

SVD2.0 Beampipe

5/12/01 EB meeting.

1. Inner CDC (Inner CDC task force)

- 2-layer small-cell chamber: can take x8 dose. (x2 by cell, x4 by electronics.)
- The inner layers of old CDC: can take x4 dose. (x4 by electronics.)

2. SVD

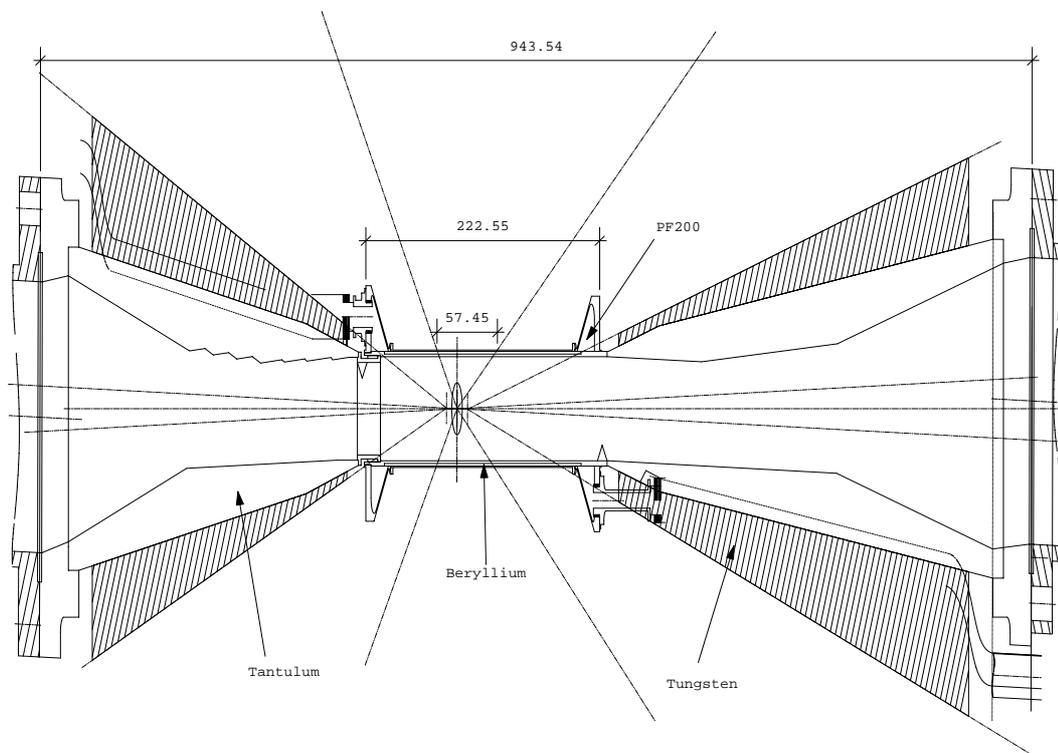
- Radiation hard: 2 MRad/yr or more.
- Practical ΨK_S vertex res. degradation: (Hara, Sumisawa)
3% at the current bkg
26% at x5 current bkg

3. IR beampipe

- $r=2\text{cm} \rightarrow 1\text{cm}/1.5\text{cm}$.
- Liquid-cooled (PF200) - 100W on Be OK.
- Tantalum vac. pipe (Water) - 100W each OK.
- Heavy metal (W) masks.

SVD2.0 IR beampipe

r=1cm version



IR Beampipe Heating Sources

1. Synchrotron Radiation

In some crazy cases,

- (yoff=5mm) 3W/4mm² on the HER mask (Swain)
- Test Au coating with 15W/25mm² of PF. (Au-coated Ta/SS piece: 5/28/01 beam-time - T. Abe/Yamada)

2. Image current

SVD2.0 (r=1cm):

- 20 W total on Be section.
- 30 W at a SS piece (5 W with Au coating)
- 20 W at a Ta pipe (8 W with Au coating)

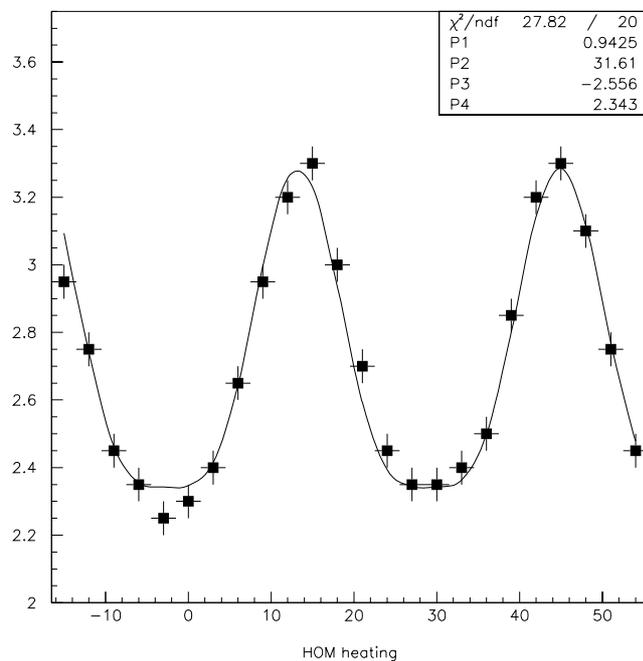
Au coating on SS and some Ta section.

3. HOM ~ 40W on the central section. (Stanic) (non-resonant)

Resonant HOM

1. Sim.(Kageyama) can predict dangerous modes:

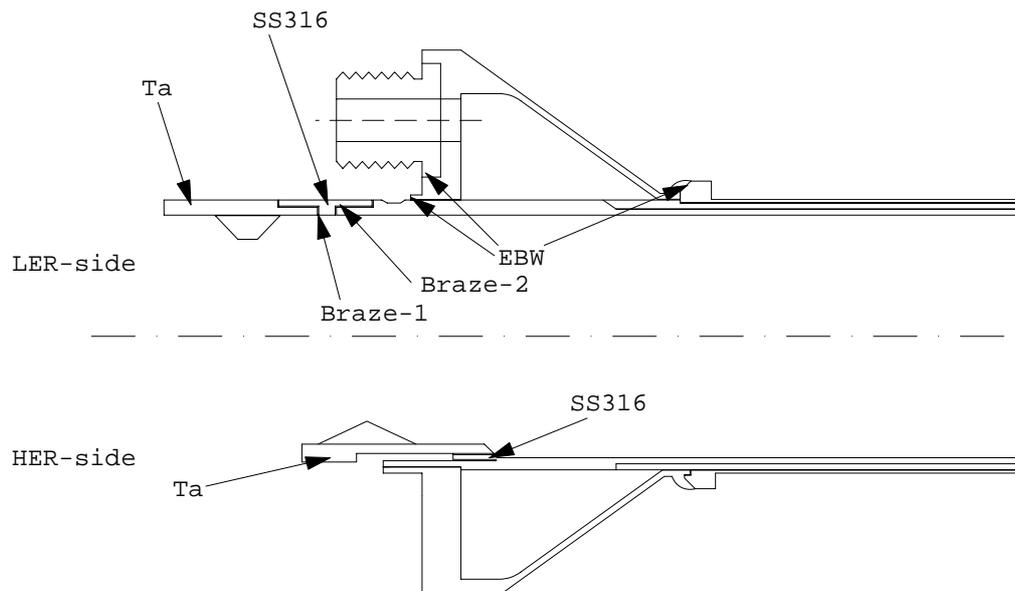
e^+ / e^- RF phase-shift study



Period = 31.61° (TM011: 31.54° expected)

2. Sim: SVD2.0 \rightarrow too many modes with $Q > 1000$.
3. Remove 'platform' on Nikko-side.
 \rightarrow one mode with $Q > 1000$.
Similar resonance enhancement to SVD1.4.

Be pipe end section design



1. No exposed SS → unlikely to have SR melting. Also better cooling.
2. Better particle bkg shield ($Ta > SS$).
3. Better HER backscat. shield ($Ta > SS$).
4. No need to build each Ta cone in two pieces. (Cooling tube connection: mess)
5. Au coating can be done with the BW piece only.
6. Brush-Wellman: 'should work, but **need tests**'.

Synchrotron Radiation

- **'Soft' SR background by HER**

Dominated by QC1 Backscat. at Oho-side Ta mask

0.5 kRad/yr (yoff = 0 mm)

67 kRad/yr (yoff = 3 mm)

- x5 before which used the LER-mask response w/ correction 1/10 - should have been $\sim 1/2$.
- $\times 1/3$ if Ta is not Au-coated.

- **'Hard' SR background by HER**

With Ta LER mask: small enough.

If no Ta LER mask: ~ 20 kRad/yr

(\rightarrow no resonance HOM)

- **'Soft' SR background by LER**

If BLWRP directly hits (it is possible):

1-80 kRad/yr for 2.5-3.5 mRad bending.

- All the above dominated by 11 keV Au L-edges.
(Contribution to occupancy is small)

Software alarm system (LER/HER)

Calculates the orbit with IP constraint
→ SR power on the IP chamber (T. Abe).

Injection SR

(HER)

- **The last EB report:**
'LER-side mask backscatt. < 0.1 kRad/yr
(Ta mask backscatt. still to be estimated)'
- **Ta backscatt. estimated:**
Fast component: 6.7 kRad/yr
Slow component: 1/40 kRad/yr

LER would be comparable or less
(to be checked)

Particle Bkg

Major developments since last EB (Trabelsi):

- Touscheck (1-turn).
Consistent with observed Touscheck lifetimes and
Touscheck background (w/i x2)
- Inner-mask optimization ($r=1\text{cm}/1.5\text{ cm}$)
SR mask + beam-stay-clear \rightarrow optimum shape.
 $r=1.5\text{cm}$ significantly superior to $r=1\text{cm}$.
- Kinematic cut study (esp. Turtle)
Brem. k/E : 5% \rightarrow 1%
(machine acceptance)
Coul. θ : 0.5 mrad \rightarrow 0.1 mrad
(movablemask acceptance)
Large ($\sim x10$) increase of dose except for
HER brem (was used earlier for cut study).
- Refinements of GEANT implementation.
Flanges, Uno masks etc.
Stray field from QC1RE to LER.
reduced bkg by $\sim x10$ for LER Coulomb.

Throughout changes,
SVD1.4 \sim SVD2.0($r=1\text{cm}$) at given radii.

Unit = kRad/yr (1yr = 10^7 sec)
(1.1A/2.6A, 1nTorr CO)

Data: SVD Iyr 1

	dose
HER	24 kRad/yr
LER	82 kRad/yr

MC: SVD Iy1 1

LER Particles entering GEANT just outside of b.p.
depends strongly on materials around b.p.
The numbers in (), such contributions set to 0.

	Brem/Coul	Touschek	total
HER	40.5	-	40.5
LER	35.2(23.3)	56.5(6.5)	91.7(29.8)

Data/MC agreement is reasonable.

MC Comparisons

SVD1.4 $r = 2cm$				
r	$L1$	$L2$	$L3$	
	$3cm$	$4.5cm$	$6.0cm$	
HER Brem	5.9	3.2	2.0	
HER Coul	34.6	13.9	7.4	
LER Brem	20.4(8.5)	9.0(3.1)	4.8(1.3)	
LER Coul	14.8	6.3	1.7	
Touscheck	56.5(6.5)	32.3(3.6)	16.9(2.0)	
Sum	132(70)	65(30)	33(14)	

SVD2.0 $r = 1cm$				
r	$L1$	$L2$	$L3$	$L4$
	$1.5cm$	$2.2cm$	$4.25cm$	$6.15cm$
HER Brem	27.5	18.7	5.7	3.3
HER Coul	35.1	21.7	6.5	4.2
LER Brem	67.2(62.8)	38.2(36.9)	9.4(8.9)	4.2(3.1)
LER Coul	51.5	18.2	7.2	2.1
Touscheck	474(464)	245(239)	57(52)	23(18)
Sum	655(641)	361(335)	86(82)	37(31)

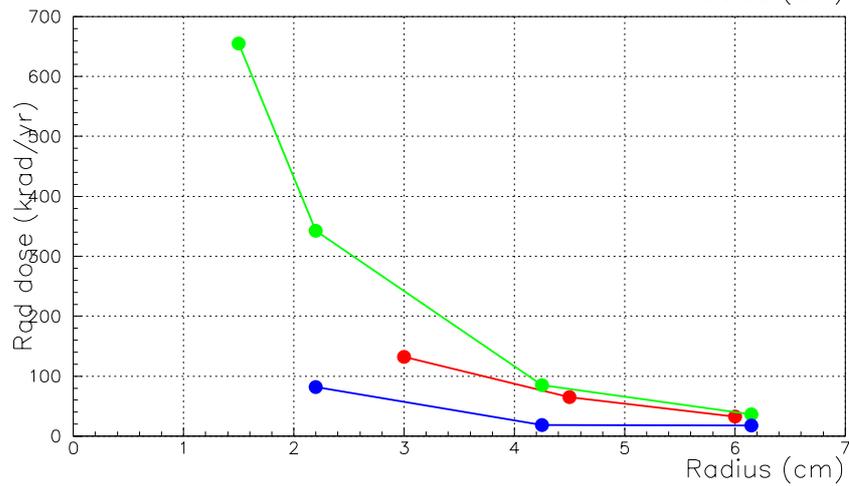
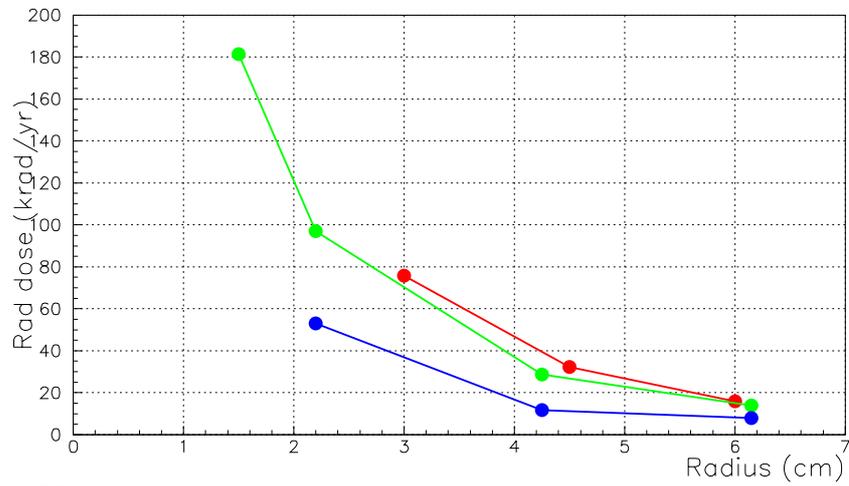
SVD2.0 $r = 1.5cm$				
HER Brem	12.5	3.0	1.9	
HER Coul	13.4	3.9	3.5	
LER Brem	13.1(9.0)	3.4(2.0)	1.6(0.6)	
LER Coul	14.0	1.4	1.0	
Touscheck	28.8(9.0)	6.7(1.3)	9.7(0.9)	
Sum	82(58)	18(12)	18(8)	

Particle Bkg Comparisons

Top: w/o Touscheck, Bottom: w/ Touscheck

- SVD1.4 (r=2cm)
- SVD2.0 (r=1.5cm)
- SVD2.0 (r=1cm)

TOTAL : SVD 1.4 (red)/SVD 1.8 r=1.5cm(blue)/SVD 1.8 r = 1.0 cm(green)



Particle Bkg Summary

- Occupancy ratio (Now→SVD2.0 design current):
= (dose ratio) × 3(current) × $\frac{1}{2}$ (shaping time)
- Dose ratios/**Occupancy ratios** for innermost lyrs:
(): ignore e^+ 's just outside b.p. at z=6.5m (LER)

$$\frac{(r1cm)}{(r2cm)} = 5.0(9.2)/7.5(14)$$

$$\frac{(r1.5cm)}{(r2cm)} = 0.6(0.8)/0.9(1.2)$$

r=1cm is not promising as it is (Touscheck!).

r=1.5cm looks good (the same noise level as now)

- Improvement on the SVD2.0(r1cm) design possible.
 - Masks entering EFC fiducial.
 - SVD2.0(r1.5cm) masks + SVD2.0(r1cm) Be b.p.
 - **Readout SVD2.0(r1cm) lyr1 on both sides.**
×1/2 for occupancy.
 - **Shorten SVD2.0 lyr2.**

- CDC rates of innermost lyrs (at same currents)

$$\frac{(r1cm)}{(r2cm)} = 1.2, \quad \frac{(r1.5cm)}{(r2cm)} = 0.5$$

×3(current) < 8 (OK)