

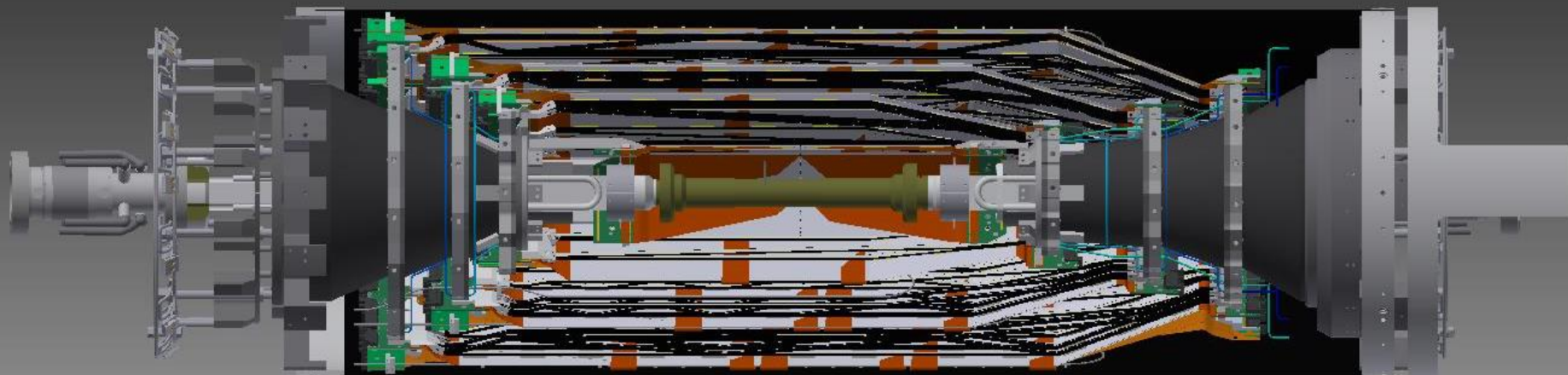
# Interaction region status

S.Tanaka (KEK)

7th Belle II VXD Workshop and 18th International  
Workshop on DEPFET Detectors and Applications

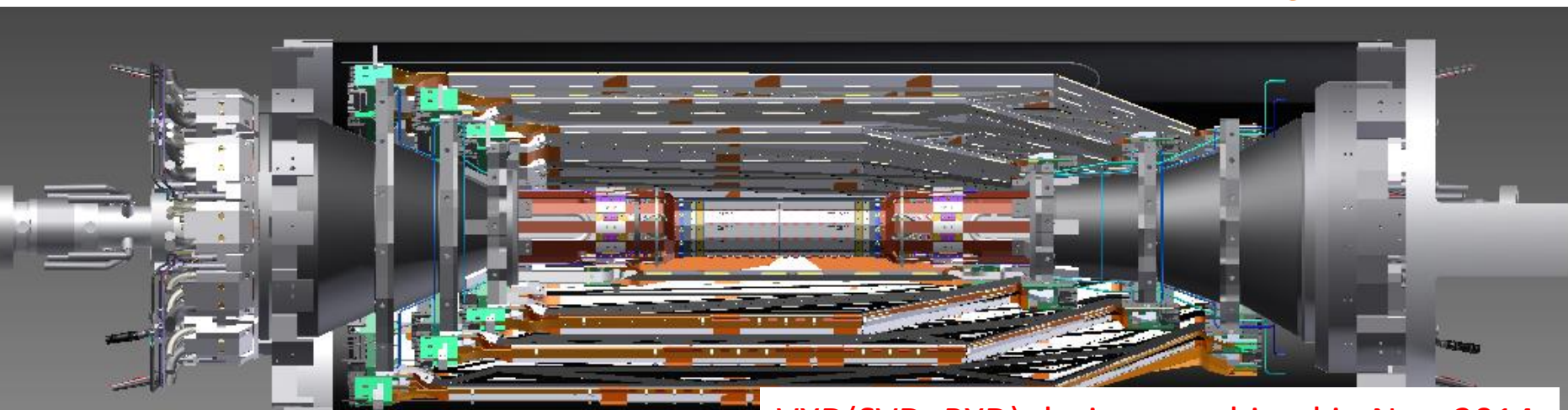
# VXD design

- 2014 summer: SVD + VXD mechanics -> SVDRev.2.2 released



[https://belle2.cc.kek.jp/svn/groups/vxd\\_mechanics/pxd/STEP-Export/VXD/](https://belle2.cc.kek.jp/svn/groups/vxd_mechanics/pxd/STEP-Export/VXD/)

- 2014 Nov SVD.Rev.2.2+PXD -> first VXD combined design released



VXD(SVD+PXD) design: combined in Nov. 2014

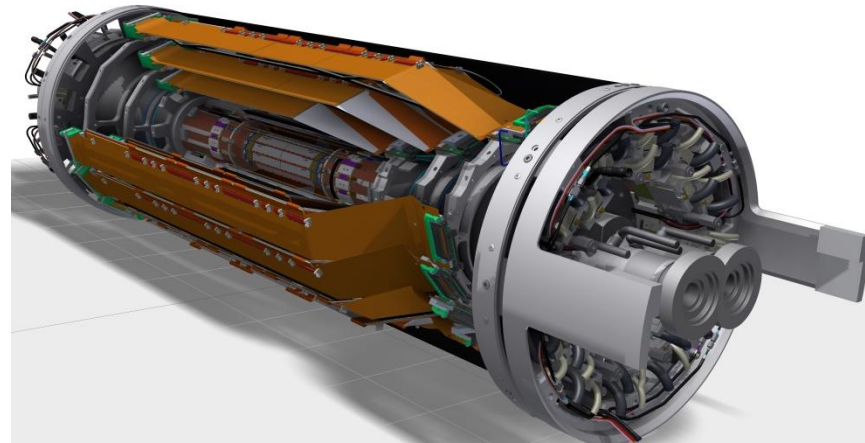
# VXD mechanics status

- The tasks of VXD design , parts preparation and their tests are shared by the VXD(SVD/PXD) mechanics group.
  - KEK: Beam pipe, Heavy metal shield and VXD structure, SVD parts assembly, Ladder mount table
  - HEPHY: SVD endring, SVD ladder design
  - MPI: PXD structure, VXD service structure, VXD installation,
  - DESY: VXD thermal mockup, SVD endring, SVD parts assembly

- VXD common task
- SVD task

## Key decisions:

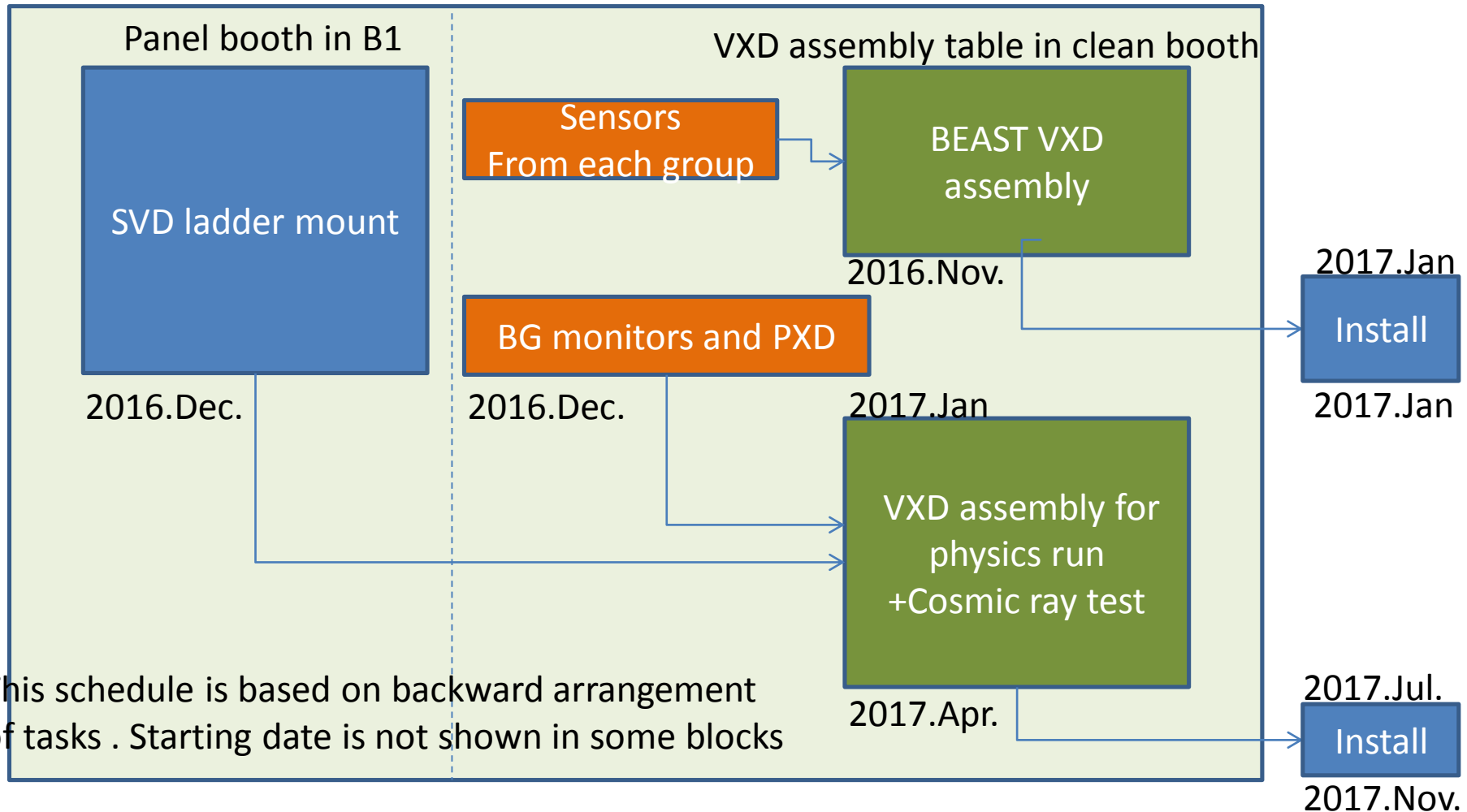
- VXD design : agreed in 2013 Nov.
  - Space allocation: done: Oct. 2013.
  - Each design have combined to common VXD design.
- VXD assembly procedure: agreed in 2013 Sep.
- VXD installation method: agreed in 2014 Jun (installation review)



# Assembly work management

- We will assemble two sets of VXD system
  - VXD for BEAST phase II
  - VXD for physics run

<https://belle2.cc.kek.jp/~twiki/bin/view/Detector/BelleIISchedule>



# Parts preparation status

Beam pipe for BEAST phase II has already delivered

SVD parts	BEAST	Physics run
Outer cover	Delivered	~Mar. 2015 (ordered)
Support cone	-	Delivered
Endring	No	~Mar. 2015 (ordered)
End-flange	Delivered	~Mar. 2015 (ordered)

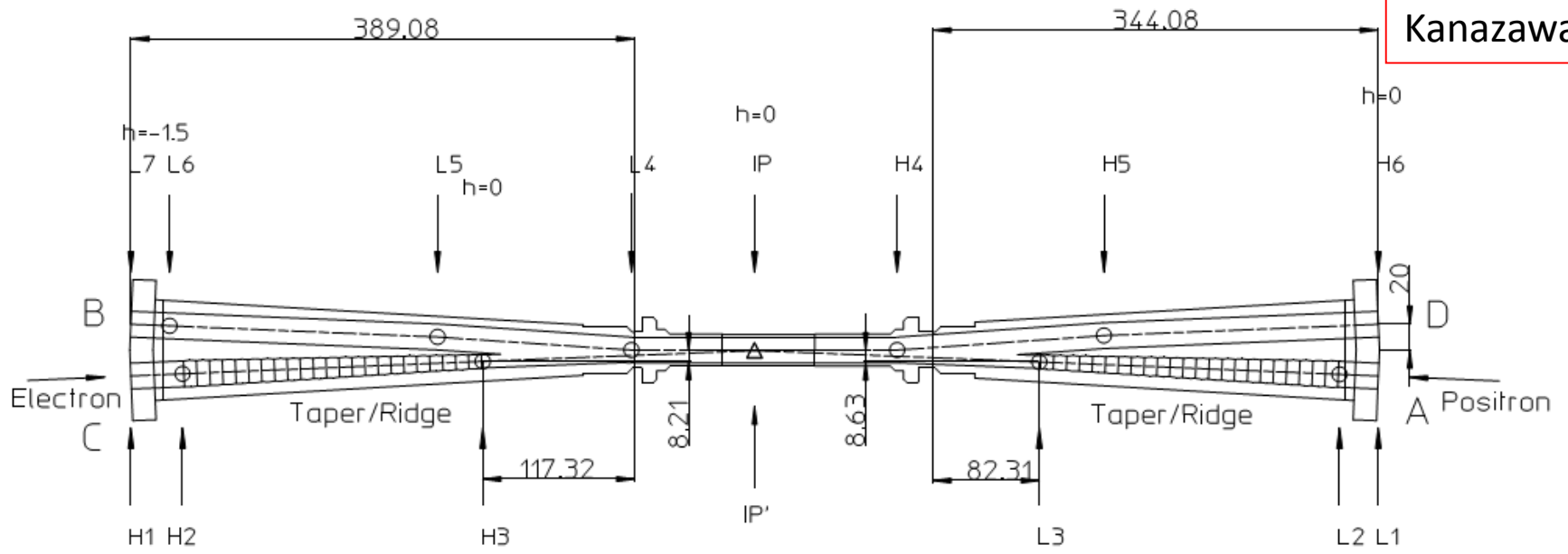
SVD tools	BEAST	Physics run
Support cone gluing tool	done	Done (+DESY option)
Outer cover gluing tool	done	Done
Endring gluing tool	Done (FWD)	FWD side (BWD side will be soon) + DESY option
SVD division tool	~Mar. 2015	~Mar. 2015

# IP beam pipe for BEAST phase II

After the EBW connection of IP chamber with BWD crotch part in Nov., we found 2 degrees of displacement at the connection point.

No vacuum leak has found after this process

By using CMM measured data, Kanazawa-san has verified the usability of this pipe for BEAST phase II operation



	mrad	A(p in)	D(e out)	L3	O	H3	B(p out)	C(e in)
equal twist	18.2561	0.365122	-0.36512	0.166678	0	-0.15901	0.365122	-0.36512
bent	1.295	-0.44558	-0.44558	-0.10659	0			
	1.0978					-0.12879	-0.42713	-0.42713
sum		-0.08046	<b>-0.81071</b>	0.060087	0	-0.2878	-0.06201	<b>-0.79225</b>
add 0.4		0.319538	-0.41071	0.460087	0.4	0.112195	0.33799	-0.39225
add 0.1		0.019538	<b>-0.71071</b>	0.160087	0.1	-0.1878	0.03799	<b>-0.69225</b>

This table shows displacement from design value (in vertical).

1st line: distributed symmetrically shifted by 1 degree to the left and right

2nd,3rd line: position displacement by bent

4th line: summing up of displacement

5th line: 0.4mm lifting up of whole BP

6th line: 0.1mm lifting up of whole BP

# Summary of comments

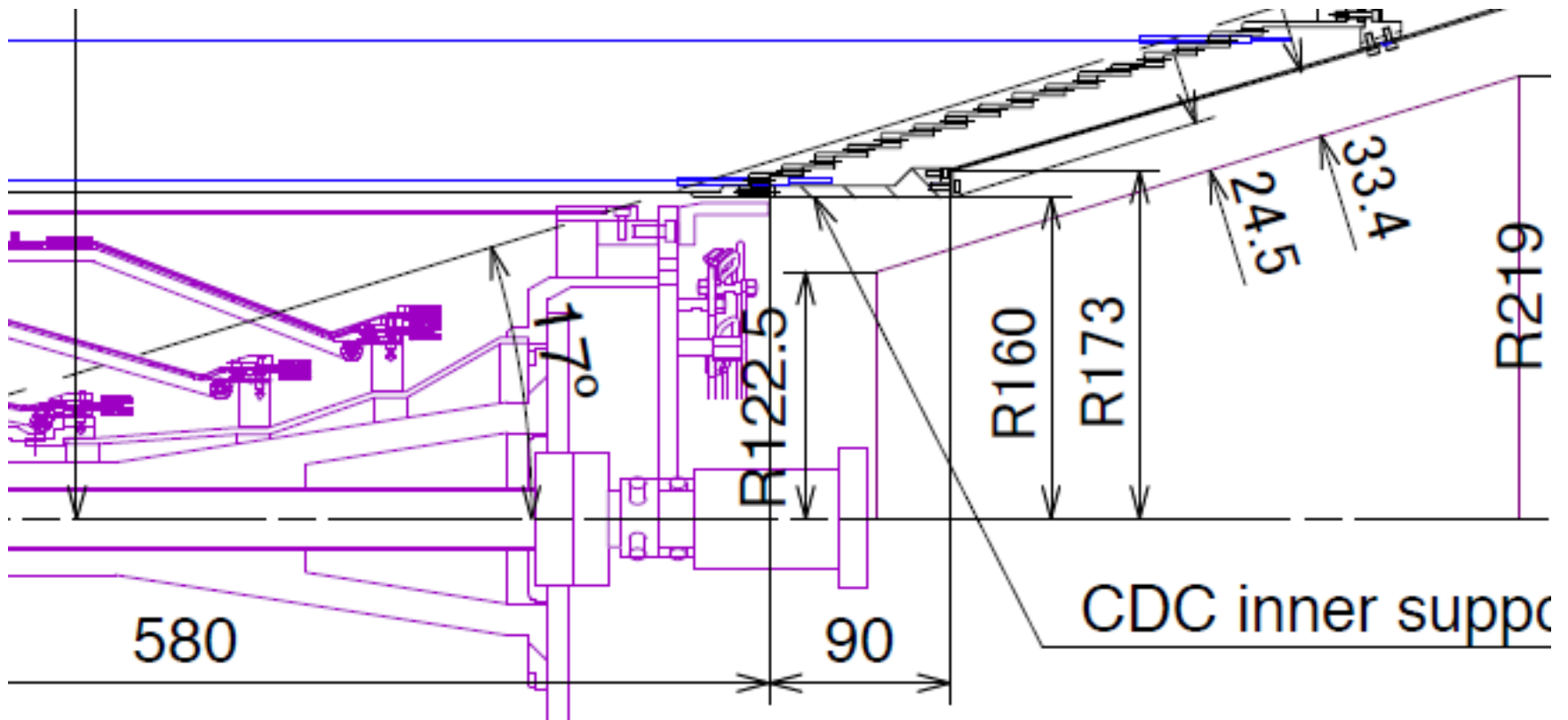
- The bent effect seems to be comparable with 2 degree twisted effect.
  - Because of longer lever (390mm for bent effect) than twist effect(36mm for twist effect)
- The solution is 0.4mm lifting up of beam pipe.
  - The position displacement can be within 0.5 mm for a whole structure
  - The position control of BP is applied by bracket between BP and heavy metal shield. Then modification of each sub-parts design is not required. (After BP delivering, BP will be measured by CMM. The brackets and PXD mount block design will be optimized by those data.)
  - Machine group agreed to use on BEAST phasell
  - Since PXD is mounted onto Beam pipe, the clearance between PXD and SVD 3<sup>rd</sup> layer on BEAST setup should be verified
  - Another issue is change of SR background level by this solution.



VXD mechanics issues

# Remaining issue

- 1, Clearance between FWD VXD service and RVC  
(making a chance to discuss in VXD workshop and DESY meeting)  
(Idea 1) Slim-up of RVC  
(Idea 2) smaller VXD service space



# Remaining issue

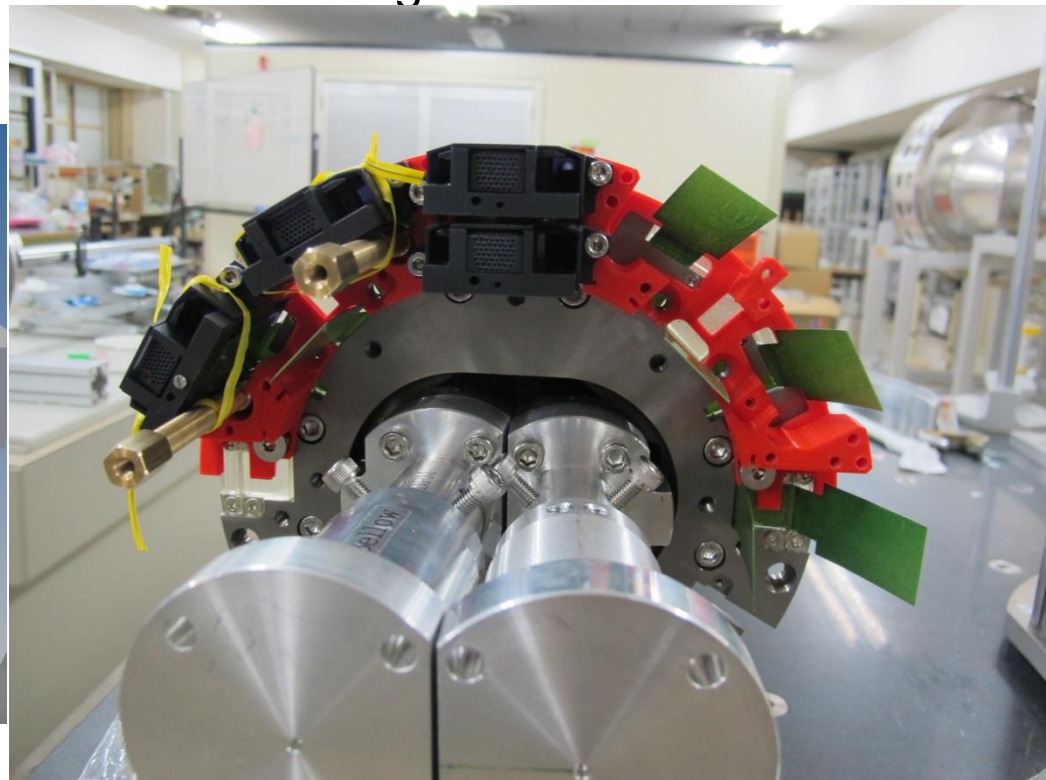
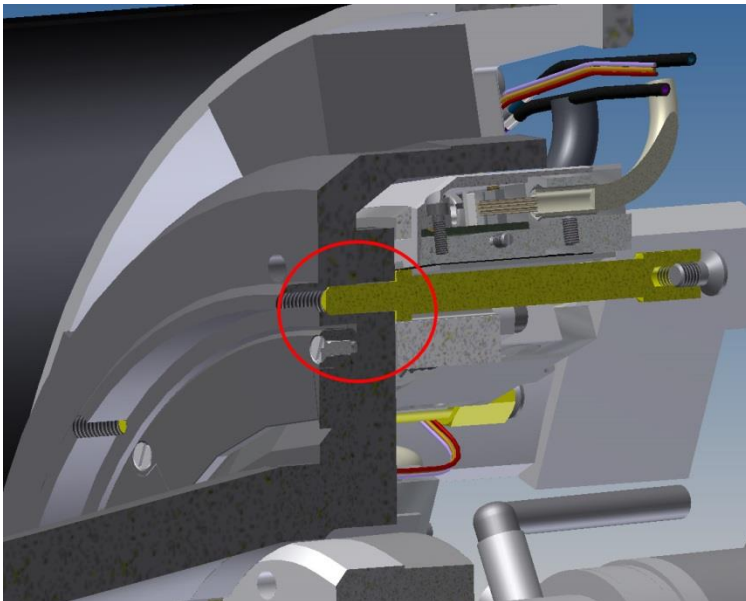
2, Interfering EndFrangle+Heavy metal connection screw position with PXD PP support on the case of PXD service installation before SVD connection. (VXD workshop and DESY meeting)

This issue is happen only on Physics system assembly.

(1) shifting screw hole position (Kohriki)

(2) making smaller PP? (Tschaelie)

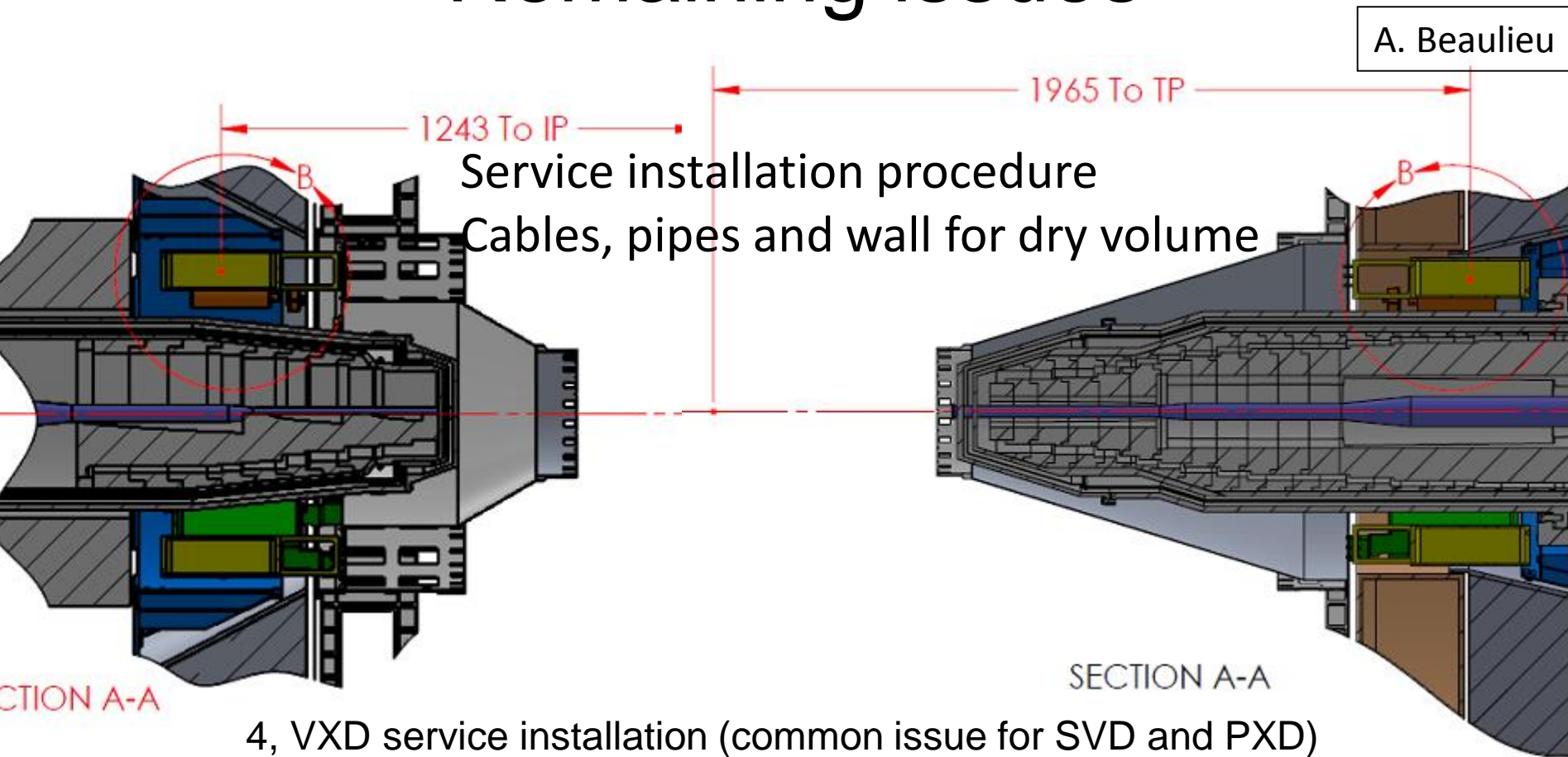
At this moment, Kohriki-san and Tsahclrie disagree with above each idea.



The production will start from Nov.



# Remaining issues



Service installation procedure

Cables, pipes and wall for dry volume

- 4, VXD service installation (common issue for SVD and PXD)
- a, How to validate service work not only around Dock area but also chicane area between IDS and Endcap?
  - b, How to validate term for those work?
  - c, Can we access CDC electronics around VXD dock area?
- We need to have partial service installation test with mockup.

# Remaining issues

- 5, Tool development to bring VXD system from B1 to B4 (B2GM)
- 6, Can we rotate BP with HM smoothly on the VXD assembly table?  
(KEK group task)
- 7, How to make warm dry volume? (will discuss at DESY meeting)  
Please show more practical design including cables and pipes.
- 8, Can we feed back the results of VXD thermal test to physics run?  
(will discuss DESY meeting)  
VXD mechanics design is almost finalized. Then parameters are only Ni flow rate and CO2 flow rate. Of course, adopting some small pieces to somewhere may be possible.
- 9, Panel house construction for IBBelle
- 10, Cooling pipe continuous bending (DESY meeting)



## New Cooling Pipe Routing End Rings

### Pipe route in SVD

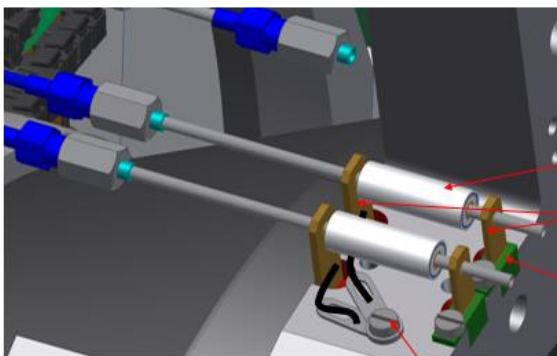
DESY mechanics meeting(26<sup>th</sup>,27<sup>th</sup>)

- Cooling pipe bending
- VXD thermal mock



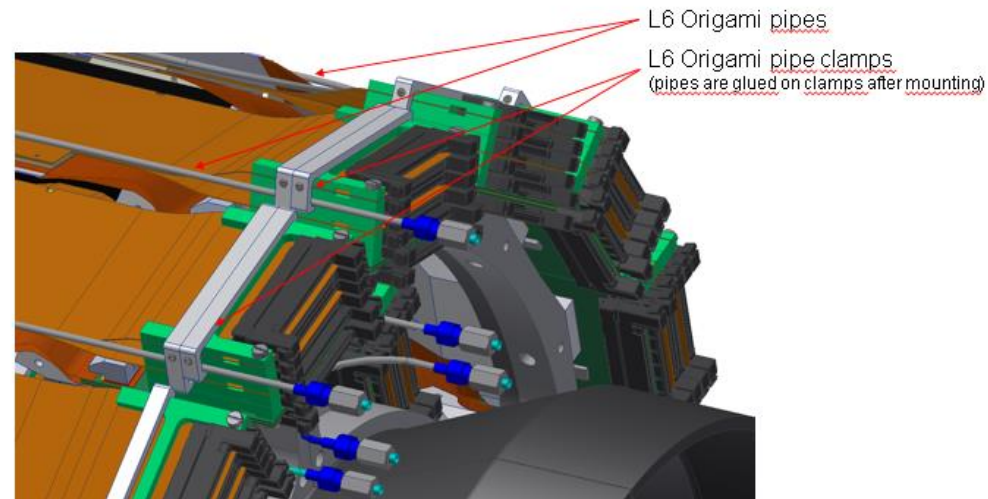
- Slightly changed from Karsten G. pipe routing because of the diamonds
- No extra grounding pipe for L5 end rings (return pipe L4 and L3 is used for grounding the L5 end rings)
- Who can bend these pipes? Welcon? (Toru-san)

### Concept For The Pipe Isolation



- Ceramic isolator (Tschalie)
- Brass torque relief (brazed on pipe)
- Torque relief isolator (FR4, like H shapes)
- Grounding point for pipes on the end flange (cable soldered the brass torque relief)

### L6 Origami Cooling Pipes & Clamps



# Discussion items and plan

- Nov. 2014 B2GM (Gemba/satellite meeting)
  - PXD PP area service work check:
  - SVD ladder mount table demonstration: fruitful discussion as first examination
    - Check position error with test gluing product (End-flange+cone+endrings)
  - VXD BEAST (PXD, SVD, monitors) space and services
  - VXD load discussion (on outer detector session): (not issue now)
- 2015 Feb. B2GM
  - VXD assembly table
    - BP + alignment,
    - PXD mount test
    - SVD halve structure connection with division tool
  - SVD ladder mount test (2nd iteration)
  - **Cooling pipe assembly (Origami, Endring pipes) -> DESY meeting**
  - SVD BEAST system mount test (cartridge idea)

SVD ladder mount starting  
From 2016 Jan.



- 2015 Jun. B2GM
  - SVD ladder mount internal review? (or Nov. B2GM)
  - VXD assembly table test
  - BEAST assembly test
- VXD service installation test by mock structure(date is not decided)
  - Clearance check between VXD and RVC
  - Service work check around VXD dock area
  - Clearance check between IDS and endcap
  - Items
    - VXD cables
    - CO2 pipes and connection
    - VXD docks
    - Wall for warm dry volume

# VXD mechanics preparation in 2015

(not including each sensor part)

- Beam pipe for physics run
  - IP chamber production (without Au plating?)
  - Crotch part production
  - w/o final EBW connection
- Heavy metal shields for physics run
  - Need to take agreement of PXD PP space and screws position between MPI and KEK
- VXD Installation ring (only FWD)
- VXD installation tools (also tool for crane work)
- Finalizing VXD assembly table
- Finalizing SVD ladder mount table
- CO2 piping work for B1 system test
- Panel house for IB Belle system at outside of Tsukuba hall

backup



# VXD assembly for physics run

Tsukuba hall B1 room

SVD  
(Ladder mount table)

Outer cover gluing ✓

Support cone gluing ✓

Endring gluing ✓

Mount SVD structure on  
ladder mount table ✓

Ladder mount ✓

Attaching to Division tool

First Practice done

BP+HM+PXD  
(VXD assembly table)

Alignment of Beam pipe position ✓

Fixing Heavy metal on the table ✓

Attaching BP onto heavy metal parts ✓

Covering upper heavy metal parts ✓

PXD assembly at MPI

Attaching PXD system

Connection BP+PXD with SVD  
(@VXD assembly table)

VXD installation ✓

Tsukuba hall B4

# Connection of IP chamber with crotch part

This pictures are EBW of IP with FWD crotch part

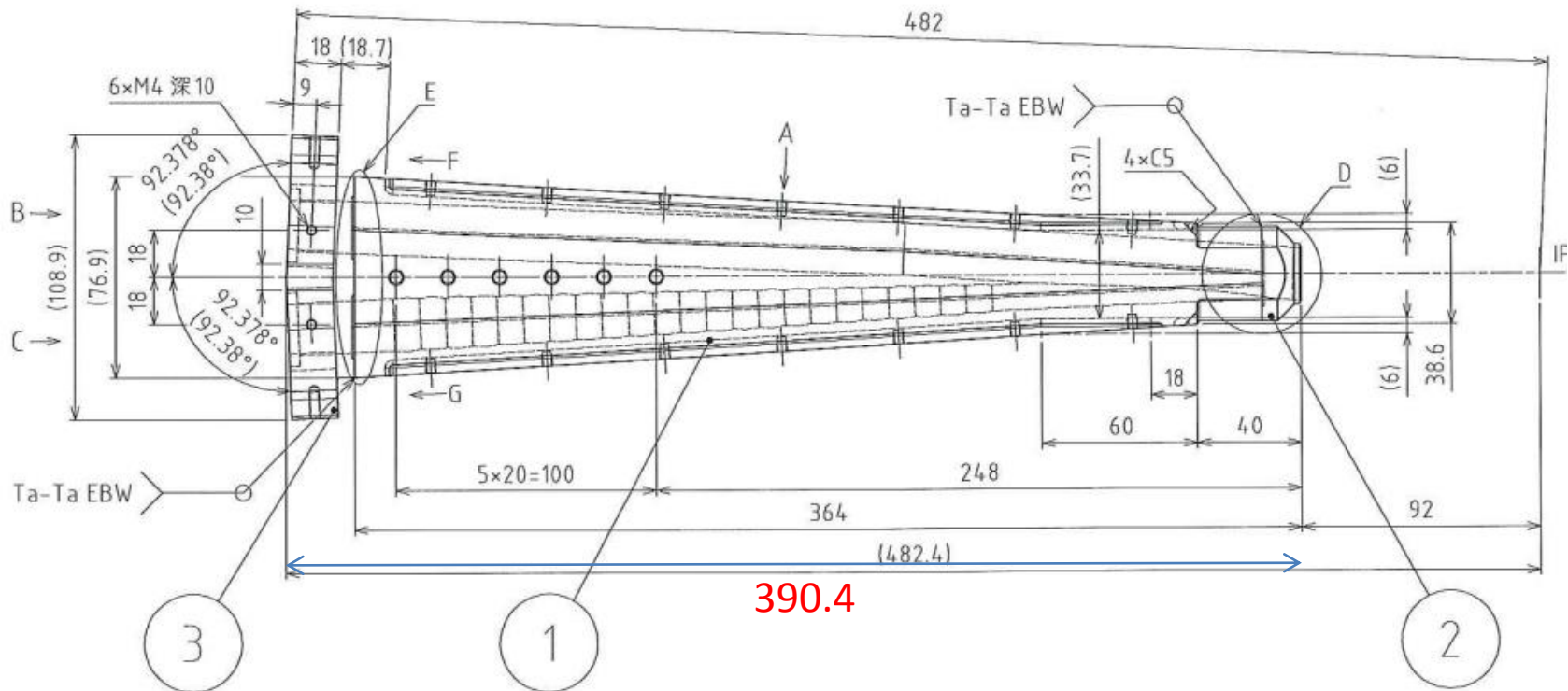


IP chamber with FWD crotch part  
No vacuum leak has measured



# Mechanical tolerance of crotch part

- Crotch part ( measured length after EBW)
  - FWD : 345.24 (target: 345.4)
  - BWD: 390.33 (target: 390.4)



BWD crotch part

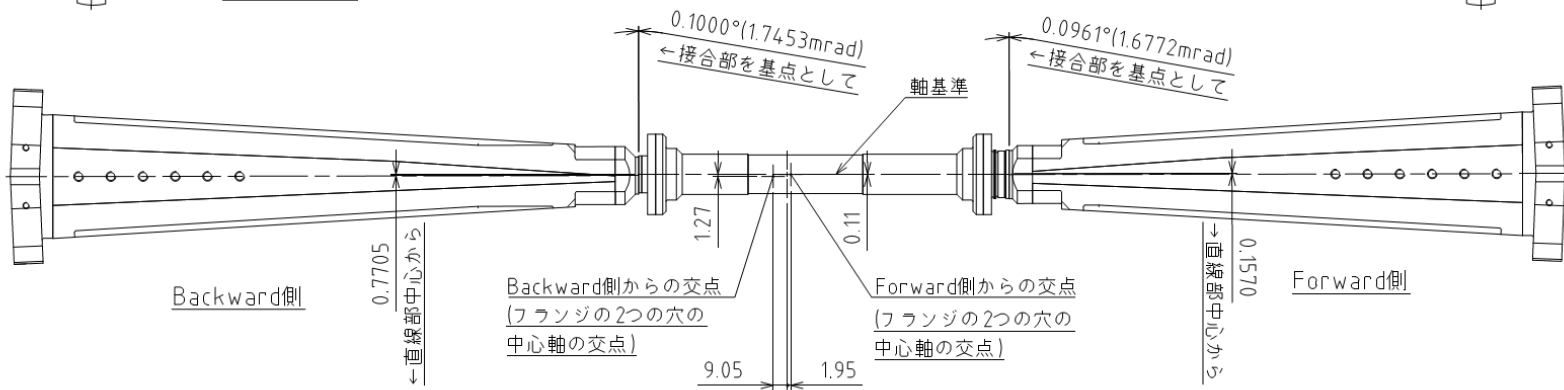
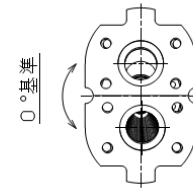
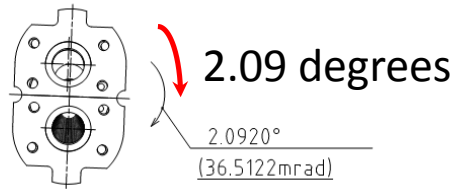




# Measured displacement after EBW connection

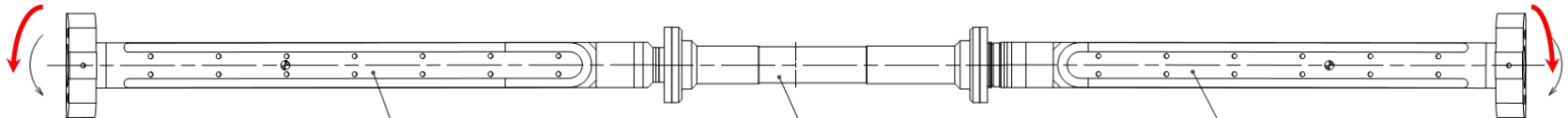
36mm (between each pipe center)

a point of reference



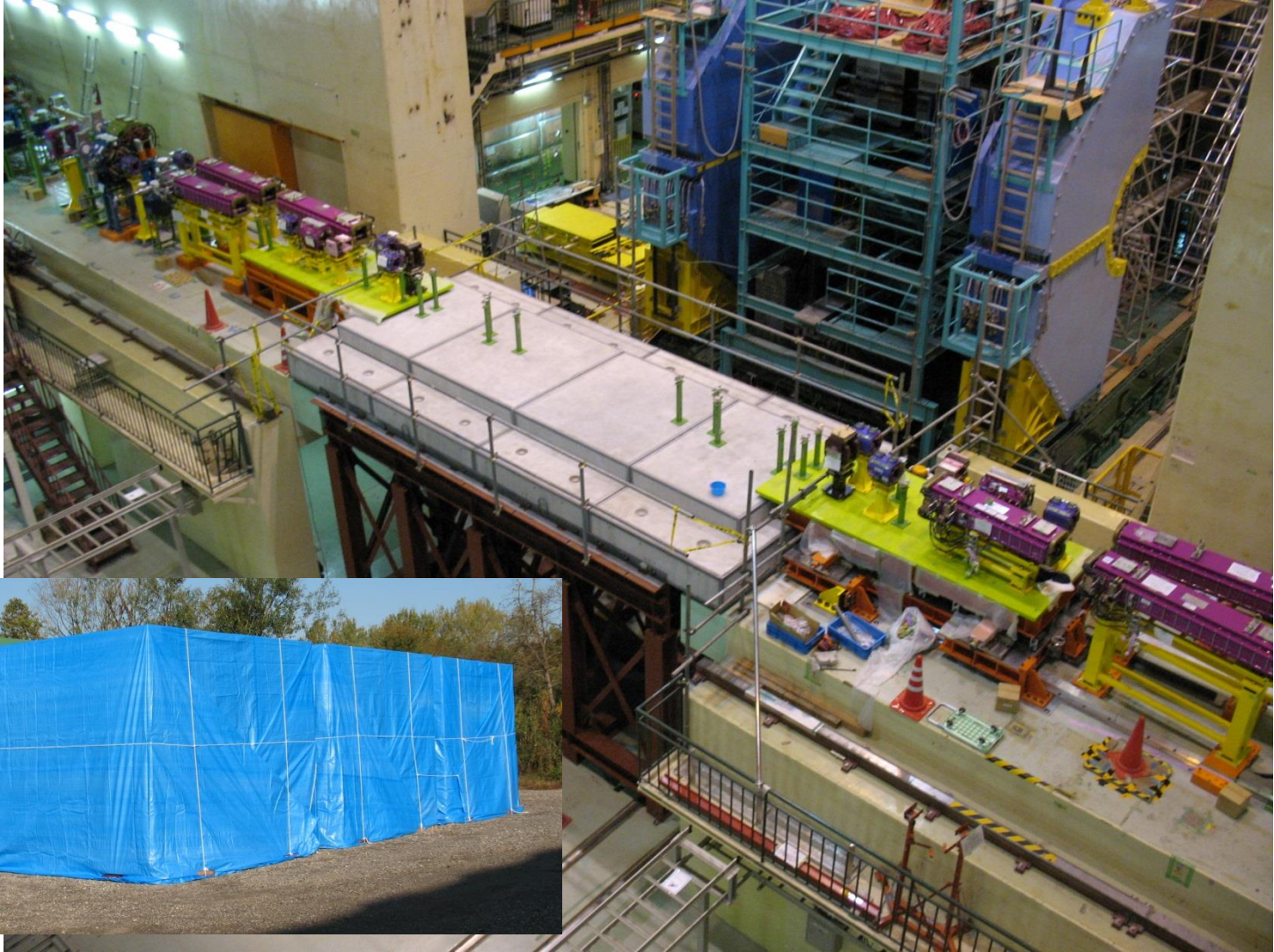
0.0629°  
(1.0978mrad)

0.0742°  
(1.2950mrad)



390mm (crotch part length)

## Snapshot of IR region



All IR magnets are installed and roughly surveyed.  
IP shield is ready.  
The supports for beam ducts are set.

# Schedule of 2015 (KEKB IR group)

		2015											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Toward s Phase 1										Concrete shield (IR and Large gate) (Akai300)			
				Repair of IP1 chamber									
		IR beam pipe installation											
		Bend		Others									
		Pumpin down of beam pipes starts						→					
		Precise alignment of magnets starts					→						
						LABM?							
Toward Phase 2					Additional concrete shield(Tsukuba hall)								
					Manufacturing				Installation				
					QCS work (Piping, cabling etc)								

This schedule may change according to the budget.



VXD installation : 1~2 days

VXD service installation: ~3 weeks

