

Mechanics news from KEK

S.Tanaka (KEK)

SVD/PXD meeting

SVD parallel session

Beam pipe preparation status

Items	Study
Beam pipe design	Almost done (minor change is still acceptable)
Beryllium part production	done
Titanium part production	Design has done
IP Cooling	OK
Mechanical tolerance estimation	OK (by weight, temperature stress)
Crotched part production procedure	OK
Cost estimation of materials	OK (1 set has ordered)
Connectivity test (Be-Ti)	OK (should be validate before this March)
Connectivity test (Ti-Ta)	OK(should be validate before this March)
Ridge shape optimization	To be finished soon
PXD mount	To be solved (space for sensor)
Au plating inside IP chamber	Start discussing with company

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

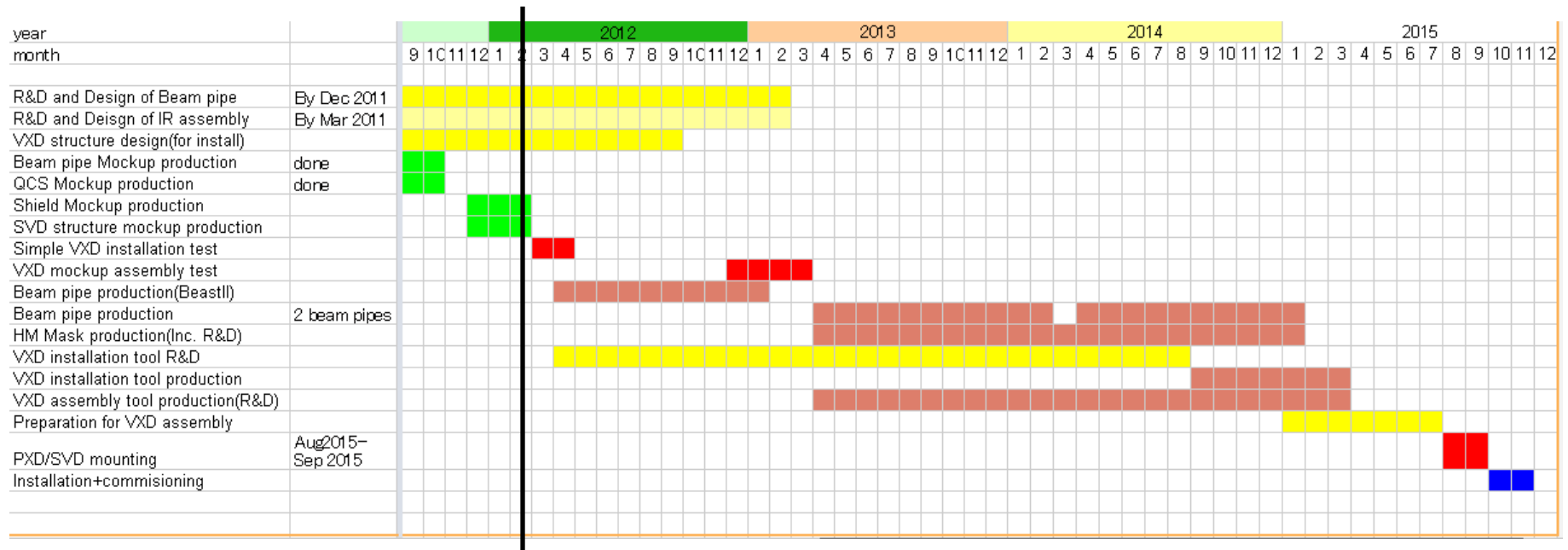
Beam pipe production

When is the time limit to produce of IR subparts?

2015

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

IR mechanics schedule



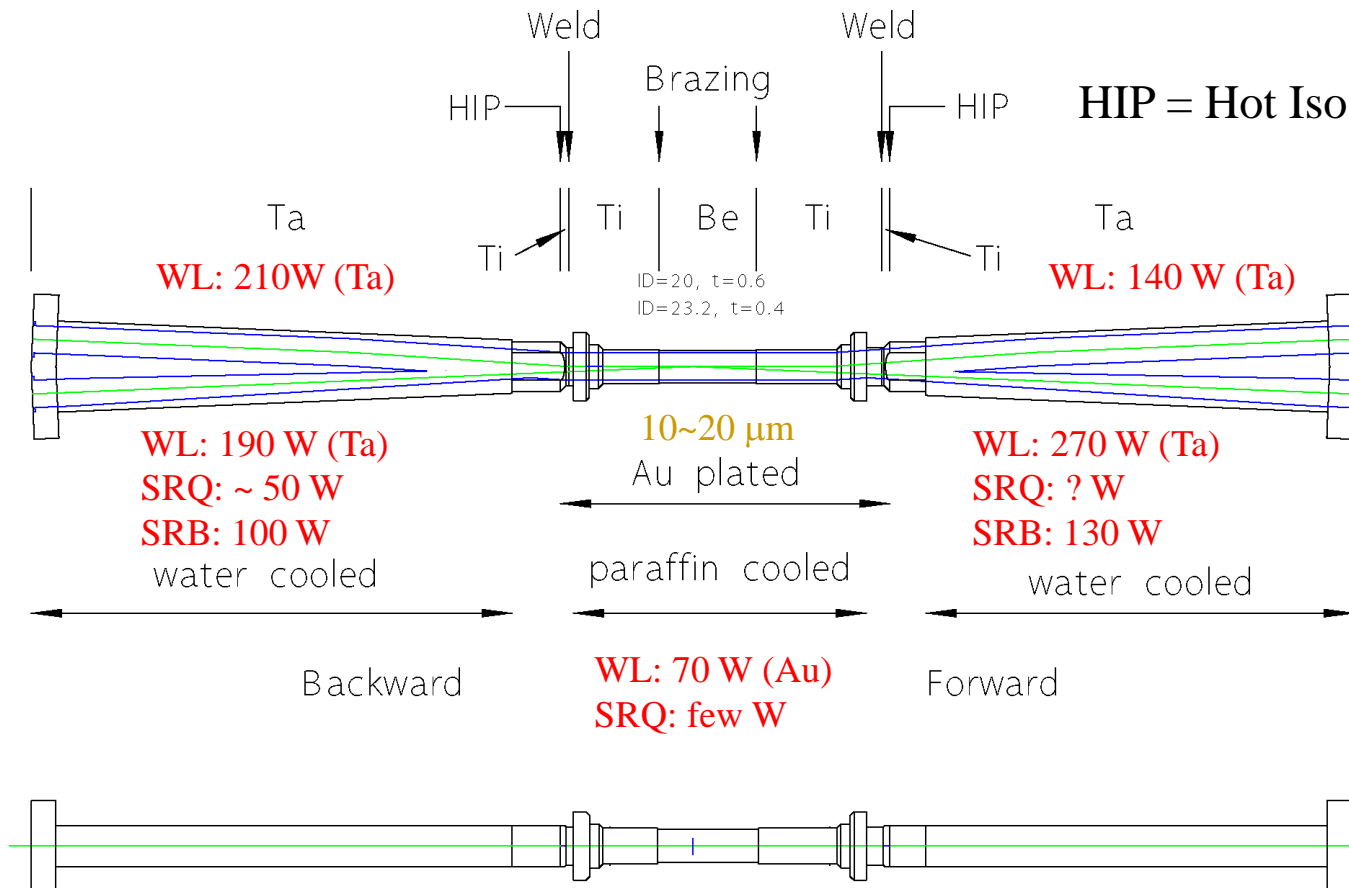
- We have still spare time to modify beam pipe design

Beam pipe production

How to optimize the IR mechanics design?

	Subject	Requirement to optimize
IP chamber	Be part	lowest atomic number metal
	Ti part	coefficient of linear thermal expansion difference with Be (similar number is better)
	Au coating	Protect SR from final focus magnet
Crotch part	Material (Tantalum)	Cost, heavy material as shield , experience using as vacuum chamber, BG simulation
	Outer shape	Production procedure, Space requirement from PXD,SVD
	Inner shape	Beam optics, SR shielding, HOM power
Shield	Heavy metal	Cost, upper limit from CDC weight request , BG simulation, Space request from PXD, SVD

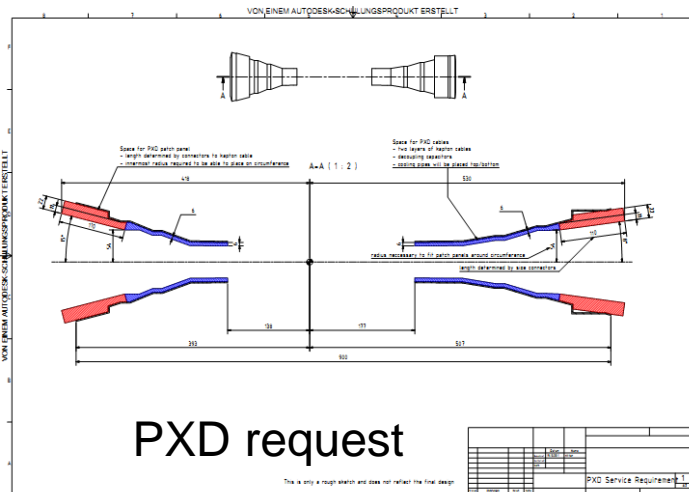
Technology choice of connectivity on each part



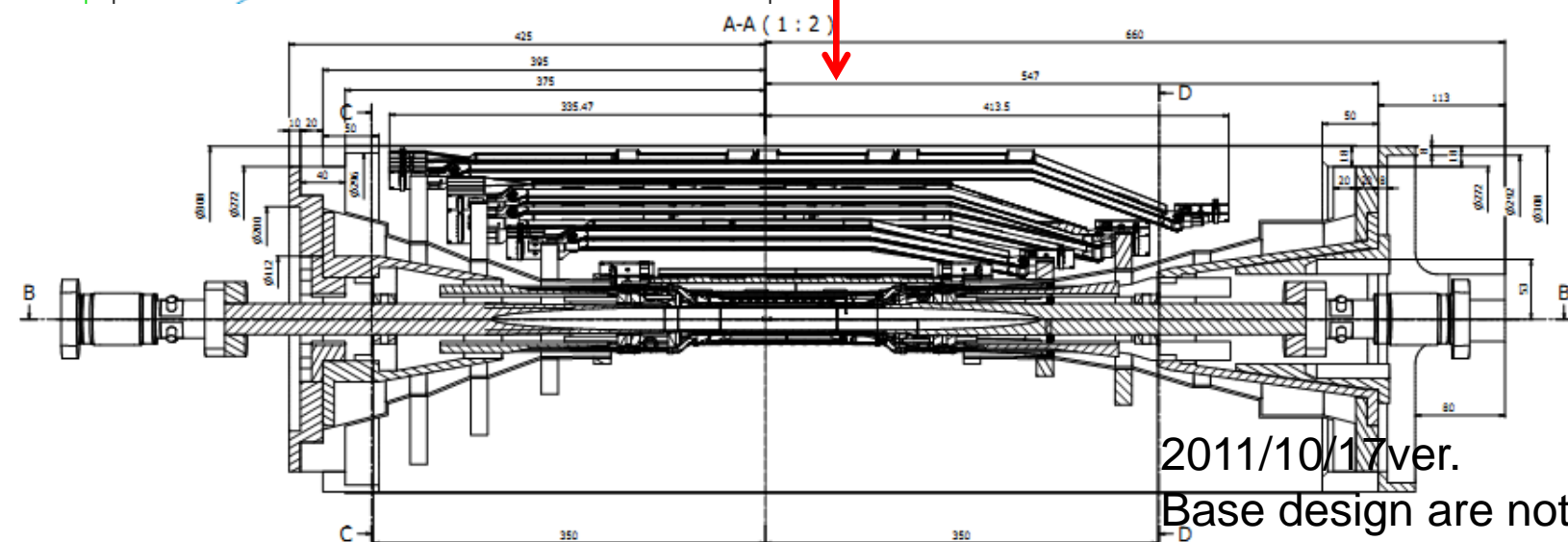
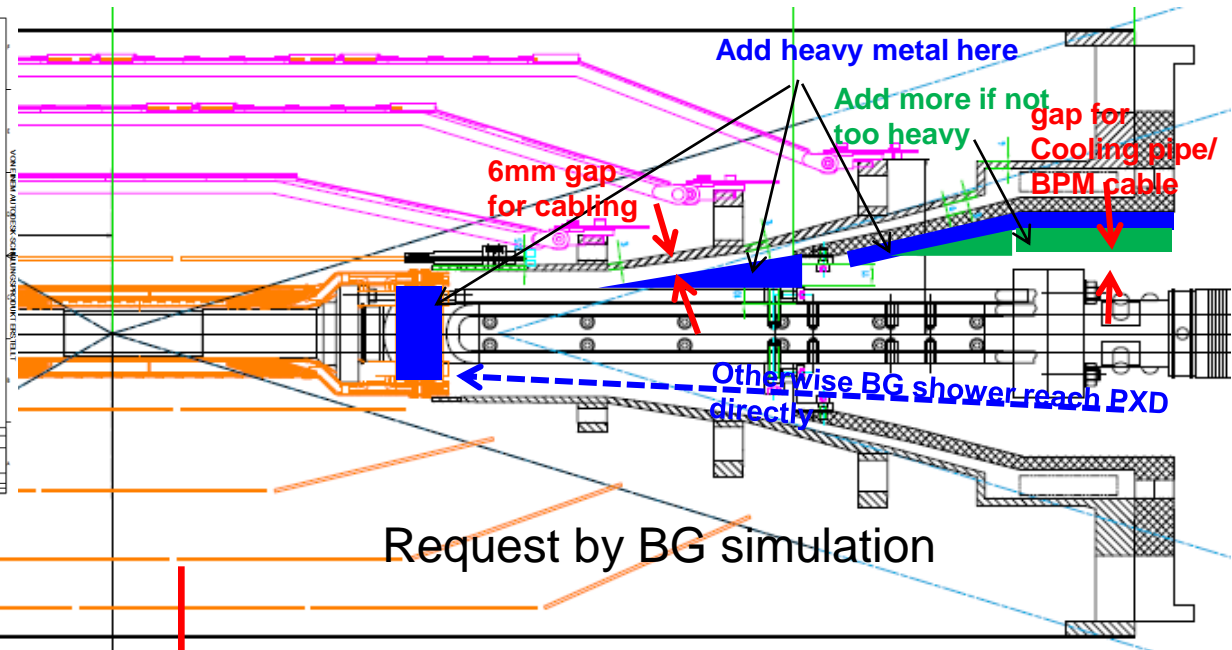
HIP = Hot Isostatic Pressing

- A test for Be-Ti brazing and Ti-Ta HIP is now undergoing.
- They are not special technologies.
- Ti is adopted instead of stainless steel to reduce the stress (see the following slides).

VXD design



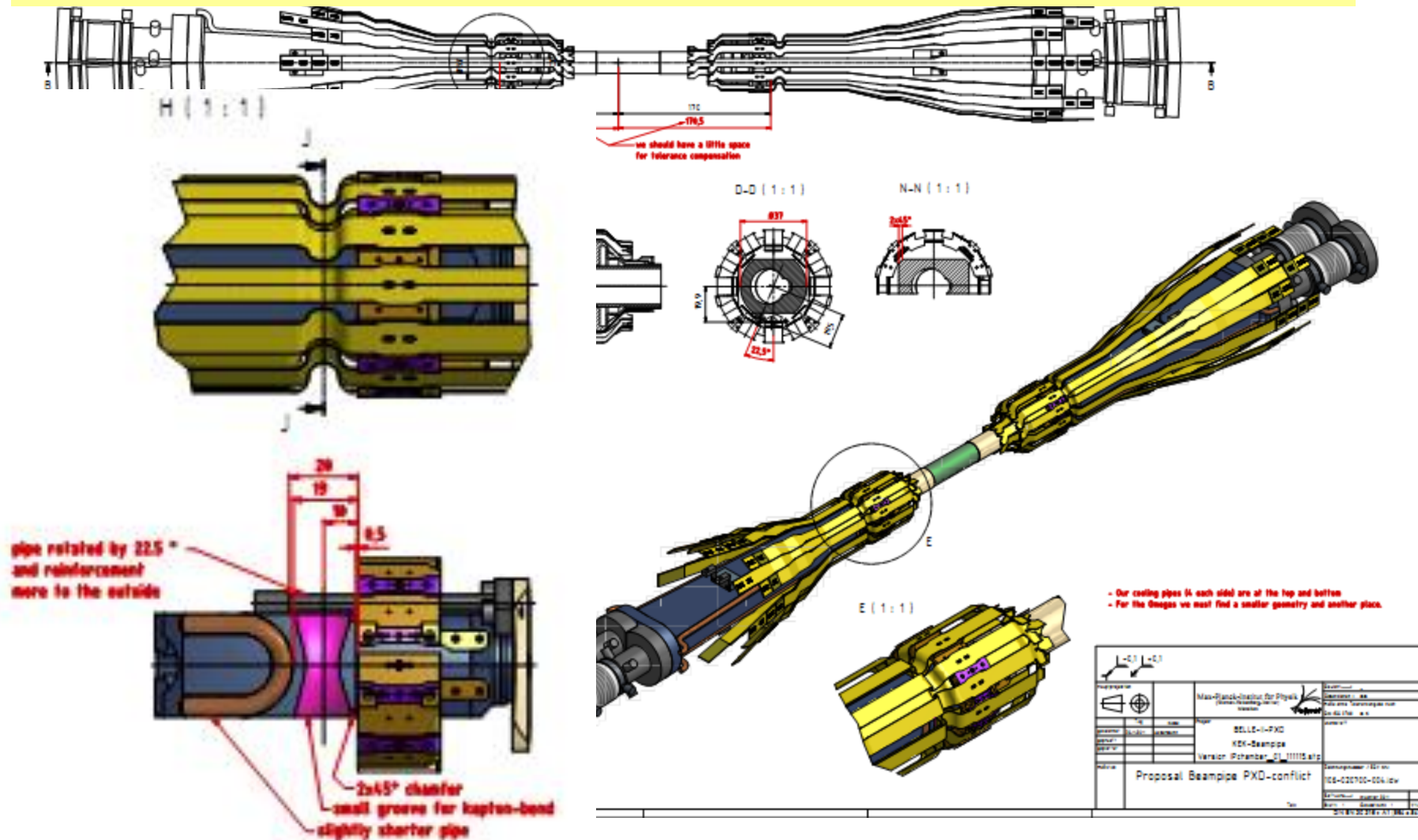
PXD request



Latest space request(Dec.) from PXD:

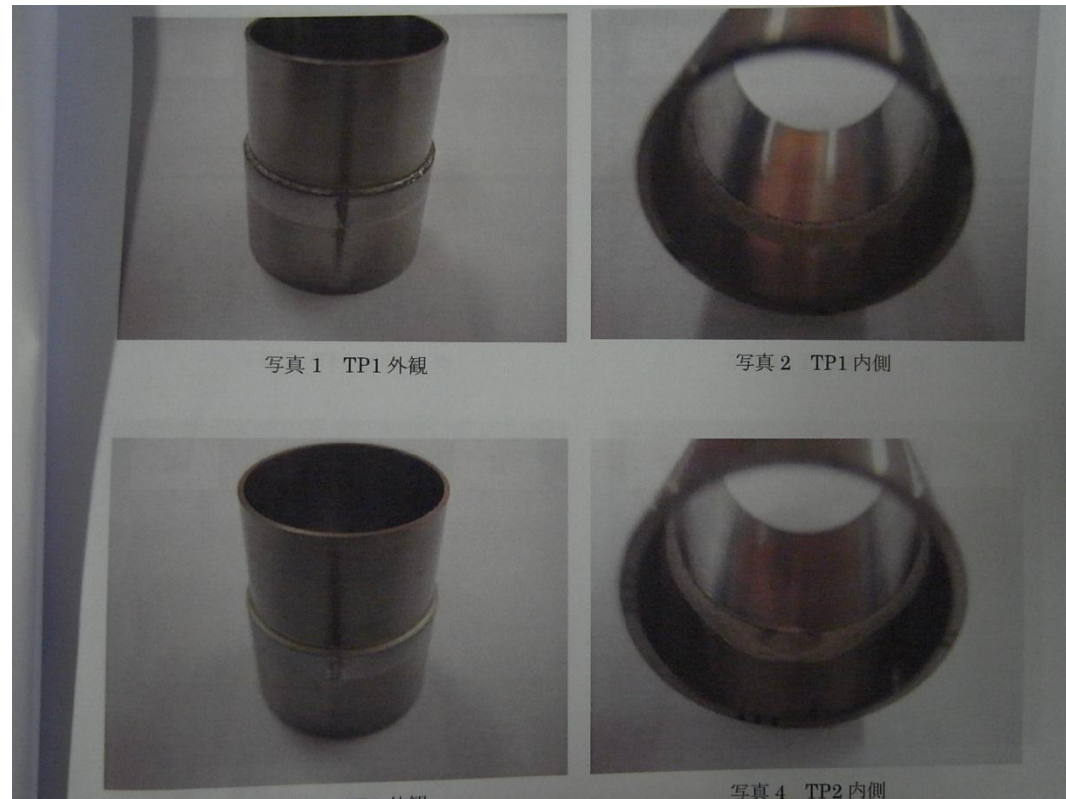
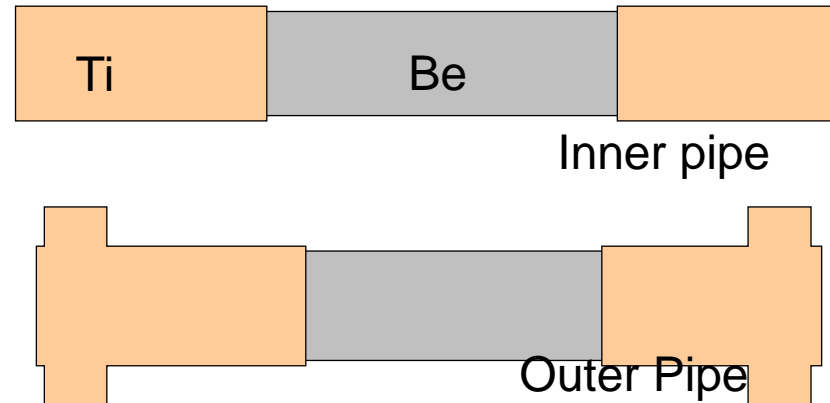
PXD group requested to make a space for Kapton flex and Omega.

We may cut the beam pipe for Kapton flex, however those region is critical to shield BG for PXD or SVD. We have enough time to discuss before production



IP chamber production(Be-Ti)

- The Brazing test between Titanium part and Beryllium part has been doing (leak test was OK).
- The mechanical stress test will be finished soon (before Mar).



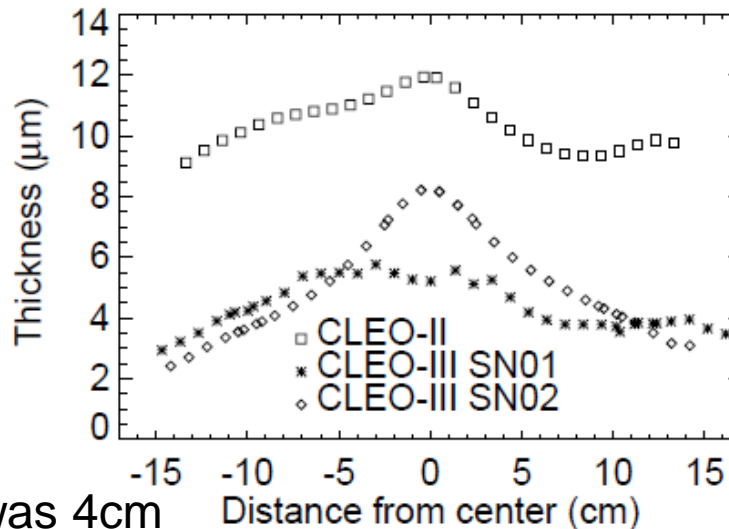
Au coating inside of IP chamber

Proceedings of the 1999 Particle Accelerator Conference, New York, 1999

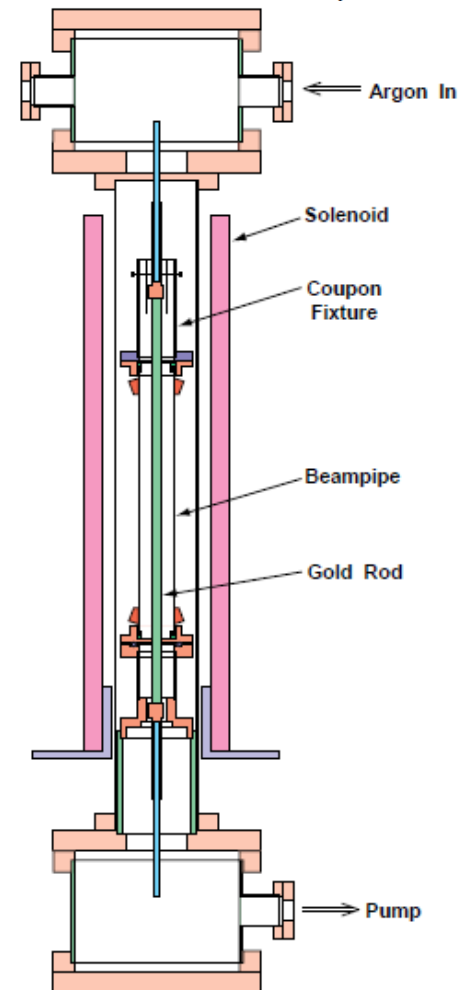
A METHOD FOR GOLD COATING EXPERIMENTAL DETECTOR BEAMPIPES*

S. Henderson[†], S. Roberts, Cornell University, Ithaca, NY

- The company, which performed Au coating, changed their policy not to use Be. Then we ask another company to produce dedicated sputtering system.
- Next fiscal year, we will try Au sputtering study using SUS pipe with CLEOII data.



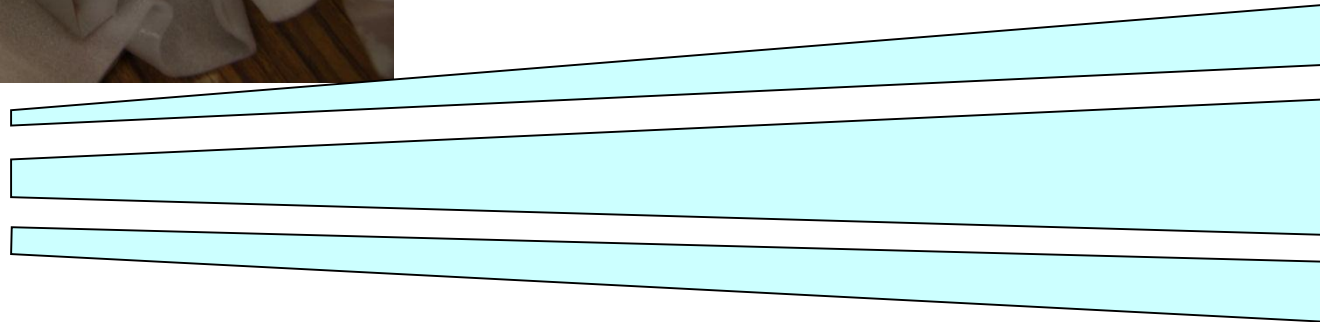
Pipe diameter was 4cm



Beam pipe (Crotch part)



Ridge shape to protect SR(x-ray)
from final focus magnet

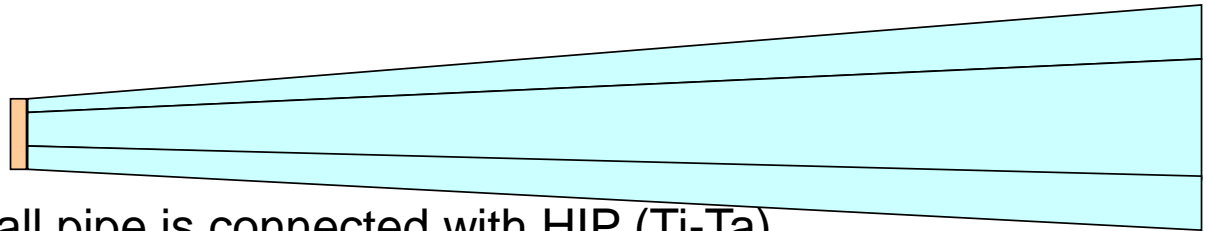
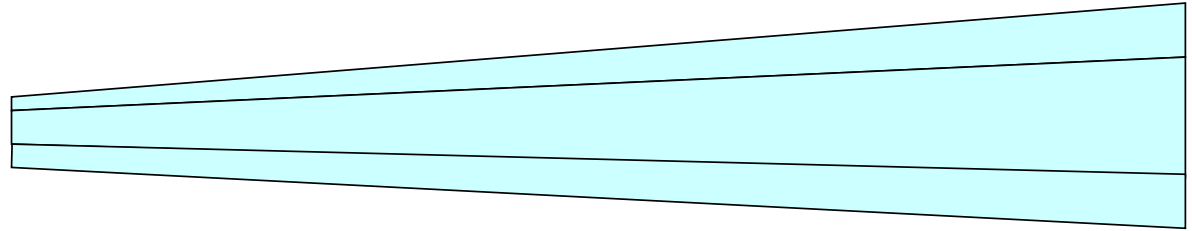


The crotch part (Tantalum) is divided into three pieces.
The inner pipe structure has made by drilling with 5-axis stage.
After then, those three pieces are joined by welding.

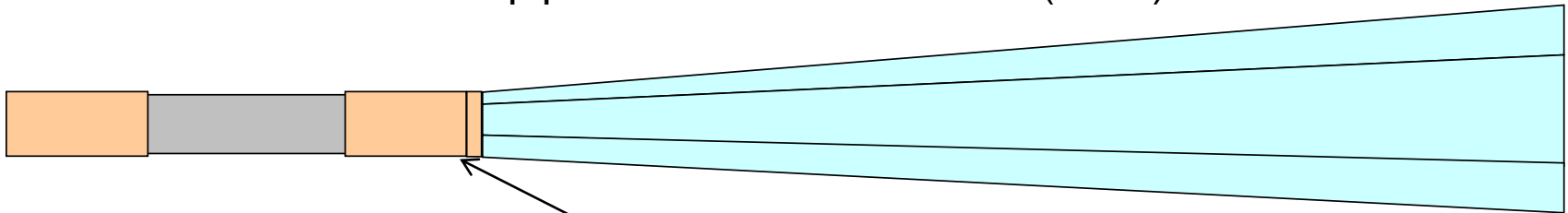
Drilling test : finished

Material for 1st version has ordered

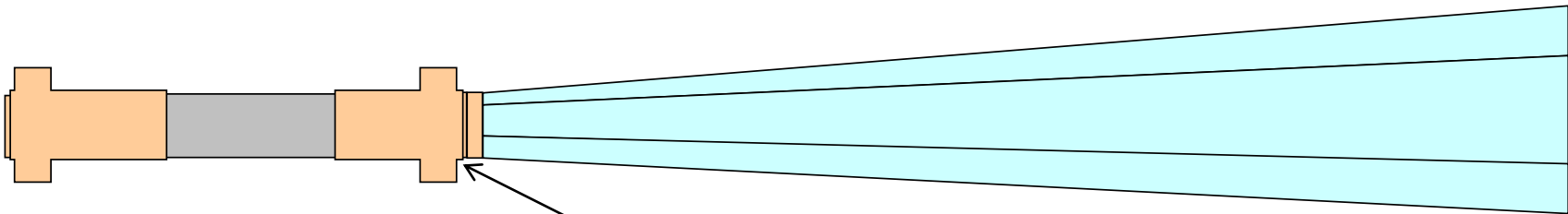
Beam pipe production



Ti small pipe is connected with HIP (Ti-Ta)



IP chamber(inner) is connected with welding (Ti-Ti)



Outer pipe of IP chamber and inner pipe are connected by EBW

Connectivity test(Ti-Ta)

Ti-Ta HIF接合予備試験(引張試験結果)

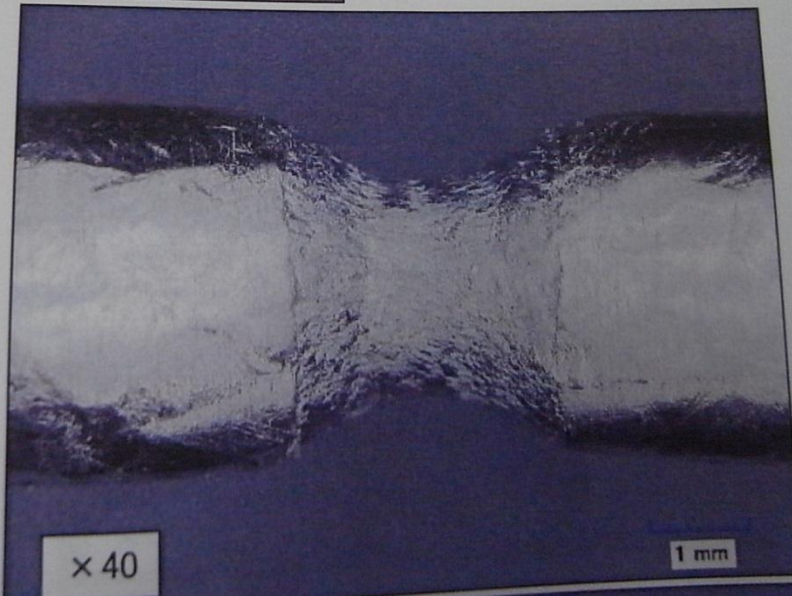
添付資料

3. 引張試験結果詳細

試験片①



直径	3.99 mm
断面積	12.5 mm ²
最大荷重	4335 N
最大応力	347 MPa



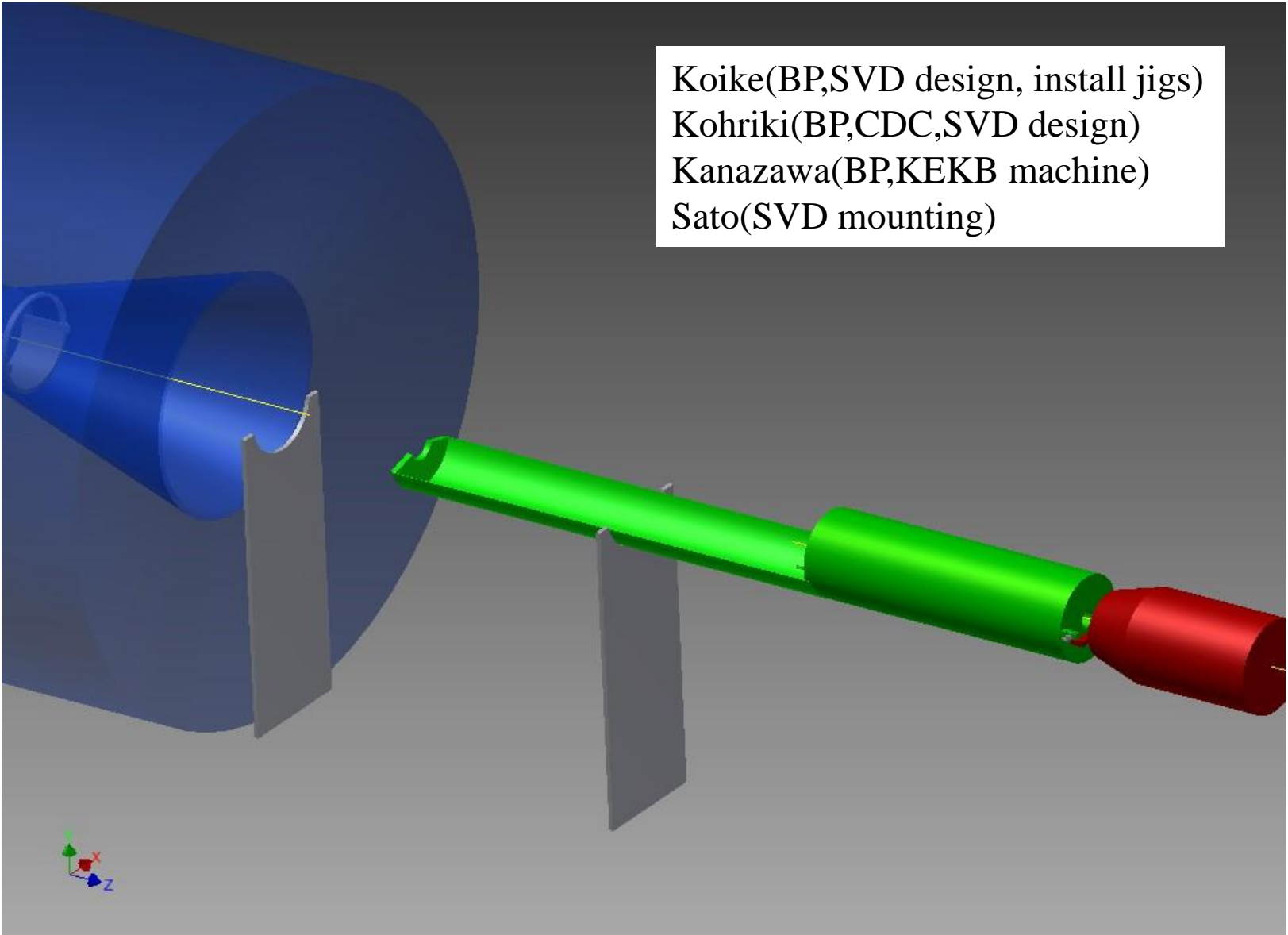
温度昇圧
20°C
100MPa
10min



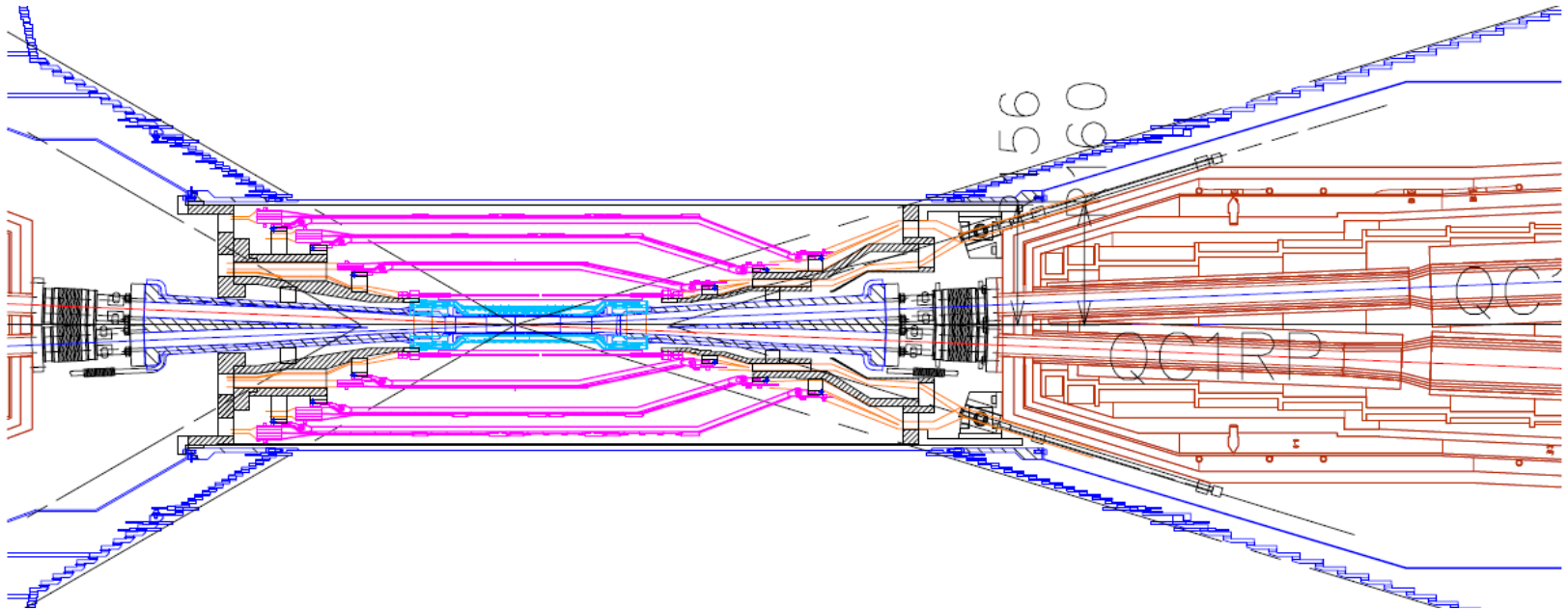
Pre-test has finished
Final test with pipe structure will be finished
Before the end of March

Vertex detector installation

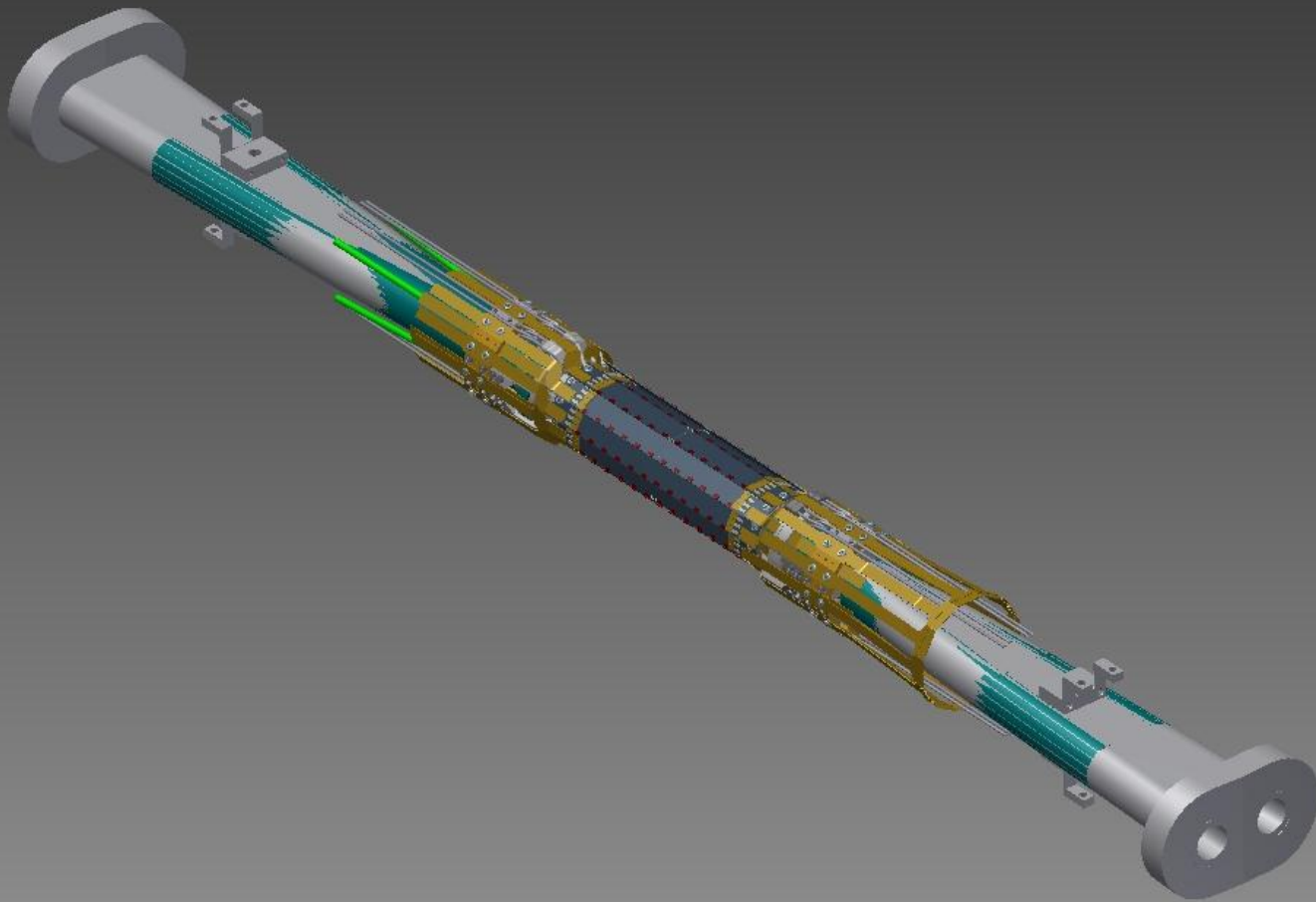
Koike(BP,SVD design, install jigs)
Kohriki(BP,CDC,SVD design)
Kanazawa(BP,KEKB machine)
Sato(SVD mounting)



Simple Installation test



- Almost all mock-up components will be produced before the end of Mar. (including CDC inner cylinder and CDC inner structure mock-up)



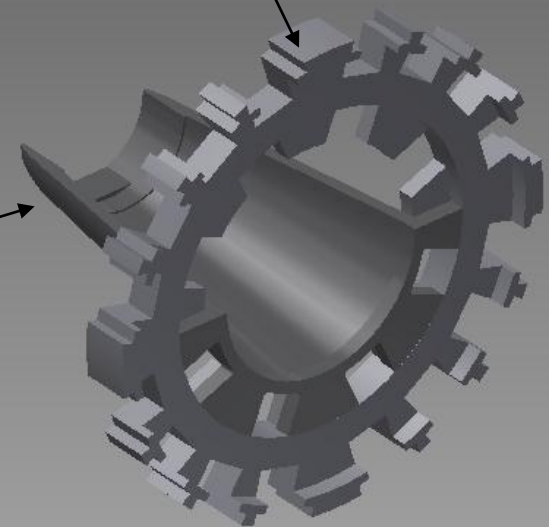
Beam pipe have been already produced(KEK and MPI)

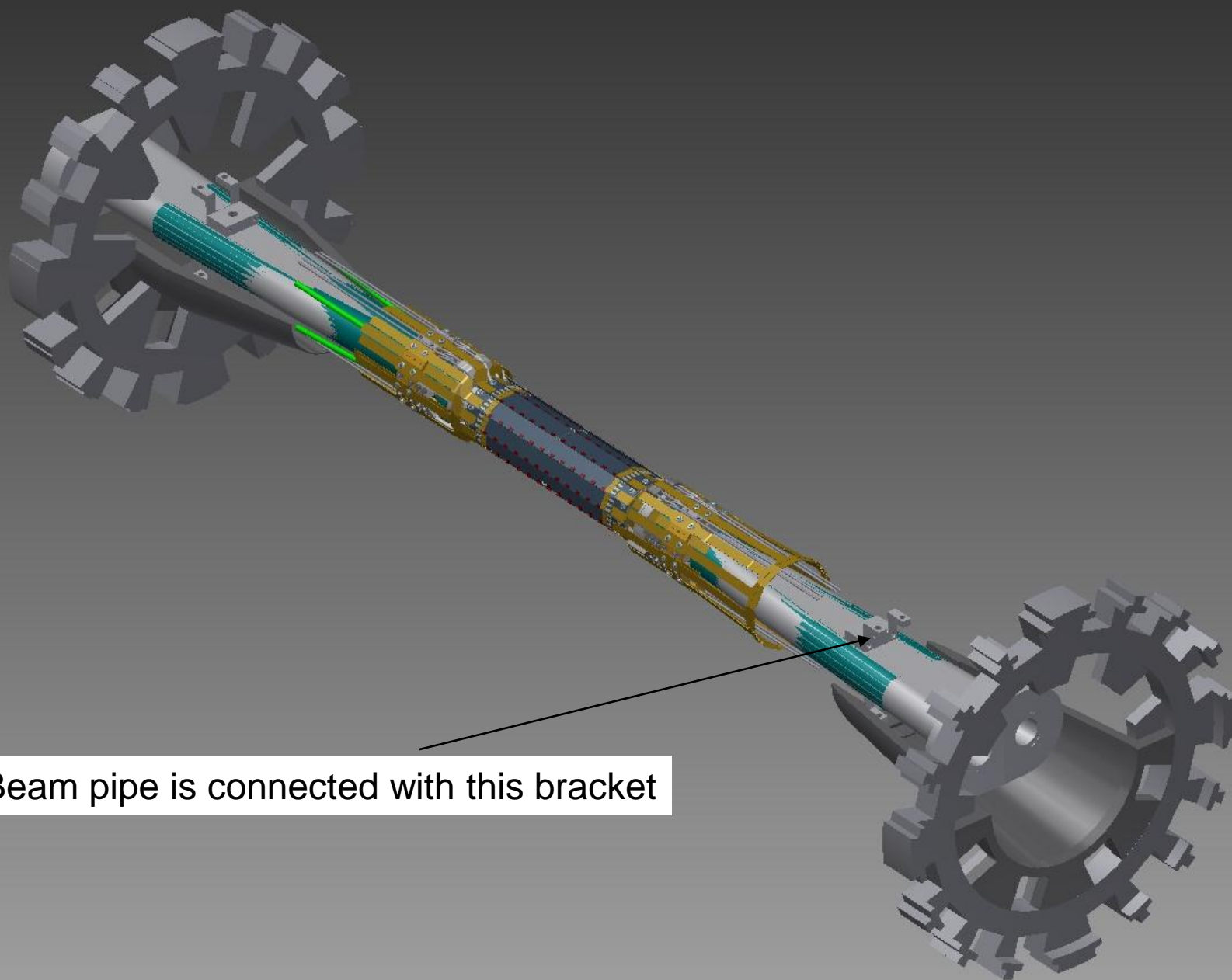




SVD end flange

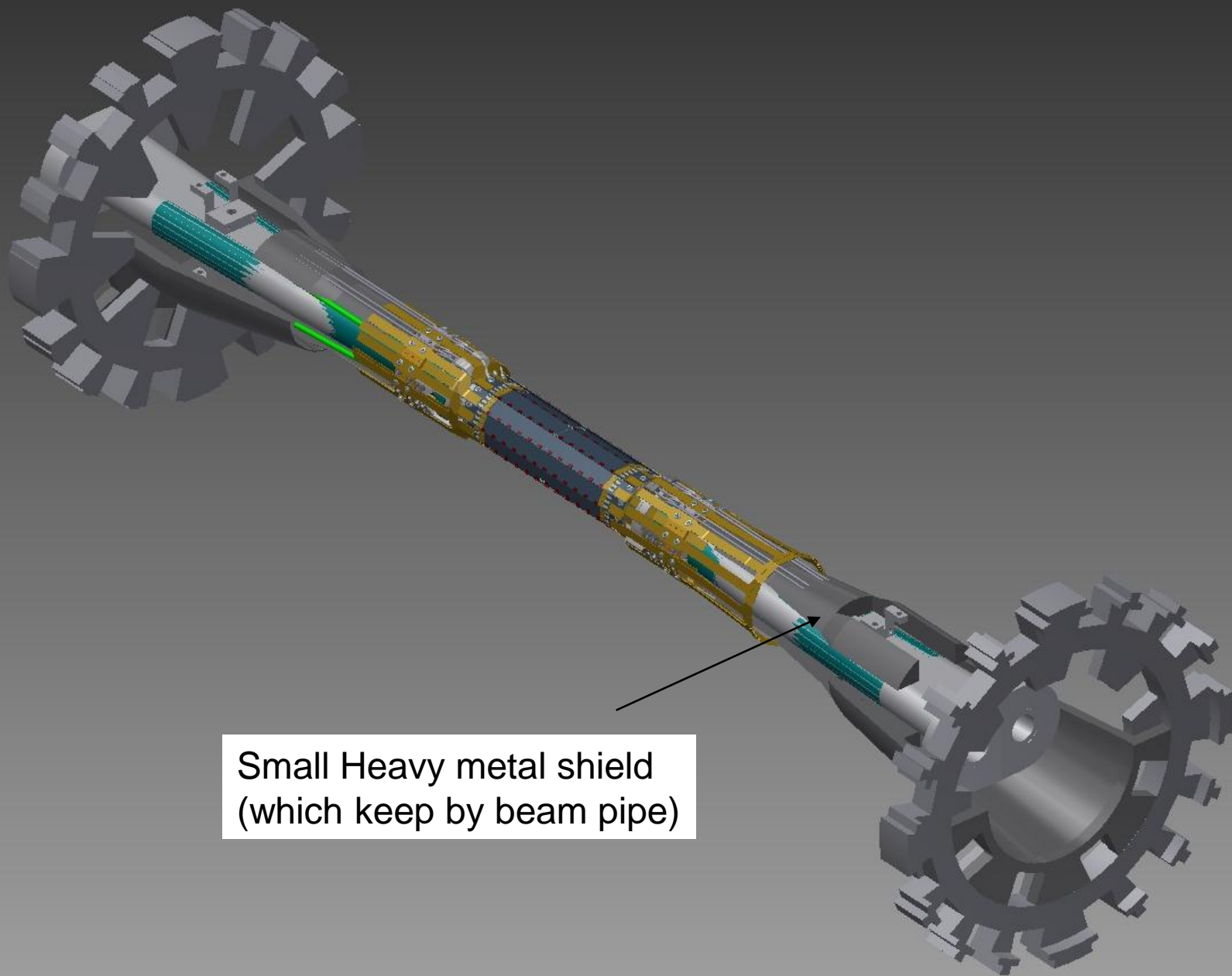
Heavy metal shield





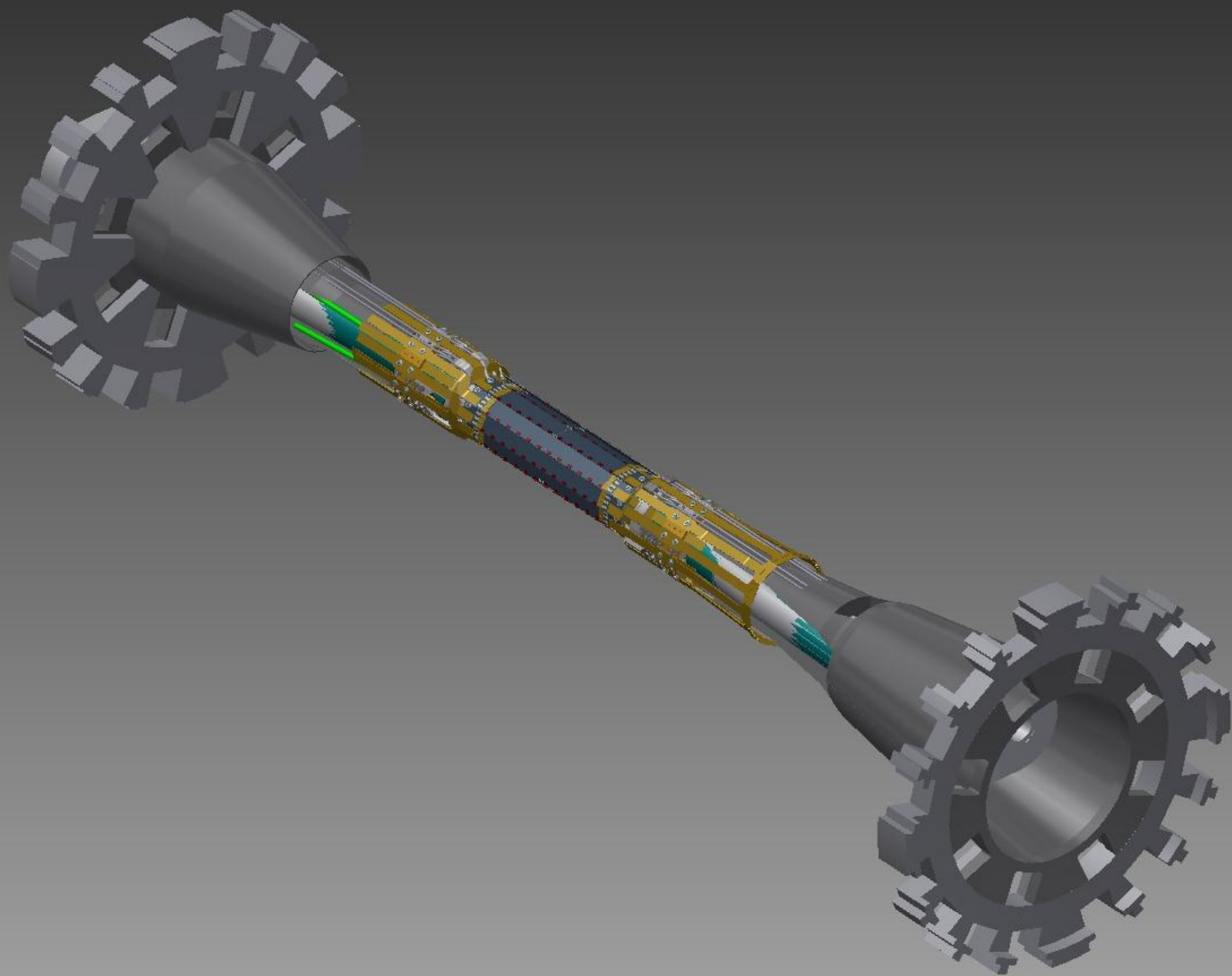
Beam pipe is connected with this bracket

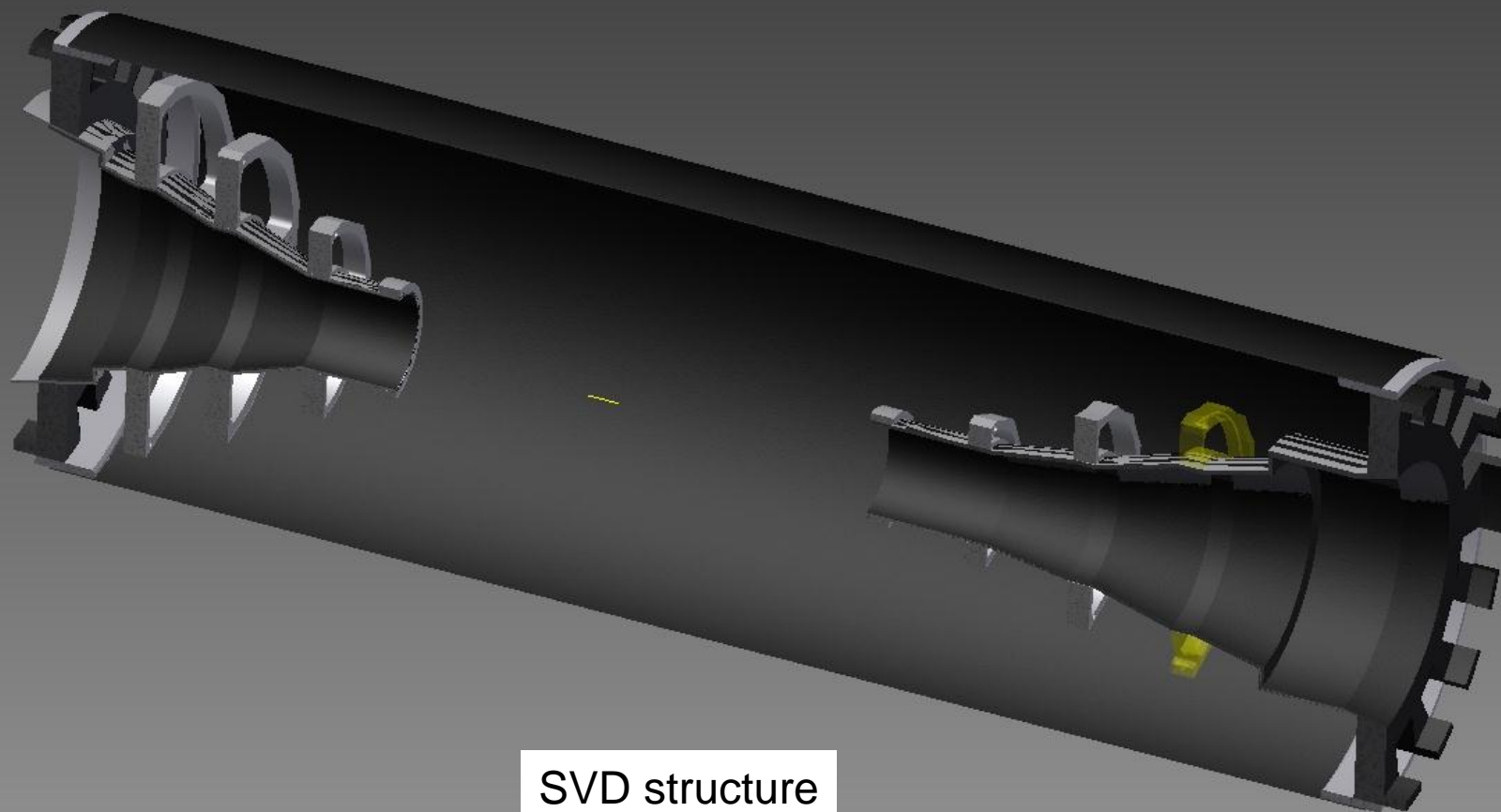




Small Heavy metal shield
(which keep by beam pipe)

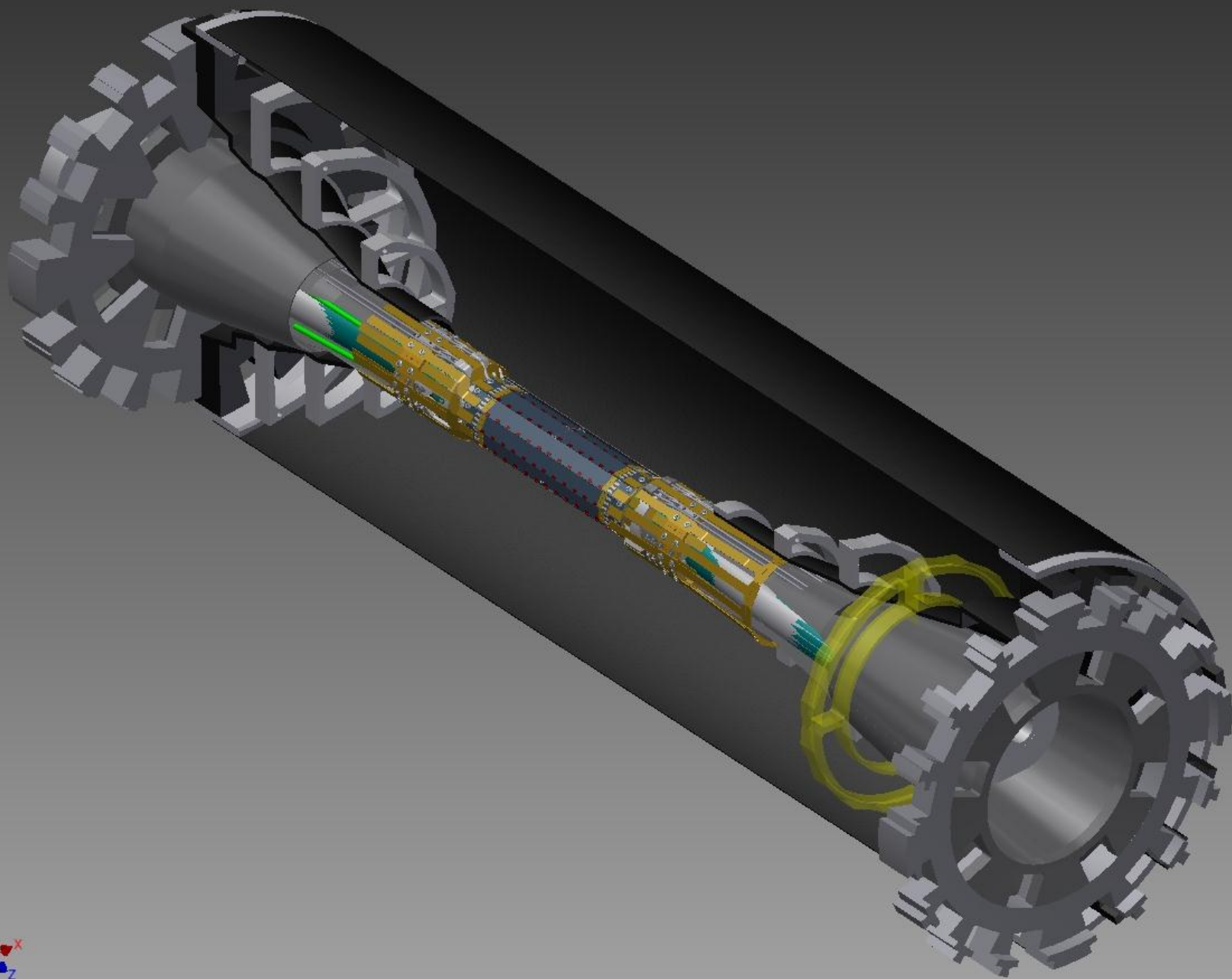


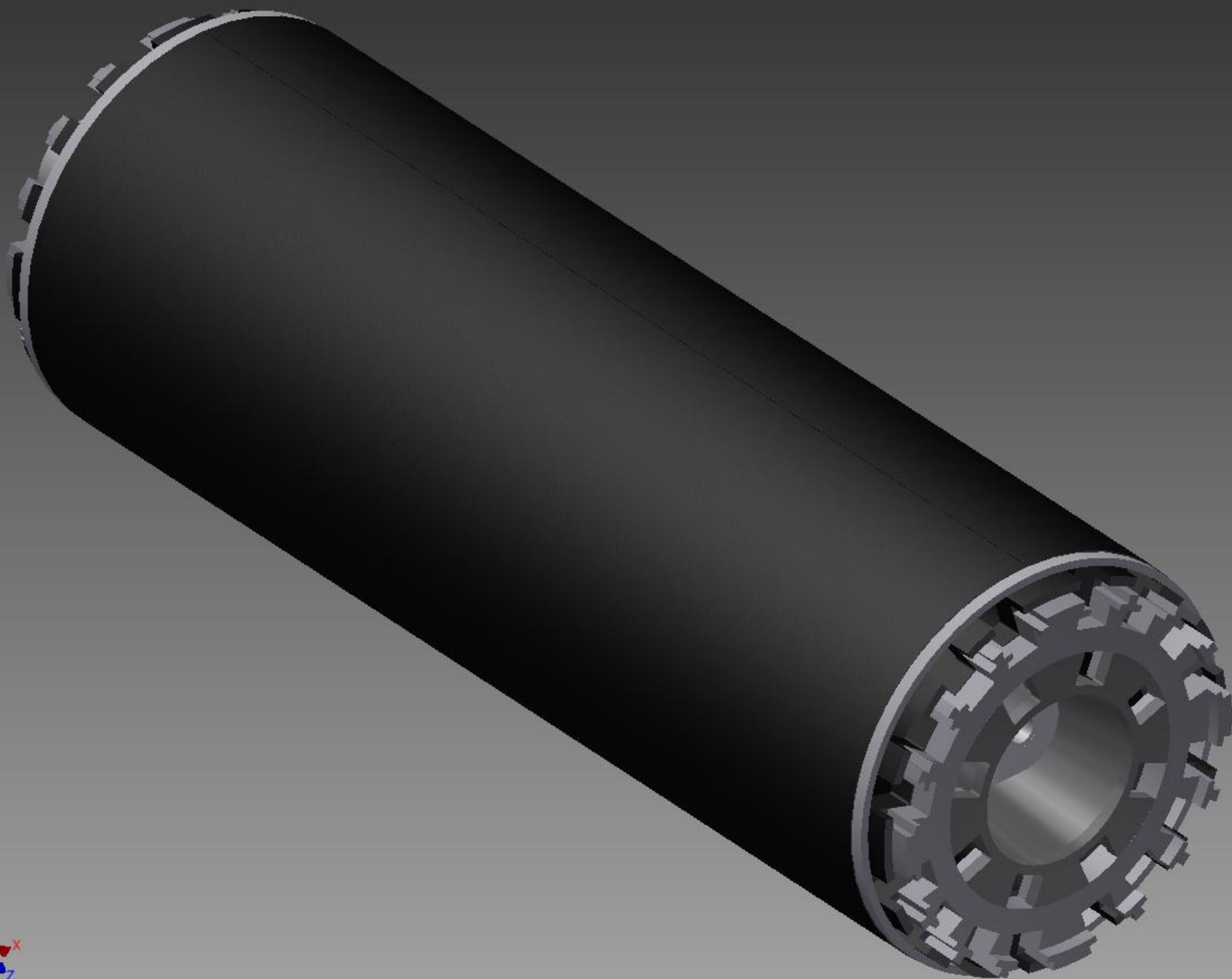


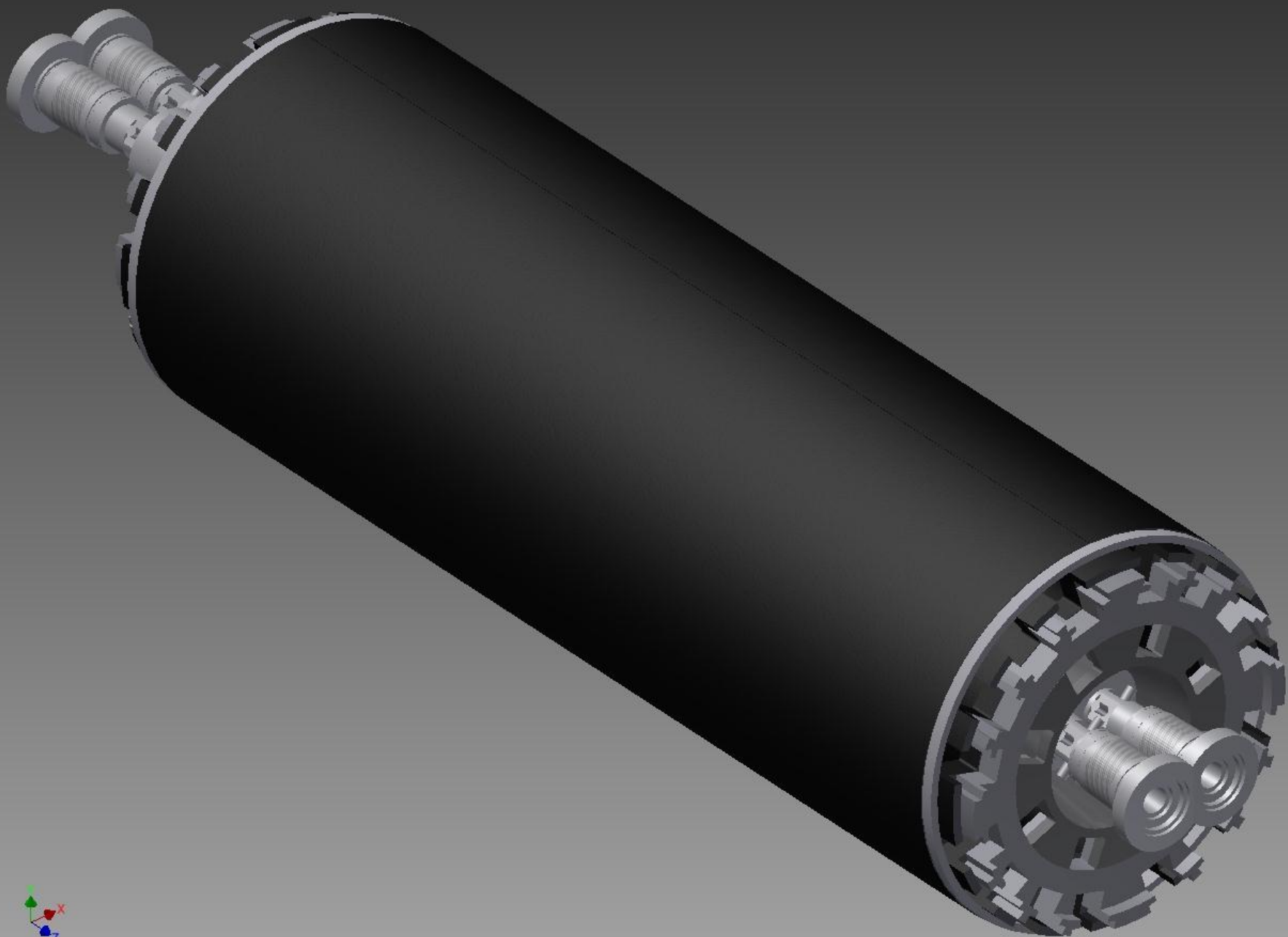


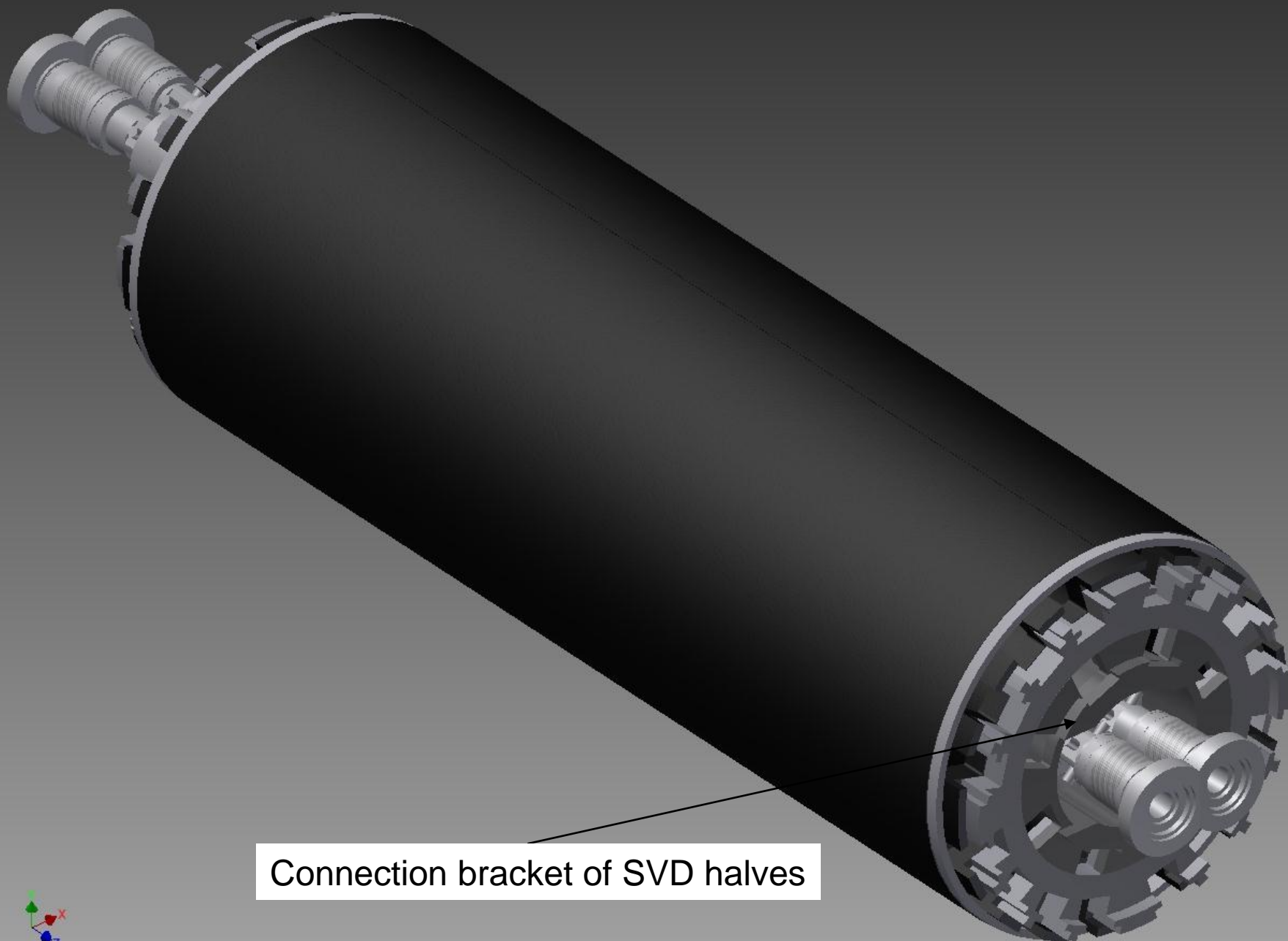
SVD structure









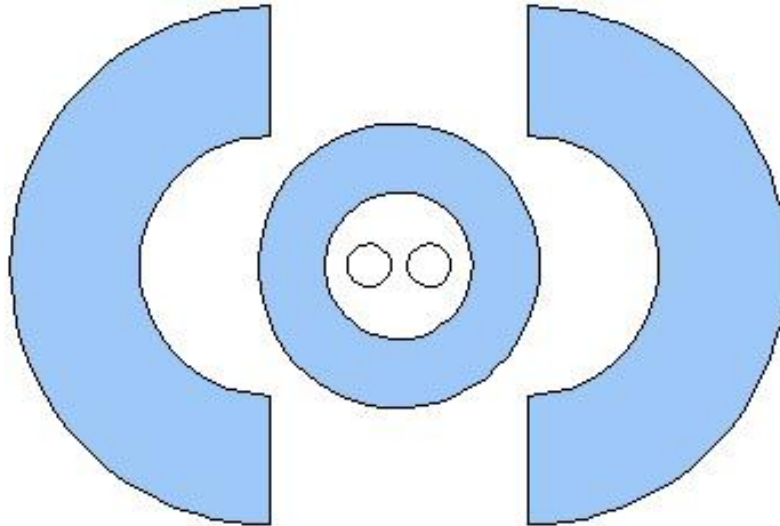


Connection bracket of SVD halves

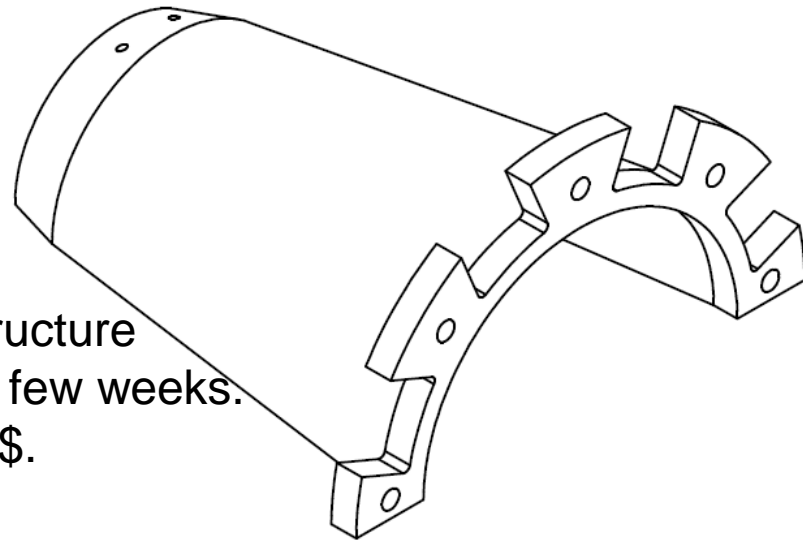


End flange

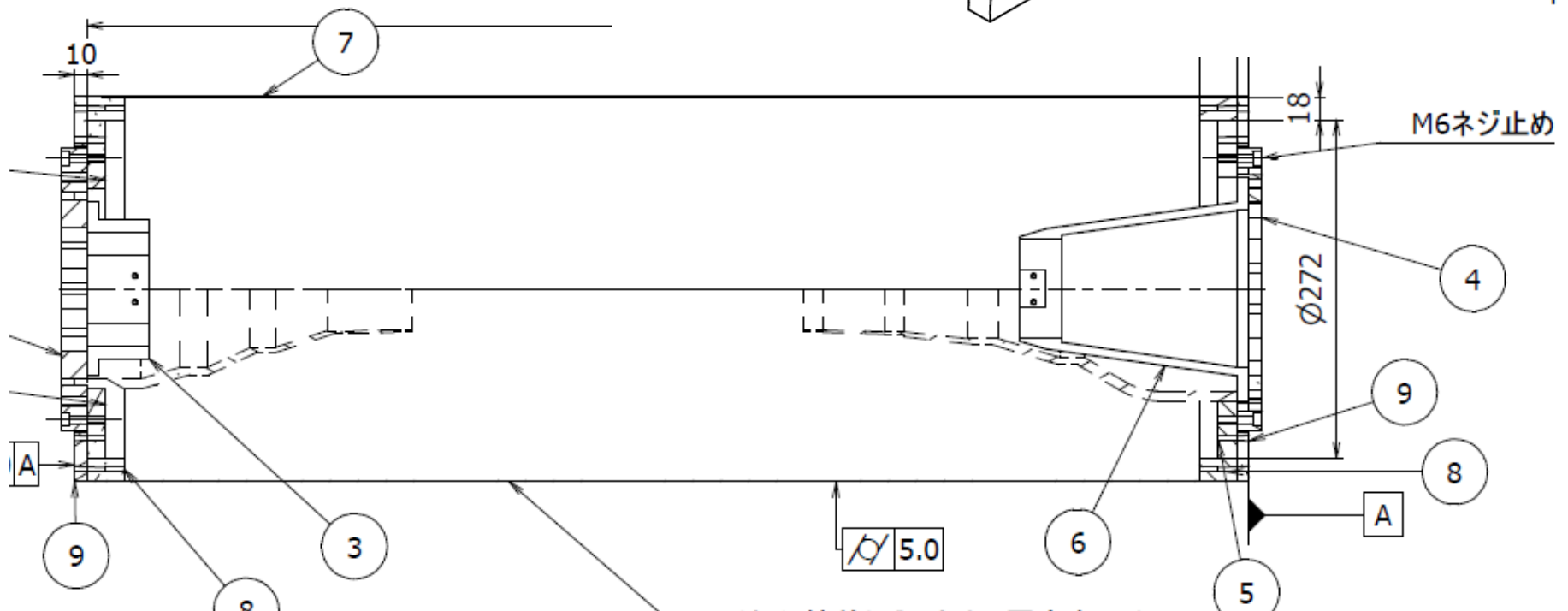
- SVD flange should take care for SVD cables and pipes.
- BP flange should take care for BP, PXD and shield support
- This two components will be assemblies, independently.



Beam pipe is keep by this shield structure
 SUS mock up will be produced in a few weeks.
 The cost of HM ver, is around 6000\$.



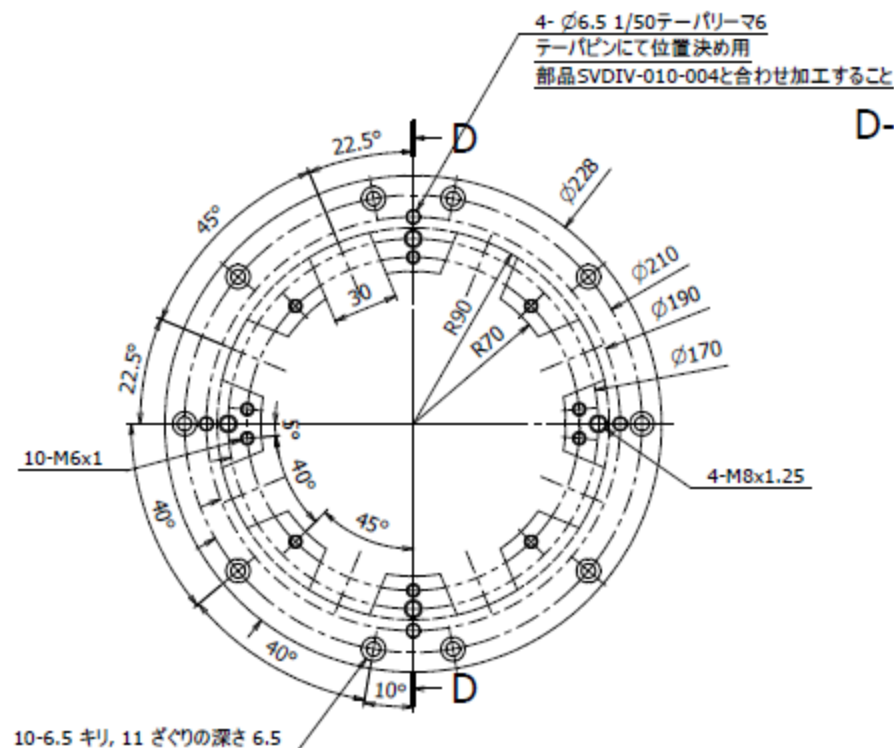
FW



The shield is fixed by the end-flange

Beam pipe end-flange

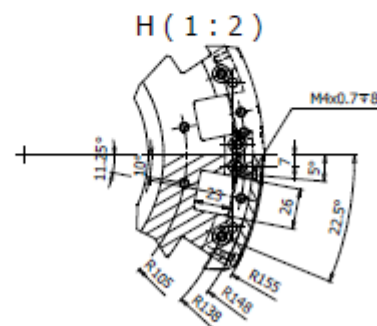
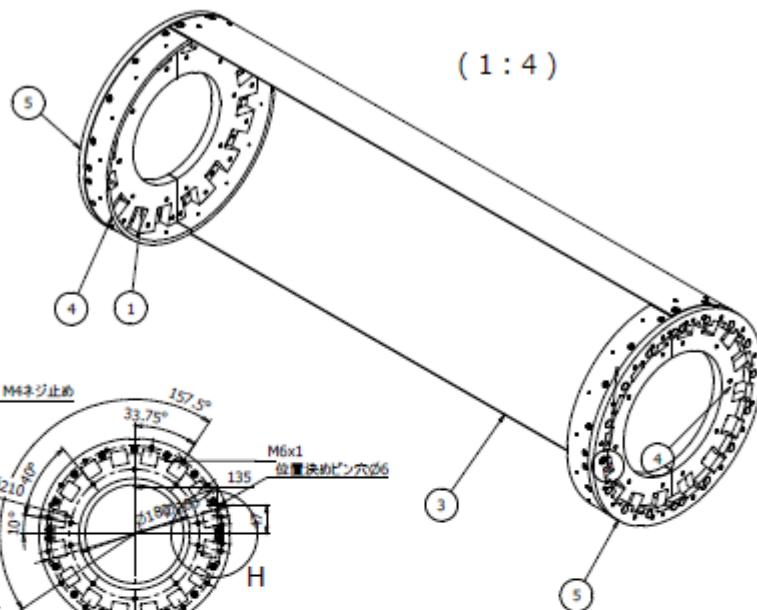
D-D (1 : 2)




注: 指示なき公差はJIS精級による
指示なきコーナーRは0.1以下、面取りは0.2以下とする

部品表					
項目	項目数	部品番号	説明	材料	質量
1	1	SVD-ESP-FW-002_mock		A5052	0.92

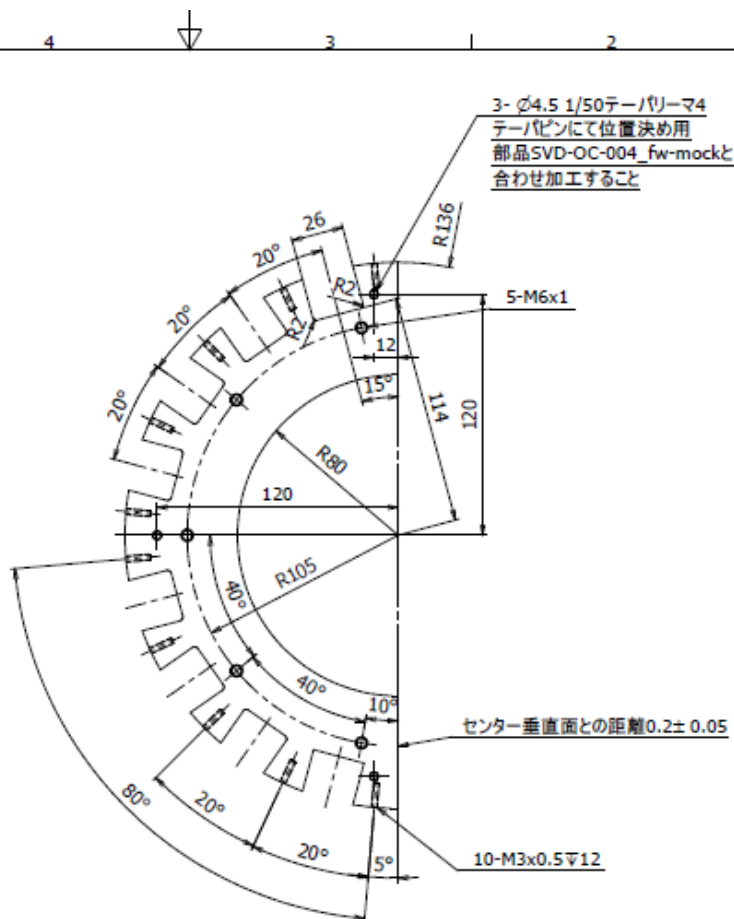
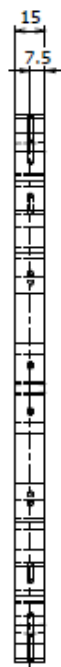
改正									
改正2		番号	名称	材質	包	合計	備考		
改正1		設計	製造	検査	承認	尺度	図名	BelleII SVD mock up	
日付	2011/12/14	koike	koike			1 : 1	図番	SVD-ESP-FW-002_mock	
高エネルギー加速器研究機構 機械工学センター								SVD-OC-mock-01_005	8/18
									A3



		部品表			
	項目数	部品番号	説明	材料	質量
A	1	SVD-BW-001-1_mock		A5052	0.68
	2	SVD-FW-002-1_mock		A5052	0.58
	3	SVD-OC-001-2_mock		A5052	1.19
	4	SVD-OC-002_FR_mock		A5052	0.3
	5	SVD-OC-004_fw_mock		A5052	0.47

申込	SVD-OC-01_mock						1	
品名	部号	名称				材質	／部・合計 数量	備考
品目	型番	規格	単位	数量	計数	図名	BelleII Syd mock up	
日付	2015/12/23	kaike	kaike		1 / 5	図番	SVDIV-10-00_004	A/B
 高エネルギー加速器研究機構 構造工学センター								

D



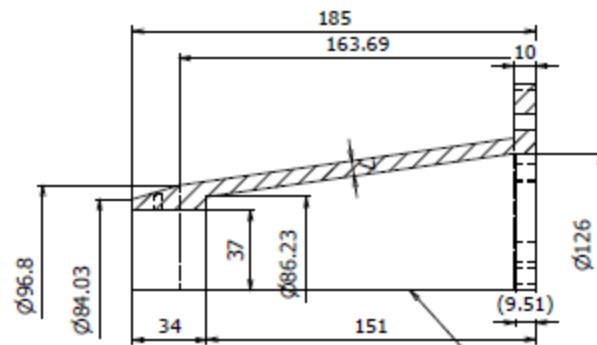
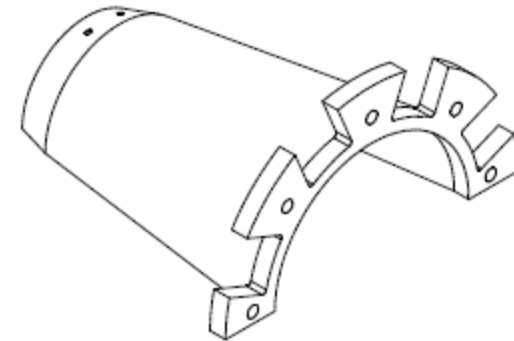
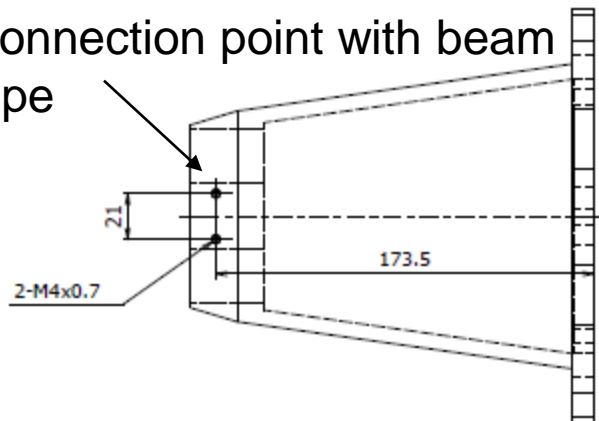
注:指示なき公差はJIS精級による
指示なきコーナーRは0.1以下、面取りは0.2以下とする

部品表					
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1	2	SVD-BW-001-1 mock		A5052	0.58

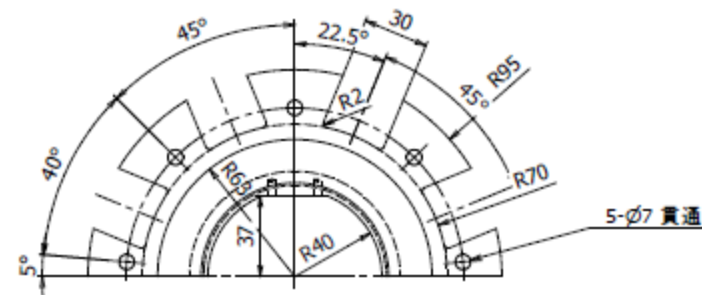
[illegible]

Heavy Metal shield

Connection point with beam pipe



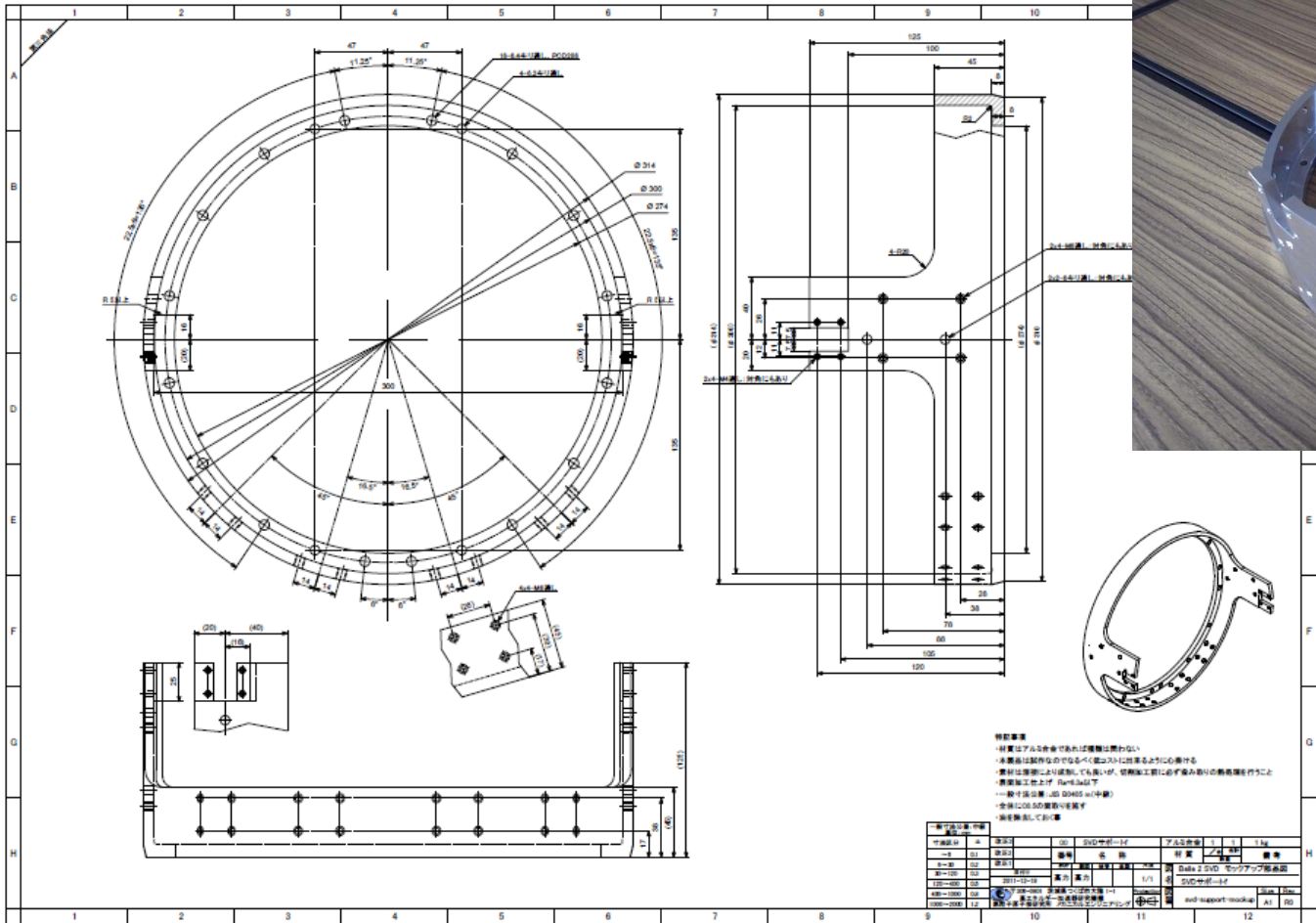
分割して製作する場合は分割幅は0.5mm以下のこと

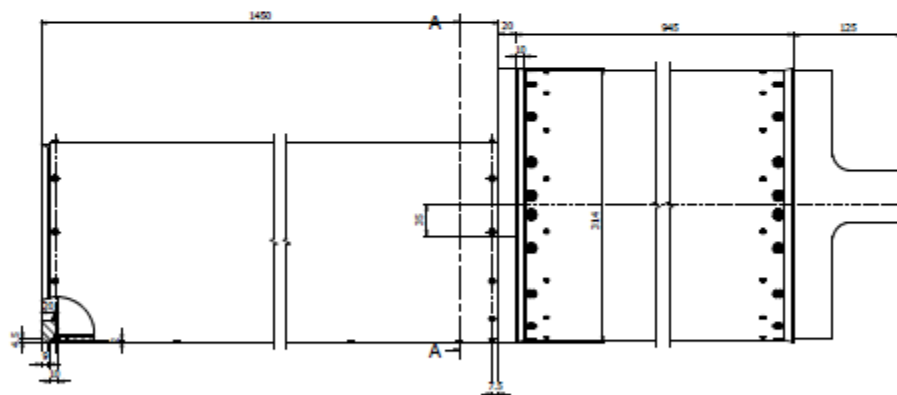
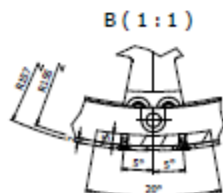
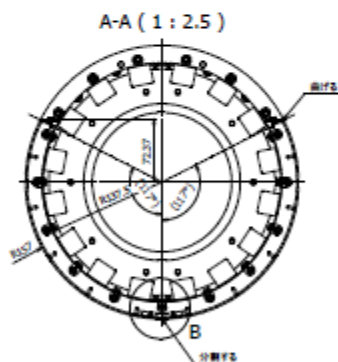
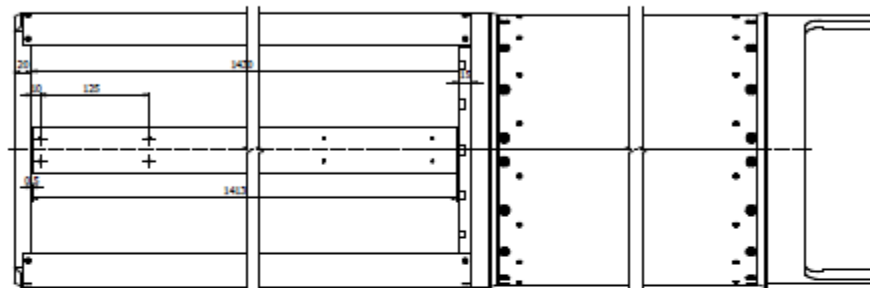


部品表					
項目	項目数	部品番号	説明	材料	質量
1	2	SVD-FW-003		HeavyMetal-IT180	4.64

改正									
改正2		番号	名称	材質	包	合計	備考		
改正1		設計	製造	検査	承認	尺度	図名	Belle_SVD_Shield	
日付	2011/12/01	koike	koike			1:2	図番	SVD-FW-003	
高エネルギー加速器研究機構 機械工学センター								SVDIV_Shield_002	2/8
									A3

SVD support flange



[illegible]

Summary of KEK group status

KEK group are preparing mock ups for simple installation test.

Beam pipe (+PXD mount): done (KEK and MPI)

QCS structure: done

Heavy metal shield:

SVD end flange (for SVD and beam pipe each):

SVD support ring: done

SVD outer cover:

CDC inner structure(between QCS and CDC):

CDC inner cylinder:

All of parts will be produced before the end of this March.

Then we will start studying installation procedure. After checking each parts, we will produce one more set of Heavy metal shield(by AI) and beam pipe end flange, then send those to MPI.

(PXD assemble check can be started from around this May or June at MPI.)

- After our installation test, those parts may use for mechanics check or cooling test(Where and how?).
- The final mock up (the target is the end of this year) will be produced including feedback or requirements from cooling or mechanics community.

Vertex detector assembly scenario

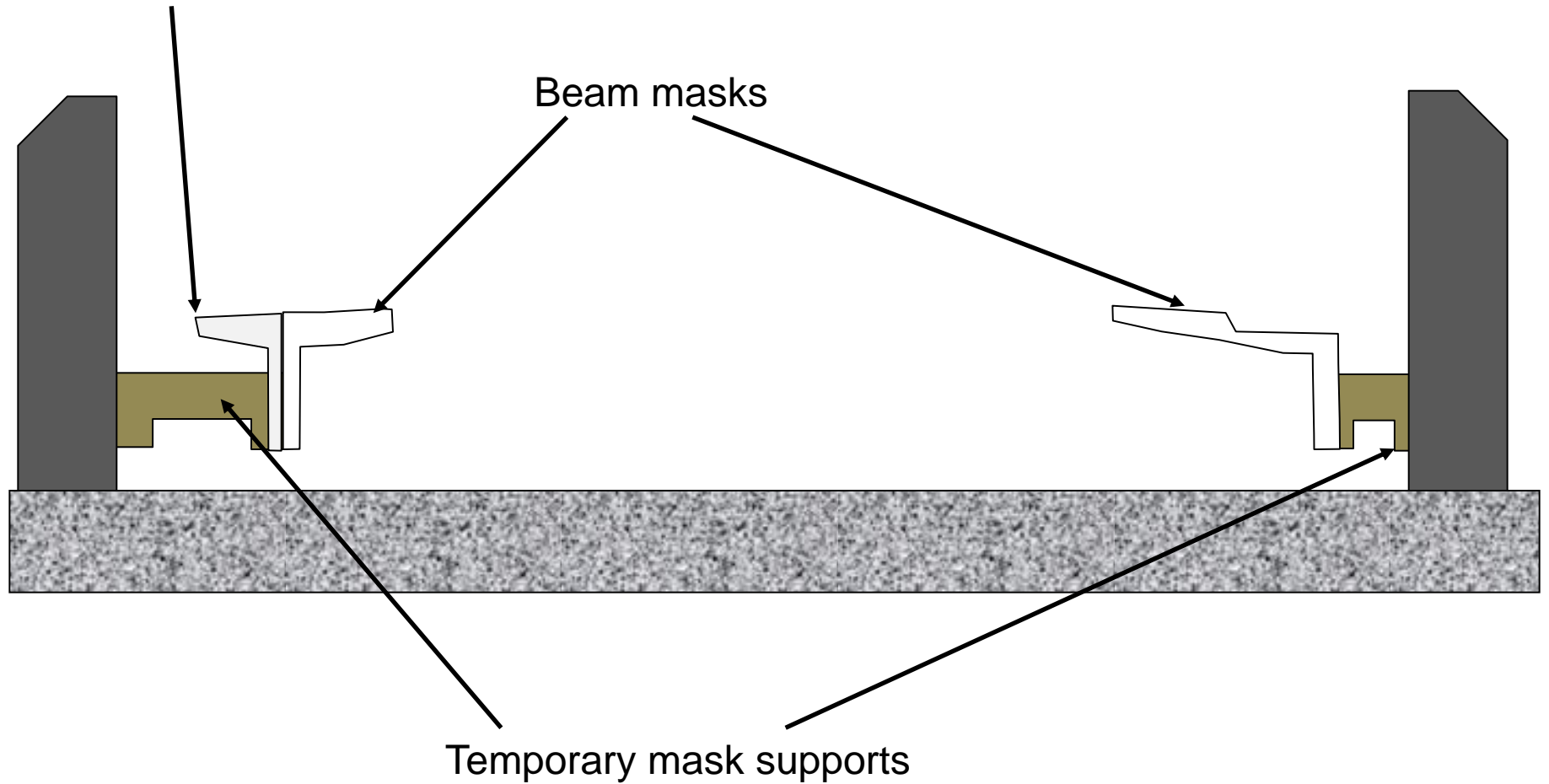
Back up material

Half Mask

Beam pipe positioner made of the heavy metal

Beam masks

Temporary mask supports



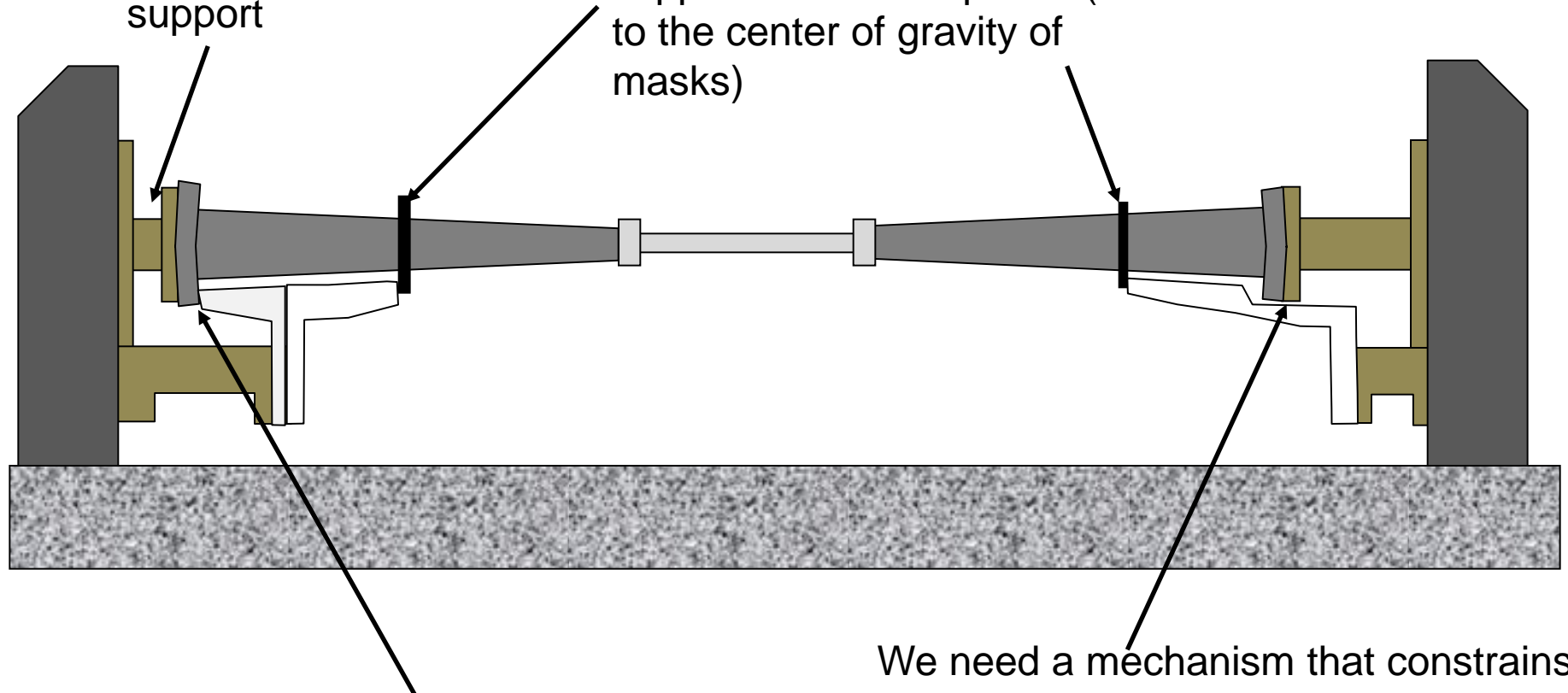
Beam pipe

Beam pipe
temporary
support

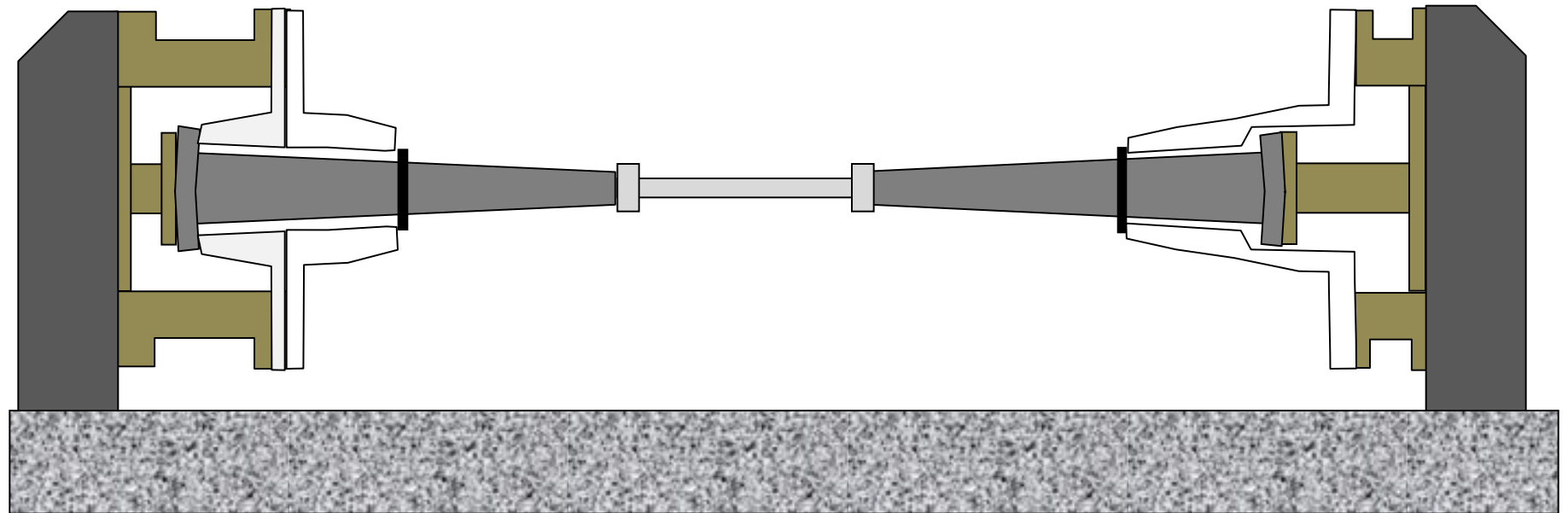
The mass of the masks are
supported at these points (close
to the center of gravity of
masks)

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 - ϕ position of the beam pipe while
allowing a slide in the Z direction.
Otherwise, the PXD position can not
be defined.



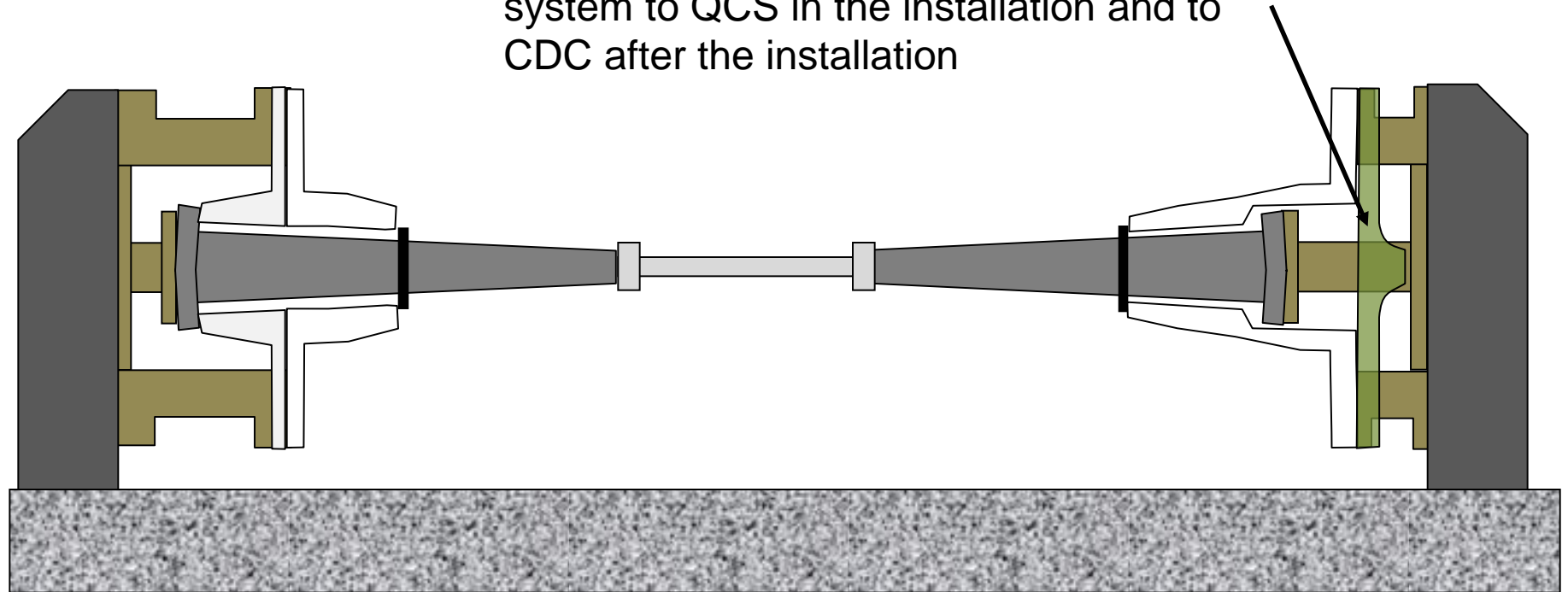
Mask2



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

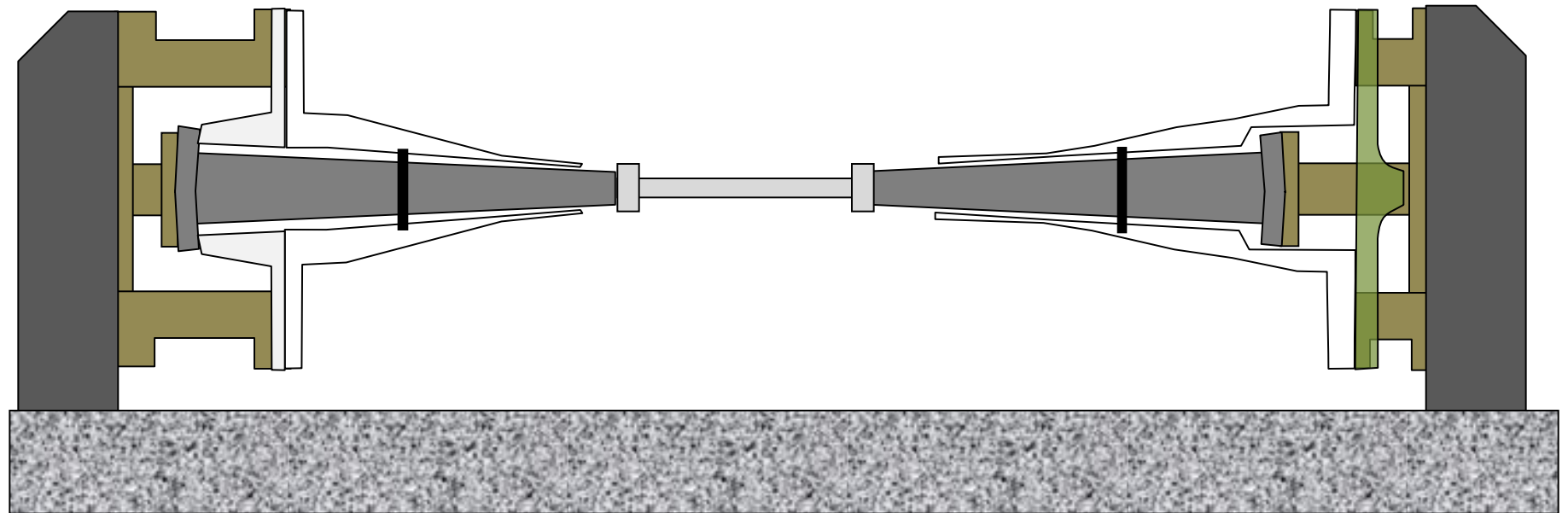
Support flange

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.

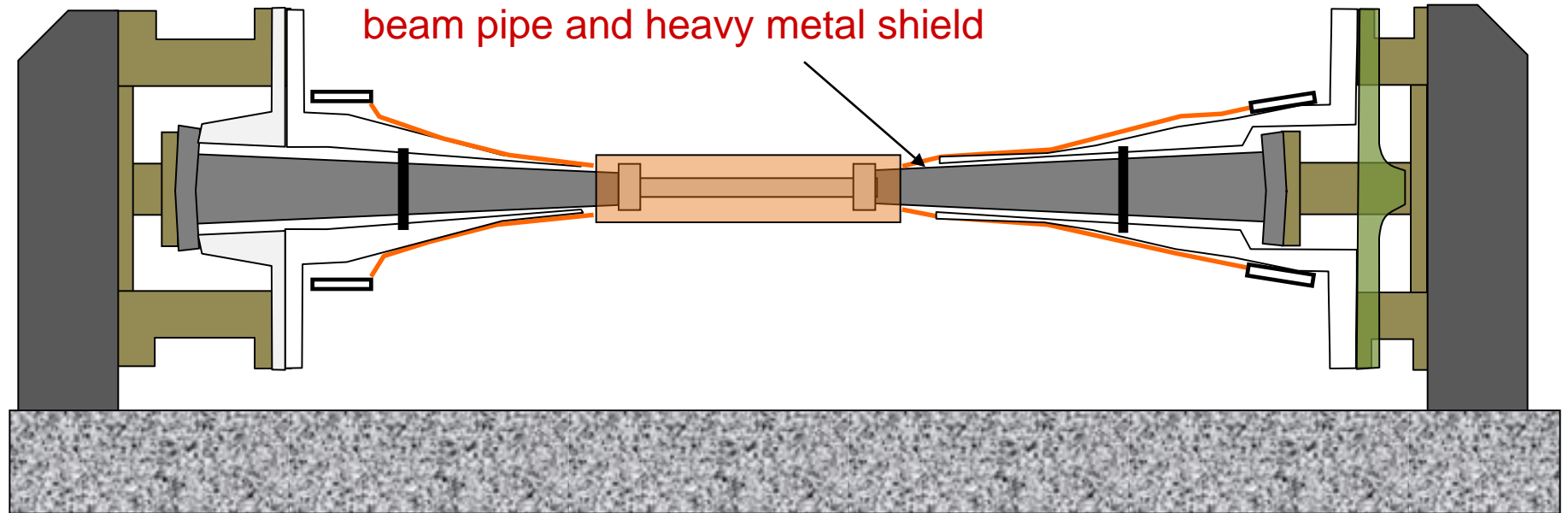
Masks are completed



The heavy metal masks are completed.

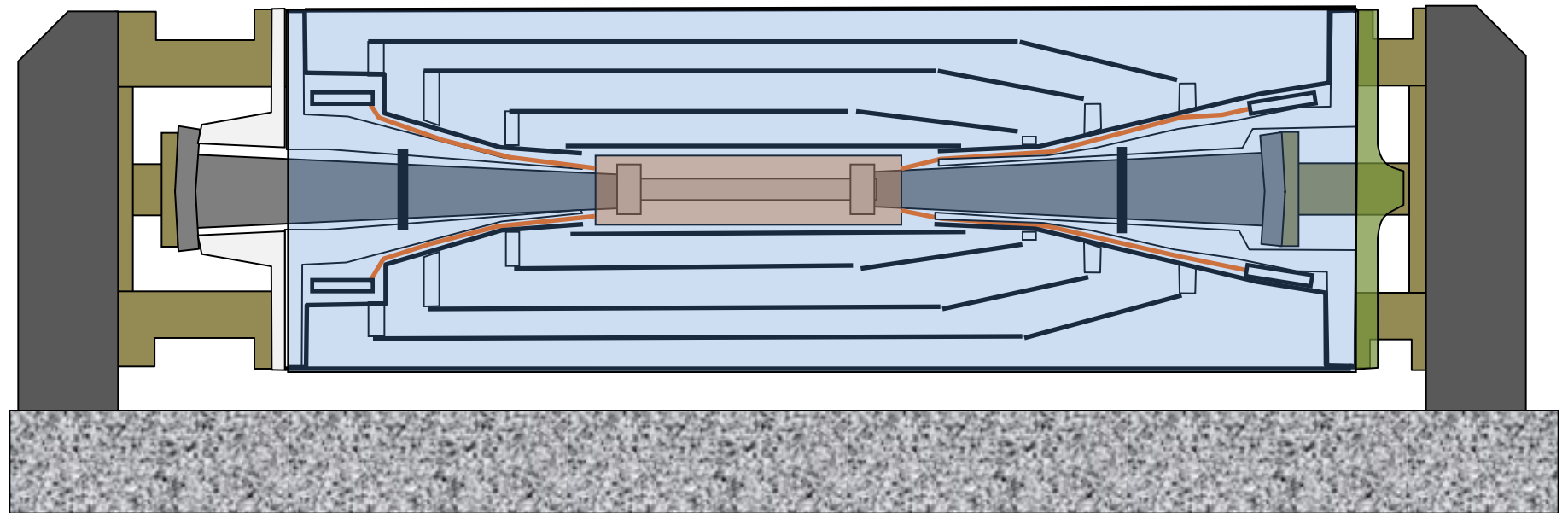
PXD

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.