Background study at ILC-IR

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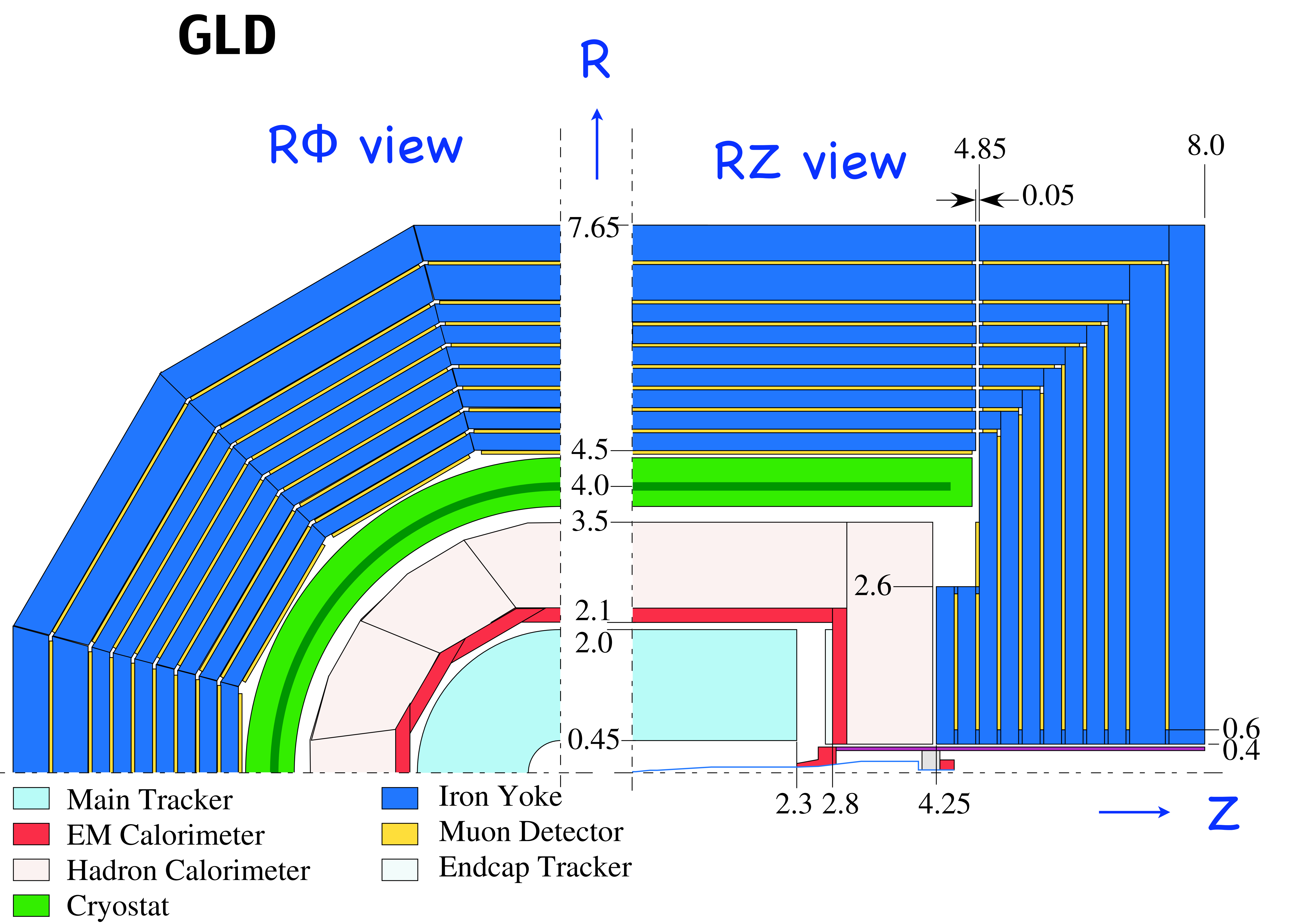
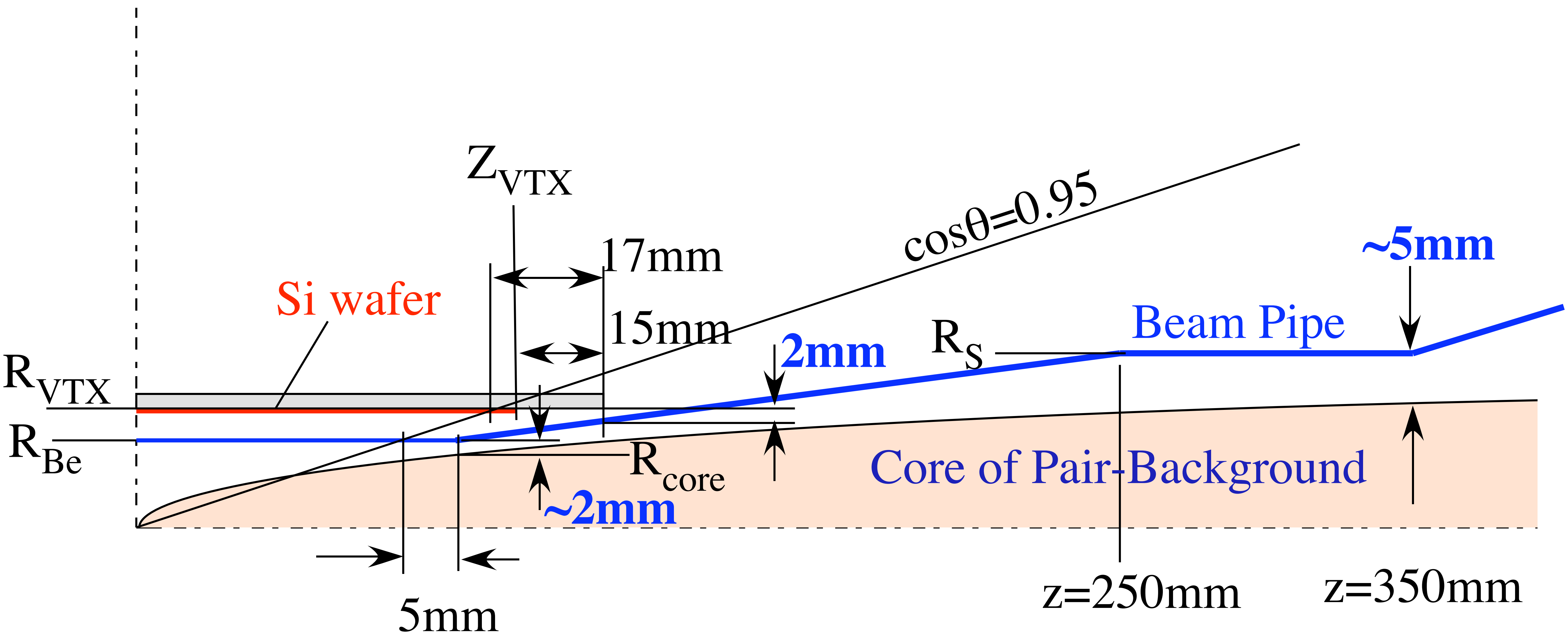
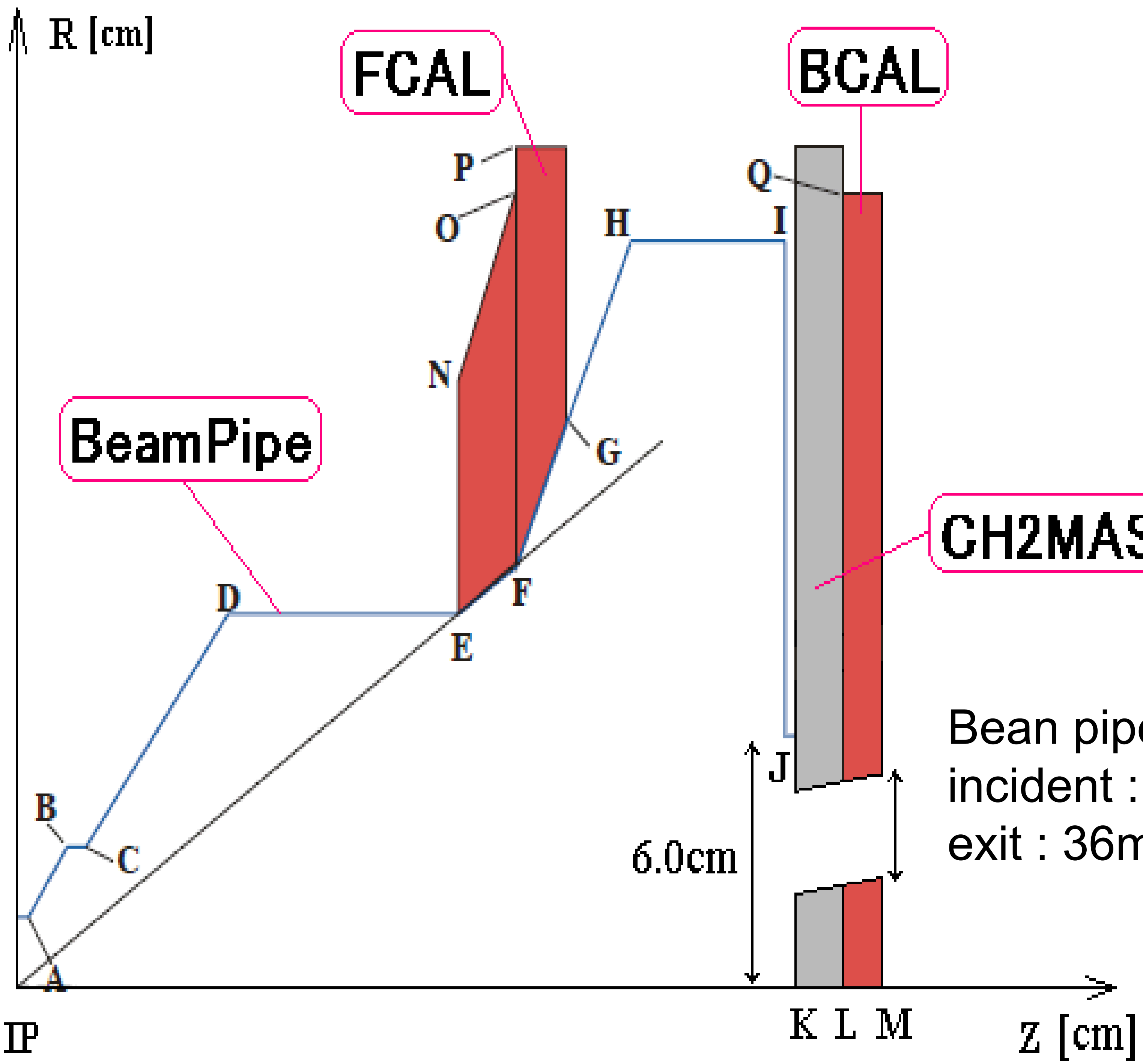
- Summary


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 ; geometris in Jupiter



Bean pipe
incident : 20mmΦ
exit : 36mmΦ

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

Q magnet design and location

Ecm=500GeV, Nominal parameter set, 14mrad

Upstream unit : cm, T/m

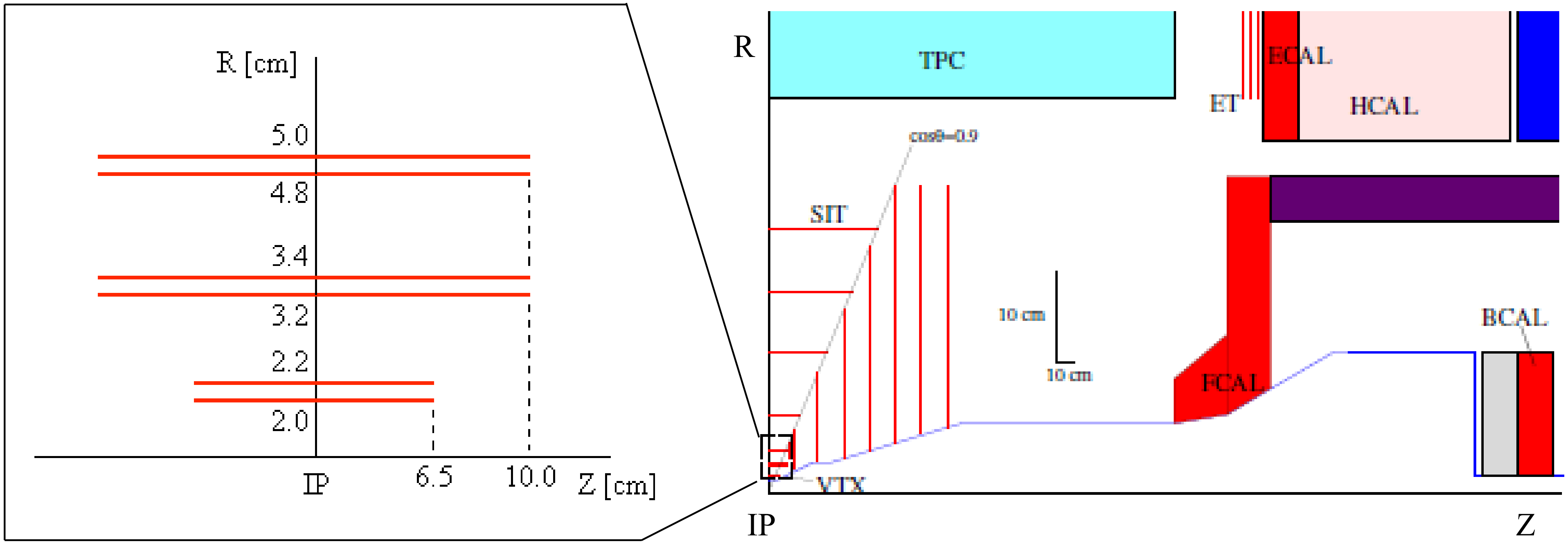
magnet	Inner radius	Outer radius	length	z position	Field gradient
QD0	1.0	3.6	220	451	-121.44
SD0/OC0	1.0	2.8	70	681	0
QF1	1.0	4.2	200	881	75.88
SF1/OC1	1.0	28.0	35	1091	0

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

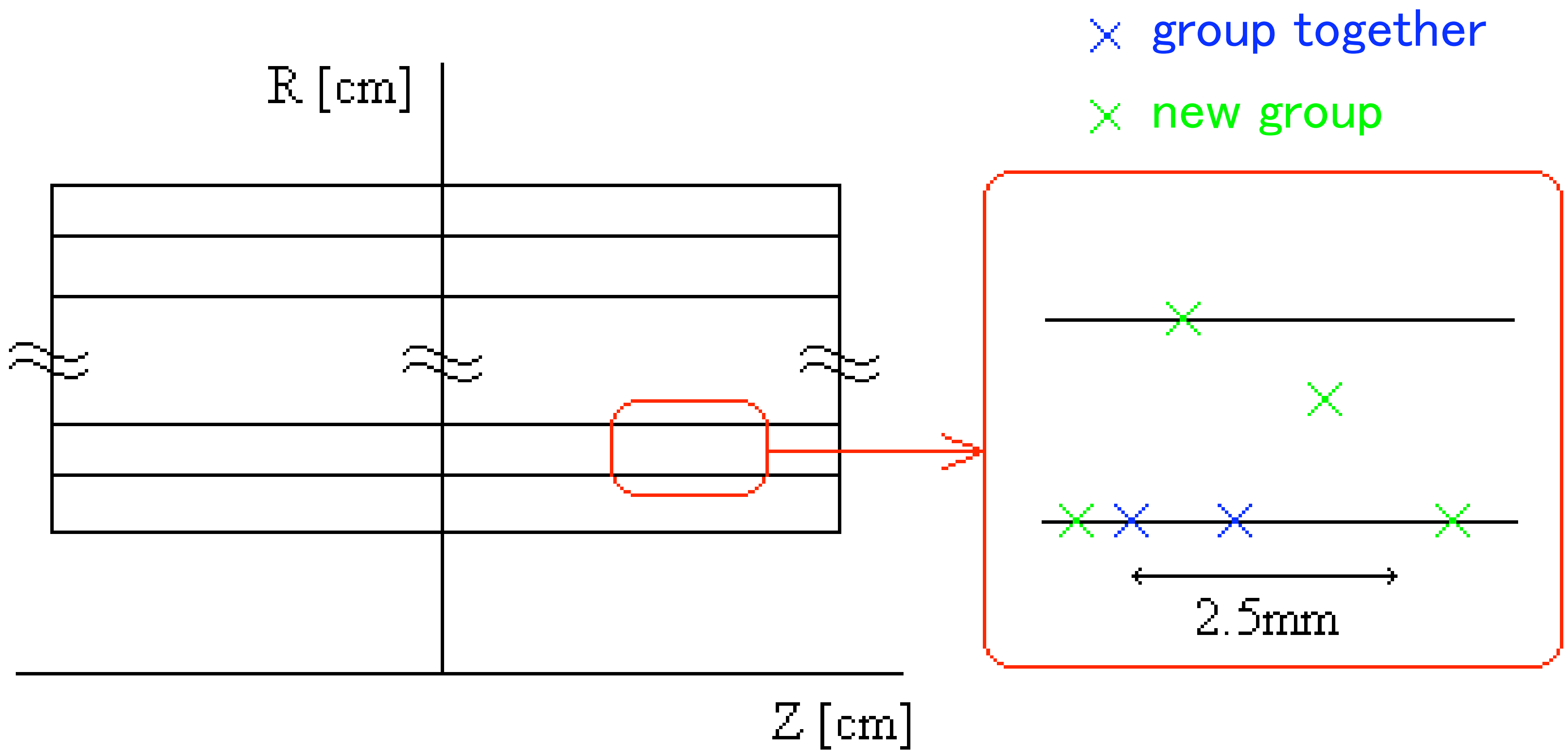
VTX	R [cm]	Half Z [cm]
0	2.0	6.5
1	2.2	6.5
2	3.2	10.0
3	3.4	10.0
4	4.8	10.0
5	5.0	10.0

TPC

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

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

Digitization of exact hits in TPC ; Jupiter



R direction

Exact hits are digitized at 200 layers.

Z direction

Exact hits are grouped together and digitized in every 50nsec,
i.e. 2.5mm for the drfift velocity of 5cm/μsec.

Φ direction

No digitization.

Simple digitization with no merging overlapped signals; conservative estimation

Simulation Results ; Jupiter

Ecm=500GeV, Nominal parameter set, 14mrad with no anti-DID

Hits/10bunch

VTX0	VTX1	VTX2	VTX3	VTX4	VTX5	TPC	digi. TPC
9033	9131	2147	1443	320	274	125827	10117

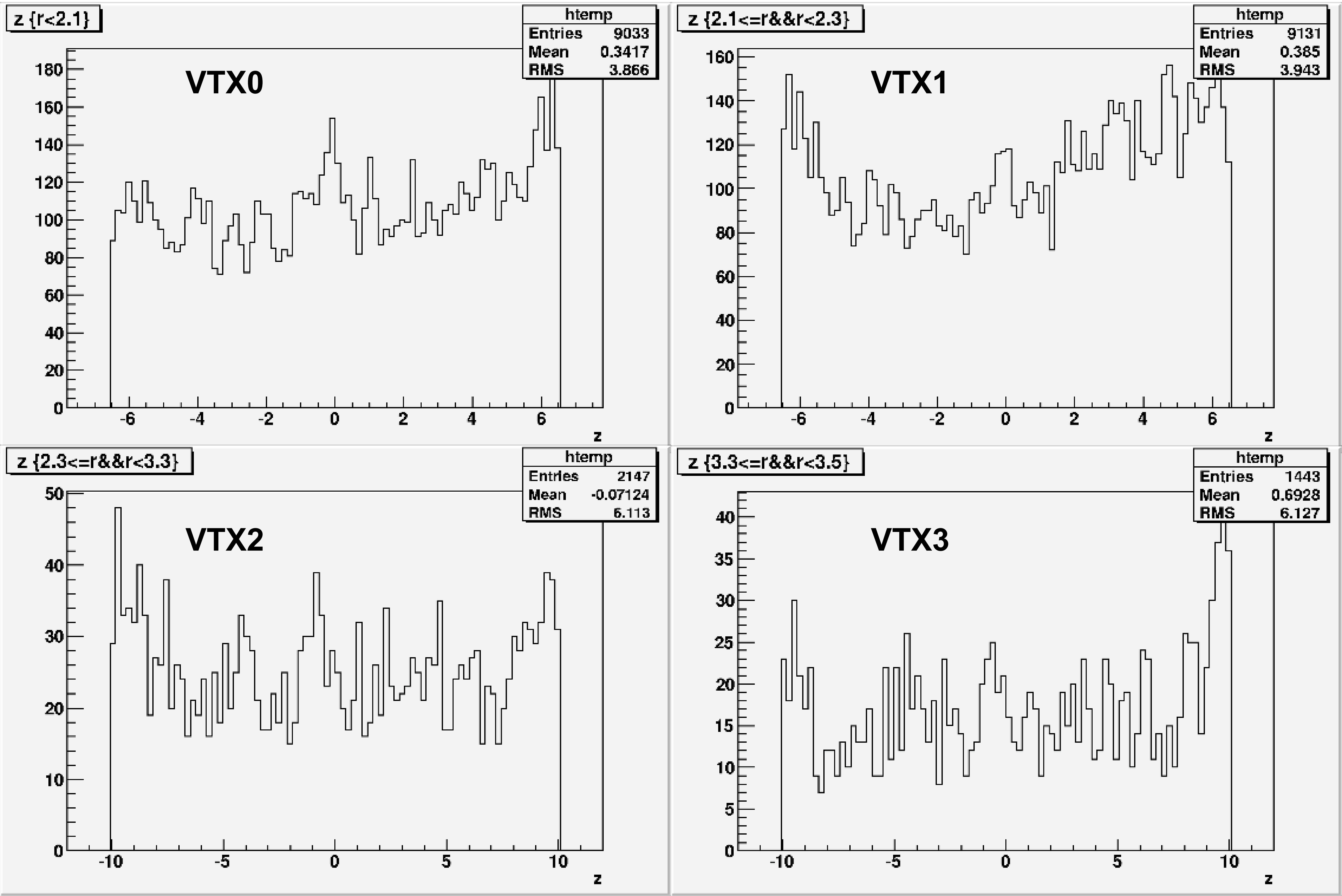
VTX : 1train=2820 bunch

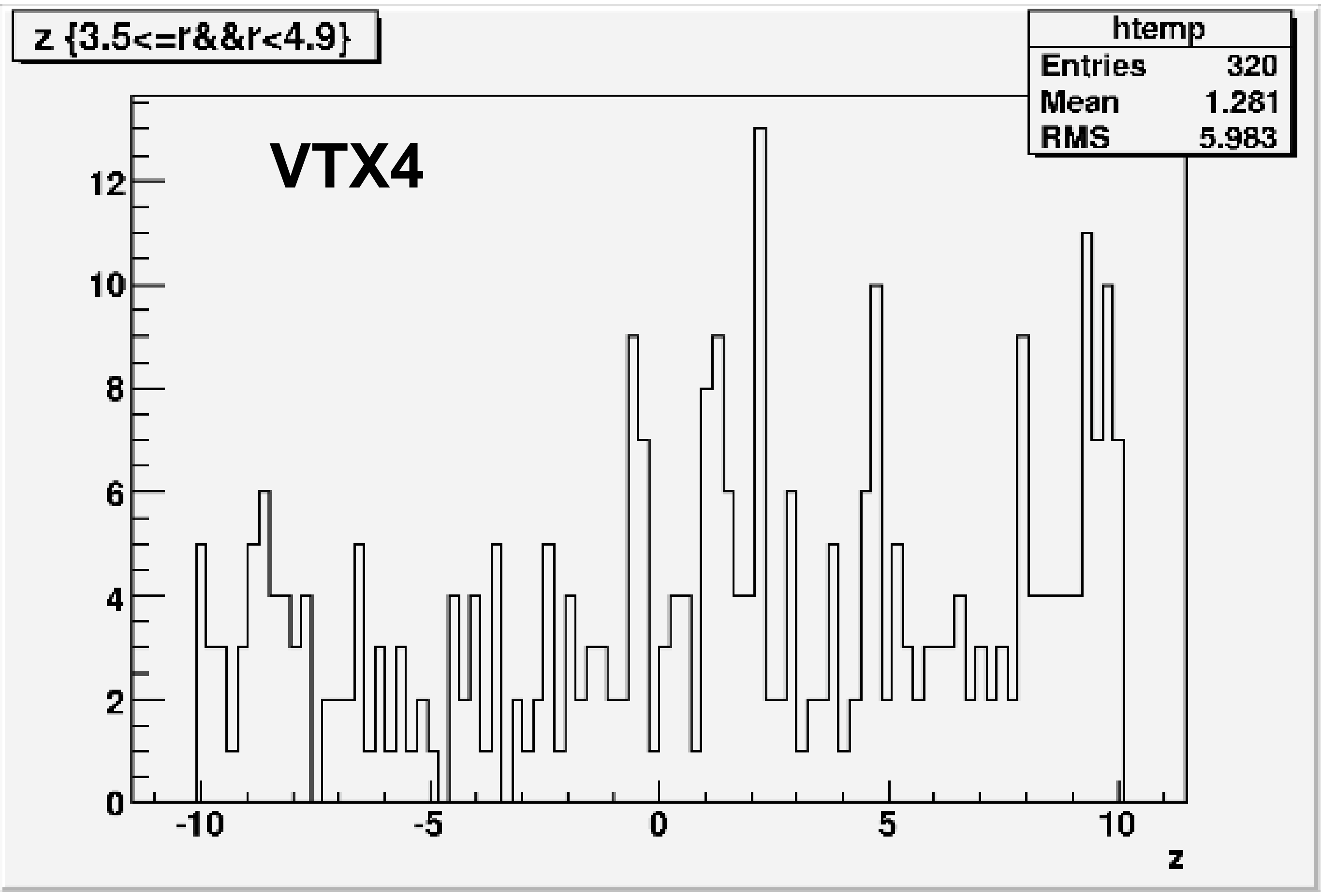
TPC : 160bunch / 50 μ sec

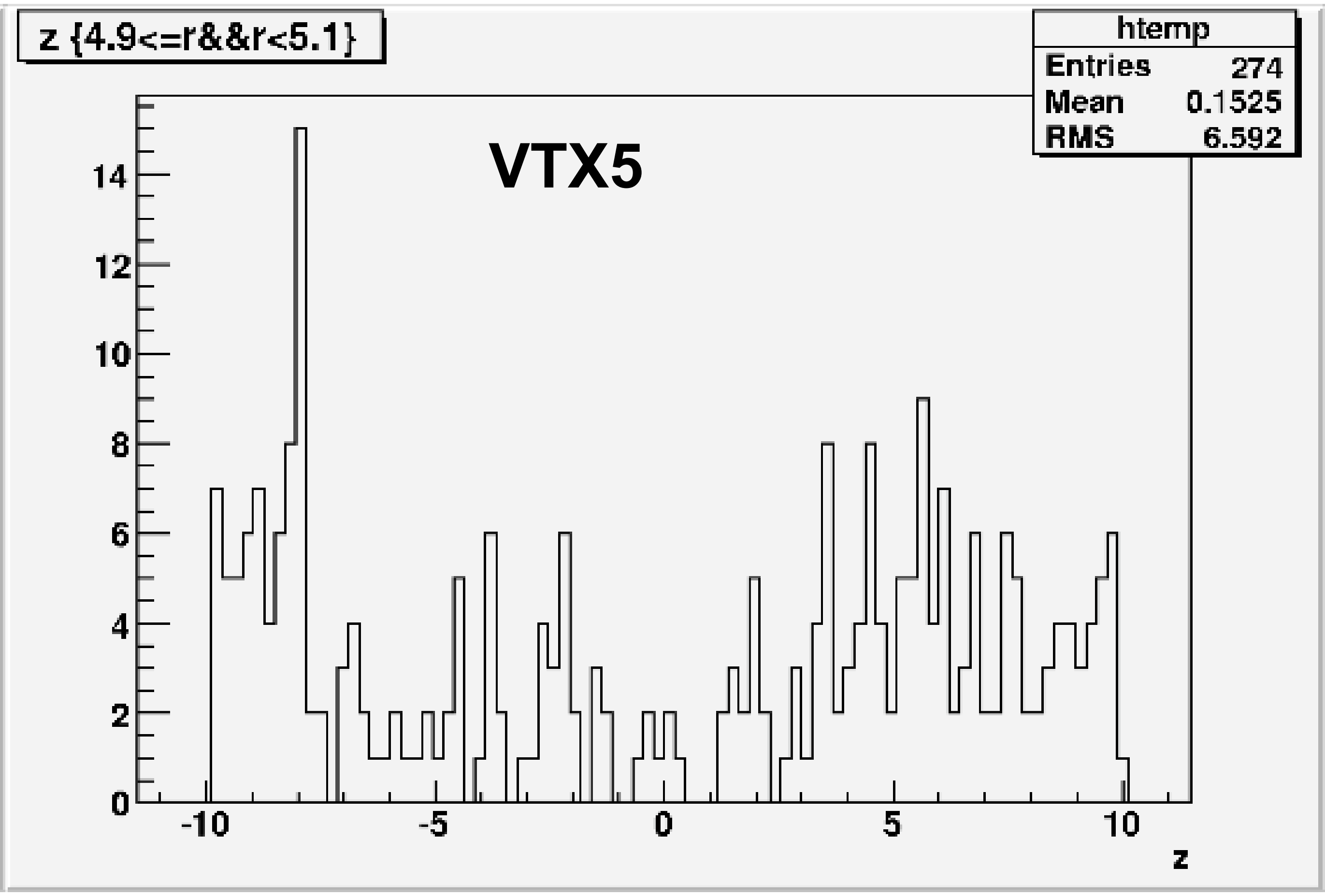
VTX : hits/cm^2/train , TPC : hits/50 μ sec

VTX0	VTX1	VTX2	VTX3	VTX4	VTX5	TPC	digi. TPC
15601	14337	1507	953	150	124	-	161872

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

Tolerances in Detectors

Table 1: Tolerances for background in VTX, TPC and CAL.

Sources : pairs disrupted beams/pairs beam halo

Detector	Hits	Neutrons	Muons
VTX	1×10^4 hits/cm^2/train	1×10^{10} n/cm^2/year	-
TPC	4.92×10^5 hits/50μsec	4×10^4 n*/50μsec	$1.2 \times 10^3 \mu$/50μsec
CAL	1×10^{-4} hits/cm^3/100nsec	-	0.03 μ/m^2/100nsec

→ 1μ/30m^2/bunch

* : The neutron conversion efficiency is assumed to be 100% in the TPC.

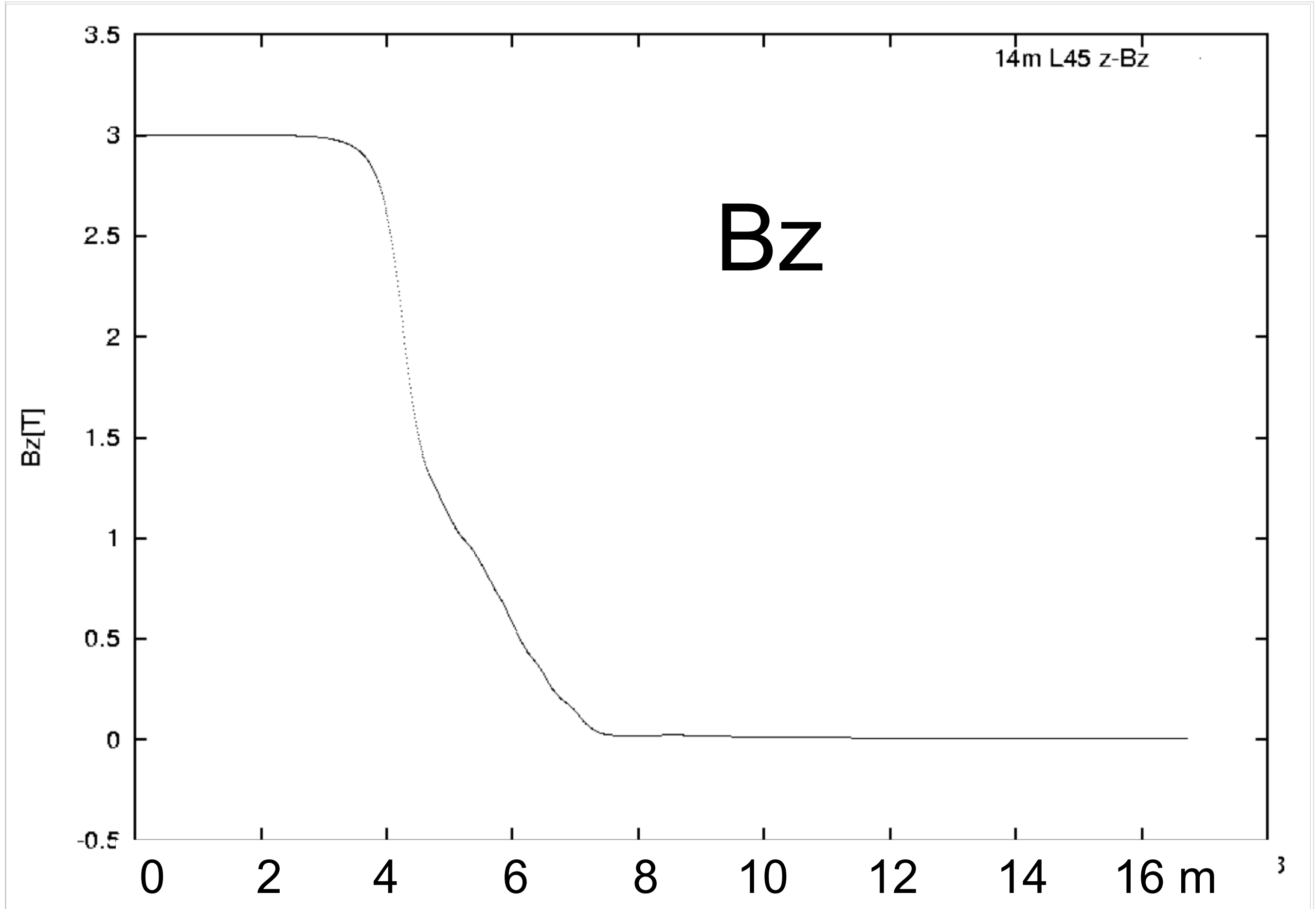
1 hit in TPC consists of 5 pads(1mmx6mm) x 5 buckets(50nsec)
A muon creates 1 pad x 2000 buckets in parallel to the beam line.
A neutron creates 10 hits in TPC.

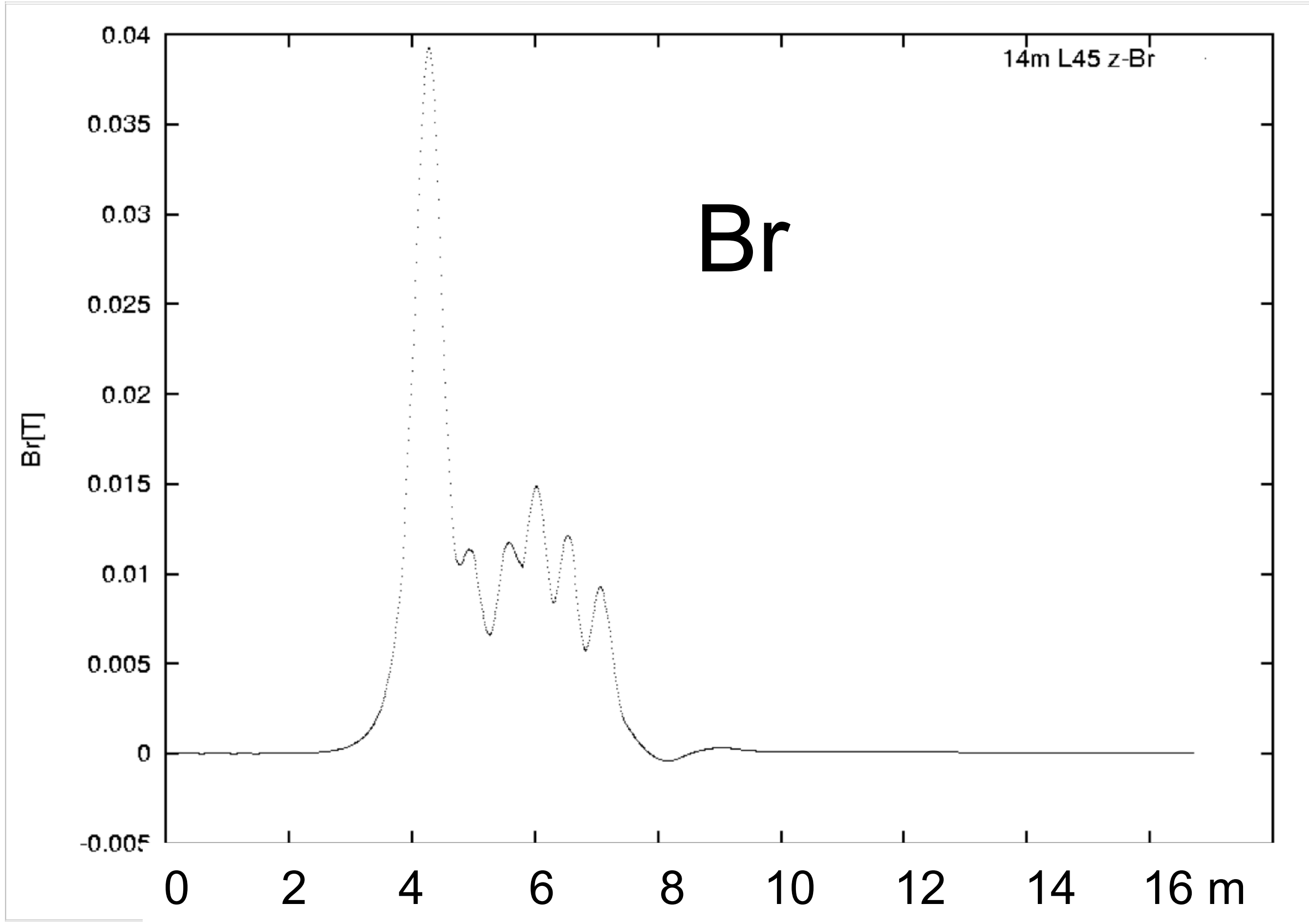
Note : 0.005μ/bunch by two "tunnel fillers"

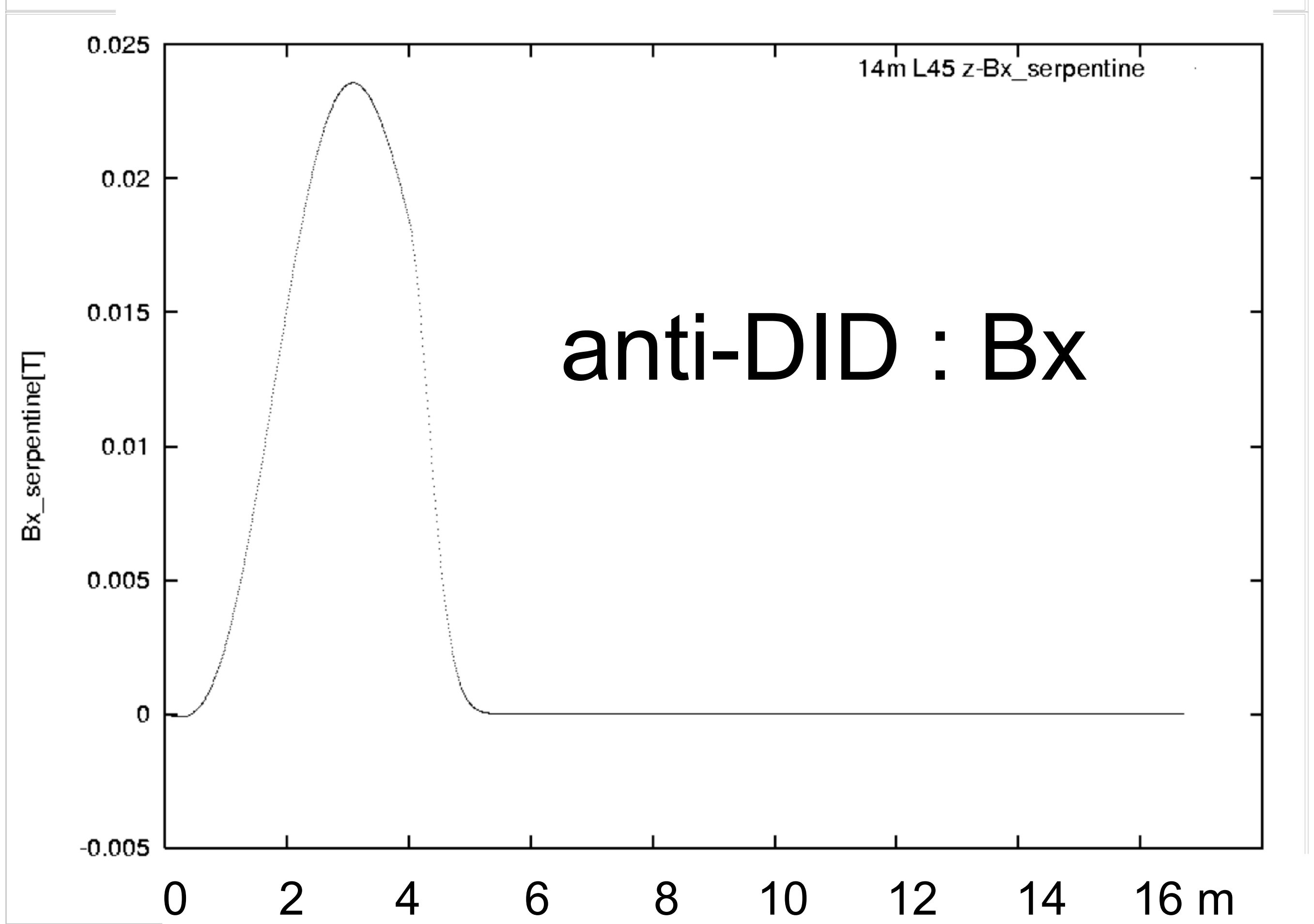
→ 0.8μ/150bunches

The 9 and 15m long spoilers at 660 and 350m from IP reduces muons by 10^{-4}

Anti-DID filed GLD Andrei optimization in Jupiter 01







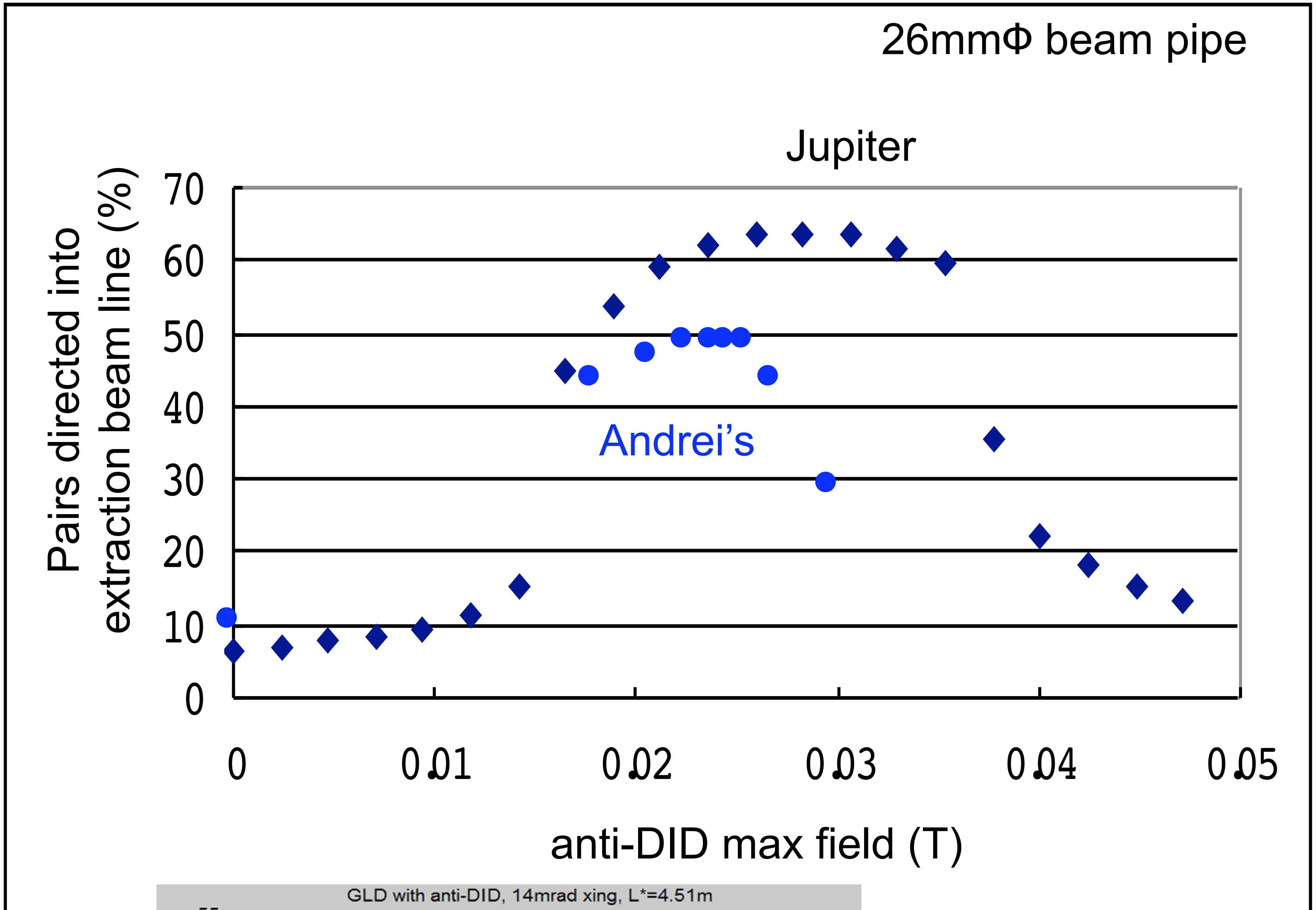
Andrei's 14mrad anti-DID field data

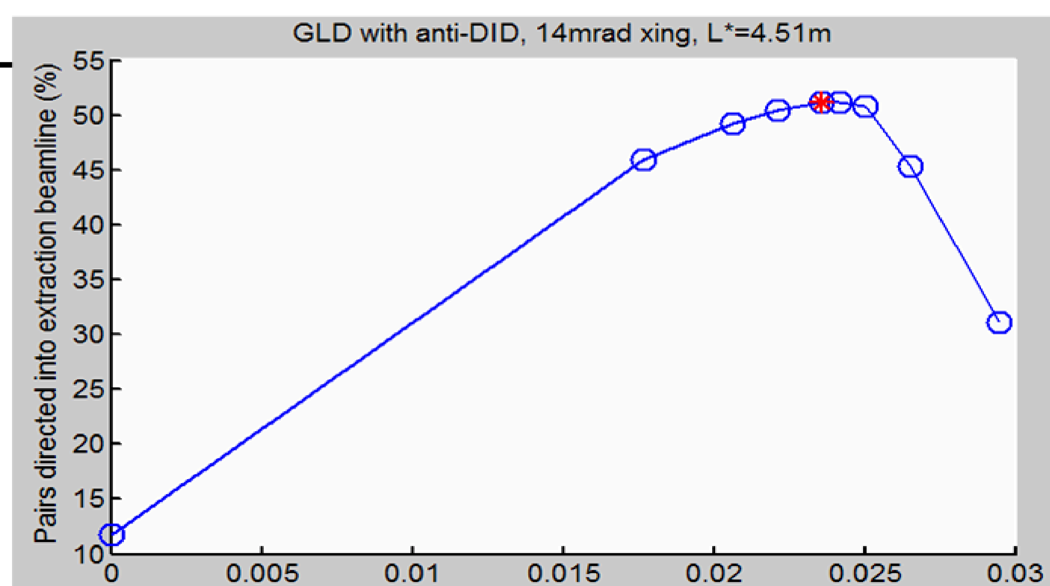
on the extracted beam line

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
- Anti-DID field is under study in order to check a consistency to Andrei's optimized one
- Background to be studied including neutrons