



# Future Physics @ COMPASS

CERN, September 26-27 2002

## Status of Off-line and of Data Analysis



Scientific

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- S. Forte (Roma)
- M. Garcon (Saclay)
- W. Kühn (Giessen)
- E. Leader (London)
- E. Klempt (Bonn)
- A. Magnon (Saclay)
- G. Mallot (CERN)
- V. Metag (Giessen)
- V. Obraztsov (Protvino)
- A. Olchevski (Dubna)
- A. Palano (Bari)
- S. Paul (München)

Nucleon spin structure

Transversity

DVCS

$\chi$ PT Tests

Exotics and Glueballs

Double Charmed Baryons



Local Organizing Committee

F. Bradamante (Trieste)

<http://c...>

**Horst Fischer**  
**University Freiburg / CERN**

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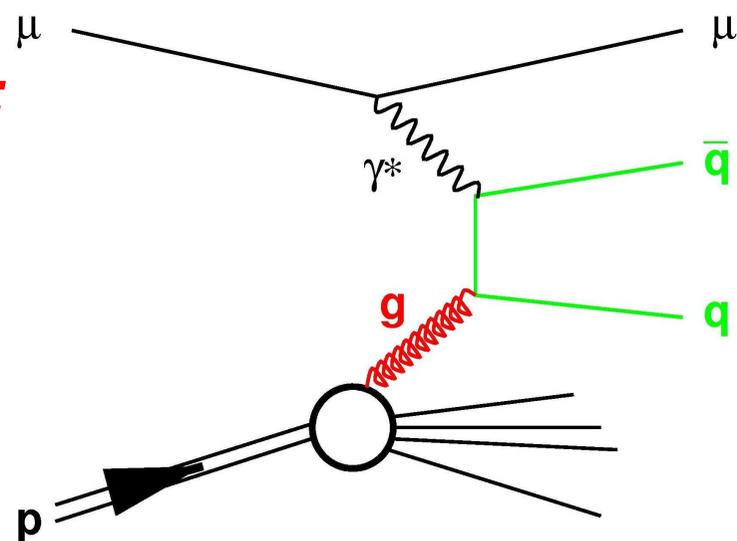
➤ *All plots shown are preliminary!*

# Measurement of the Gluon Polarization

*Direct measurement of  $\Delta G/G$ :*

*Photon-Gluon-Fusion:*

- *Production of open charm*
- *Events with two jets*



*Event Signature:*

- *Beam and scattered Muon*
- *Production of  $D^0$  or  $D^*$*
- *$D^0 \rightarrow K\pi$  or  $D^* \rightarrow D^0\pi \rightarrow K\pi\pi$*

*Measure cross-section asymmetry*

# Central Data Recording

## CCF:

- Linux PCs
- 100 dual Processor PCs = 200 Intel PIII CPUs

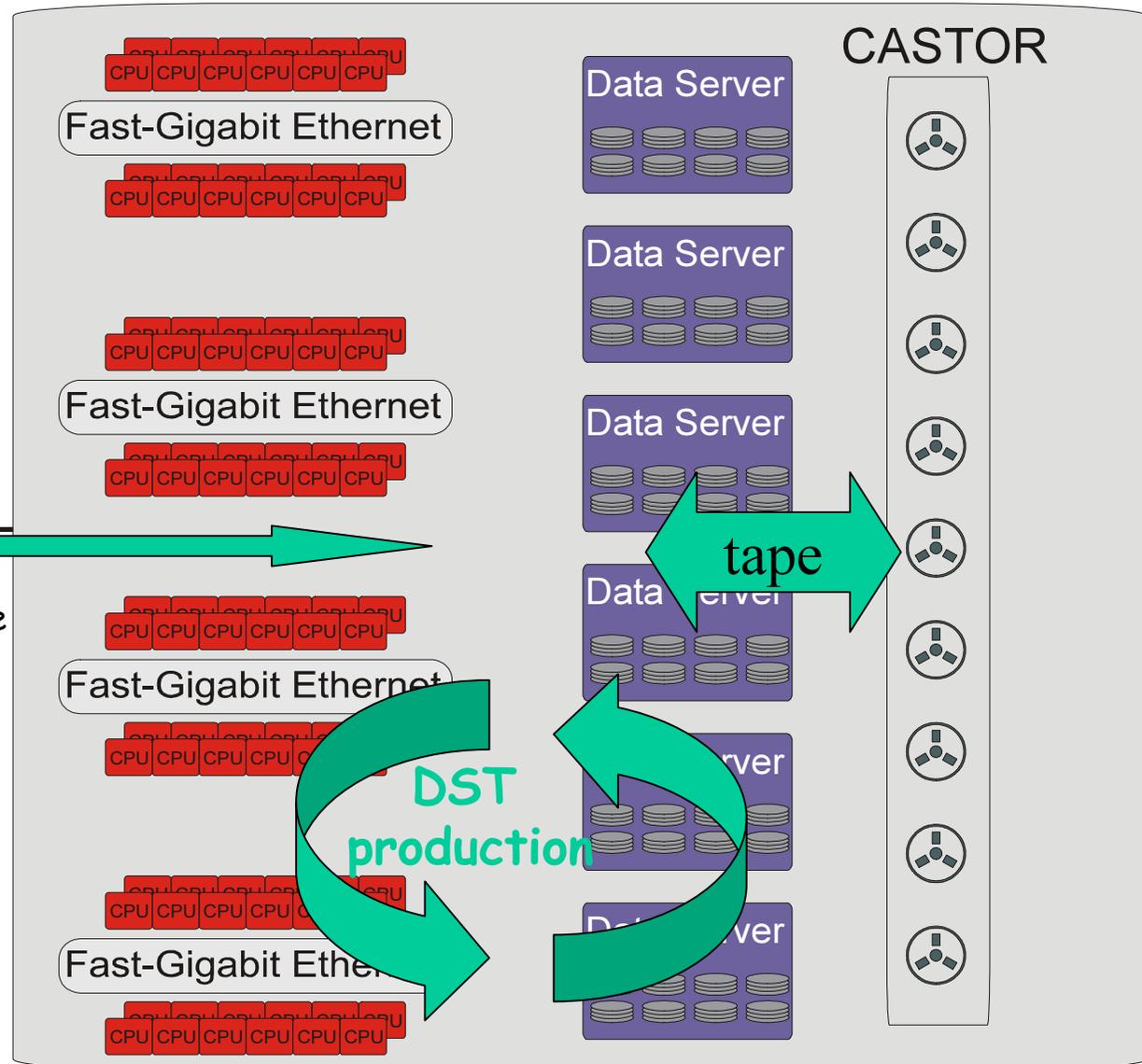


Data servers:  
Up to 20 x 500GB

## CASTOR:

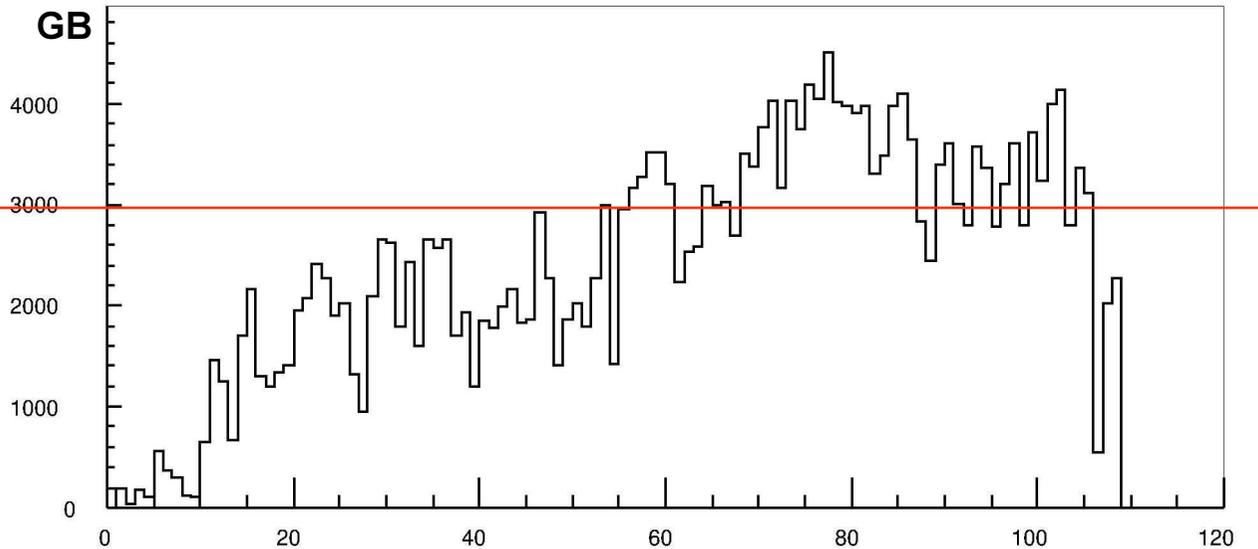
CERN development of a "infinite file system"

COMPASS is the first experiment which uses CASTOR heavily

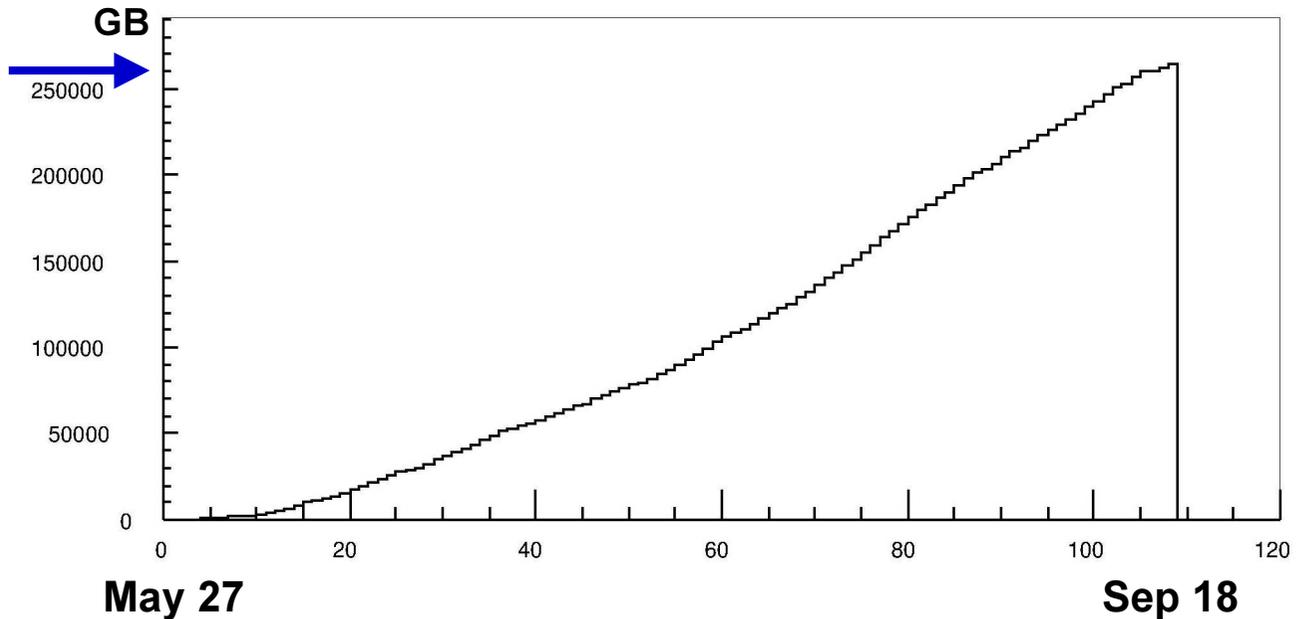


# Central Data Recording

*Design value (35MB/s)*



*260 TByte in ~100 days*



*Compare to BaBar:*

*1TByte/day*

*662 TByte in 1999-2002*

# Data taking 2002

## Statistics:

- Target polarized longitudinally: 57 days, 173k spills
- Target polarized transversely: 19 days, 52k spills
- On average 22k triggers/spill → 5 Gev (3.8Gev, 1.2Gev)
- Stored in ~260,000 files
- Expected for 2002: 29000 D<sup>0</sup> and 3800 D\* inside cuts @ 100% reconstruction efficiency

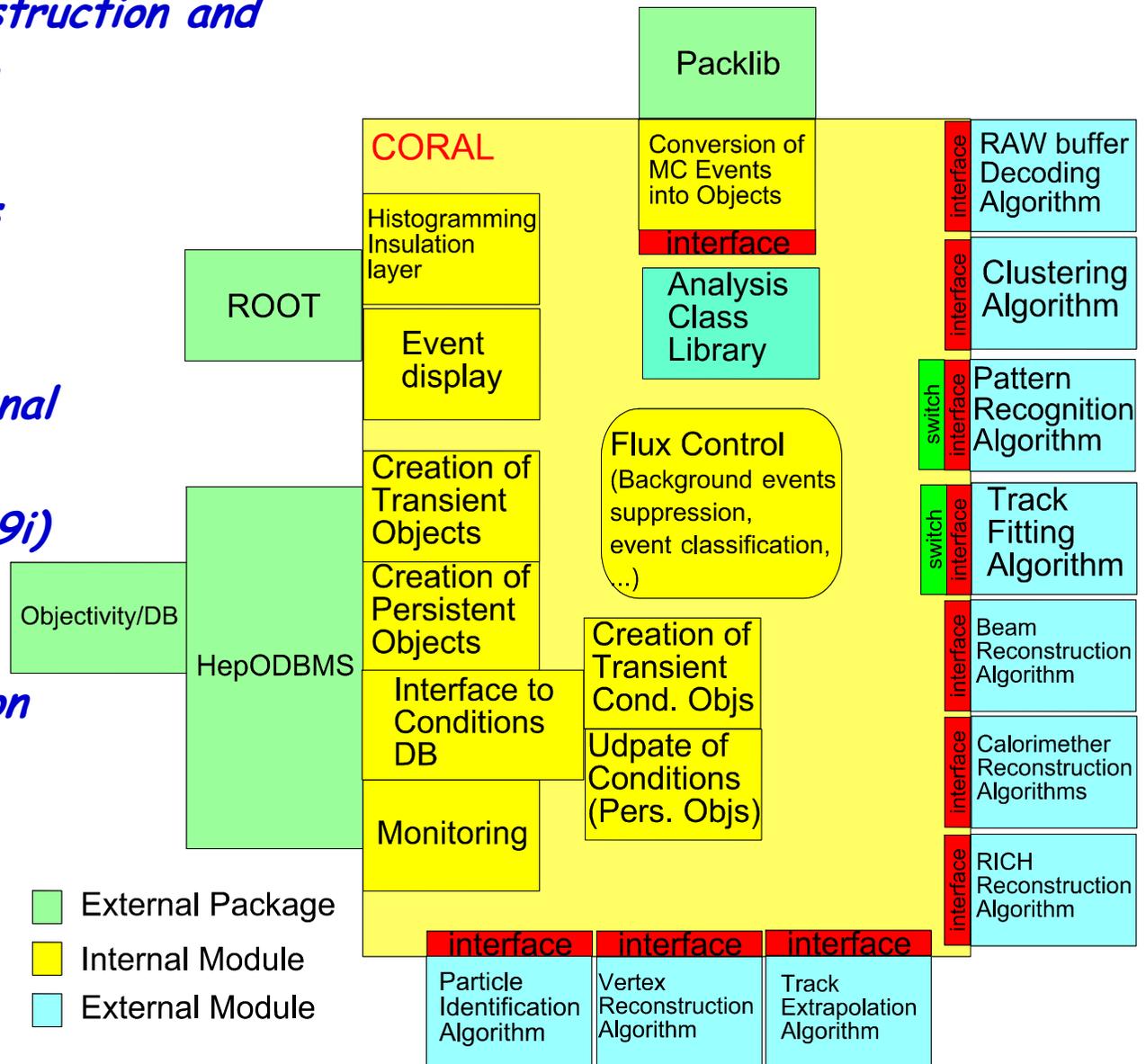
## Reconstruction:

- Average time to process one event: 700ms/ev (400...1300ms/ev)
- $5\text{Gev} * 700\text{ms/ev} = 3.5\text{Gs} / 200\text{CPUs} = 17.5\text{Ms/CPU}$   
at 100% efficiency: = 200 days on 200 CPUs
- Today: pre-processing of 14407 files is completed  
(~50% since end of run)

# CORAL - our Reconstruction Code

= COMPASS Reconstruction and AnaLysis Program

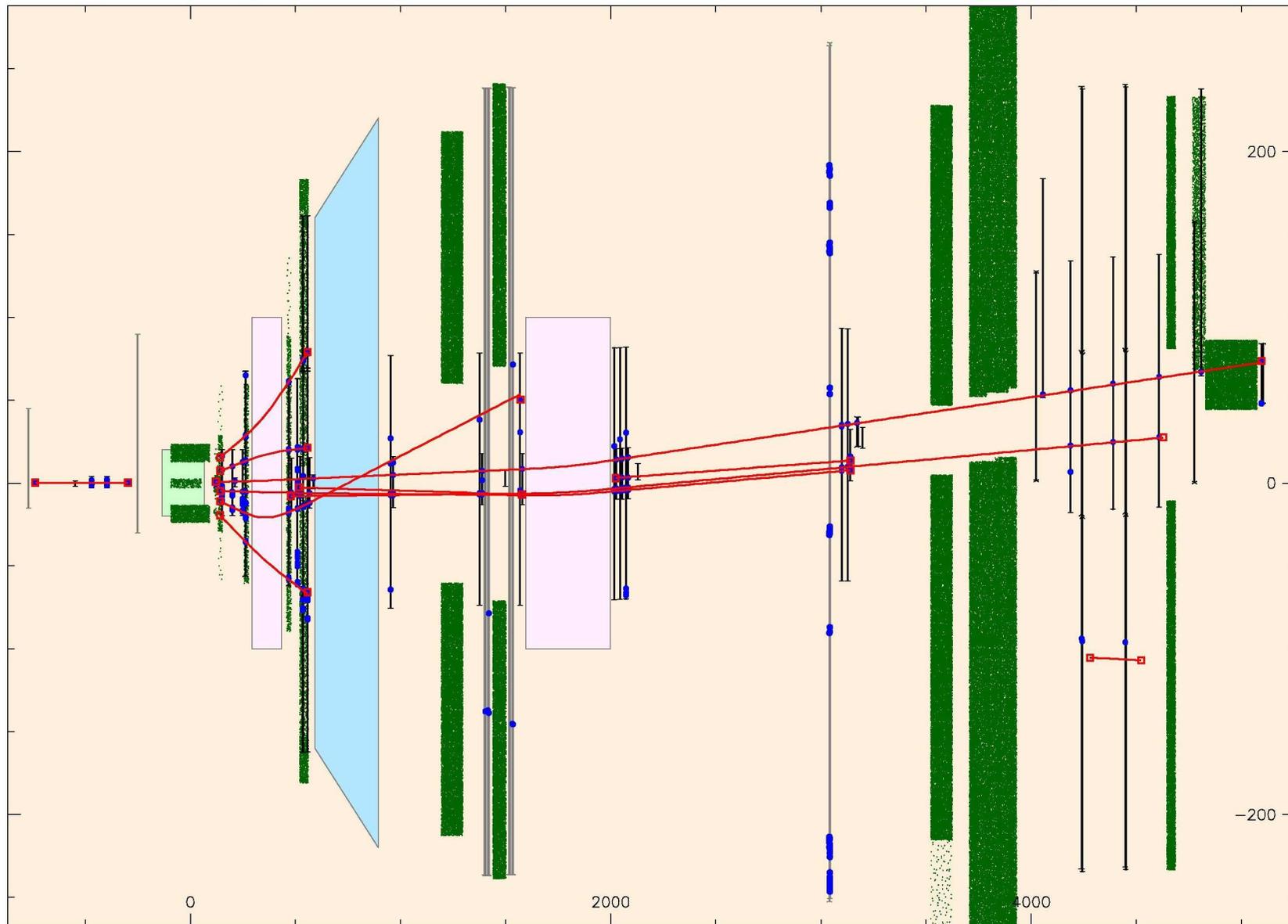
- Modular architecture
- Following OO techniques
- Fully written in C++
- Defined interfaces for easy exchange of external packages  
(e.g. OB/DB → Oracle 9i)
- Access to event, conditions and calibration data bases
- Written from scratch



# *And that is what comes out: The typical event*

Projection 0.0 deg.

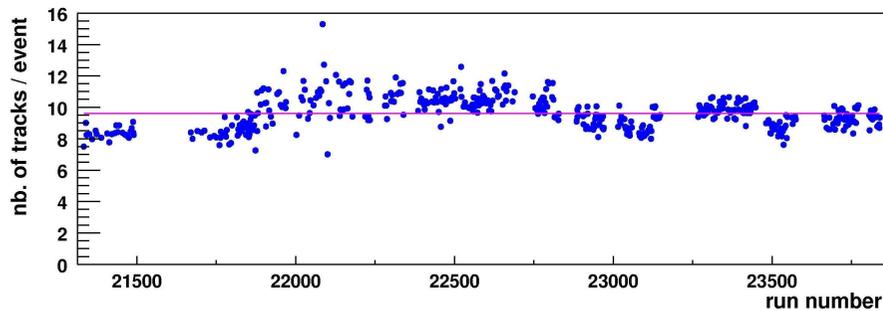
Run 20079 Event in burst 13503 Trigger(s) 0 2 Nhits 1348



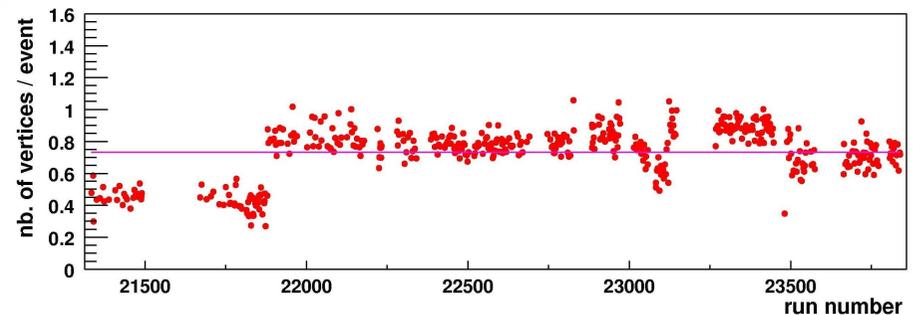
# Quasi-Online Data Quality Check

- ✓ Continuous and regular data quality checks during data taking
- ✓ *Full event reconstruction*
- ✓ Lower yields during data taking with transverse polarized target because different triggers

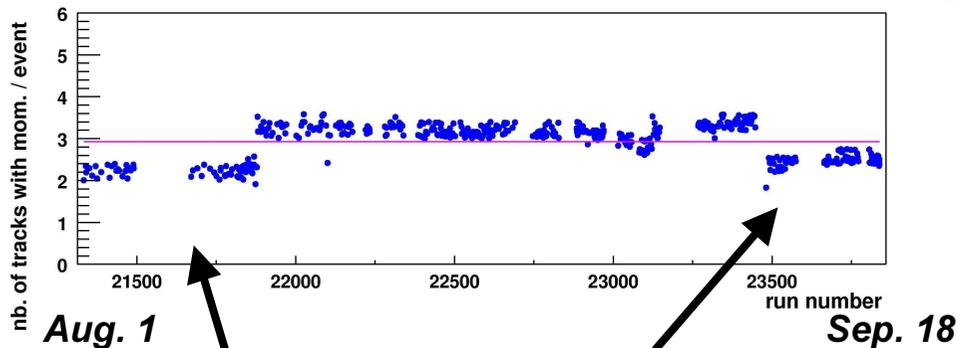
Number of tracks vs. run number



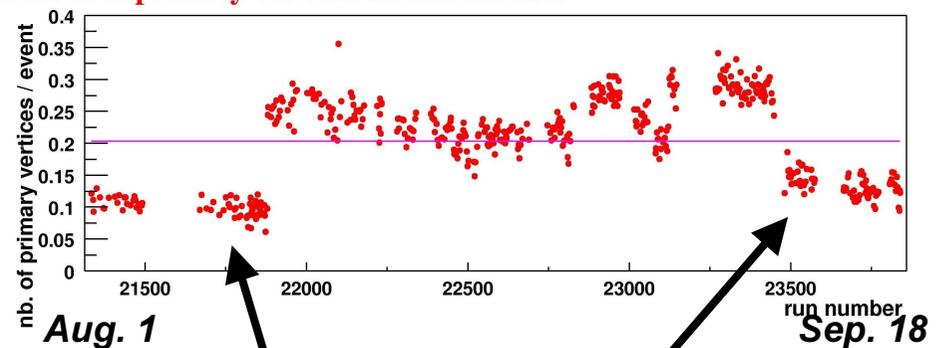
Number of vertex vs. run number



Number of tracks with mom. vs. run number



Number of primary vertices vs. run number



*Transverse target polarization*

*Transverse target polarization*



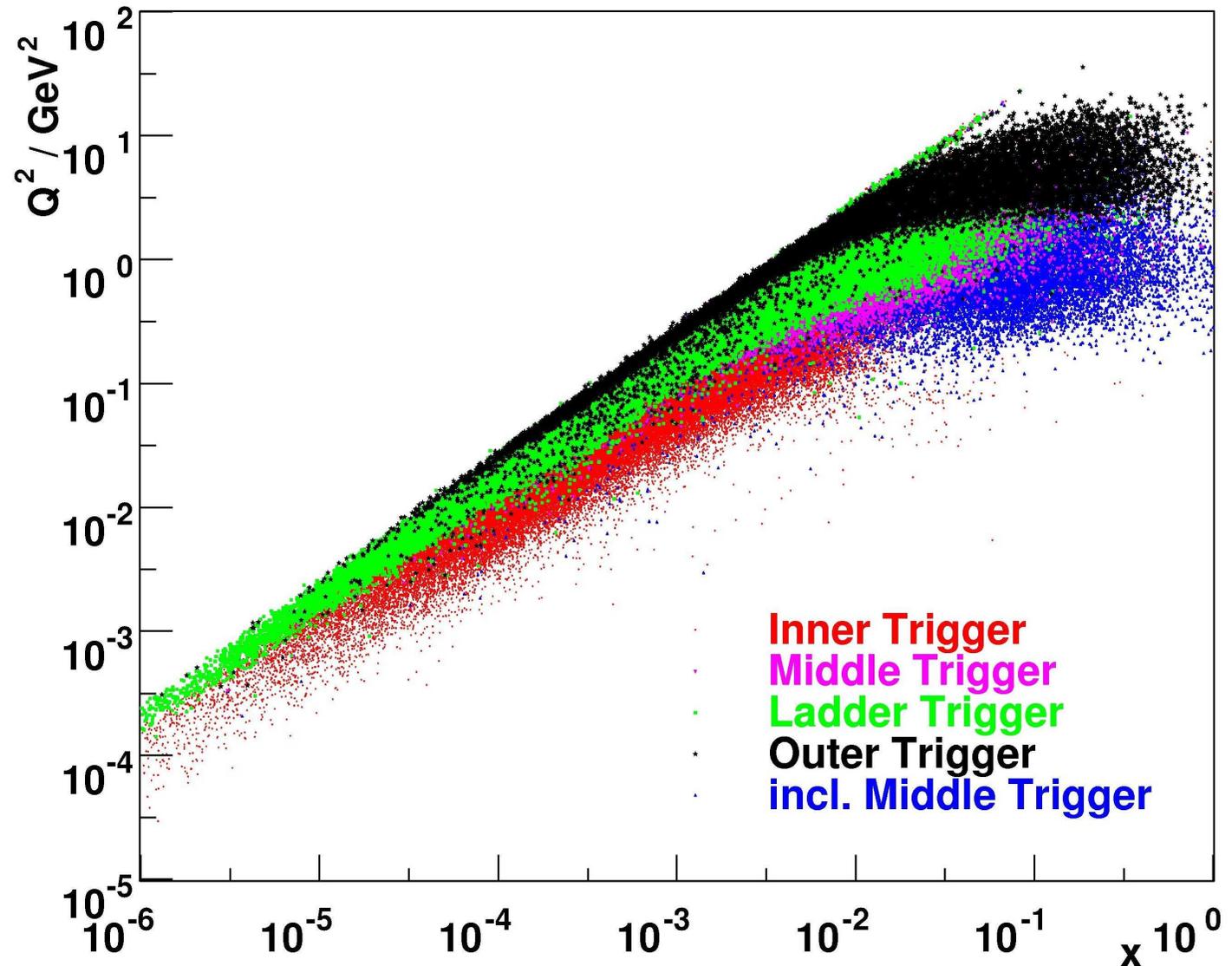
# *Kinematic Range accessible with the Present Setup*

*Wide dynamic  
range*

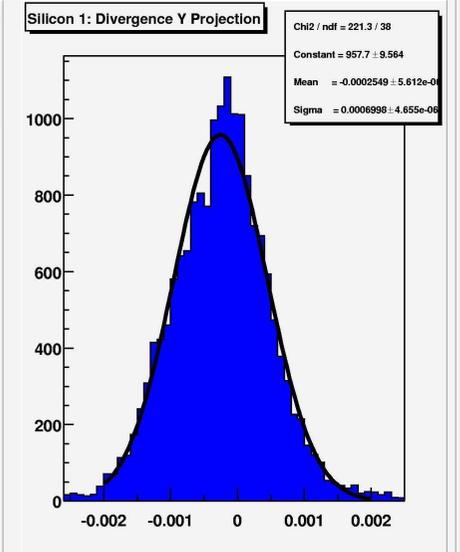
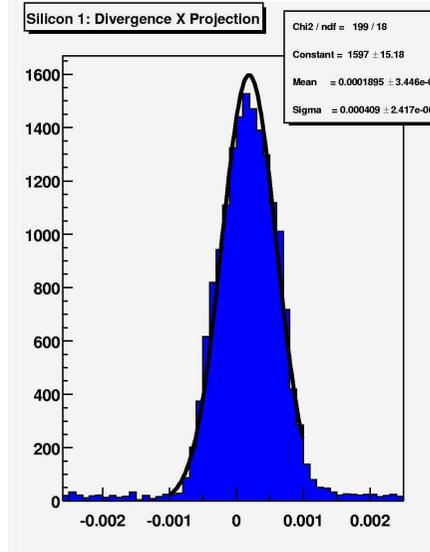
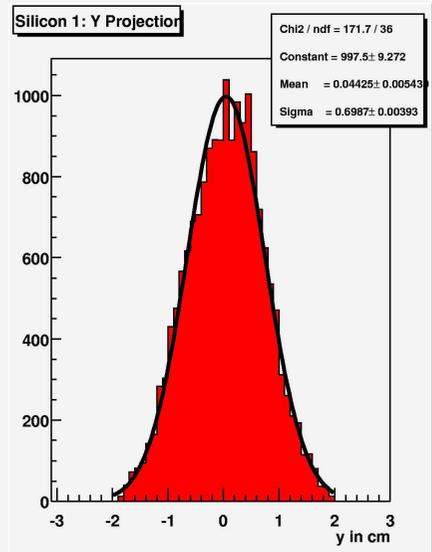
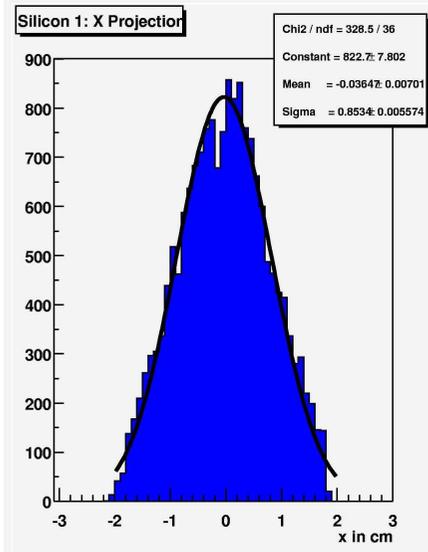
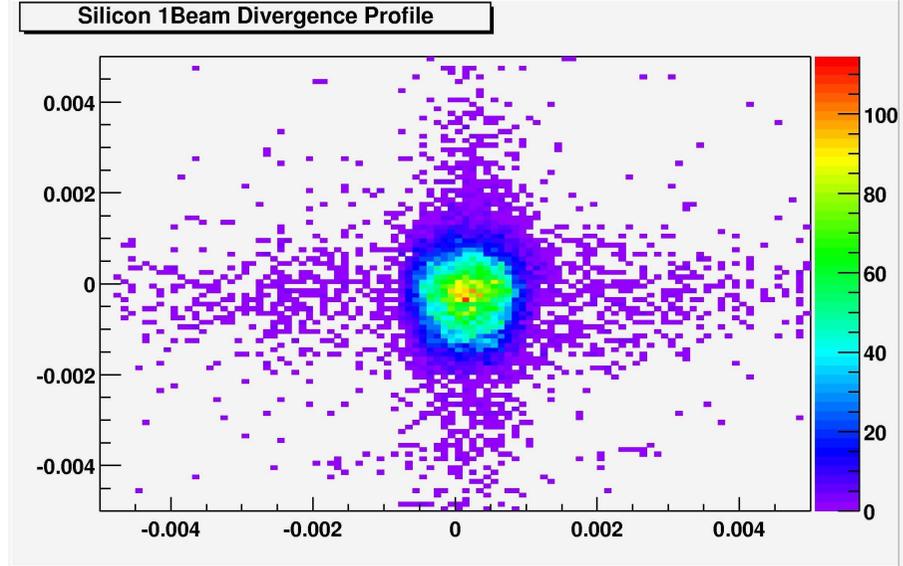
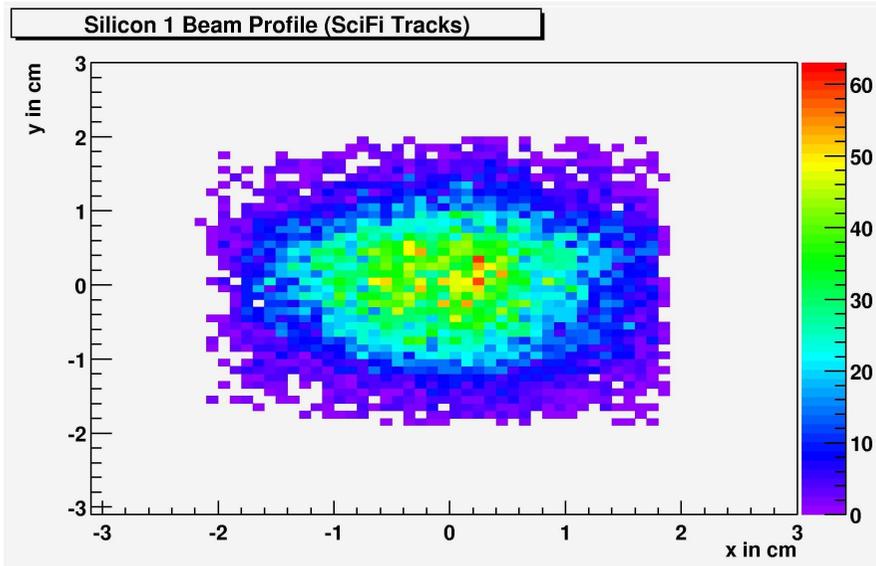
*Access to:*

➤ *very low  $Q^2$*

➤ *small  $x$*



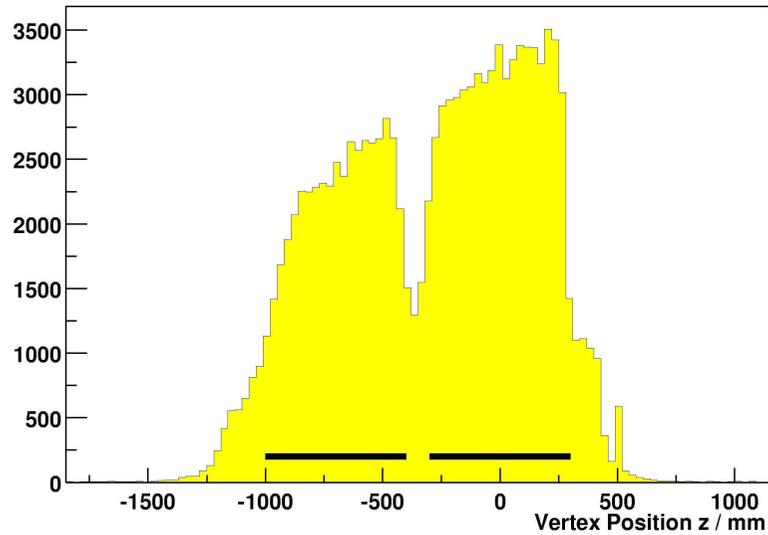
# Beam Reconstruction



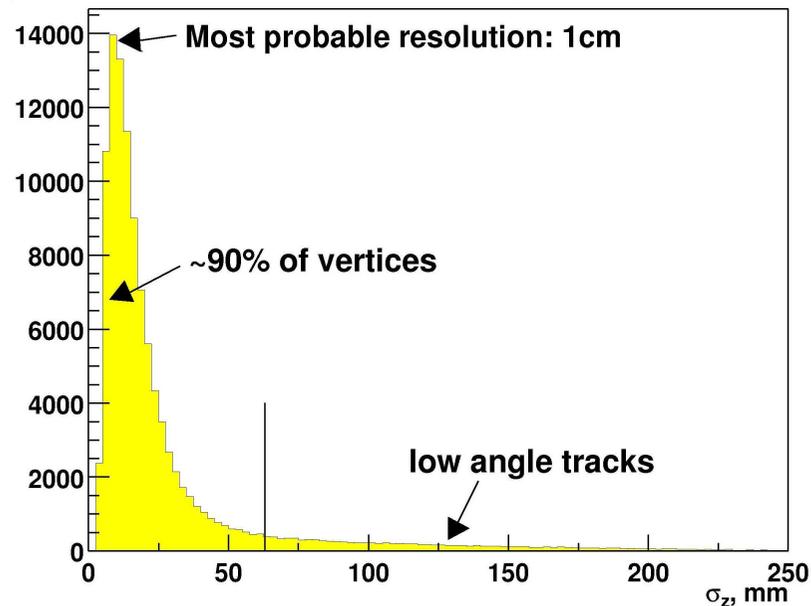
*Presently: Beam reconstruction 52%, still room for improvement*

# Vertex Reconstruction

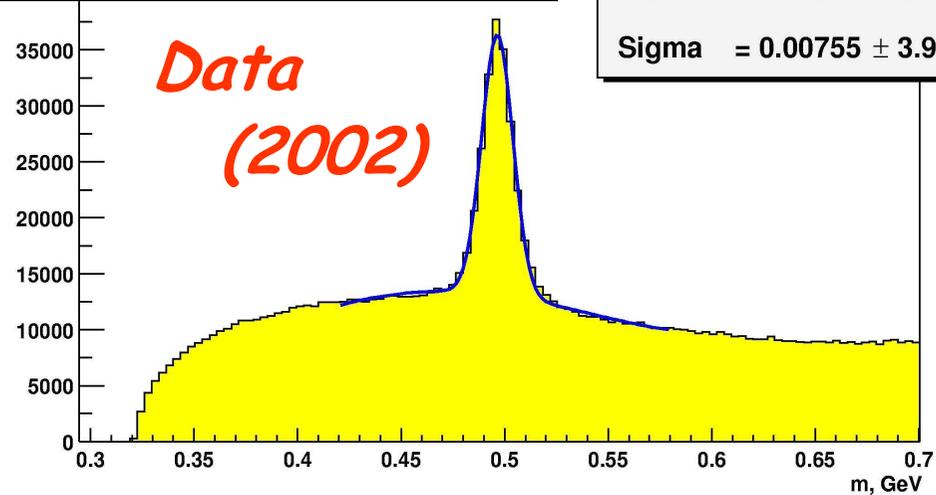
Vertex distribution along Z,  $N_{\text{trk}} > 2$



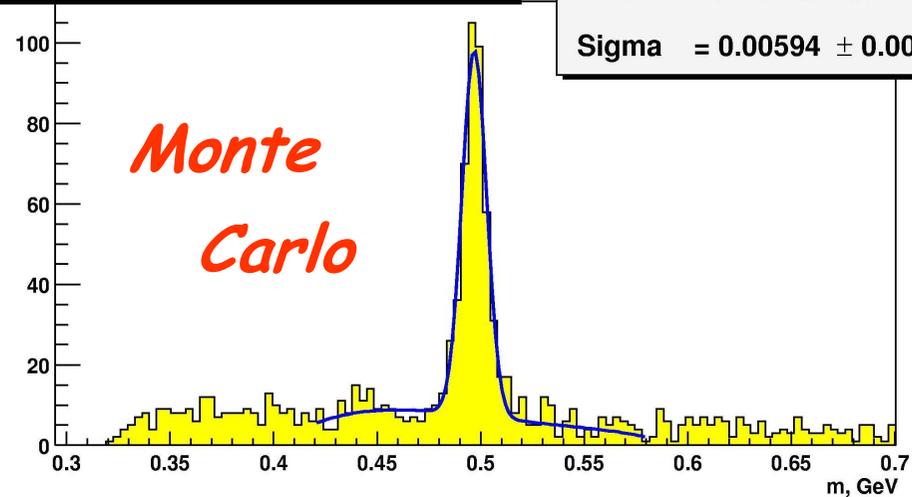
Vertex Resolution along Z,  $N(\text{trk}) > 2$



$\pi^+\pi^-$  invariant mass,  $z > 35\text{cm}$



$\pi^+\pi^-$  invariant mass,  $z > 35\text{cm}$

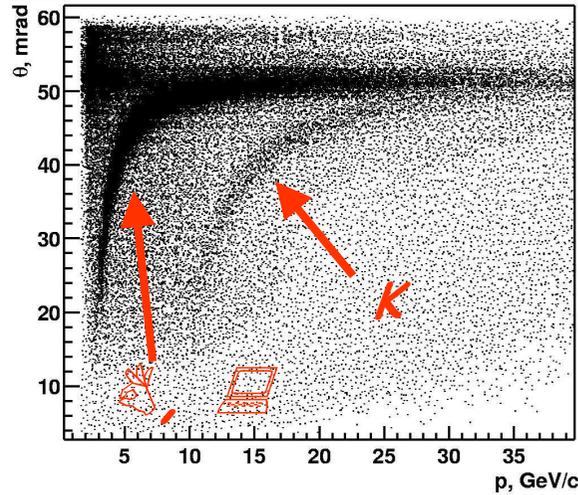


# Hadron Identification

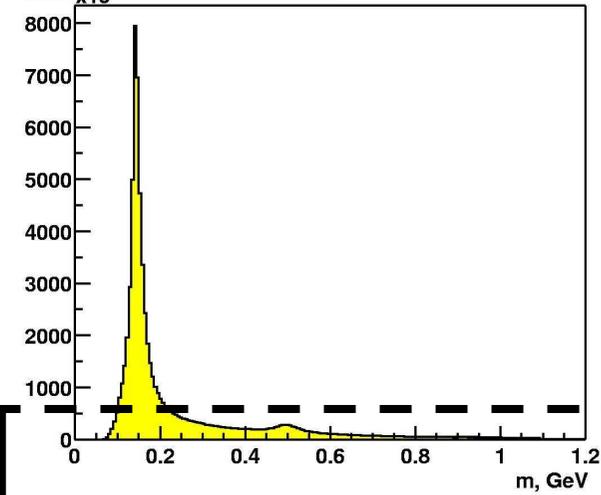
By the RICH...

...and by hadronic  
sampling  
calorimeters

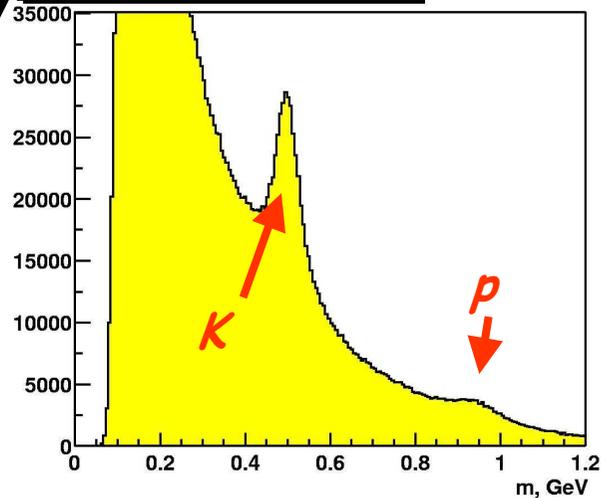
Cherenkov  $\theta$  vs momentum



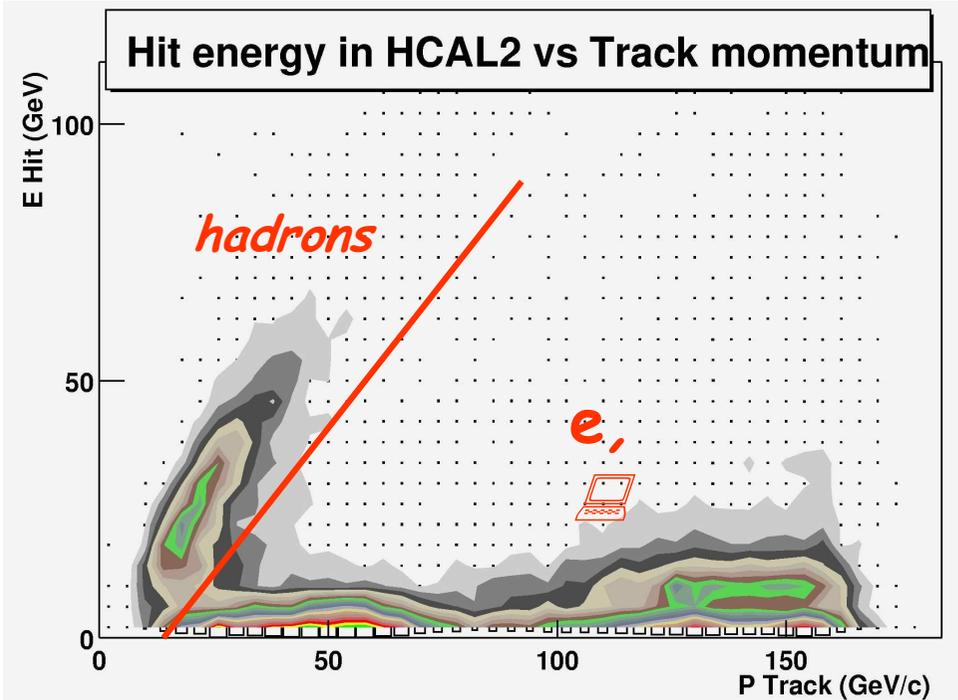
Mass of positive particle



Mass of positive particle (zoom)



Hit energy in HCAL2 vs Track momentum



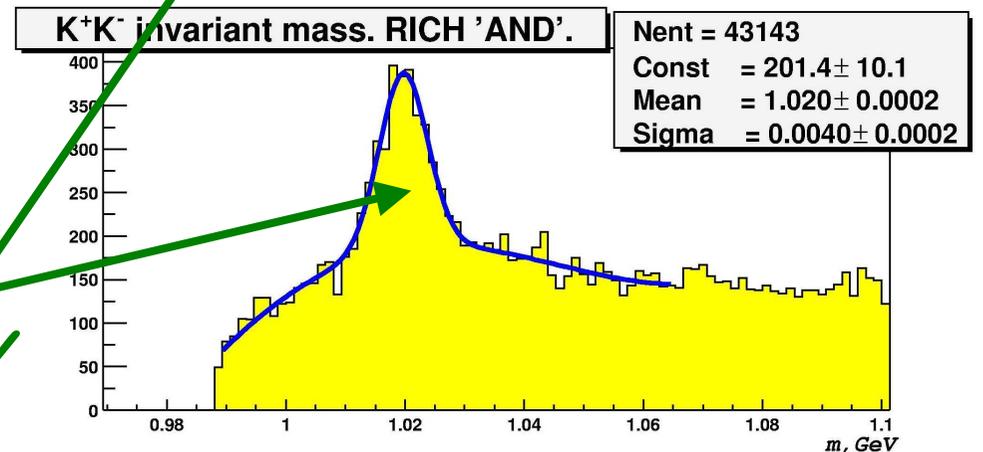
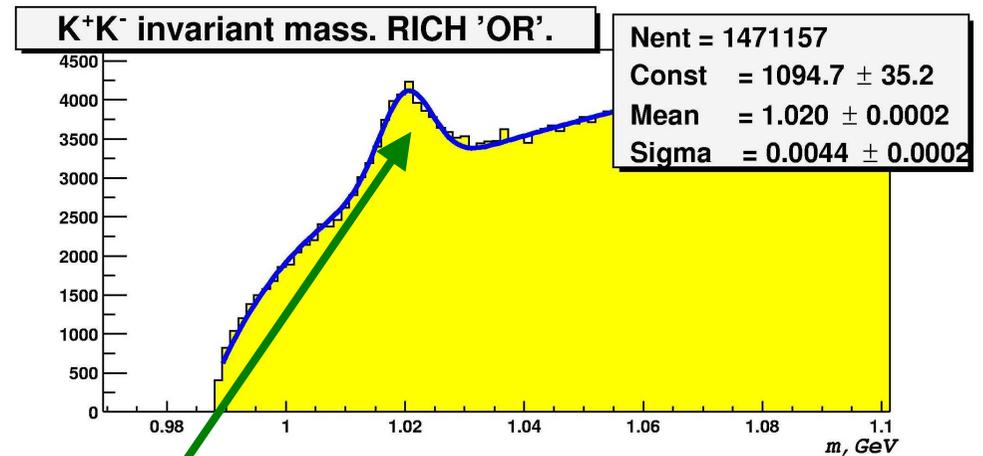
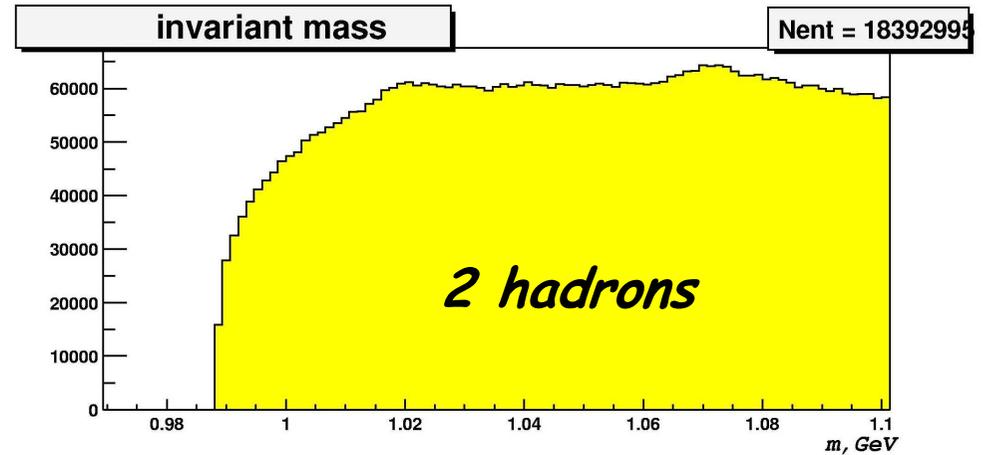
# Hadron reconstruction without and with RICH

Decay:  $\Xi \rightarrow K^+ K^-$

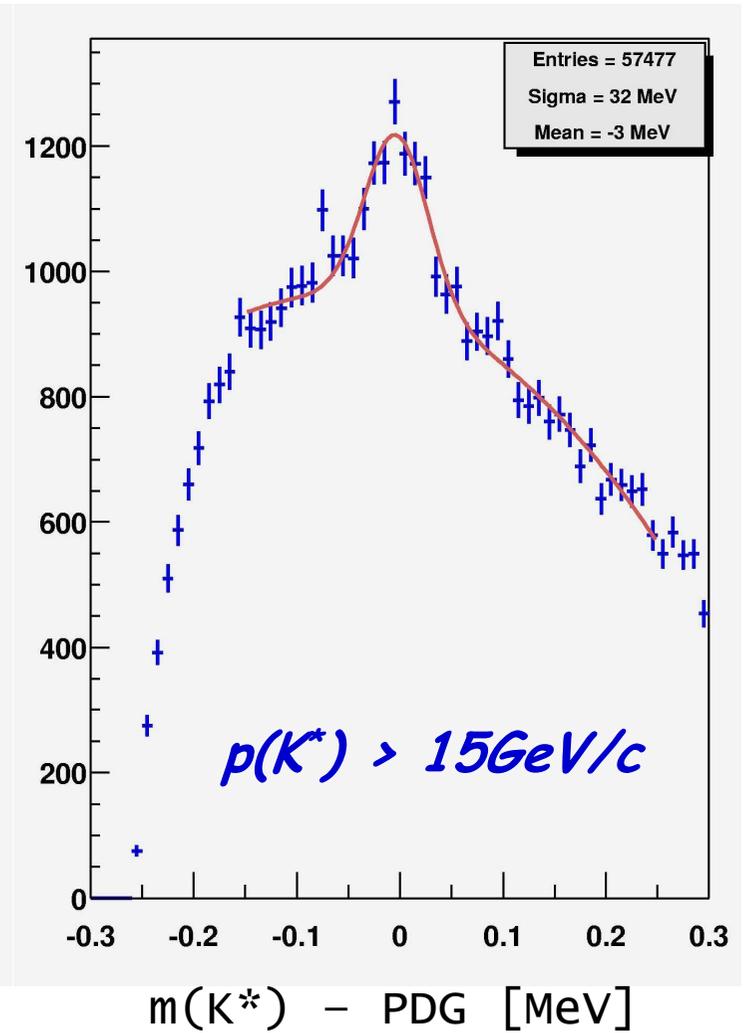
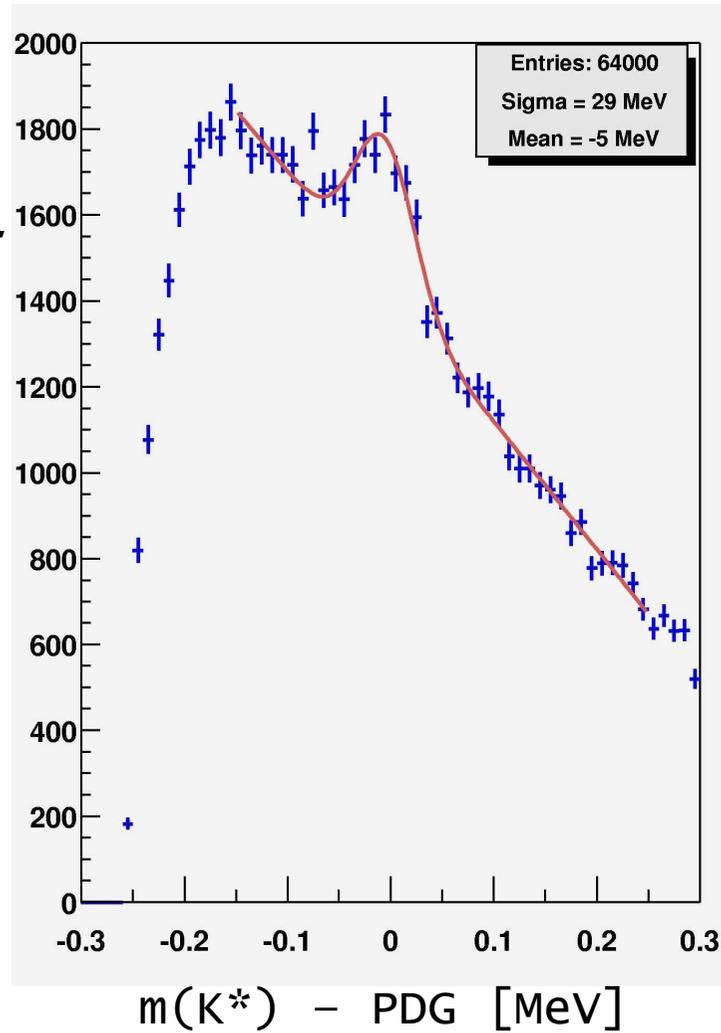
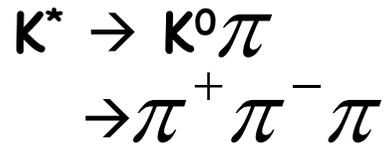
one or two Kaons  
identified in RICH

both Kaons  
identified in RICH

→ Kaon identification  
efficiency from  $\Xi$ -decay  
~35%



# $K^*(892)$



**COMPASS:  $N(K^{*+}) > N(K^{*-})$**

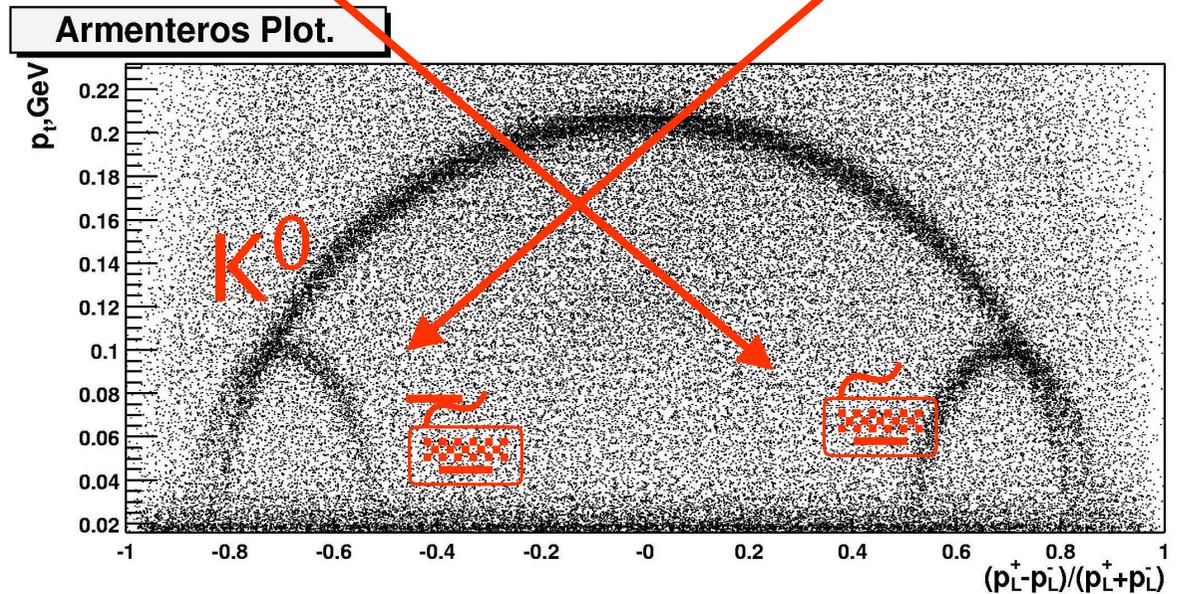
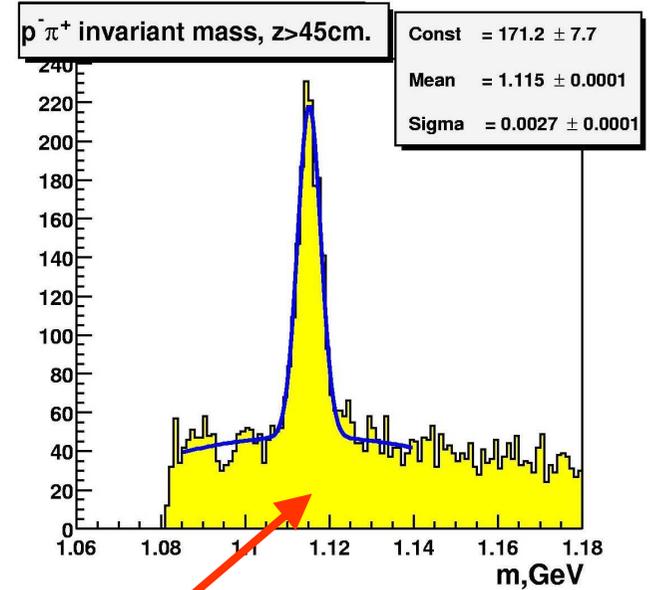
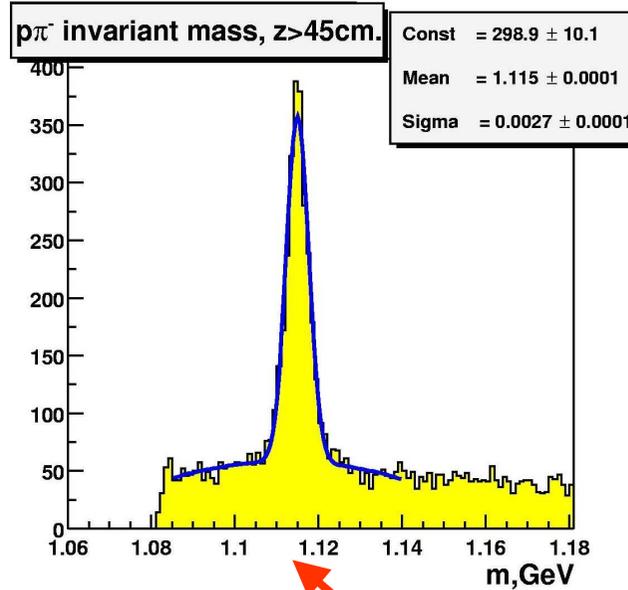
# Reconstruction of $\rho^0$ and $\omega$

expected from  
2002 run:

$\rho^0$ : 58k

$Q^2 > 1$ : 46k

$\rho^0/\omega \sim 0.5$



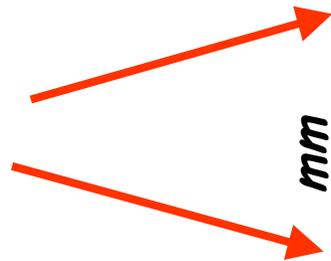
# Outlook

- *The challenges in the COMPASS off-line and data analysis are enormous*
- *Successful reconstruction of  $K^0$ , ,  and  $K^*$  demonstrates the functioning of spectrometer and software → Now we are attacking the  $D^0$  and  $D^*$*
- *Need to increase the statistics on DST level and improve the calibration data grid*
- *Also during next few months we have to migrate Objectivity DB to Oracle 9i (transfer the full 260TB)*
  - *Raw events are stored outside of DB*
  - *DST data are stored in plain files*



Alignment with SM1 OFF  
 Data displayed: SM1 ON

Scale!!



Alignment with SM1 ON  
 Data displayed: SM1 ON

