Background study at GLD-IR

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Low P v.s. Nominal

- Anti-DID field
  - Andrei optimized field in Jupiter
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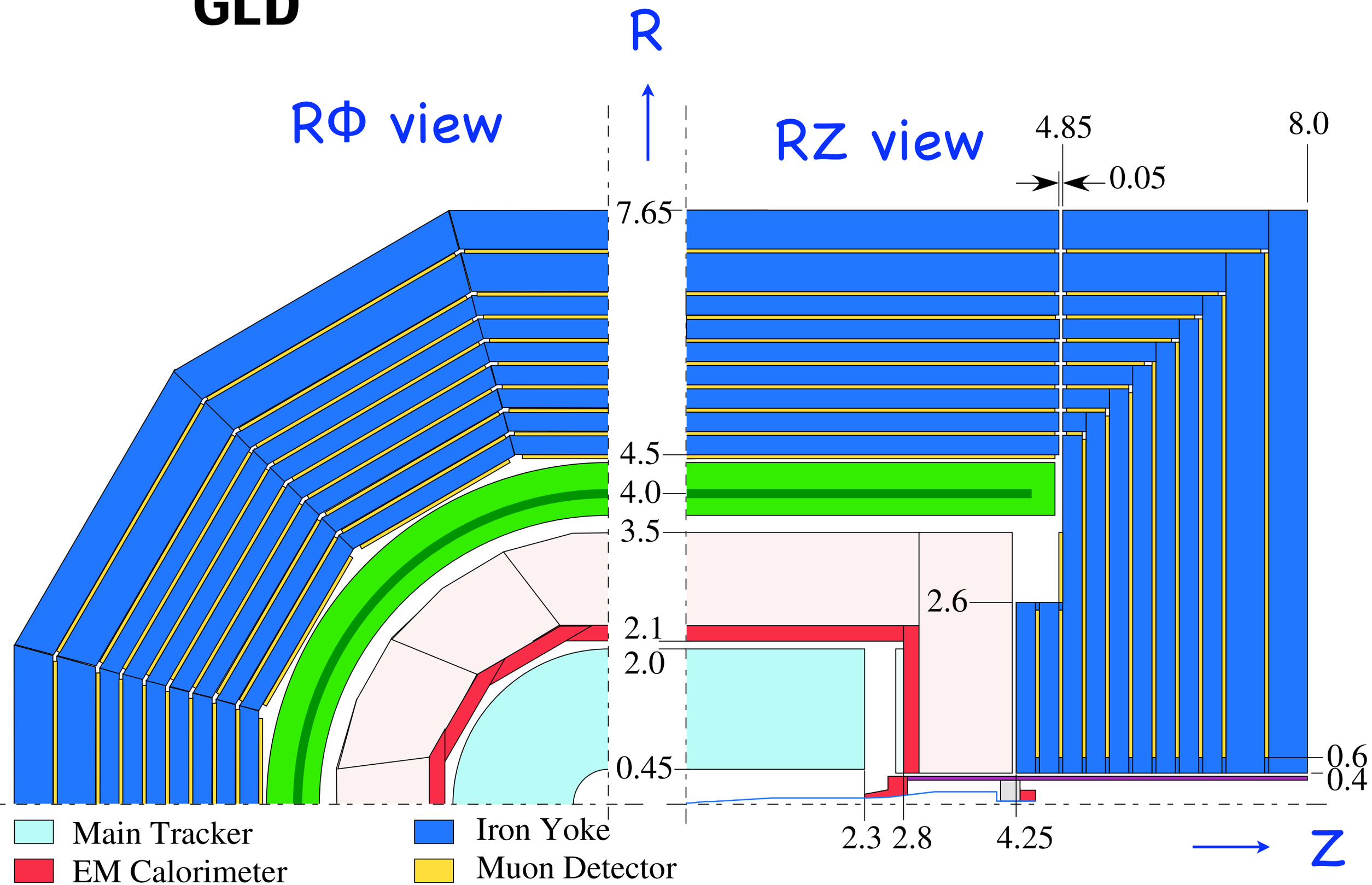
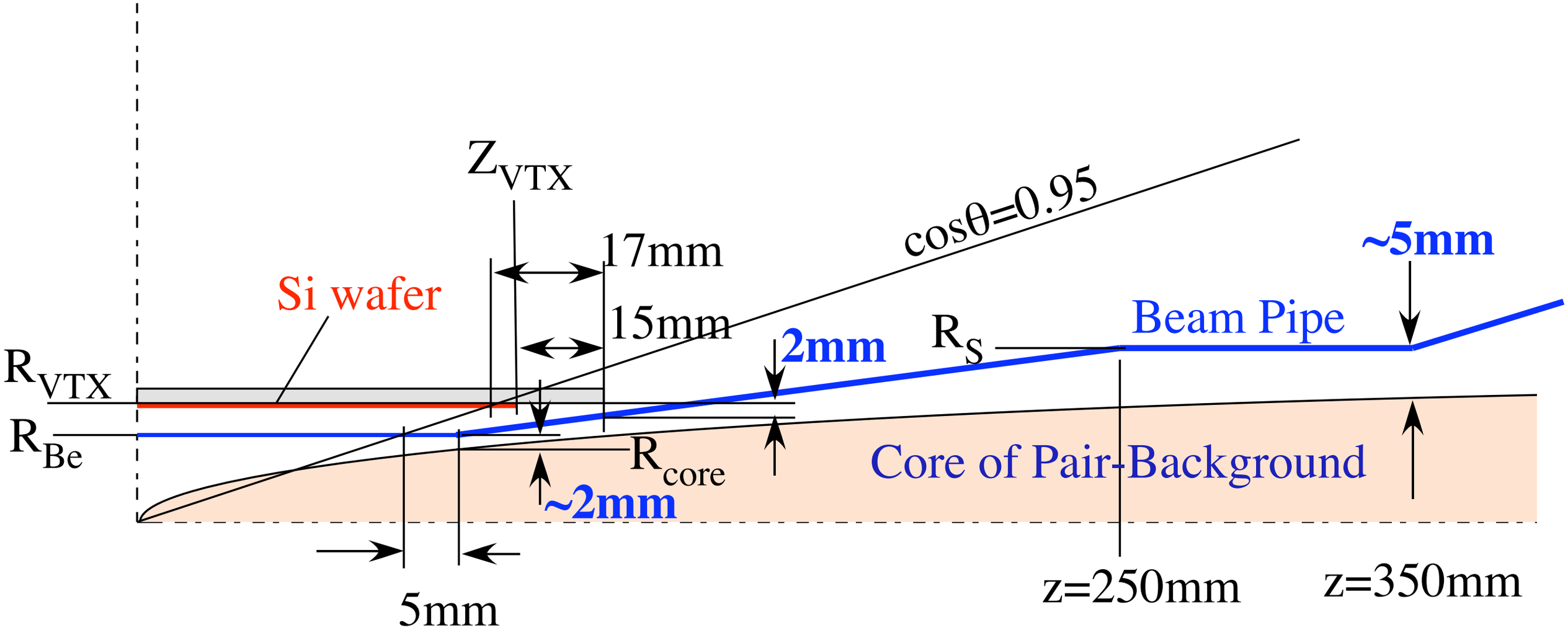
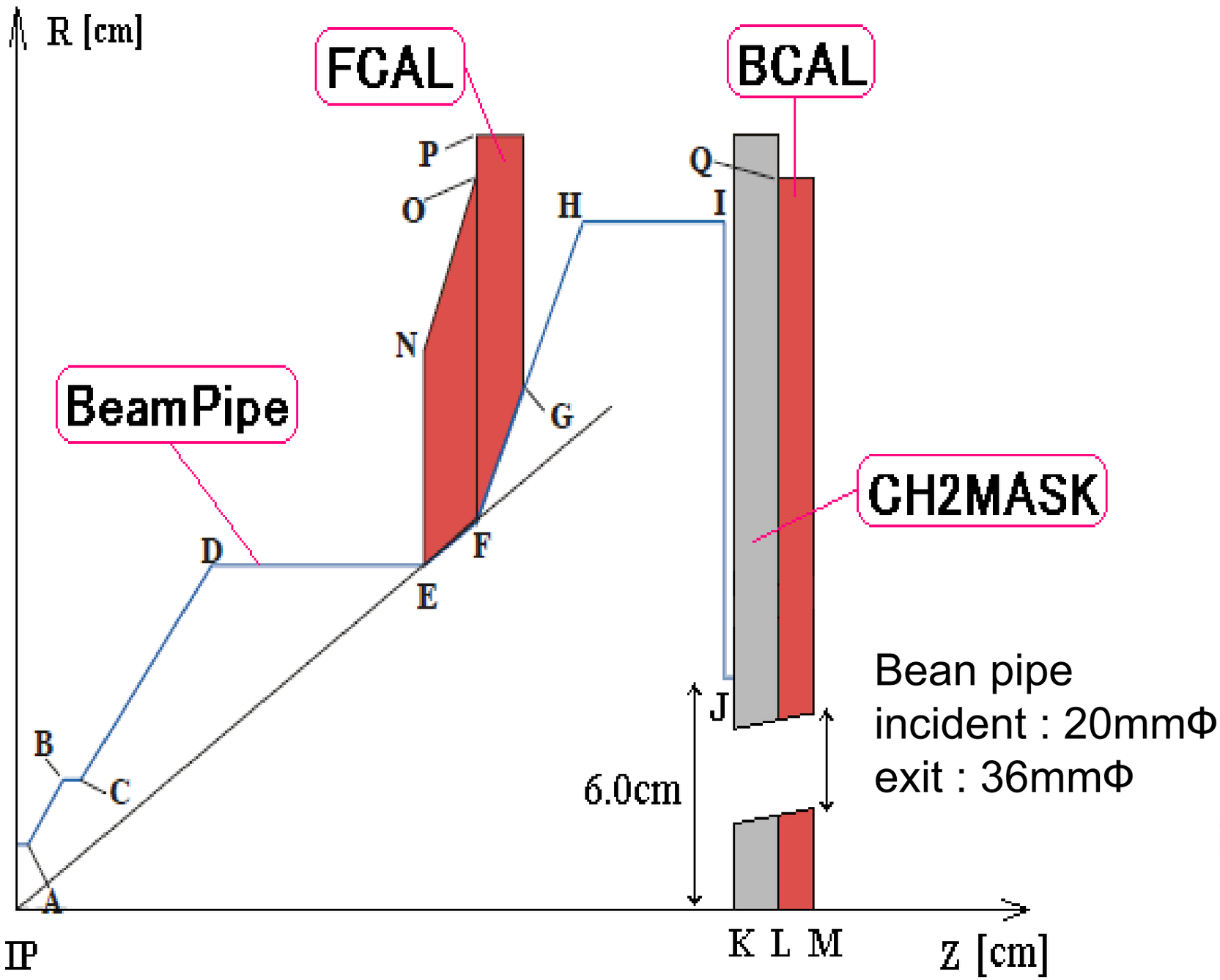
GLD


R
RΦ view
RZ view
4.85
8.0
0.05
7.65
4.5
4.0
3.5
2.6
2.1
2.0
0.45
0.6
0.4
2.3
2.8
4.25
z
Main Tracker
EM Calorimeter
Hadron Calorimeter
Cryostat
Iron Yoke
Muon Detector
Endcap Tracker

Interaction Region (IR) Design
Beam Pipes etc.



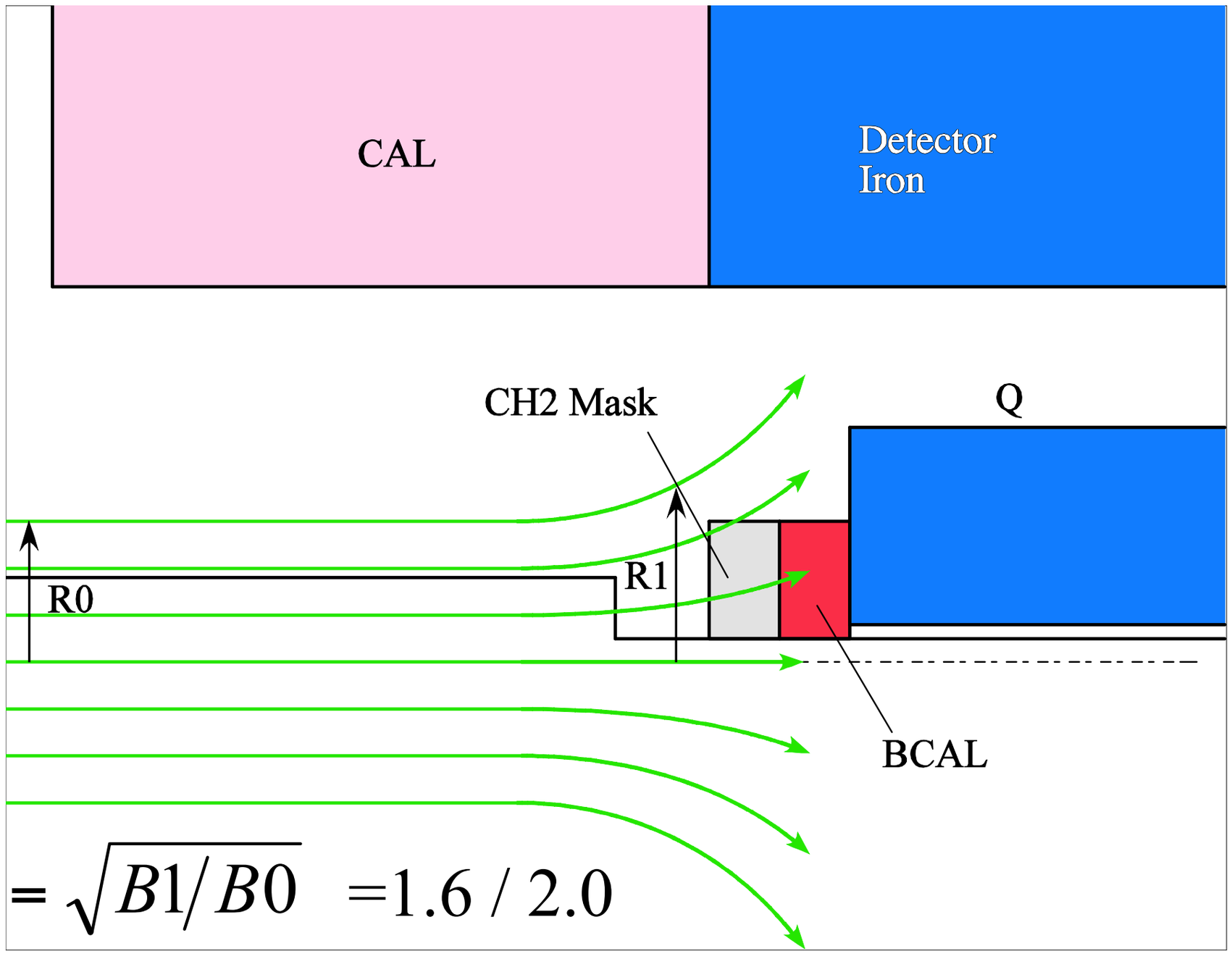
IR region of GLD ; geometries in Jupiter



Position	R [cm]	Z [cm]
A	1.3	4.5
B	3.4	25
C	3.4	35
D	8.2	110
E	8.2	230
F	9.04	260
G	11.94	285
H	16	320
I	16	400
J	6.0	400
K	0	405
L	0	430
M	0	450
N	13	230
O	17.7	260
P	36	260
Q	20	430

Y.Sugimoto

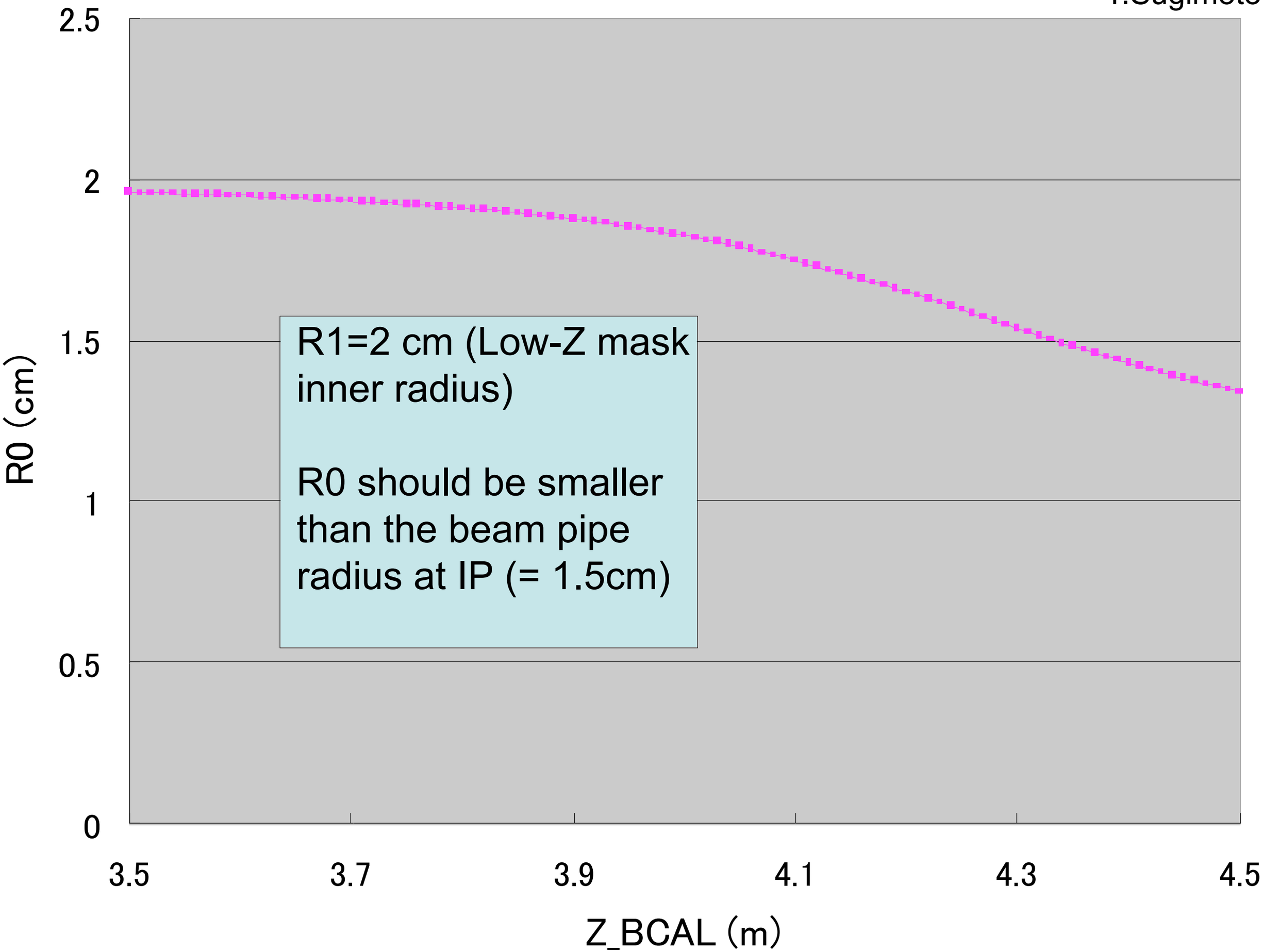
e+/e- backscattering



$$R0 / R1 = \sqrt{B1/B0} \quad = 1.6 / 2.0$$

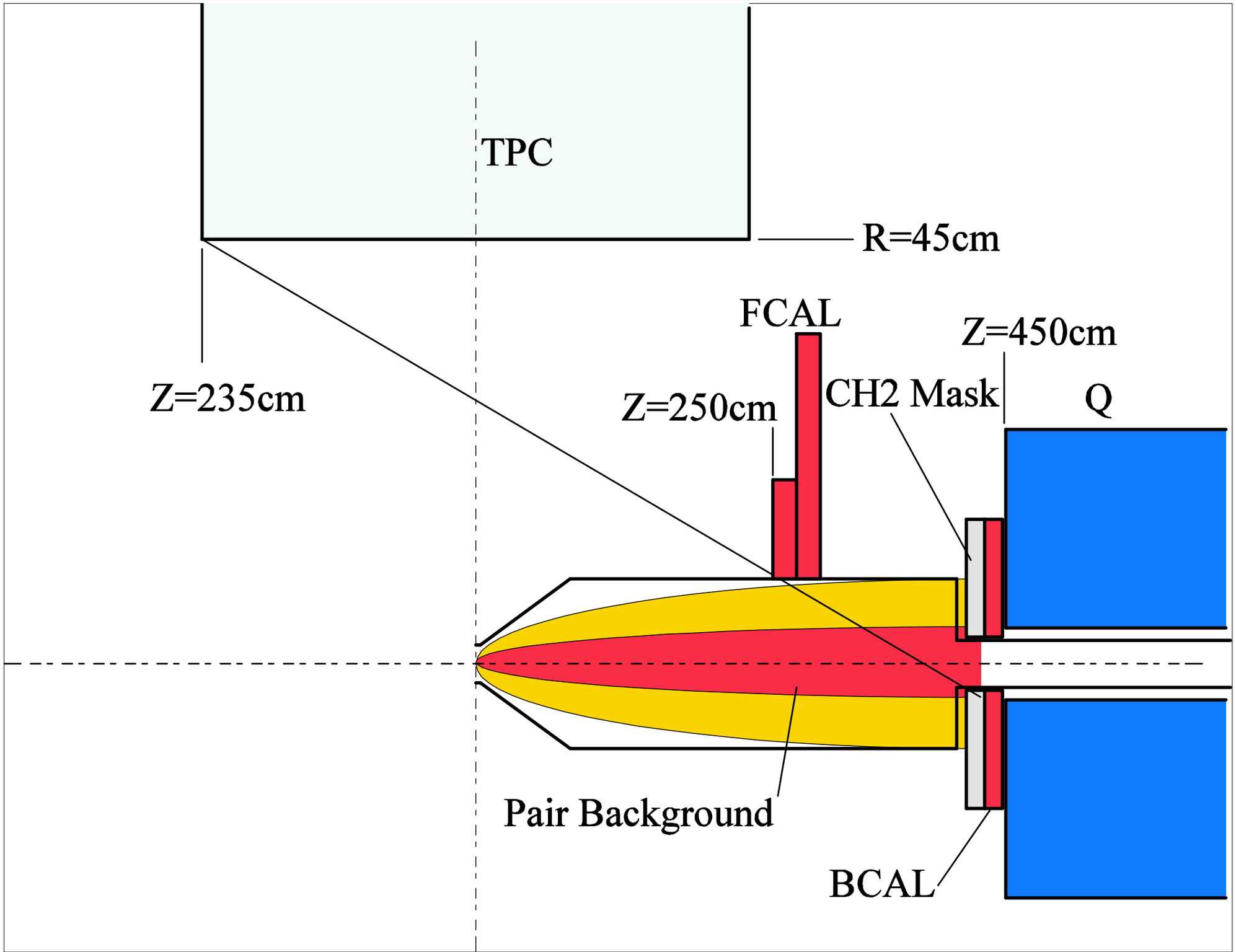
(Z1=L*-0.2m=4.3 m)

Y.Sugimoto


2.5
2
1.5
1
0.5
0
R0 (cm)
R1=2 cm (Low-Z mask inner radius)
R0 should be smaller than the beam pipe radius at IP (= 1.5cm)
3.5
3.7
3.9
4.1
4.3
4.5
Z_BCAL (m)

Y.Sugimoto

γ back scattering



Q magnet design and location

Ecm=500GeV, Nominal parameter set, 14mrad

Upstream

unit : cm, T/m

magnet	Inner radius	Outer radius	length	z position	Field gradient
QD0	1.0	3.6	220	451	-121.44
SD0/OC0	1.0	2.8	70	681	0
QF1	1.0	4.2	200	881	75.88
SF1/OC1	1.0	28.0	35	1091	0

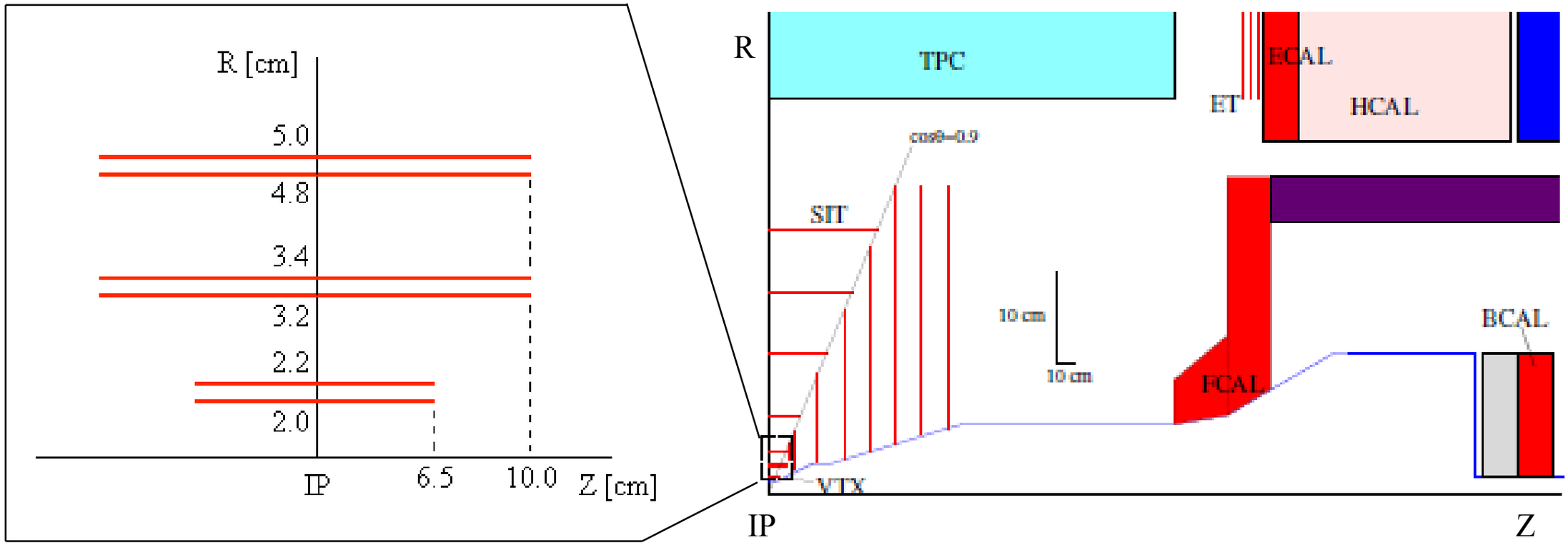
Note : Sextupole magnetic fields are not installed in Jupiter, yet.

Downstream

unit : cm, T/m

magnet	Inner radius	Outer radius	length	z position	Field gradient
QDEX1A	1.8	4.6	164	600	83.33
QDEX1B	2.4	6.2	164	794	50.00
QFEX2A	3.0	7.2	162	988	40.00

Vertex detector and TPC



VTX : Super double layers

VTX	R [cm]	Half Z [cm]
0	2.0	6.5
1	2.2	6.5
2	3.2	10.0
3	3.4	10.0
4	4.8	10.0
5	5.0	10.0

TPC

R [cm]	45~200
Half Z [cm]	255*
No. of layers	200

*GLC DOD value is 230cm for the fiducial volume.

Treatment of TPC exact hits

R direction

Exact hits are digitized at 200 layers.

Z direction

Many hits is generated along z direction.

Digitize only in z direction.

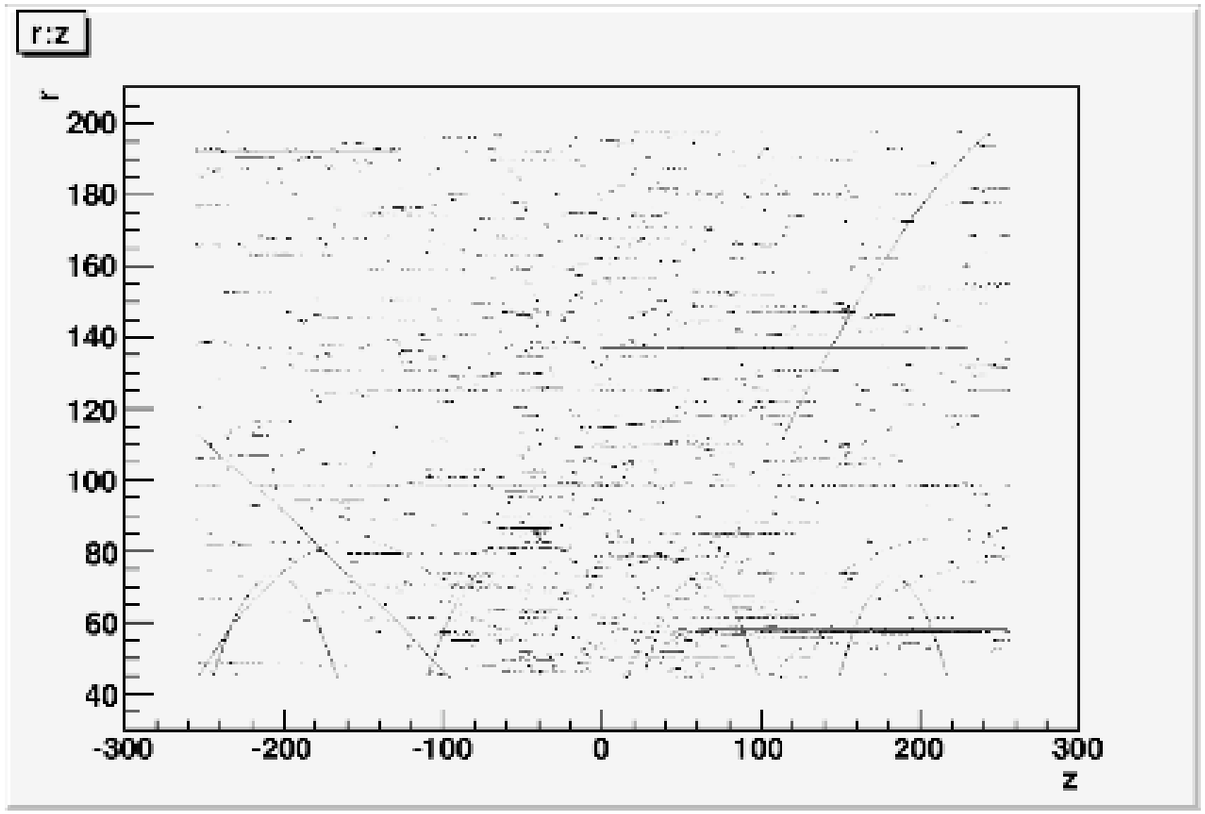


Fig.2 TPC exact hits

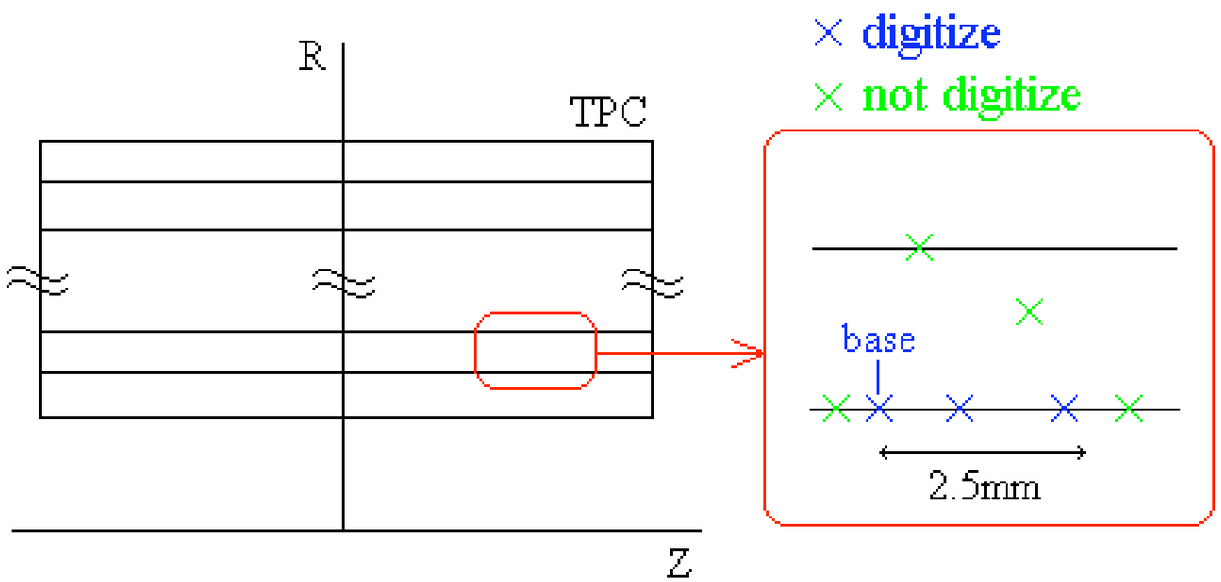


Fig.3 TPC digitization

Reading interval: 50 nsec

Drift velocity: 5cm / μsec

=> 2.5 mm

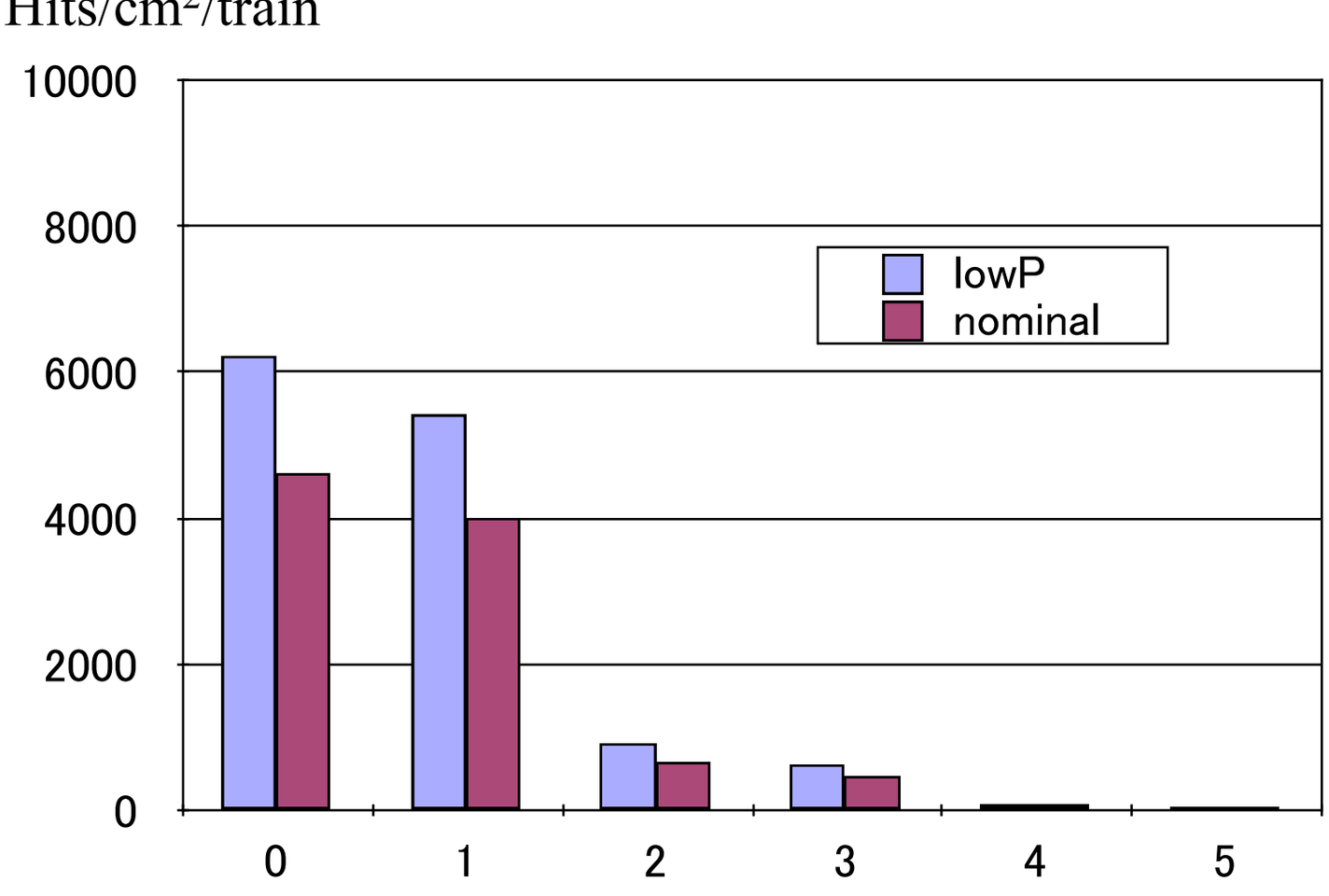
Simple digitization with no merging overlapped signals; conservative estimation

VTX hits and tolerance

Hits/cm^2/train

Layer	0	1	2	3	4	5
Nominal	4619	4025	675	488	99	67
LowP	6227	5449	930	658	89	63

MC statistics : Nominal: 20 bunch data, LowP: 1 bunch data

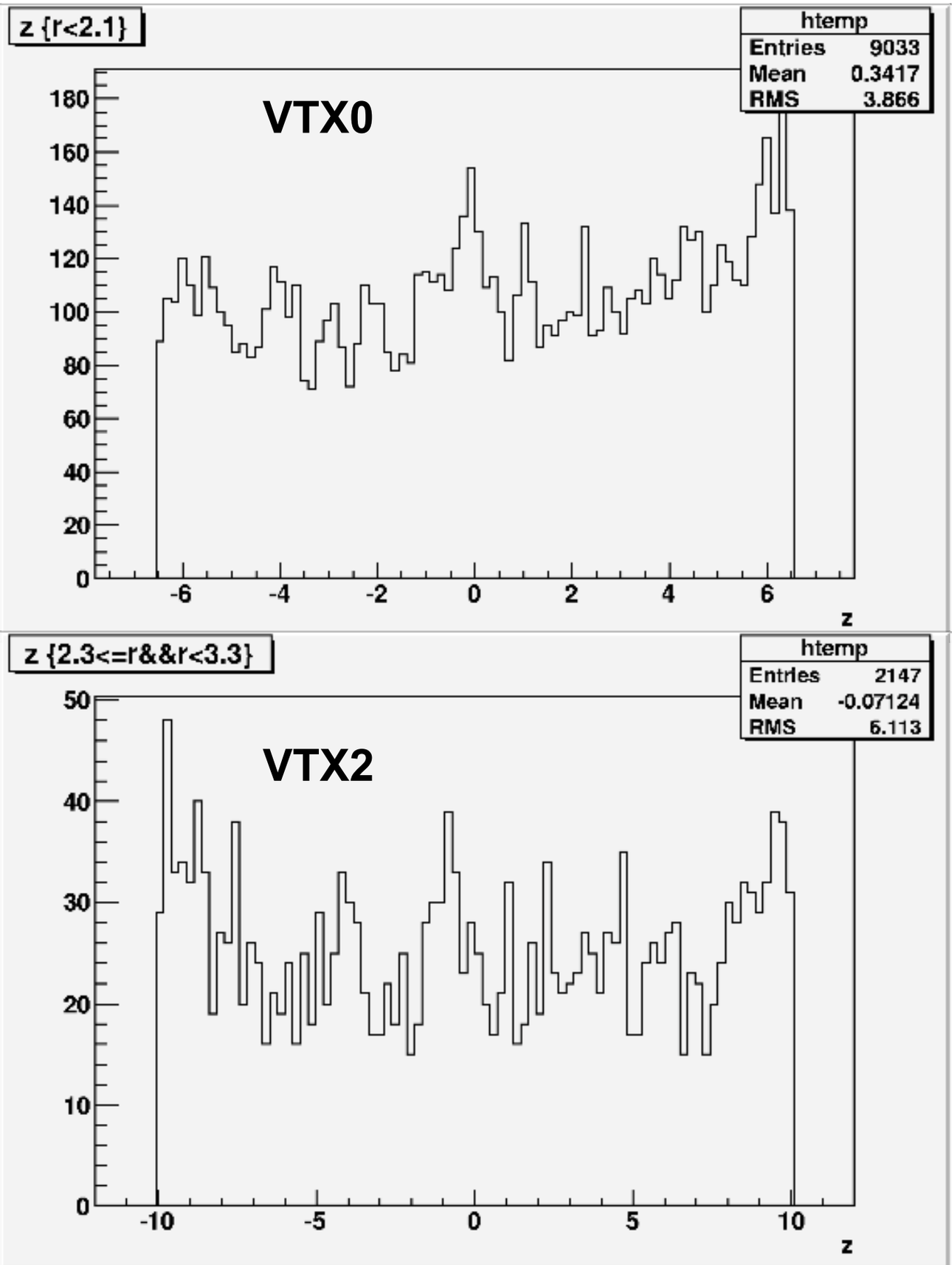


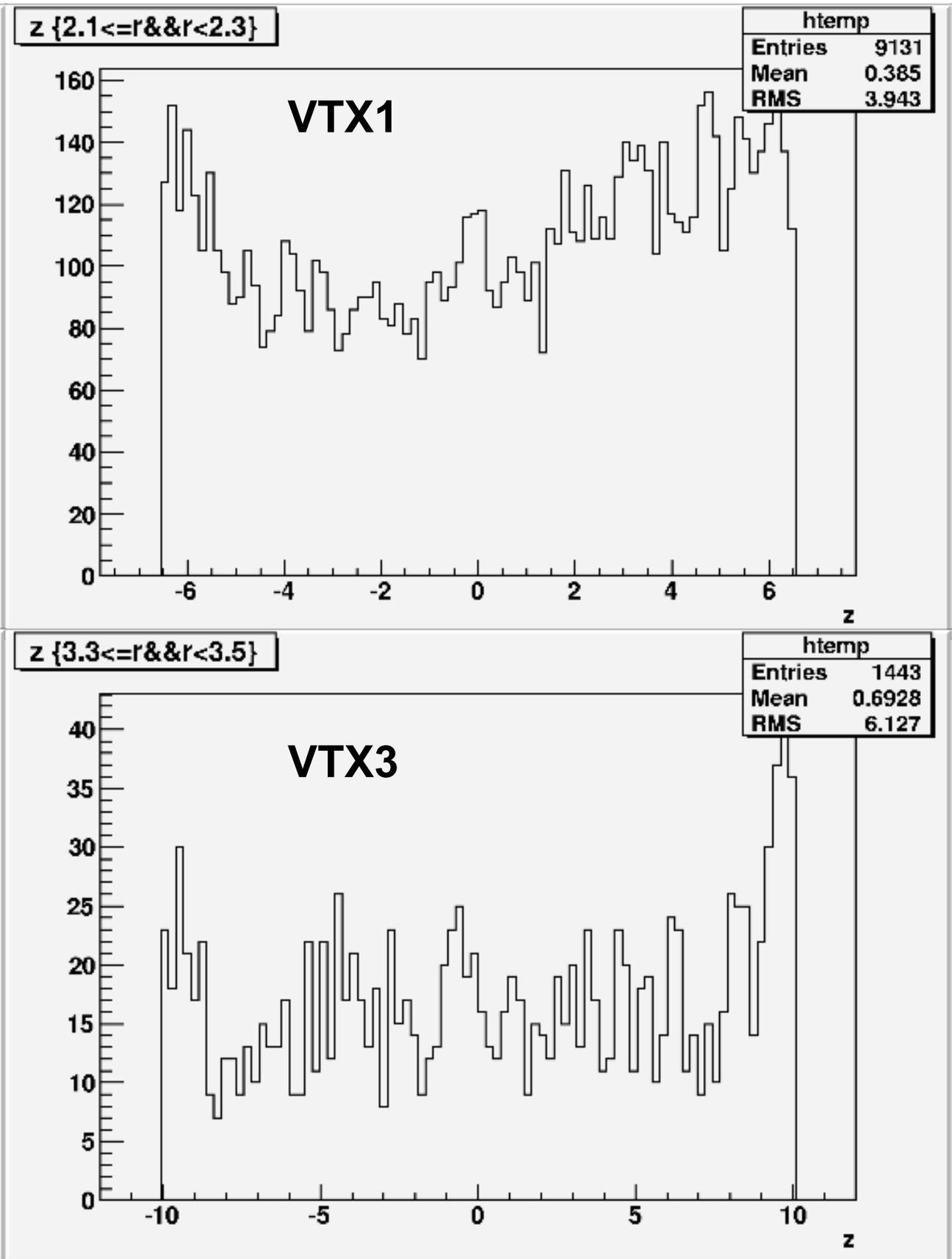
Tolerance: 1.0×10^4

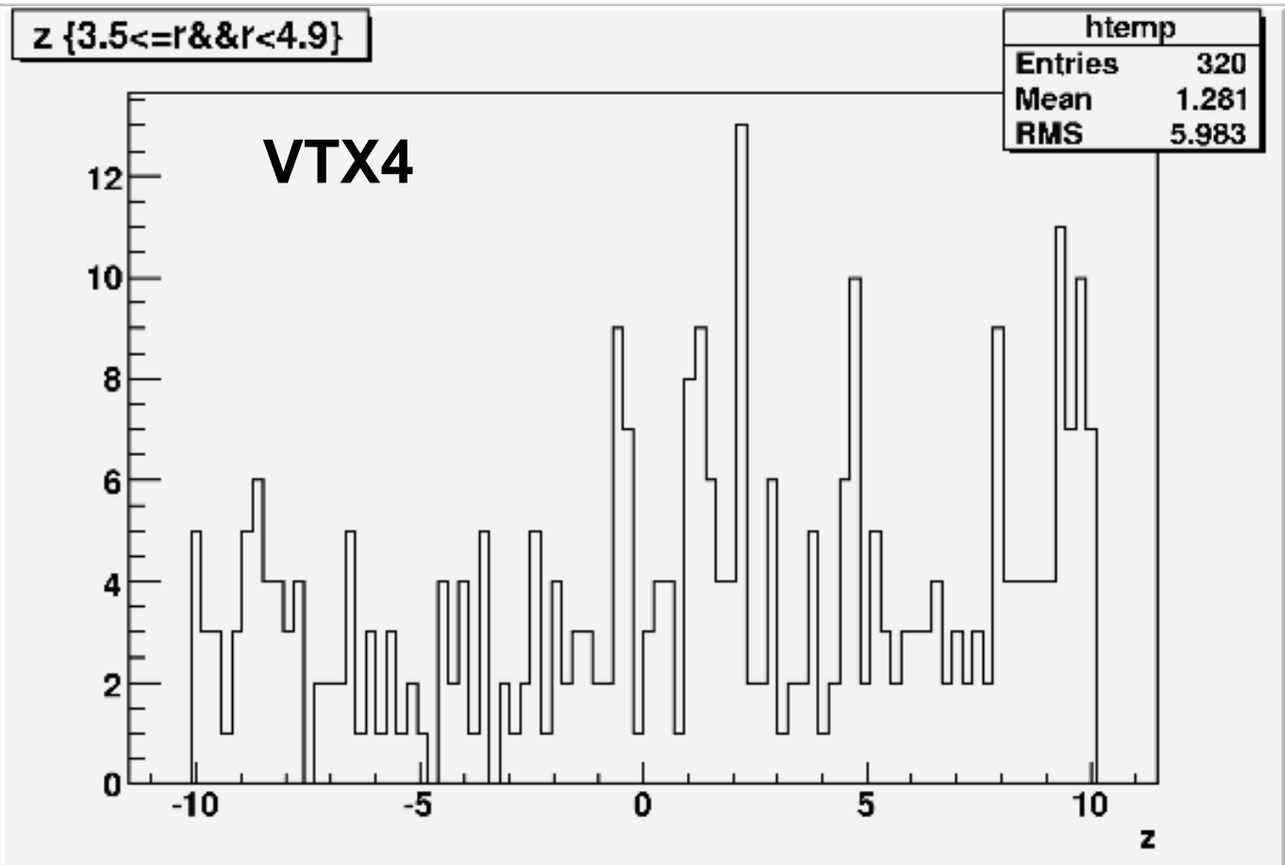
Below tolerance.

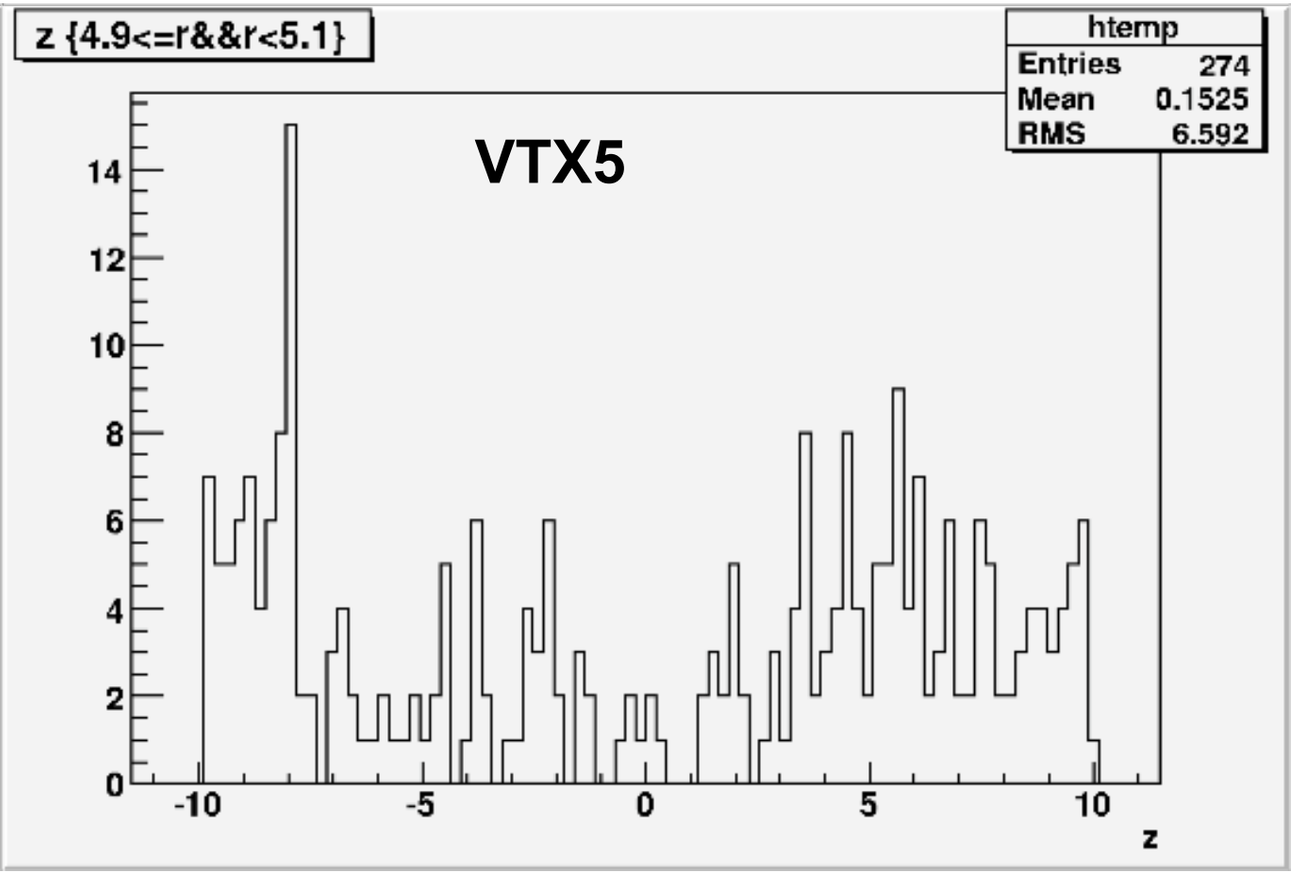
LowP background is more than nominal background.

VTX Hits distribution as a function of Z at each layer





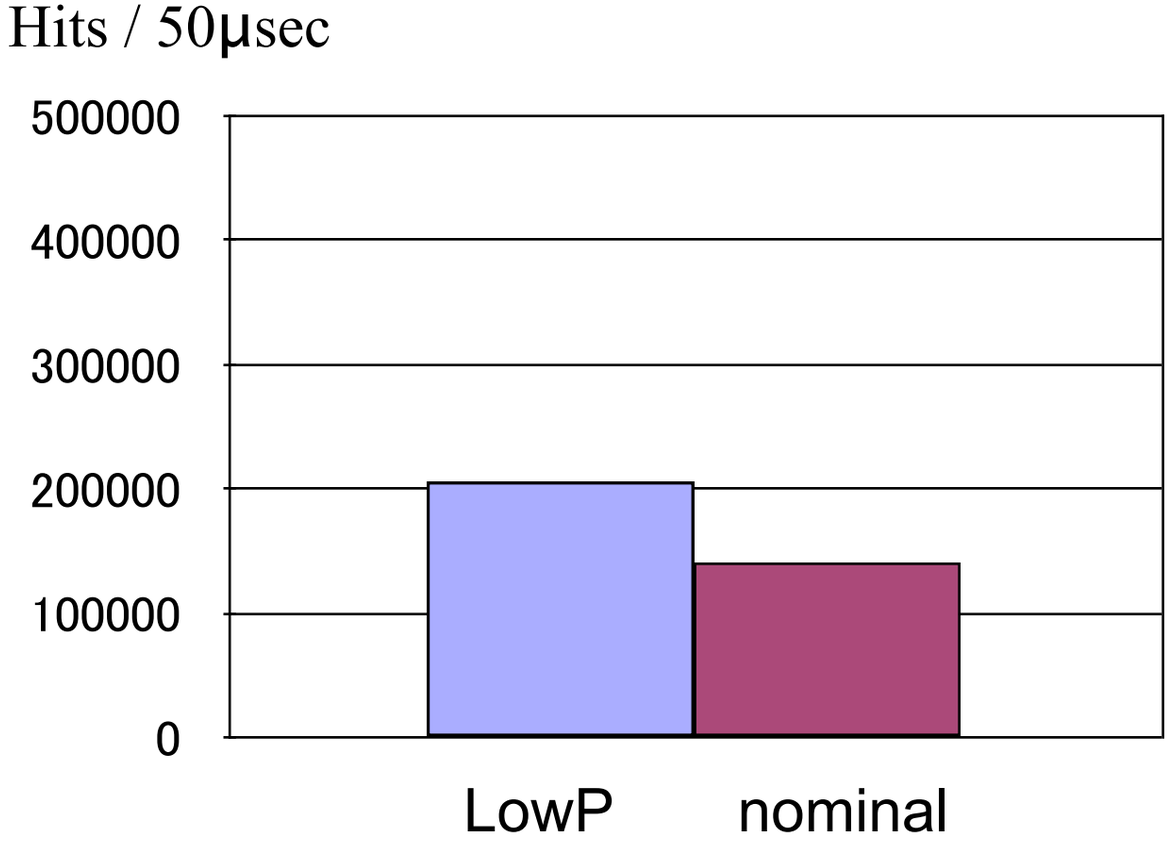

z {3.5<=r&&r<4.9}
htemp
Entries 320
Mean 1.281
RMS 5.983
VTX4
z


z {4.9<=r&&r<5.1}
htemp
Entries 274
Mean 0.1525
RMS 6.592
VTX5
z

TPC hits and tolerance

	hits/bunch	hits/50μsec
Nominal	883.8	141,408
LowP	2590	207,200

MC statistics : Nominal: 20 bunch data, LowP: 1 bunch data



Tolerance: $4.92*10^5$

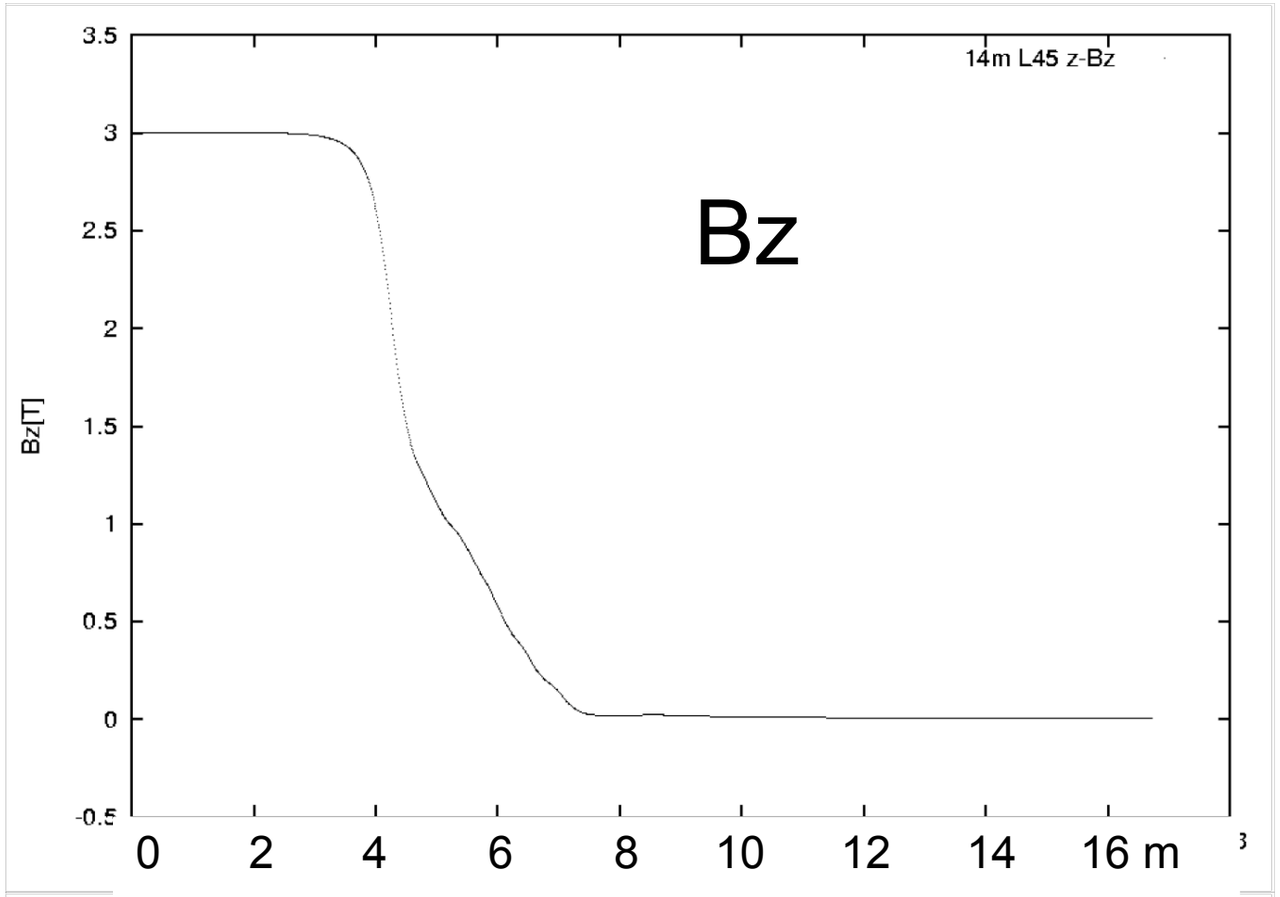
Below tolerance.

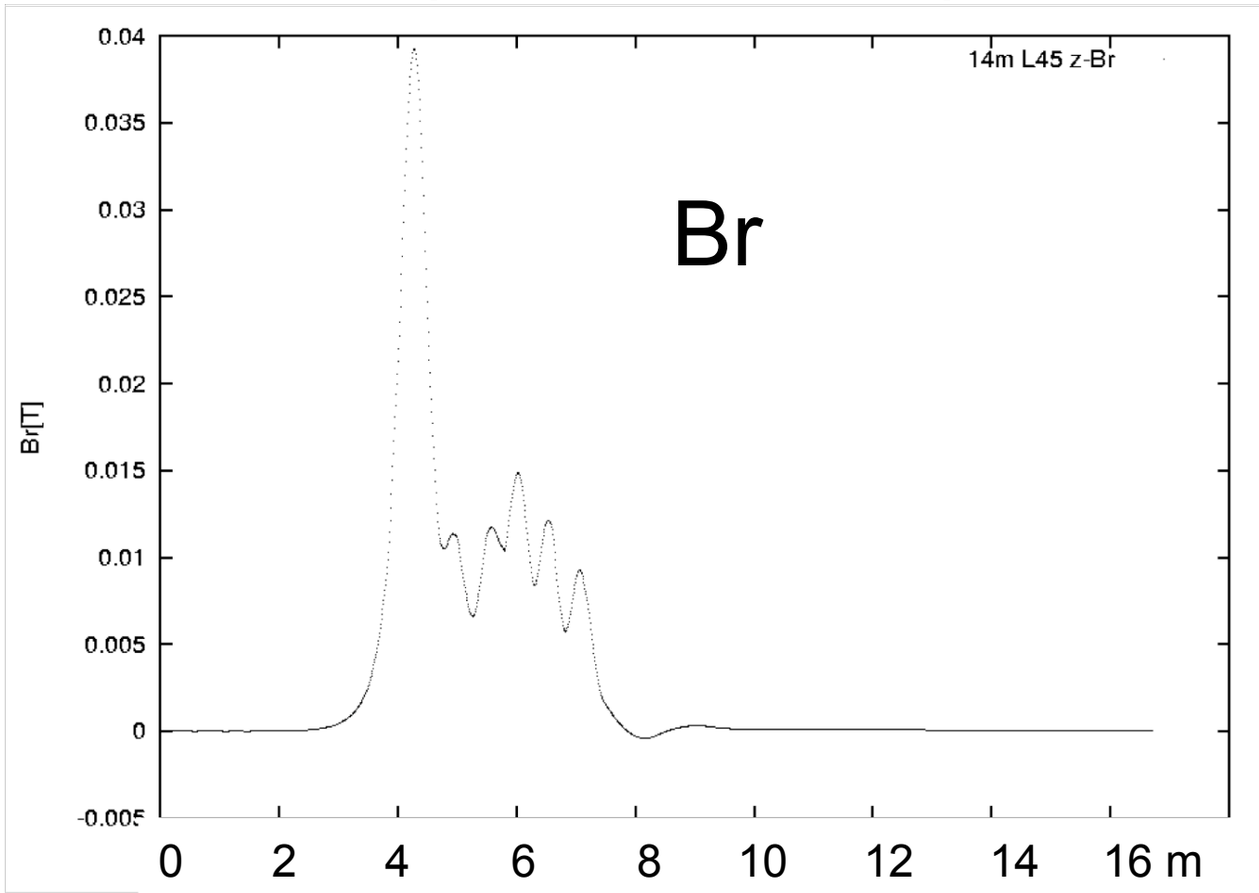
LowP background is about 1.5 times nominal background.

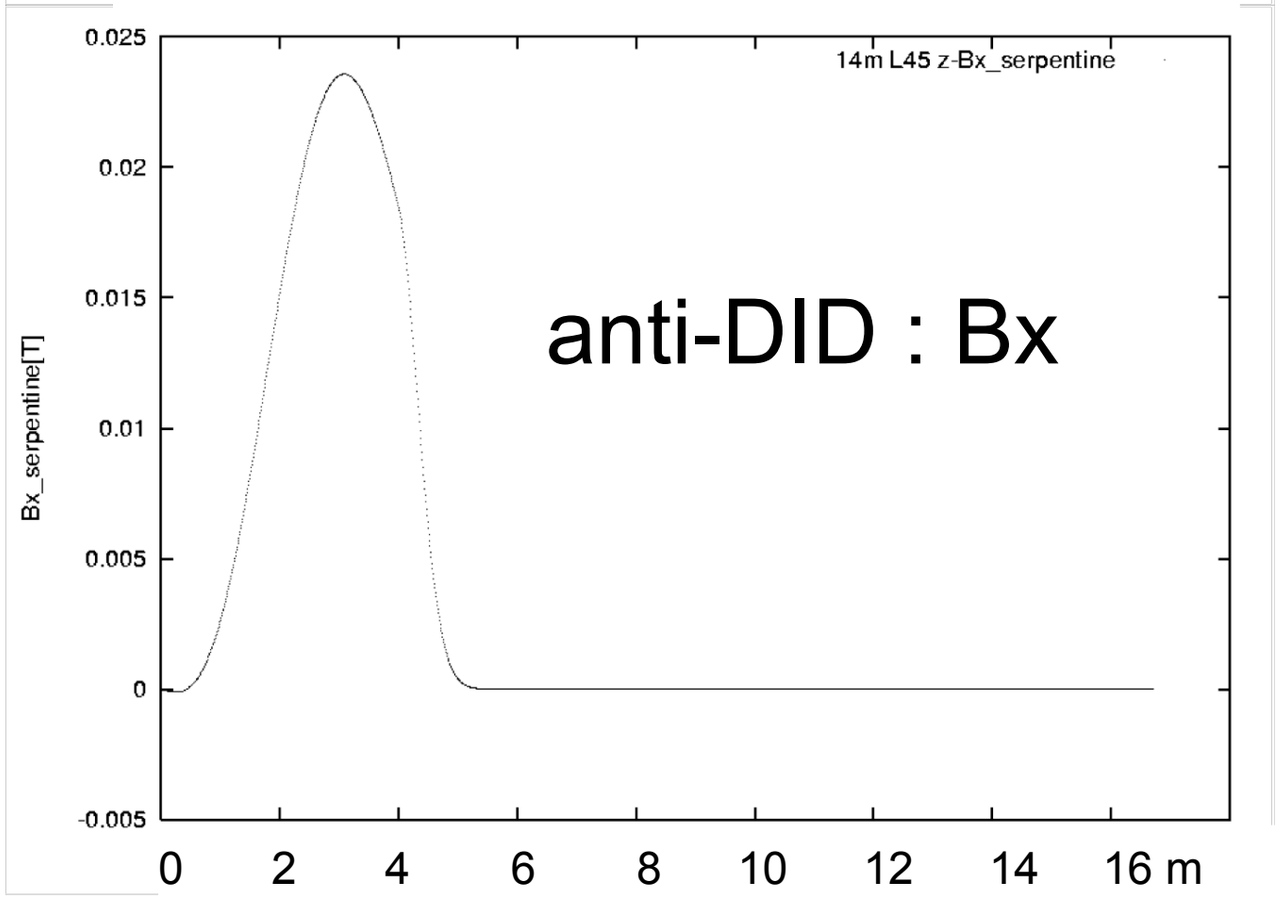
Anti-DID filed

GLD

Andrei optimization in Jupiter 01







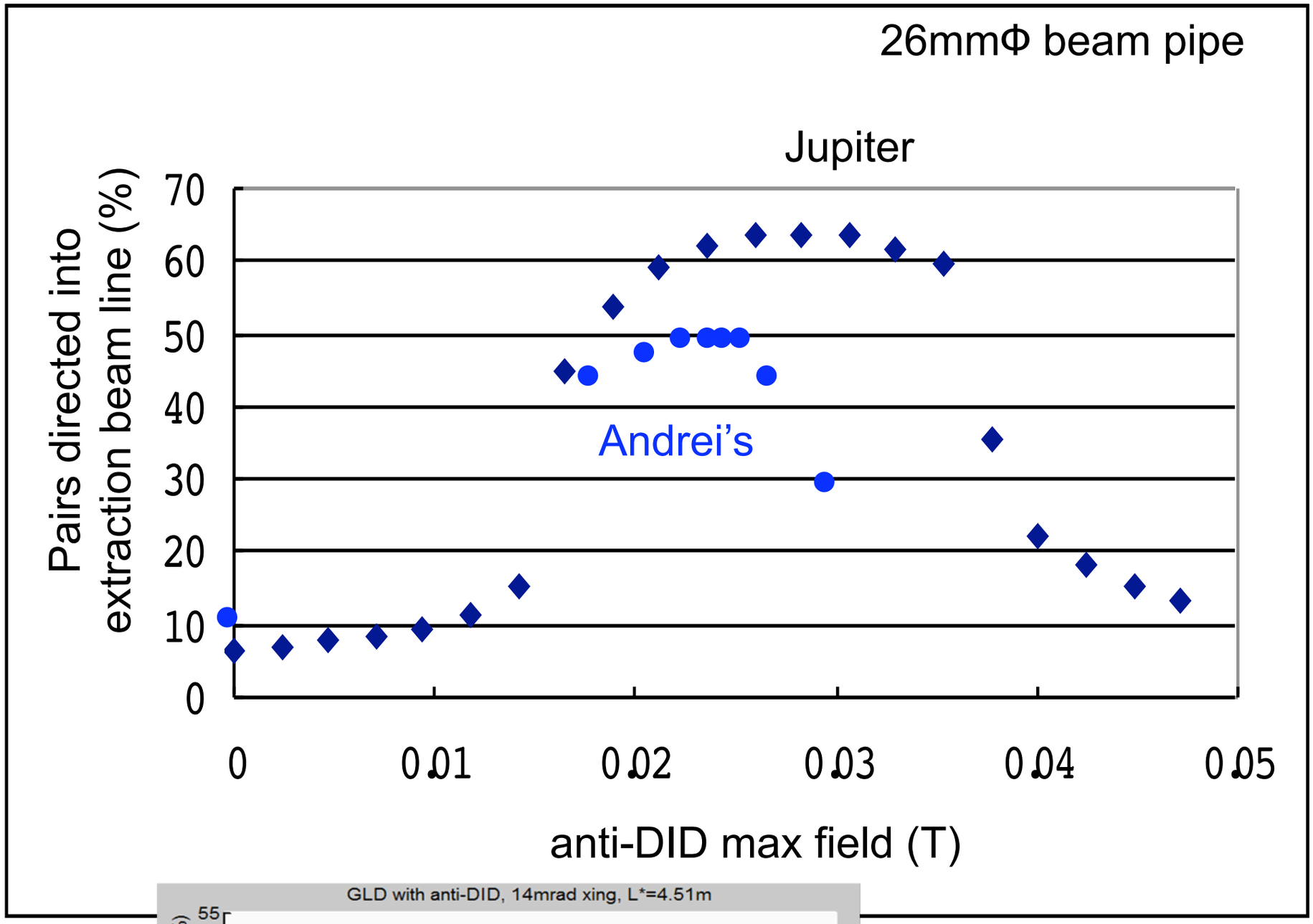
Andrei's 14mrad anti-DID field data

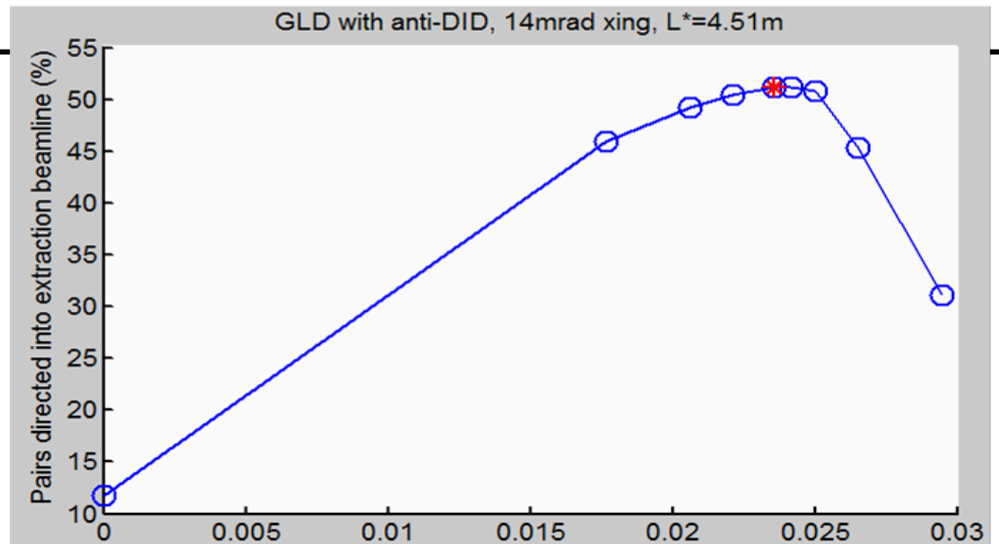
on the extracted beam line

Br = linear function of r

anti-DID Bx = no function of r

Pairs directed into extraction beam line (%)





Andrei's results
at Nanobeam 2005, Oct.2005

Summary

- Digitization of TPC hits in Jupiter
- Background hits in VTX, TPC with 14mr crossing, no anti-DID
- LowP background is about 1.4 times nominal background in VTX(layer 0-3)
- LowP background is about 1.5 times nominal background in TPC.
- Anti-DID field is under study in order to check a consistency to Andrei's optimized one
- Background to be studied including neutrons