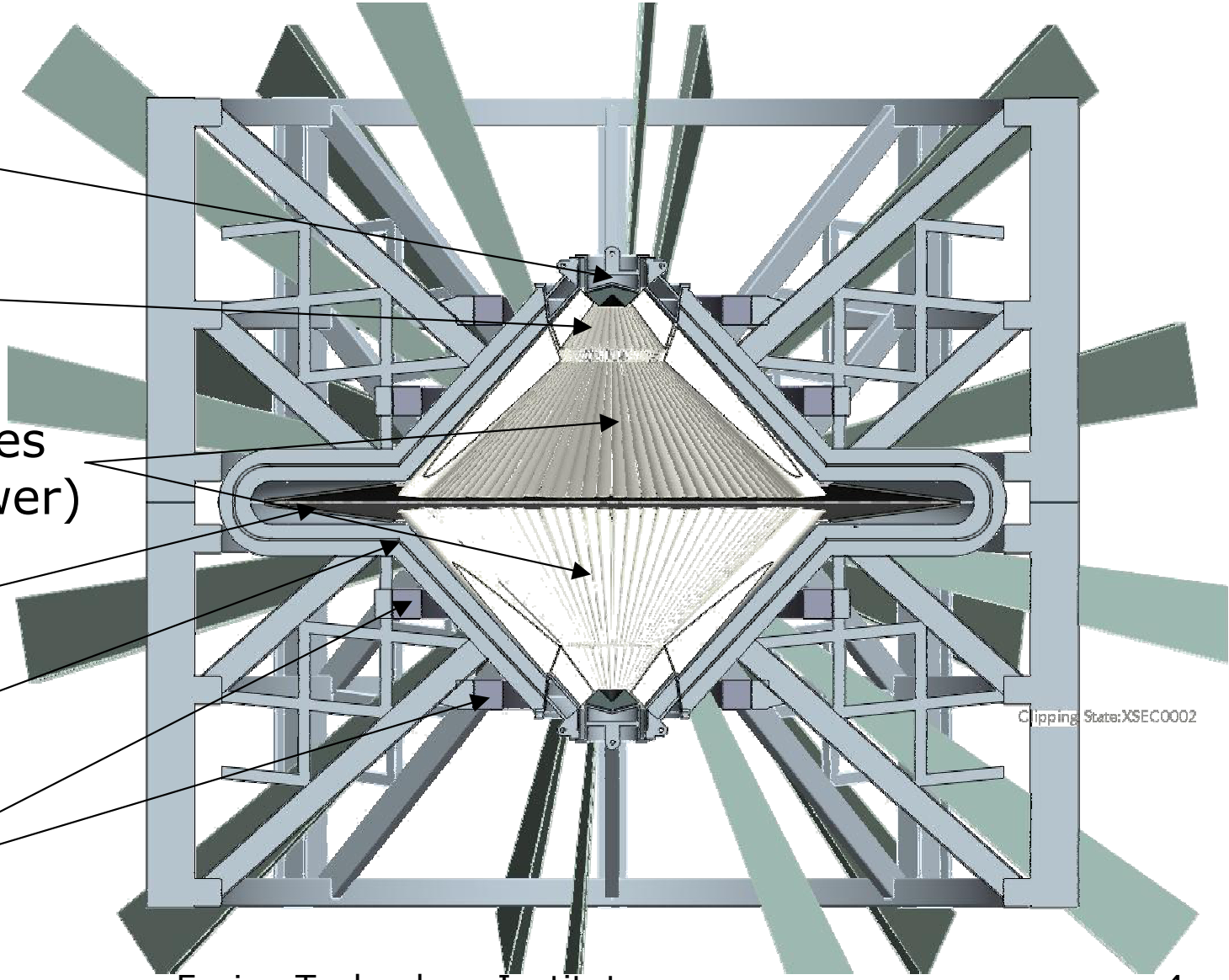
Pole Blanket module

Mid Blanket modules (16 upper & 16 lower)

Ring Cusp Armored Dump

Shield/VV

Magnets

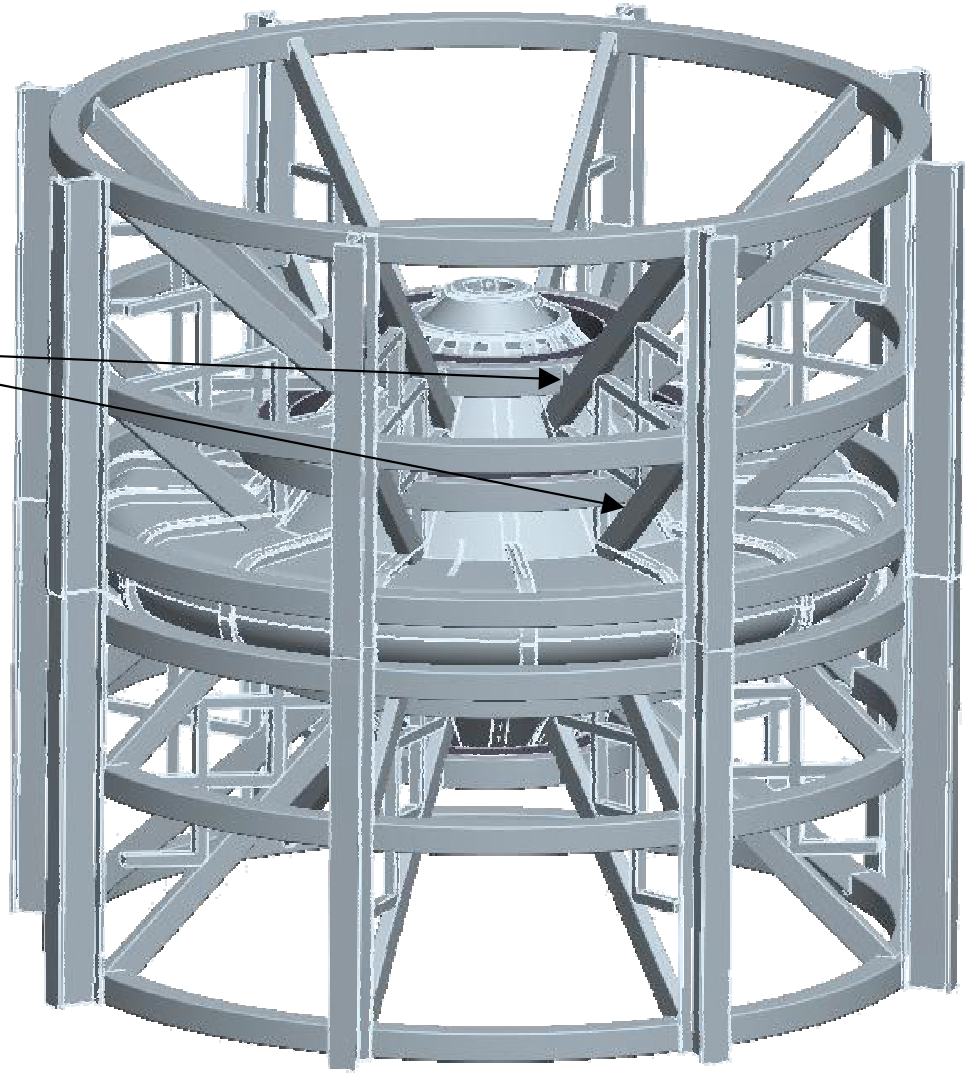


Shield/VV Design Overview

- 50 cm thick
- Water cooled
- 75% steel and 25% water
- Maintenance access via removable modules at each pole
- Chamber access minimizes impact on plant systems (i.e., magnets & beam ducts)
- Minimizes remote handling requirements of plant systems (i.e., those outside Shield)
- Outer 20 cm is re-weldable

Shield and VV Design Details
(beam lines not shown for clarity)

Magnet support integrated into shield & VV support structure



Shield and VV Design Details
(beam lines and support structure not shown)

Removable dump and
blanket modules

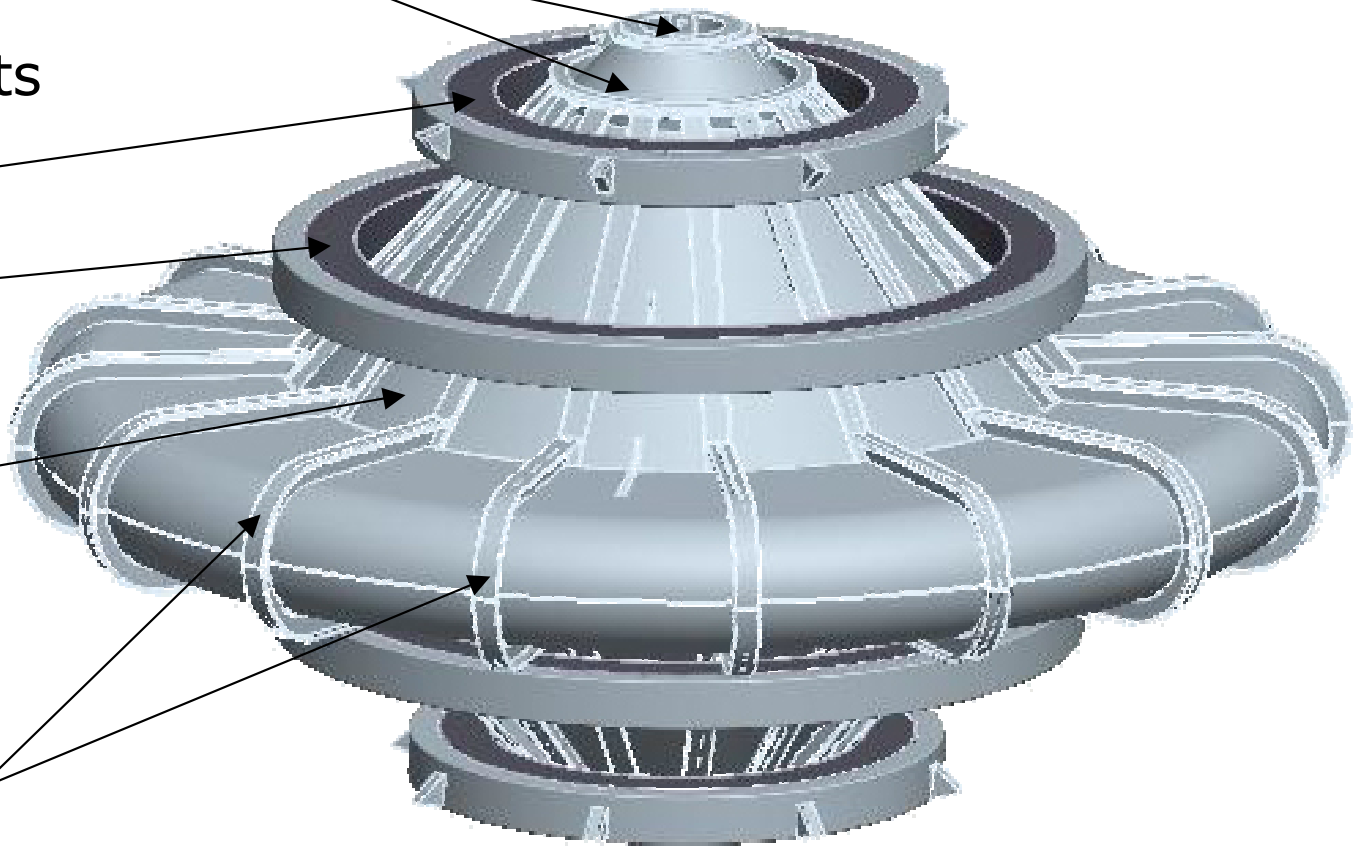
Magnets with supports

4.3m R x 6.65m Z

6.9m R x 3.5m Z

Shield
(50 cm thick)

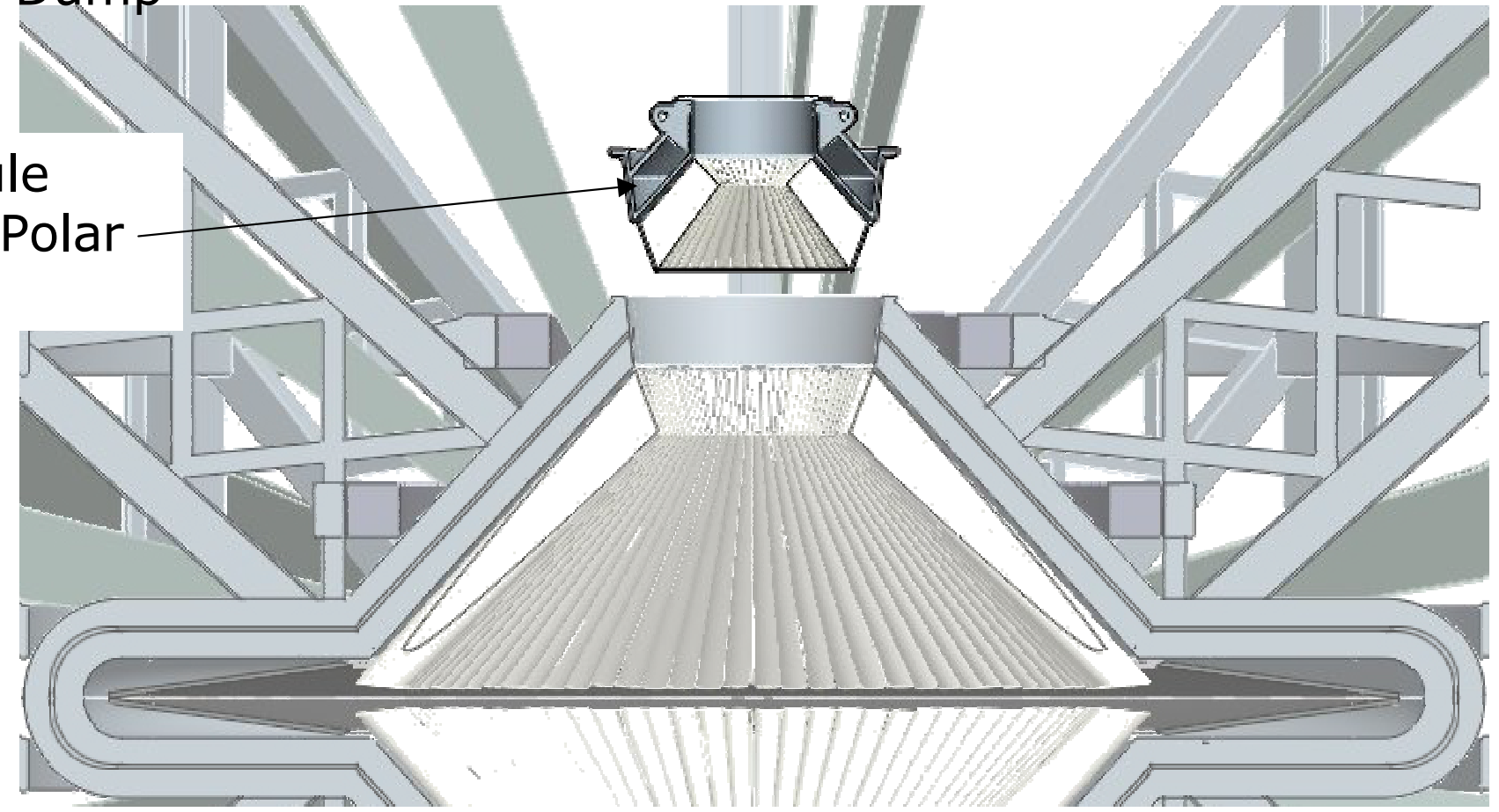
Support I-beams



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

VV Module Housing
Polar Cusp
Armored Dump

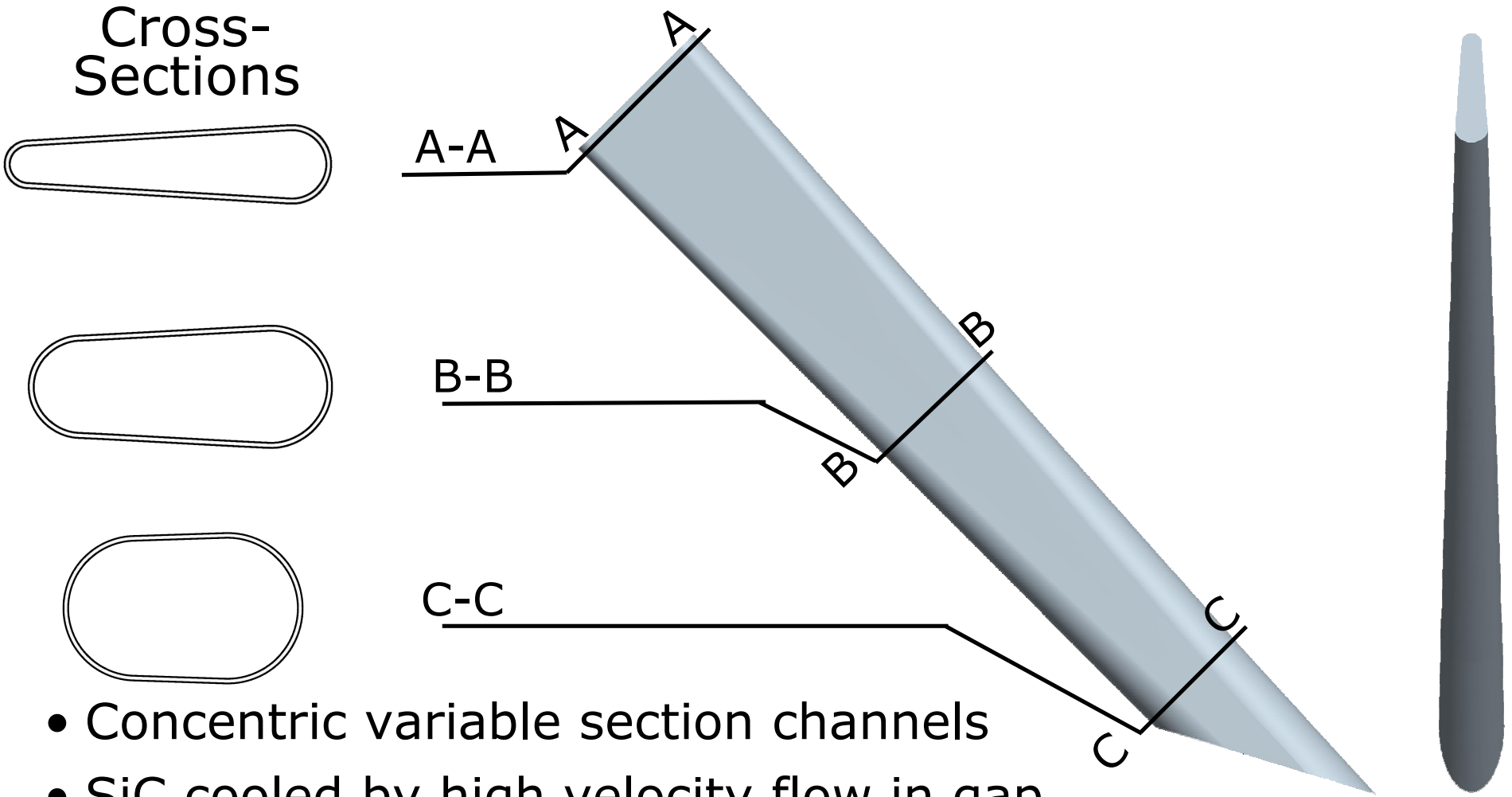
VV Module
housing Polar
Blanket



Blanket Design Overview

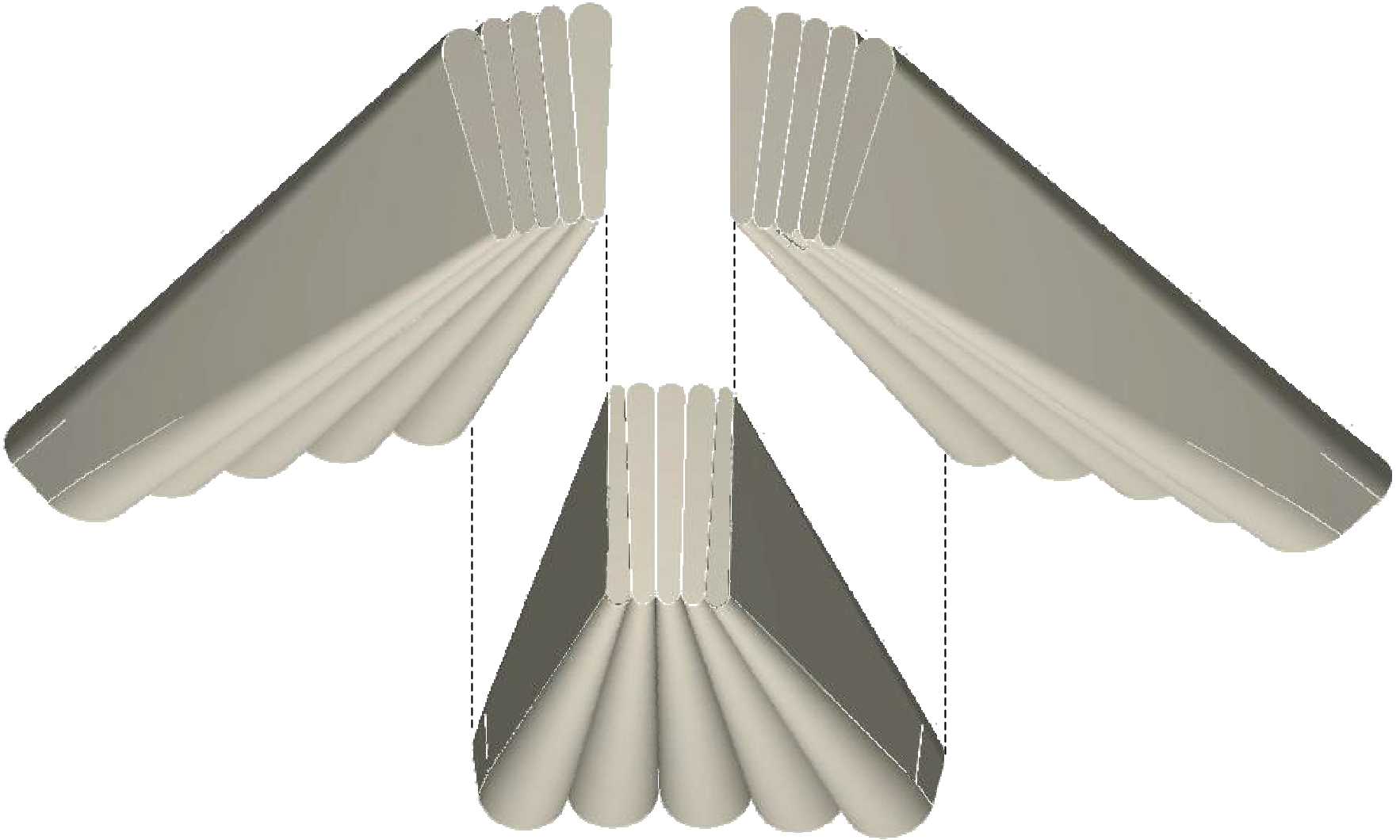
- PbLi or Flibe Coolant
- Silicon Carbide Blanket structure
- Maximum FW temperature of 1000°C
- Maximum allowable PbLi/SiC Temp. 1000°C
- Concentric channel approach similar to earlier HAPL blanket designs
- Self-draining
- Modular design facilitates remote maintenance

Curved Sub-Module Design Required for Strength Reasons



- Concentric variable section channels
- SiC cooled by high velocity flow in gap
- Low velocity return flow in center channel

Alternating Blanket Modules have differing end sub-module profiles



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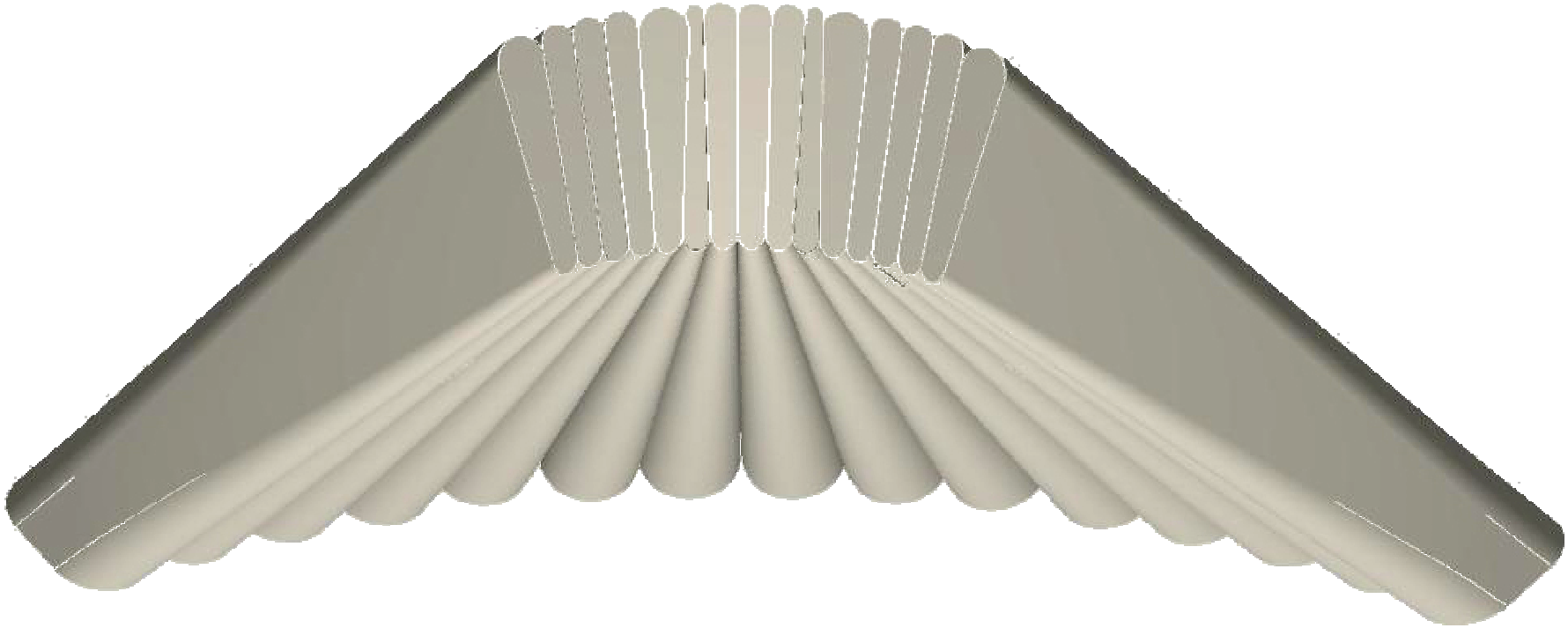
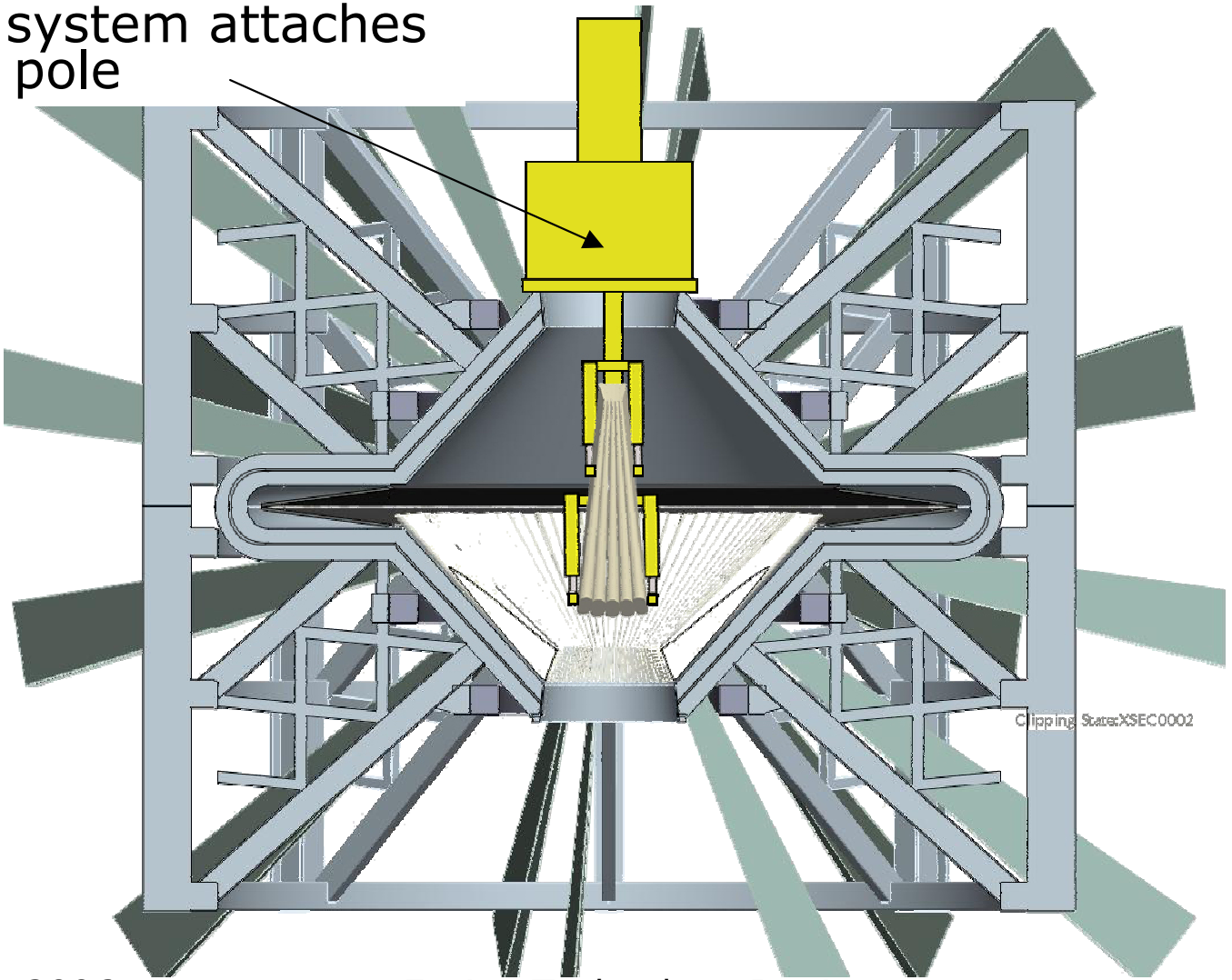


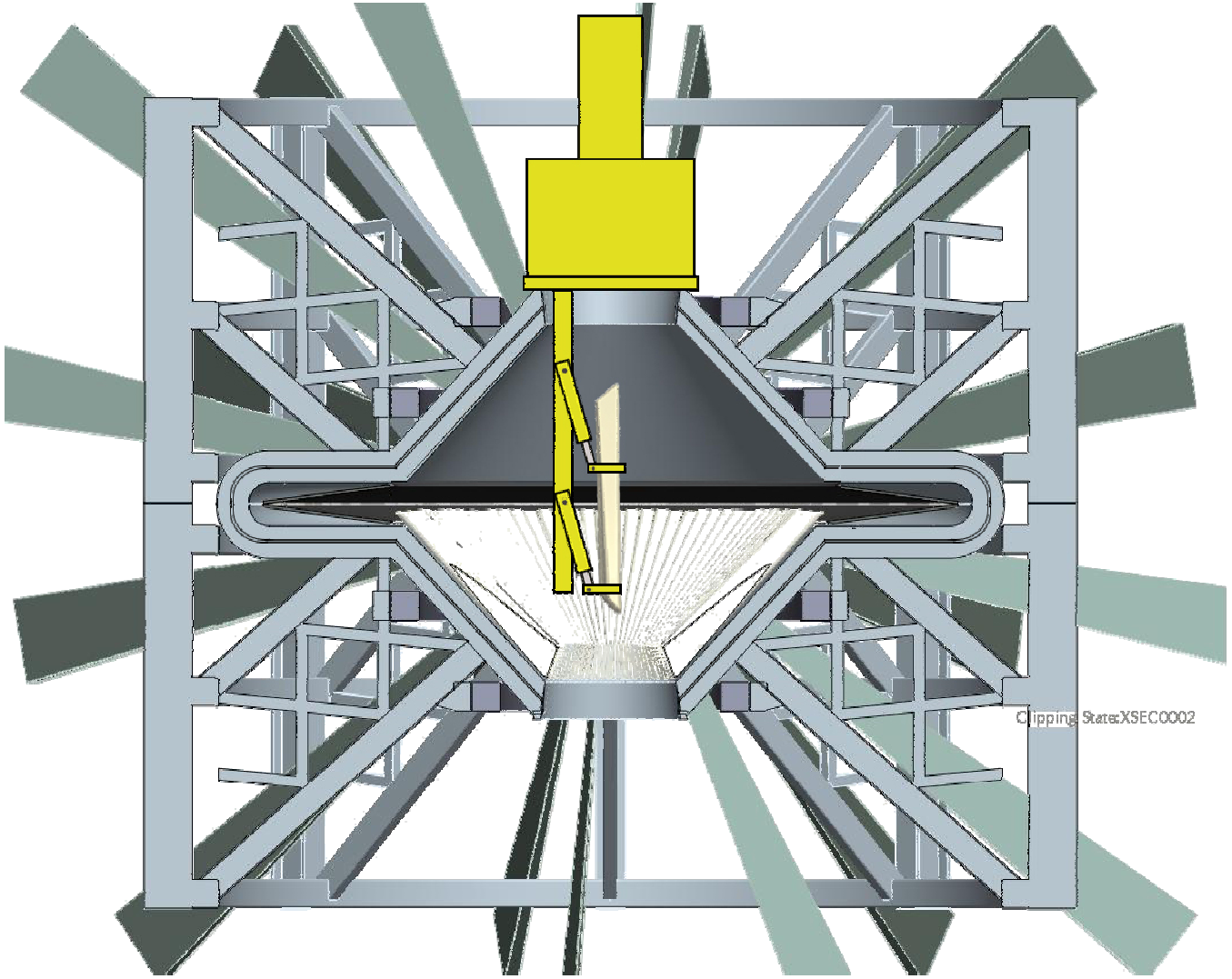
- Simplifies Installation
- Maintains pressure balance between modules

Blanket Maintenance Scheme

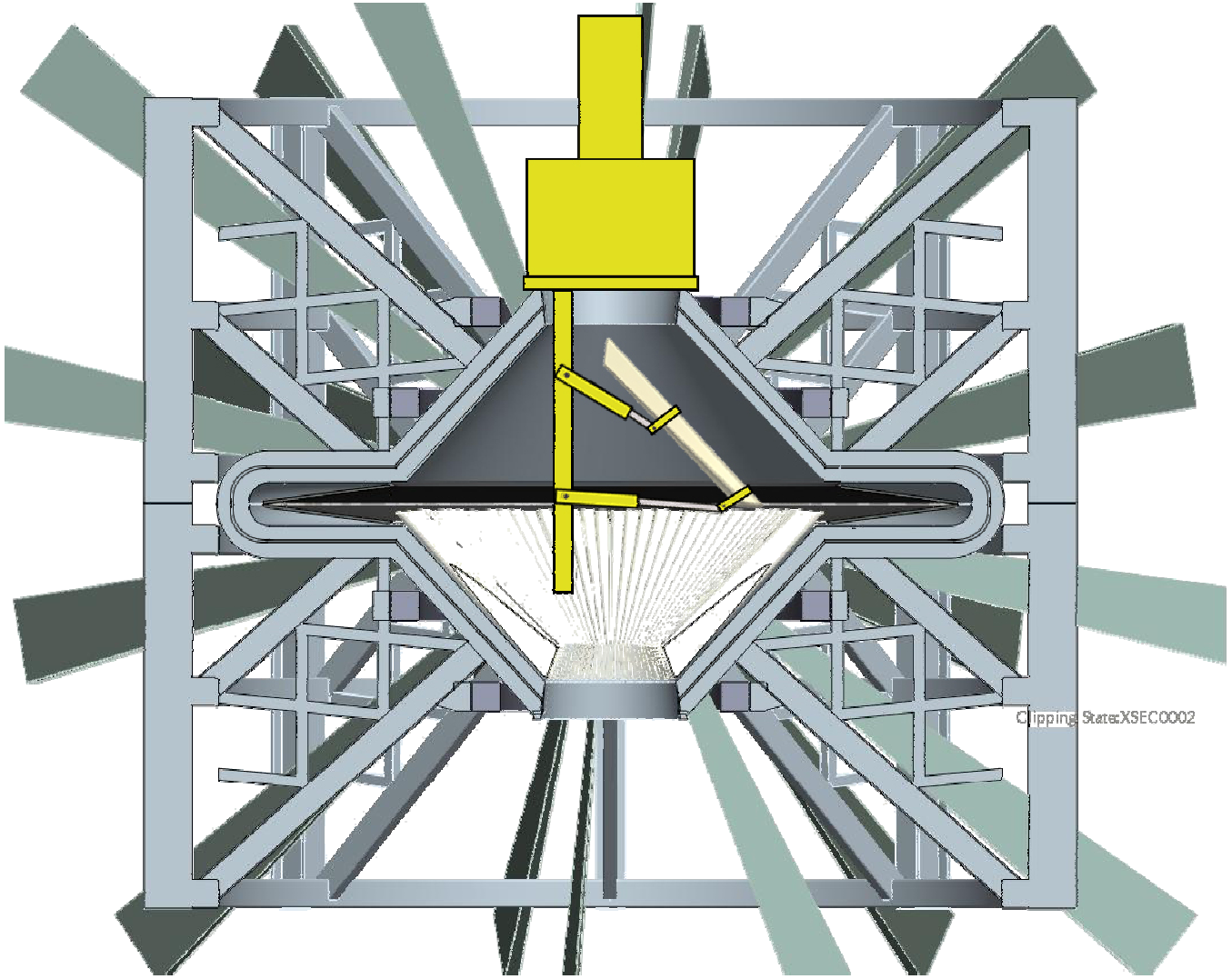
Self-contained remote handling system attaches vessel at pole



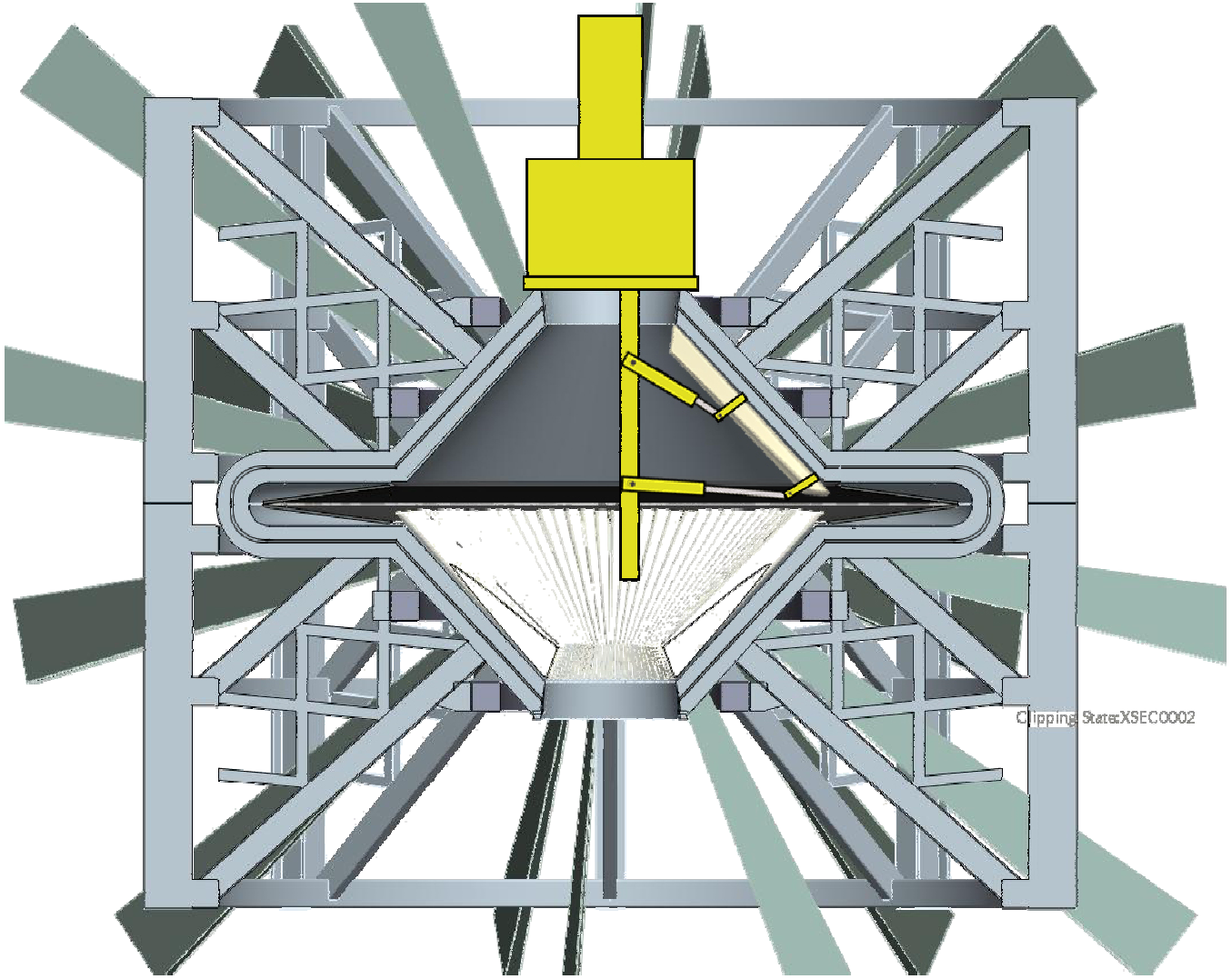
Blanket Maintenance Scheme



Blanket Maintenance Scheme



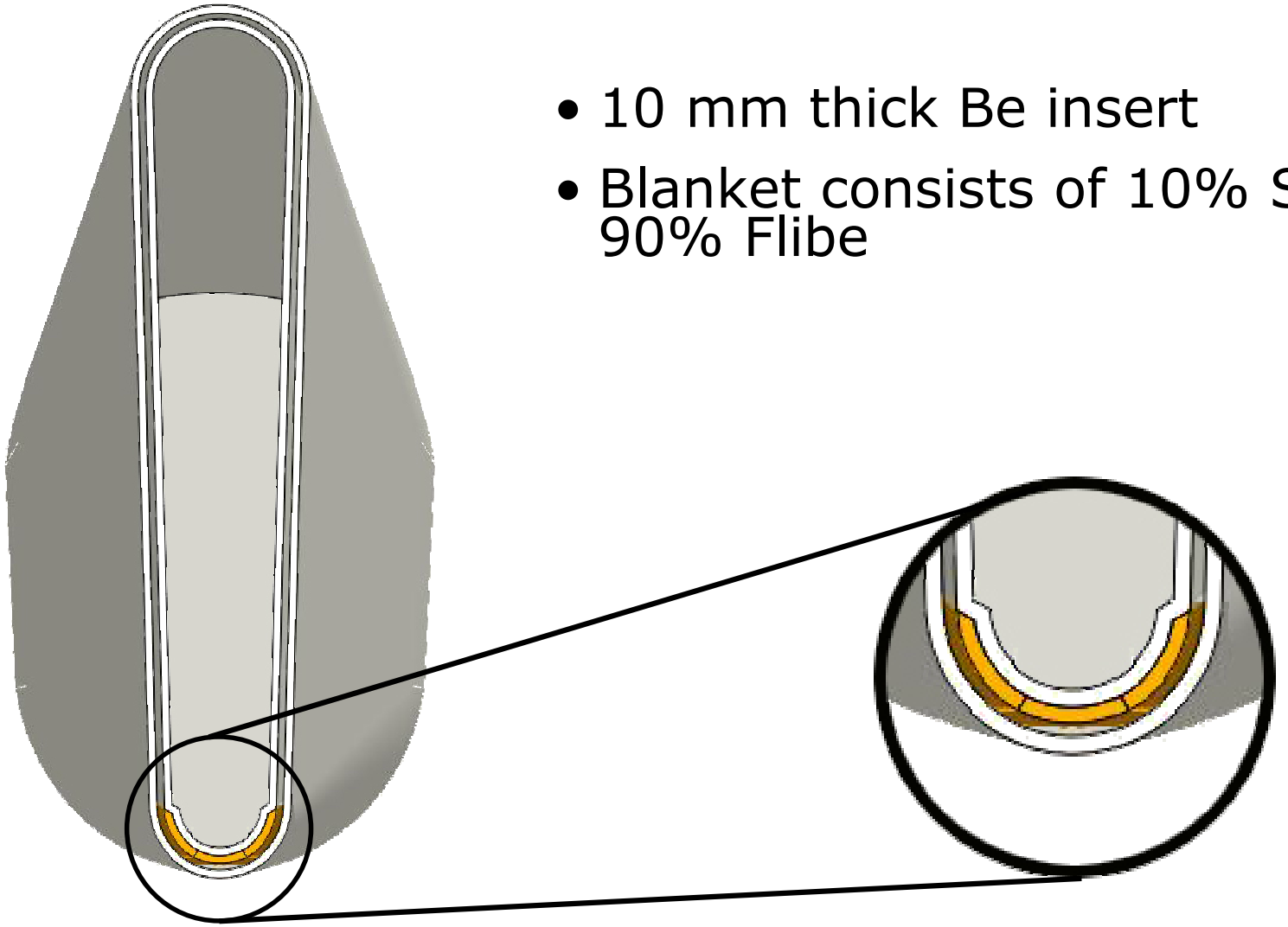
Blanket Maintenance Scheme



Requiring Further Consideration

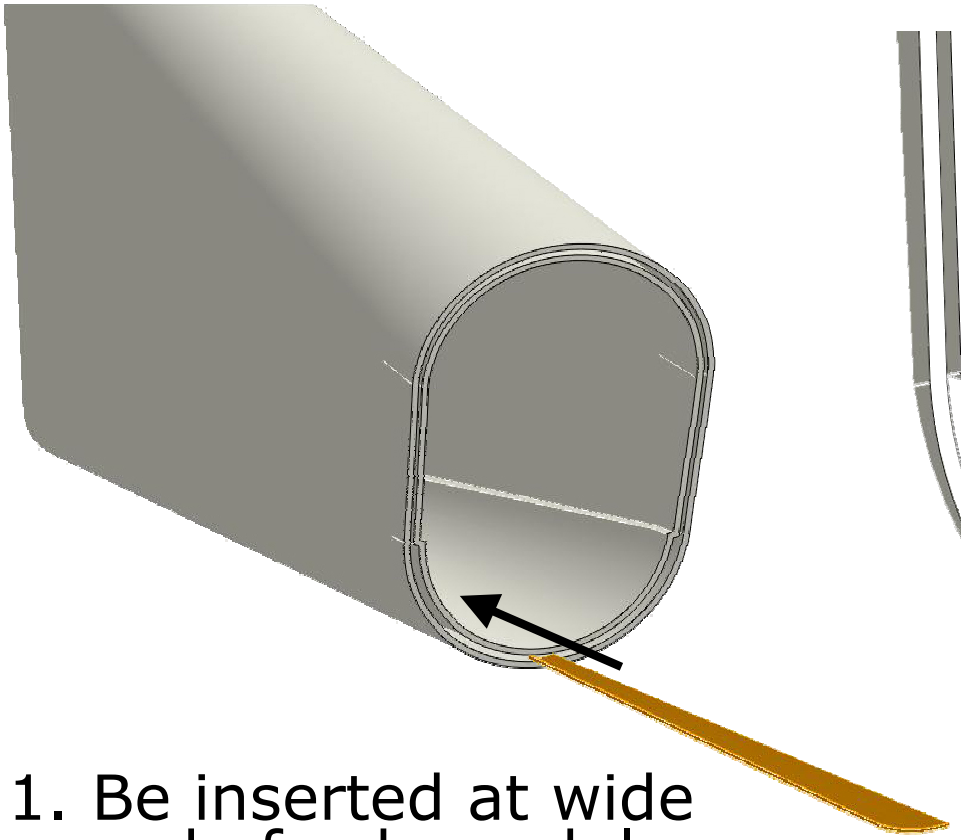
- Coolant plumbing connection/disconnection
  - Modules include integrated manifold with a single supply and return line
  - Mechanical connection inside VV
  - Or cut/re-weld lines inside or outside VV
- Module attachment/removal
  - Modules have integrated frame with VV connection mechanisms capable of remote engagement and disengagement

Sub-module for Flibe blanket concept



- 10 mm thick Be insert
- Blanket consists of 10% SiC 90% Flibe

Flibe Sub-module Assembly



1. Be inserted at wide end of sub-module
2. Be insert secured to inner channel wall once in place

Conclusions

- General magnet intervention chamber design concept
- Chamber maintenance has little/no impact on magnets or lasers
- VV design minimizes remote handling requirements of plant systems (i.e., magnets and other components outside the shield)
- Blanket module profile redesigned to facilitate installation/removal
- Remote handling concept for blanket maintenance
- Be incorporated using multiple shaped inserts