Beam Background

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1. IR design from the viewpoint of the beam background

Crossing angle	±11mrad
Separation bending magnets	Not necessary
β_x^*	0.33m
Coupling($\varepsilon_y / \varepsilon_x$)	2 %
Beam pipe at IP	round shape 40mm$^\phi$ Helium cooling

No bending magnets
No off-center Q magnets
for both incoming beams

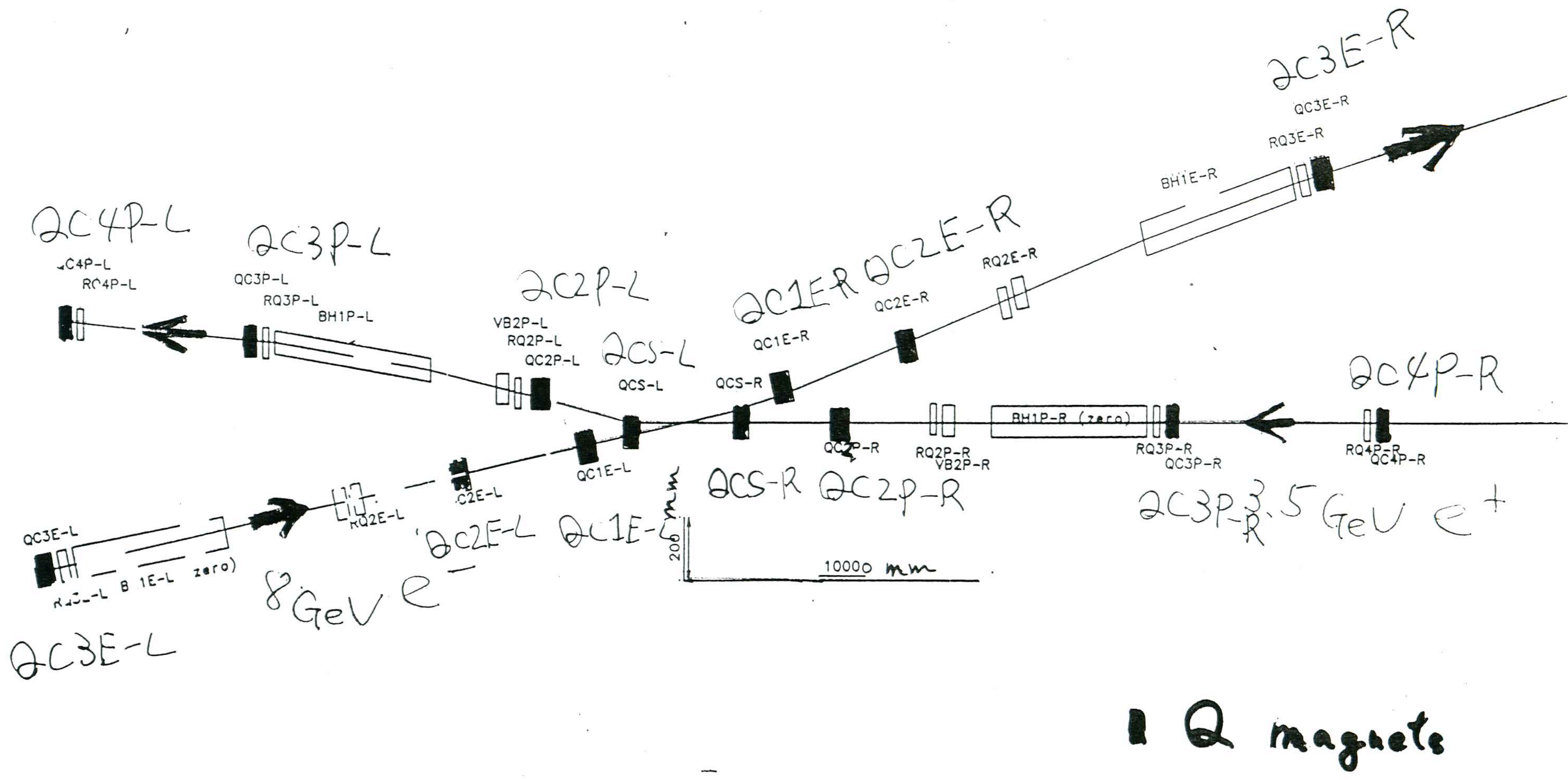
↓

No strong synchrotron radiation sources
No strong seep magnets

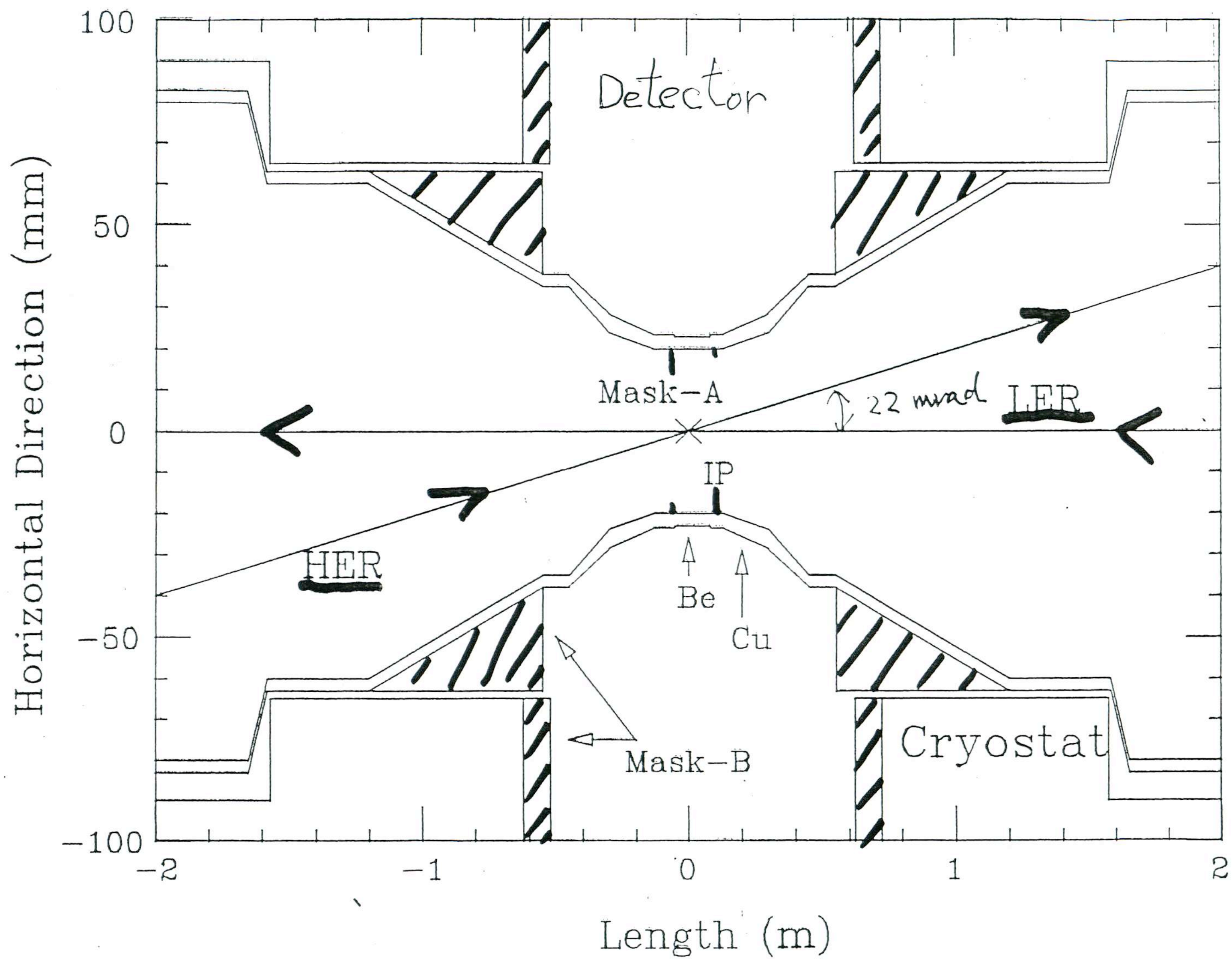
↓

Beam background is less severe.

New IR Design (±11 mrad crossing angle)



Beam Pipe and Mask



2. Synchrotron Radiation Background

2-1 SR photons from QCS and QC1

Go through without hitting Mask-A and the beam pipe inside the cryostats.

Mask-A prevents the backscatter photons from entering the detector.

2-2 SR photons from QC2 and QC3

Can hit Mask-A.

But,

The critical energy is very small(< 2 KeV)

⇓

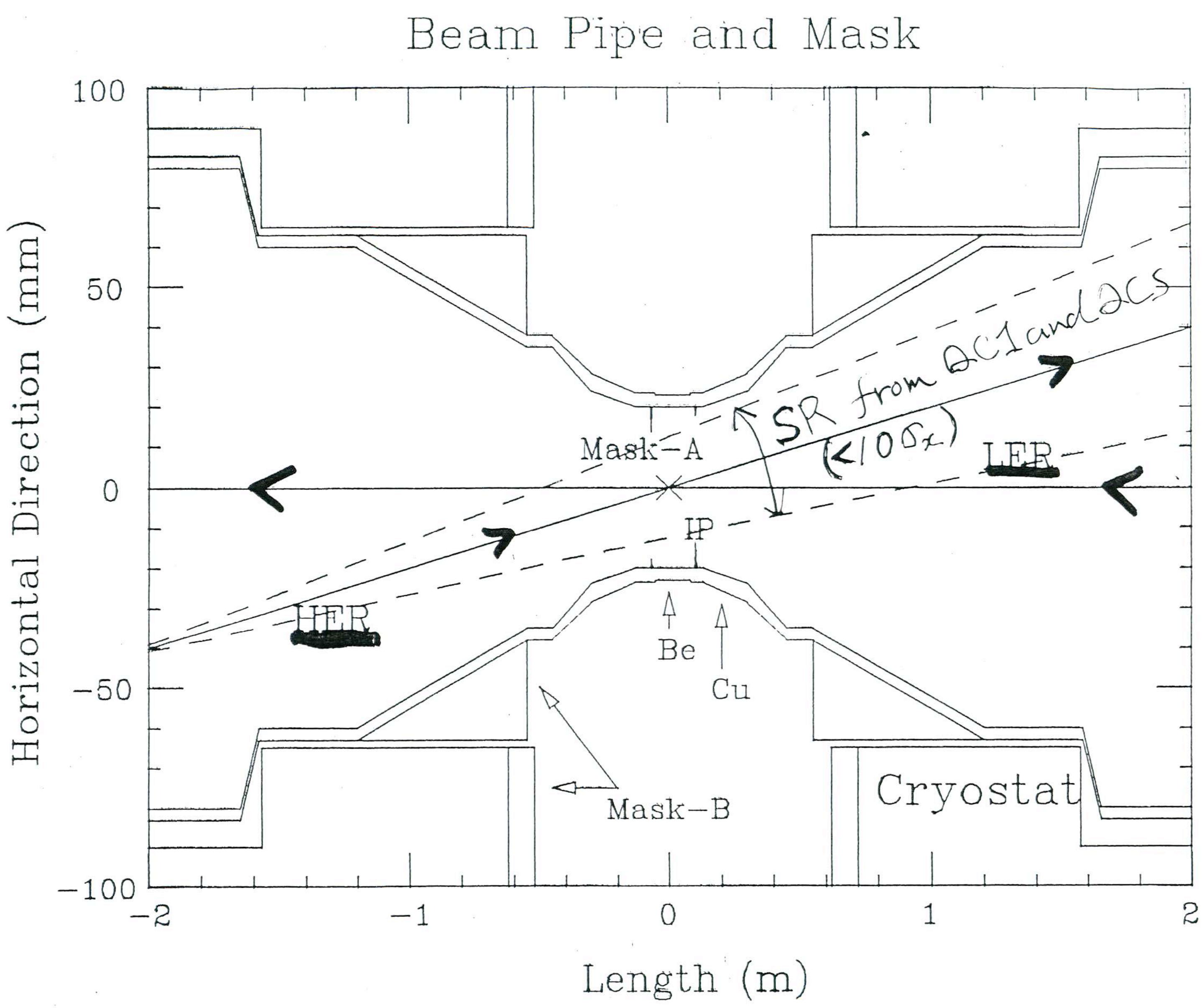
No problem (EGS4 simulation)

2-3 SR photons from other magnets

Can be intercepted by the movable masks installed just upstream of QC3.

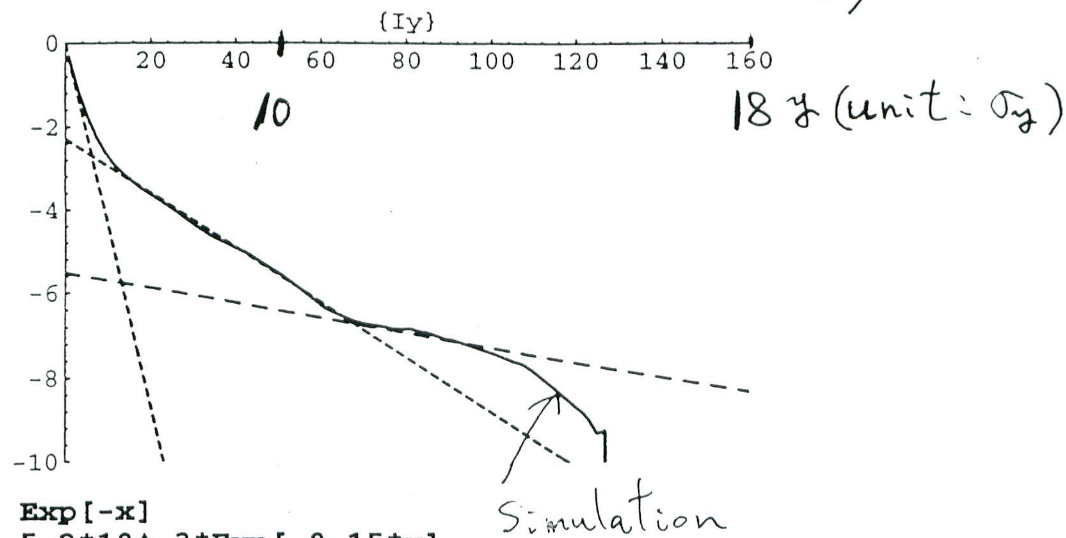
2-4 SR photons from bending magnets for arc section and local correction

Weak magnets are installed for the last bending.

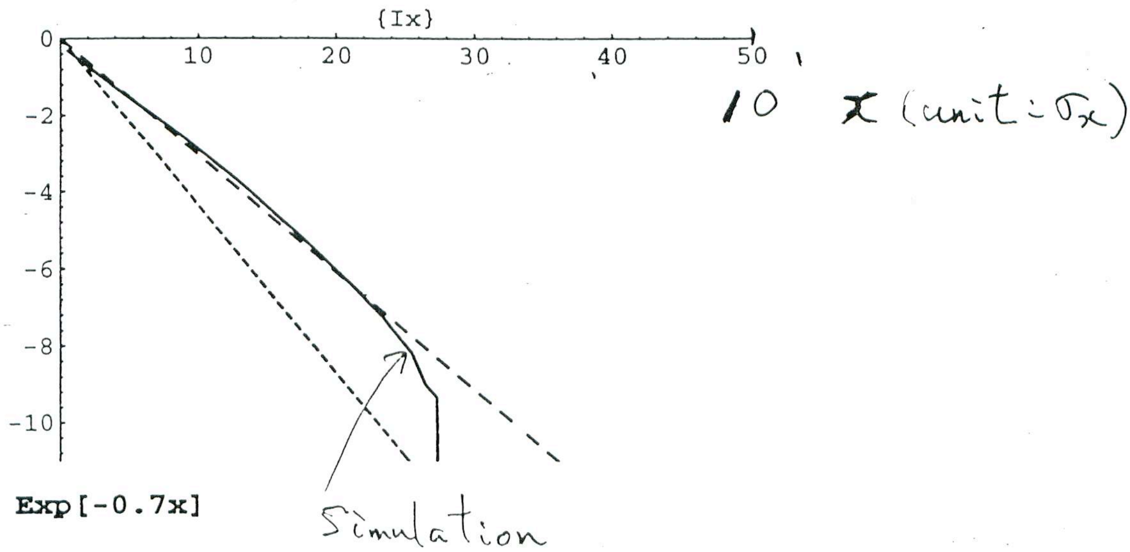

Beam Pipe and Mask
Horizontal Direction (mm)
100
50
0
-50
-100
-2
-1
0
1
2
Length (m)
Mask-A
IP
Be
Cu
Mask-B
Cryostat
HER
LER
SR from QC1 and QCS
(<10σx)

Tail simulation

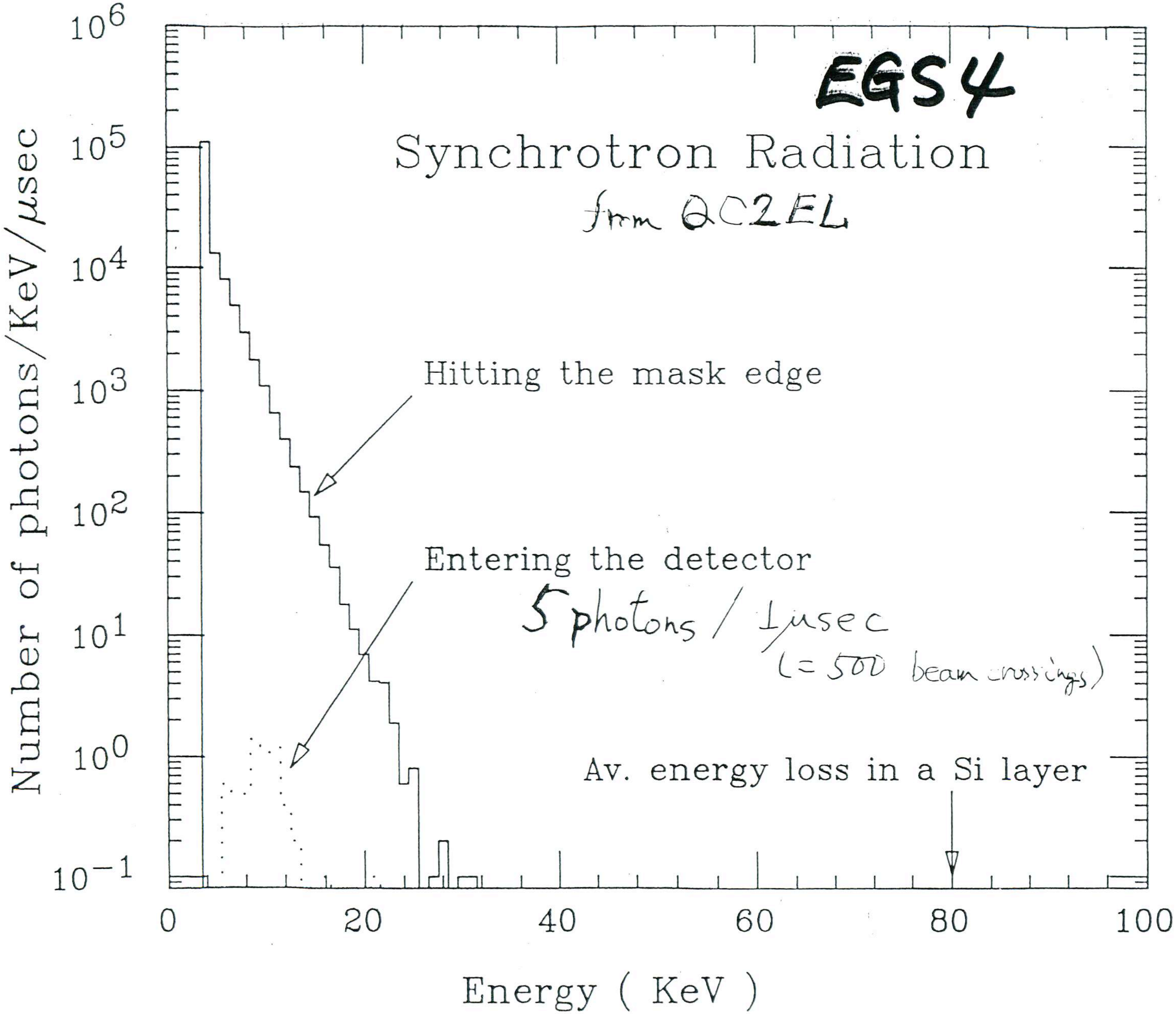
by Dr. Hirata



Exp[-x]
5.2*10^-3*Exp[-0.15*x]
3*10^-6*Exp[-0.04*x]



Exp[-0.7x]



~800 hits
for electronic noise
in Si VTX.

3. Particle Background

3-1 Brems. e

Hit the beam pipe between the two cryostats (-53cm < Z < 72cm).

Rate (estimated with DECAY TURTLE)

assuming a 1ntorr vacuum pressure

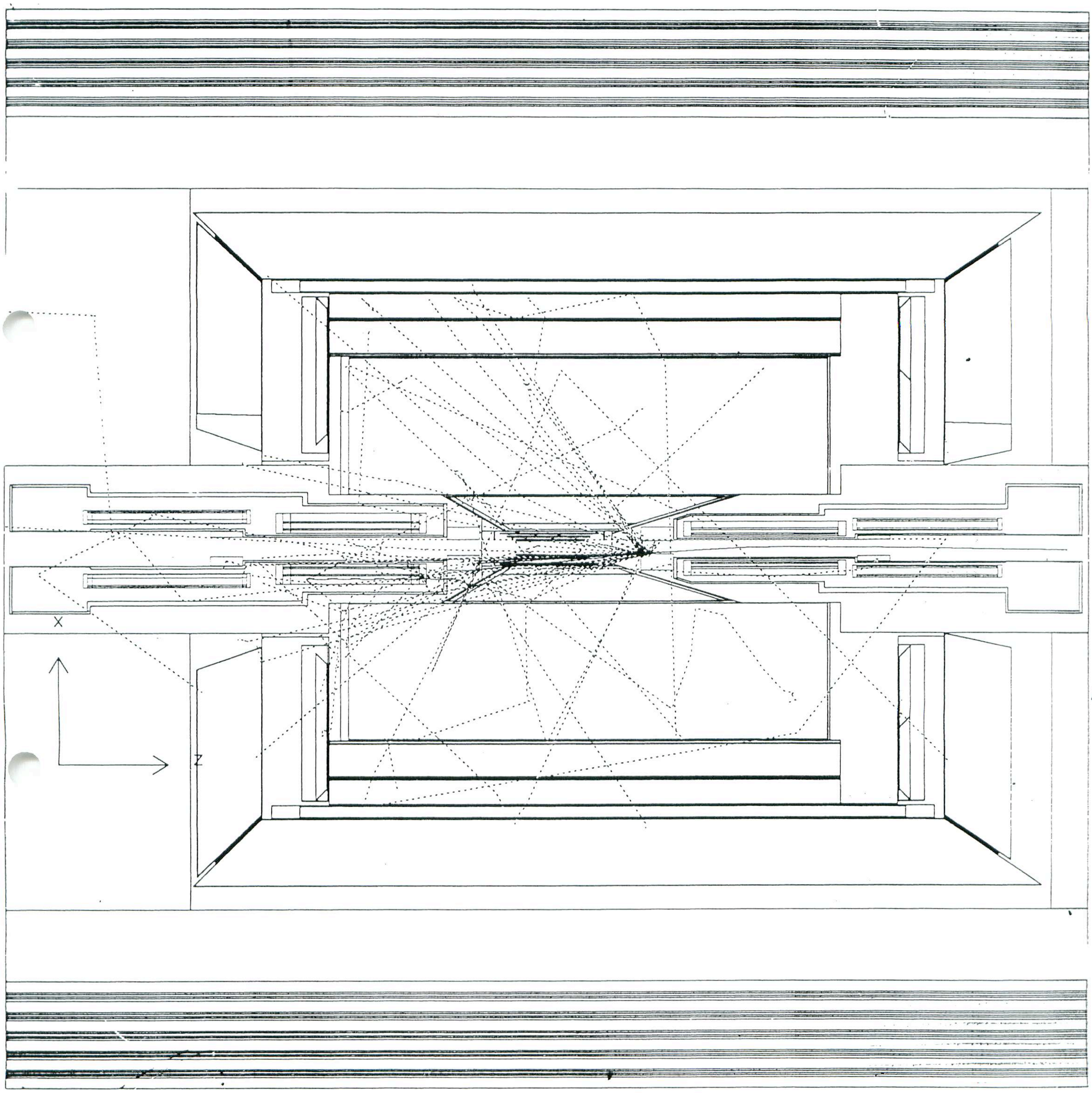
~ 90 kHz for LE
~ 40 kHz for HE
~ 130 kHz in total

This rate is a factor of three smaller than that for the LoI reference design.

GEANT simulation have been done for the LoI design.

3-2 Coulomb scattering

~ 10% effect of that of the Brems. e .



source 2 0.82 GeV

SVD

Results

by H. Ozaki

Radiation dose to SVD (prelim.)

Dose from source#1 << from source#2.

SVD1: ~0.83 krad/y
SVD2: ~0.44 krad/y
SVD3: ~0.21 krad/y (1y=10^7 sec.)

~1 krad/year

Strong φ dependence <-> consistent with b.g. from source#2. See fig.
z dependence ~flat. See fig.

Occupancy (very prelim.)

	SVD1	SVD2	SVD3
rφ	0.16	0.11	0.06
z	0.18	0.10	0.05 %/3μsec

~0.1%

#ch. to be readout (after sparse data scan)

spent e+- b.g. : ~ ~~20~~ ~~55~~ 90 ch.
electronic noise : ~780 ch. (thrs.=3.7*ENC)
BB event : ~240 ch. (pt>50MeV)
(cf. total # readout ch. : ~87k)

TOF

by Sagawa

Table 5.4: Trigger rates for different TOF and TSC combinations.

Trigger condition	discri. [m.i.p]	$N_{TOF} \geq 1$ [kHz]	$N_{TOF} \geq 2$ [kHz]
Barrel TOF (no TSC)	0.1	174	46
	0.2	82	10.4
Barre' TSC1&TSC2	0.1	9.0	0.3
	0.2	1.4	≤0.2
Barrel+Forward TSC1&TSC2	0.1	11.8	0.4
	0.2	3.4	≤0.2
Barrel+Forward/Backward TSC1&TSC2	0.1	46	7.4
	0.2	32	3.6

Tolerable level
~70 kHz

CsI

by Sagawa

Table 5.9: Number and average energy of background photons produced by spent electrons.

		barrel	forward endcap	backward endcap
Rate	$E_\gamma > 100$ keV	148	10	54
($N_\gamma/10\mu s$)	$E_\gamma > 1$ MeV	20	0.8	18
	$E_\gamma > 10$ MeV	0.6	0.02	1.8
average E_γ	$E_\gamma > 1$ MeV	3 MeV	3 MeV	4 MeV

Radiation Damage Test

12. rad / year

~ 20% light loss for 10 K rad

3-3 Radiative Bhabha ($e^+e^- \to e^+e^-\gamma$)

Zero angle scattering -->> huge cross section

Off momentum particles are produced at IP, and can hit the beam pipe around the edge of the cryostats.

Rate

~ 60 MHz for hitting the left side

Enegy < 0.5 GeV

~ 80 MHz for hitting the right side

Energy <1.5 GeV

↓

Back sprash only affects the detector.
(a few MeV photons)

GEANT simulation is necessary.

But,

No effect on the final trigger

Small effect on the Si vertex detector

4. Summary

4.1 Unless we use the separation bending magnets the synchrotron radiation do not cause any serious problems.

4.2 The particle background is tolerable, considering the rates.
However, more GEANT simulations are necessary to optimize some masks and shields.