GLD background study with Jupiter

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2005 ALCPG @snowmass

Introduction

tools

result@snowmass

plan

Introduction

It is very important when you design IR and protection of Det. from various bkgs.
Background study has been done by 2 other concepts very strongly for many years.

=> Do we need own background study?

No. Just borrow others results for GLD design to save manpower

Yes. we have to do it in order to justify our design.
Bkg had been estimated but reality provides more.
Many studies from different group would help !?

Which kind of background we have consider?

IR: beam-beam interaction : CAIN or gineapig

   pair background

   disrupted beam

   beamstrahlung photon

  physics process

   two photon -> hadrons

   radiative Bhabha

these e/gamma produce hits in detector
directly and after several interactions
around detector components.
 not only PE,Compton interactions
but also e/gamma-nucler interactons

BDS: beam core and halo produce many bkgs

   synchrotron radiations

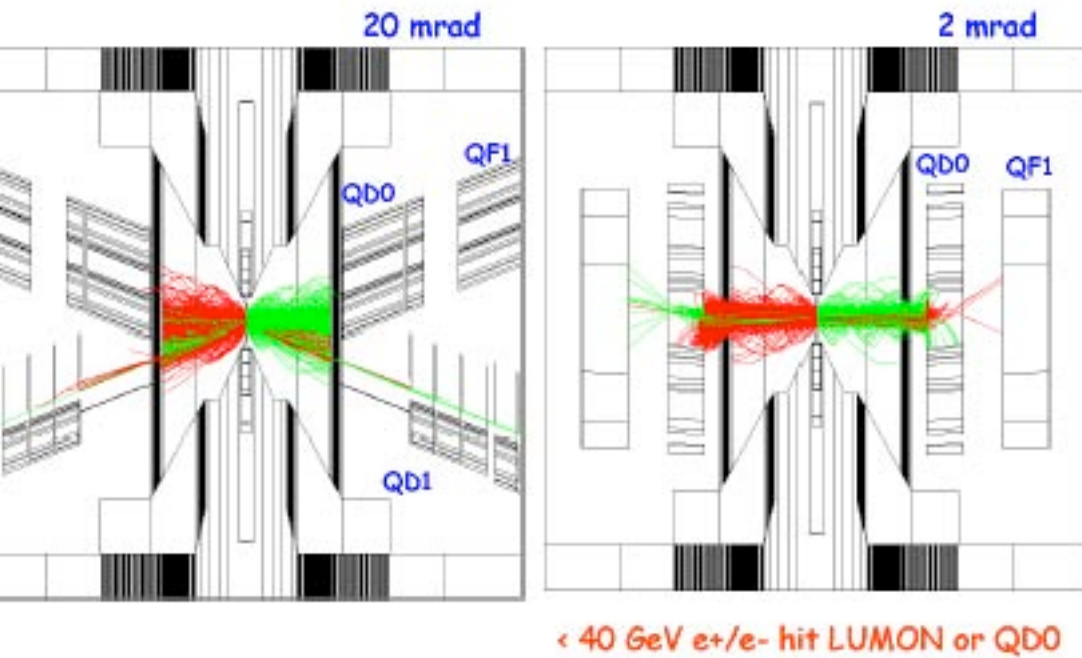   muon production at collimators

   neutron productions

JUPITER

(Det. Full simulator w/ GEANT4)

LCBDS

(BDS components w/ GEANT4)

Tauchi report for T.Abe

other concepts

Added dipole correction field ("DID")

Pairs in two schemes

20 mrad

2 mrad

QF1
QD0
QD1

QD0   QF1

B
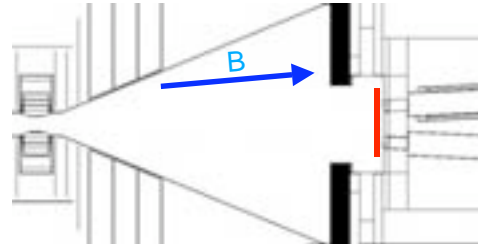
No realistic fieldmap yet!
Simple solution $B_x = 0.01\, B_z$

< 40 GeV e+/e- hit LUMON or QD0

Hits / BX

- 2 mrad
- ro=2.4-2.4
- ro=2.4-2.0

CCD-Layer
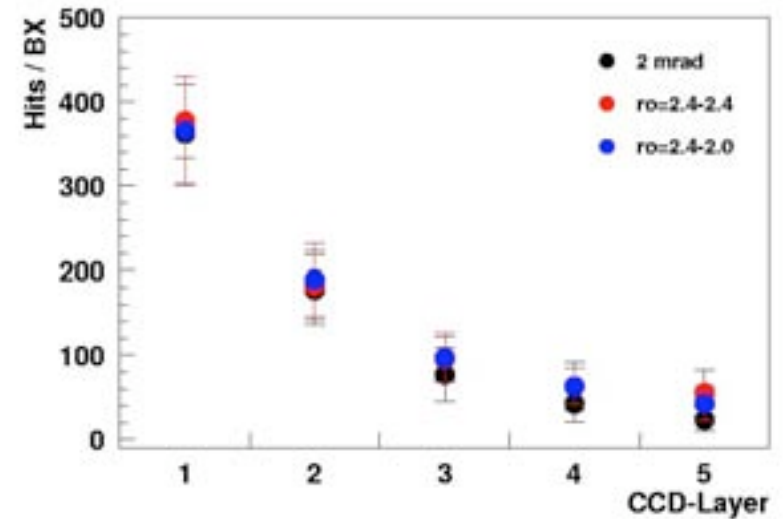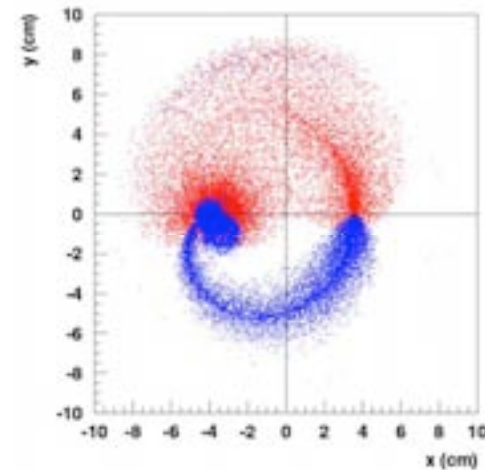
2 mrad for comparison

SiD
by T. Maruyama

DID field removes
asymmetries

LDC
by K. Buesser

Status

Actual work has been started after ACFA8(July 05)

CAIN bkg   provided   from   T.Tauchi

IR components into Jupiter   ----->   A. Miyamoto

LCBDS (originally developed at Aihara's Lab.:U.Tokyo)
      setup   ------> T.Abe
      BDS SAD files   from   S.Kuroda

User   -------> Sugiyama(myself)
                                the first end user for JUPITER (?)
                                       modest experience of C++
                                       tiny experience of ROOT
                                       no experience of GEANT4
                                       no knowledge about IR/Accelerater

Jupiter is almost ready at snowmass (but geometry is not complete yet)
                                  VTX radius is not updated
Computer shutdown for Power outage@KEK (1st week of snowmass)
         try to use Tohoku computer w/ help of Jeri,Fujikawa
Sim. work can be started from Sunday night
Obtained result is very few, but study has been started at snowmass

Status of tools

sub detectors provide exact hits : only partial digitization

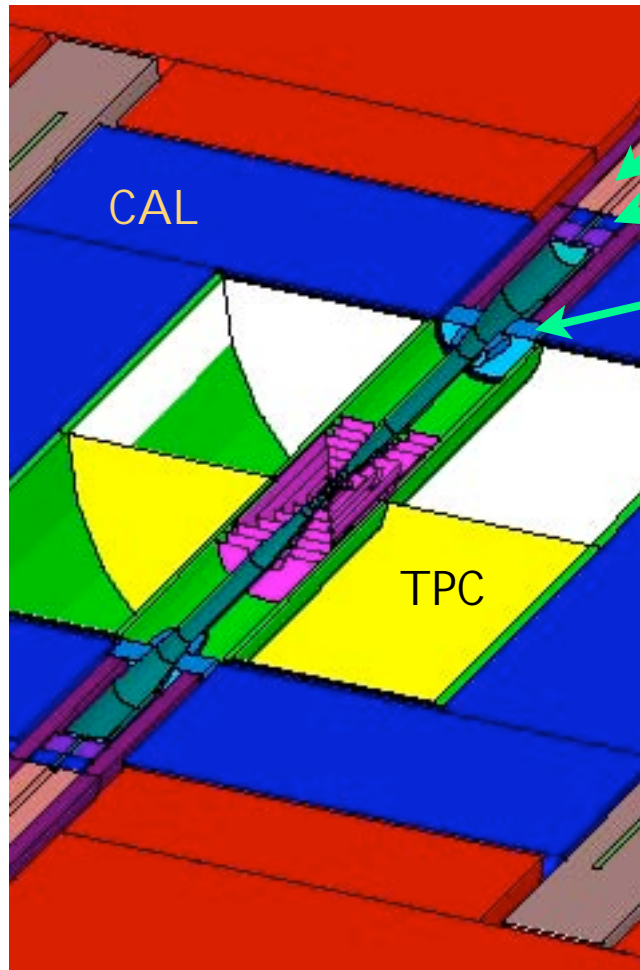## JUPITER

IR geometry   X angle   2mrad w/L*=4.5m and L*=3.5m
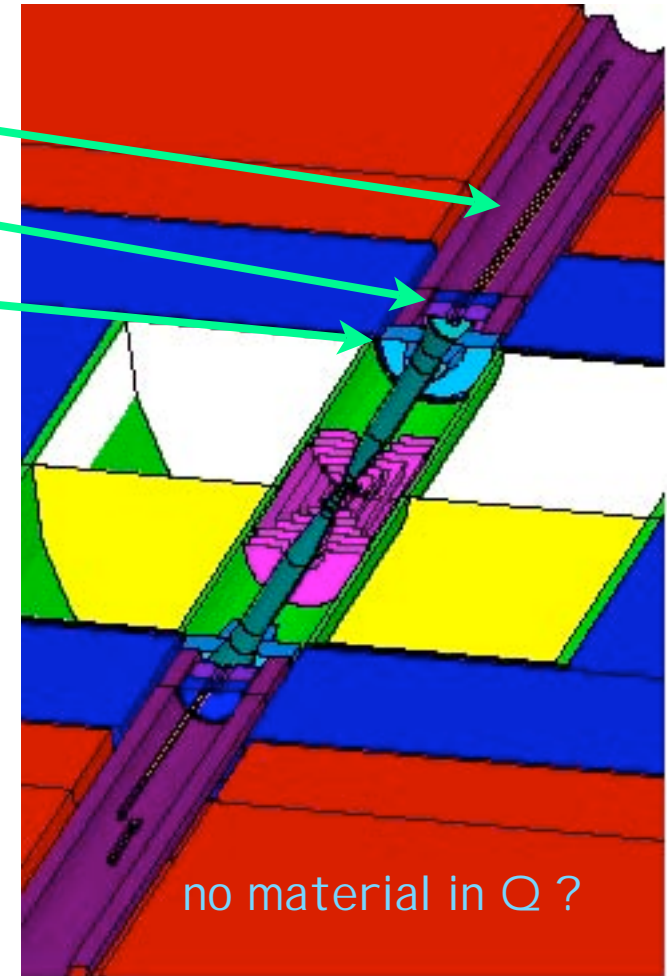
20mrad w/ L*=3.5m

Hadron crossection   default of GEANT4

(few information for neutron)

geometry

2mrad w/ L*=4.5

20mrad w/ L*=3.5

Q   ?

BCAL

FCAL

CAL

TPC

no material in Q ?

spent two days to get figures

CAIN output — 7 machine params. w/ 2 energy

pair background

Results of CAIN (v21e) at Ecm=500GeV

parameter	unit	Nominal	Low Q	Large Y	Low P	High Lum	High Lum-1	High Lum-2
E_{CM}	GeV	500						
Luminosity	10^{34} cm^{-2}s^{-1}	2.07	1.98	1.73	2.00	5.08	3.44	2.82
N_{gamma}	/electron	1.296	0.834	1.911	1.861	1.798	1.30	1.28
Inc. Pairs:E>3MeV	10^4 /bunch	6.45	2.47	7.07	15.9	18.5	10.01	8.16

Results of CAIN (v21e) at Ecm=1TeV

parameter	unit	Nominal	Low Q	Large Y	Low P	High Lum	High Lum-1	High Lum-2
E_{CM}	GeV	1000						
Luminosity	10^{34} cm^{-2}s^{-1}	3.42	3.48	3.18	3.60	10.33	6.91	5.67
N_{gamma}	/electron	1.472	1.01	2.515	2.218	2.336	1.765	1.730
Inc. Pairs:E>3MeV	10^4 /bunch	11.9	4.98	16.5	33.1	45.6	25.05	20.21

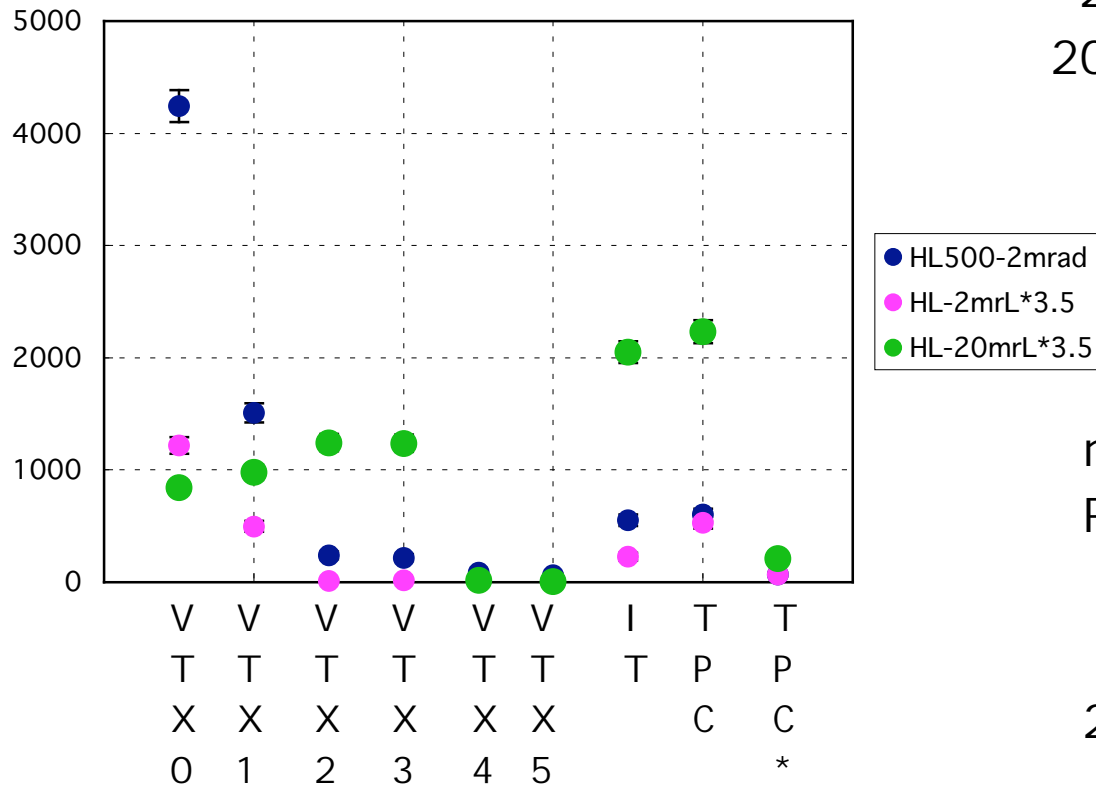Beamstrahlung photon, disrupted beam output were also prepared

Jupiter takes ~5 hours/3000 events

needs ~1000 hours to finish complete set (500GeV) of 1 BX pair bkg

20~25 BX sets are studied for error estimation

HighLum500 pair (181k events)

2mrad L*=4.5	use ~1/5 of 1BX
2mrad L*=3.5	~1/15
20mrad L*=3.5	~1/30

radius of VTX is NOT updated
R0 =2cm --> 2.4cm
     #hits@VTX0 must be < 1000

2mrL*=3.5 provides smaller hits !???
     material of Q exist ?

#hits on VTX ~ similar   except VTX0/1
     (LDC VTX1 ~400 VTX5 ~50)

#hits on TPC ~1/10 of LDC(~4000)

Many TPC hits produced by
same electron traveling TPC

PLAN

Continue study

check suspicious things

fix bugs

use proper Physics List

include DID (almost ready by Miyamoto)

CPU time

Until acc. design be fixed, available time is limited

borrow predecessors results as much as possible

focus into GLD specific points   where is it ?

suggestions from experts are necessary

these can be modified after ACC. design fixed ??

Is it better to do LCBDS study now ?

I'm going to recruit one student for this study(CAIN+JUPITER / LCBDS).

Background tolerances are discussed at snowmass

10% occupancy of TPC is considered !!

We have to make sure it does work or not using

full sim. + recon. + ZH event + background data

Summary

Nothing to summarize

just
Tools/environment for background study
became almost ready at Snowmass