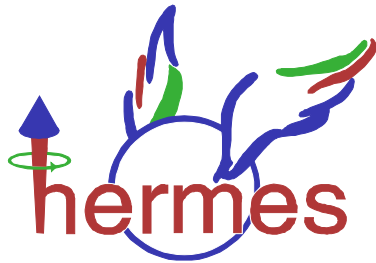
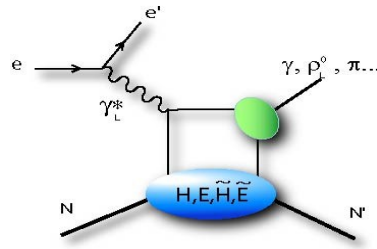
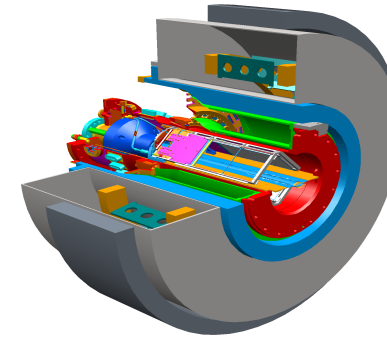


First analysis of **hard exclusive** data using



hermes Recoil Scintillating Fiber Tracker



T. Keri, M. Düren, R. F. Perez-Benito, W. Yu

- a) Motivation
- b) Detector
- c) Performance

Motivation

$$\frac{1}{2} = \frac{1}{2} \Delta\Sigma + Lq + \Delta G + Lg$$

$\Delta\Sigma$:= spin of quarks
 $\approx 1/3$ via DIS and SIDIS

ΔG := spin of gluon
 $\approx O(0.1)$ from COMPASS and HERMES

Lq := orbital angular momentum of quarks
yet unknown

Lg := orbital angular momentum of gluon
yet unknown

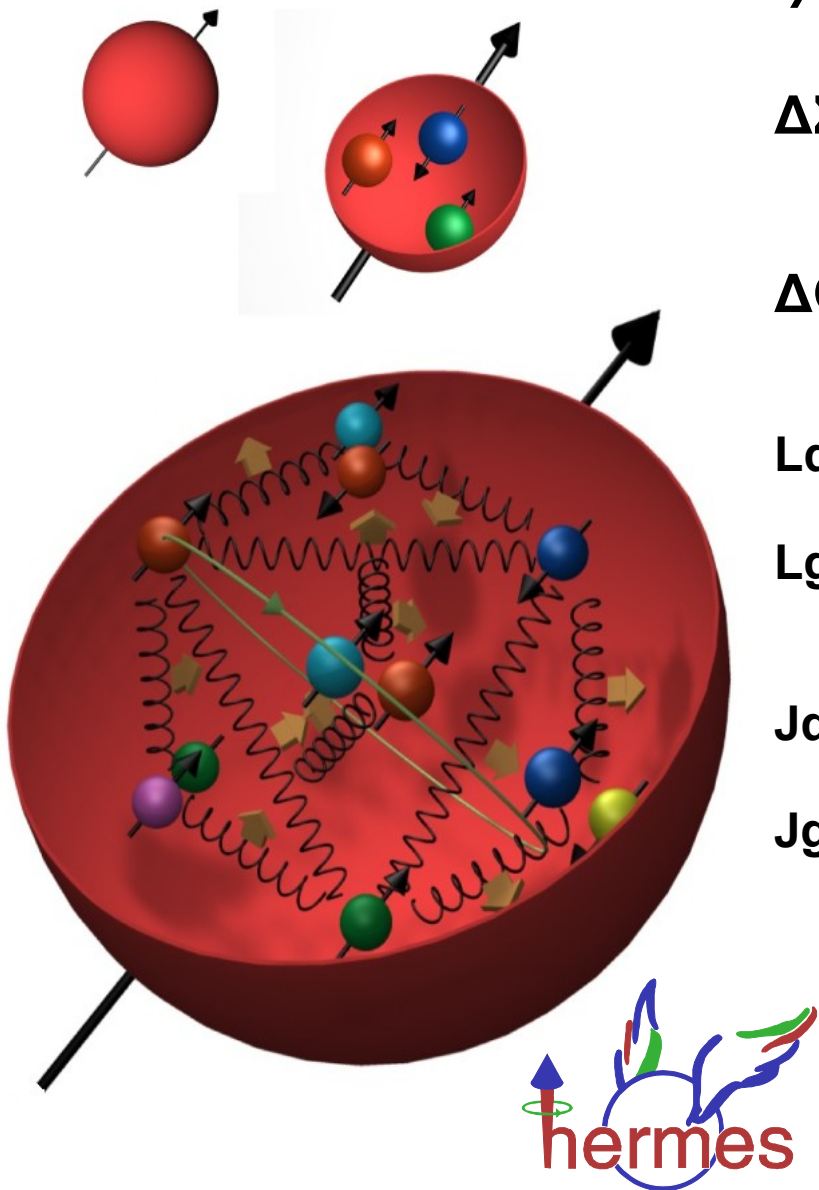
Jq := total angular momentum of quark
 $= \frac{1}{2} \Delta\Sigma + Lq$

Jg := total angular momentum of gluon
 $= \Delta G + Lg$

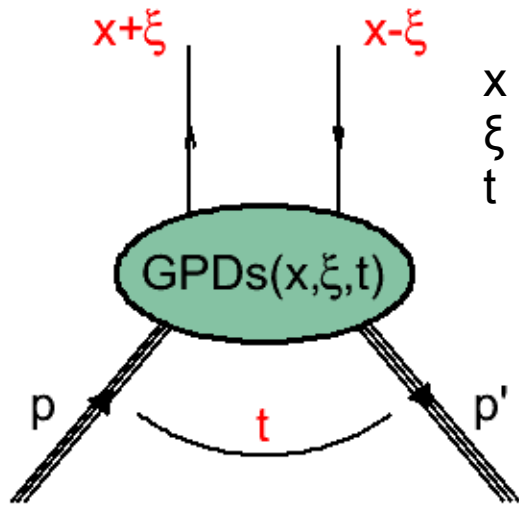
motivation for the

HERA MEasurements of **S**pin

experiment



Generalized Parton Distributions



x momentum transfer fraction
 ξ skewness
 t target momentum transfer

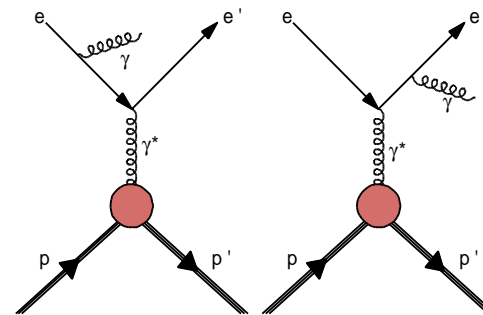
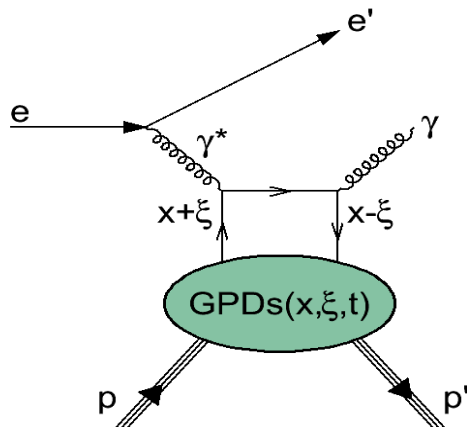
unpolarized	polarized	nucleon helicity
$H(x, \xi, t)$	$\tilde{H}(x, \xi, t)$	conserved
$E(x, \xi, t)$	$\tilde{E}(x, \xi, t)$	flipped

$$J_{q,g} = \lim_{t \rightarrow 0} \int_{-1}^{+1} dx \quad x (H_{q,g}(x, \xi, t) + E_{q,g}(x, \xi, t))$$

Ji's sum rule Ji, PRL 78(1997)610

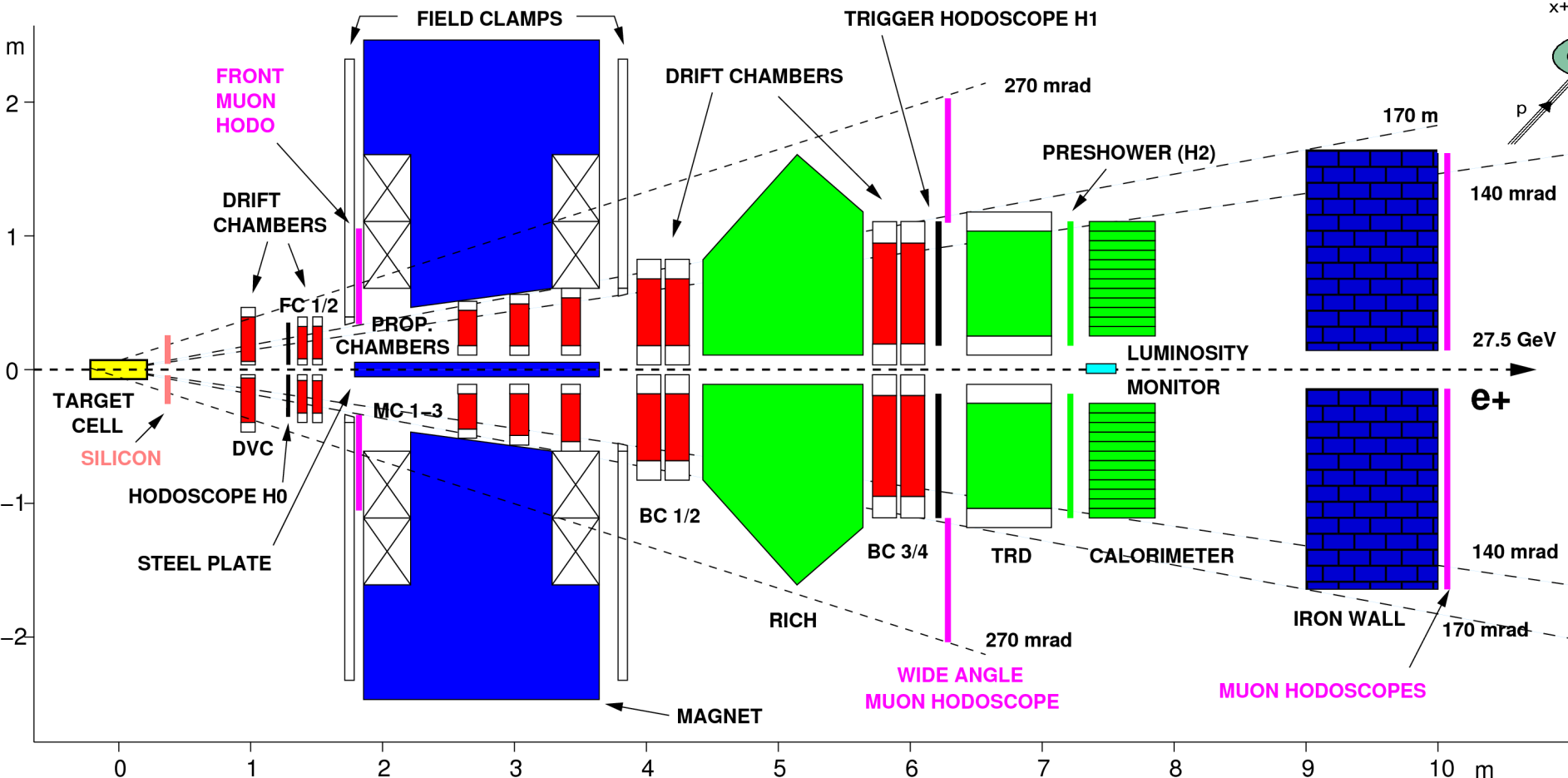
Deeply Virtual Compton Scattering simplest access to GPD

Bethe Heitler process same final state



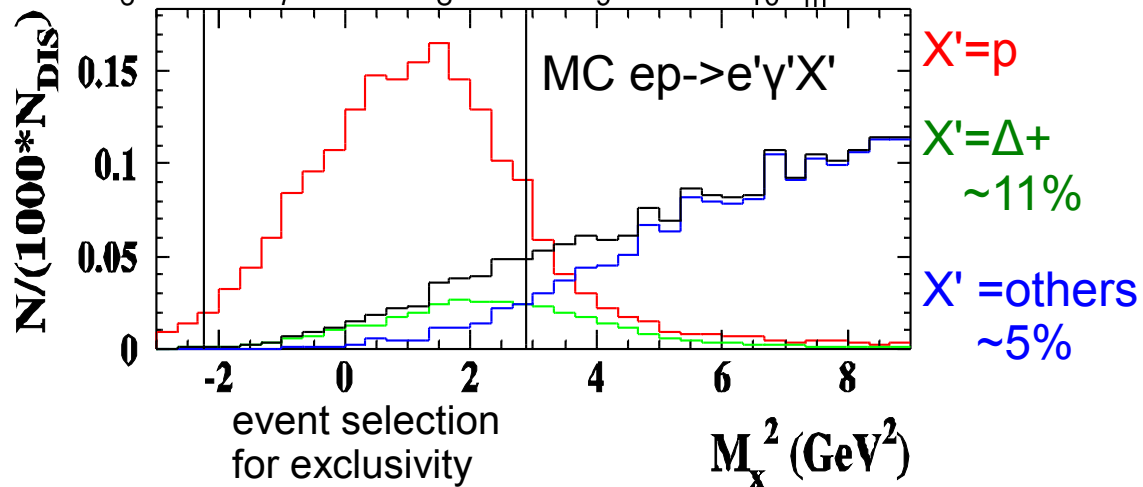
$$d\sigma \propto |\tau_{DVCS} + \tau_{BH}|^2 = |\tau_{DVCS}|^2 + |\tau_{BH}|^2 + (\tau_{DVCS}^* \tau_{BH} + \tau_{BH}^* \tau_{DVCS})$$

HERMES forward spectrometer

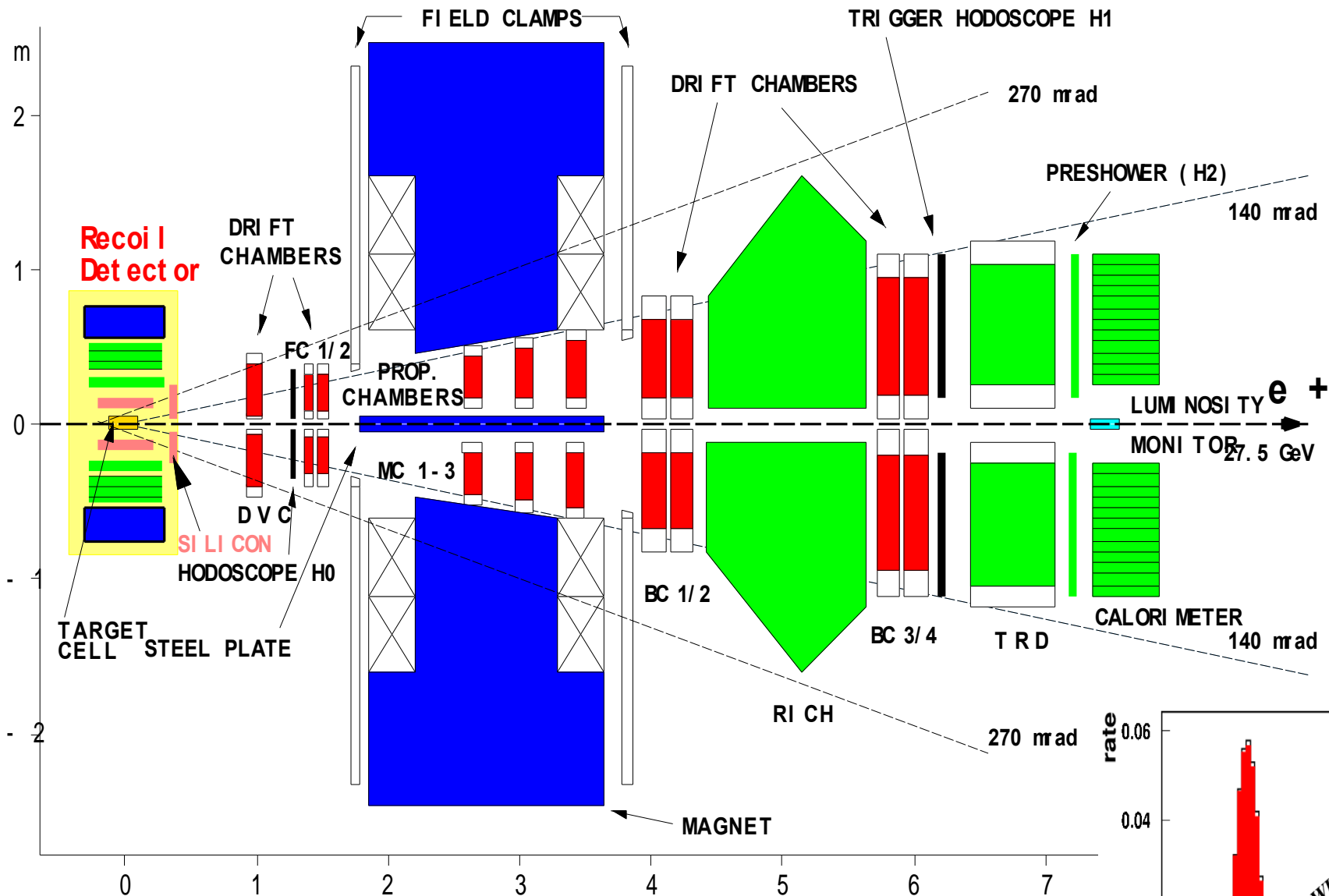
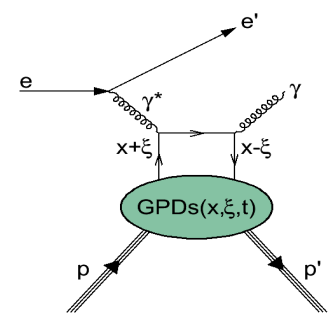


- **27,6 GeV** e-/e+ beam
- (un)polarized **gas target**
- high efficient **PID** via RICH/TRD/EM-Calorimeter
- exclusivity via missing mass kinematic

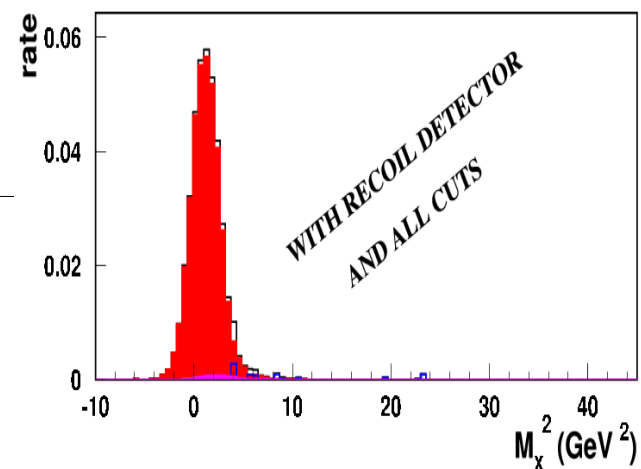
$$M_x^2 = (p_e + p_p - p_{e'} - p_{g'})^2$$



HERMES Recoil Detector

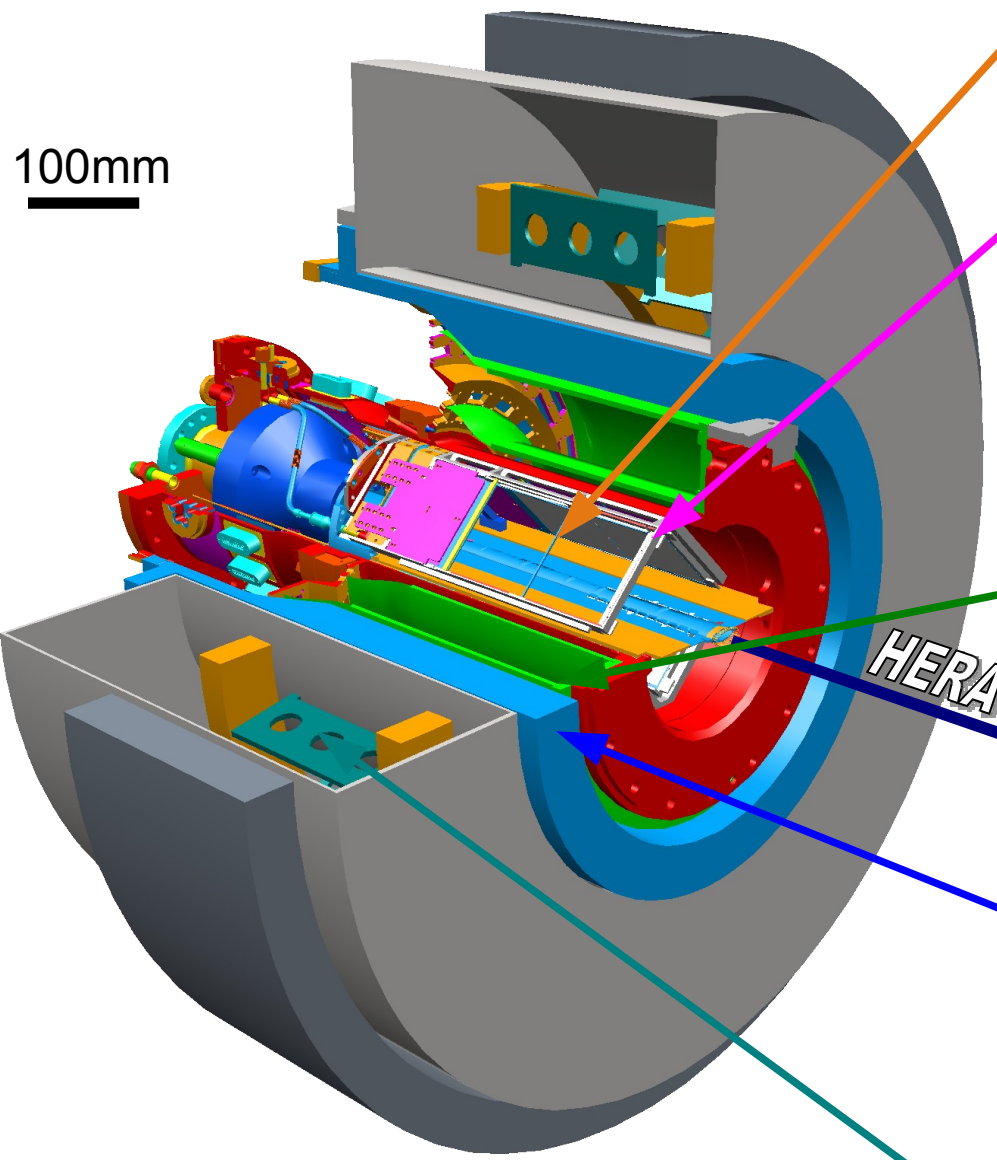


Recoil Detector :
 detection of recoiling proton
 background **suppression** below 1% to improve exclusivity
 improve **t-resolution** for kinematic studies



Realization of Recoil Detector

100mm



a) Target cell

- unpolarized H_2 and D_2 gas

b) Silicon Strip Detector (SSD)

- 2 layers with total 16 double sided Tigre-sensors
- PID/momentum reconstruction
- inside beam vacuum

c) Scintillating Fiber Tracker (SFT)

- 2 barrels, each with 2 parallel / 2 stereo(10°) layers
- PID/momentum reconstruction
- built by Giessen group

d) Photon Detector (PD)

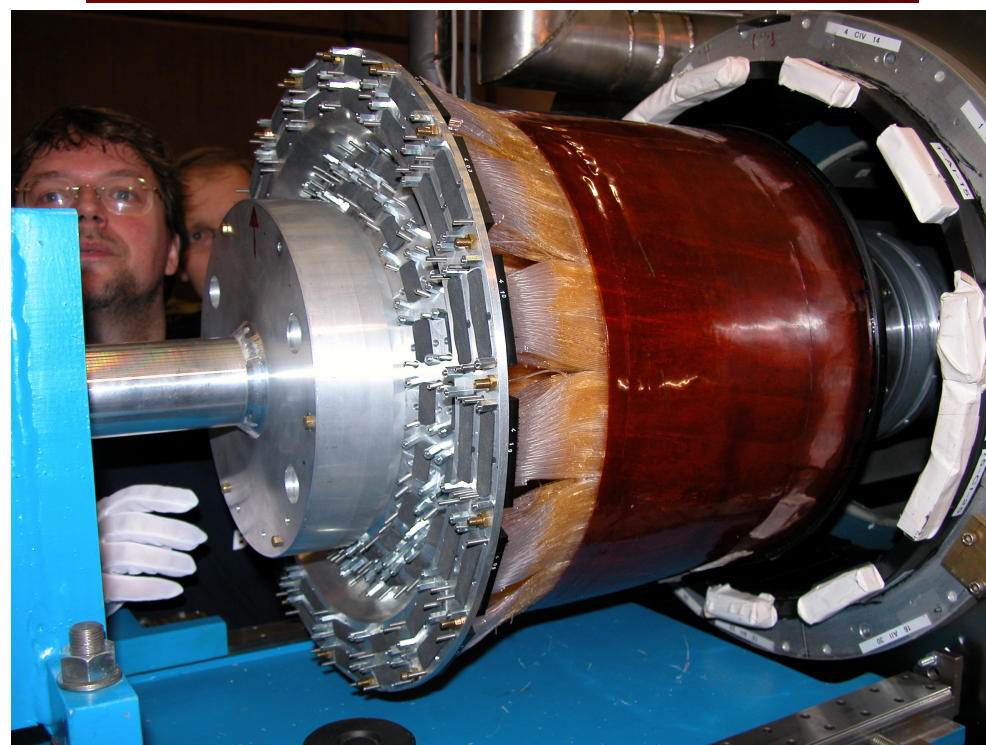
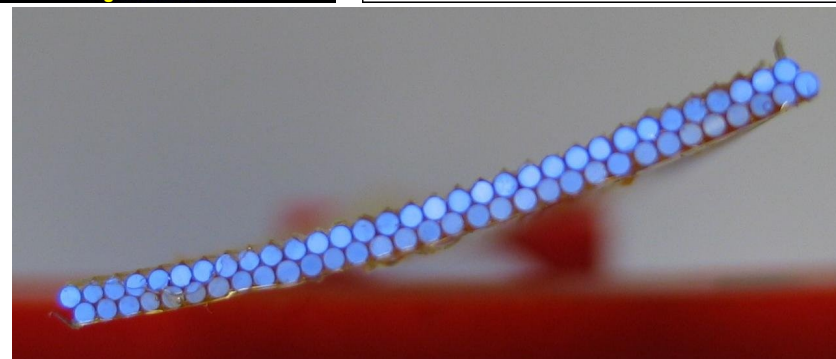
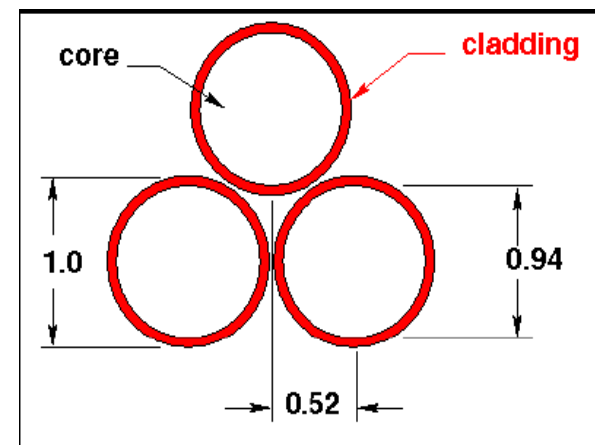
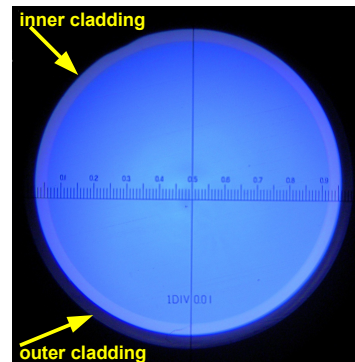
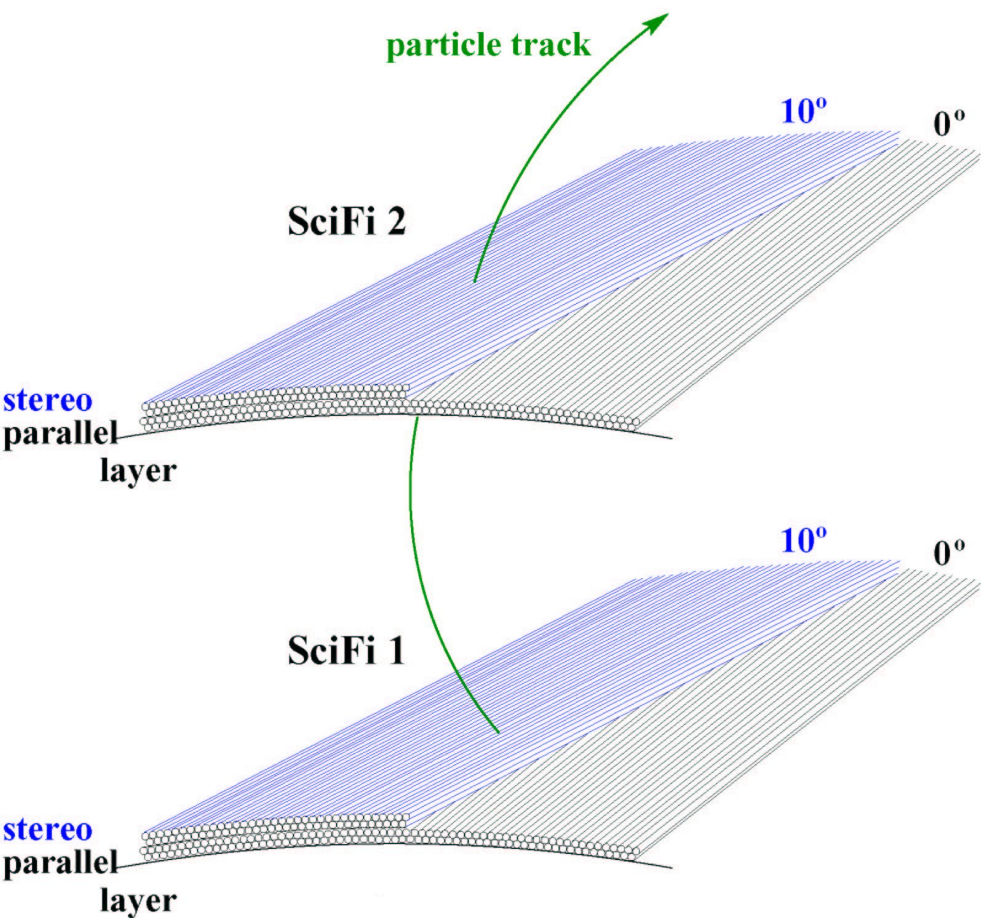
- 3 layers of tungsten and scintillators ($0^\circ/+45^\circ/-45^\circ$)
- PID/EM-calorimeter
- cosmic trigger for alignment, calibration...

e) 1T superconducting solenoid

- for momentum reconstruction

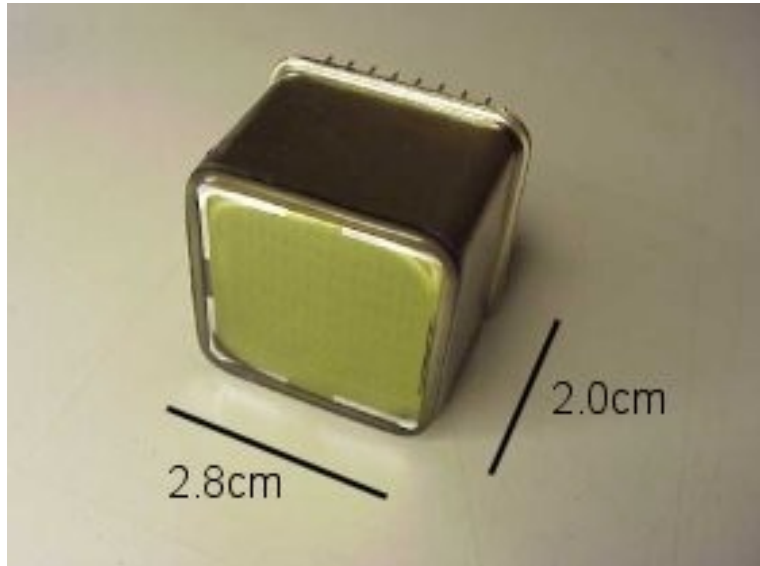
Summary : Sergey Yaschenko, 10.03 16:30 HK11.1 2C
SSD : Andreas Mussgiller, 11.03 12:30 HK 25.6 2C

Scintillating fiber tracker



- Kuraray fibers for detector
- Poly-High-Tech fiber for light guides between detector and PMT;
- azimuthal 2π coverage / 8mrad resolution
- ~ 7000 fibers, dbl. cladding, mirrored at end
- p-momentum range $250\text{-}1400\text{MeV}/c$

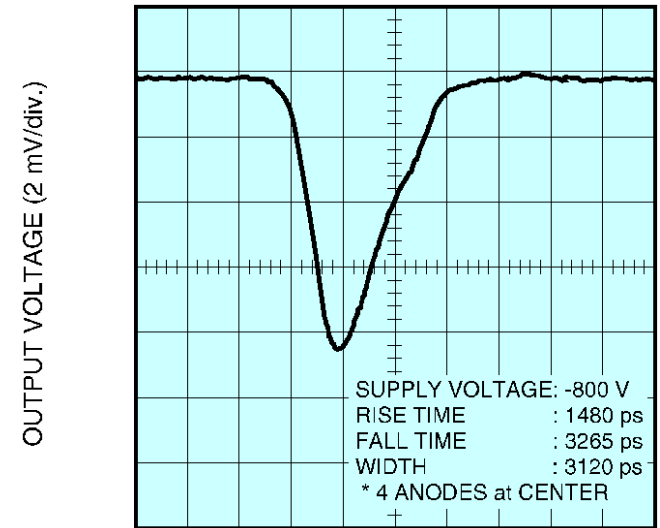
optical converter via MAPMT



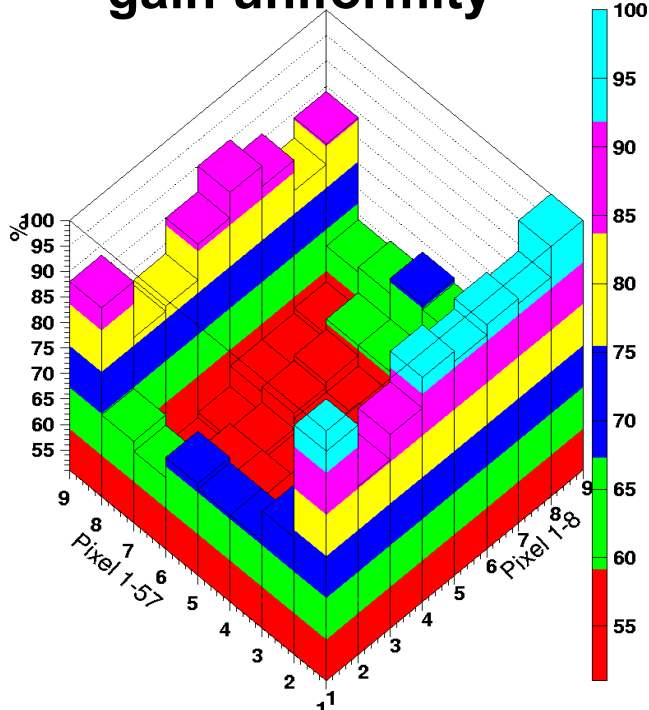
Hamamatsu H7546B

8x8 Multi-Anode-PMT head-on type, high speed Response, low cross talk, 12 stages, or'd Dynode 12 signal for fast signal tracking

sample signal

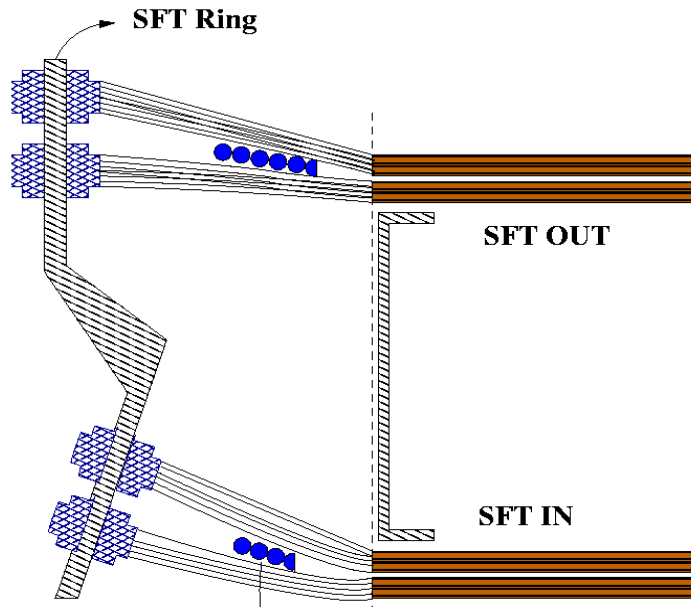


gain uniformity

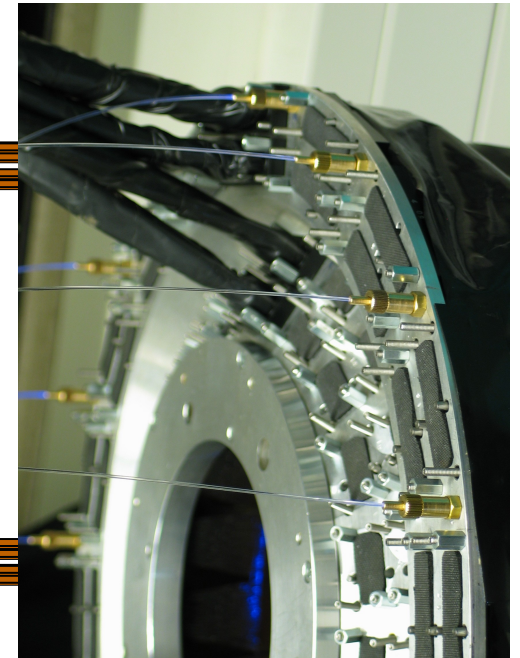


relative pixel input for same pixel response

Gain Monitoring System

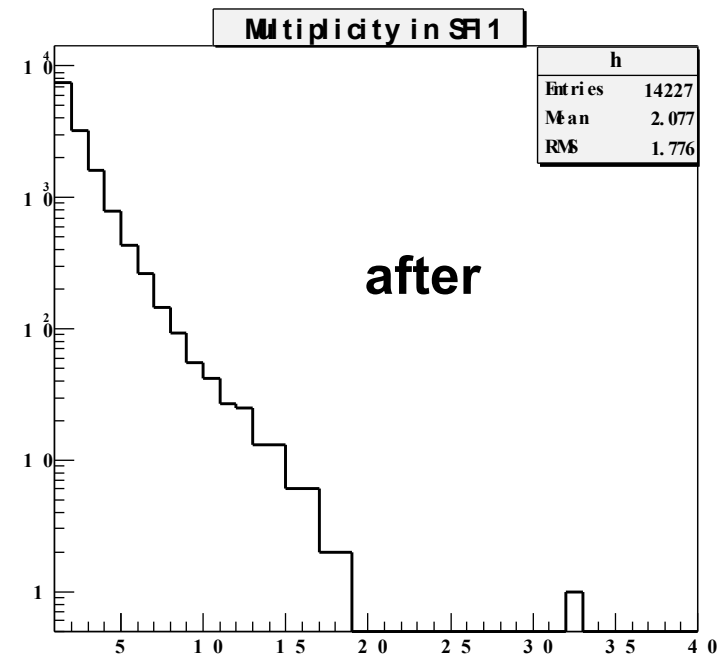
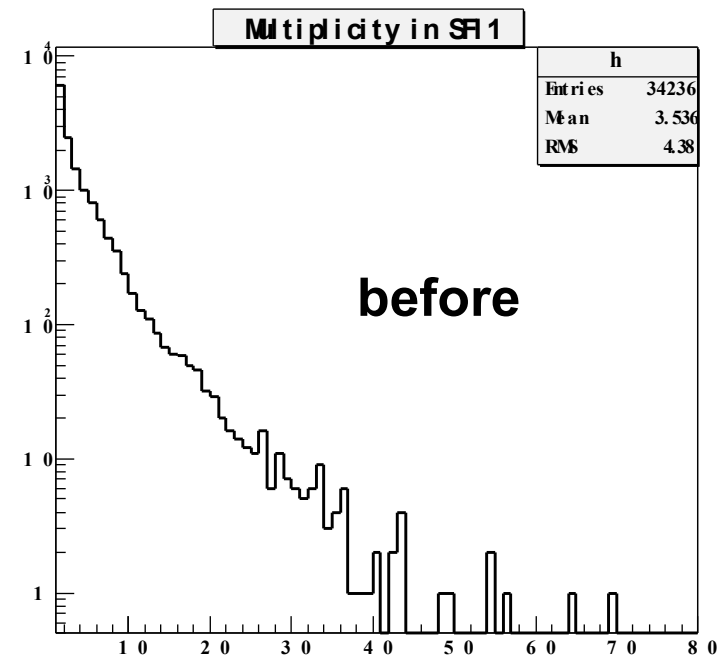
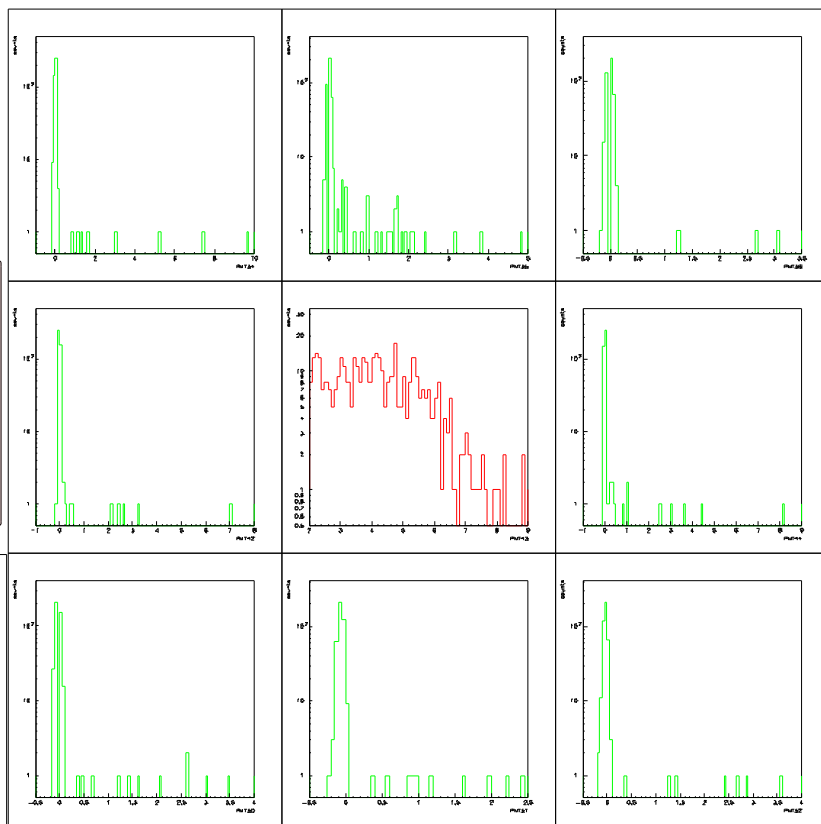
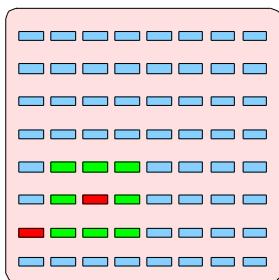
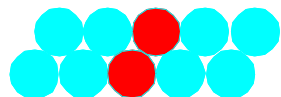
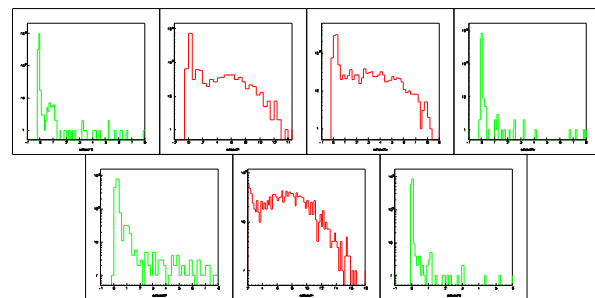
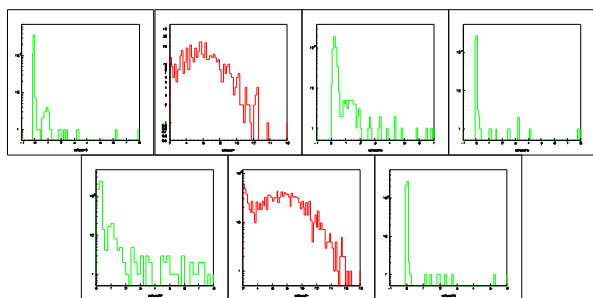
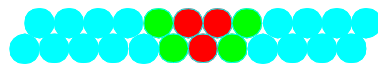
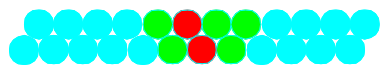


TIME (2 ns/div.)



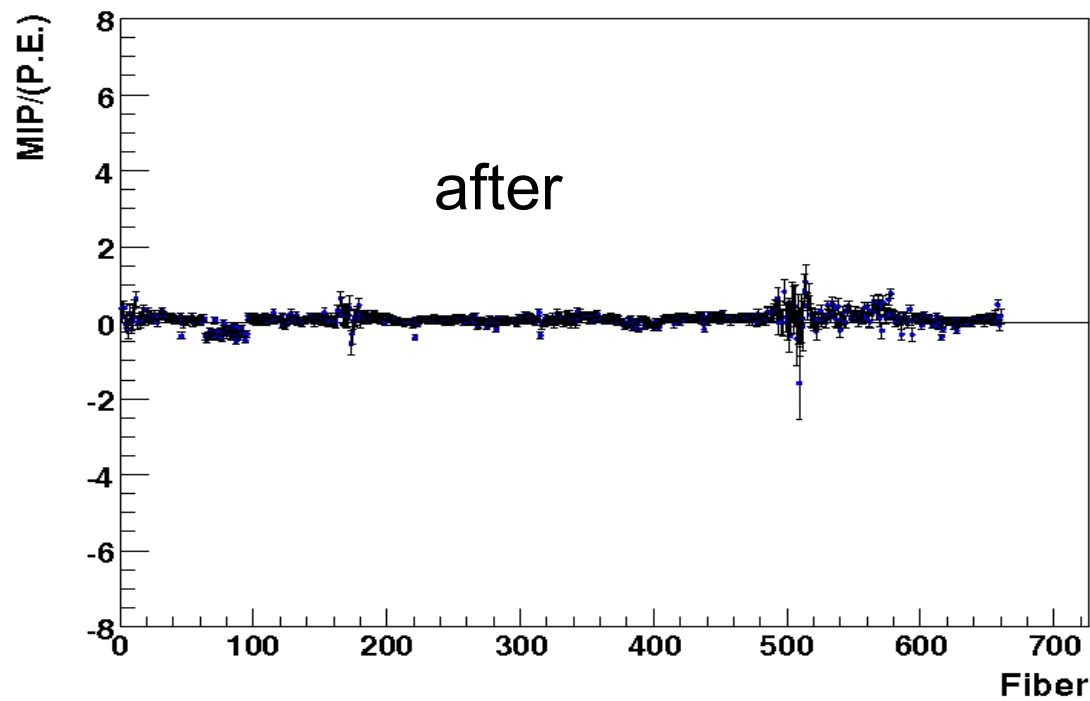
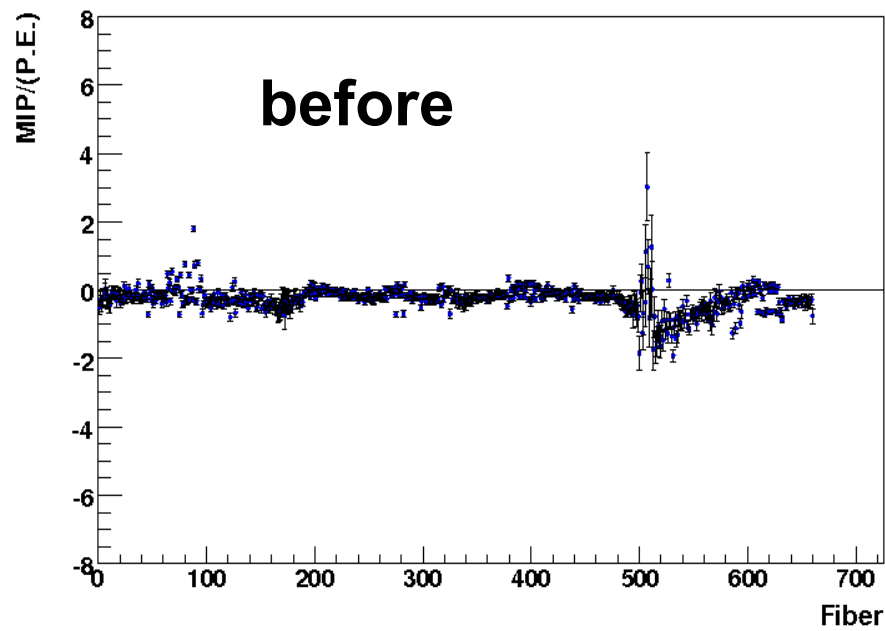
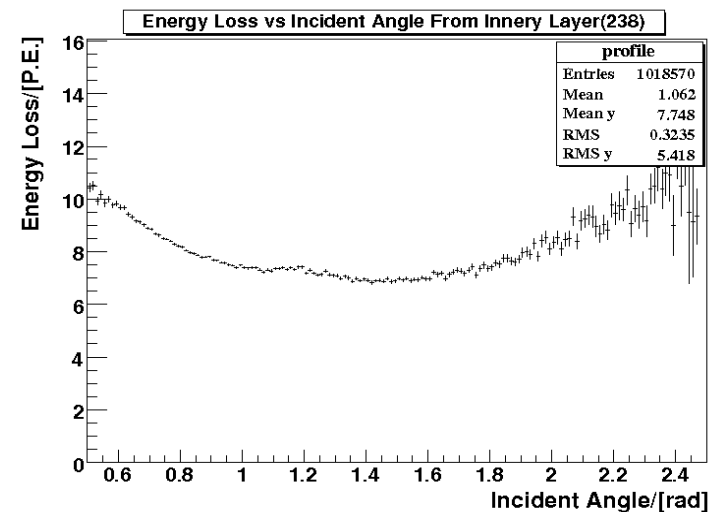
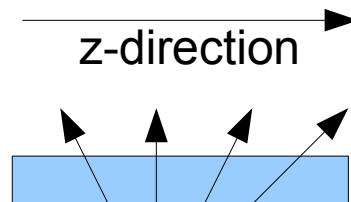
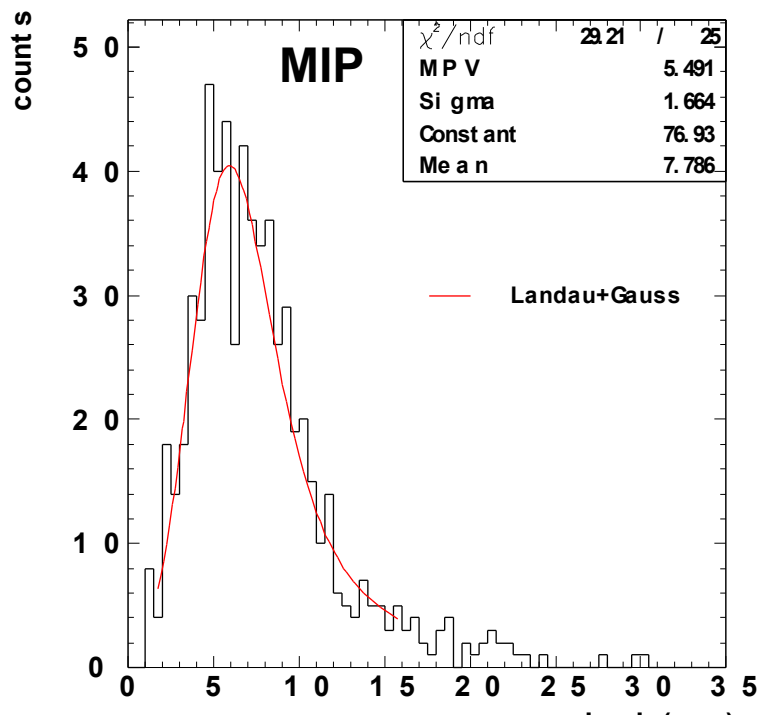
Crosstalk detection and suppression

- crosstalk in neighboring fibers
- knight walk for crosstalk reduction
- accumulations of signal amplitudes



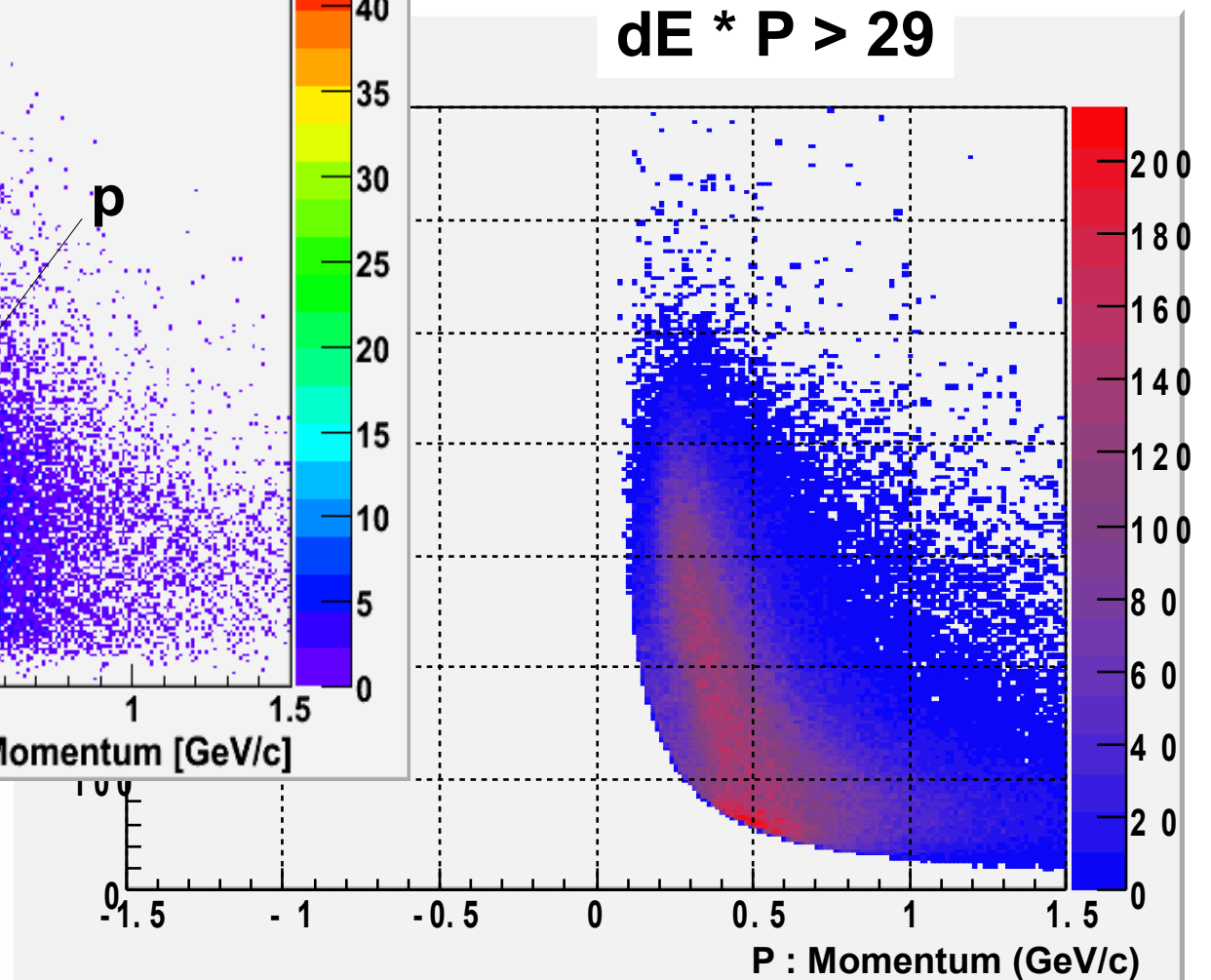
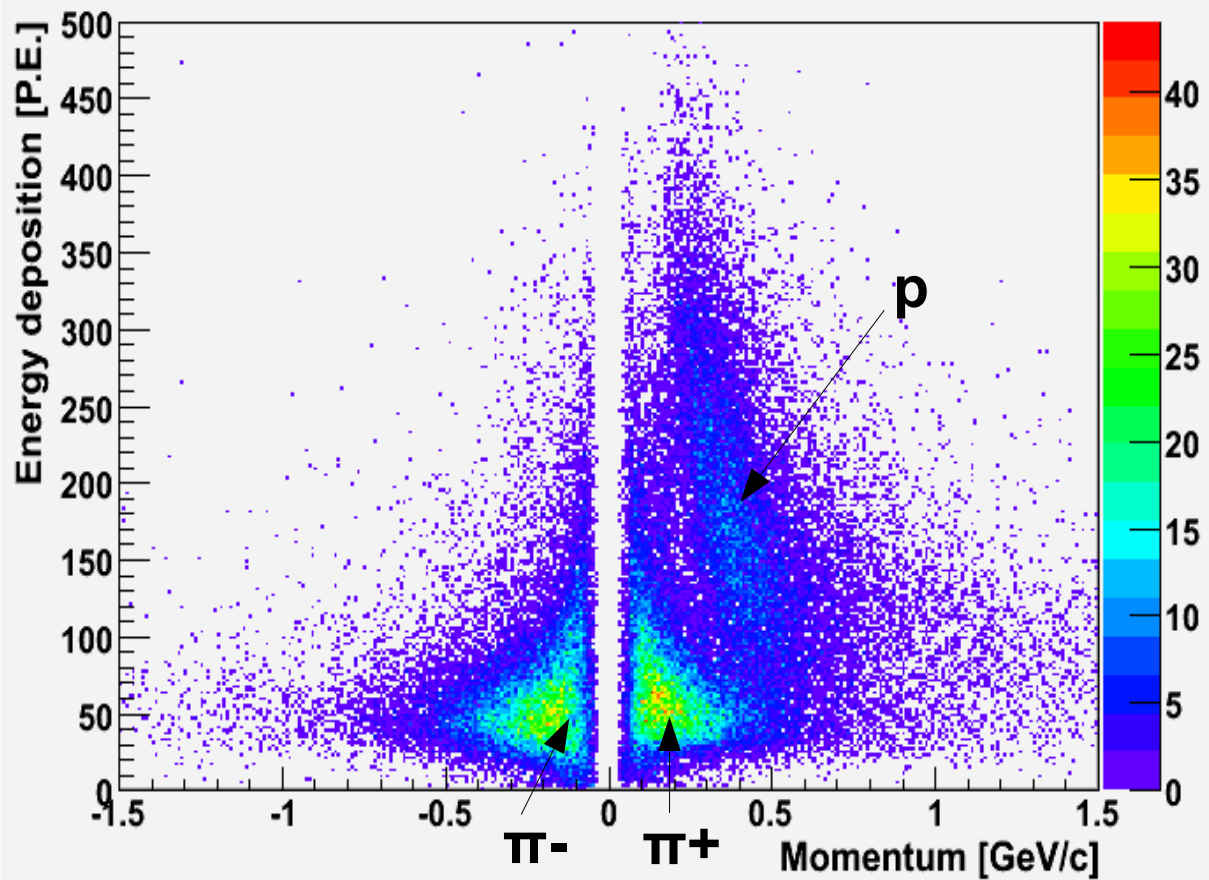
Calibration

recent success in fine tuning
example : first inner stereo layer
ready for the next production



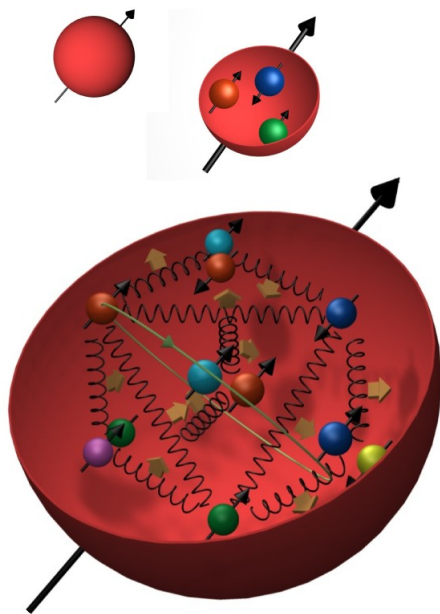
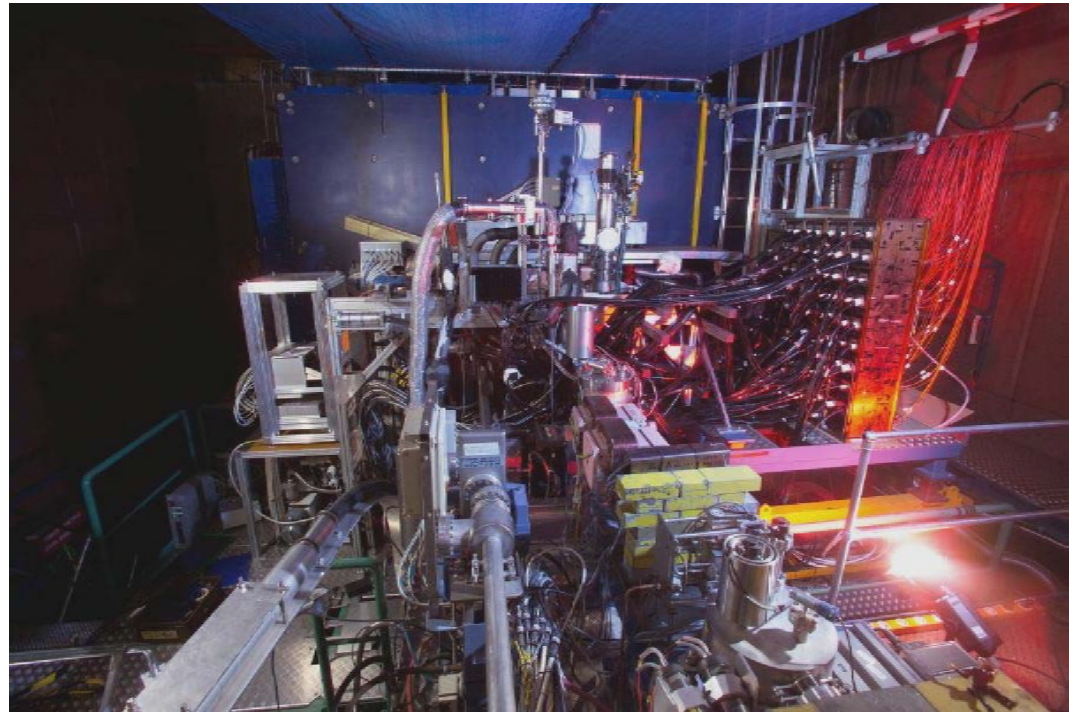
Particle identification

- track finding and fitting for pions/protons
- PID for particles between 250MeV/c and 1400MeV/c
- pions will be used for calibration



Summary and Outlook

- Detectors successful installed in 2005 and data taken until HERA shutdown 2007
- currently fine tuning in progress
- dedicated crew rapidly improves Chapeau :)



- Available data (events) for HERMES recoil
 - e- H2: 5k DVCS / 3.0M DIS
 - D2: 1k DVCS / 0.8M DIS
 - e+ H2: 42k DVCS/ 28M DIS
 - D2: 10k DVCS/ 7M DIS
- after fine tune start of physics analysis
- previous analysis will be iterated with new informations