



# BDIR/MDI Summary ECFA Final Plenary

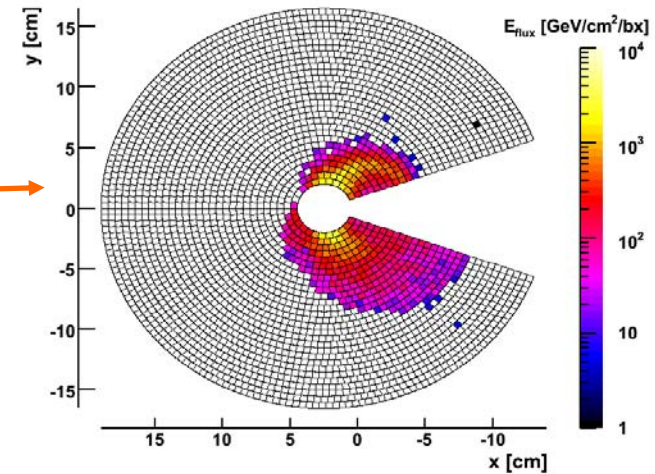
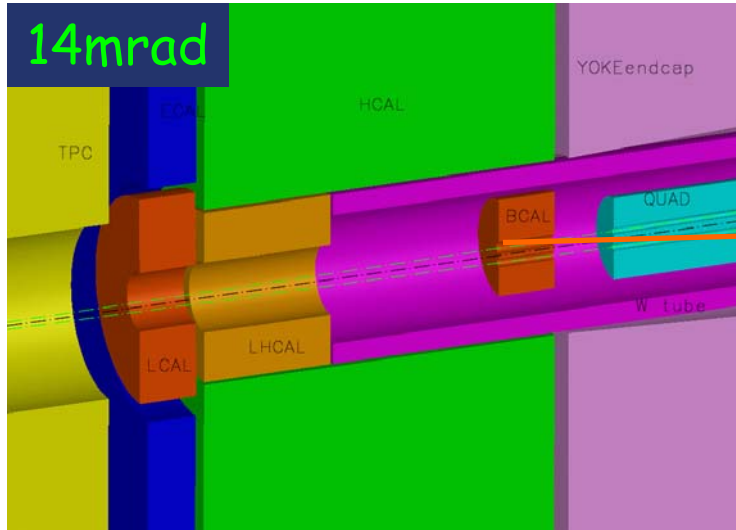
C.Grah

ILC ECFA 2006  
Valencia, 10<sup>th</sup> November 2006





# Beamdiagnostics in the Forward Region of the ILC Detectors



Energy deposition at BeamCal front face  
14mrad DID

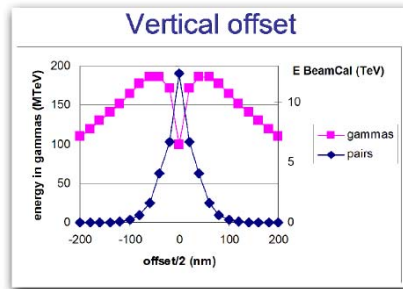
Resolution by single parameter reconstruction

Parameter	Unit	Nom.	14mrad antiDID	
			$\mu$	$\sigma$
$\sigma_x$	nm	655	653.89	2.27
$\sigma_y$	nm	5.7	5.395	0.229
$\sigma_z$	$\mu\text{m}$	300	299.83	4.11

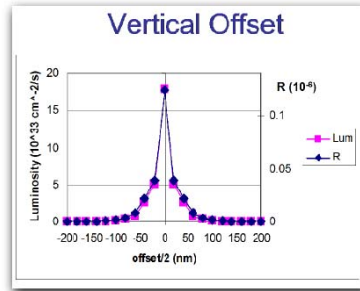
$$\begin{pmatrix} \text{Observables} \end{pmatrix} = \begin{pmatrix} \text{Observables} \\ \text{nom} \end{pmatrix} + \begin{pmatrix} \text{Taylor} \\ \text{Matrix} \end{pmatrix} \begin{pmatrix} \Delta \text{BeamPar}^* \end{pmatrix}$$



# GamCal



- Max pairs when beams aligned.
- Min  $\gamma$ s when beams are aligned.



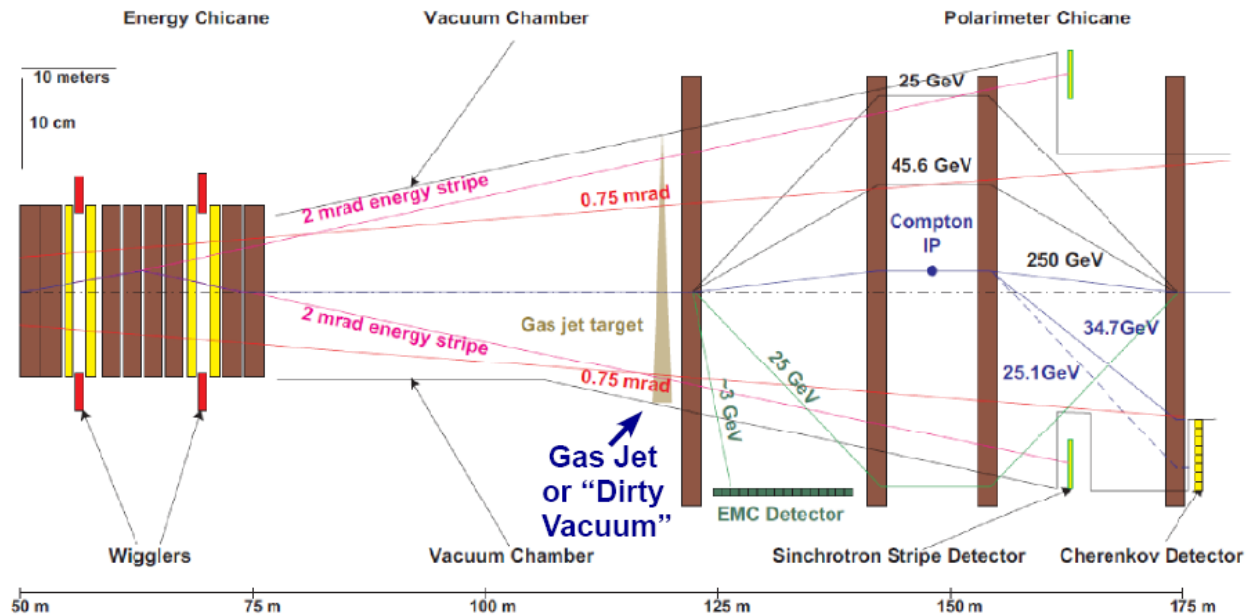
Ratio gives a good luminosity signal.



Complementary information from beamstrahlung photons and beamstrahlung pairs

ratio  $E_{\text{pairs}}/E_{\text{phot}}$  scales with luminosity

Diagram of the Energy Chicane and Polarimeter Chicane in the 14/20 mrad extraction line



Idea for the technical implementation

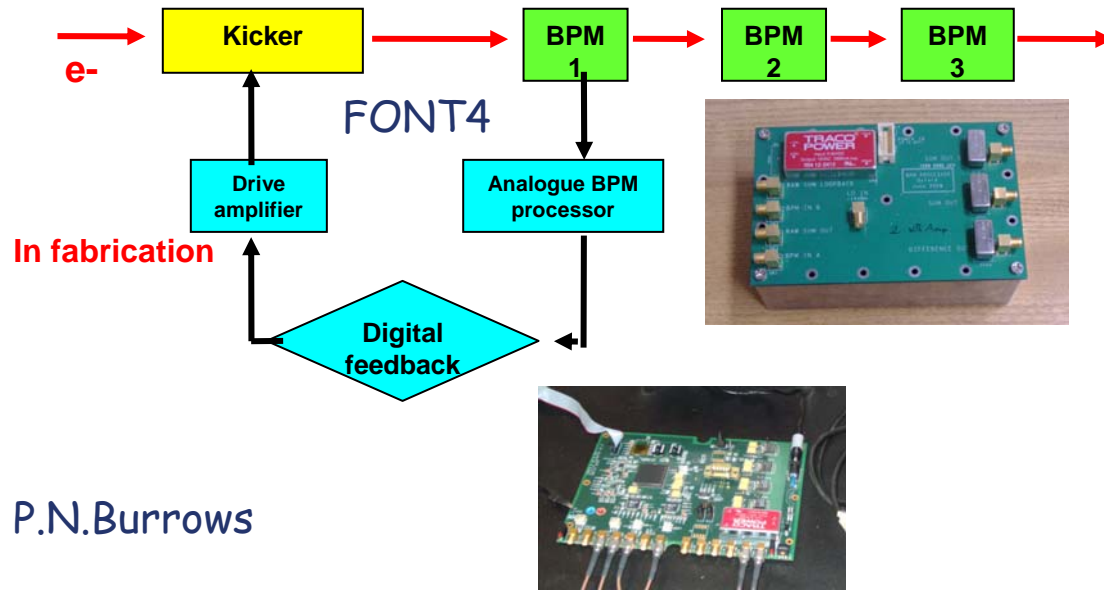
B.Parker

10-Nov-2006

C.Grah: BDIR/MDI

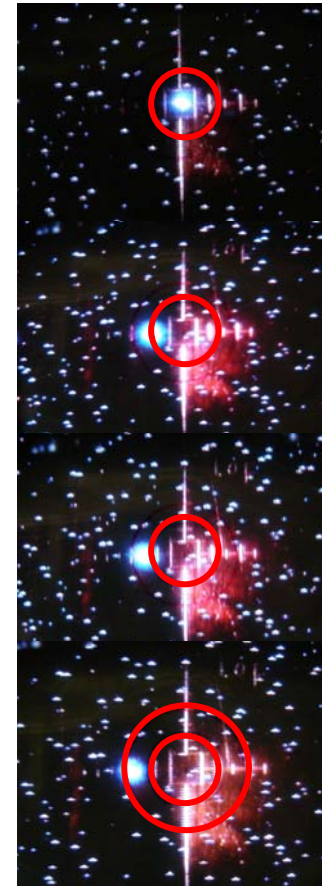


# Status of IP Fast Feedback Prototype

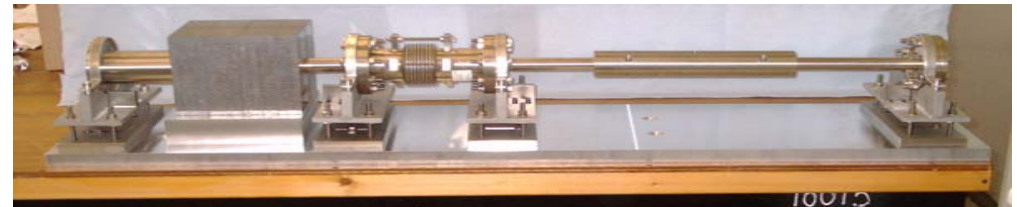


P.N.Burrows

- Time of flight kicker - BPM:
- Signal return time BPM - kicker:
- Irreducible latency: 22ns
- BPM processor:
- ADC/DAC (3.5 89 MHz cycles)
- Signal processing (8 357 MHz cycles)
- FPGA i/o
- Amplifier
- Kicker fill time
- Electronics latency: 118ns
- Total latency budget: 140ns



## FONT Test Module for ESA

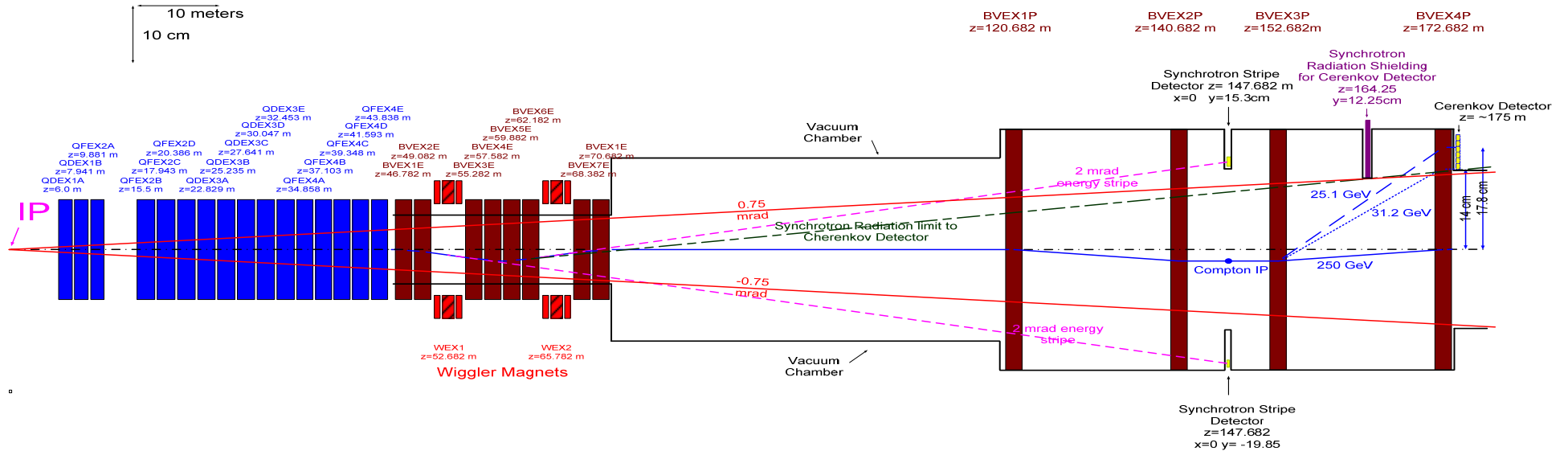




# 14 mrad Extraction Line

Energy Chicane

Polarimeter Chicane



## 14 mrad extraction line

0.5 TeV CMS

•Performance of Energy Spectrometer and Polarimeter Meets Goals

1 TeV CMS

•Performance of Energy Spectrometer and Polarimeter Meets Goals

•Large background from scattered synchrotron radiation photons at the Cherenkov Detector

•Concern about large beam losses for Low Power beam parameters

2 mrad extraction line investigated ... more concerns.

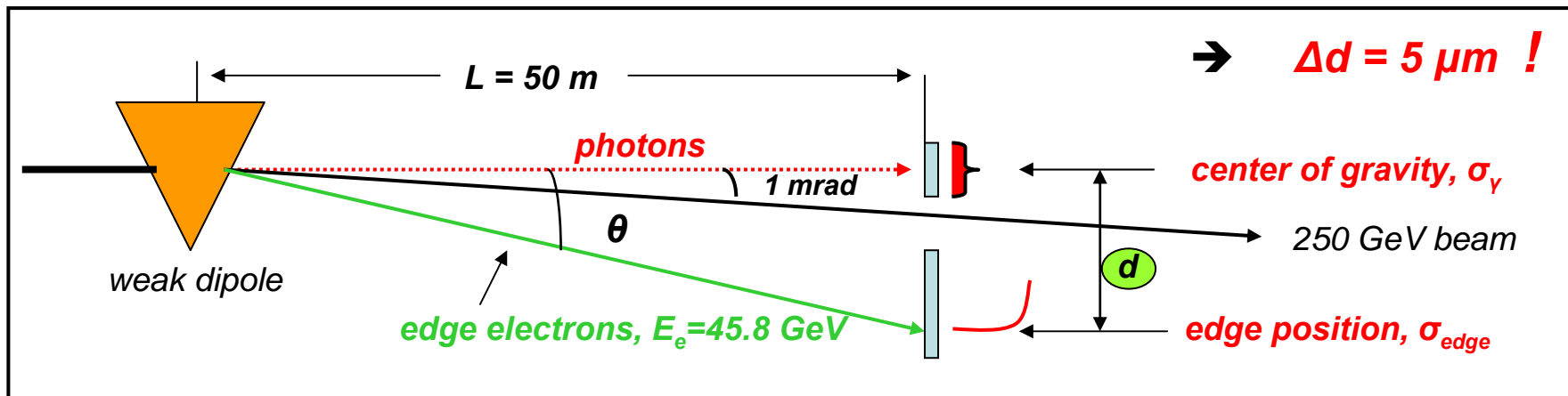
K.Moffeit



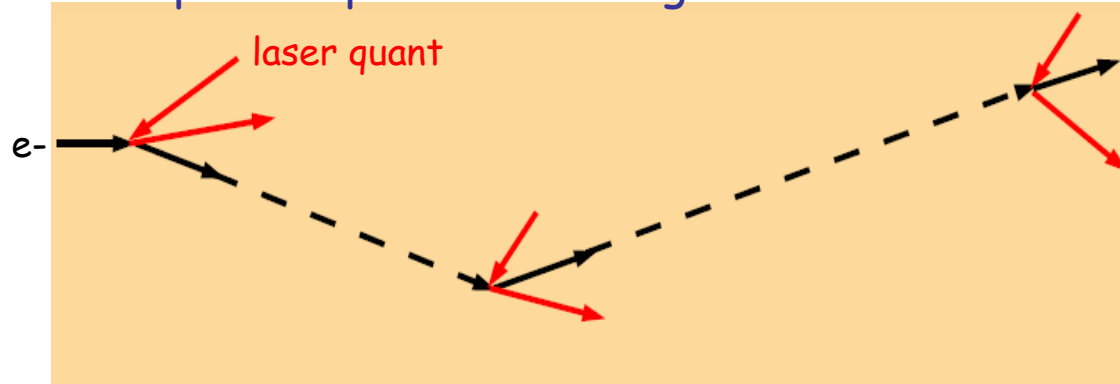
# Precise ILC Beam Energy Measurement using Compton backscattering

$$\Delta E_b/E_b = 10^{-4}$$

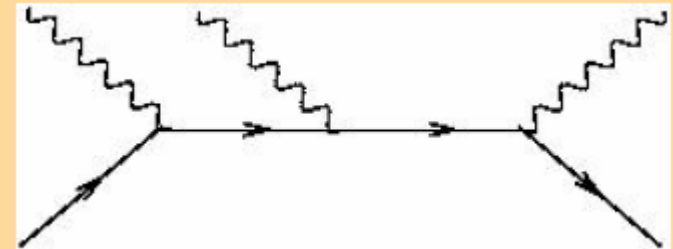
and infrared Nd:YAG laser ( $E_L = 1.165 \text{ eV}$ )



## Multiple Compton scattering



## Non linear effects

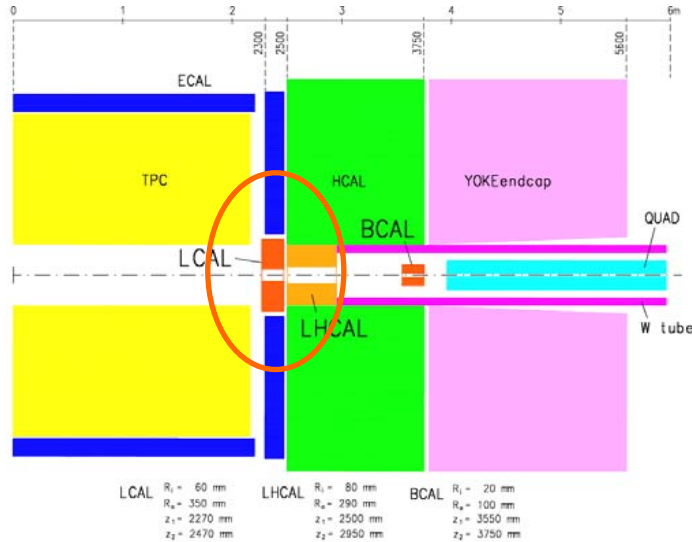


Both effects shown not to reduce the precision!

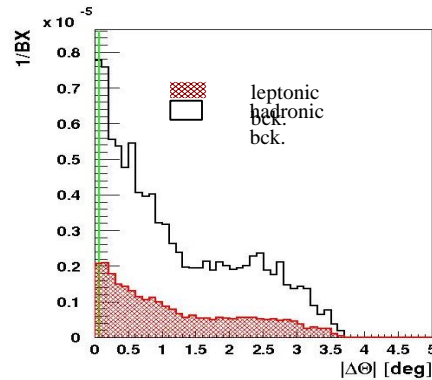
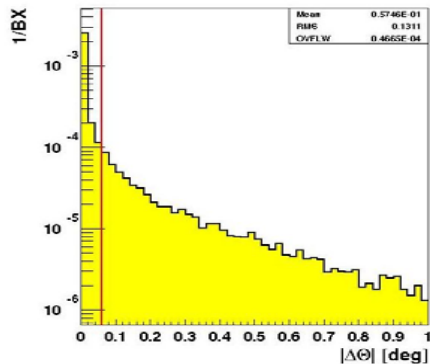
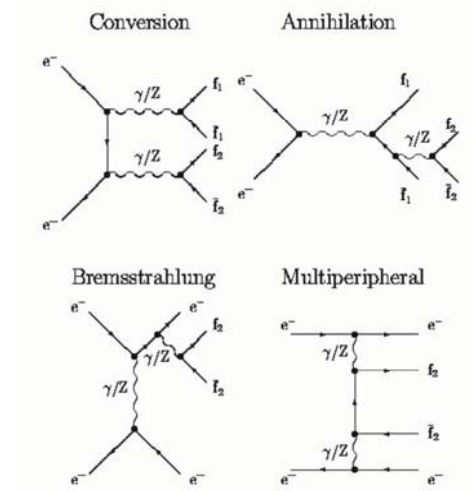


# Four-fermion processes as a background in the ILC luminosity calorimeter

BACKGROUND to bhabha events



$\Delta L/L = 10^{-4}$   
by counting bhabha events



- Isolation cuts are**
- Acollinearity cut
  - Acoplanarity cut
  - Relative energy cut
  - Energy balance cut

$$B/S = 1.3 \cdot 10^{-4} / \epsilon_{\text{bhabha}} = 80.6 \%$$

I.Bozovich

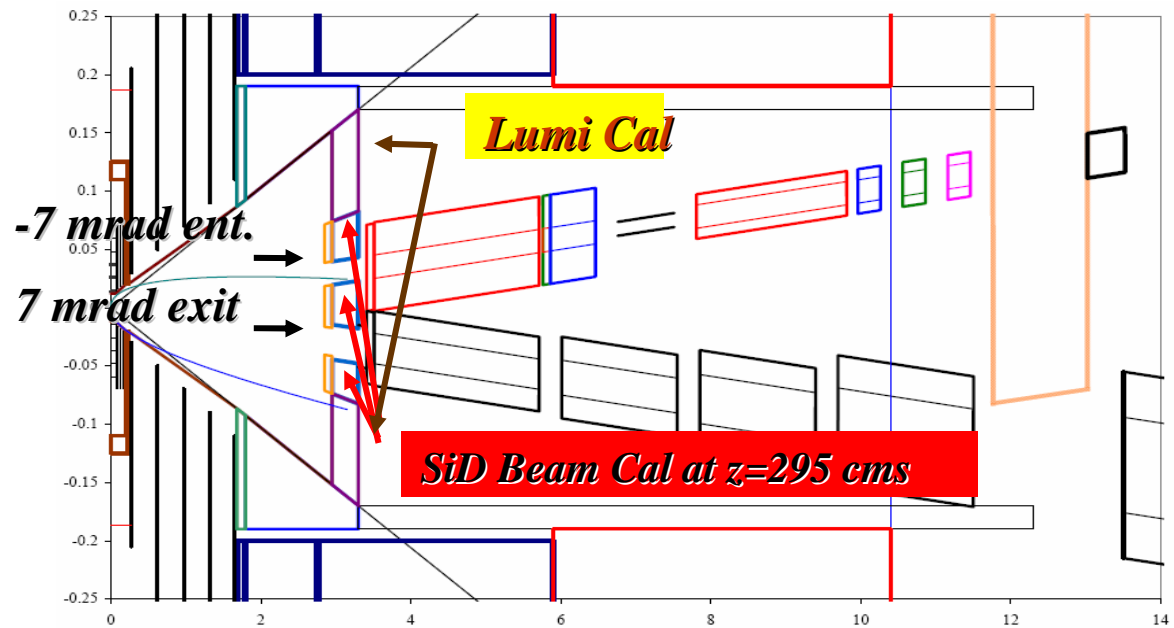
10-Nov-2006

C.Grah: BDIR/MDI

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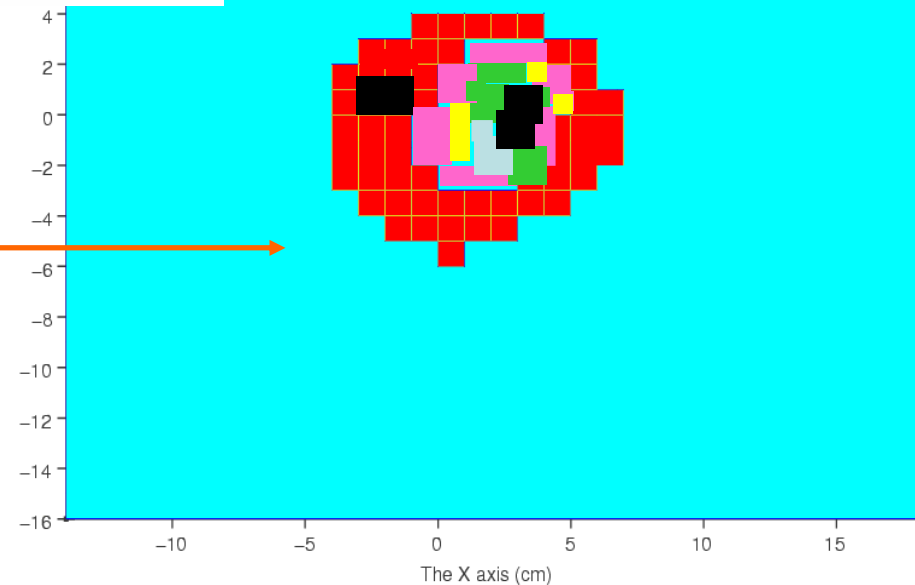
# SIMULATION OF BEAMCAL WITH B FIELDS



Moliere Radius  $\sim 1$  cm

- 0-100 GeV/cm<sup>2</sup>
- 100-250 GeV/cm<sup>2</sup>
- 250-500 GeV/cm<sup>2</sup>
- 500-750 GeV/cm<sup>2</sup>
- 750-1000 GeV/cm<sup>2</sup>
- In beampipes

*Anti-DiD scale factor = 1.2*



U.Nauenberg

10-Nov-2006

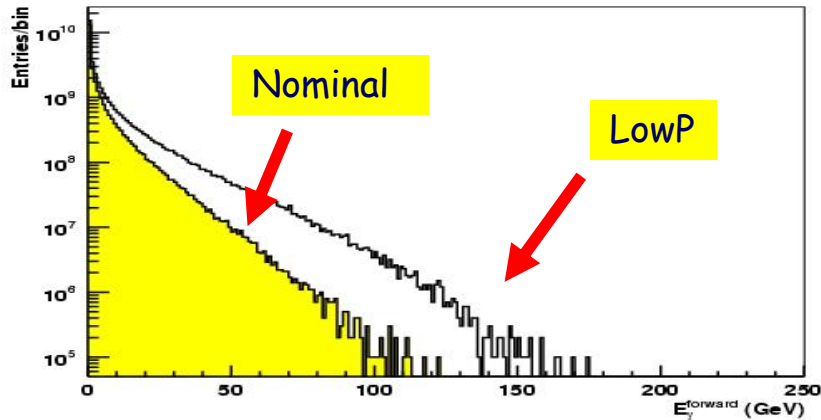
C.Grah: BI





# LowP Option

Energy spectrum of beamstrahlung, Nom - LowP



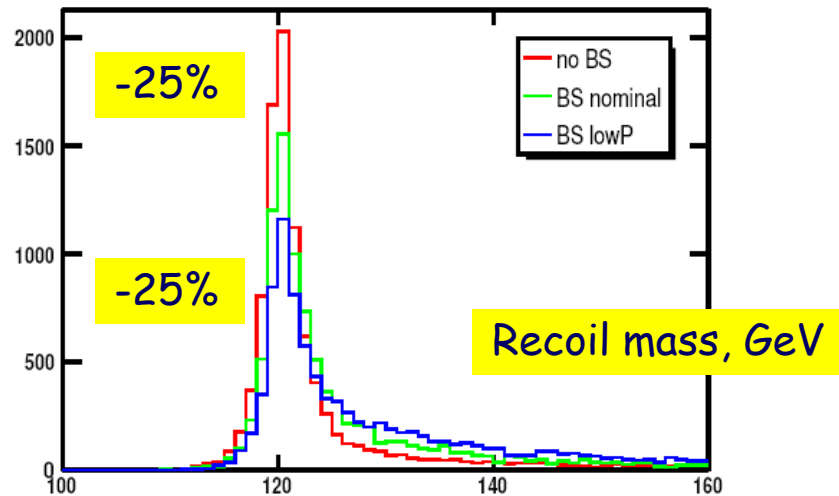
$\frac{1}{2}$  RF power -  $\frac{1}{2}$  luminosity:

The LowP option could restore the luminosity to  $2 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$  at the cost of:

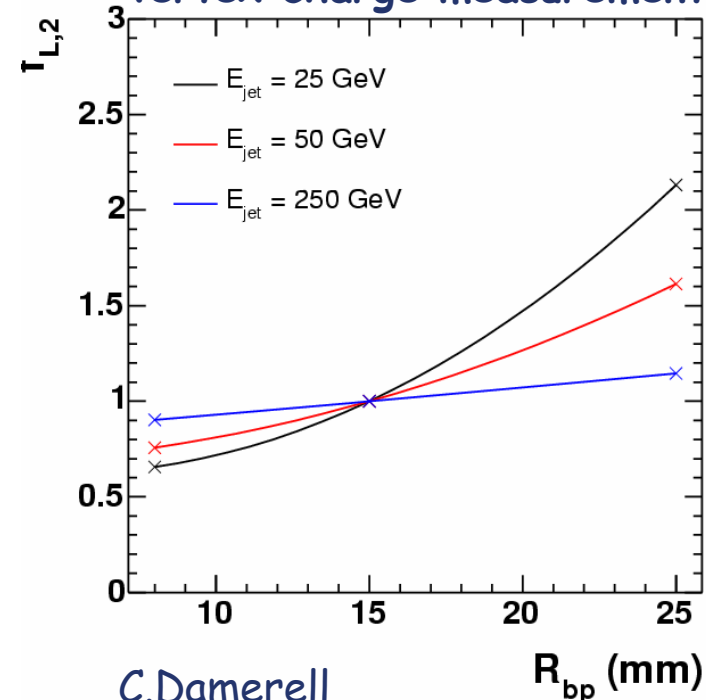
increased energy spread  
(ave E-loss 2.2%  $\rightarrow$  5.7%)

increased beamstrahlung/pair production

Higgs Recoil mass (no ISR, FSR, momentum blur  $7 \cdot 10^{-5}$ )



vertex charge measurement



W.Lohmann

10-Nov-2006

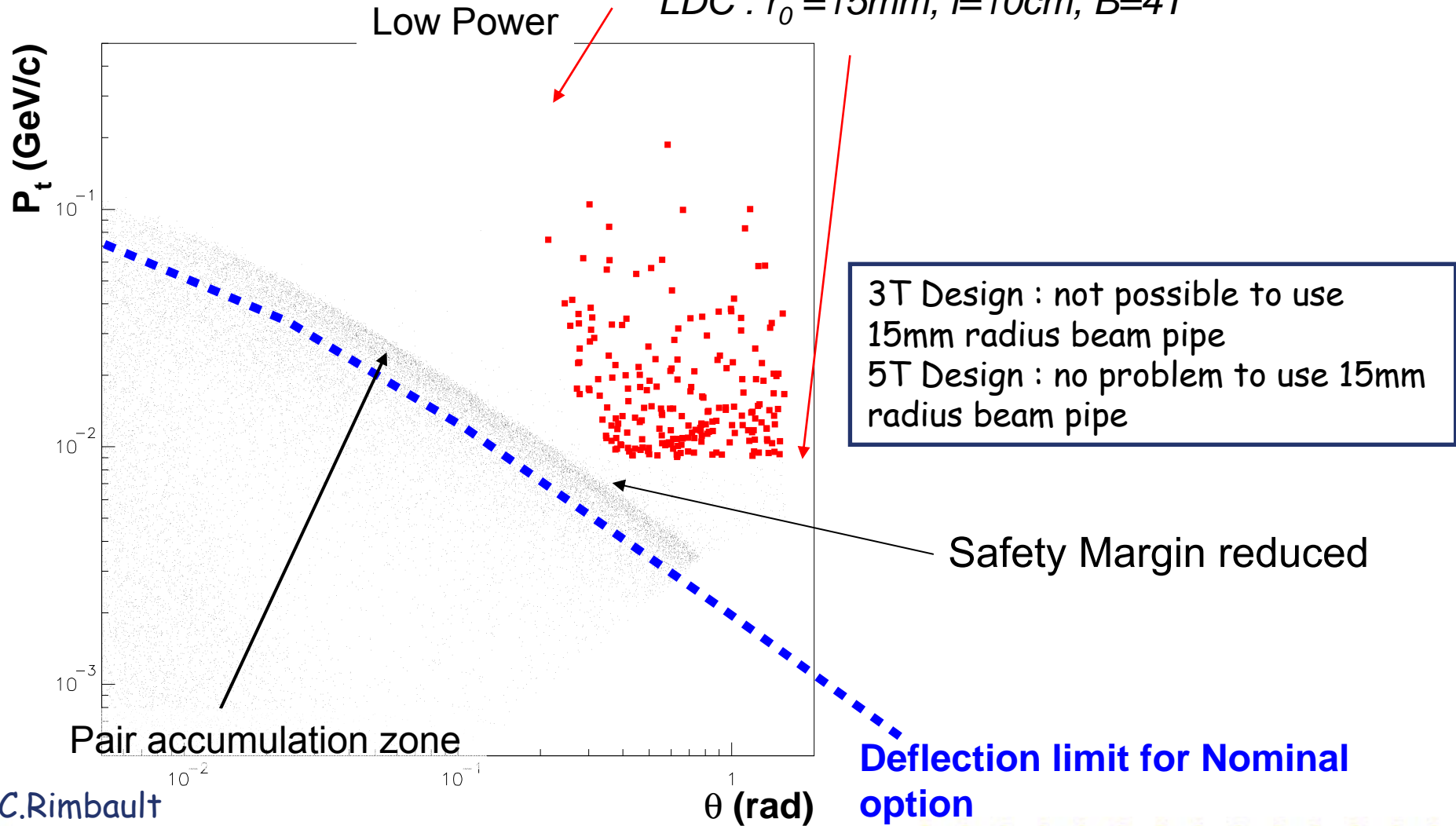
C.Grah: BDIR/MDI

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# Flexibility of the Low Power option regarding the pair background in the microvertex detector at 4T

**VD acceptance** depends on  $B, r_0, l$   
LDC :  $r_0 = 15\text{mm}, l = 10\text{cm}, B = 4\text{T}$



C.Rimbault

10-Nov-2006

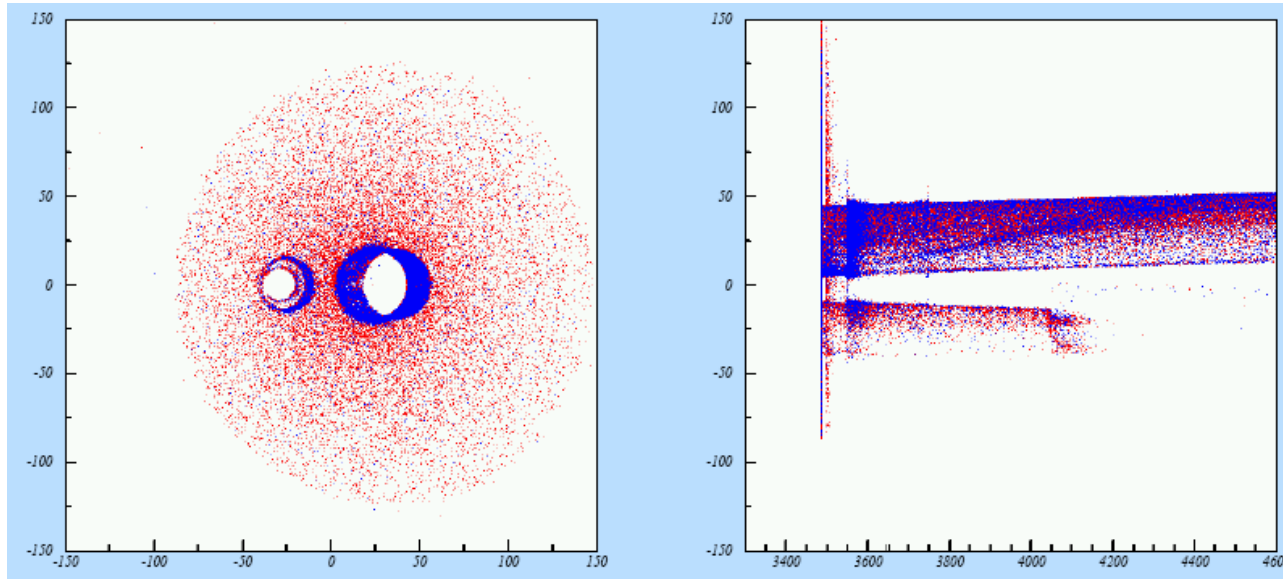
C.Grah: BDIR/MDI

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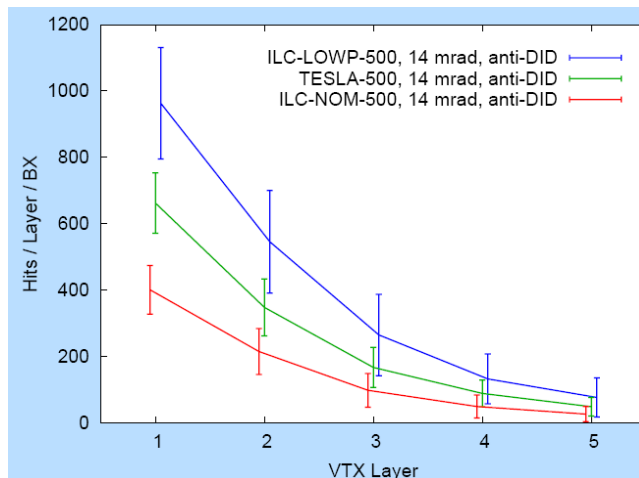


# Beam-Induced Backgrounds in the LDC Detector

## Dirty Business at Low Angles



Origins of backscattered **electrons** and **positrons** which enter the inner parts of the detector



Neutron fluence (no NIEL scaling applied yet)

- $(2.3 \pm 4.0) \cdot 10^8$  neutrons / cm<sup>2</sup> for ILC-NOM-500
- $(6.1 \pm 7.4) \cdot 10^8$  neutrons / cm<sup>2</sup> for ILC-LOWP-500

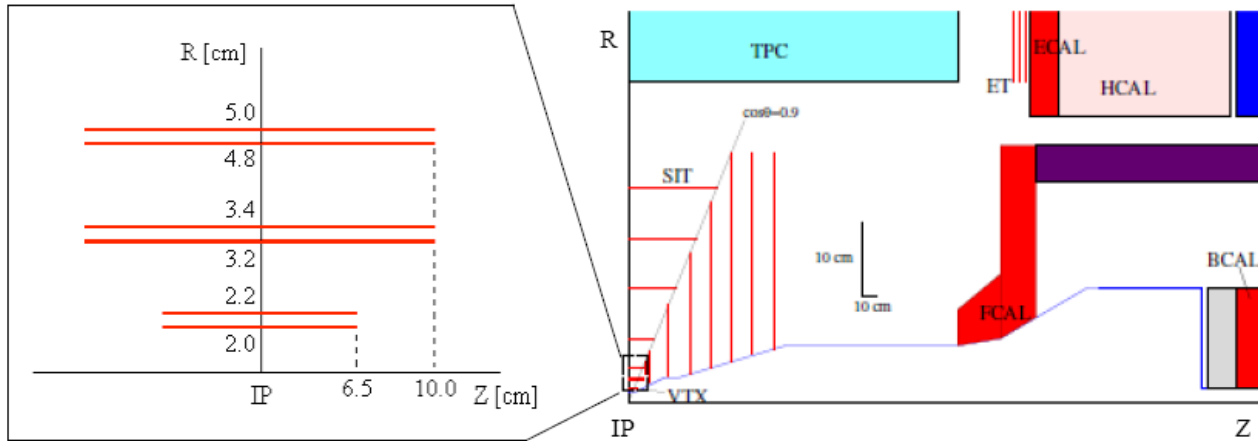
■ Particles entering the TPC (per BX)

	Nominal	Low P
Neutrons	142 ± 20	590 ± 68
Photons	947 ± 57	3108 ± 148
Electrons	6 ± 13	30 ± 32

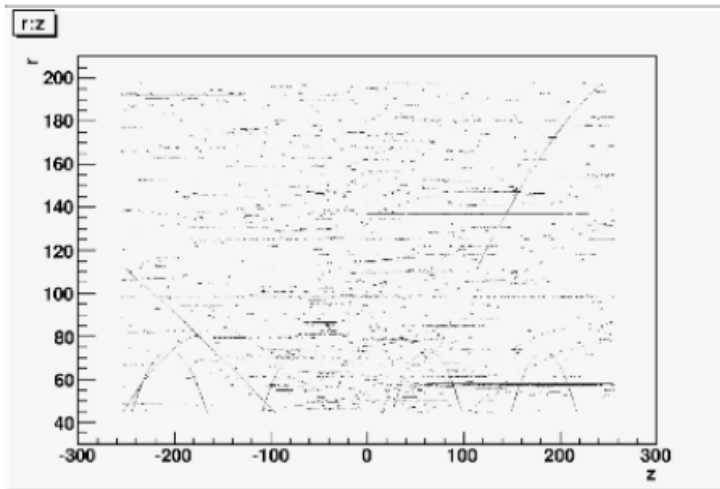
A.Vogel



# Background study at GLD-IR



Simulation of  
GLD forward region  
(14mrad solenoid)



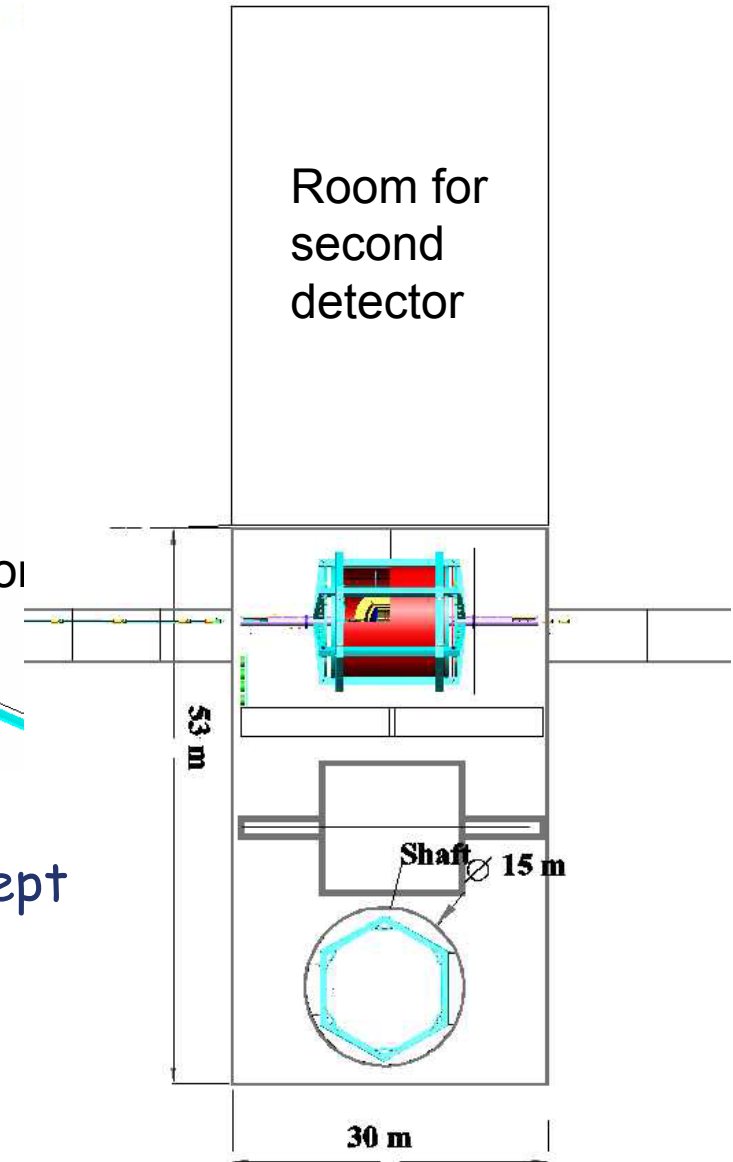
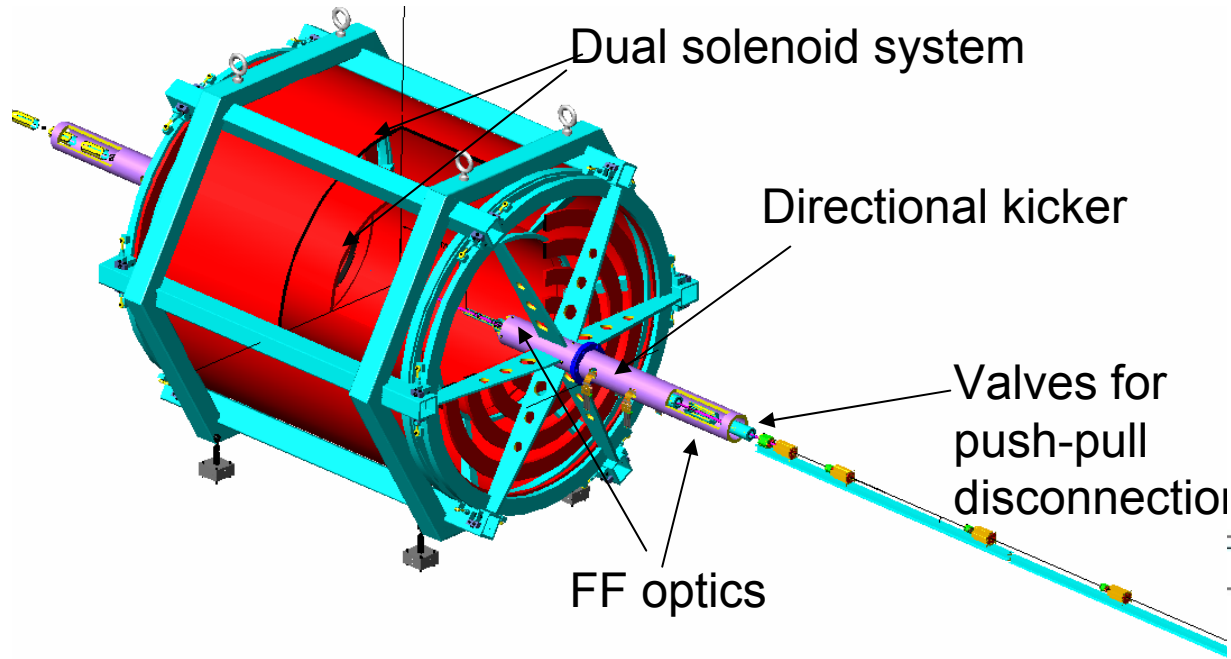
	hits/bunch	hits/50μsec
Nominal	883.8	141,408
LowP	2590	207,200

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

T.Tauchi



# 4-th Concept and MDI issues



4th Concept presented their detector concept and showed their ideas for the integration.

A. Mikhailichenko

10-Nov-2006

C.Grah: BDIR/MDI

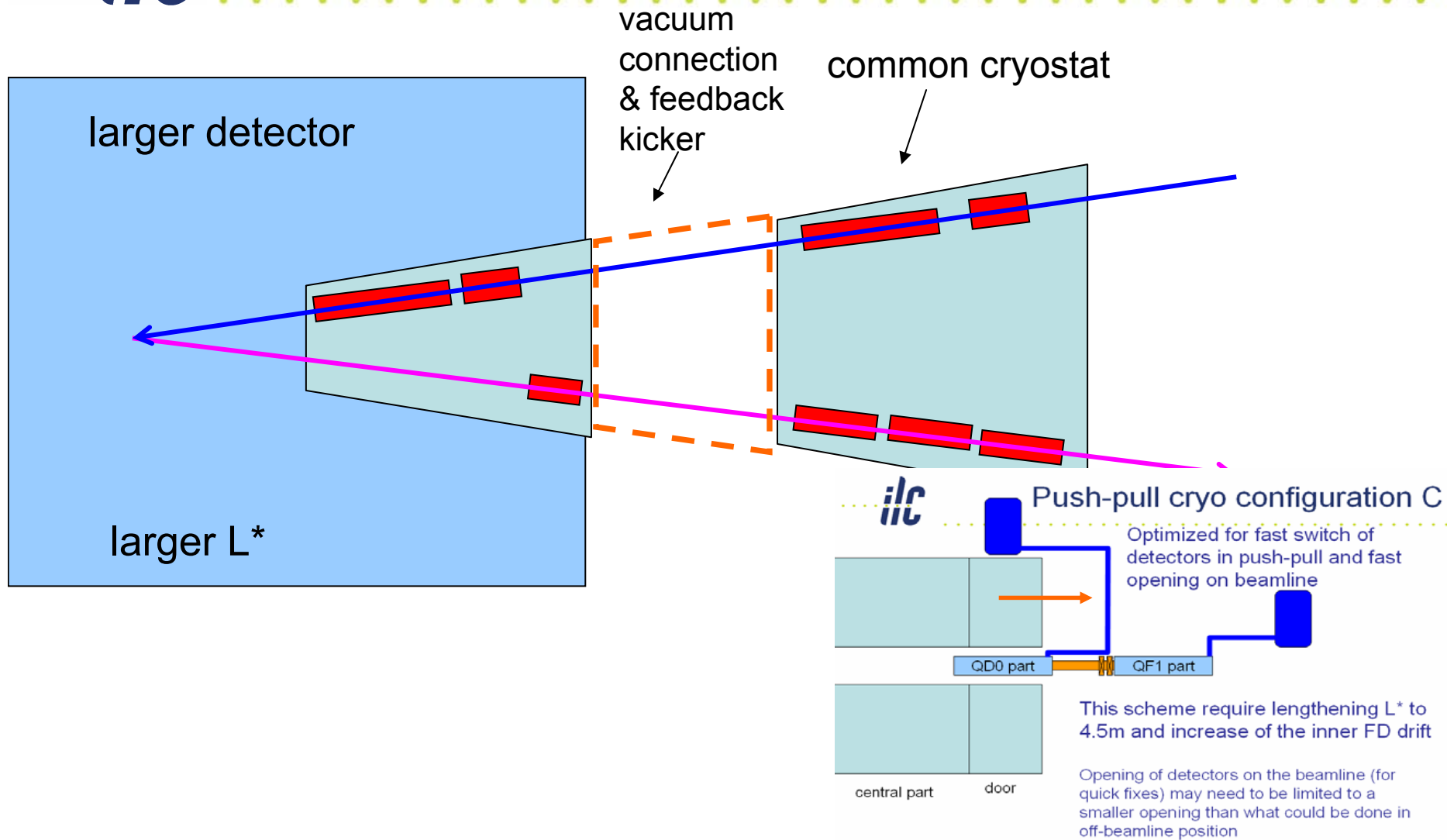


# Changes since Vancouver

- Approved:
  - CCR from 2/20mrad to 14/14mrad, single collider hall
  - 5m muon walls instead of 9+18m
  - On surface detector assembly
- Under Study:
  - Single IR - evaluation of push-pull



# Technical evaluation of push-pull



A.Seryi

10-Nov-2006

Sep 21-Nov 6, 06

Global Design Effort

push-pull: 47

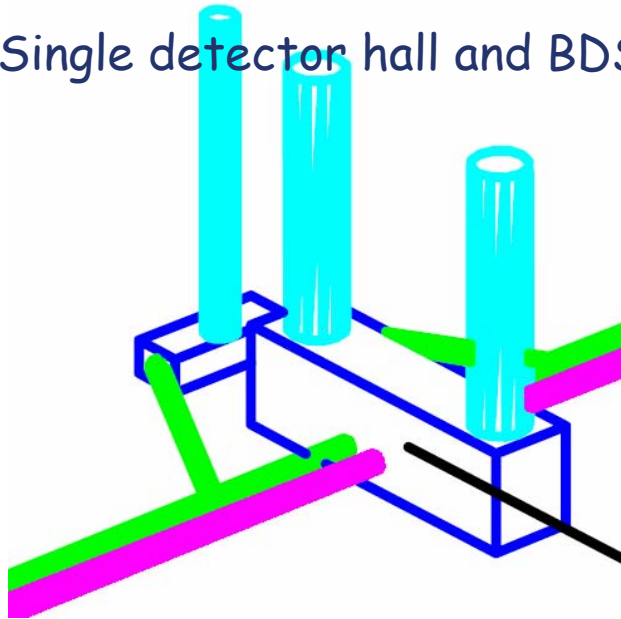
C.Grah: BDIR/MDI

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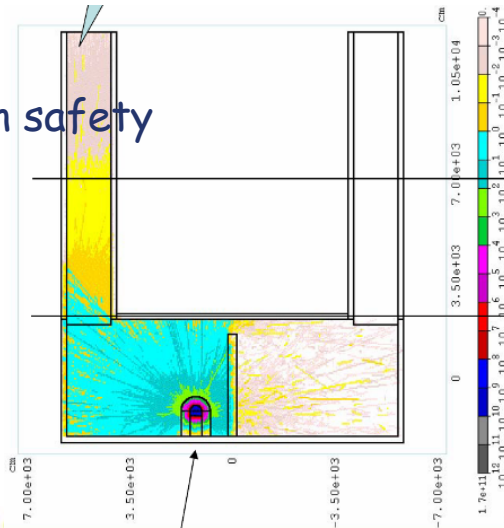
# Technical evaluation of push-pull

Single detector hall and BDS



Movement on airpads (CMS like)

Radiation safety



Tremendous amount of work was done since end of september.





Thanks for your attention!