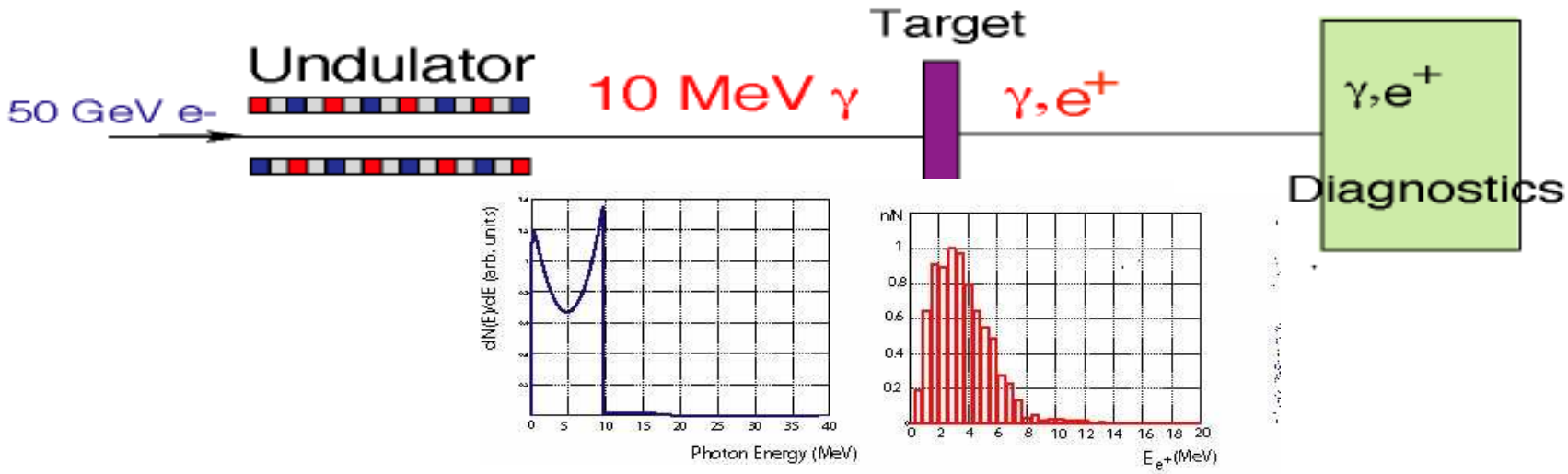
Status of the E166 Experiment

Roman Pöschl
DESY Hamburg
E166 Collaboration

Production of Polarized Positrons Using a Helical Undulator

LCWS05 Stanford/USA March 2005

Principle of the E166-Experiment



- E-166 uses the 50 GeV SLAC-Beam in conjunction with a 1m long helical Undulator for the production of Polarized Photons.

- These photons are converted by a ~0.5 X_0 thick Absorber into Polarized Positrons (und Electrons).

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- The Polarization of the Positrons (und Photons) is measured

The E166 Collaboration

G. Alexander[DE,TA], P. Anthony[SL], V. Bharadwaj[SL], Y. K. Batygin[SL], T. Behnke[DE], S. C. Berridge[UT], G. R. Bower[SL], W.M. Bugg[UT], R. Carr[SL], E. Chudakov[JL], J. Clarke[DA], J. E. Clendenin[SL], F.-J. Decker[SL], R. Dollan[DE], Y. Efremenko[UT], T. Fieguth[SL], K. Flöttmann[DE], M. Fukuda[TO], V. Gharibyan[DE], T. Handler[UT], C. Hast[SL], T. Hirose[WA], R. H. Iverson[SL], Y. Kamychkov[UT], H. Kolanoski[HU], K. Lathem[DE], T. Lohse[HU], C. Lu[PR], K. T. McDonald[PR], N. Meyners[DE], R. Michaels[JL], A. A. Mikhailichenko[CO], K. Mönig[DE], G. Moortgat-Pick[DU], M. H. Munro[SL], M. Olson[SL], T. Omori[KE], D. Onoprienko[BR], N. Pavel[HU], E. Reinherz[TA], R. Pitthan[SL], R. Poschl[DE], S. Riemann[DE], L. Rinolfi[CE], K.-P. Schüler[DE], D. Scott[DA], T. Schweizer[HU], J. C. Sheppard[SL] S. Spanier[UT], A. Stahl[AC], Z. M. Szalata[SL], J. Turner[SL], D. Walz[SL], A. W. Weidemann[SC], J. Weisend[SL]

[AC] RWTH Aachen, Aachen, Germany;
[BR] Brunel University, Uxbridge, Middlesex UB8 3PH, United Kingdom;
[CE] CERN, CH-1211 Geneva 23, Switzerland;
[CO] Cornell University, Ithaca, NY 14853;
[DA] Daresbury Laboratory,Daresbury, Warrington, Cheshire, United Kingdom;
[DE] DESY, D-22603 Hamburg, Germany;
[DU] University of Durham, Durham DH1 3HP, United Kingdom;
[JL] Thomas Jefferson National Accelerator Facility, Newport News, VA 23606;
[HU] Humboldt University, Berlin, Germany;
[KE] KEK, Tsukuba-shi, Ibaraki, Japan;
[PR] Joseph Henry Laboratory, Princeton University, Princeton, NJ 08544;
[SC] University of South Carolina, Columbia, SC 29208;
[SL] Stanford Linear Accelerator Center, Stanford, CA 94309;
[TA] University of Tel Aviv, Tel Aviv 69978, Israel;
[TO] Tokyo Metropolitan University, Hachioji-shi, Tokyo, Japan;
[UT] University of Tennessee, Knoxville, TN 37996;
[WA] Waseda University, 389-5 Shimoyamada-machi,Machida,Tokyo 194-0202.

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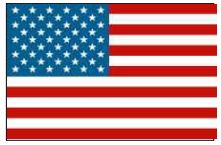


Participation from all three 'ILC Regions'

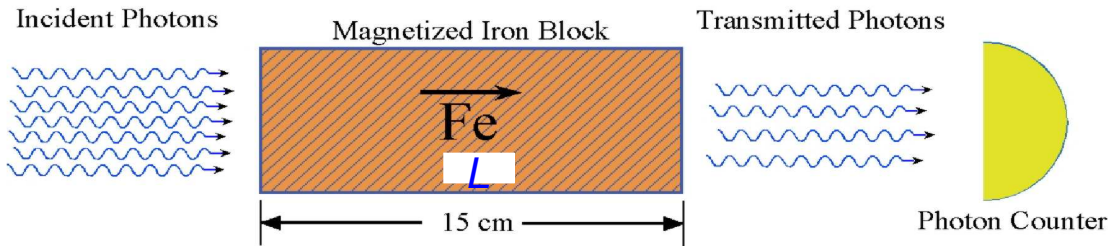
E166 – Hardware Responsibilities

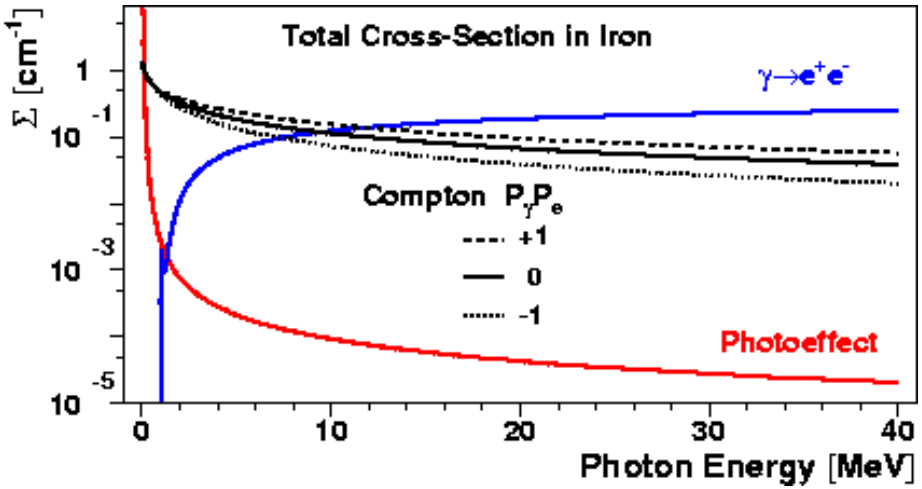
Electron-Beamline (Linac)	SLAC
Undulator	Cornell
Positron-Beamline(Spectrometer)	Princeton/SLAC
Photon-BeamLine	SLAC
Polarimetry:	
Overall:	DESY
Magnetized Fe-Absorber	DESY
Cerenkov-Detectors	Princeton
Si-W-Calorimeter	Tenn./ S. Carolina
CsI-Calorimeter	DESY/Humboldt
DAQ	SLAC/Humboldt Uni Berlin

Transmission Polarimetry

Analyzer Magnet

M. Goldhaber et al. Phys. Rev. 106 (1957) 826





$$\sigma = \sigma_{phot.} + \sigma_{comp.} + \sigma_{pair}$$

$$\sigma_{comp.} = \sigma_0 + P_e P_\gamma \sigma_p$$

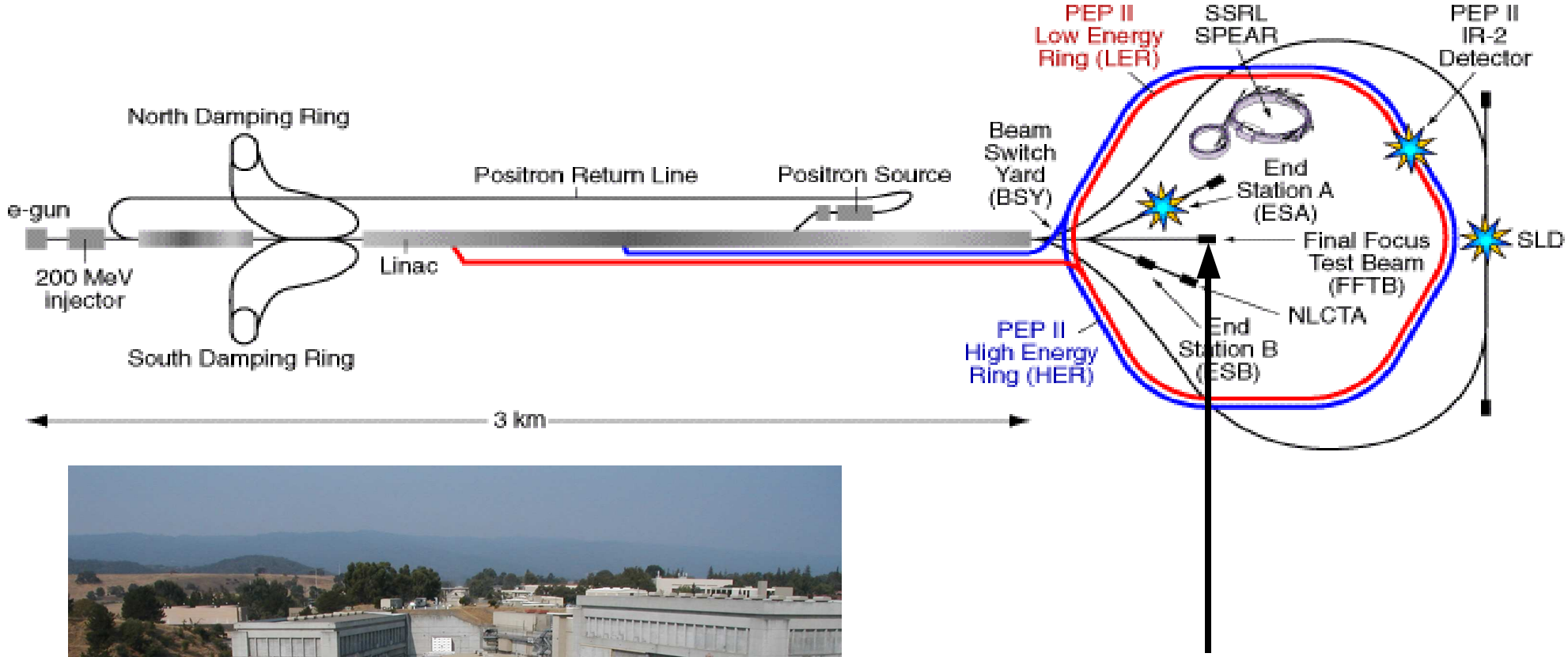
$$T^{\pm}(L) = e^{-nL\sigma} = e^{-nL(\sigma_0+\sigma_{phot}+\sigma_{pair})}\, e^{\pm nLP_eP_\gamma\sigma_P}$$

$$\delta(L) = \frac{T^+(L) - T^-(L)}{T^+(L) + T^-(L)} = \tanh(nLP_eP_\gamma\sigma_P) \approx nLP_eP_\gamma\sigma_P$$

Unpolarized Contributions cancel in Transmission-Asymmetry δ

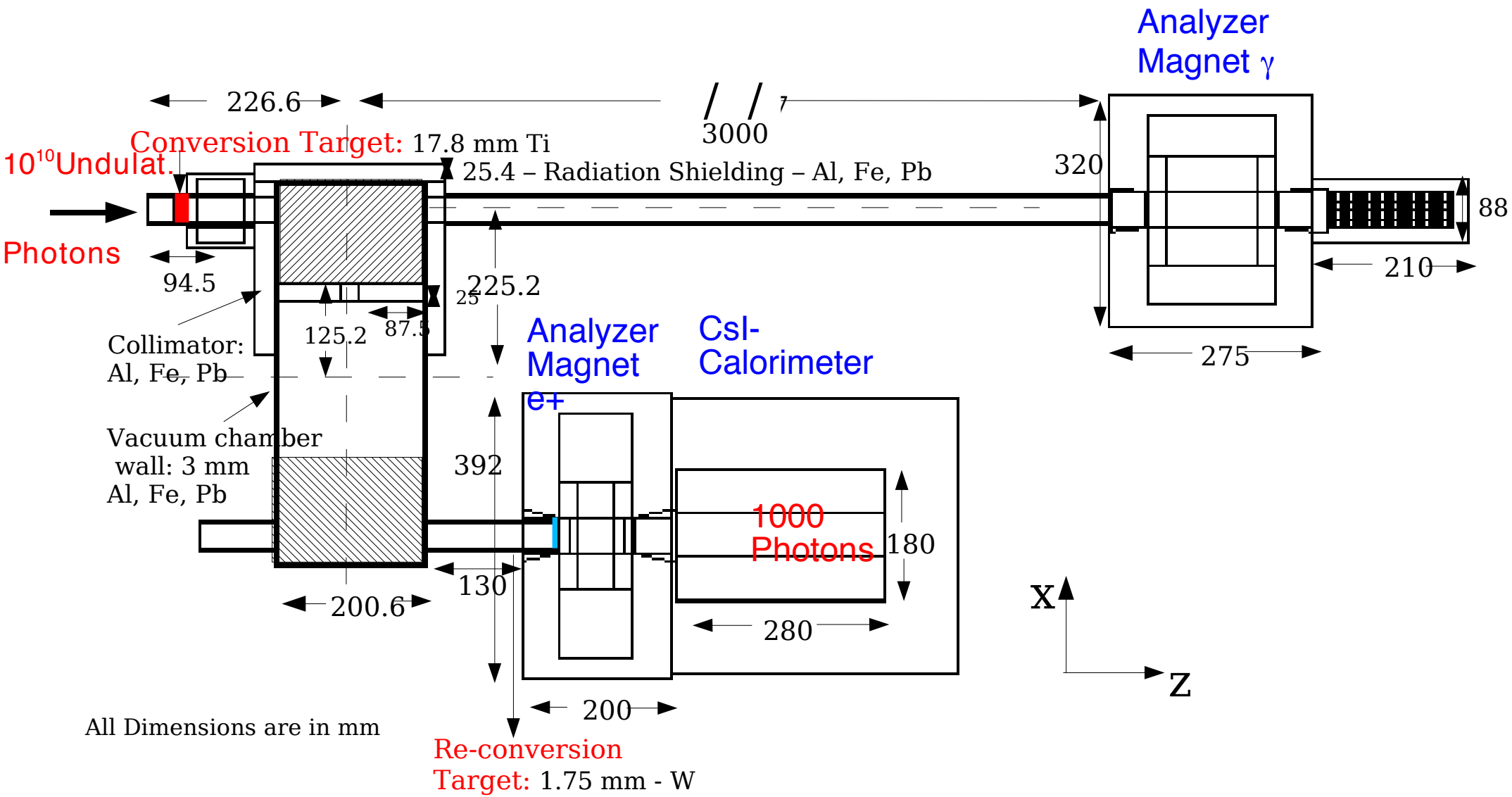
Measure: $P_{e^+} = \frac{\delta}{P_{e^-} A_{e^+}}$ A_{e+} = Analysing-Power

E166 @ SLAC

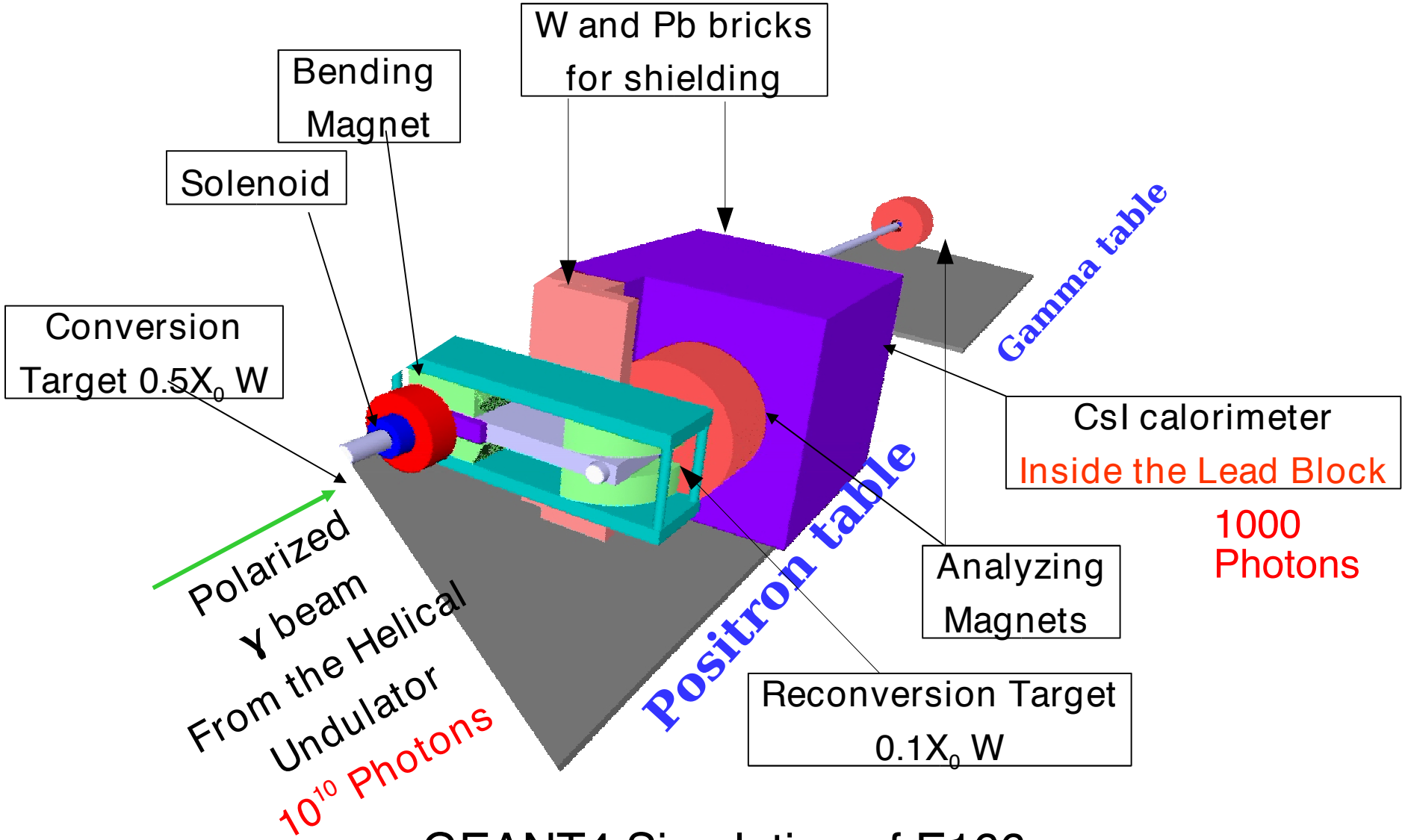


We are here !
(FFTB @ SLAC)

Schematic Overview

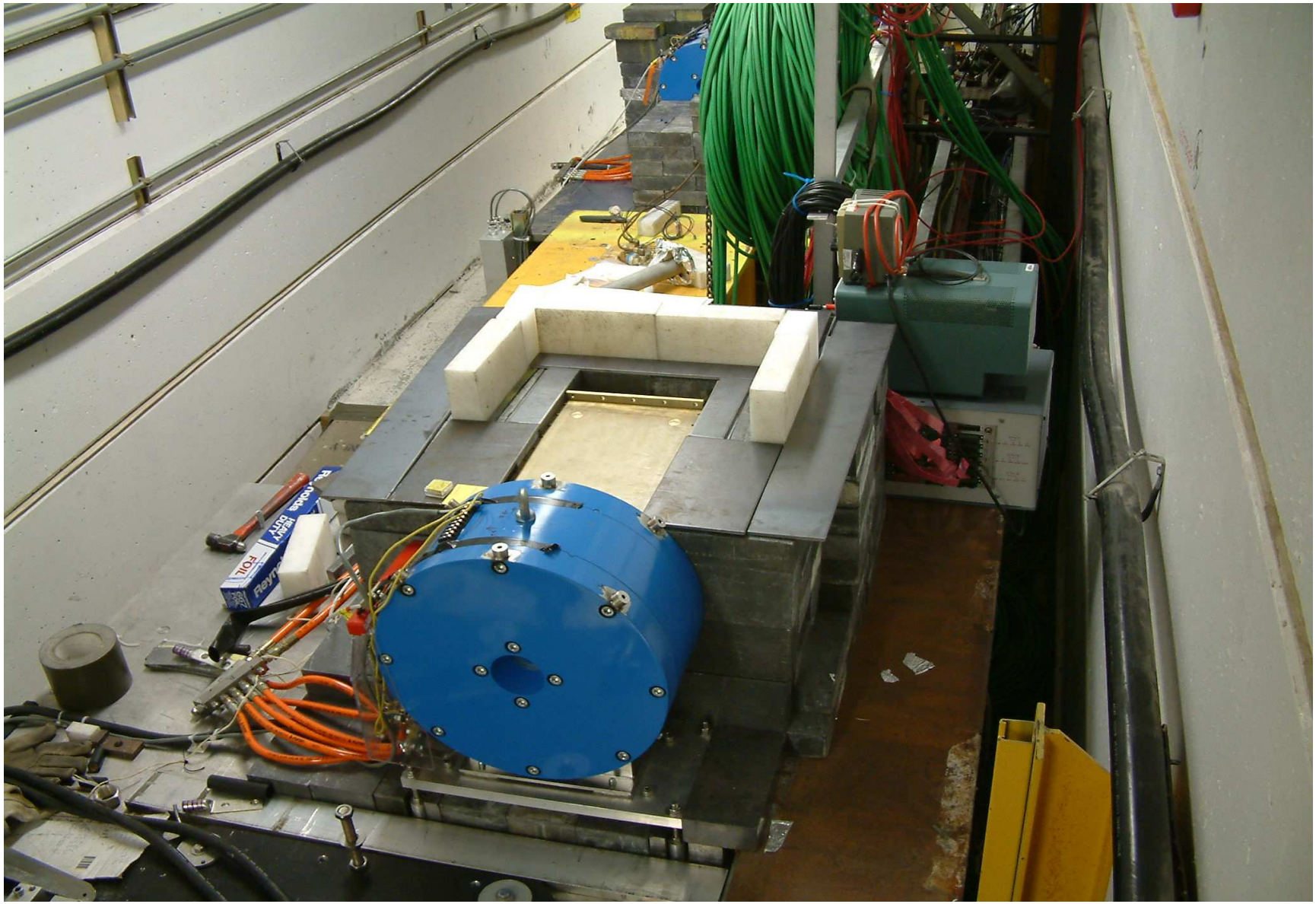


E166 on Paper

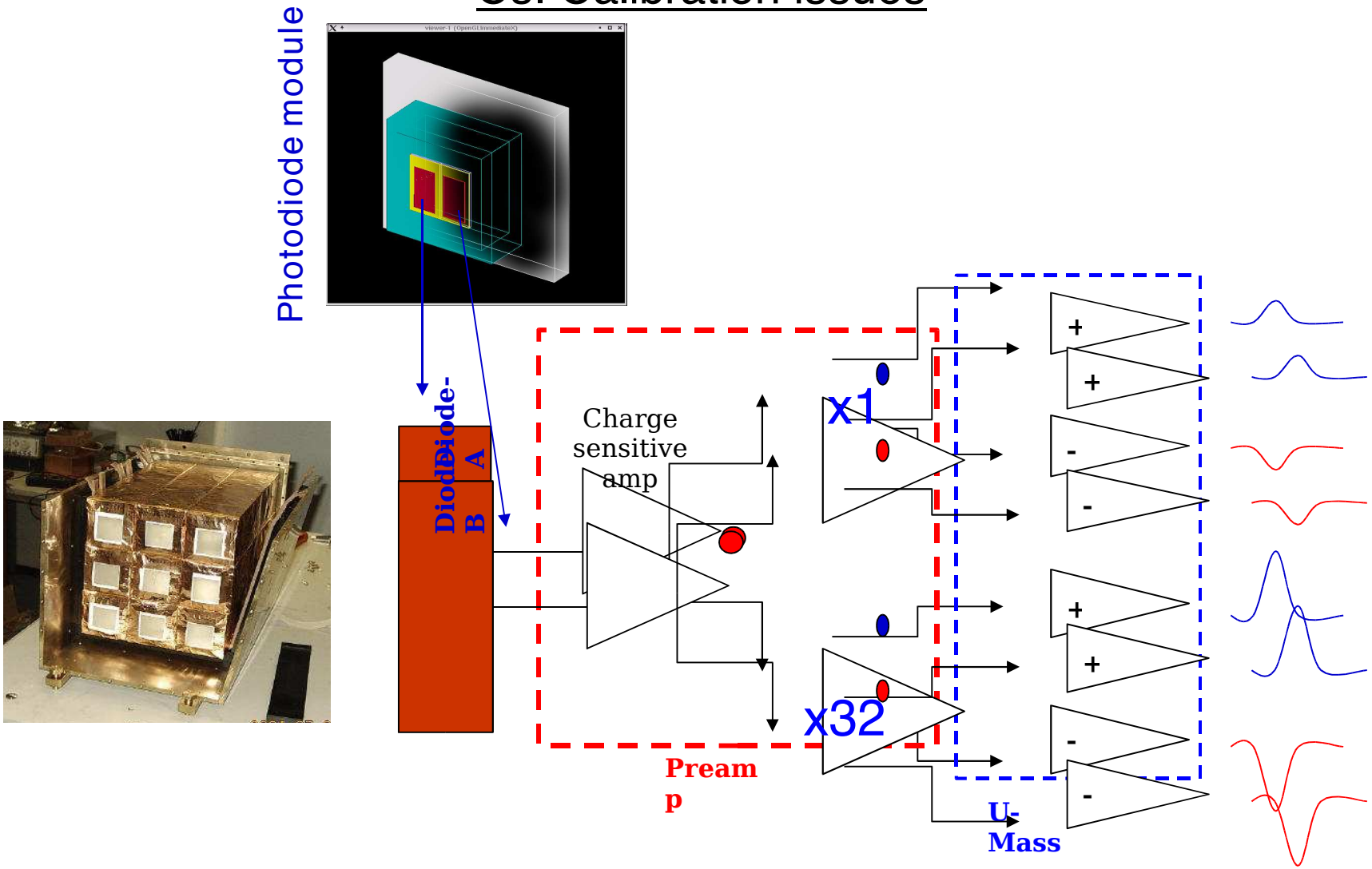


GEANT4 Simulation of E166

... and in Reality



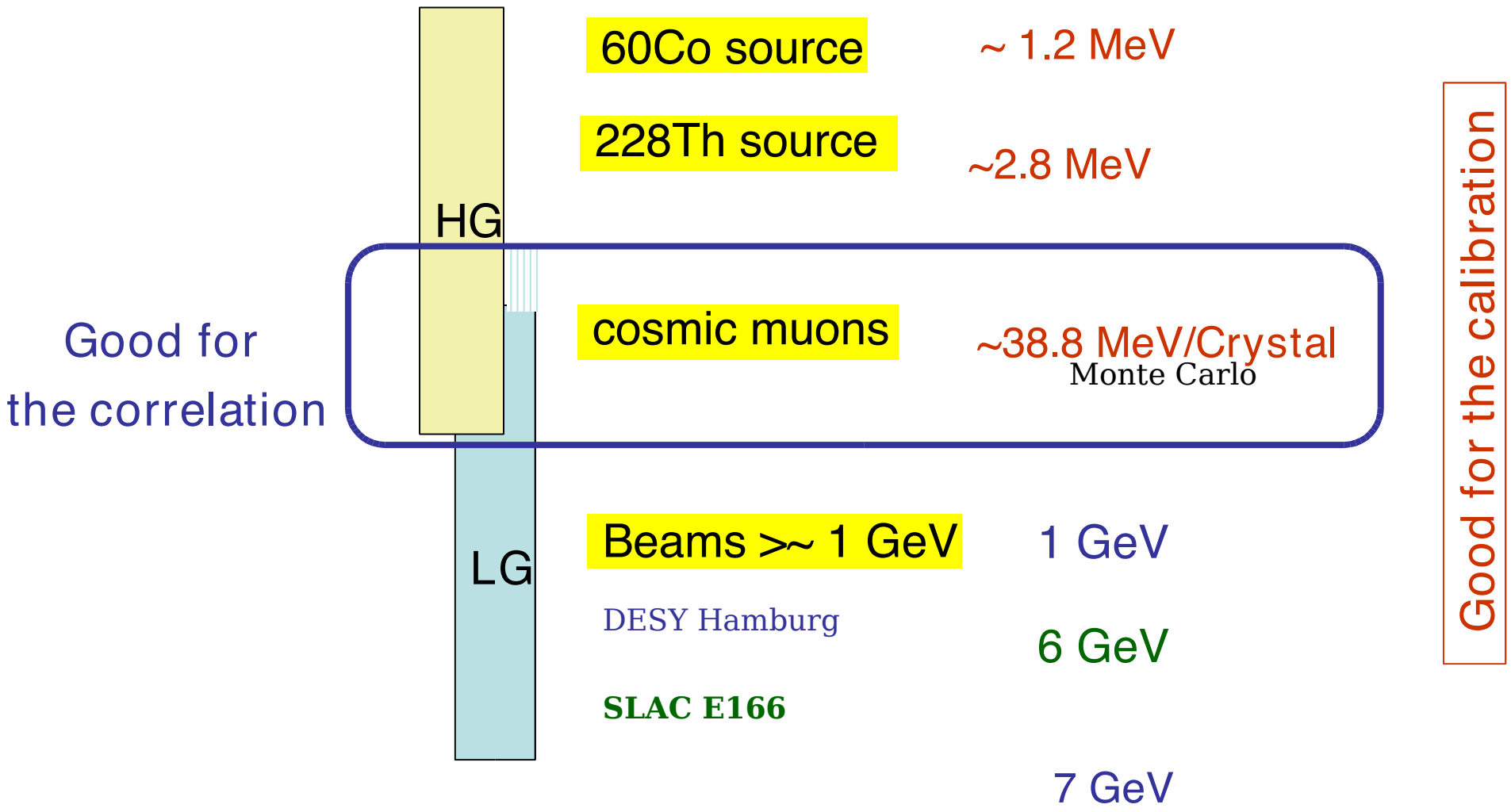
CsI Calibration issues



CsI(Tl) Calorimeter

Readout electronic scheme

Calibration procedure

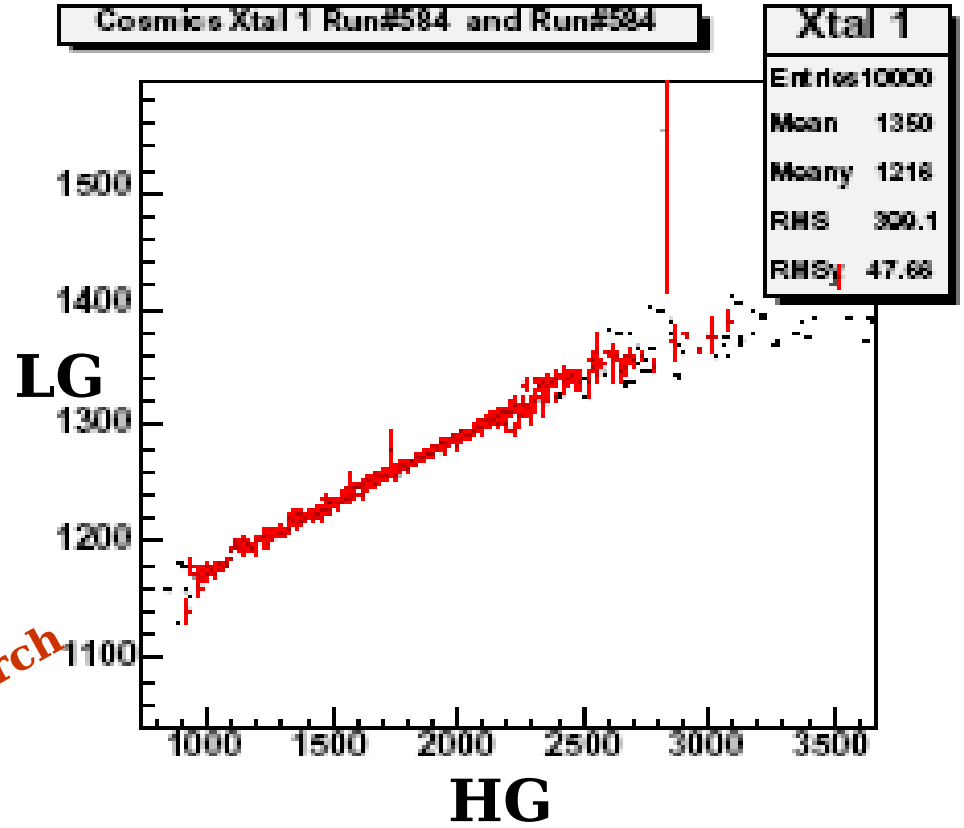


Use Source for abolute calibration
Cosmics to transport Calibration between two Gains

Correlation between High Gain and Low Gain

Scintillator paddles C15 & C16

Result of Cosmic Run



February-March 2005

Good Correlation between both Gains
(Not so easy to get there)

Goals of running period in October

- Establish stable beam condition

- Demonstrate feasibility of fundamental premise of the experiment
  i.e. Production of polarized photons by Undulator

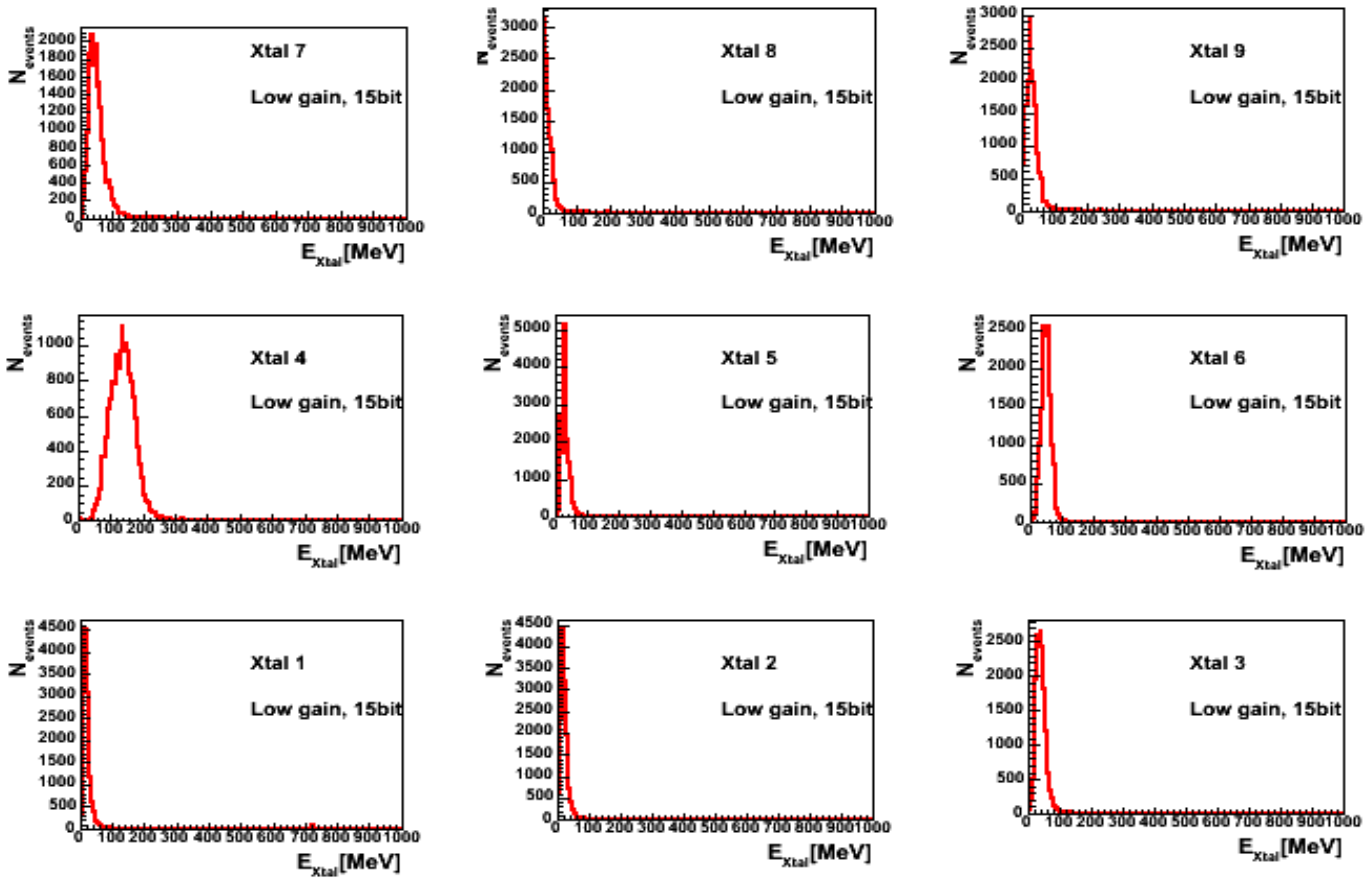
- Checkout of all Detector Components

- Study Background conditions and develop remedies

- See first (polarized) positrons in CsI Calorimeter

First Beam Spectra – Run 518 10/10/04

Goal: Bring beam to beam dump and first noise check



Small background < 100 MeV
Compare with 1000 x 5 MeV Photons= 5 GeV Energy depos.
Promising Result

Summary and Outlook

- E166 Experiment setup in FFTB tunnel at SLAC
- Operation interrupted by SLAC accident and subsequent measures
- Time since then used to understand performance of CsI Calorimeter and to improve other devices
- Detailed implementation of E166 within GEANT4
  - include polarization into simulation

- First 'real' running period foreseen for May 2005
- Final check out of experiment components
- First task is to confirm positive impression of background conditions
- Second Run Period envisaged later this year (summer ?)