IR/Backgrounds & Beam Instrumentation Summary

Six Sessions, 20 talks

Instrumentation:

–WAB Monitor (2)

–Polarimeter, Energy Spectrometer (4)

IR:

–SB2009 Parameters (1)

–QD0 & DID Design (2)

–Push-Pull, Vibration Modeling (3)

–FCAL & Pair Monitor (4)

–IP Feedback (2)

–Beam Gas & IR Vacuum (2)

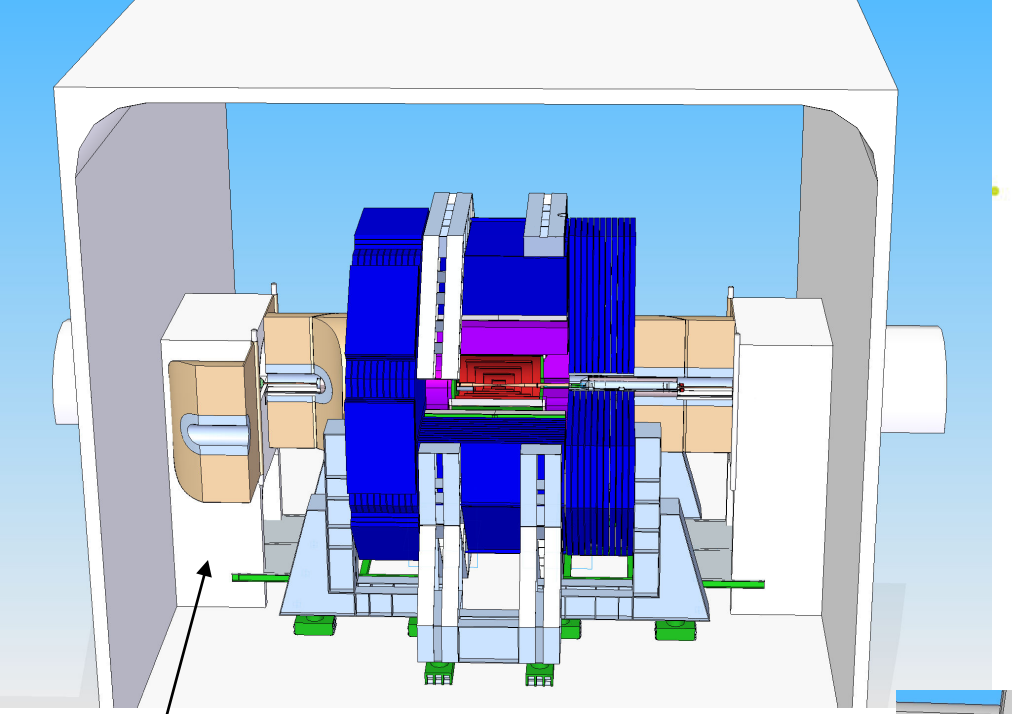
Tom Markiewicz/SLAC

ALCPG'09, UNM, Albuquerque

3 October 2009

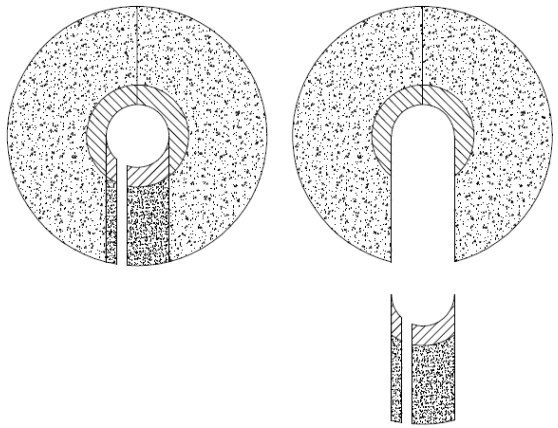
Take Away Points

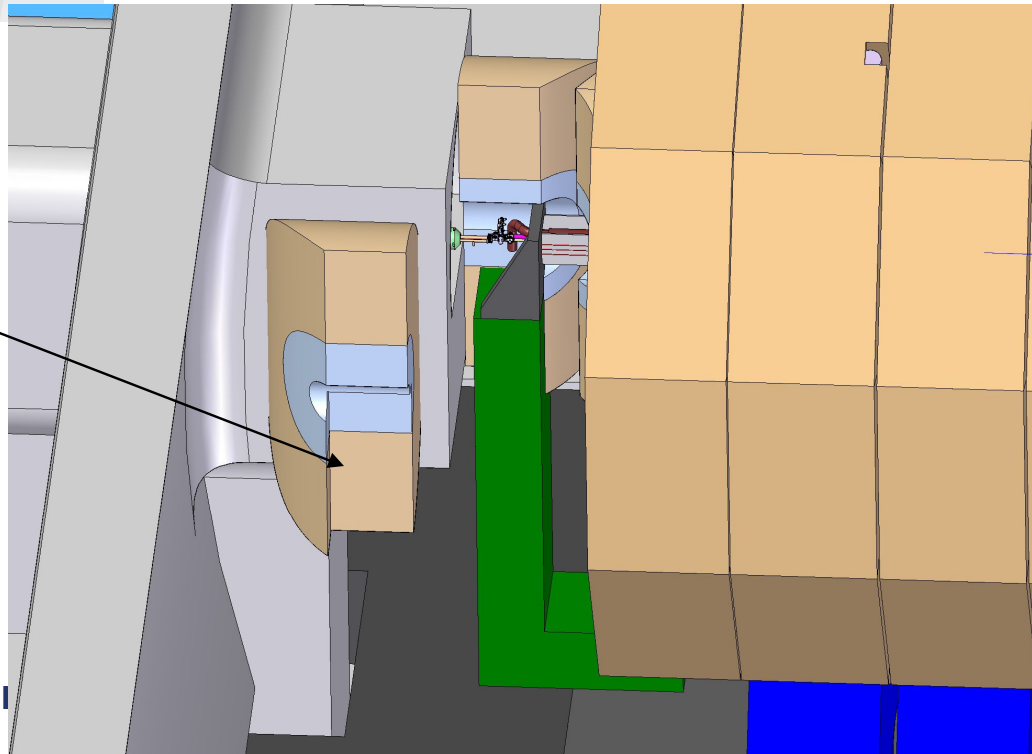
- Post LOI Collaboration on Push-Pull Solutions has begun
  - **"Easy" problems have solutions (Pacman Interface)**
  - **Understanding that "Hard" choices (Platform or No Platform) must be based on calculation, simulation, and measurement (not bias)**
- ANSYS-based studies of vibration response of SiD and ILD have begun
  - **Don't look too bad, but:**
    - What is the mechanical engineering requirement
    - How to make design better
  - **Measurements at KEK-Belle & CERN-CMS (to be discussed at CLIC'09)**
- SB2009 Low Power Parameter set with or without "Travelling Focus" Needs Study
  - **IP Backgrounds, Beampipe dimensions & apertures**
  - **Collimation system: Muons, SR, Jitter, etc.**
  - **Luminosity sensitivity to jitter, effect of IP feedback and stricter requirements of upstream system stability**
    - DR Kicker jitter &/or RTML feed forward stabilization
- Steady Progress on challenging instrumentation despite limited support
  - **First observation of Optical Wide Angle Bhabha Rad. & use as a beam monitor**
  - **Improved IP Vacuum requirement calculation**
  - **Other results as time allows**



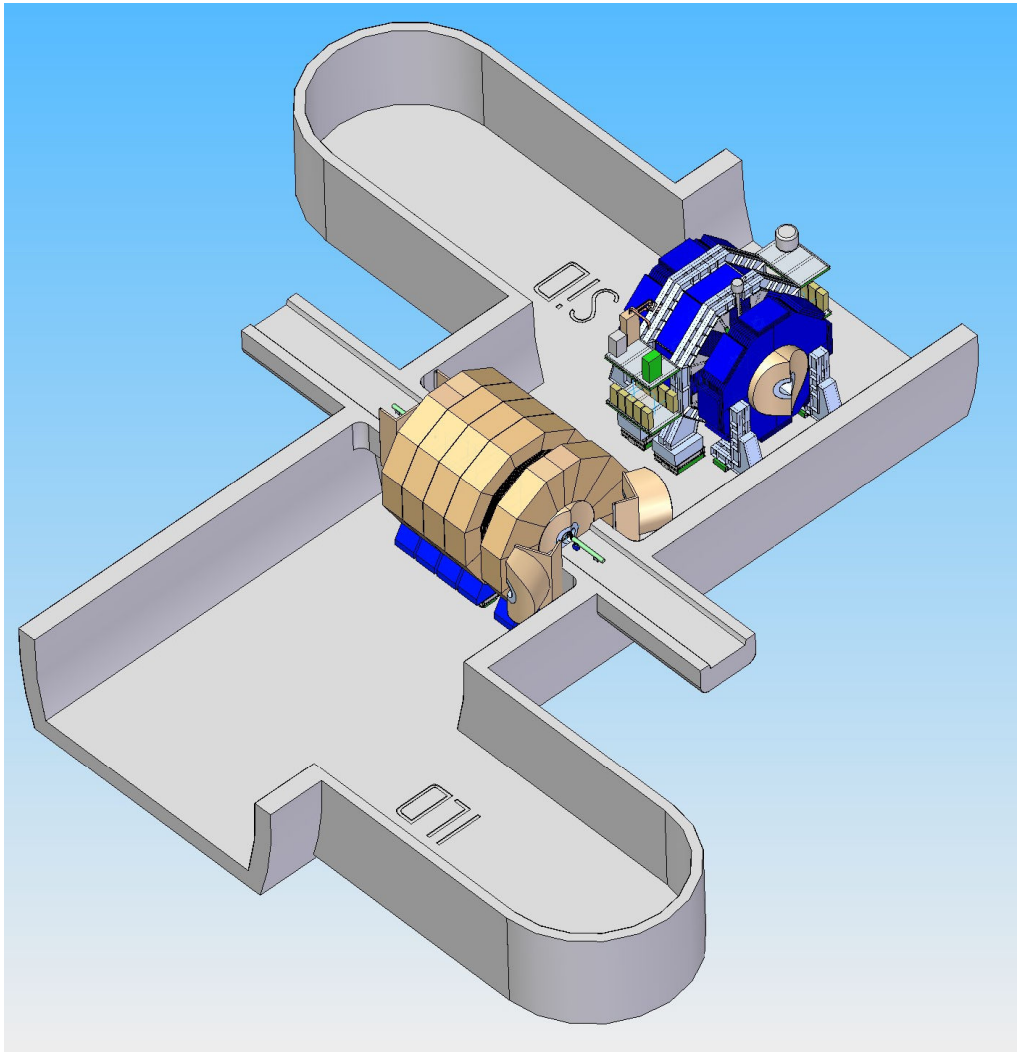
CMS-Inspired Hinged PacMan w/ Cut-outs for ILD Pillar and Plugs

SiD ILD

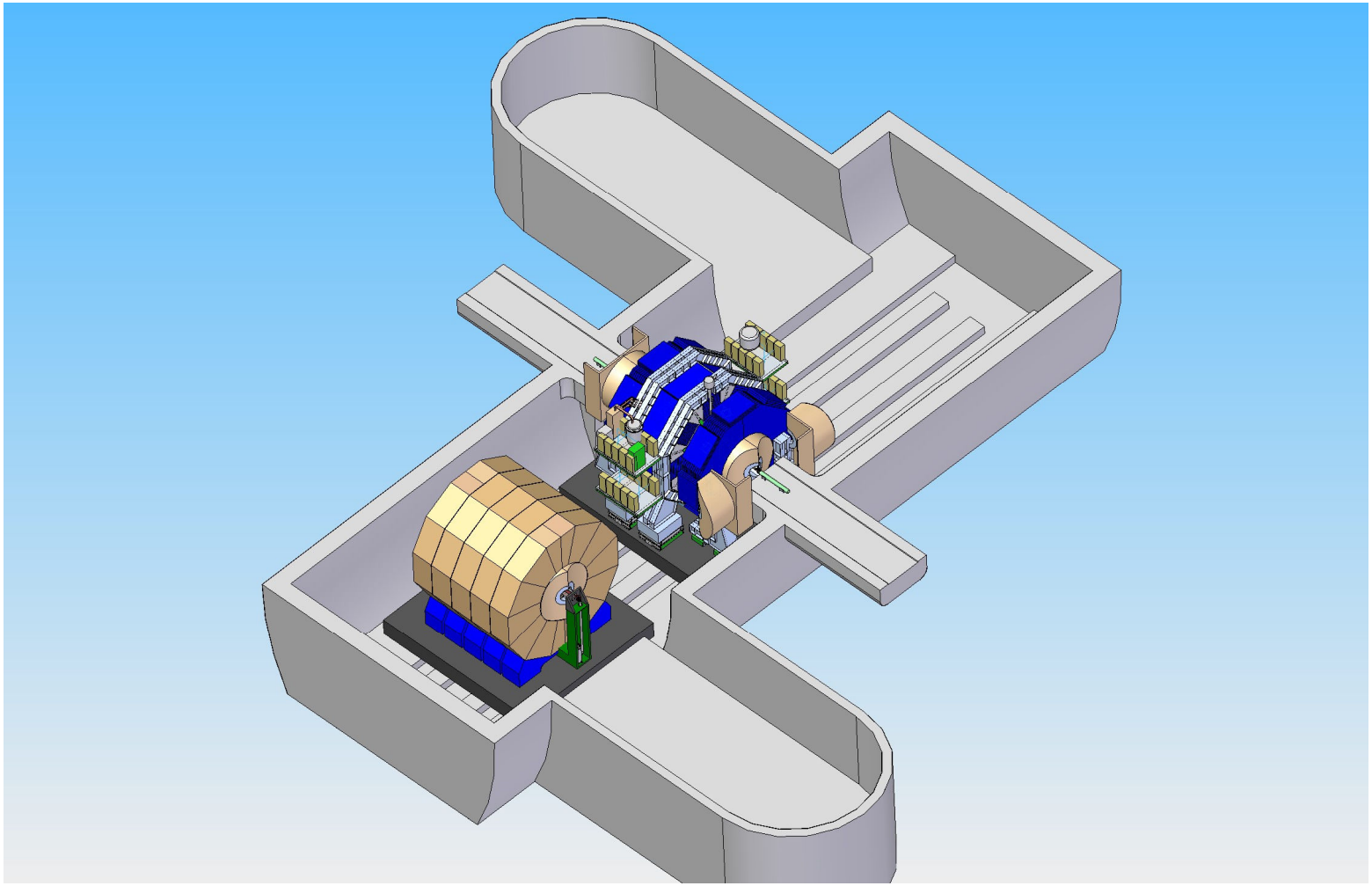




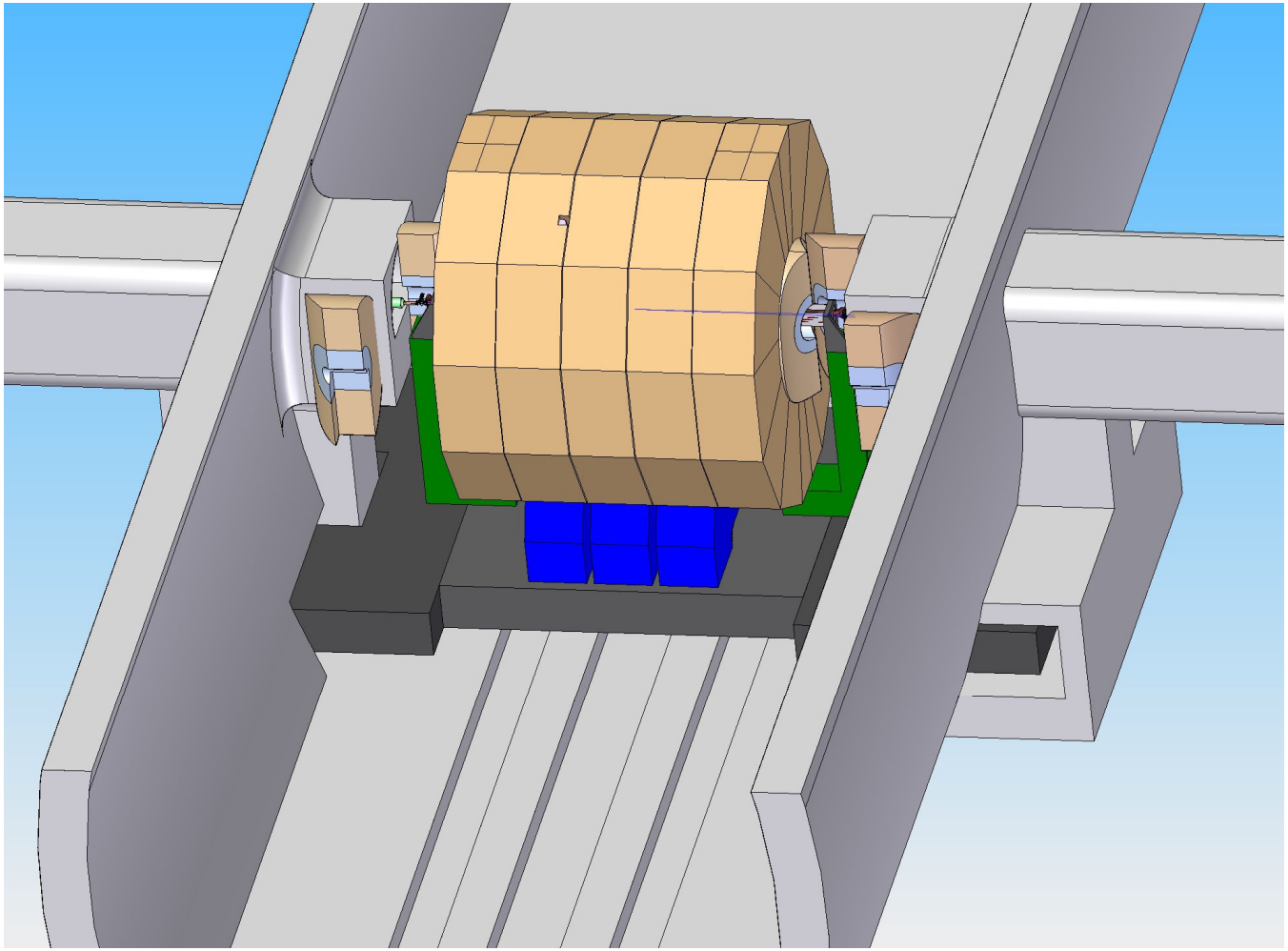
All detectors without platform



All detectors on platform

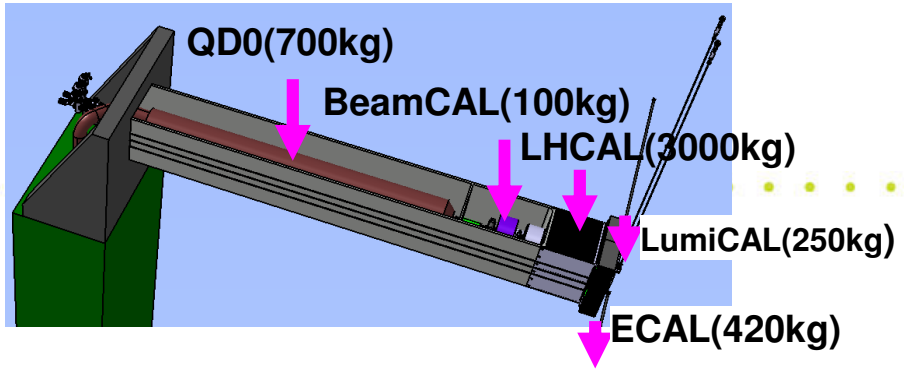


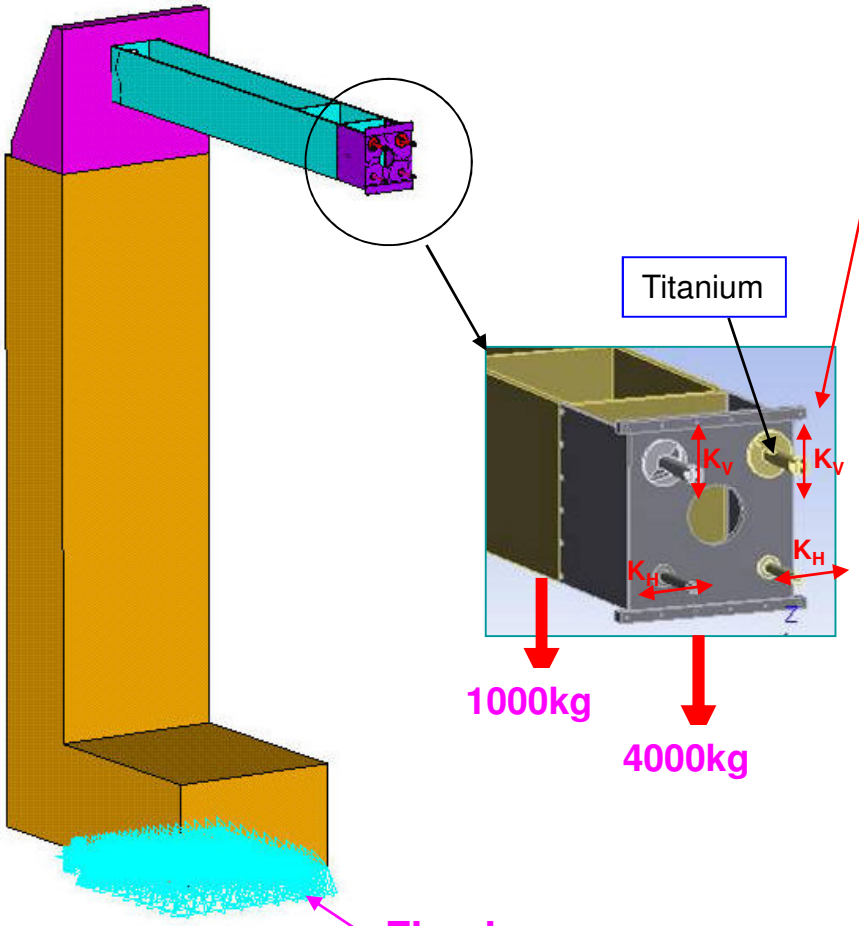
Half Platform w/ Pocket Storage



Assumptions

ILD

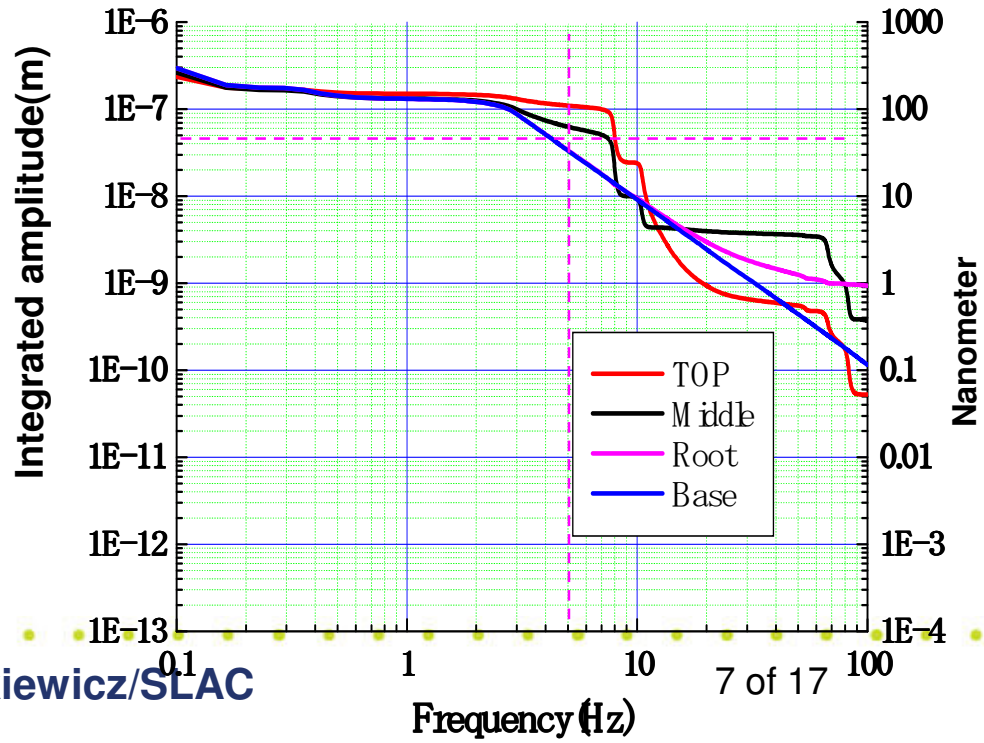




Calculation of spring constant of the tension rods.

For the modeling of tension rods, spring constants are defined on the top of support rods.

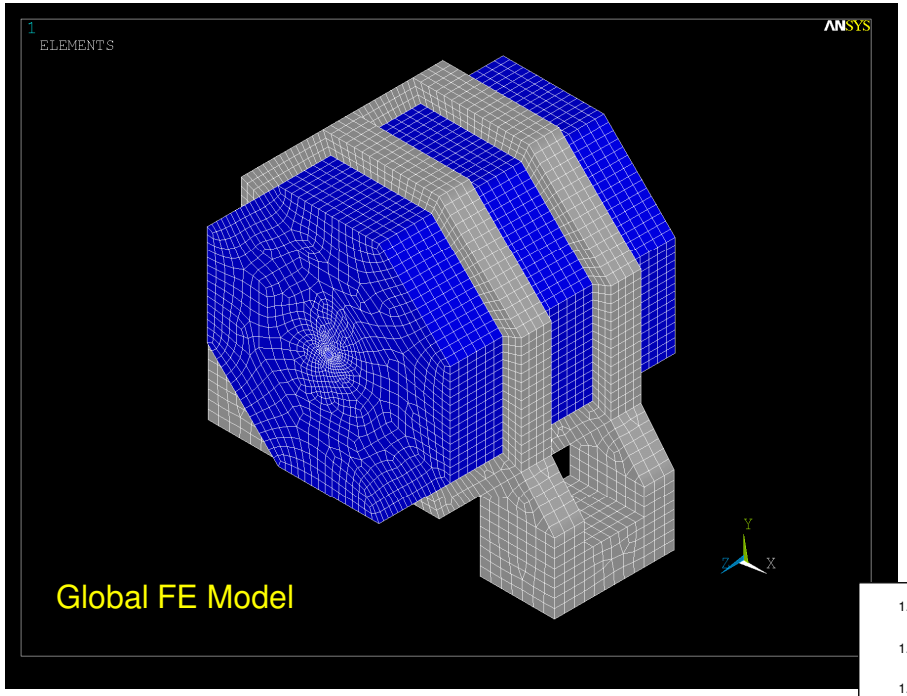
Tension rods; CFRP
E=130GPa
Density: 1.5e-6kg/mm^3

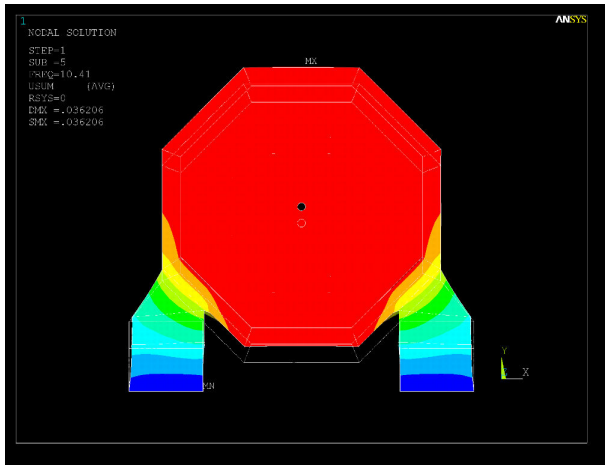


- Spring constant
- Static loads

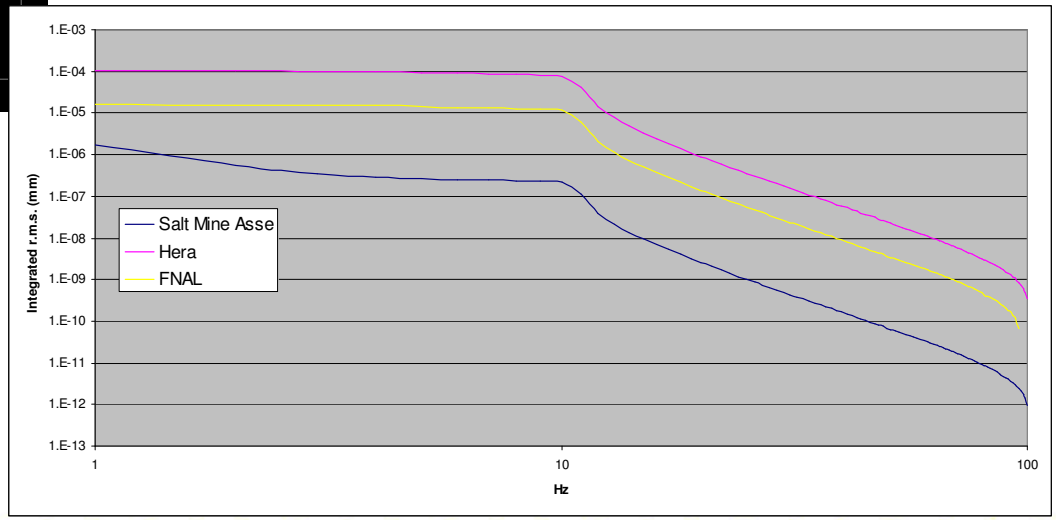
are defined.

SiD ANSYS

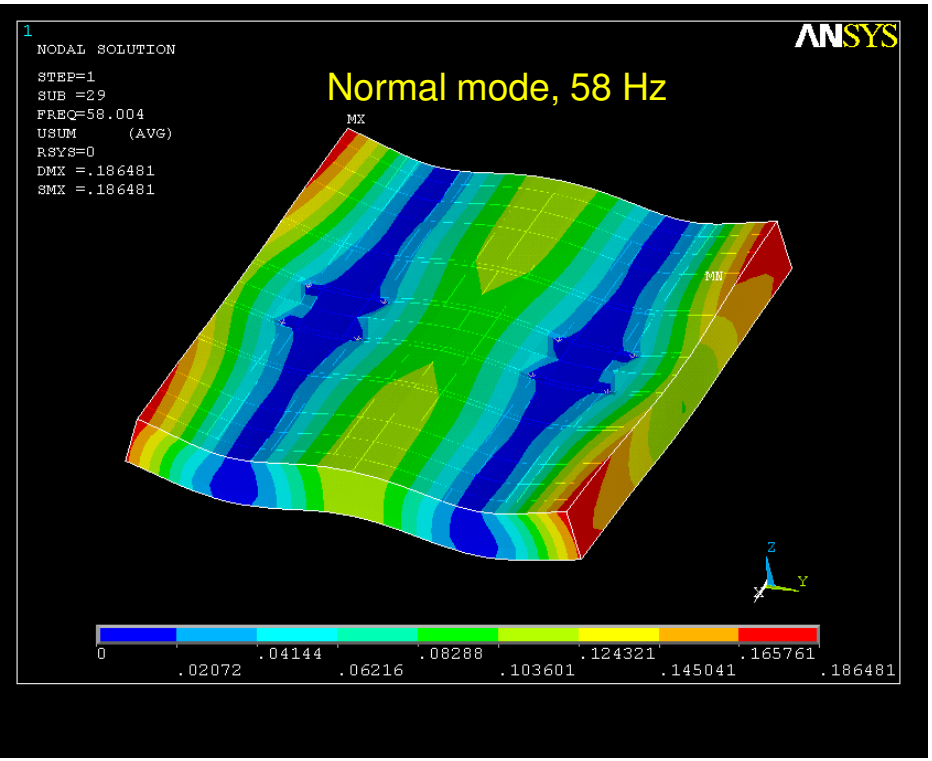


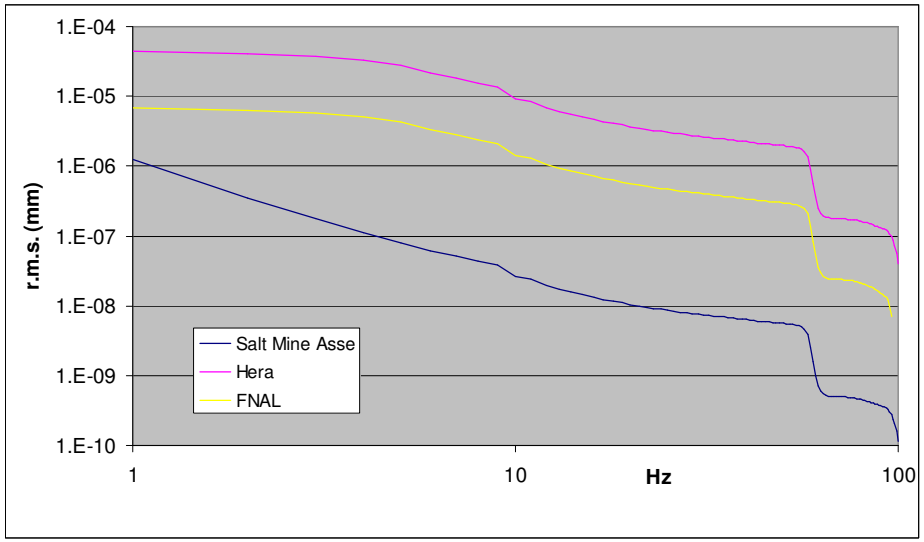


5th Mode, 10.42 Hz



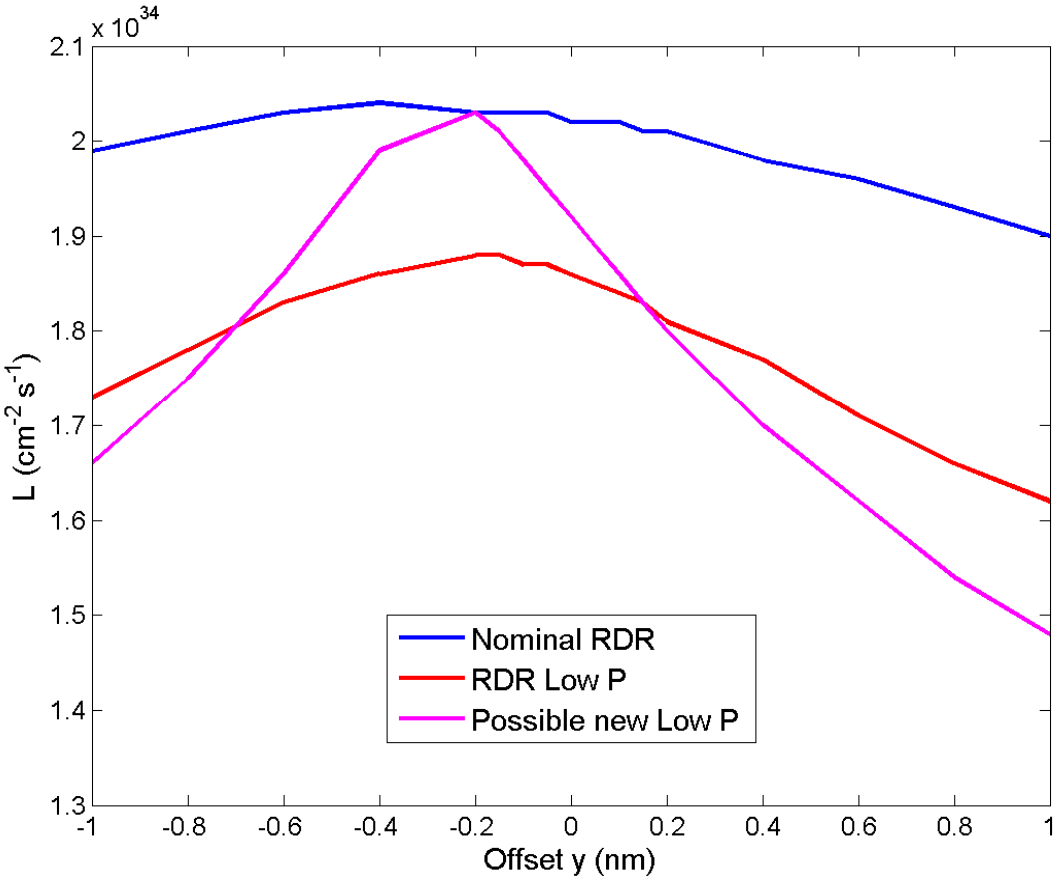
Preliminary
ANSYS analysis of Platform





Low P Parameter Set w/w.o. Traveling Focus

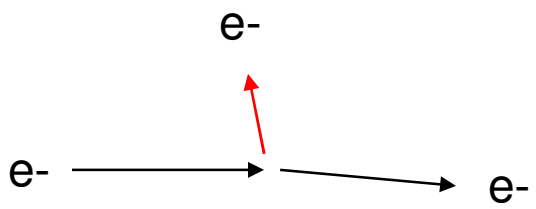
- Higher Disruption
  - **Higher sensitivity to Δy**
  - **Intratrain Feedback more challenging**
    - Vertical beam offset must be kept <200pm for <5% lumi loss
  - **Constraints on Bunch-Bunch uniformity coming into BDS**
  - **More IP pairs at larger angles**
- βx(LP)~50% βx(RDR)
- βy(LP-TF)~50% βy(RDR)
  - **Collimation depth 1.4x deeper (smaller holes)**
  - **Muons**
    - enhanced spoilers
  - **Collimator wake jitter**

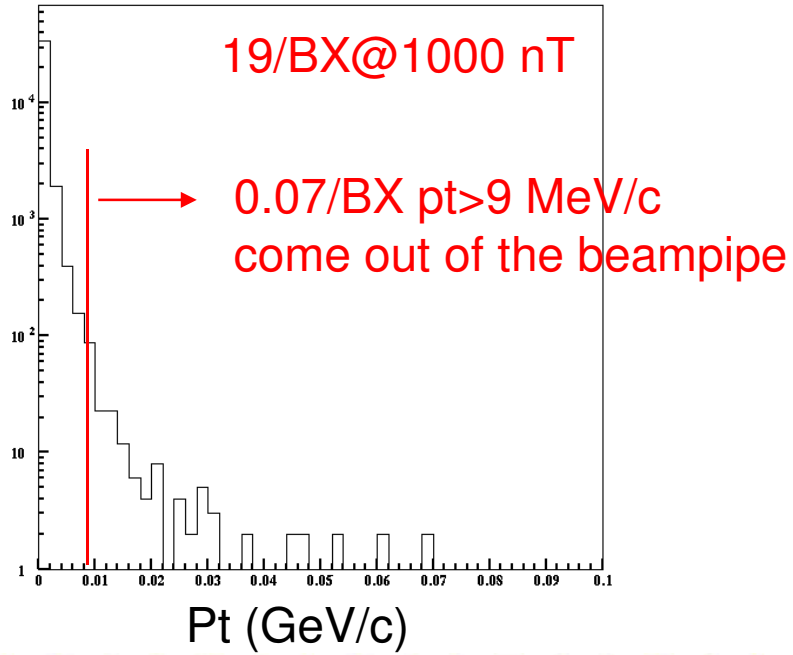


Beam gas scattering inside the detector is negligible compared to the luminosity background even at 1000 nT

250 GeV e- ⟶ 2.4-cm ϕ 7-m long gas (H_2/CO/CO_2)

- Among the three beam gas scattering processes considered in the BDS, only Moller scattering off atomic electrons is significant.



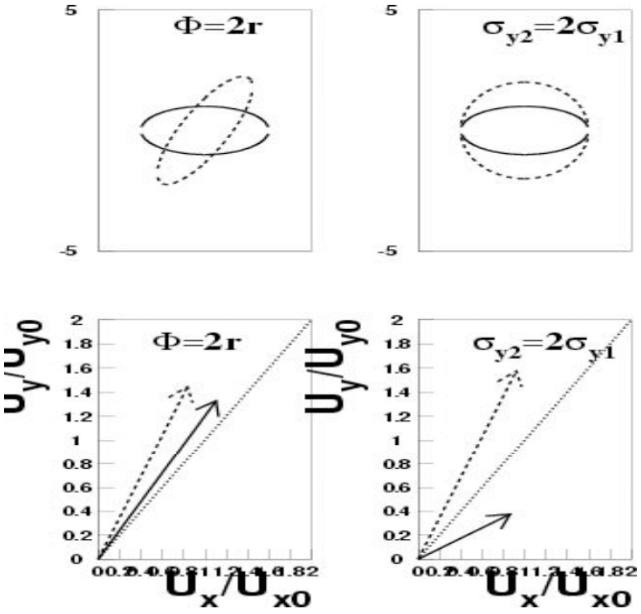


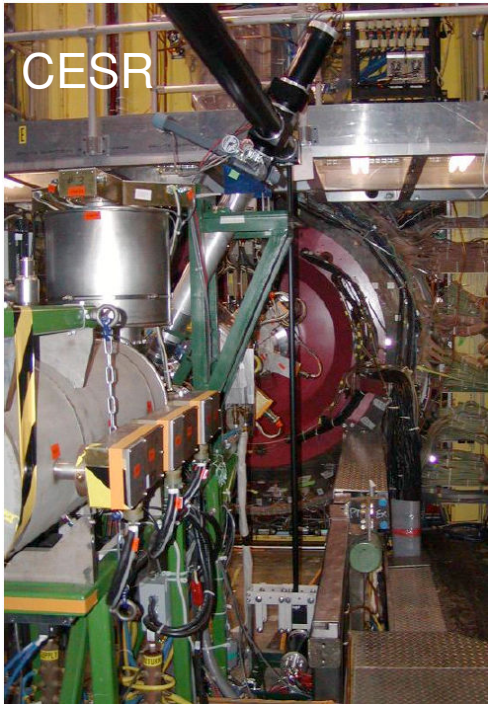
Luminosity backgrounds (pairs, $\gamma\gamma \rightarrow$hadrons) are much higher.

First Observation of Optical Wide Angle Beamstrahlung

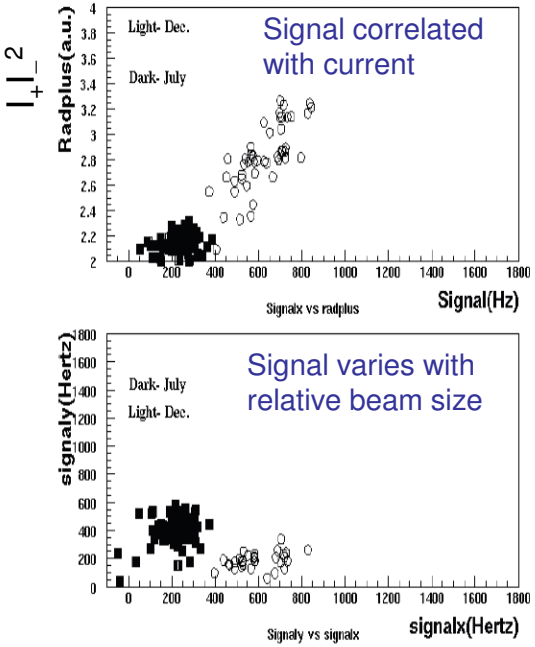
G. Bonvincini

- polarization directions, amplitudes sensitive to beam parameters:

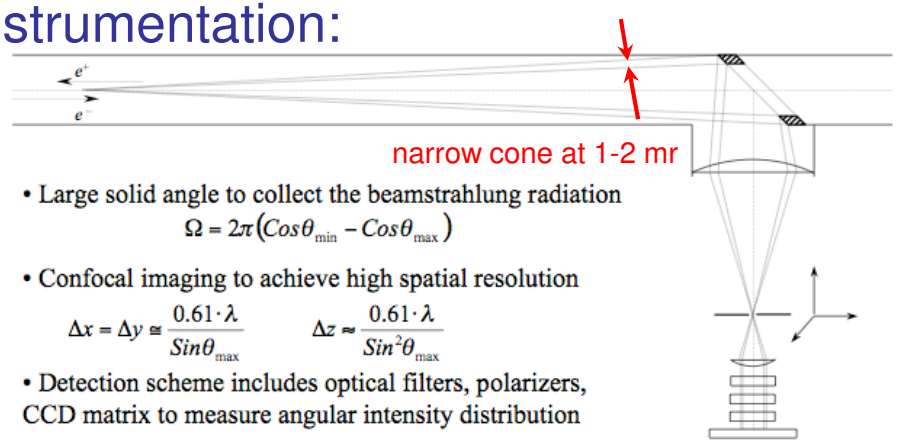




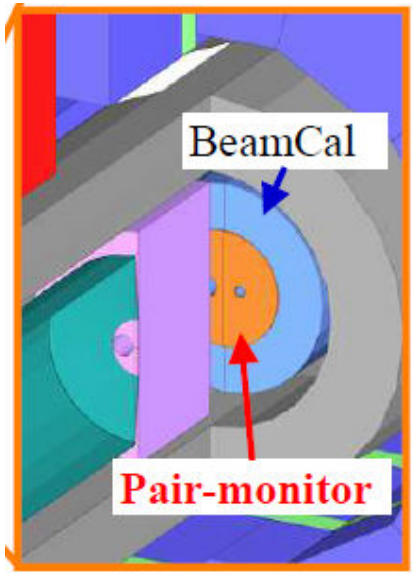
Data:

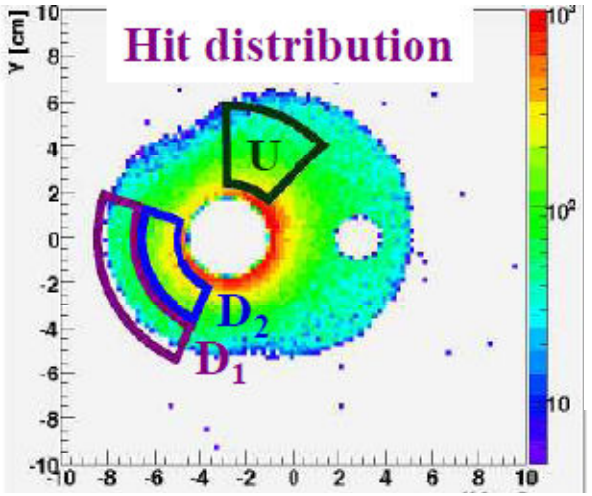


- Should be considered for ILC instrumentation:
  - Systems being designed for KEKB, Frascati



Pair Monitor Studies (and ASIC Development)





8 measurement variables were defined.

Pair-monitor	BeamCal
R_{max}	R_{ave}
N_{D1}/N_{all}	N_D/N_{all}
N_U/N_{D2}	N_U/N_D
$1/N_{all}$	$1/Edep_{all}$

Tohoku University

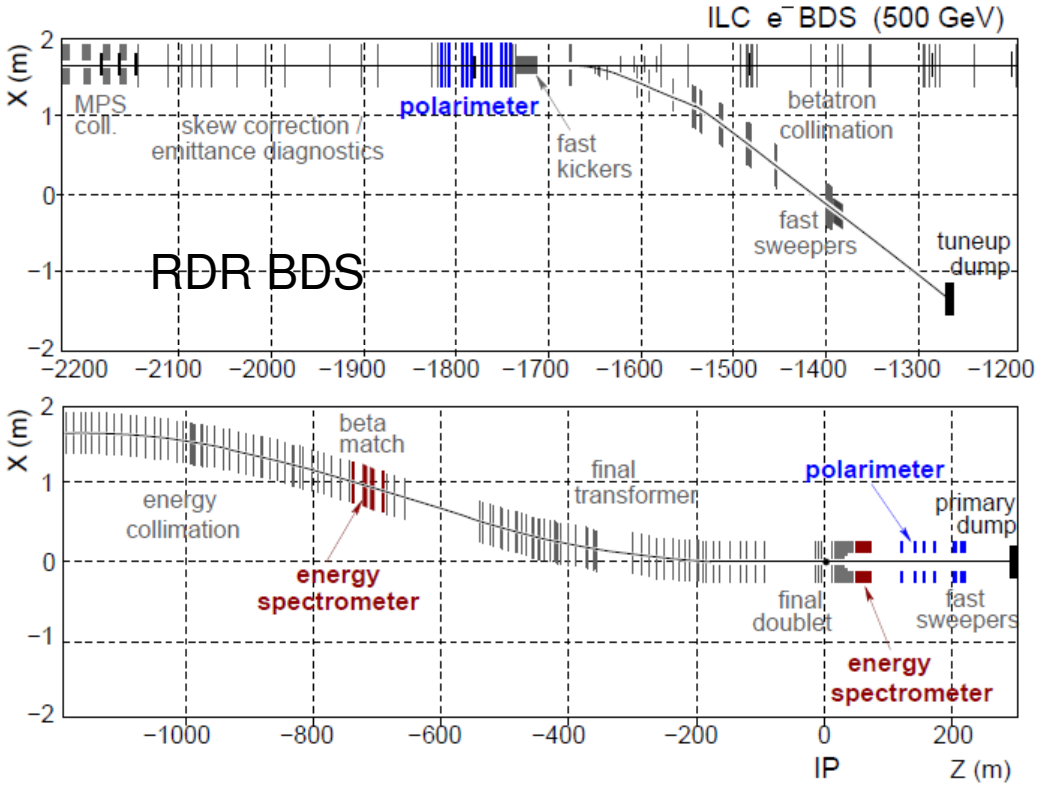
Measurement accuracy

	Pair-monitor	BeamCal	Pair-monitor + BeamCal
σ_x	3.2 %	4.1 %	2.8 %
σ_y	10.1%	15.6 %	8.6 %
Δ_y	8.6 %	9.4 %	7.4 %

Energy and Polarization: A Reminder

K. Moffeit

- Redundant measurements:
  - control systematics, measure effects of beam-beam interaction



Accuracy driven by Physics:

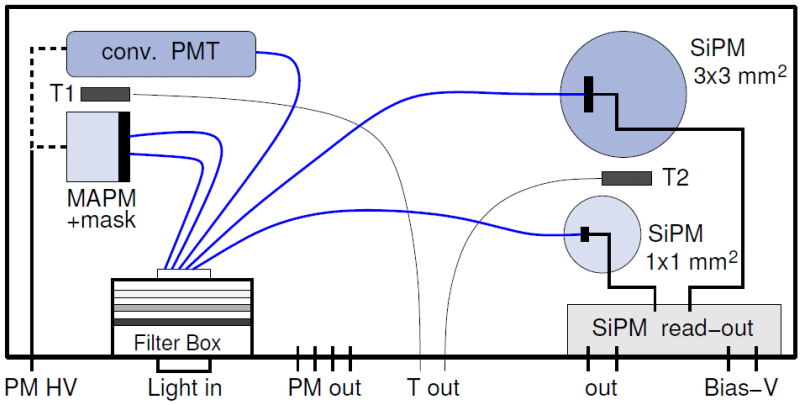
- $\Delta E_{beam}/E_{beam}$ ~ 100-200 ppm
  - precision measurements of particle masses
  - Spectrometer techniques
- $\Delta P/P$ ~ 0.25%
  - Precision EW
  - Evolution of SLC polarimeter
    $\Rightarrow$ lower systematics

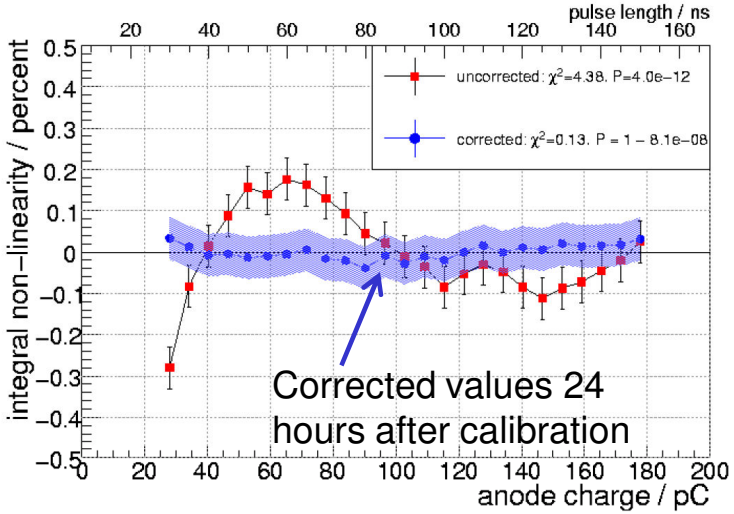
- R&D: system integration tests, reduction of systematic effects

Polarimetry: Prototypes & Systmatics

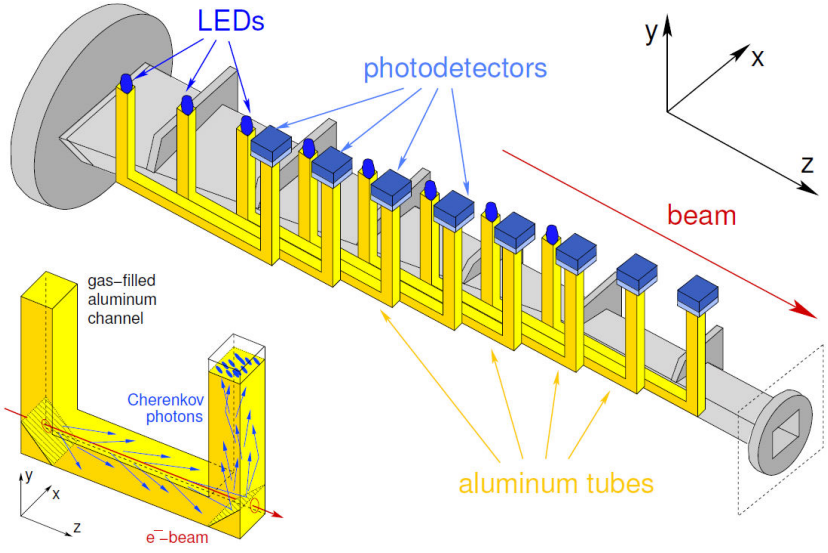
D. Kaefer

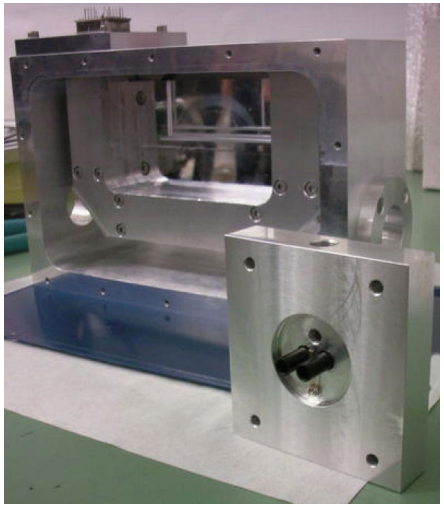
- Measurements/Correction of non-linearities to sub-percent level



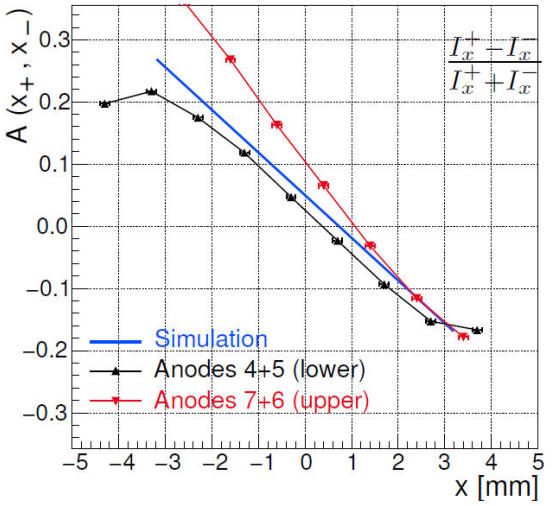


- Prototype Channel in Electron Beam test





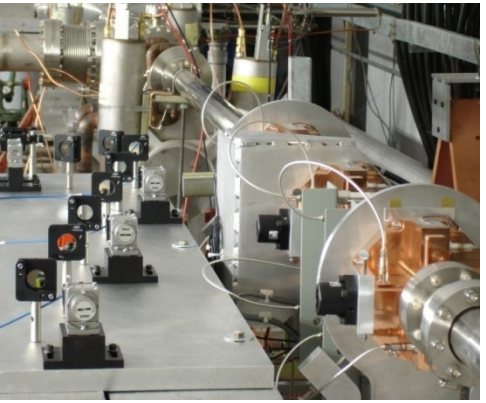
Measured Asymmetry compared with Simulation:

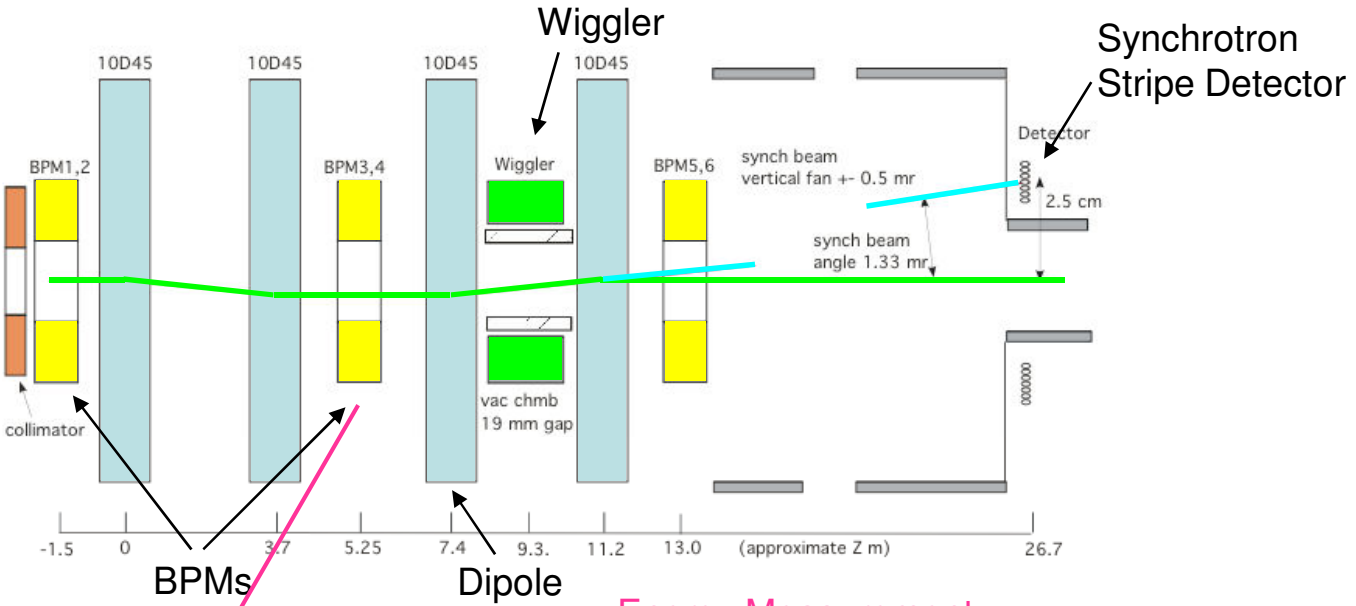


Magnetic Spectrometer Tests: SLAC ESA

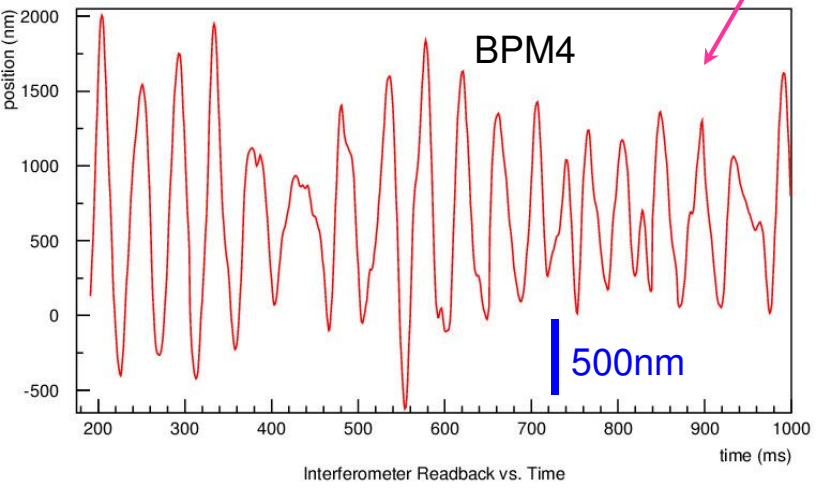
M. Hildreth

- Energy Spectrometers in 4-magnet chicane (2007)

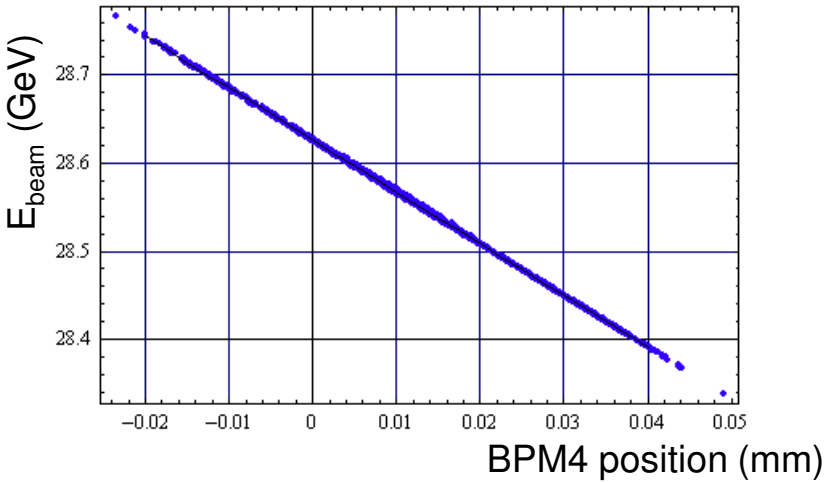




Large BPM Vibration:

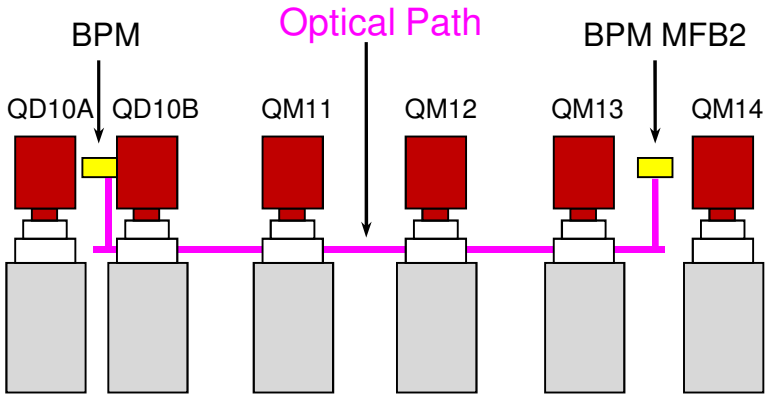


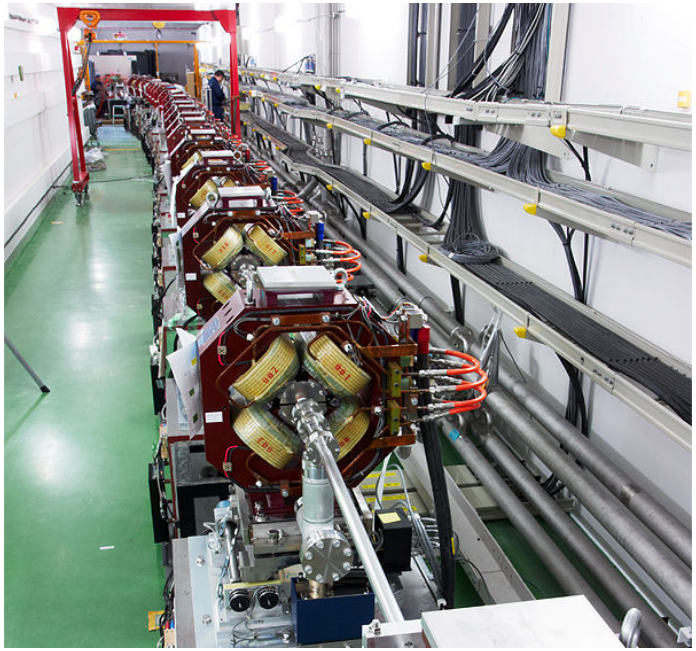
Energy Measurement:

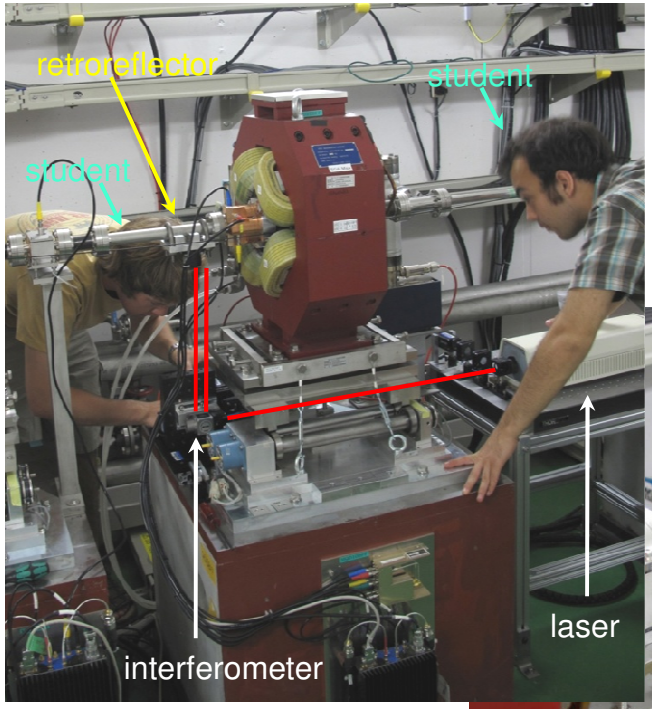


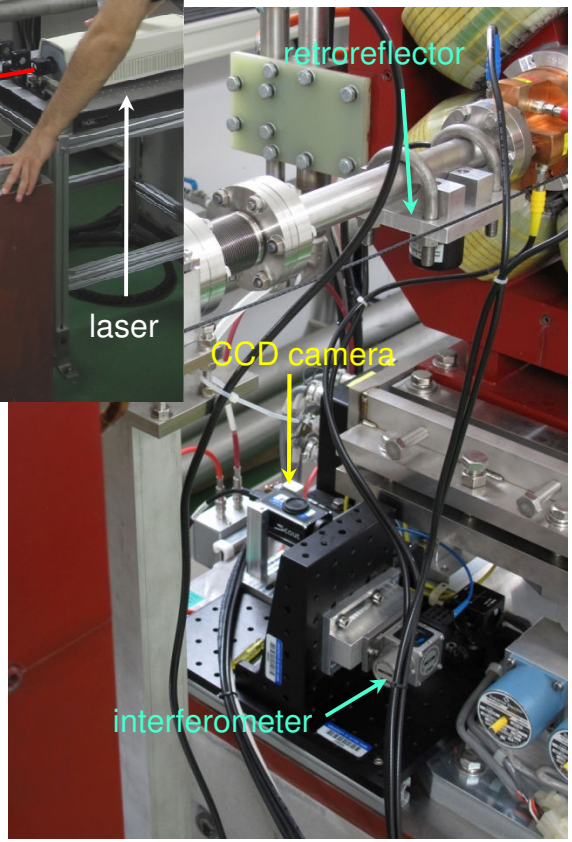
Straightness Monitor ATF2 Installation

- Measure/correct position of BPMs used in IP steering feedback:









Installed for 2009
ATF2 Running