Beam Optics and beam pipe mock-up

S. Tanaka (KEK)

Situation of beam parameter optimization

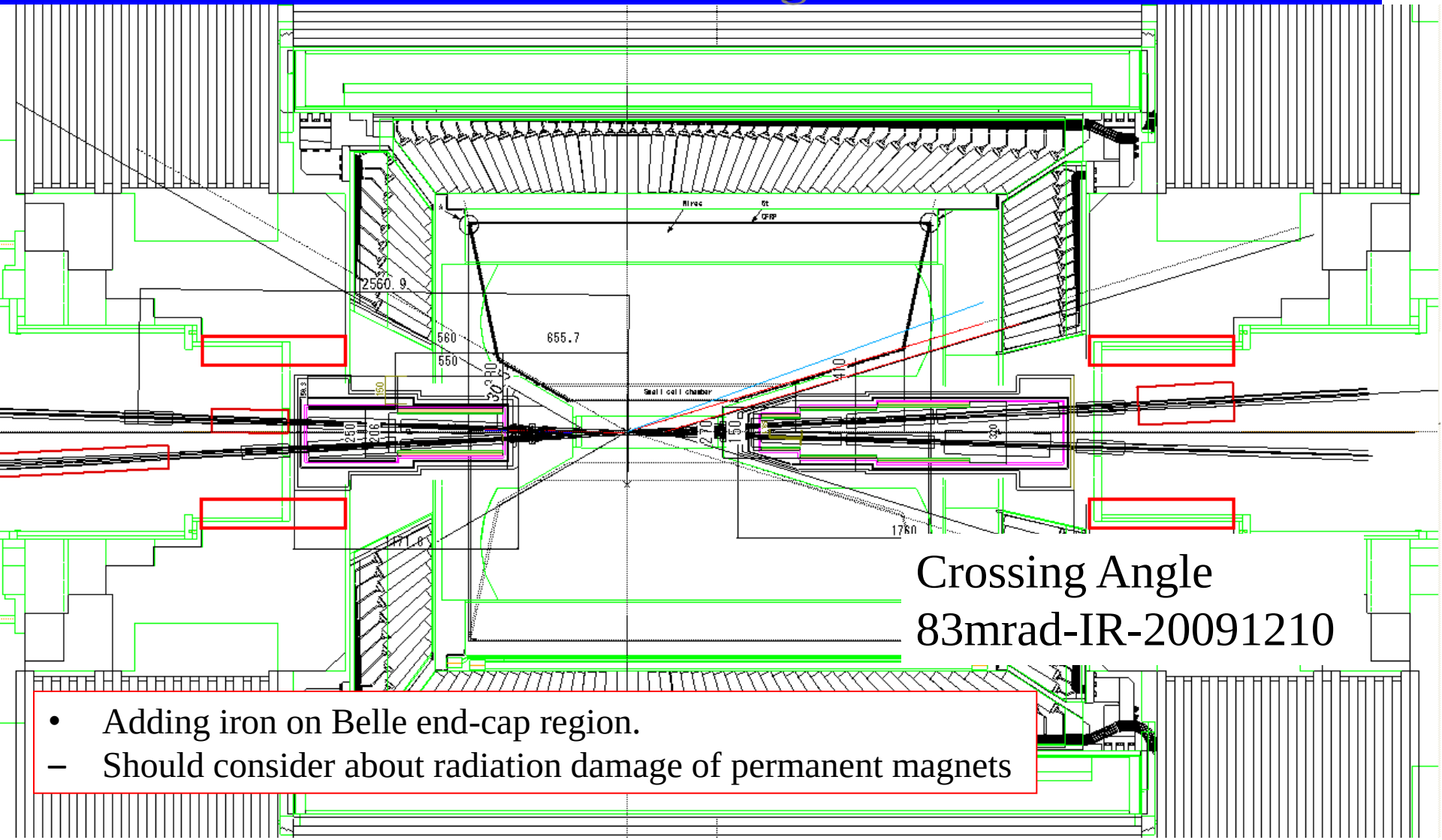
Dynamic Aperture with LER 2-family LCCS

Snap shot - Effect of Orbit / y-Dispersion -

Bz Config.	Tous. Life (sec)	εx (nm, intra)	εy (pm, @0A)	file /users/oide/SuperKEKB/LER/
Ver 3	223	3.3	4.1	lerfqlc_Oide_1117
V3.99.3	408	3.0	3.1	lerfqlc_Oide_1137
V3.99.1.1	448	3.1	2.4	lerfqlc_Oide_1146
V4	403	3.1	2.4	lerfqlc_Oide_1158

- **Touschek life time is still around 400 sec.**
  - **Parameter study is on going,**
- **The reduction of solenoid magnetic field is still kept as option.**

Original design + (QC2 permanent magnets) + Rotating Belle axis



- Adding iron on Belle end-cap region.
  - Should consider about radiation damage of permanent magnets

BelleII IR

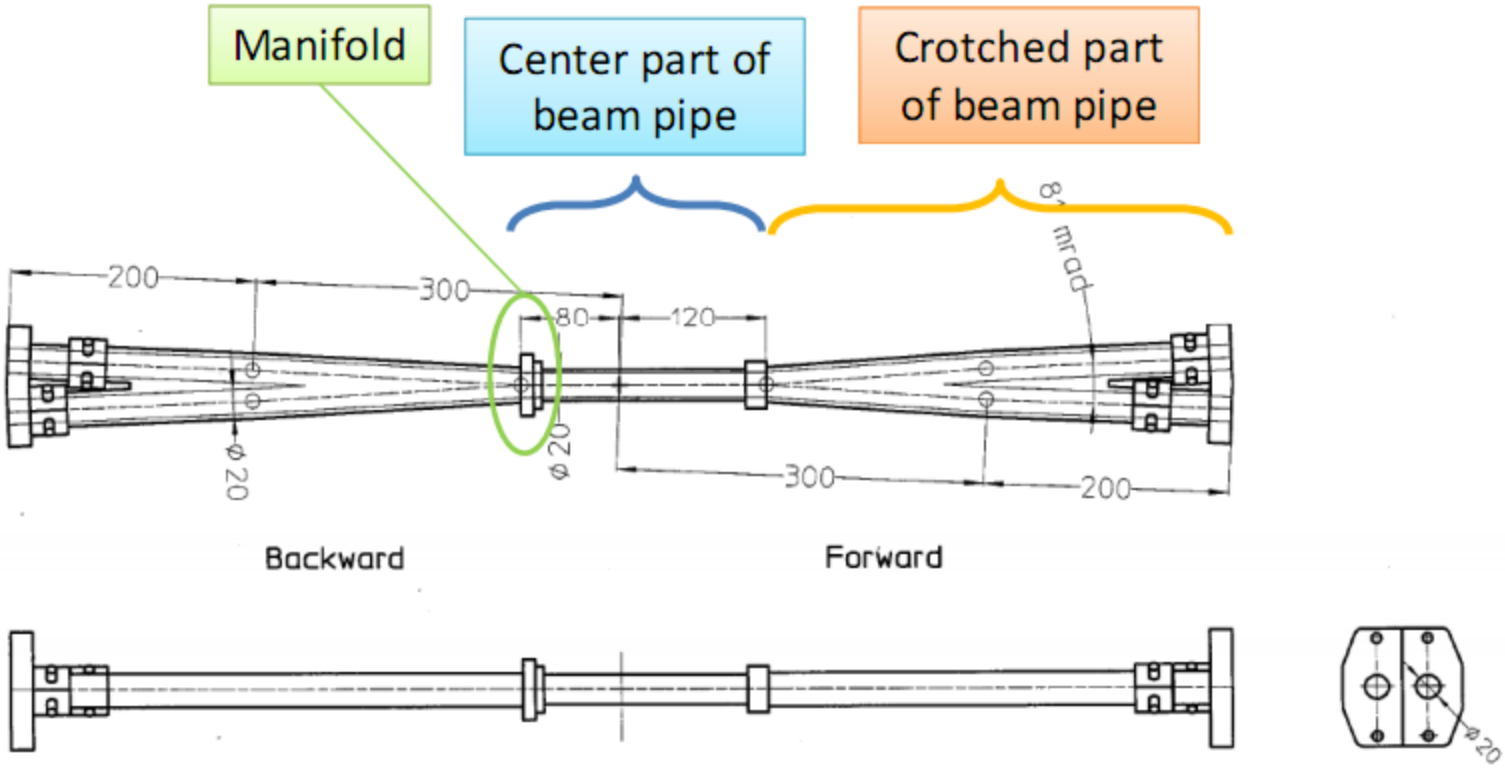
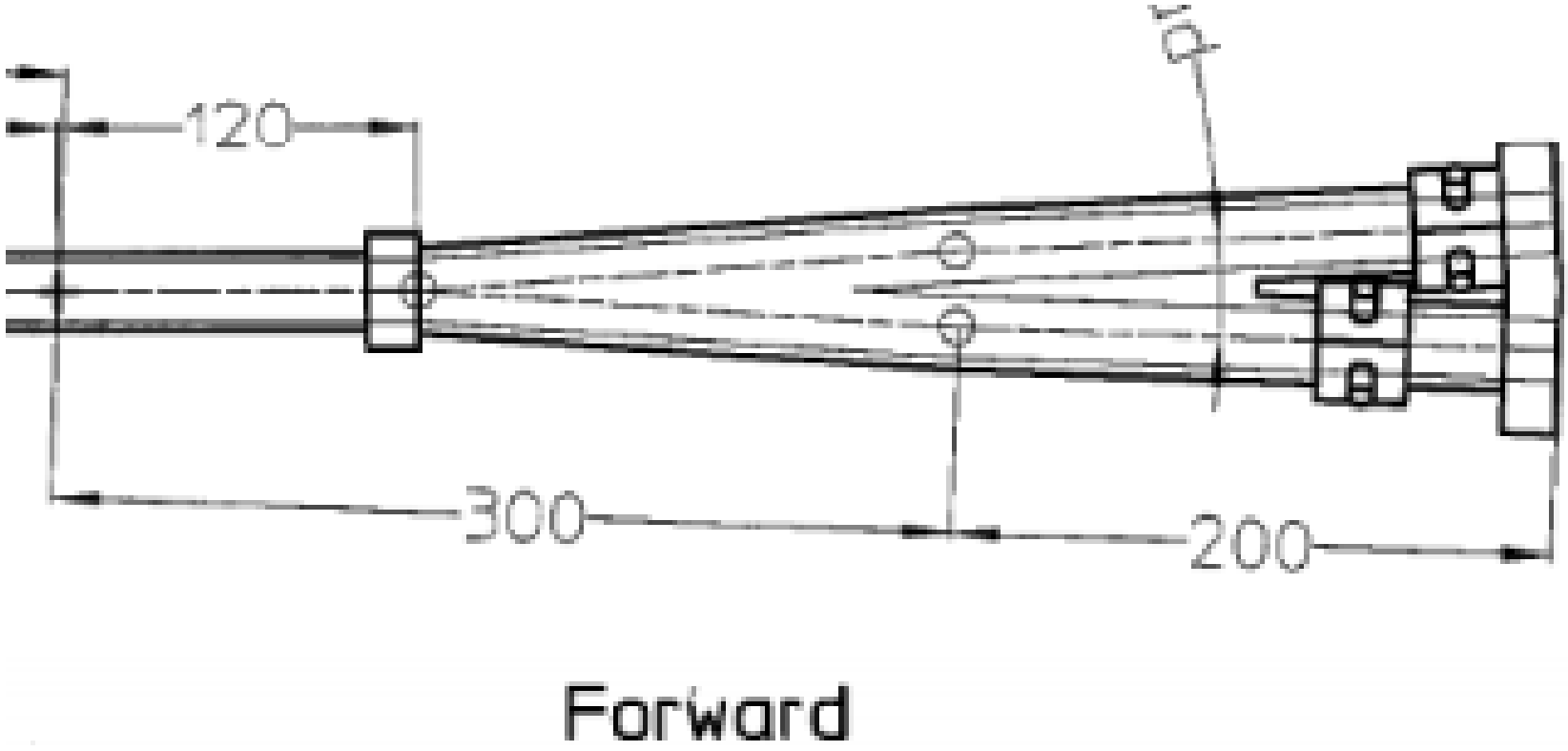


Figure 3.13: Picture of IP chamber

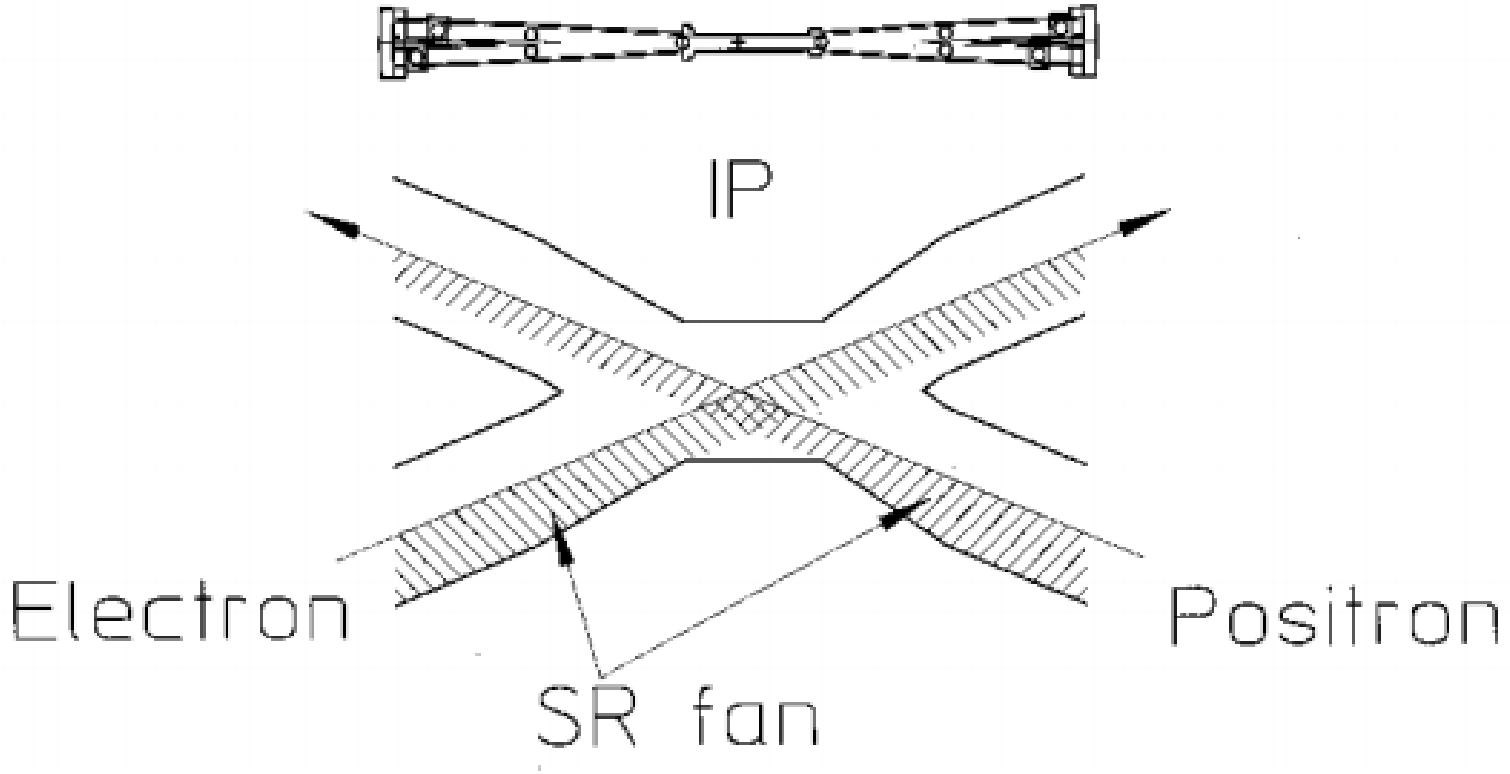
Not final

(Belle TDR, page 71)

BelleII IR



Length of IP straight section is 200mm.
Each Beam is centered in beam pipe, when distance from IP is more than 300cm.



In the current Belle IP-chamber, there are SR mask to prevent the direct SR hit to the central IP-chamber part. In SuperKEKB, the polarity of the last bend is designed so that SR fan from the bend may not directly hit the central part of the IP chamber.

Dimension of IP

Table 3.7: Basic parameters for the central Be part of the IP chamber.

Gold plate	Thickness	10 μm	Ti/Si coating ?
Inner Be pipe	Inner radius	10mm	
	Thickness	0.6mm	
Gap for coolant	Thickness	1mm	
Outer Be pipe	Outer radius	12mm	
	Thickness	0.4mm	

These parameters are almost copy of SVD2 case. if we want to change this, the validation study will be need.

Bellenote #362

EFFECT OF GOLD COATING ON THE BEAMPIPE FOR SYNCHROTRON RADIATION BACKGROUND

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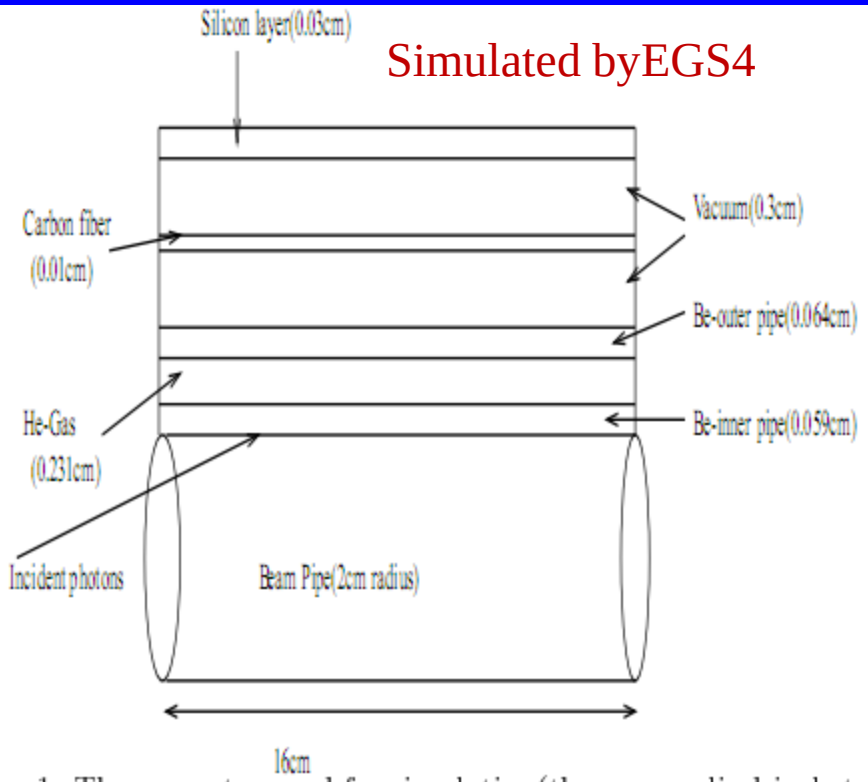
The Synchrotron radiation background is produced when high energy charged particles(beam)pass through magnetic element of the machine. Accordingly, several sources must be considered

- Direct synchrotron radiation.
- Photons that scatter through a mask tip.
- Sources of synchrotron radiation from the elements far upstream of IP.
- Sources of backscattered photons from downstream surfaces.

Tip scattering is dominated by Rayleigh scattering and X-ray fluorescence, while back-scattering is dominated by Compton scattering and X-ray fluorescence.

In summer,1999 synchrotron radiation background was the main concern because it was killing the SVD. The hybrid of the SVD first layer was damaged and, also, there were burn marks on the beam pipe on the upstream side. Most probably, SR photons were bouncing back from the burnt portion of the beam pipe. These caused damage to the first layer only, so those were low energy photons. The angle with which the SR was hitting the SVD hy-

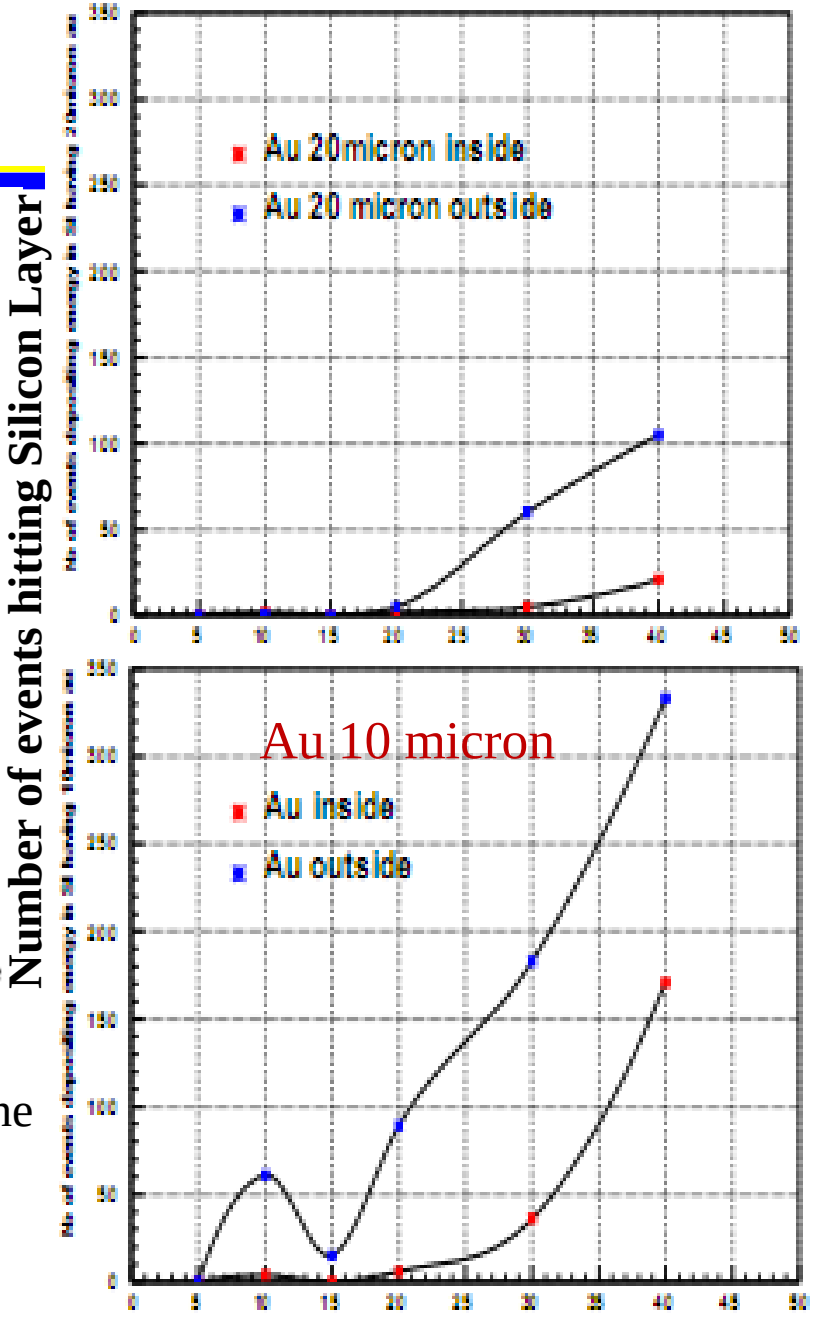
Belle II



Simulated byEGS4

Figure 1: The geometry used for simulation(these are cylindrical structure

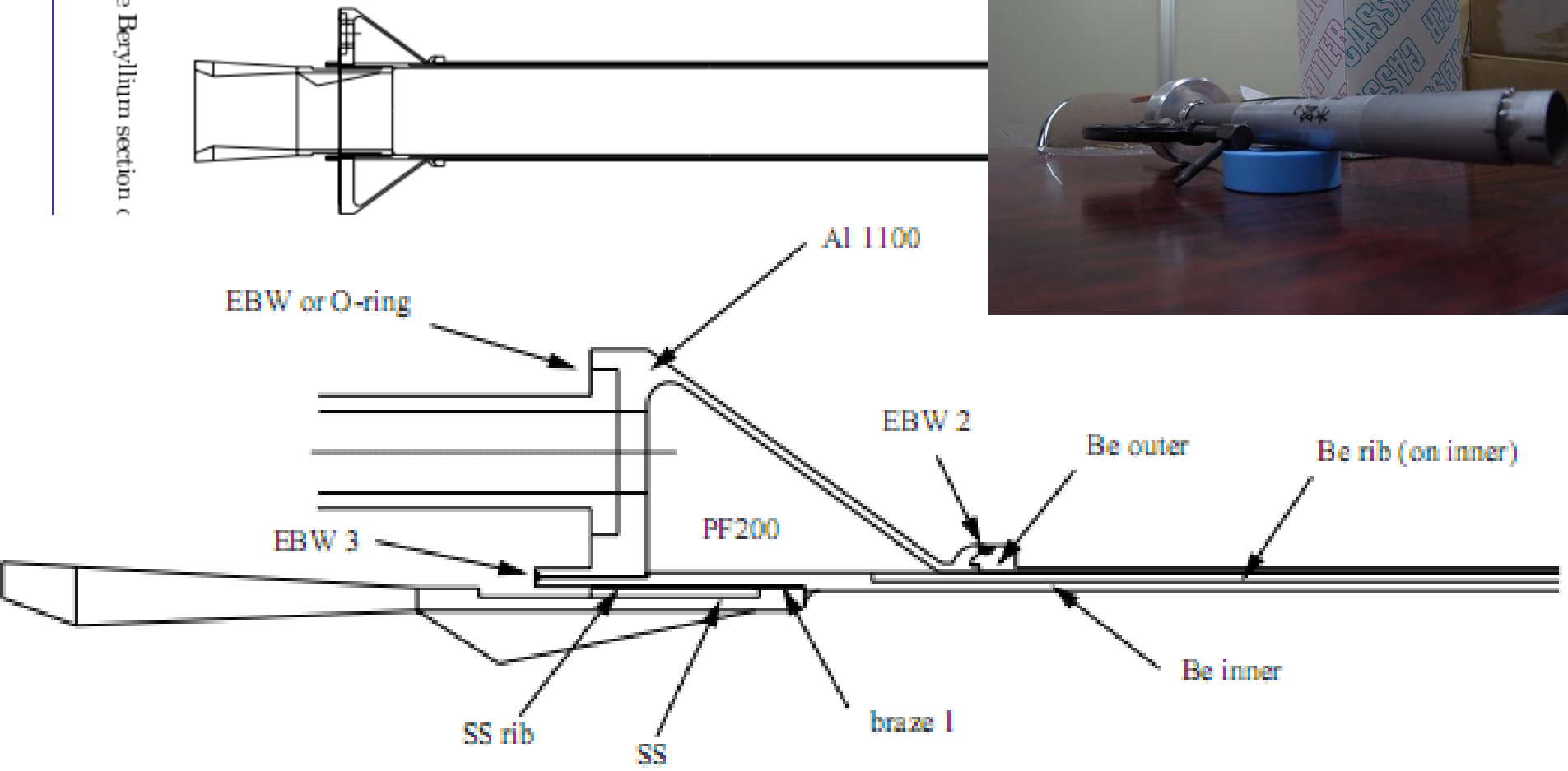
Monochromatic photons(10000events each time) were shot at a angle of 5 degree with respect to the beam pipe.



What we should know (do) related on IR?

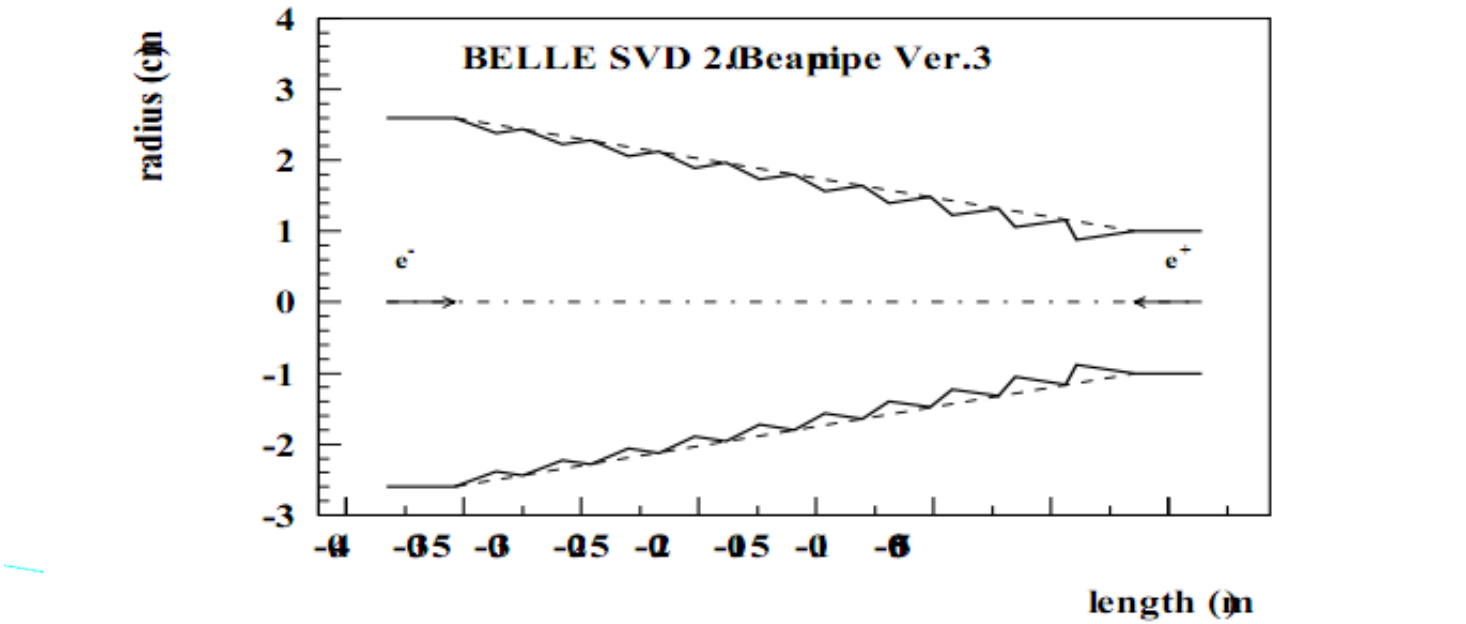
- Material selection for each part
- Verification of mechanical strength on joint point.
- Need to reduce the radius of cooling flange on IP.
- Optimization of Saw-tooth structure.
  - How to make it?
- How to make cooling drain on Crotched part?
- *Learn from the report and related information on Belle IR.*
  - *SVD2 TDR*
  - *bn507:A Beam Test of the Radiation Tolerance of the Au Coating on the Belle Beam pipe*
  - *bn:172 Generator for Studies of Background due to Beam-gas Interactive at KEK B-factory*
  - *bn277:Beam background in the BELLE detector*
  - *bn270: An Analytical Study of IR Beam pipe Cooling*
  - *bn:341:HOM Heating of the BELLE Beam-pipe*
  - *bn226: Pixel detector in a B-Factory Environment and throughout on use in Belle*
  - *bn231:Effect of Air Cooling on the Hybrid for the BELLE SVD and so on….*

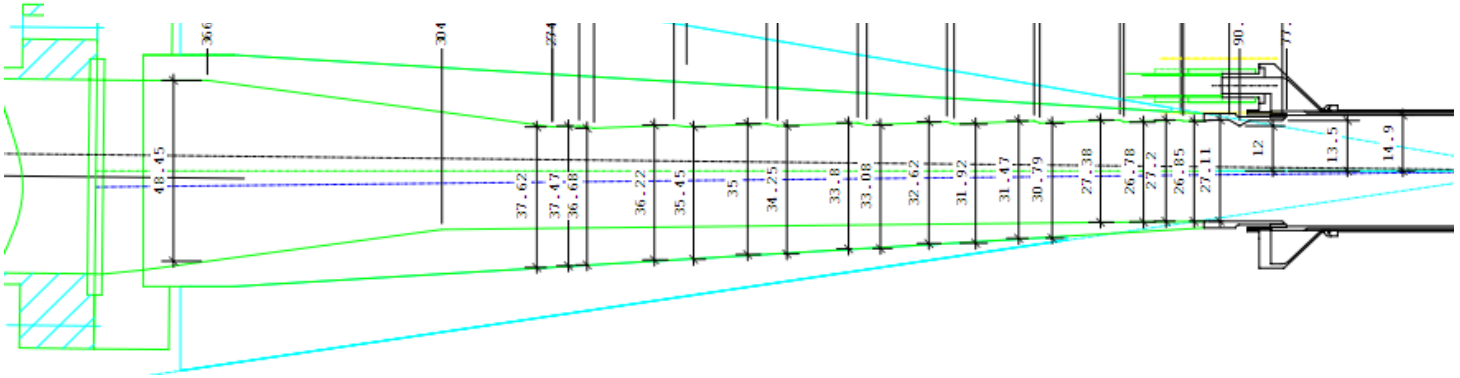
SVD2 IP (as reference)



EBW: Electron Beam Welding

Saw-tooth structure(reference)

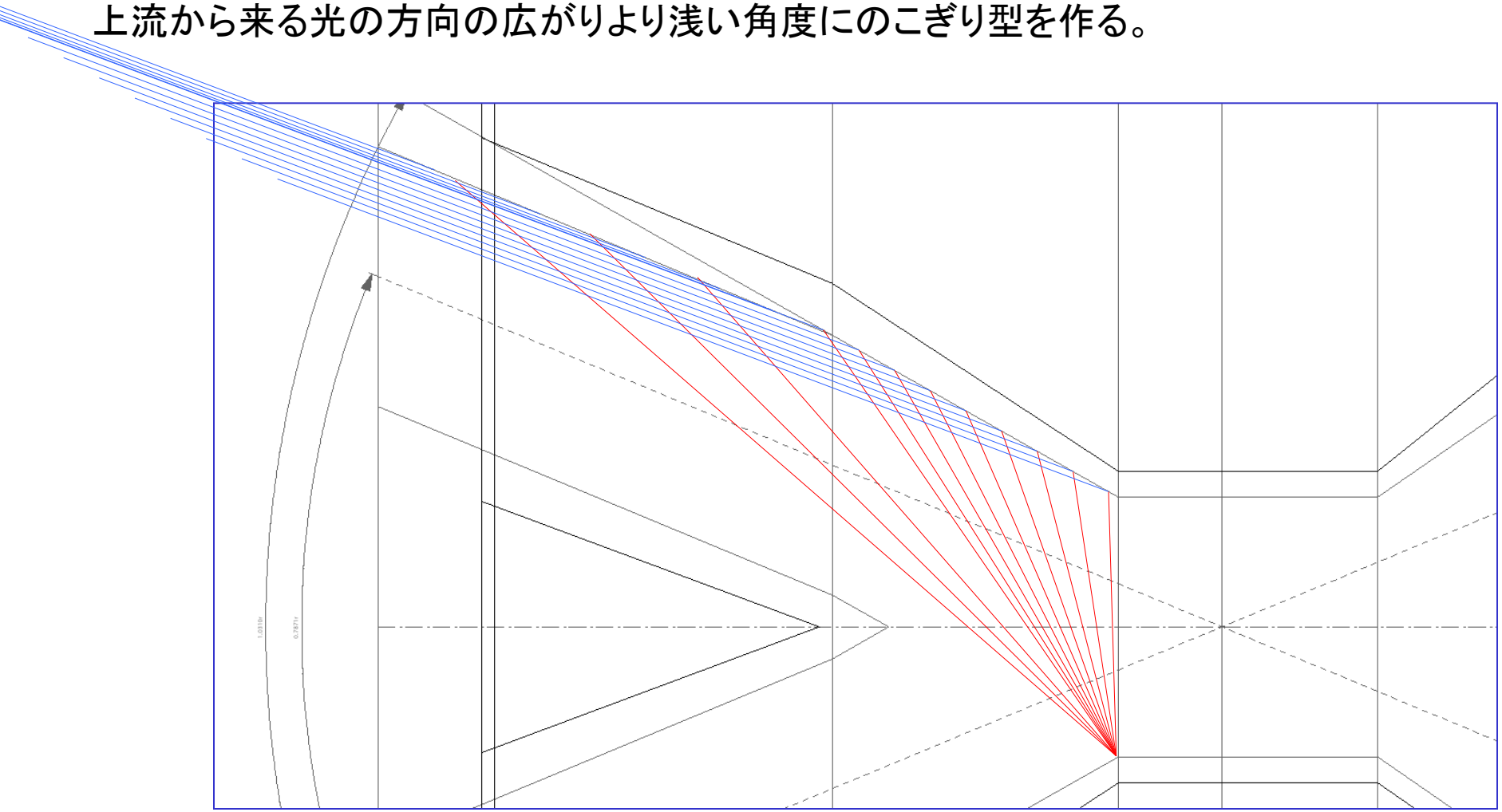




Saw-tooth structure is need to avoid to hit into IP chamber by scattered SR.

Saw-tooth structure

上流から来る光の方向の広がりより浅い角度にのこぎり型を作る。



Test procedure

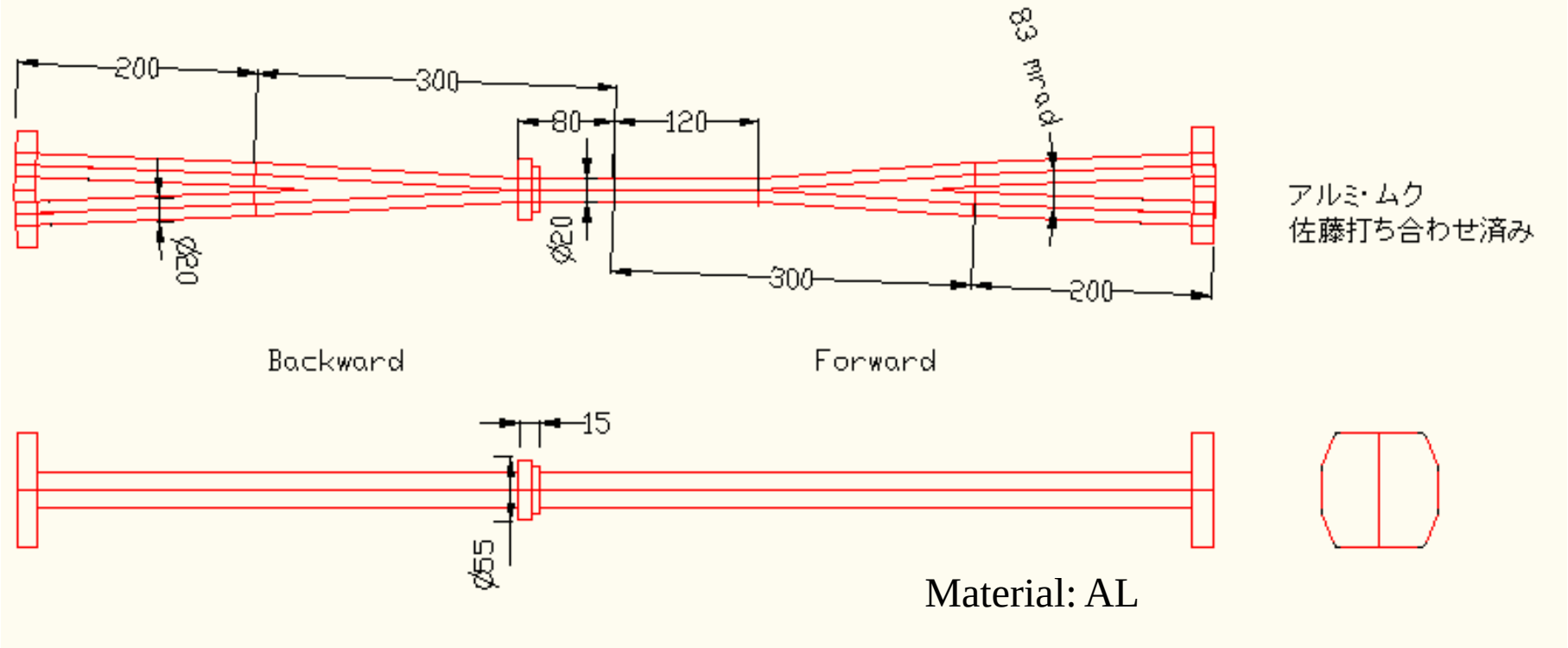
- Mockup 1(Make beam pipe structure)
  - to check design and arrangement of services

  Next step-> make mask by Heavy Metal.

  ->We can check where repeater boards and cables can be located. *(will be within 3 month?).*
- Mockup2(IP region with cooling)
  - Verification of cooling power by the SVD2 like method
- Mockup3 (Connection and material test)
  - Verification of mechanical

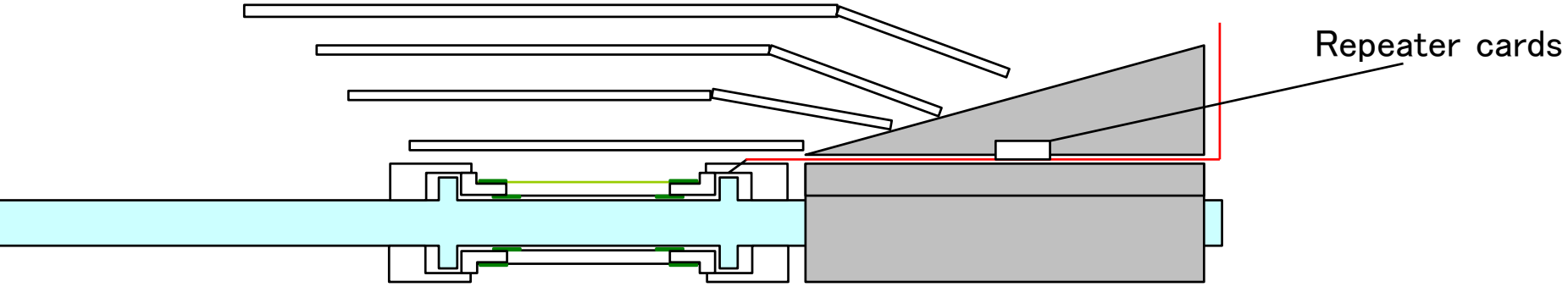
  strength between Be part and SUS rib.

Mockup1 of IR region



Designed by H.Nakayama

Next step of Mockup1



Check the space for Repeater cards and services.

Schedule and summary

Three type of mockup study is on going.

- Make beam pipe structure(to know alignment)
- IP region with cooling
- Connection and material test

Related subject on PXD

- Reduction of the magnetic field of Belle solenoid (acceptance, BG)
- Touschek life time (PXD operation)
- Design by cooling pipe flange on IP (PXD support structure)
- Design of beam mask (repeater board size, location)
- Operation temp. of IP chamber (1st layer PXD cooling)
- Material choice of IP chamber (vertex resolution)

Backup