

# **Belle II IR 2**

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**KEK**

**Joint Belle II & superB Background meeting**

**2012//Feb/8-9th**

# Requested to discuss about IR

- **IR magnets**
  - magnetic field calculation, canceling coils, canceling solenoid, leak field, fabrication status, cryostat (Ohuchi-san'talk)
- **IR mechanical design**
  - beam pipe design, fabrication process, cooling, heavy metal shield, **installation procedure, assembly**, cabling space),
  - Movable collimator (shape, material, instability, impedance, secondary particles)
  - Vertex detectors
  - Beast II ( Belle II commissioning)

# History of Belle Vertex detector

## SVD1->SVD2

Beam pipe :  $R_{in} = 2.0$  cm

SVD1 :  $R = 3.0, 4.5, 6.0$  cm

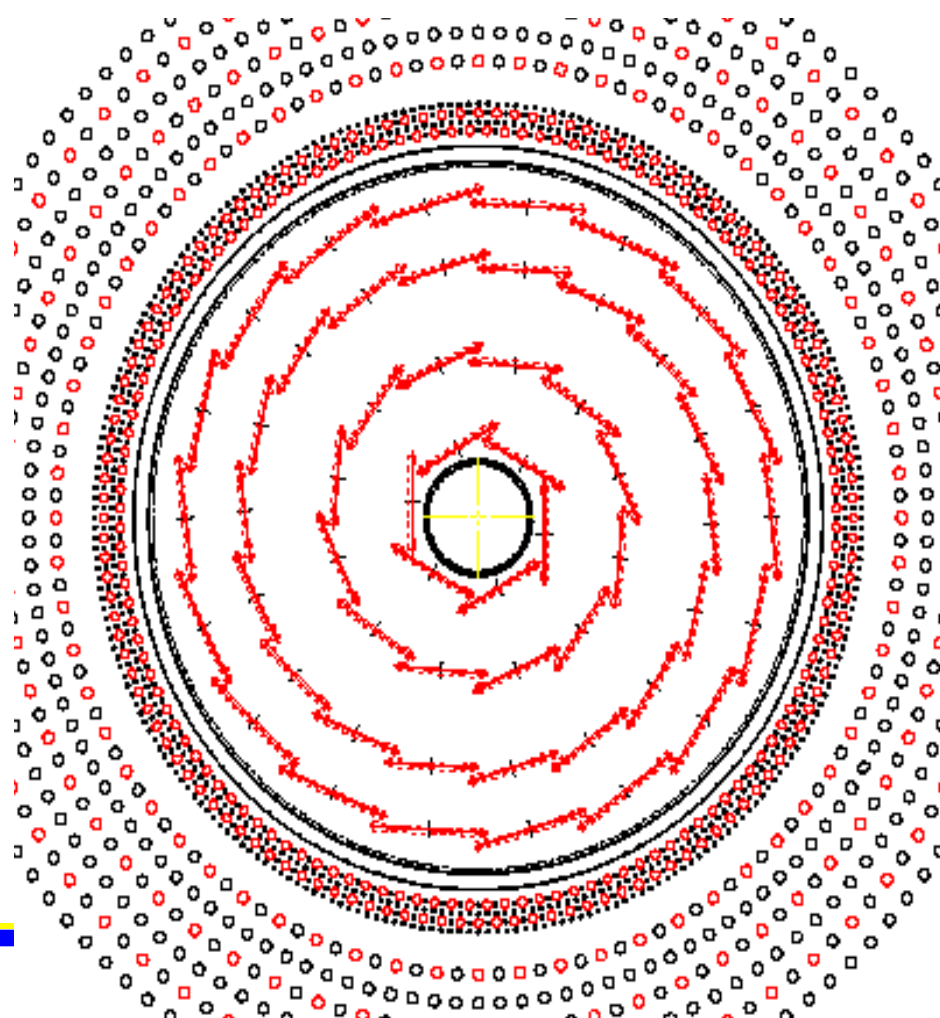
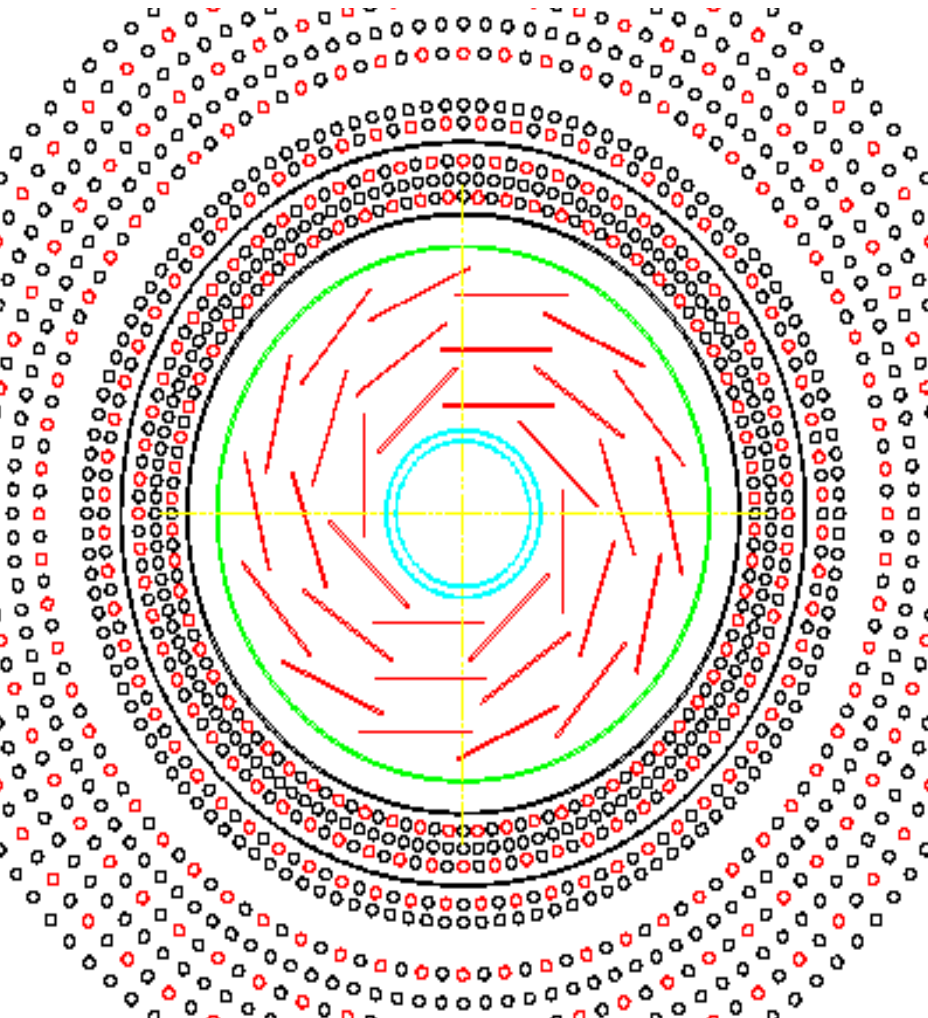
CDC : 3 layers of Cathode part



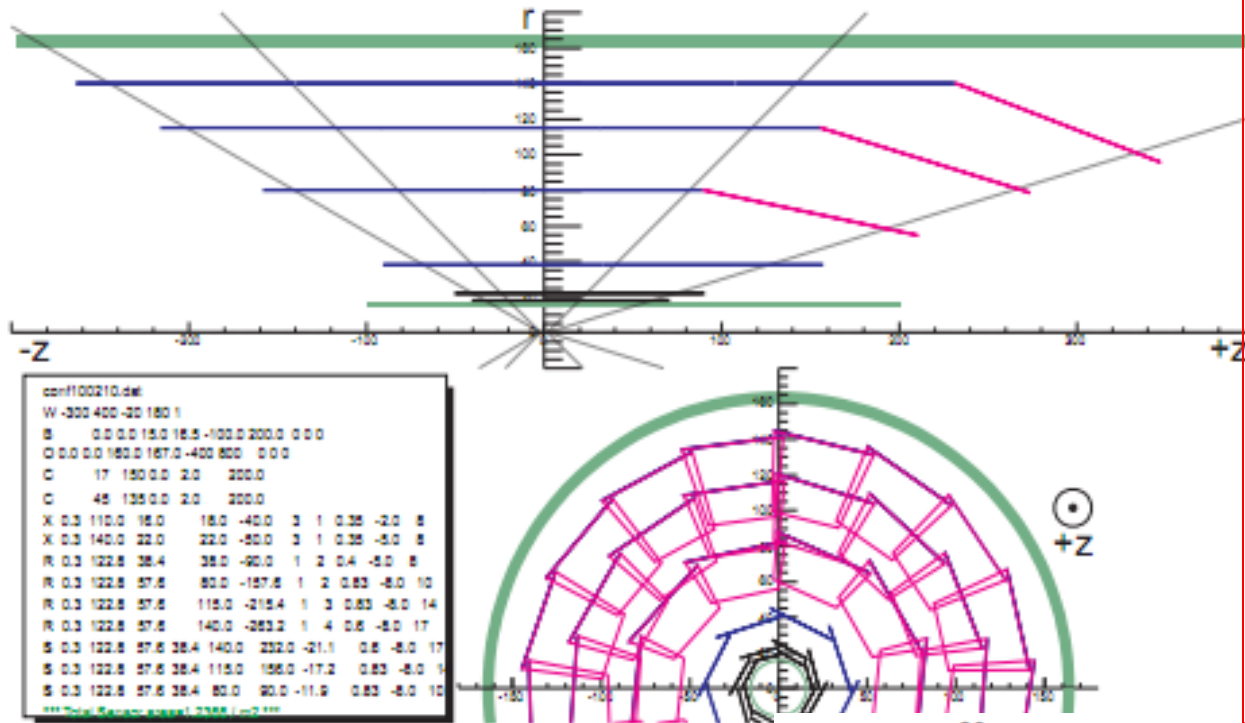
Beam pipe :  $R_{in} = 1.5$  cm

SVD2 :  $R = 2.0, 4.35, 7.0, 8.8$  cm

CDC : 2 layers of small cell chamber



# History of Vertex detector SVD2-> BelleII SVD



Beam pipe radius:  
@IP (Tsukuba hall)  
*Topaz*: 50mm  
*Belle*  
(SVD1): 20mm  
(SVD2): 15 mm  
**BelleII**: 10mm  
More challenge on  
mechanics design

Figure 5.3: Configuration of the four strip layers, with : and the two PXD layers. All dimensions are in mm.

- 1, Slant structure
- 2, High speed readout (800ns->20ns)
- 3, 20mm diameter beam pipe
- 4, PXD detector (NEW: R=14, 22mm)

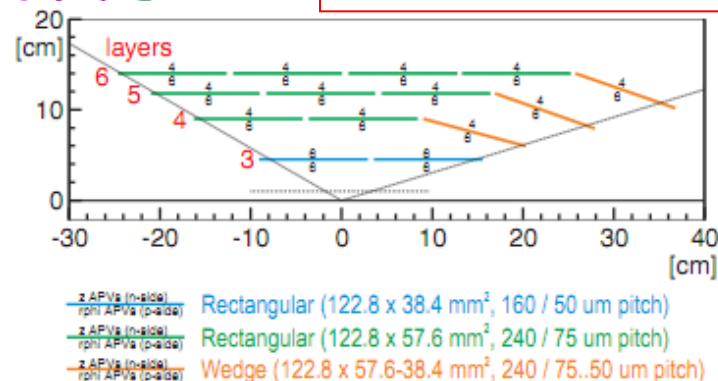
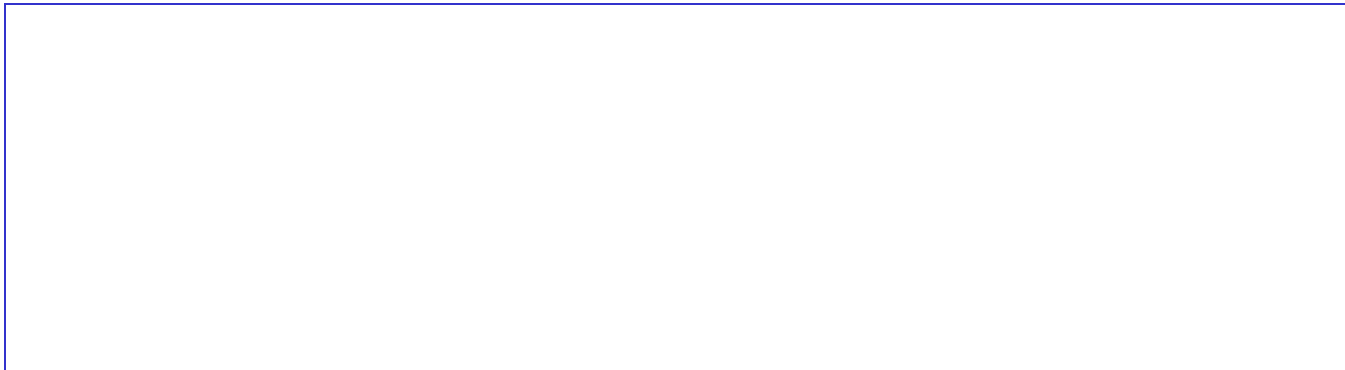


Figure 5.4: Schematic configuration of APV25 readout chips.

4 times larger volume coverage

# Assembly procedure

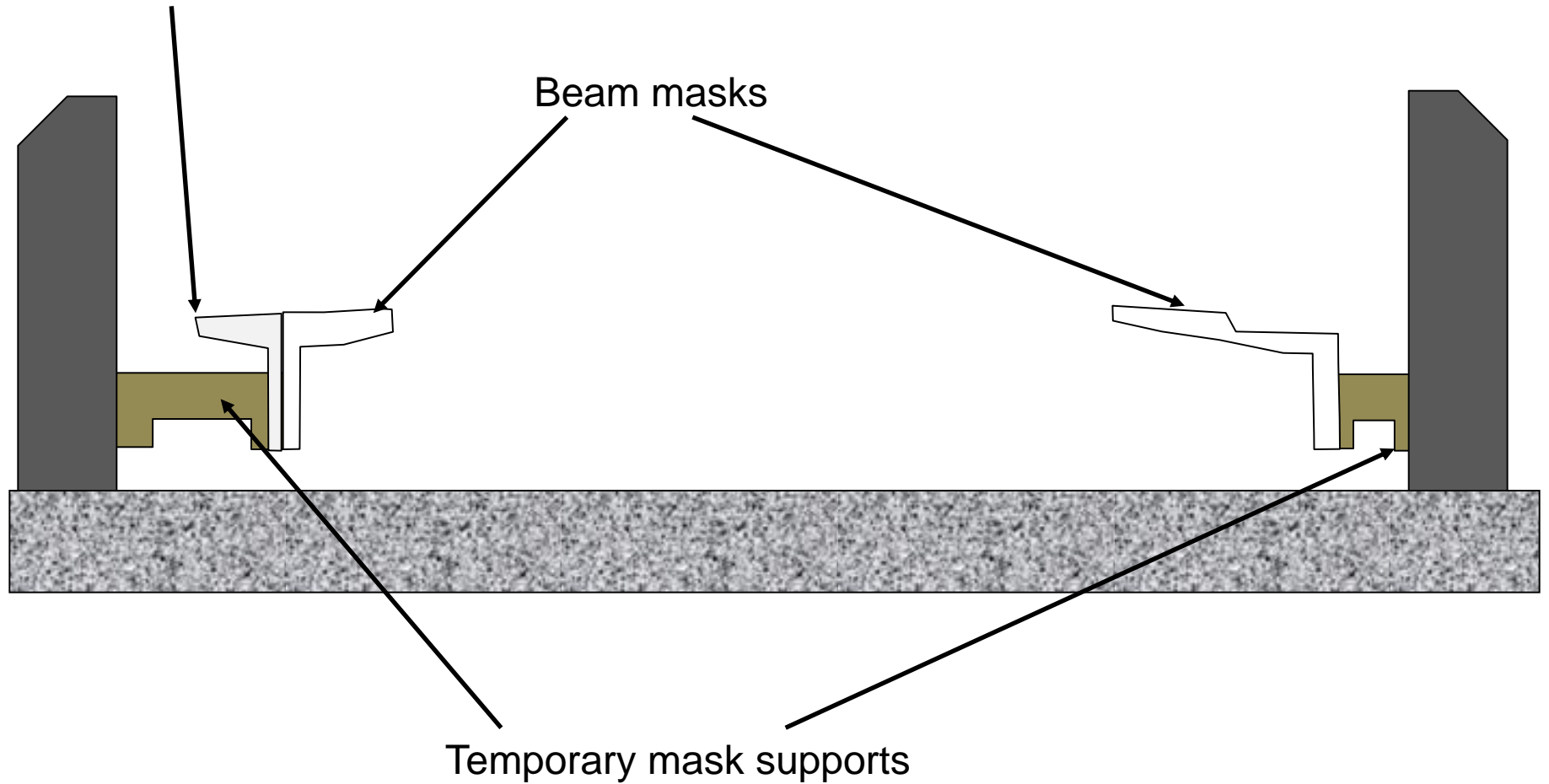


# Half Mask

Beam pipe positioner made of the heavy metal

Beam masks

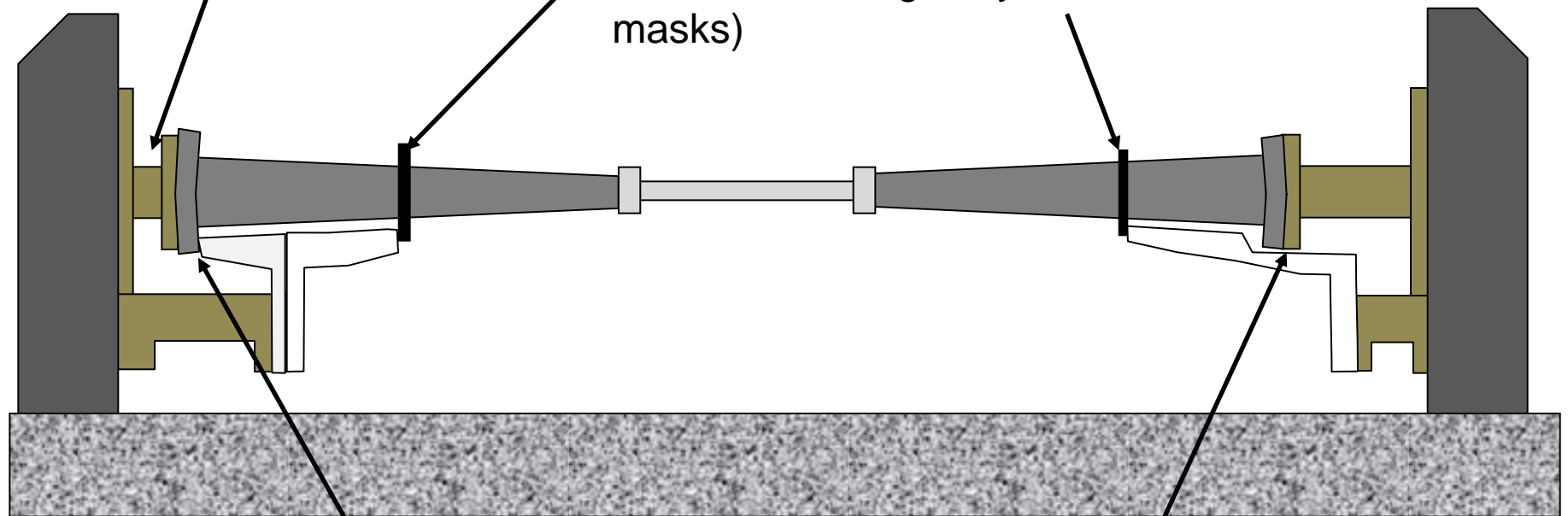
Temporary mask supports



# Beam pipe

Beam pipe temporary support

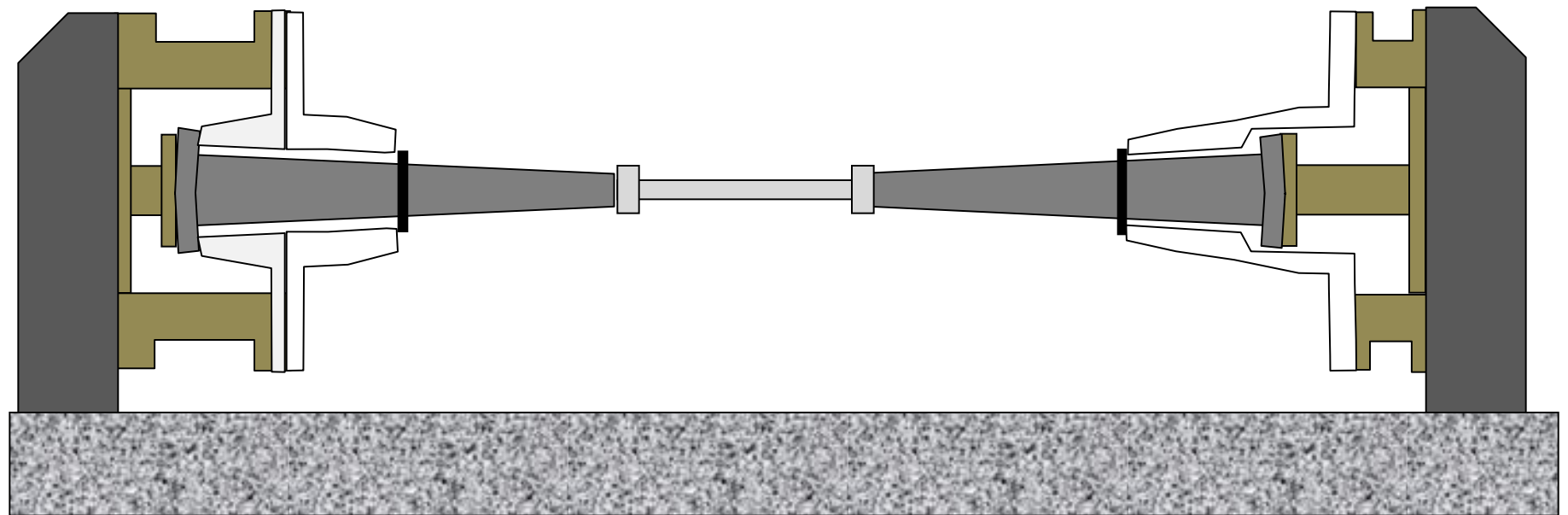
The mass of the masks are supported at these points (close to the center of gravity of masks)



The position of the beam pipe is defined in the backward at this point after installation to CDC.

We need a mechanism that constrains the  $r$ - $\phi$  position of the beam pipe while allowing a slide in the Z direction. Otherwise, the PXD position can not be defined.

# Mask2

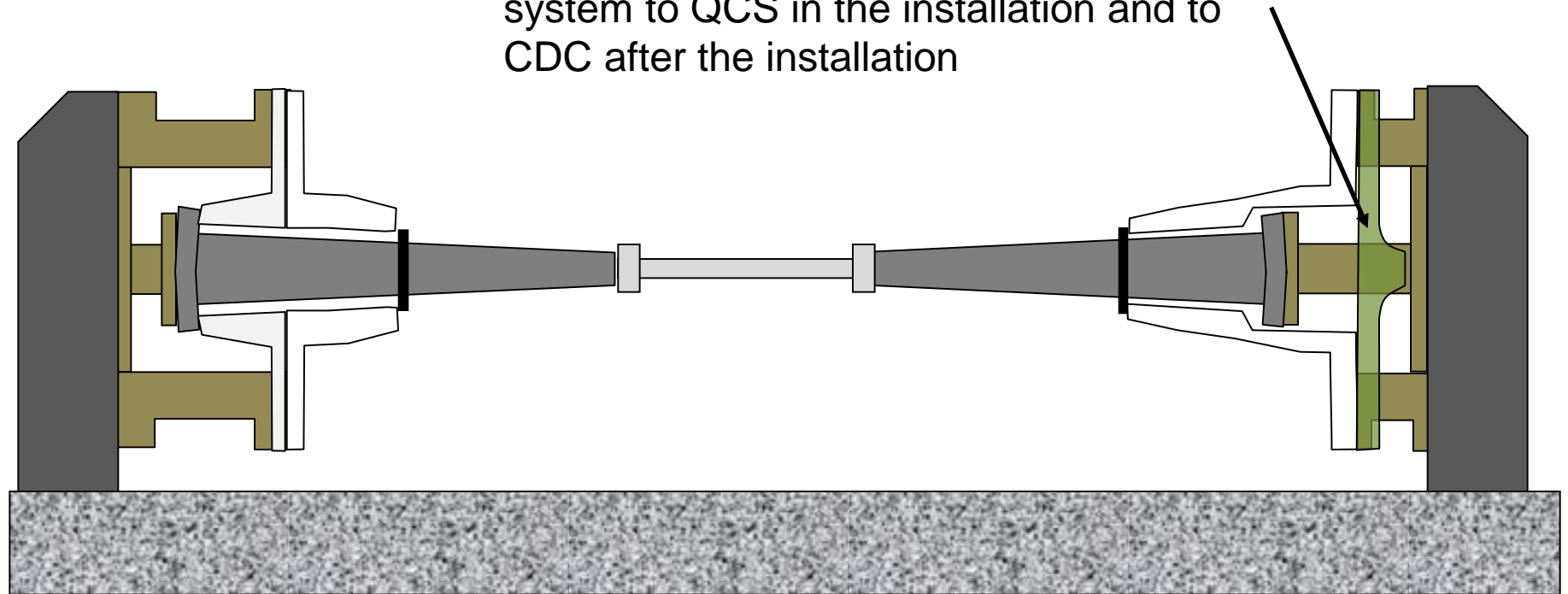


- (1) The left side and right side masks are screwed into one piece.
- (2) Rotate by  $90^\circ$  so that the masks support the beam pipe from left and right.



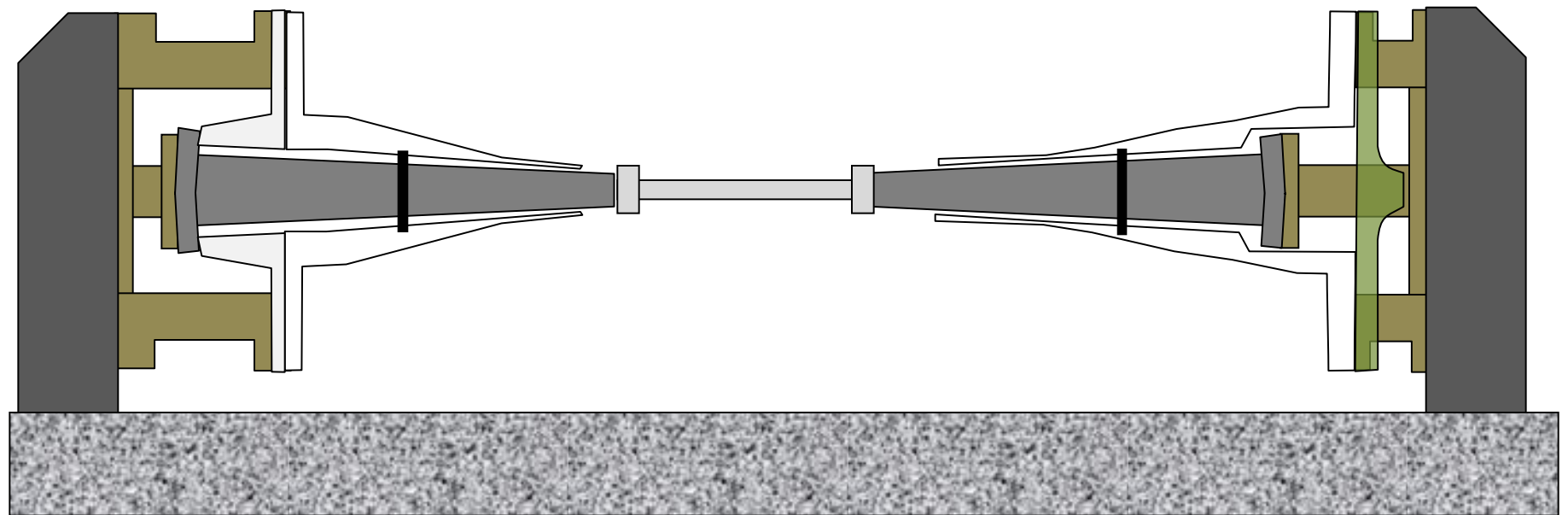
# Support flange

The support flange for supporting the IR system to QCS in the installation and to CDC after the installation



Support flange will be put in the forward side.

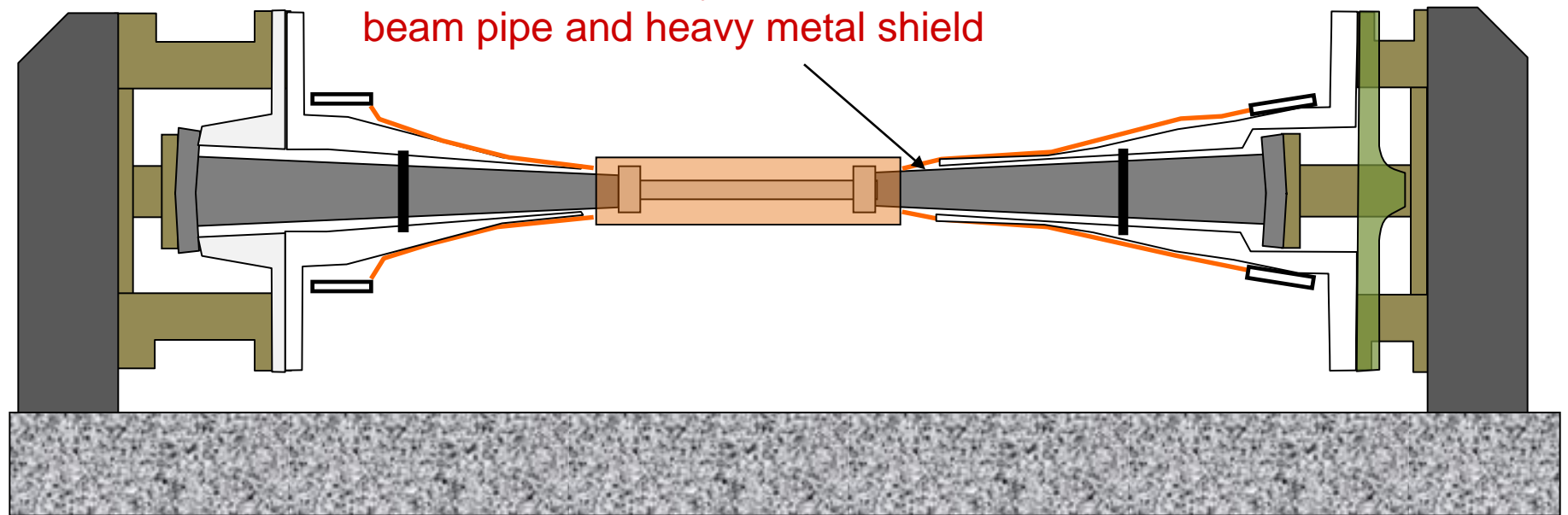
# Masks are completed



The heavy metal masks are completed.

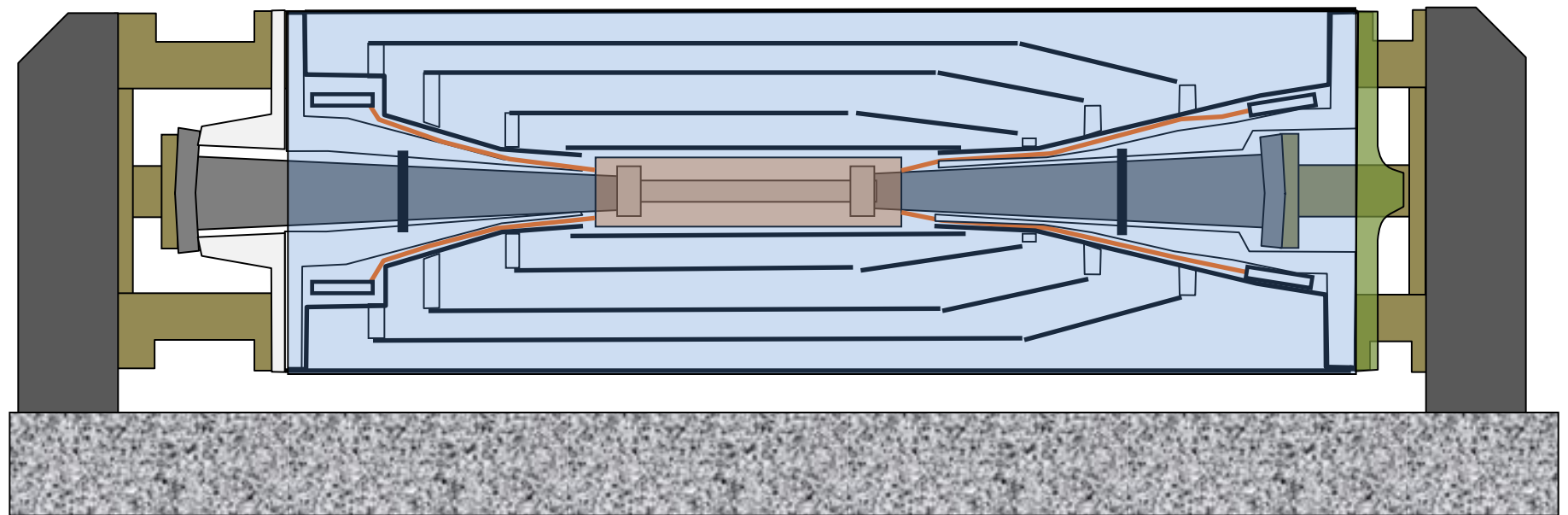
# PXD

need some flexibility for relative movement between beam pipe and heavy metal shield



PXD is assembled to two halves in another stage and put together to the beam pipe. Cables and tubes will go to the slot in the masks.

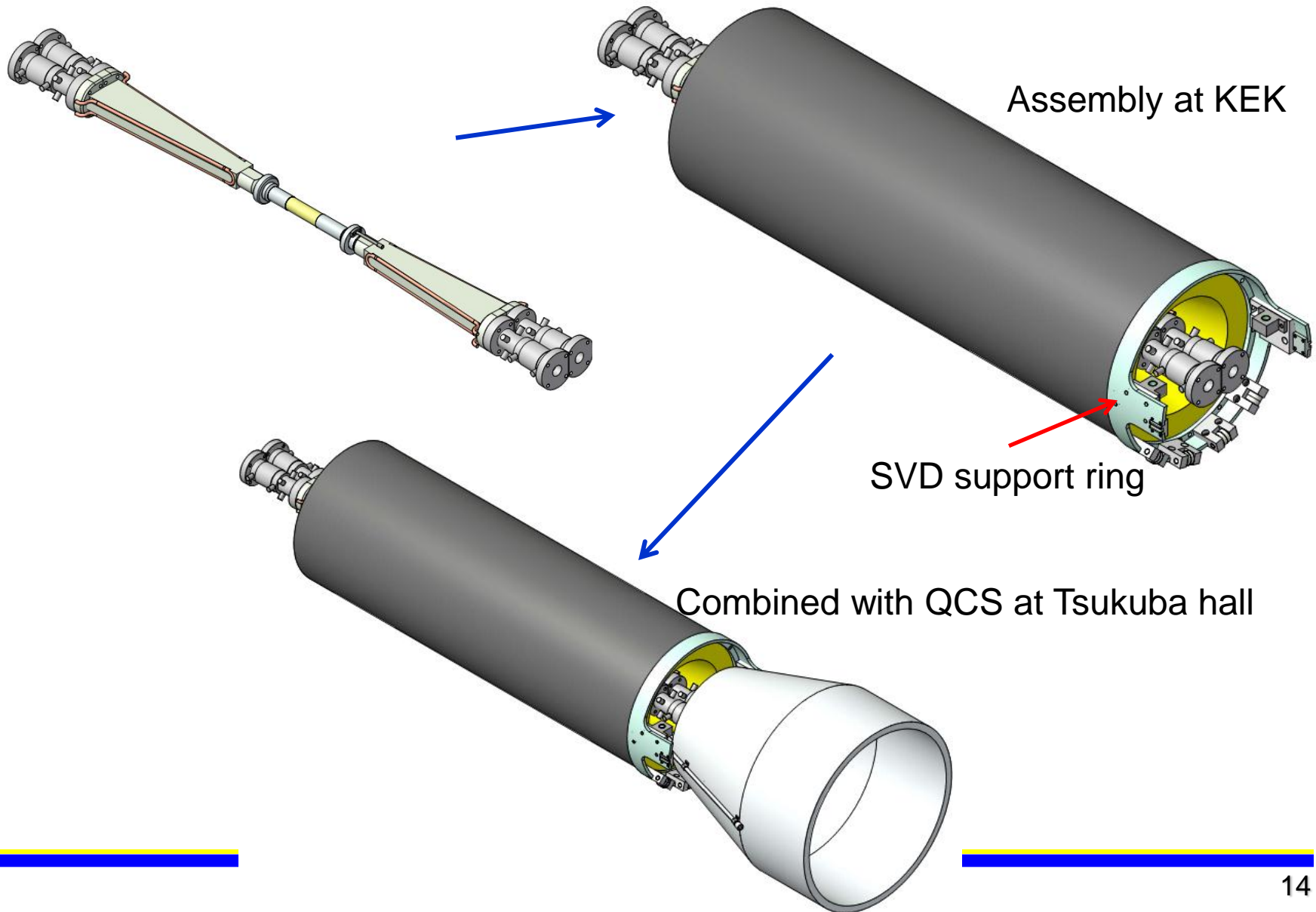
# Combine with SVD



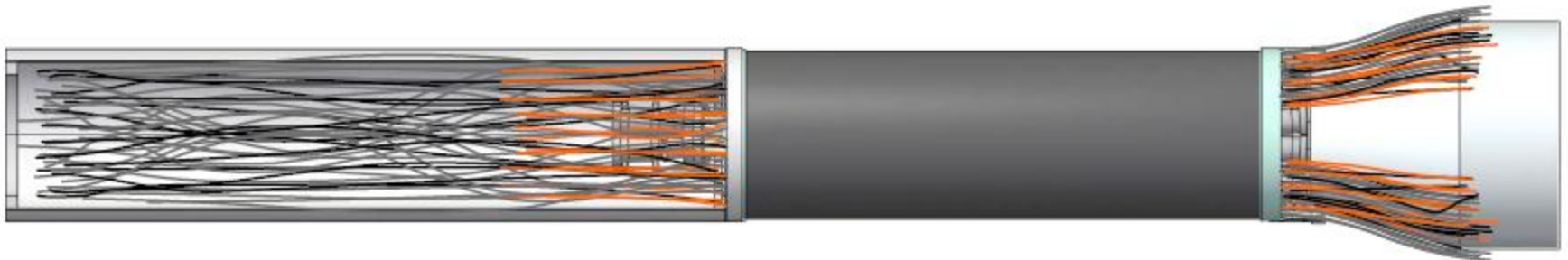
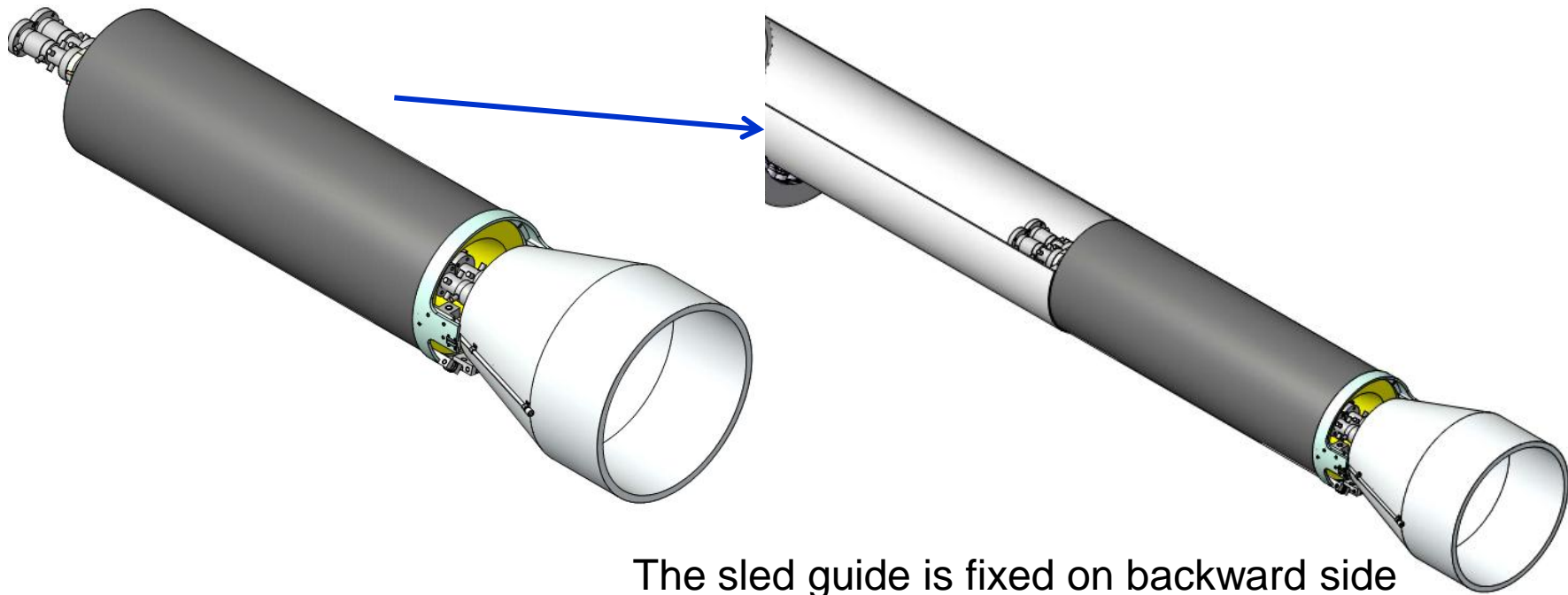
SVD is also assembled in another stage. The forward and backward support cones are then fixed with the outer cover, made of CFRP. Then they are put together around the beam pipe.

# VXD installation procedure

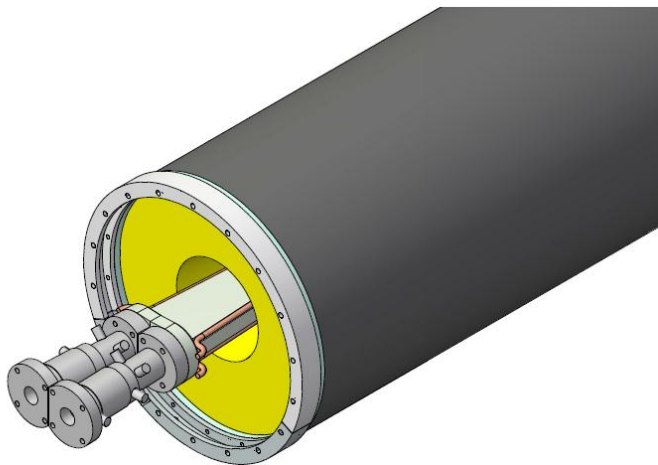
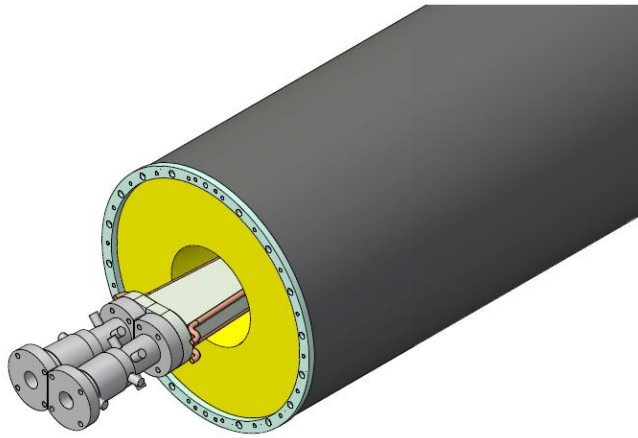
# Vertex detector installation



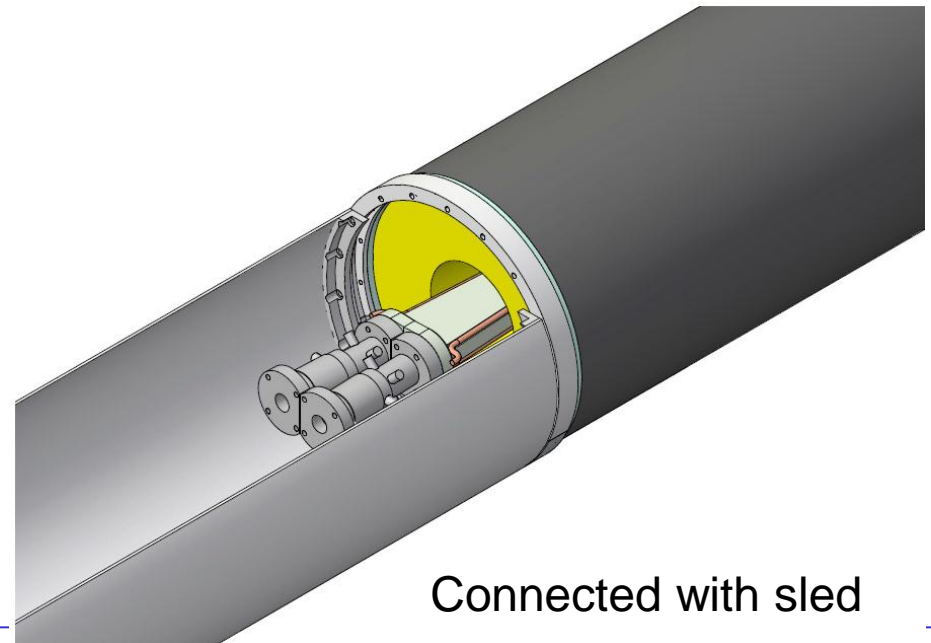
# *Vertex detector installation*



# How to connect with backward sled



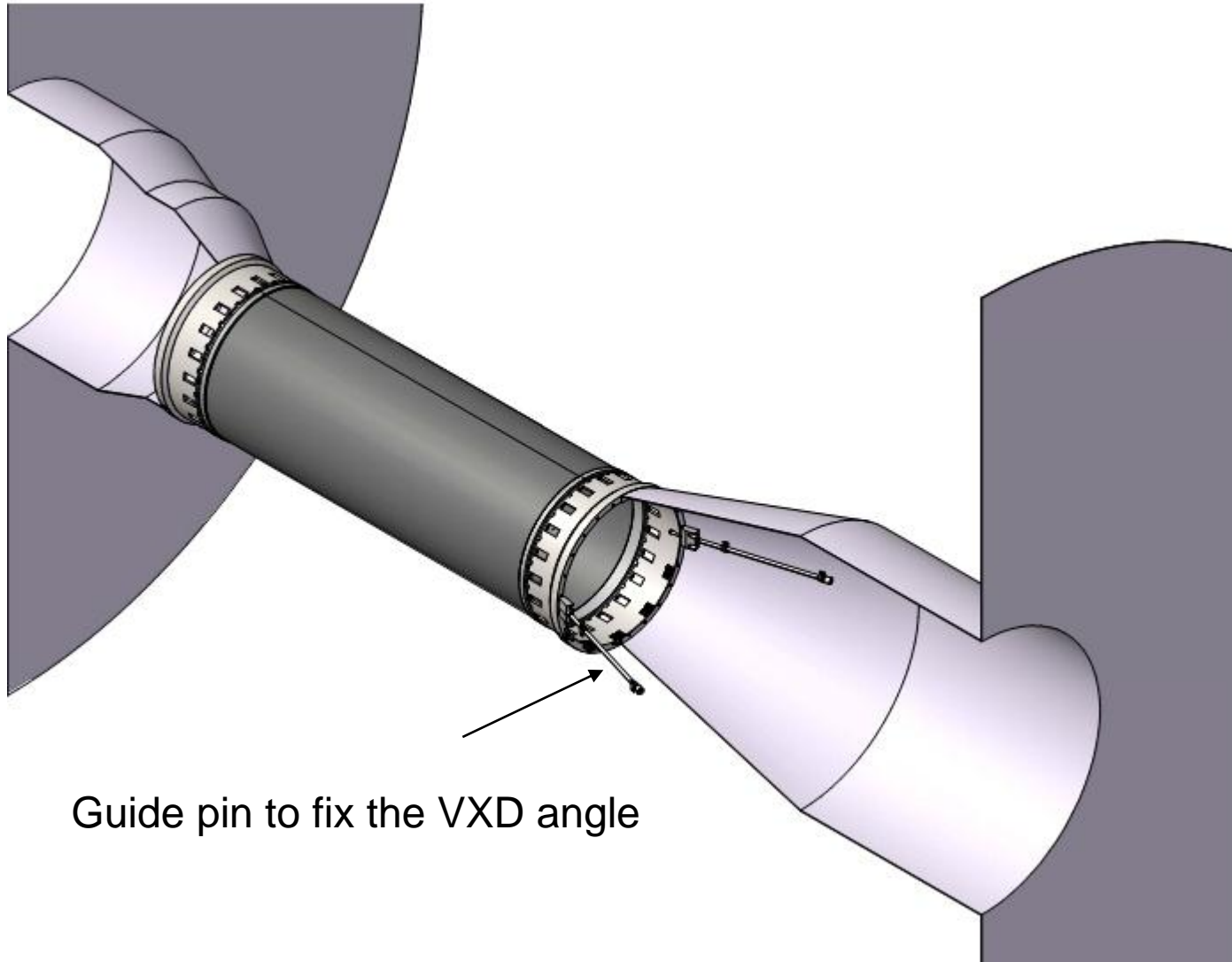
Adapting support ring



Connected with sled

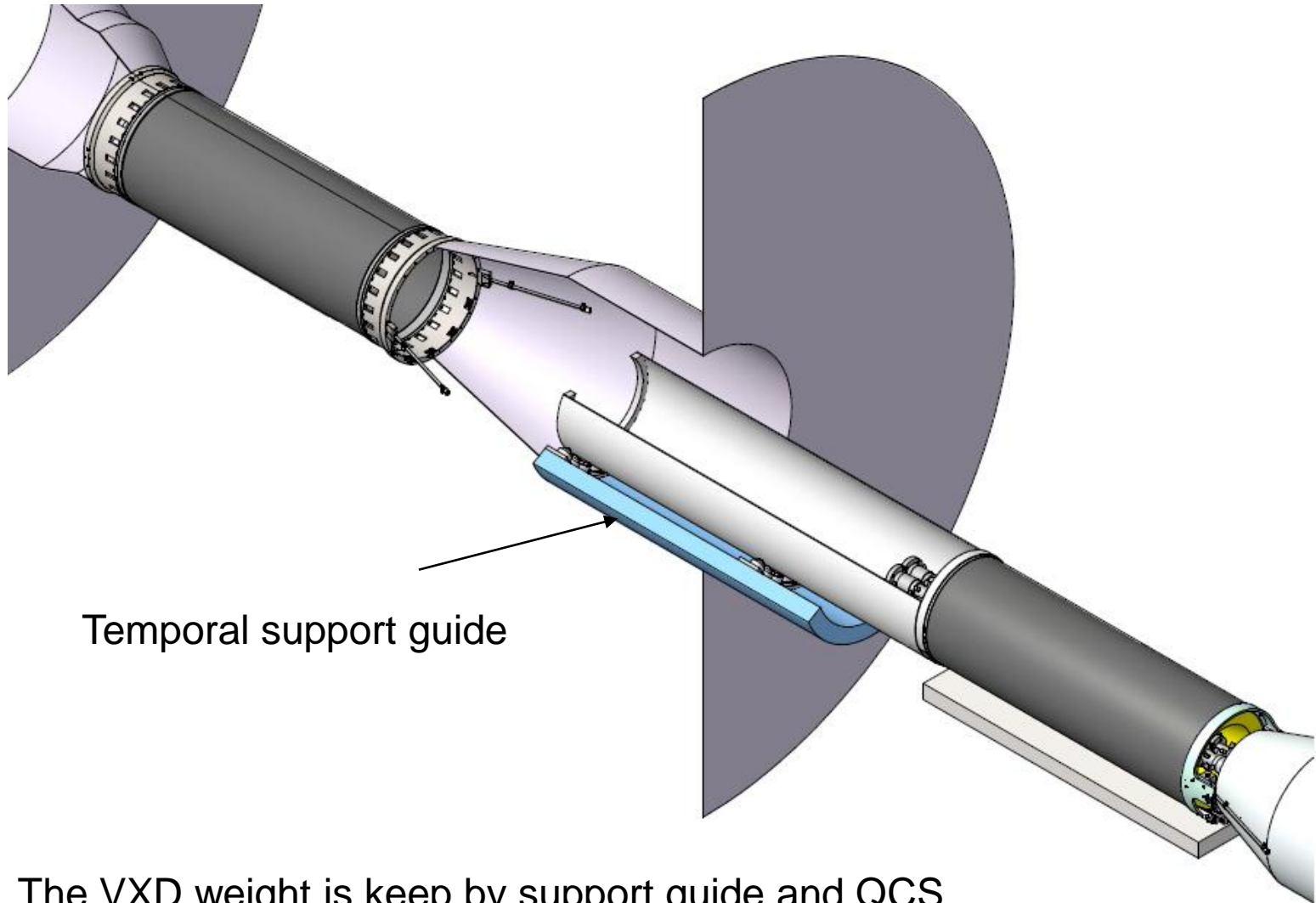


# *Vertex detector installation*



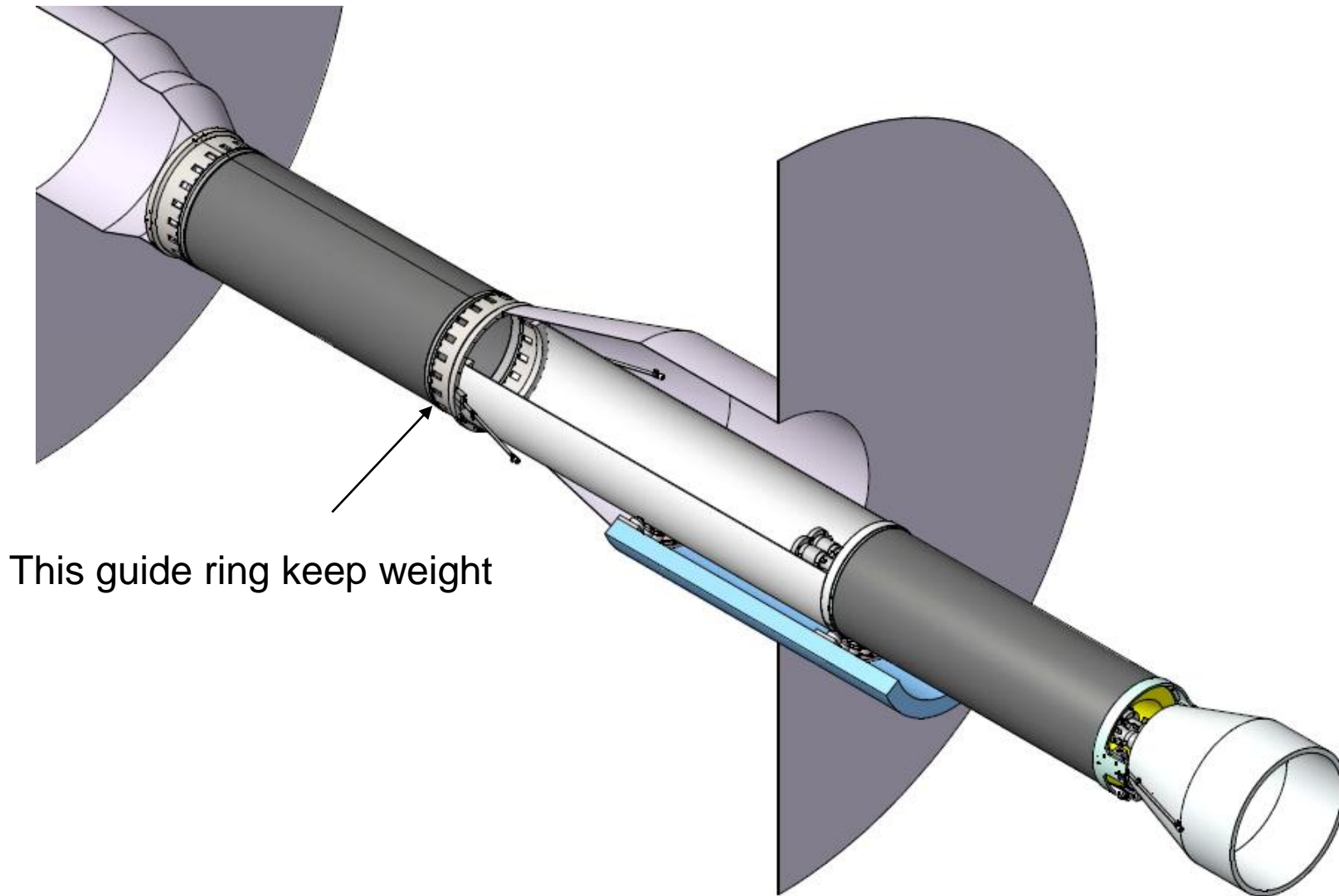
Guide pin to fix the VXD angle

# *Vertex detector installation*



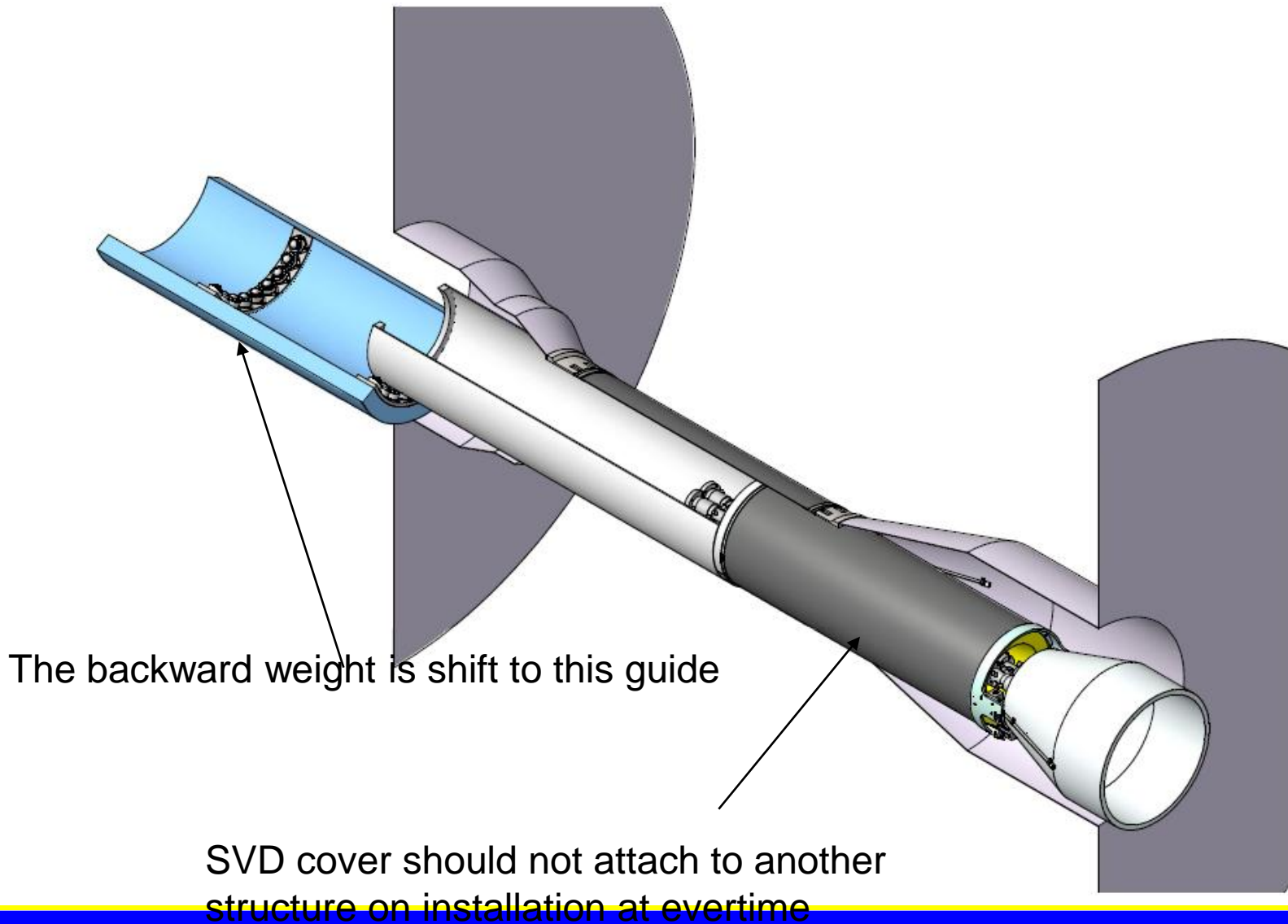
The VXD weight is kept by support guide and QCS

# *Vertex detector installation*

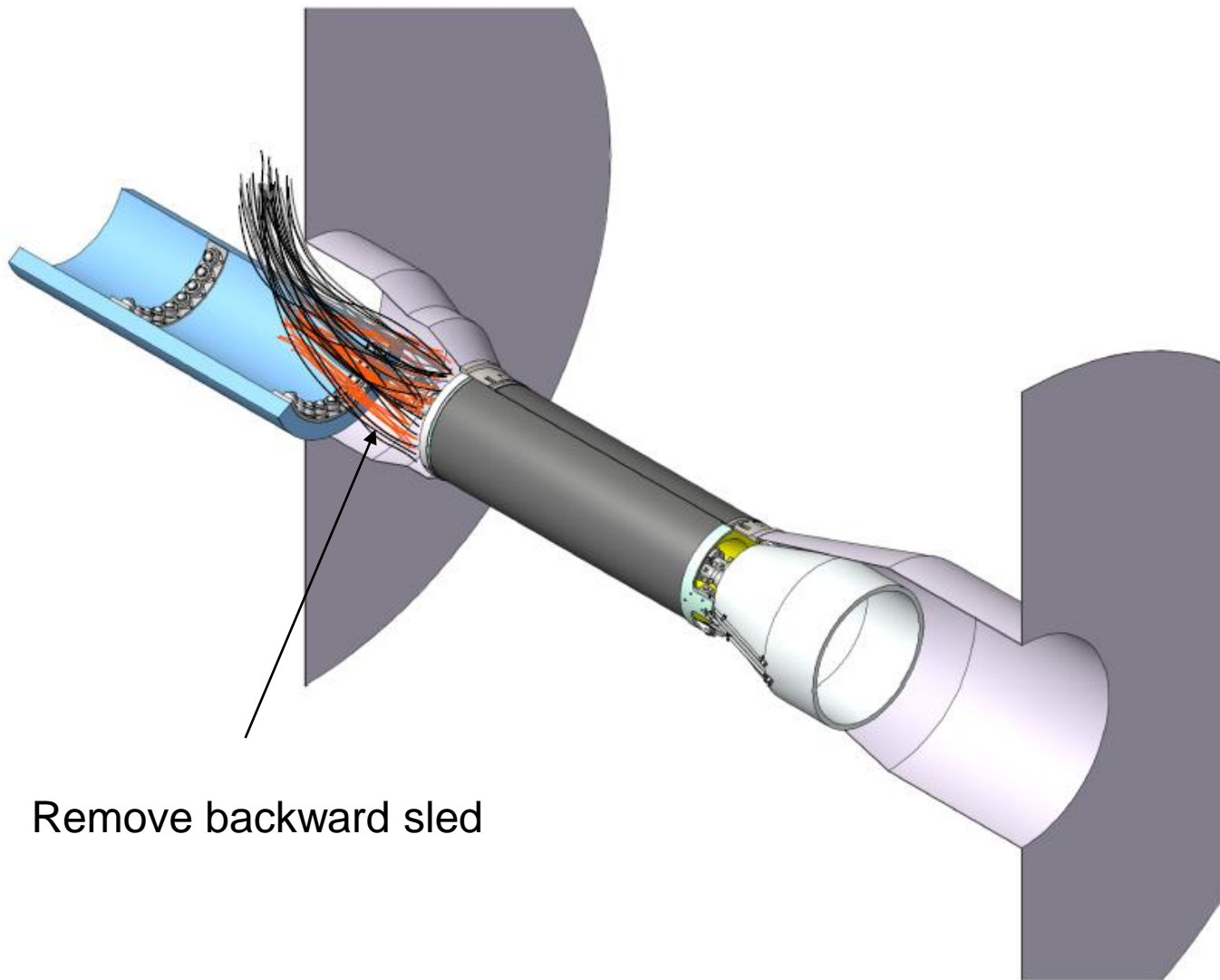


This guide ring keep weight

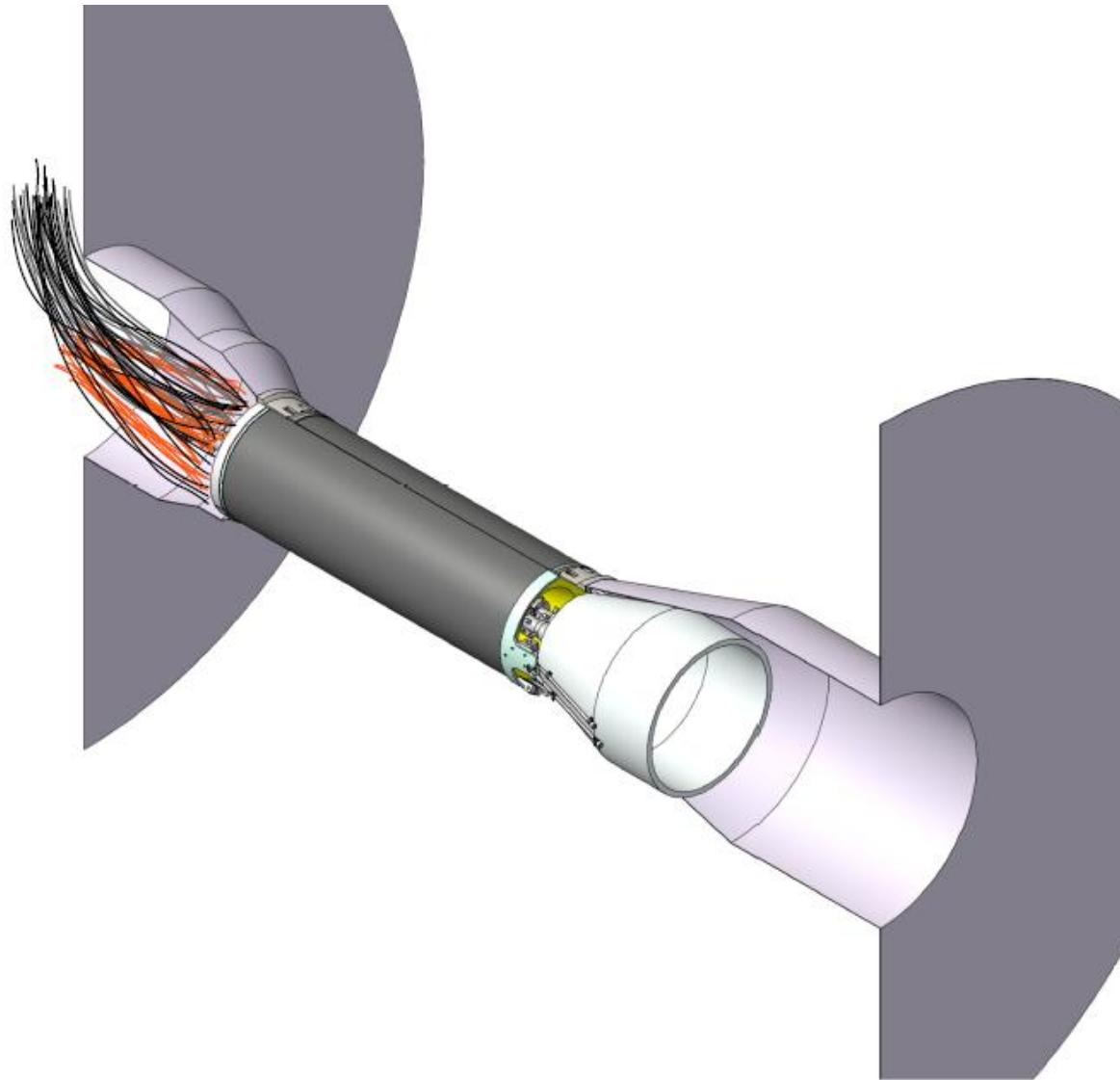
# *Vertex detector installation*



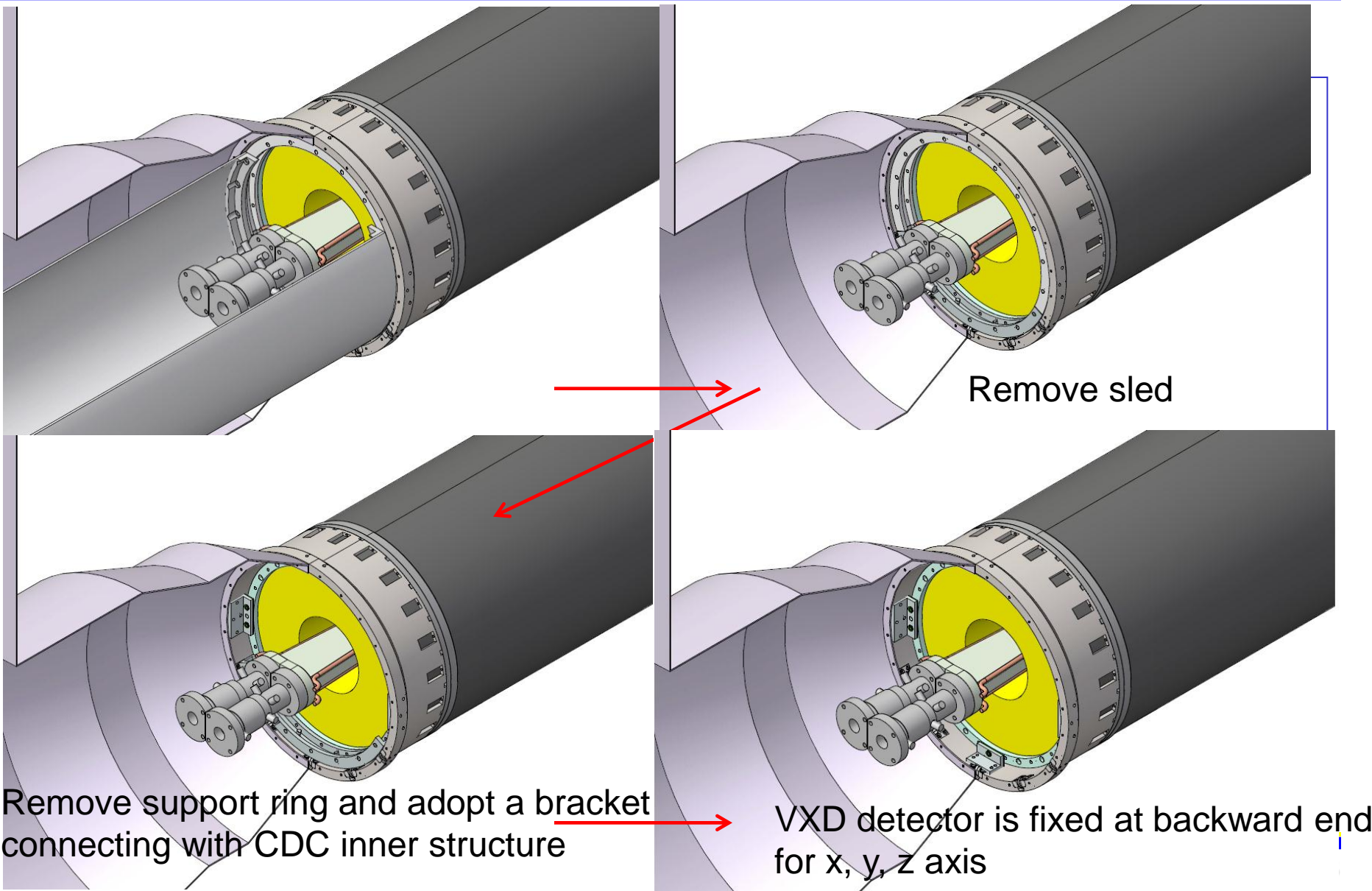
# *Vertex detector installation*



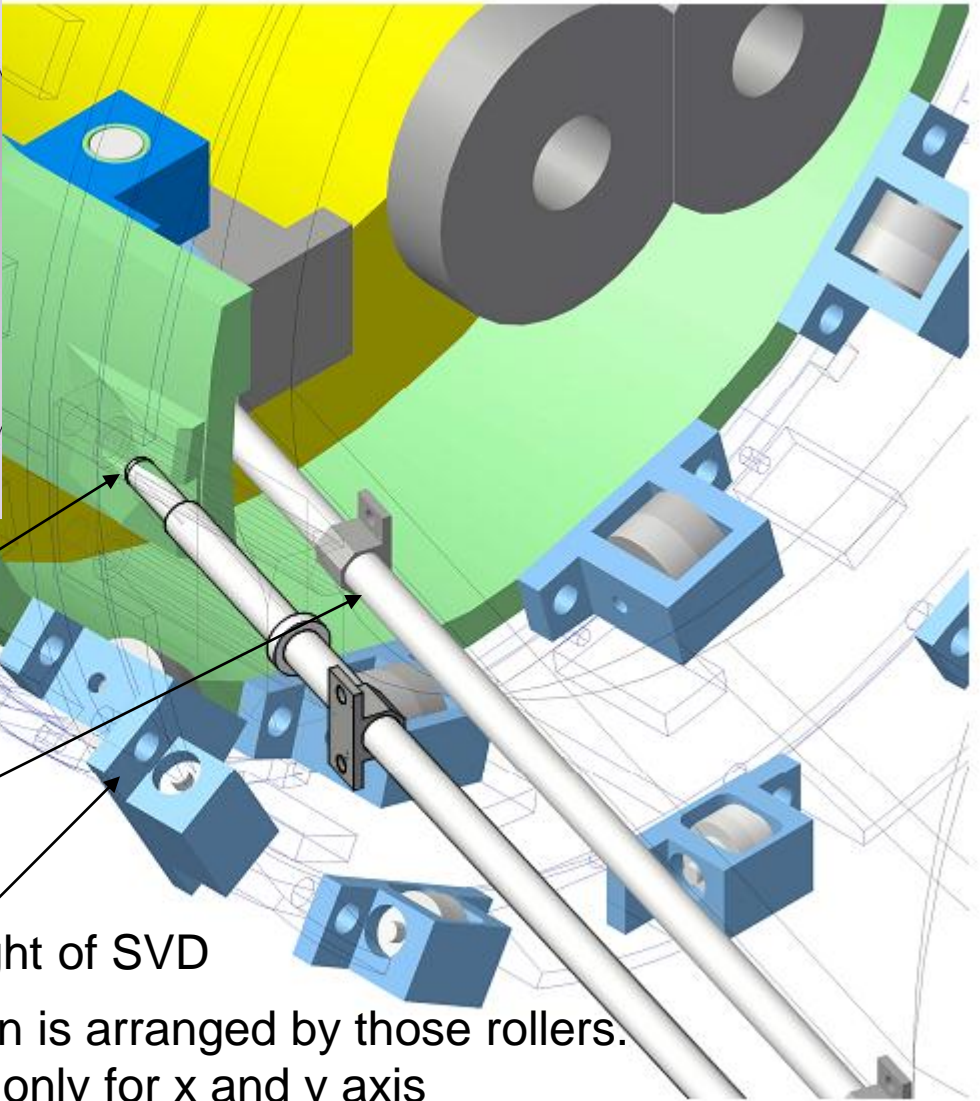
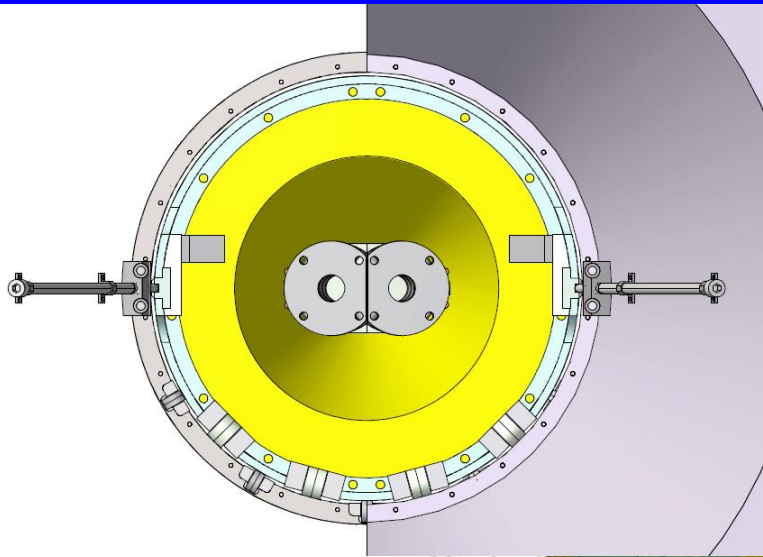
Remove backward sled



# How to fix at SVD backward



# SVD support ring at forward region



Positioning guide pin  
(CDC side)

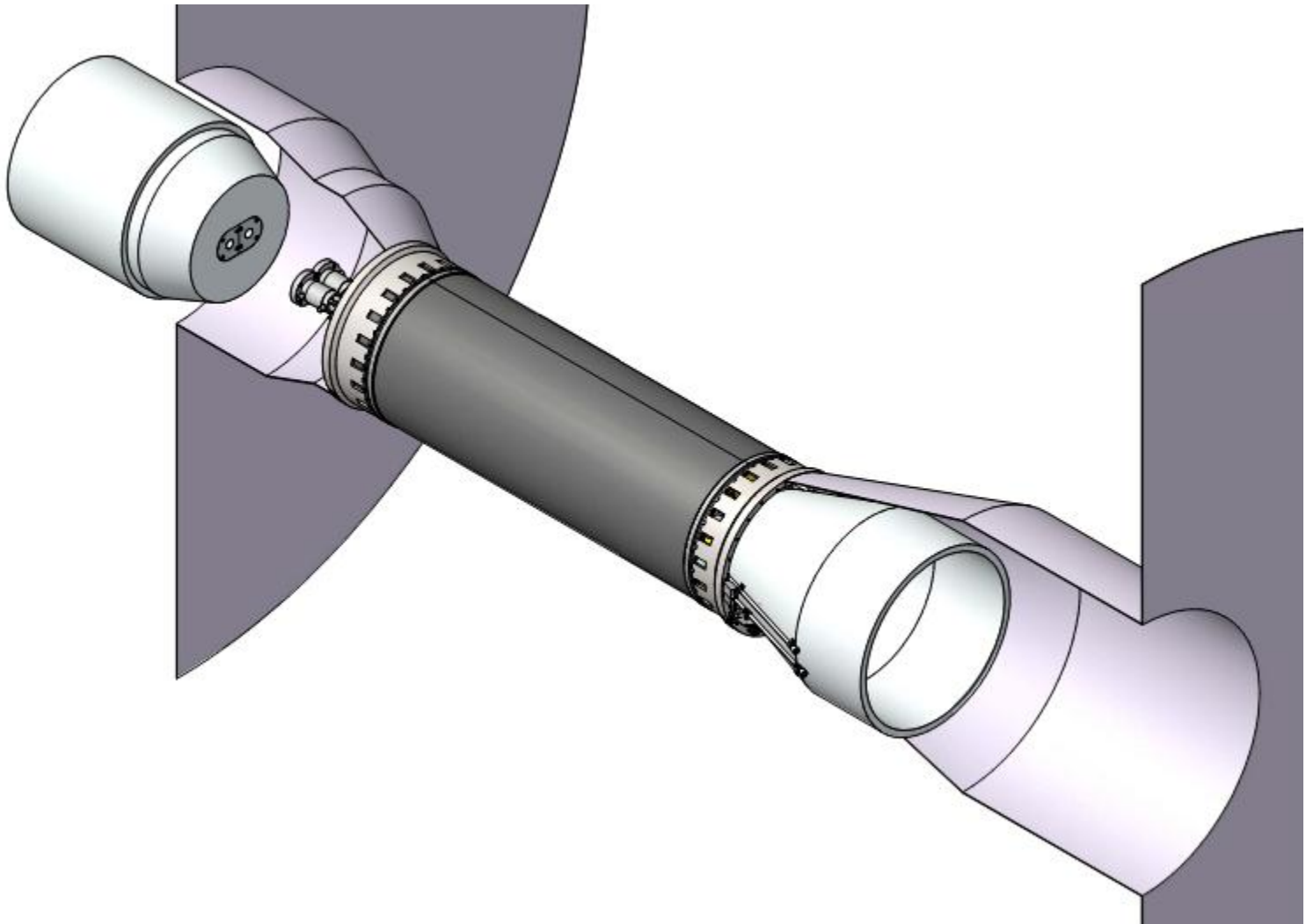
Release control rod after install  
(QC cryostat side)

Guide roller to keep weight of SVD

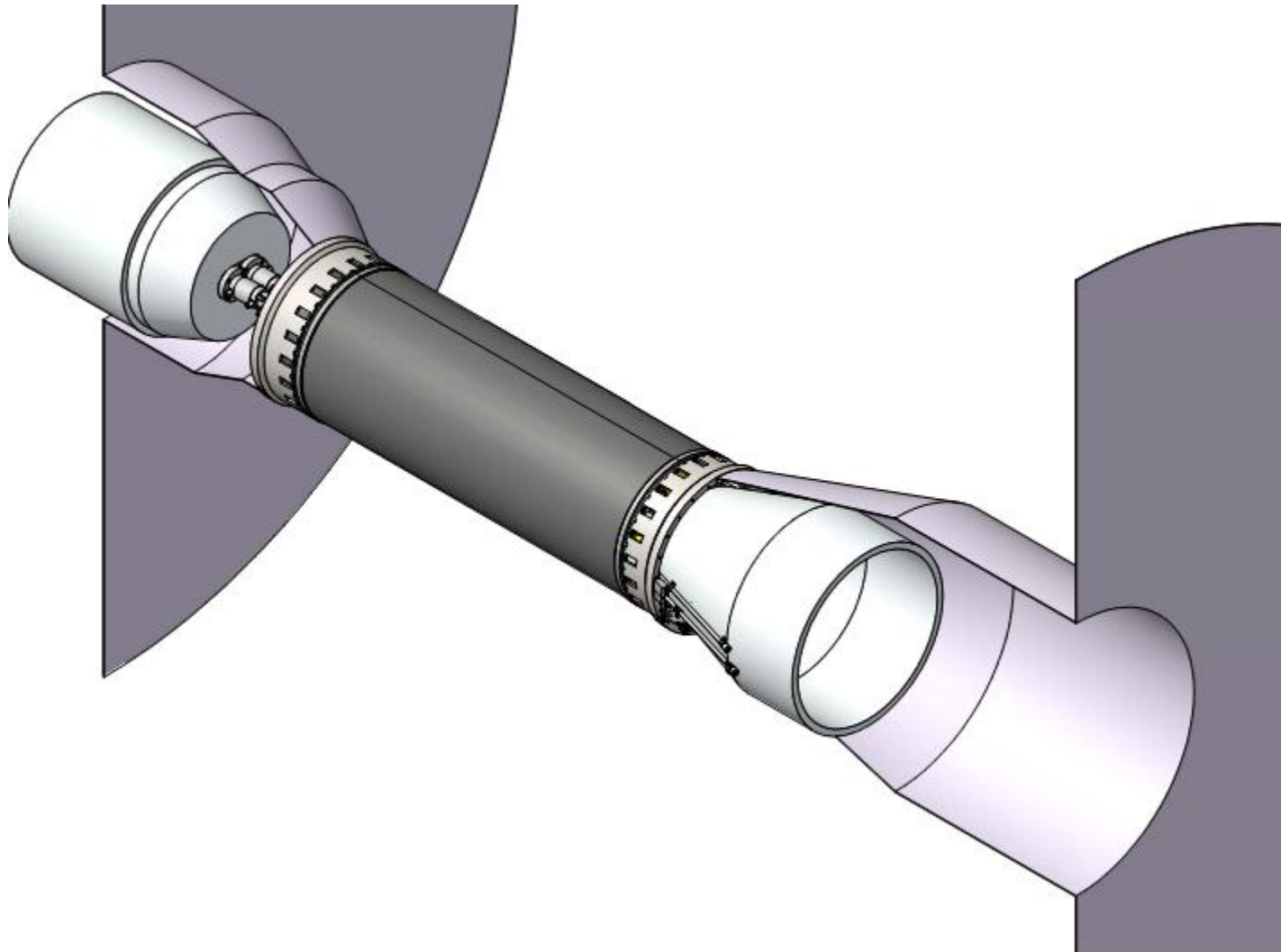
The VXD center position is arranged by those rollers.  
Forward region is fixed only for x and y axis



# *Vertex detector installation*



# *Vertex detector installation*



# Schedule (IR mechanics)

**2011** *Optimizing production procedure(writing rough sketch note for each procedure) for first prototype.*

- *Service space allocation will be decided*
- *Validate the technology of connectivity for each materials.*

**2012** From the end of 2012

- **Starting VXD mock-up assembly**

**Mechanics check -> installation test , Cooling test**

**Beam pipe production(for BEASTII)**

**Freezing the mechanics design (including cooling system, cabling, monitors)**

**2013** SVD Ladder mount start (SVD) (2013 Sep.)

**Beam pipe production**

**2014** **End of 2014 -> BEAST**

**Beam pipe production**

**2015** Starting VXD assembly(Aug-Sep) (CR test ) and installation