Background estimation in GLD detector

A. Sugiyama(Saga Univ.)

what is bkg for

Vtx, SIT, TPC, CAL in GLD

where is source

relation to IR design

How to estimate BkG?

Plan for snowmass

What is bkg for Detector?

Pair Background ->VTX beam pipe, mask, Bcal

bck. scat. -> TPC, SIT, CAL

source of neutron

Synchrotron Radiation from beamline/dipole,quad

collimator, mask -> VTX

(bck.) scat. may affect to dete.

Muon Background

off e bunch+iron produce muon along beamline

spoiler -> TPC, CAL

Neutron Background e/gamma N scattering

how to reduce? -> TPC, (rad. damage to Si), CAL

All of them are related to IR/BDS design

mini-jet Background

physics process in collision

TPC Performance is degraded

occupancy hit point efficiency track finding eff.

easier : chg. track

mini-jets

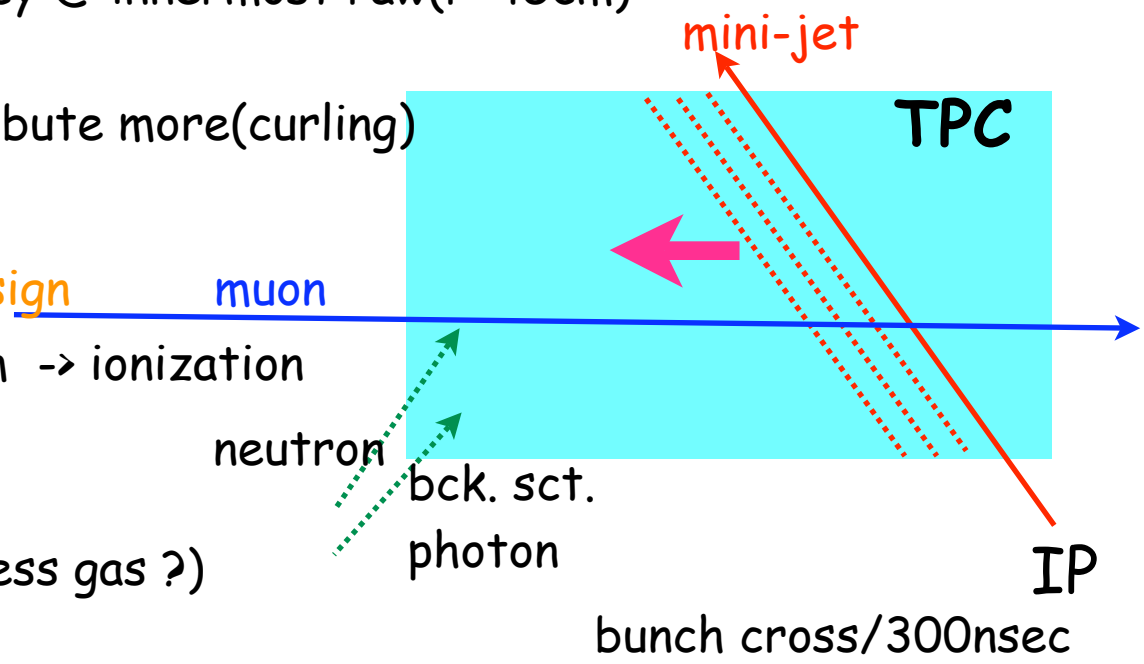
2×10^4 tracks/train ~ 10 tracks/bunch

if 1 hit cov. 5mm, 20Mhz FADC readout

~O(0.3%) occupancy @ innermost raw(r=45cm)

naive estimation

low Pt tracks contribute more(curling)



there rates are dep. on BDS/IR design

difficult : photon, neutron -> G4 sim -> ionization

electron prod. by PE, Compton

GAS in TPC (H less gas ?)

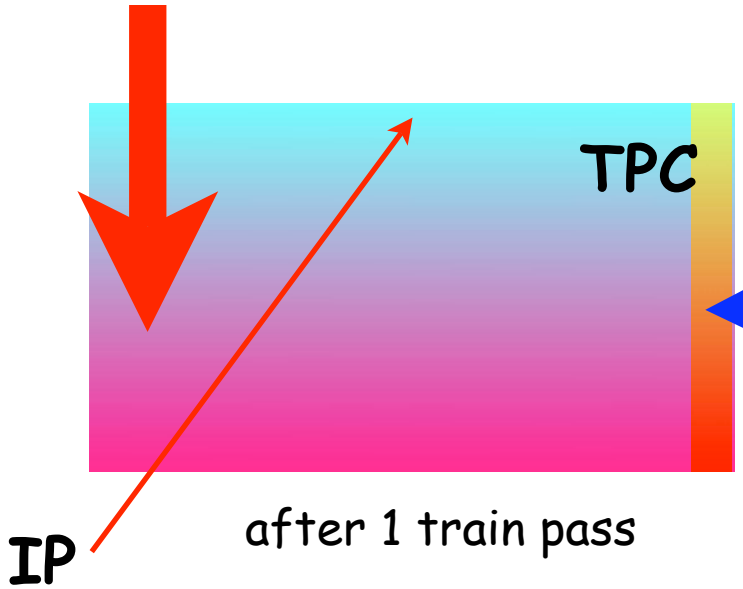
We have to know the max. allowable occupancy for tracking under realistic track-finder condition.

A.Yamaguchi will give this answer soon

E field distortion by ions

may deteriorate momentum resolution
extrapolation to VTX

primary ionization is inevitable

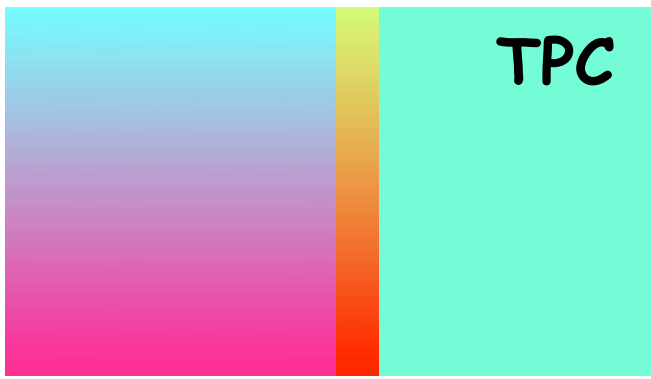


after 1 train pass

Ionization by bkg. produce a lot of ions
bunch cross dependent
ions are accumulated due to slow drift
R dependet (which may result in Er)
may depend on type of bkg.

Ions by gas multiplication
it may not be swept away until next train
(depend on ion drift velo.)
it produce very dense ion cloud in Z (move)
w/o gating

Ion back drift from gas multiplication
must be minimum!!
MPGD best case $O(10^{-3})$



just before the next train

Electric field
R, Z, time(bucb cross) dependent !!!
Occupancy is only for 160BX,
but ion effect is for a few trains.

How much E distortion is
acceptable for TPC ??

$$\int \frac{E_r}{E_z} dz$$

Also a issue to the field cage and gating design

How much background is tolerable ?

this is included in the "urgent questions to MID" list (Tauchi show yesterday)

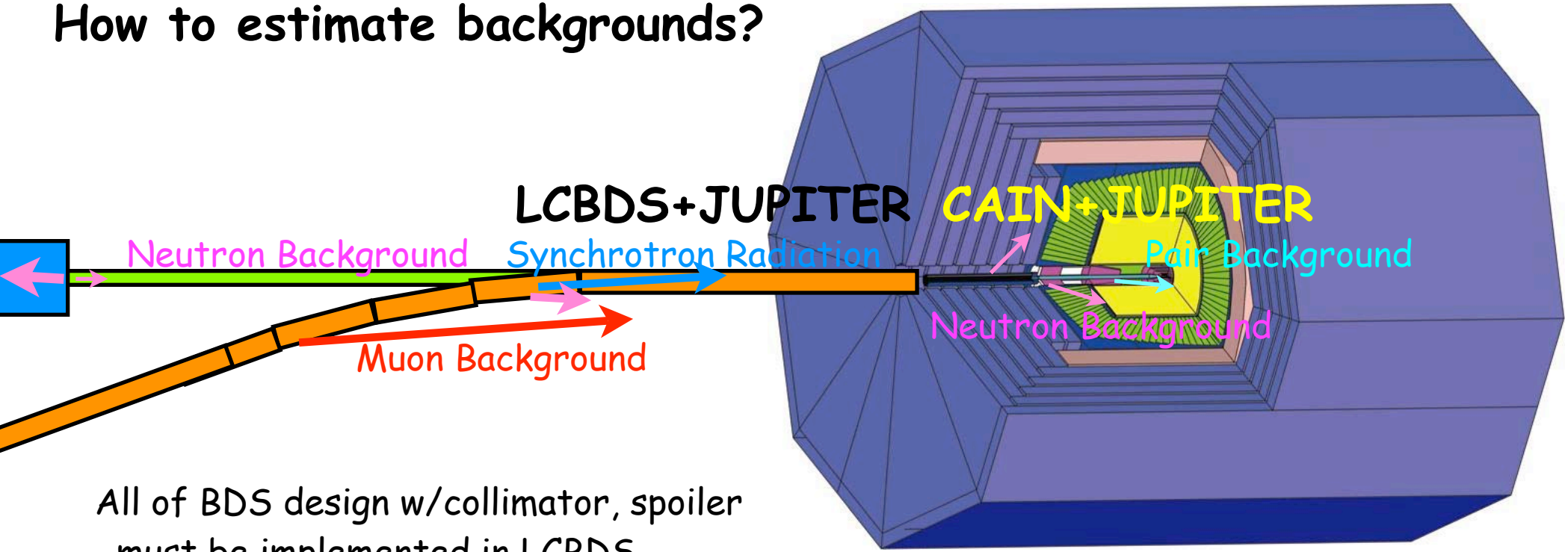
tolerable #bkg to keep the same performance
(acceptable(?) #bkg to operate sub detector under limited condition)

acceptable #bkg./bunch or /train

sub detector	pair	photon	neutron	muon	mini-jet	total
VTX						
SIT						
TPC						
ECAL						
HCAL						

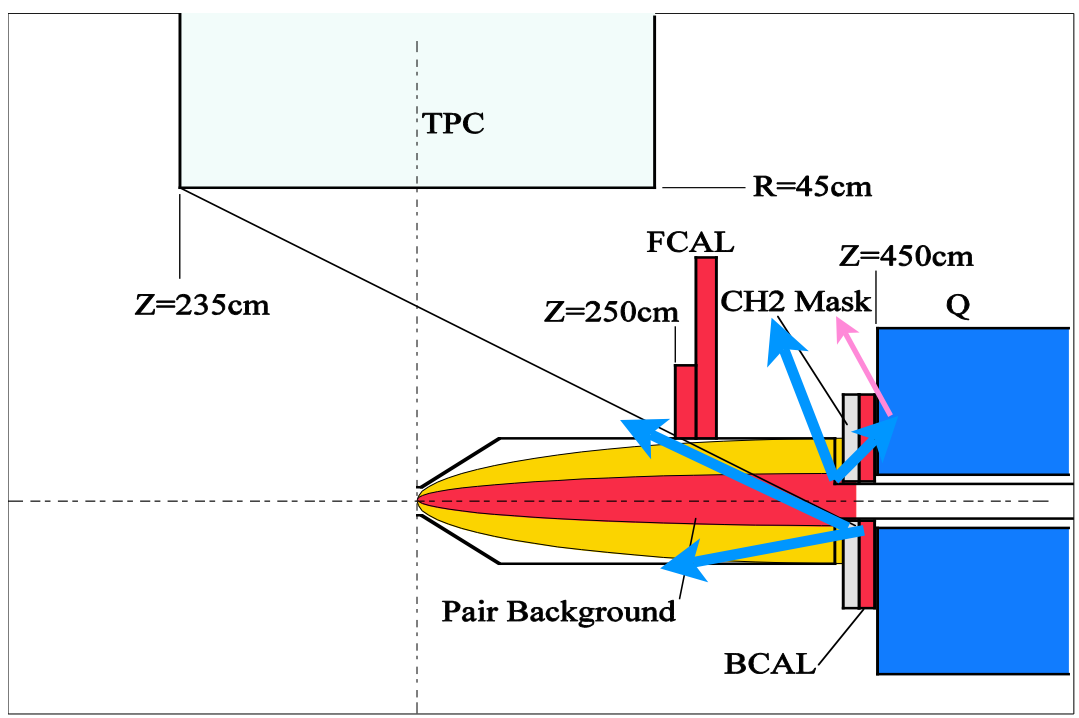
realistic number cannot be obtained without realistic reconstruction program

How to estimate backgrounds?

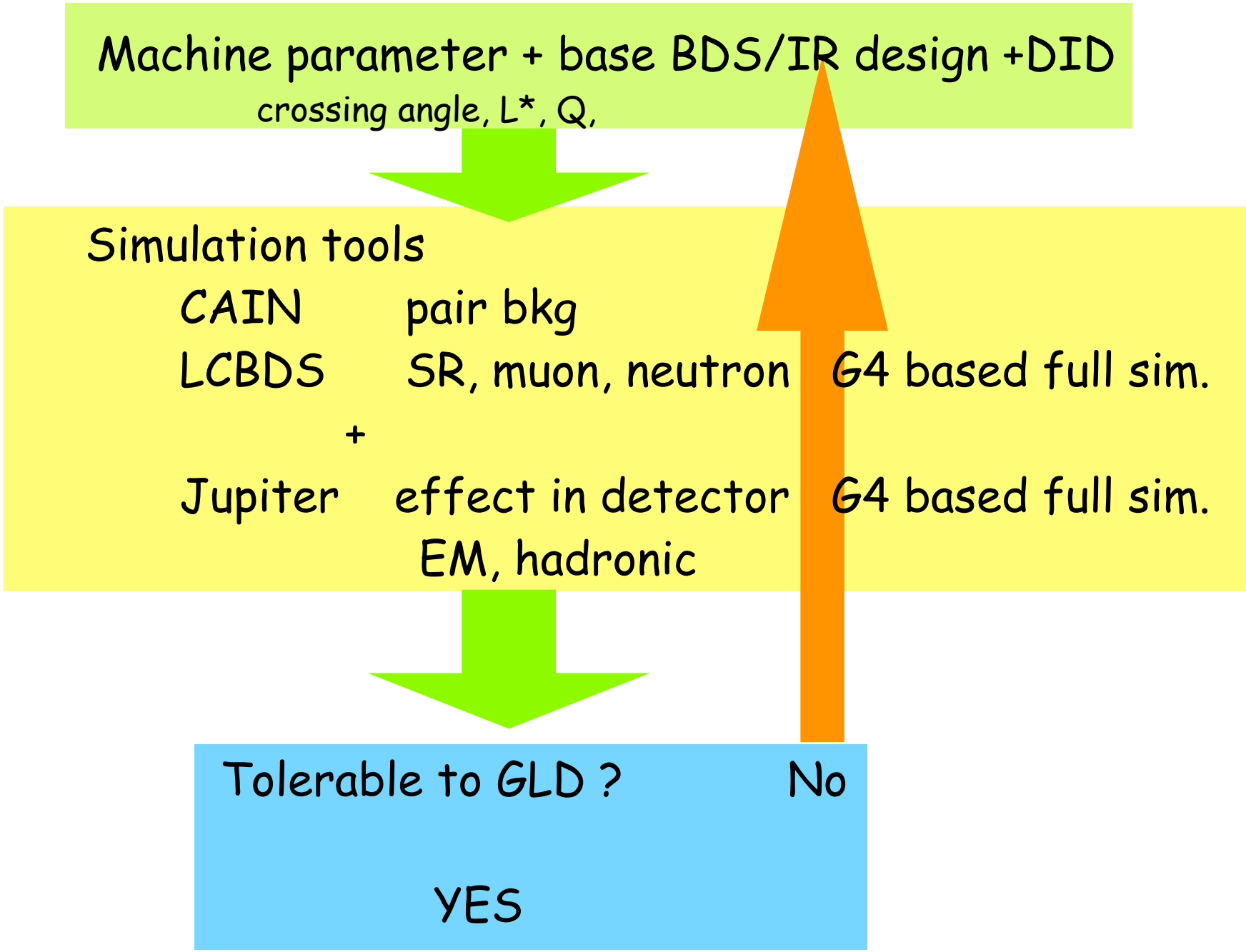


All of BDS design w/collimator, spoiler must be implemented in LCBDS

All of IR design/B field map + DID must be in JUPITER



How to optimize BDS/IR design according to bkg issue?



STATUS of bkg. study in GLD

CAIN(pair bkg) : Tauchi
LCBDS : Aihara, Abe + ?(implement BDS design)
JUPITER : Miyamoto + ?(implement IR design)

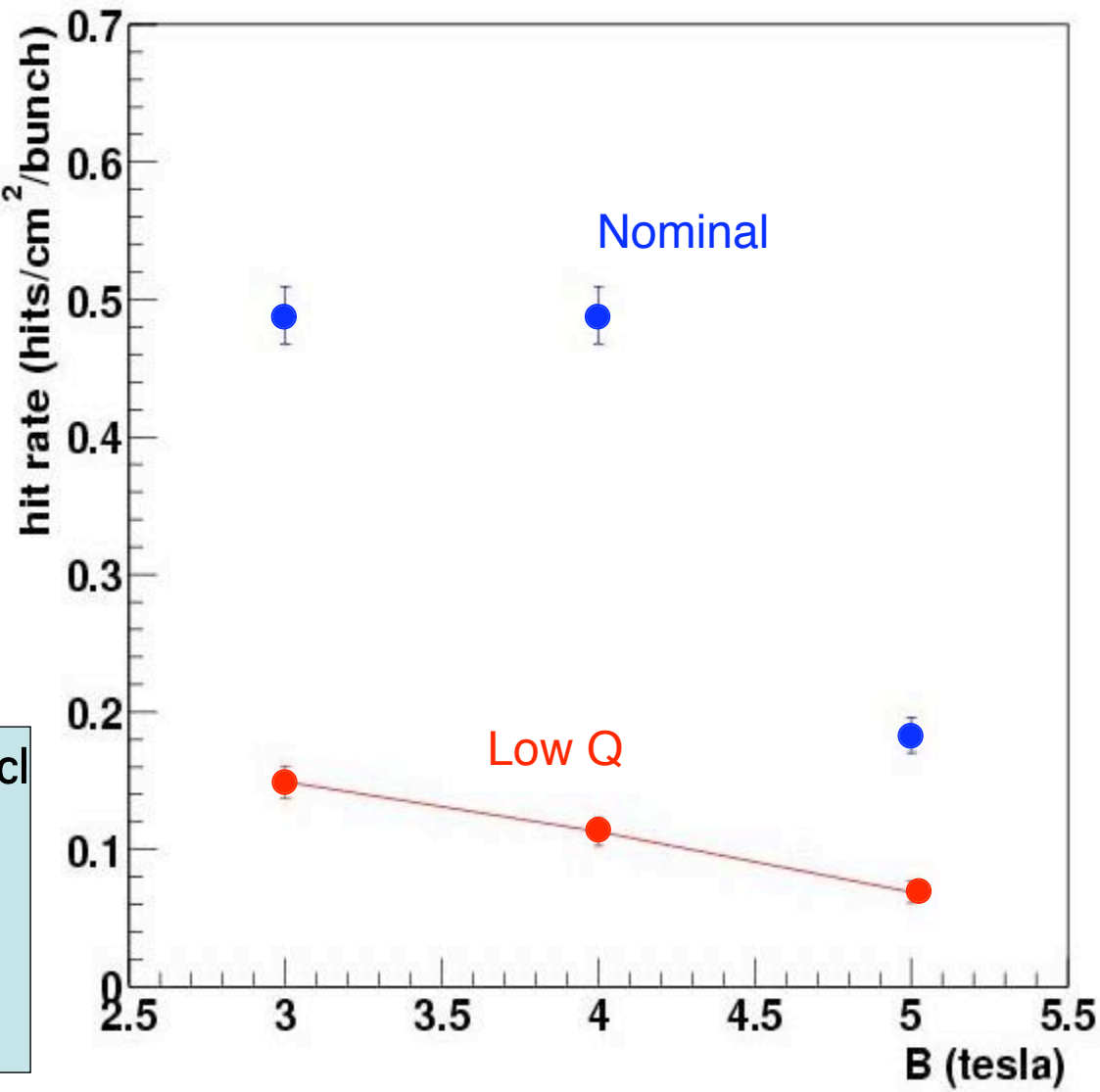
VTX : Sugimoto, Fujikawa active: pair bkg + IP design

SIT : H.J.Kim + ?
TPC : Sugiyama + ? just started:
CAL : Takeshita + ?

until Snowmass,
we hope to do 1st iteration(bkg study w/ default design)
at least!

Simulation Study

- Pair background hit rate on the 1st layer of the Vertex Detector (R=24mm)
- Simulation using CAIN and JUPITER
- Hit rate of the Low Q option is ~1/3 of the nominal option, as expected



Pair B.G. hit rate (/cm^2/buncl		
B(tesla)	Nominal	LowQ
3	0.488	0.149
4	0.48	0.113
5	0.183	0.069

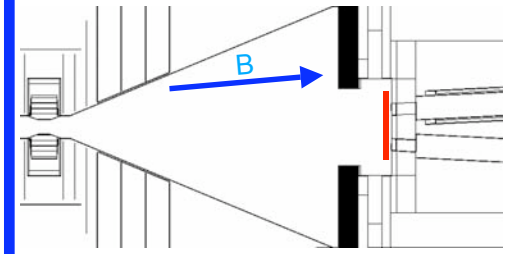
bkg. study by other concepts

Pair background : Karsten Busser(DESY)

pair bkg: GUINEA-PIG
TESLA beam parameters
IR design
- Crossing angle 2*1 , 2*10 mrad
- L*=4.05m
- holes for incoming/outgoing beam

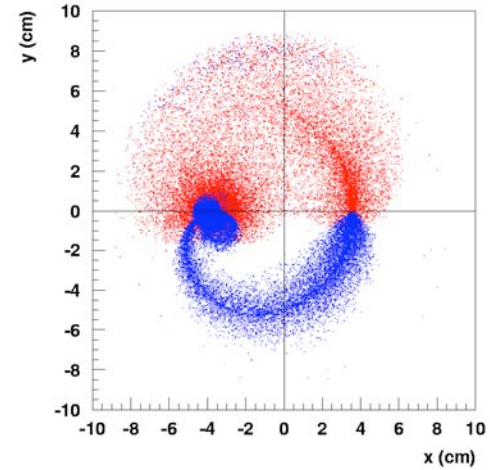
G3 TESLA det. simu.
DID

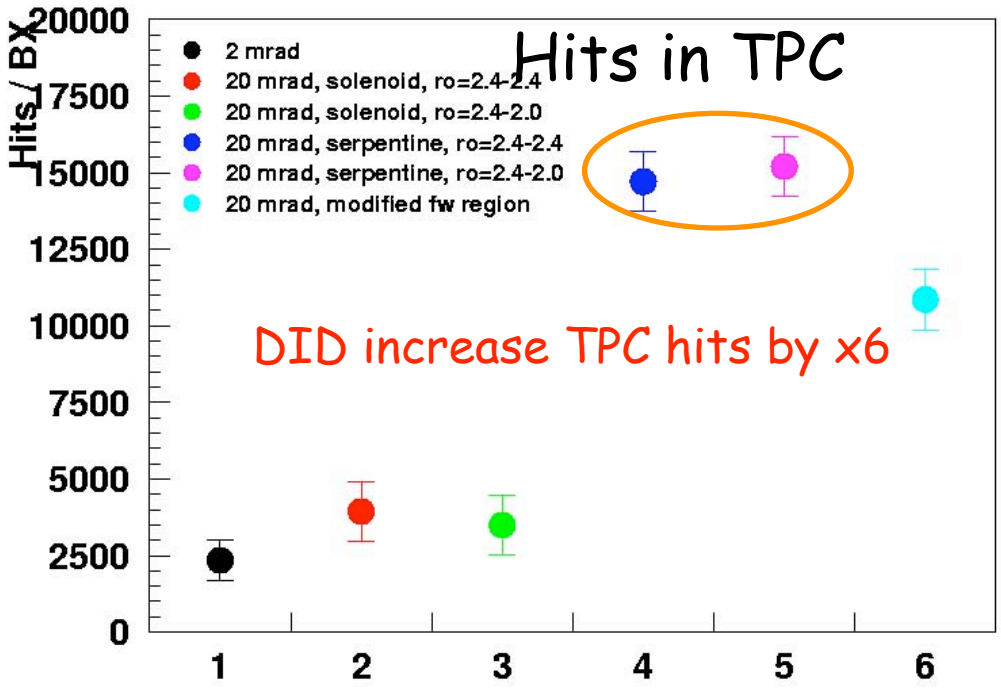
Added dipole correction field ("DID")



No realistic fieldmap yet!
Simple solution B_x=0.01 B_z

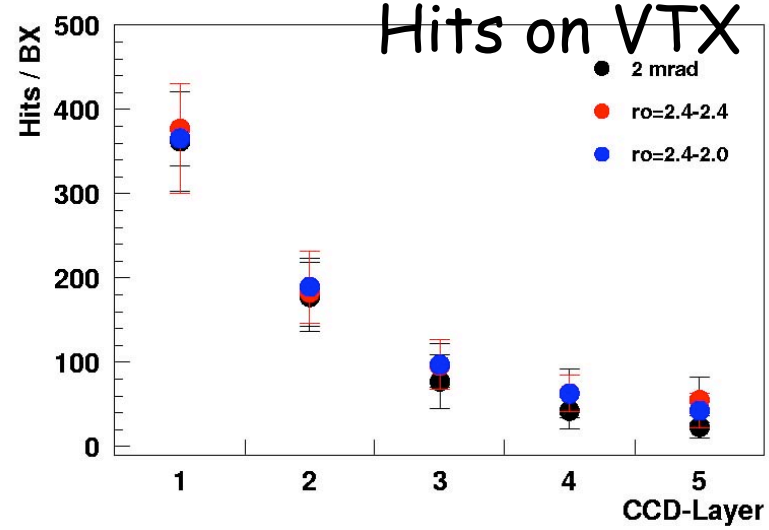
pairs on Bcal





Hits in TPC

DID increase TPC hits by x6



Hits on VTX

2 mrad for comparison

DID field removes asymmetries

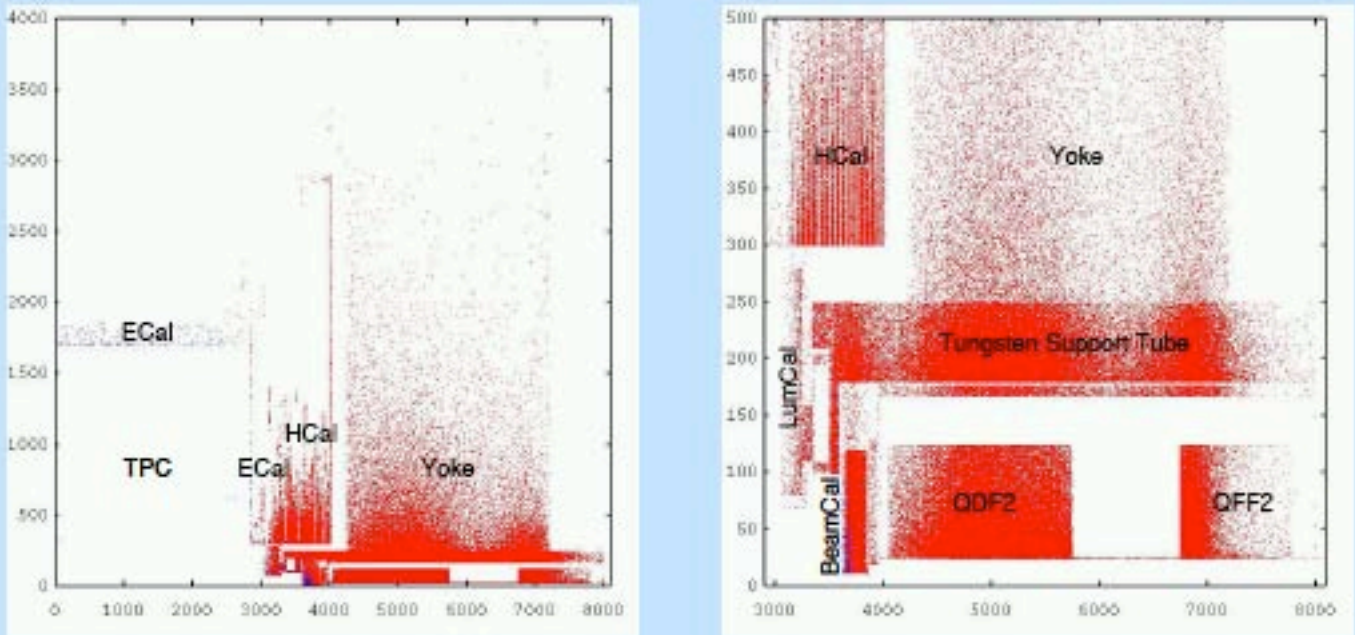
bkg. study by other concepts

nuetron background : Adrian Vogel(DESY)

produced from pair bkg.
IR design
Crossing angle 2*1
L*=4.05m
G4 MOKKA det. simu.
TDR gas in TPC

517 neutrons
go into TPC
5361 hits in TPC
per bunch cross

Neutron Production – Cross Section



Origins of neutrons (blue ones reach the TPC)

SUMMARY

SiD, LCD are ahead of us.
but not perfect yet
AND they don't care GLD design

We have to do own bkg. study for GLD
before machine/BDIR parameters are fixed
at Snowmass(?)

Each sub detector group must provide
acceptable bkg. rate
active worker for background
We need a lot of help from simulation group also.

meeting is scheduled every other Wednesday 14:00~