Future Physics @ COMPASS

CERN, September 26-27 2002

Status of Off-line and of Data Analysis

Scientific

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A. Palano (Bari)
S. Paul (München)

Nucleon Spin Structure
Transversity
DVCS
χPT Tests
Exotics and Glueballs
Double Charmed Baryons

Local Organizing Committee

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Table of Contents

- Central Data Recording & Compass Computing Farm
- Event Reconstruction
- Alignment and Calibrations and Data Quality
- First look on the data
  - Vertex reconstruction
  - Hadron identification
- Outlook

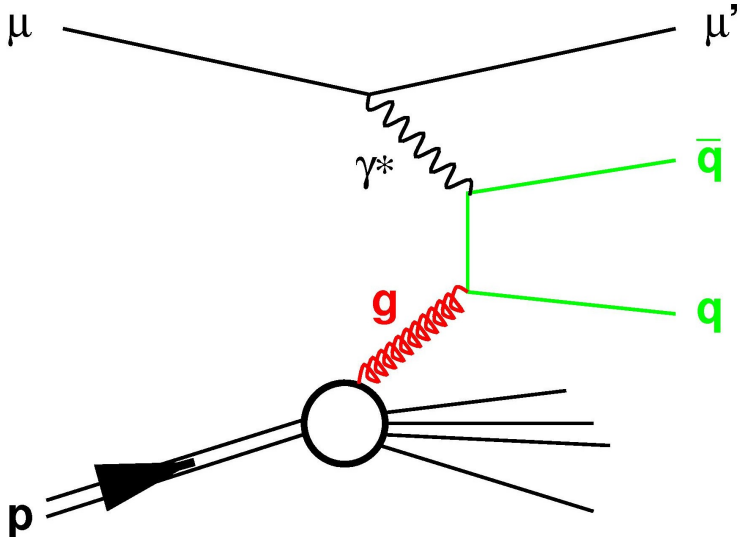
- All plots shown are preliminary!

Measurement of the Gluon Polarization

Direct measurement of $\Delta G/G$:

Photon-Gluon-Fusion:

- Production of open charm
- Events with two jets



Event Signature:

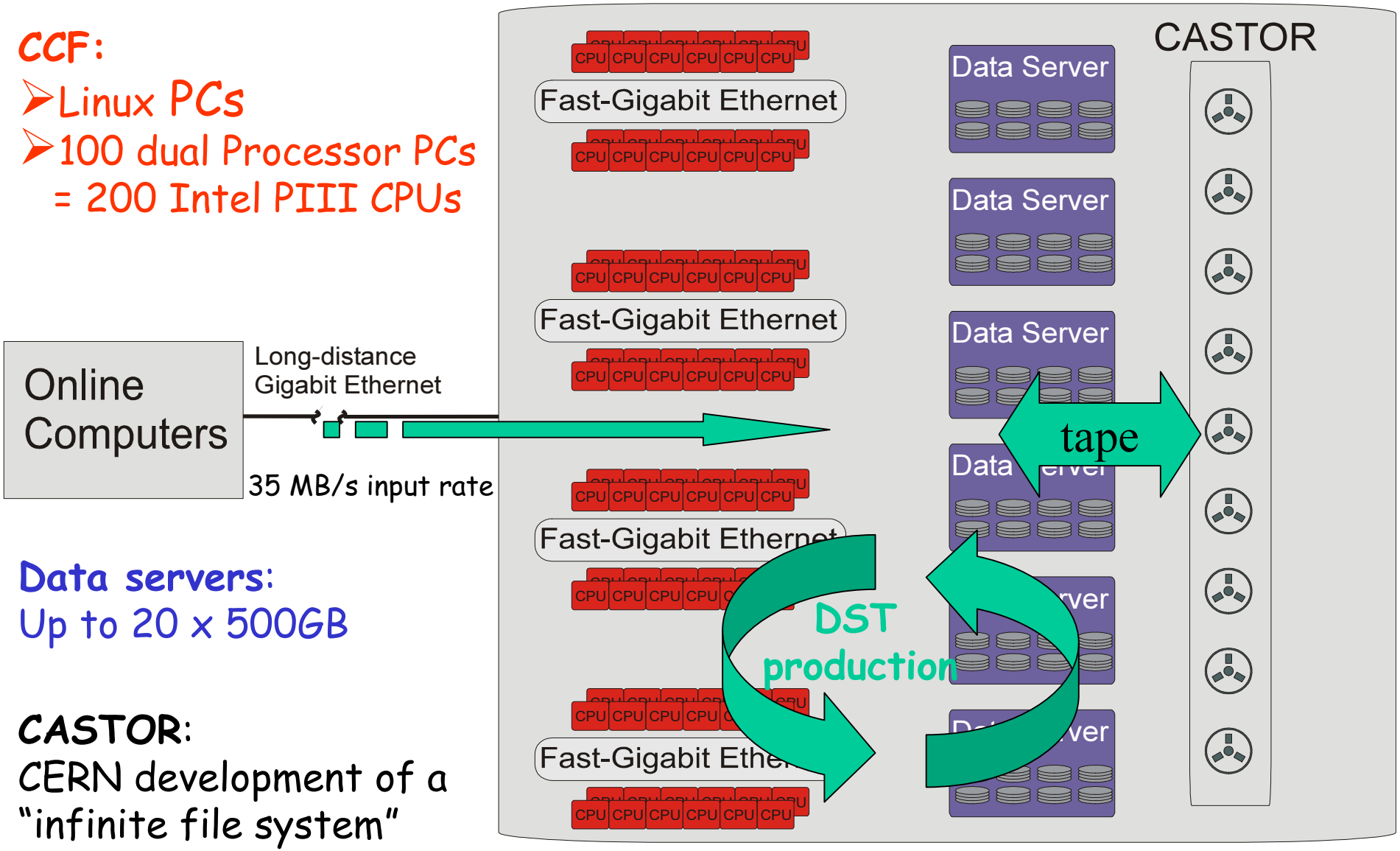
- Beam and scattered Muon
- Production of D^0 or D^*
- $D^0 \rightarrow K\pi$ or $D^* \rightarrow D^0\pi \rightarrow K\pi\pi$

Measure cross-section asymmetry

Central Data Recording

CCF:

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

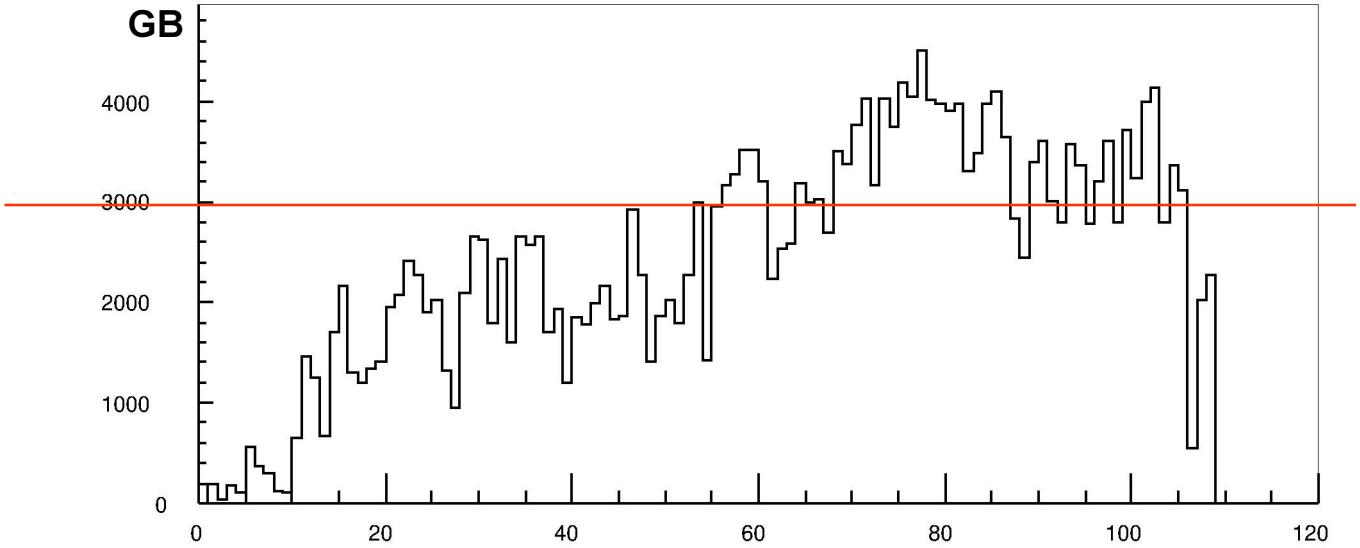


Data servers:
Up to 20 x 500GB

CASTOR:
CERN development of a "infinite file system"
COMPASS is the first experiment which uses CASTOR heavily

Central Data Recording

Design value (35MB/s)

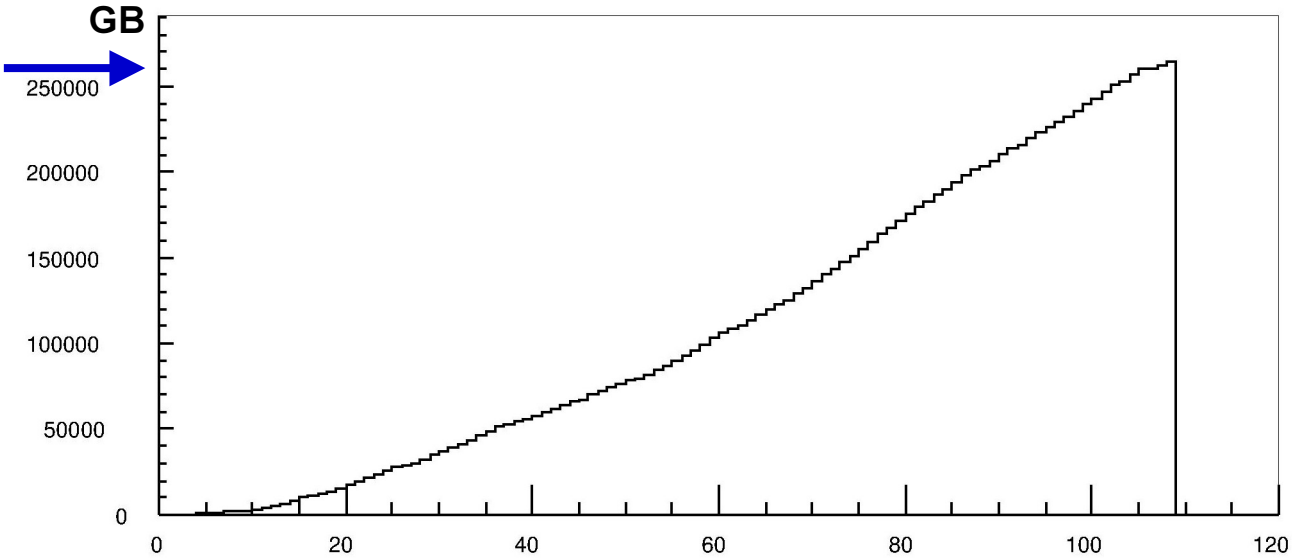


260 TByte in ~100 days

Compare to BaBar:

1TByte/day

662 TByte in 1999-2002



May 27 **Sep 18**

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^0 and 3800 D* inside cuts @ 100% reconstruction efficiency

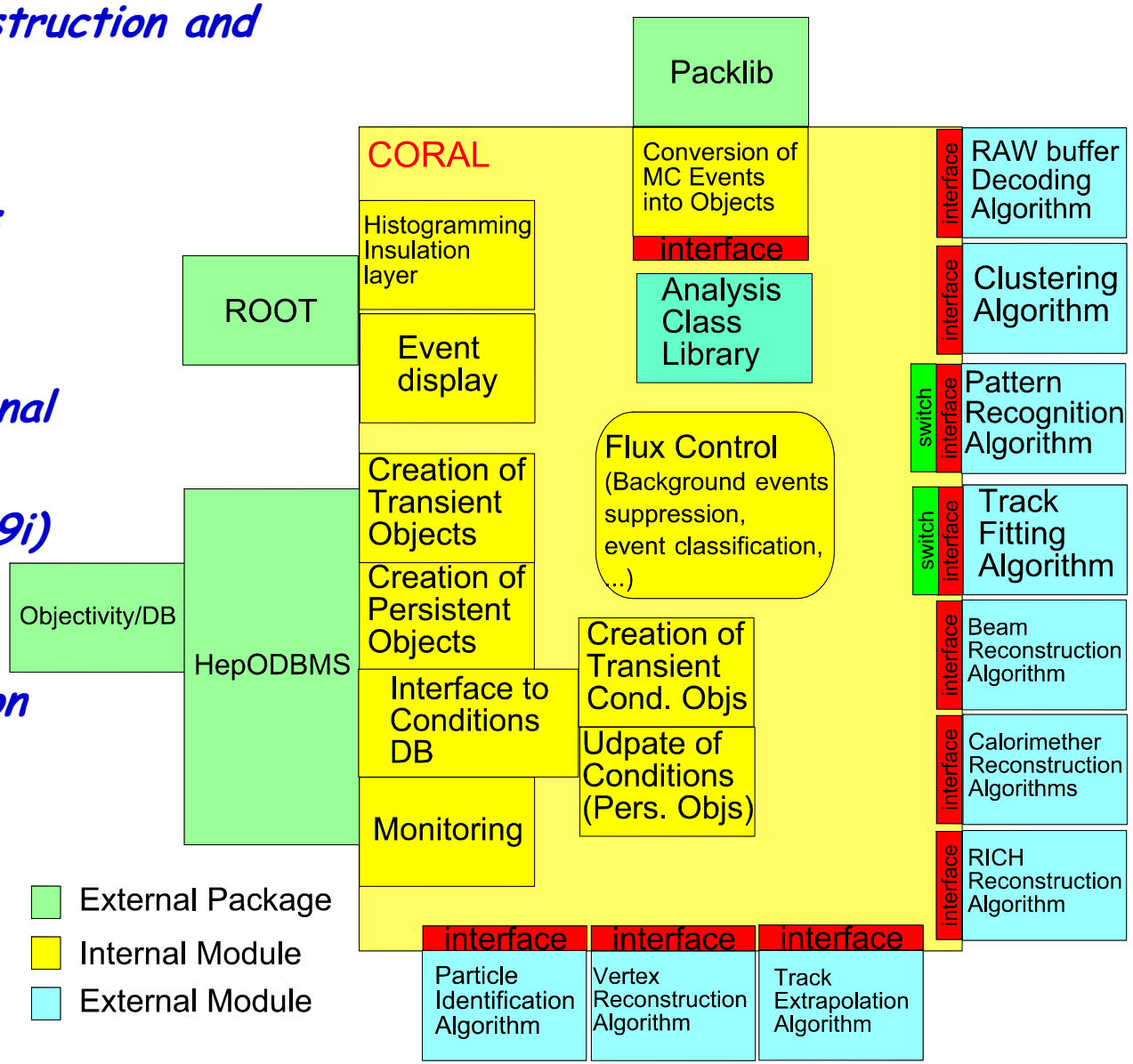
Reconstruction:

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

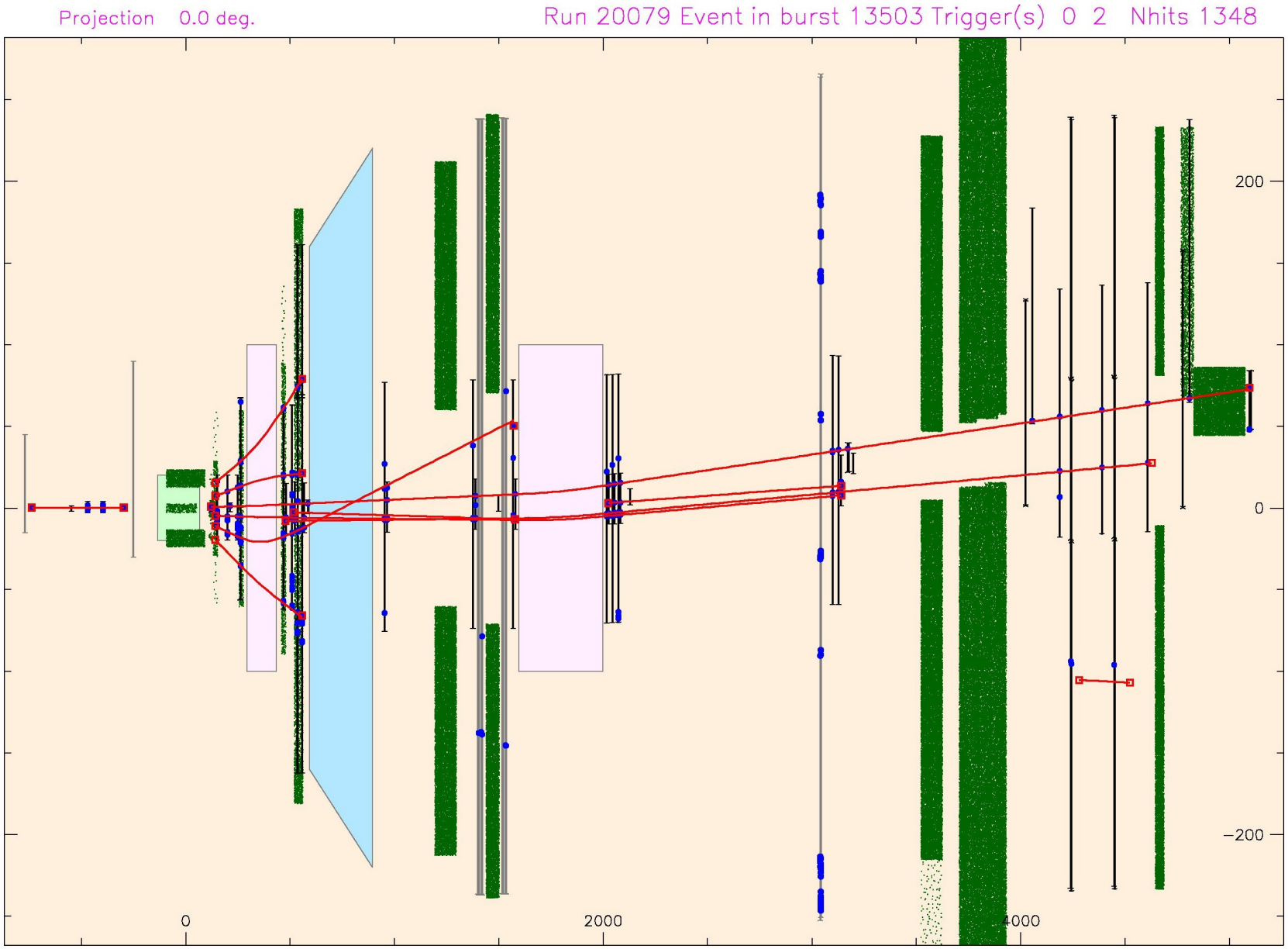
CORAL - our Reconstruction Code

= 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



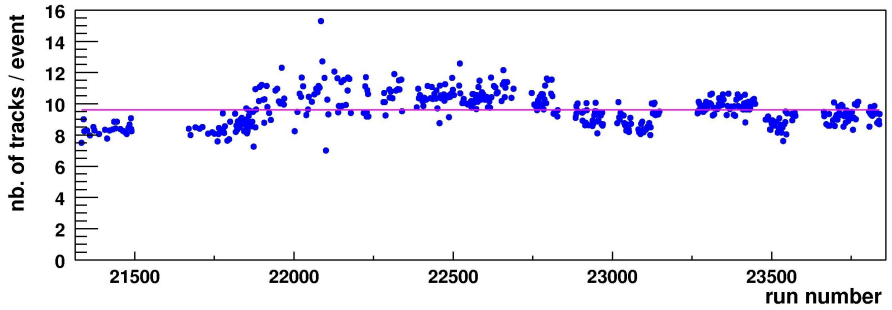
And that is what comes out: The typical event



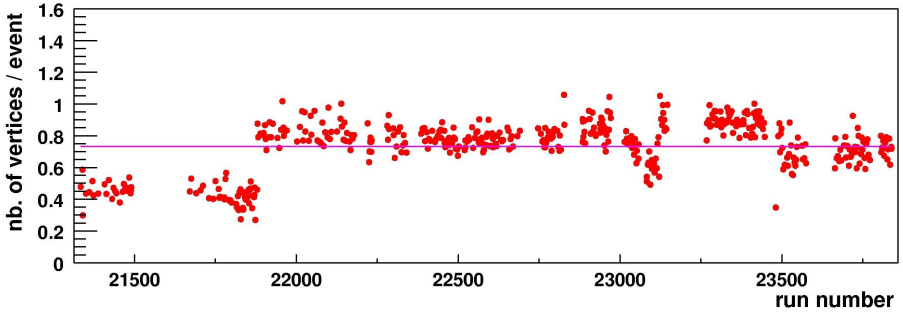
Quasi-Online Data Quality Check

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

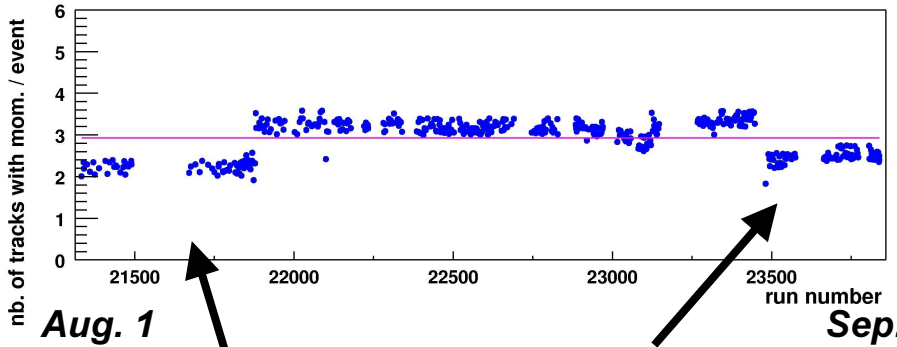
Number of tracks vs. run number



Number of vertex vs. run number

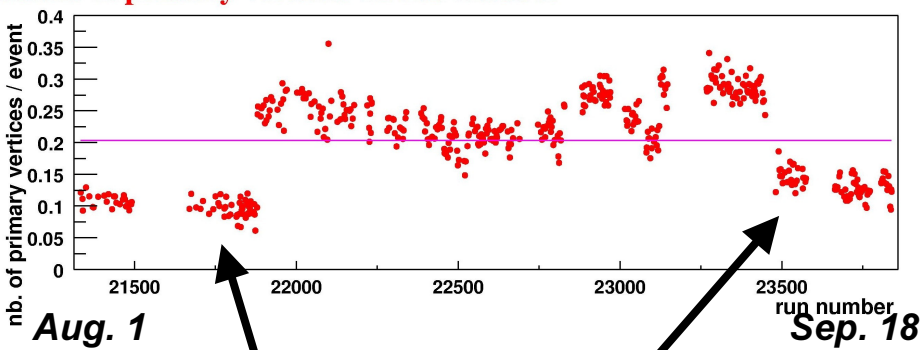


Number of tracks with mom. vs. run number



Transverse target polarization

Number of primary vertices vs. run number



Transverse target polarization

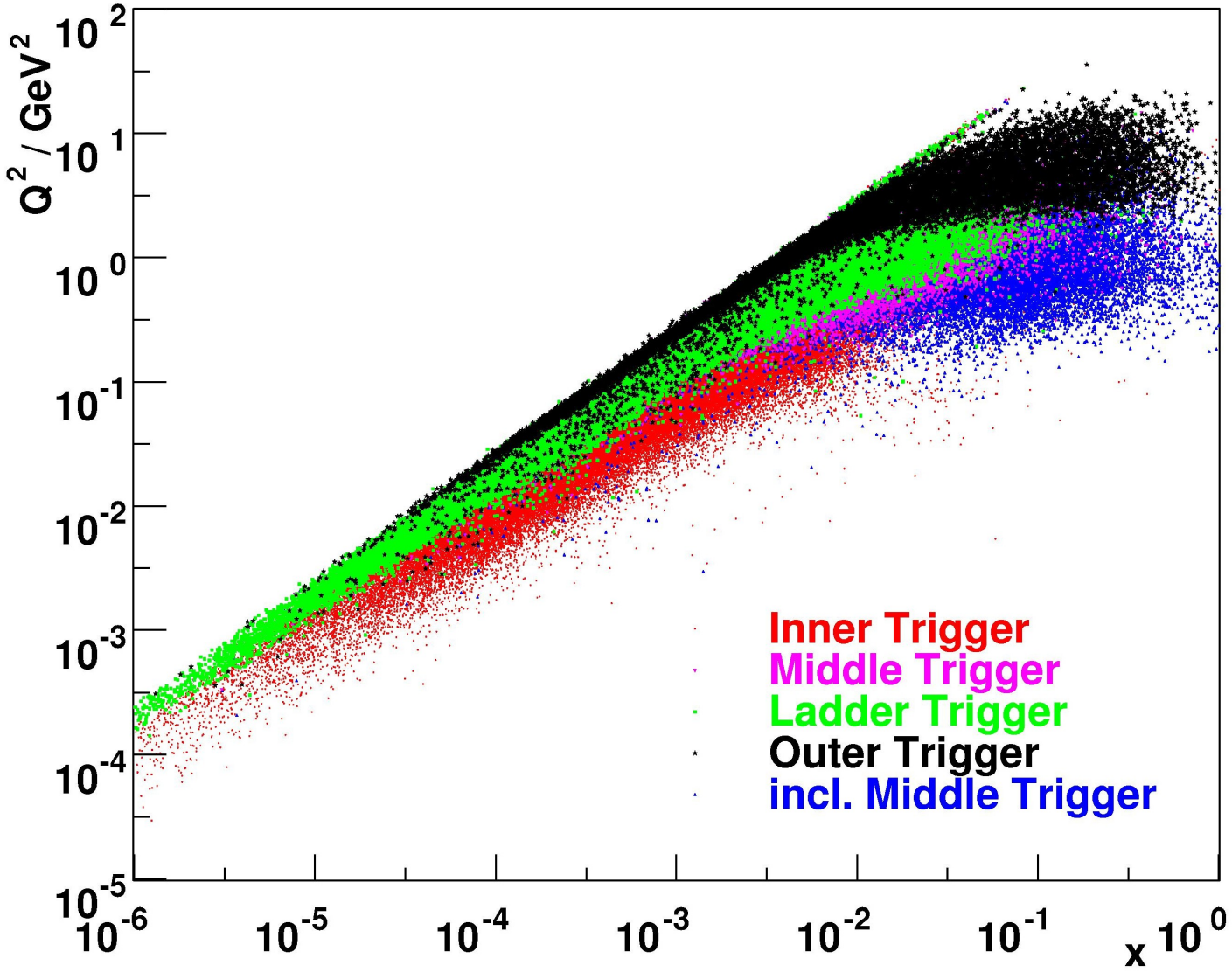
Alignment Runs 2002

Run #	FI01	FI02	FI03	FI04	FI05	FI06	FI07	FI08	FI15	SI01	SI02	DC01	DC02	DC03	MMO1	MM02	MM03	GM01	GM02	GM03	GM04	GM05	GM06	GM07	GM08	GM09	GM10	PS	PA01	PA02	PA03	PA04	PA05	PA06	PA11	PB01	PB02	PB03	ST03	ST04	DW01	DW02	MA01	MA02	MB01	MB02	COMMENTS
19076	al	al	al	al	al	al	al	al	al	nw	al	np	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	na	na	na	na	na	na	SI01 noisy
19079	al	al	al	al	al	al	al	al	al	nw	al	np	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	na	na	na	na	na	na	SI01 noisy
19597	al	al	al	al	al	al	al	al	al	nw	al	np	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	na	na	na	na	na	na	SI01 noisy
20072	al	al	al	al	al	al	al	al	al	al	al	nw	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	nw	np	na	na	na	na	na	na	DC01,ST03 noisy
20474	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	np	na	na	na	na	na	na	
20816	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	nw	np	na	na	na	na	na	na	ST03 noisy
21287	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	na	na	na	na	na	na	na	
21350	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	na	na	na	na	na	na	na	transverse
21774	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	na	na	nw	nw	MB Y missing
22016	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	na	al	al	na	na	na	na	
22377	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	na	al	al	na	na	na	na	
22751	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	na	na	nw	nw	MB Y missing
23513	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	na	na	na	na	na	na	na	
23597	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	al	na	na	na	na	na	na	na	

- Stations aligned
- Stations partially aligned (specific detector problems)
- Stations not fully aligned
- Stations not on the floor

Kinematic Range accessible with the Present Setup

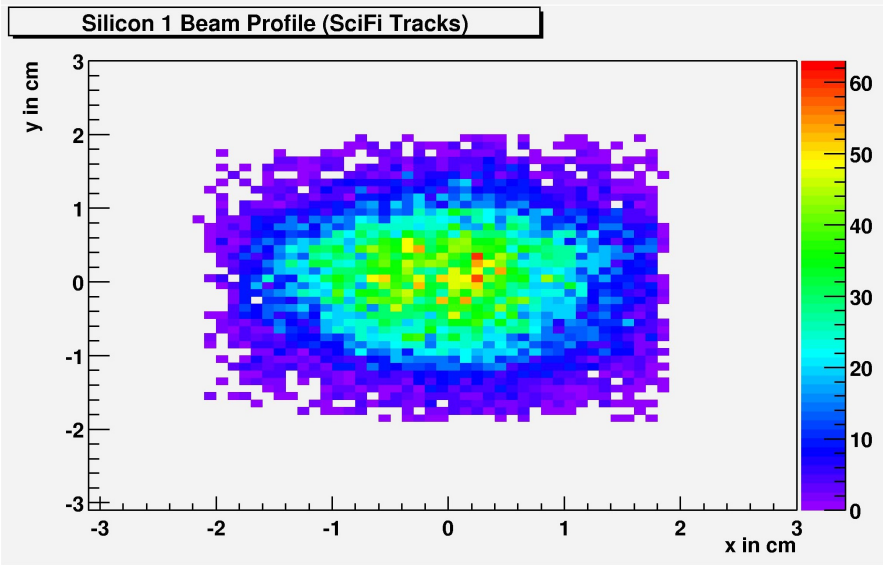
Wide dynamic range

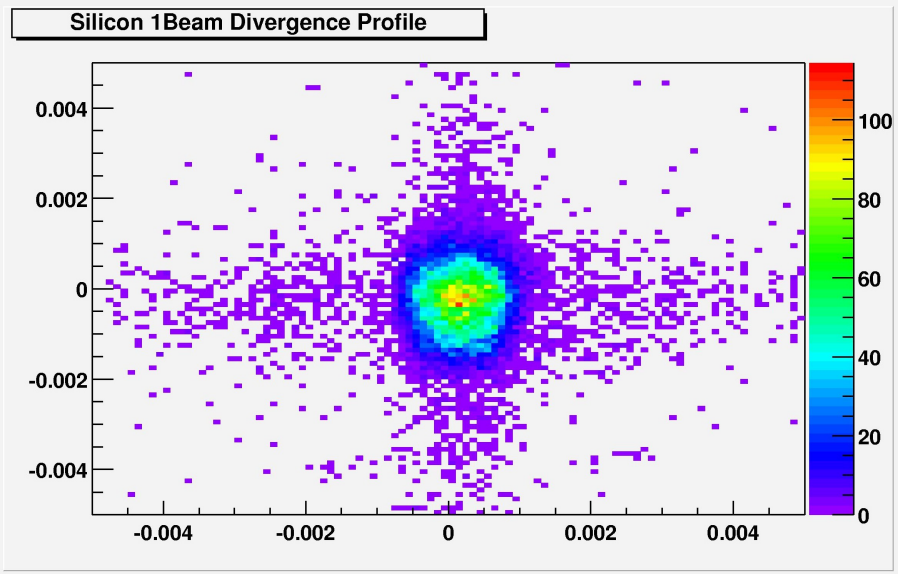


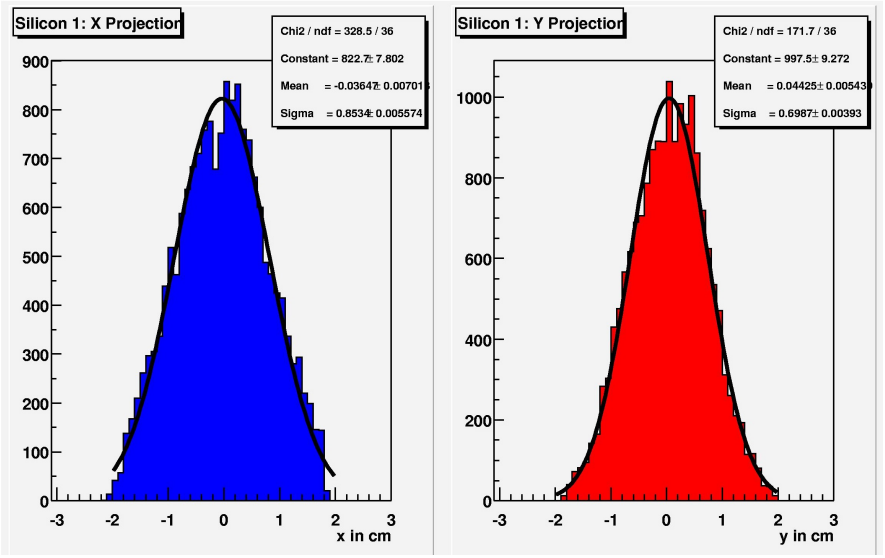
Access to:

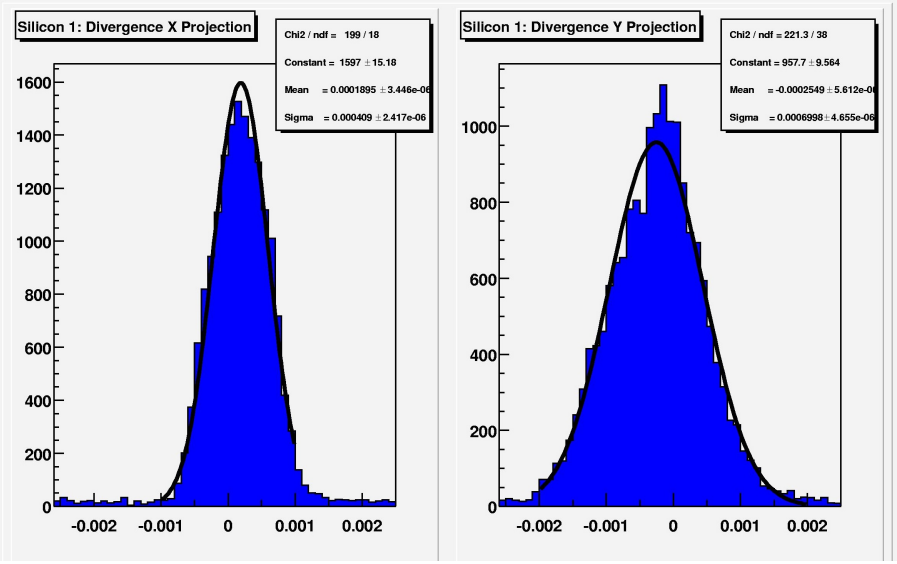
- *very low Q^2*
- *small x*

Beam Reconstruction





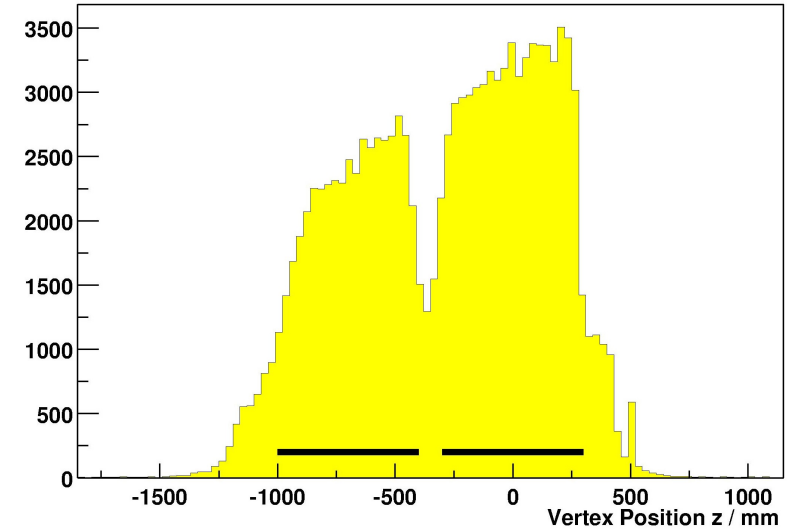




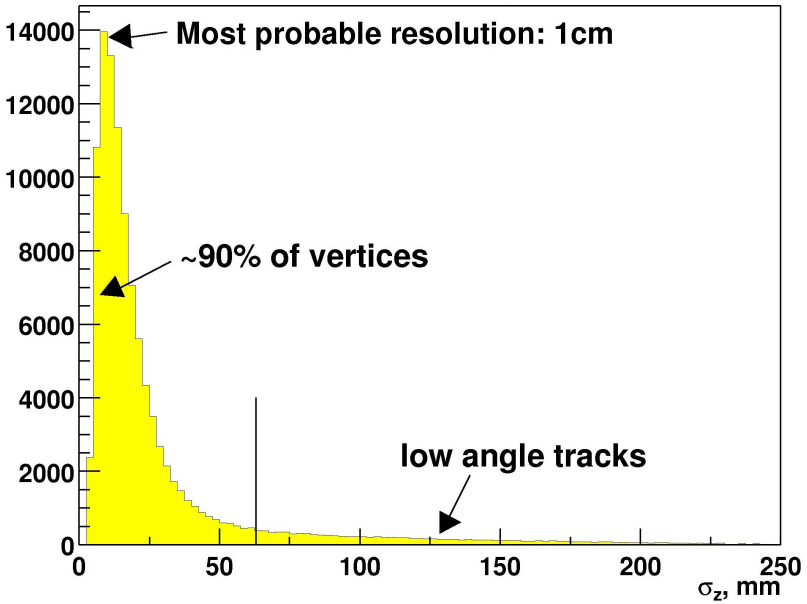
Presently: Beam reconstruction 52%, still room for improvement

Vertex Reconstruction

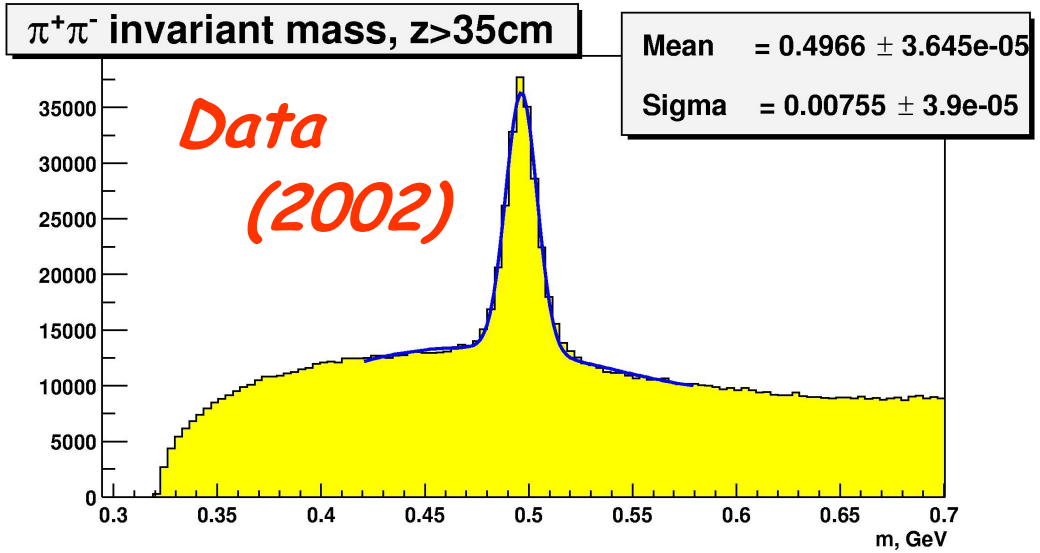
Vertex distribution along Z, $N_{trk}>2$



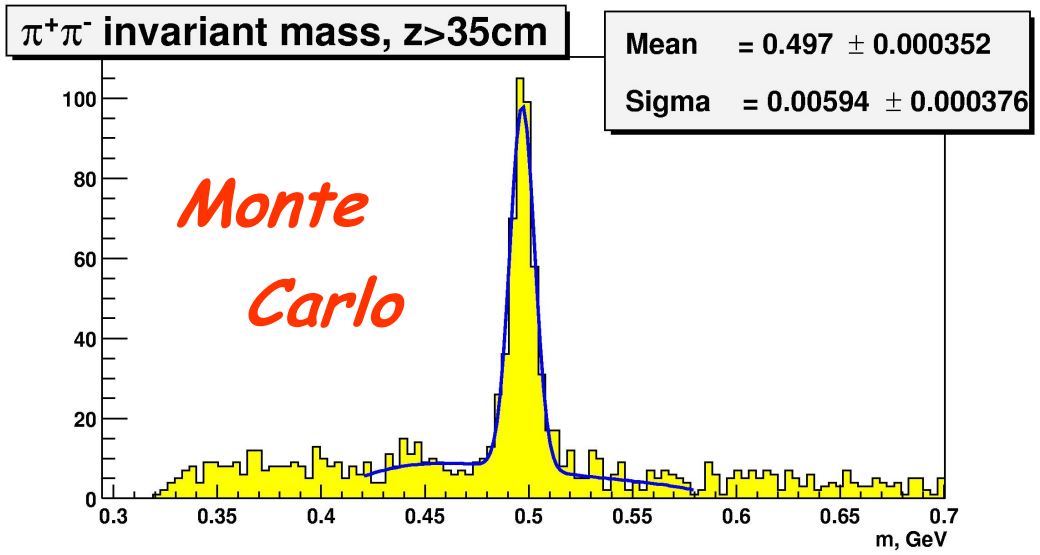
Vertex Resolution along Z, N(trk)>2



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



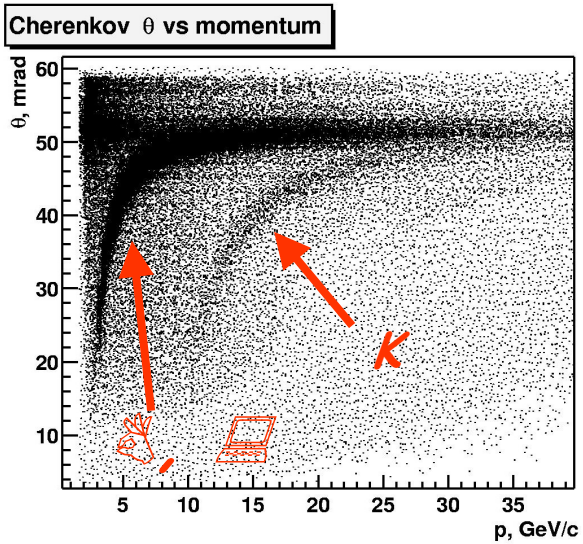
$\pi^+\pi^-$ invariant mass, z>35cm

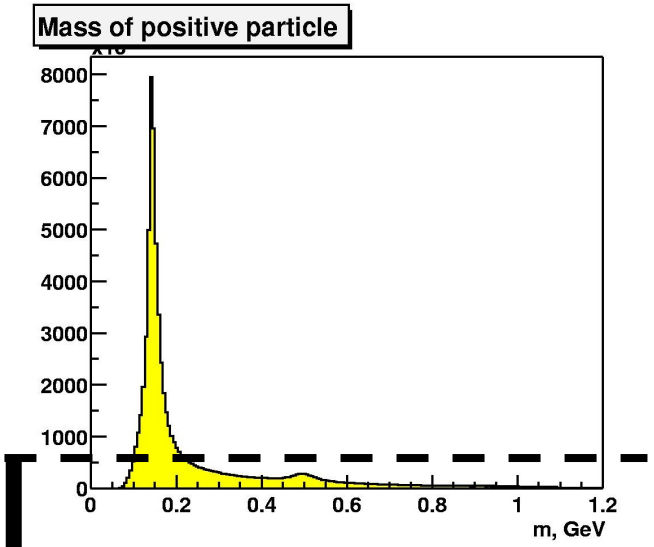


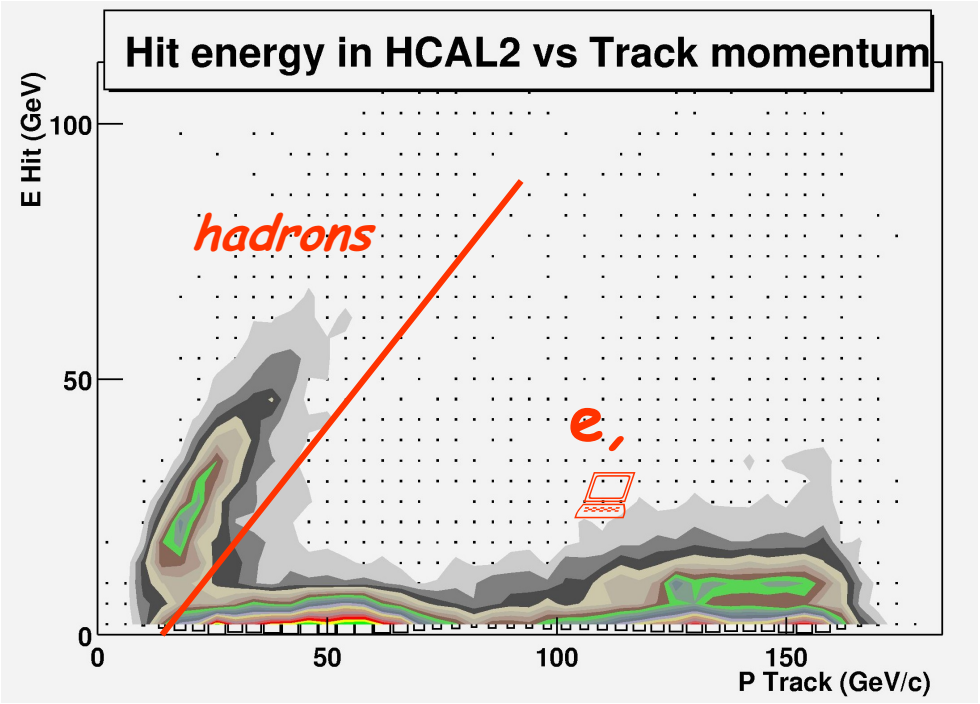
Hadron Identification

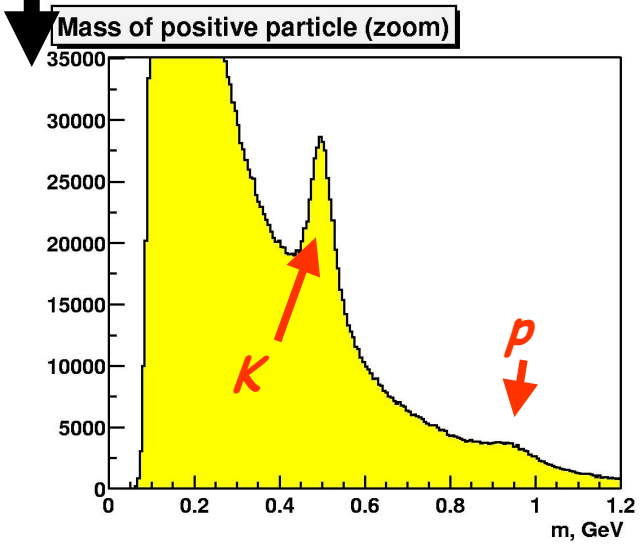
By the RICH…

…and by hadronic sampling calorimeters









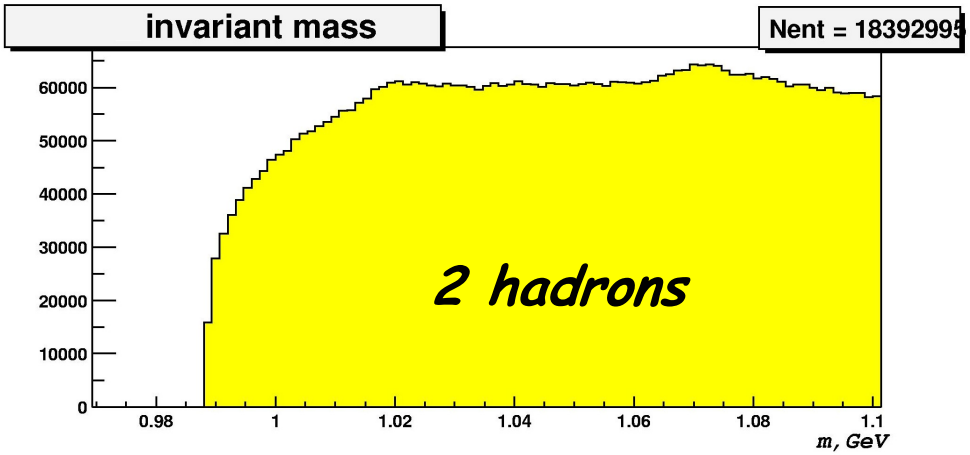
Hadron reconstruction without and with RICH

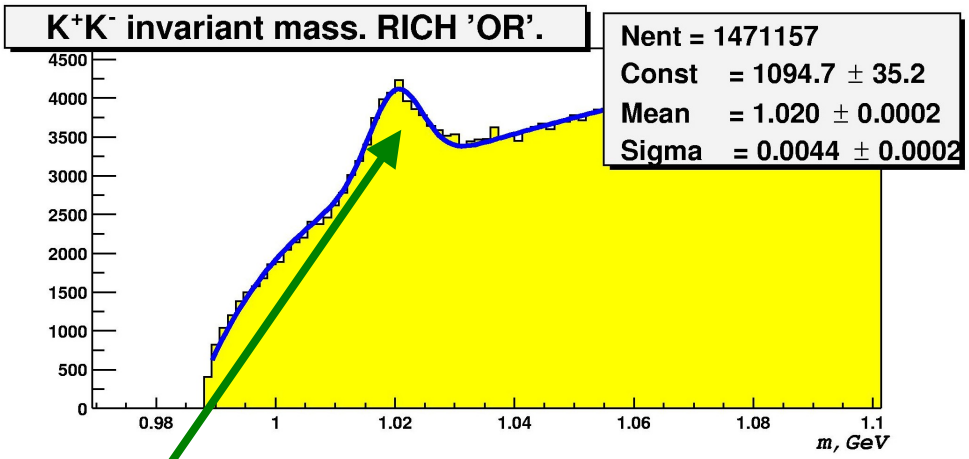
Decay: ☠ → K^+ K^-

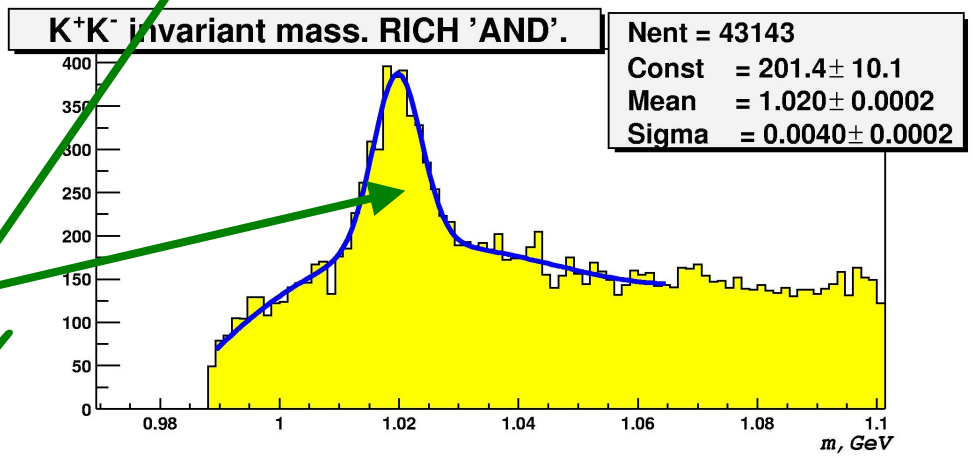
one or two Kaons identified in RICH

both Kaons identified in RICH

→ Kaon identification efficiency from ☠-decay ~35%



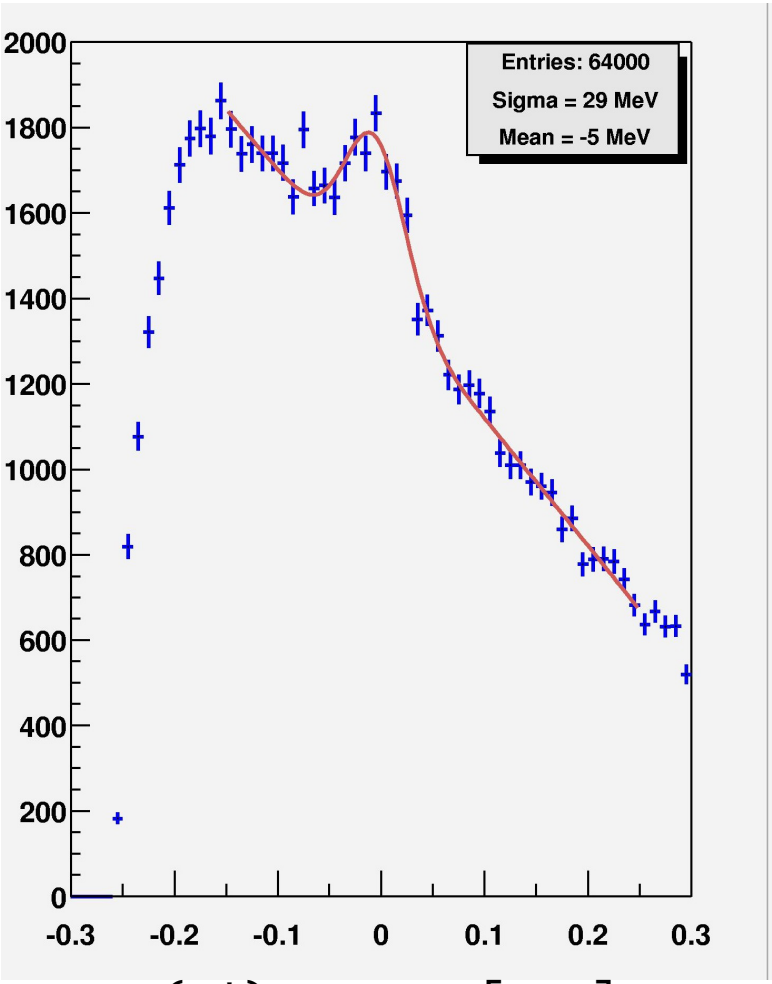


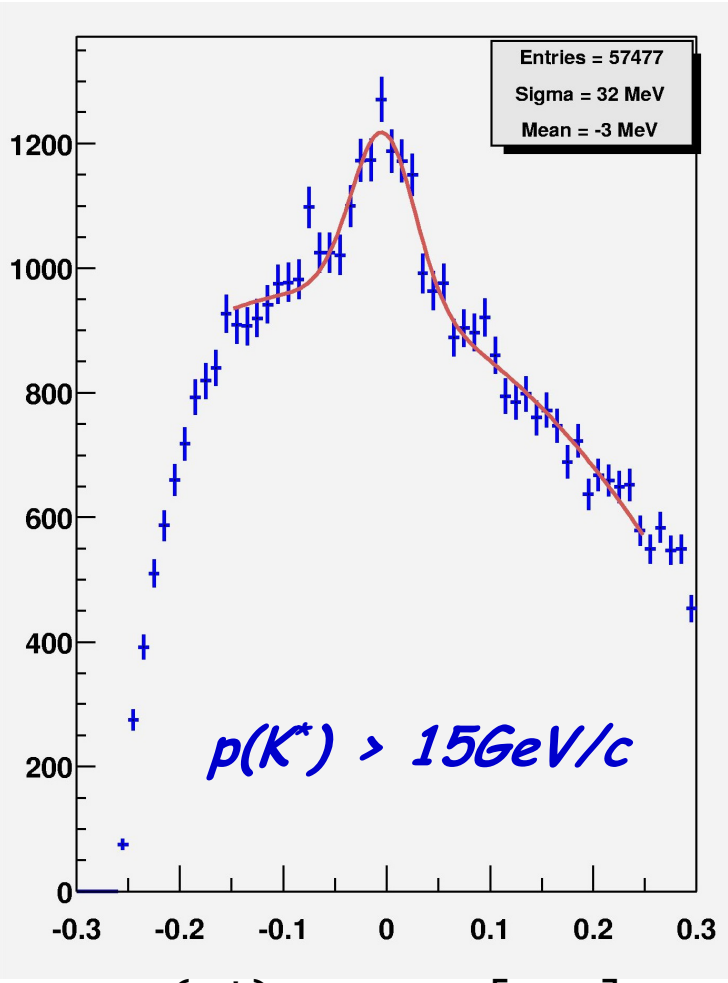


K*(892)

$K^* \rightarrow K^0\pi$

$\rightarrow \pi^+\pi^-\pi$





COMPASS: N(K*+) > N(K*-)

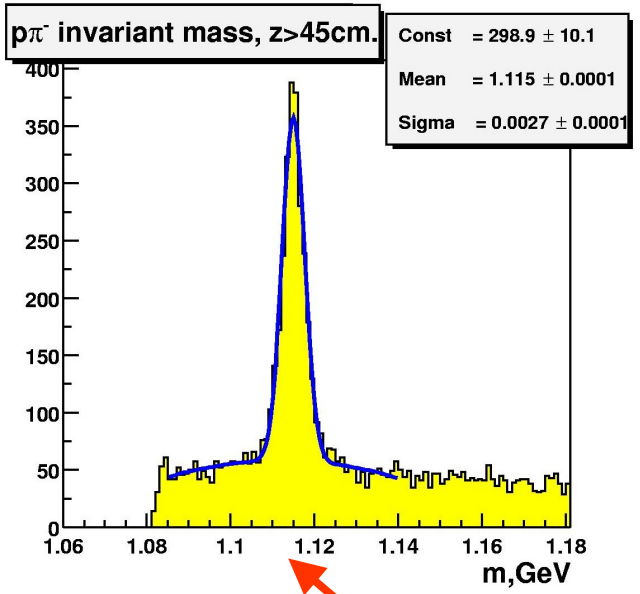
Reconstruction of $\tilde{}$ and $\bar{\tilde{}}$

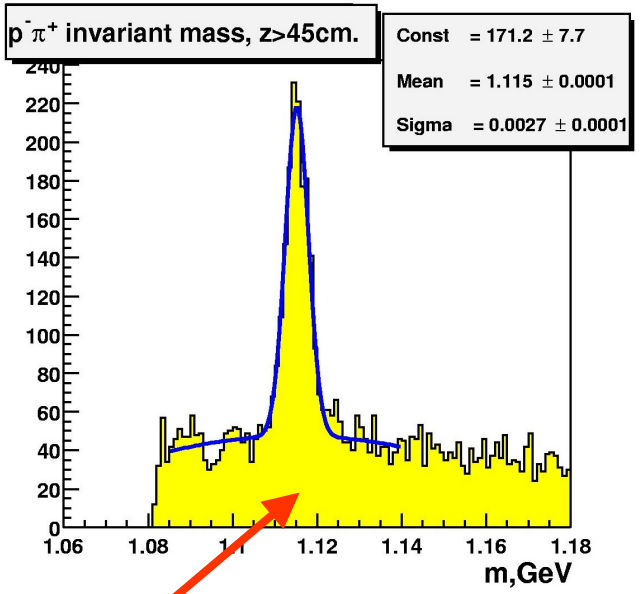
expected from 2002 run:

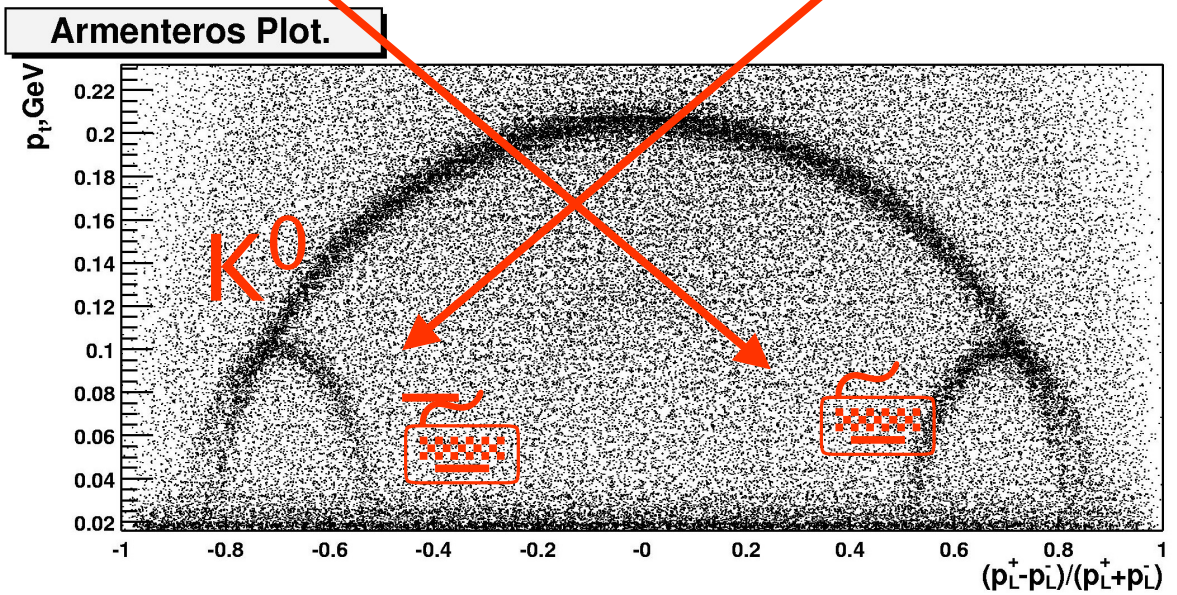
$\tilde{}$: 58k

$Q^2>1$: 46k

$\bar{\tilde{}}$ ~ 0.5

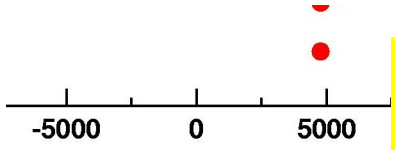






Outlook

- 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



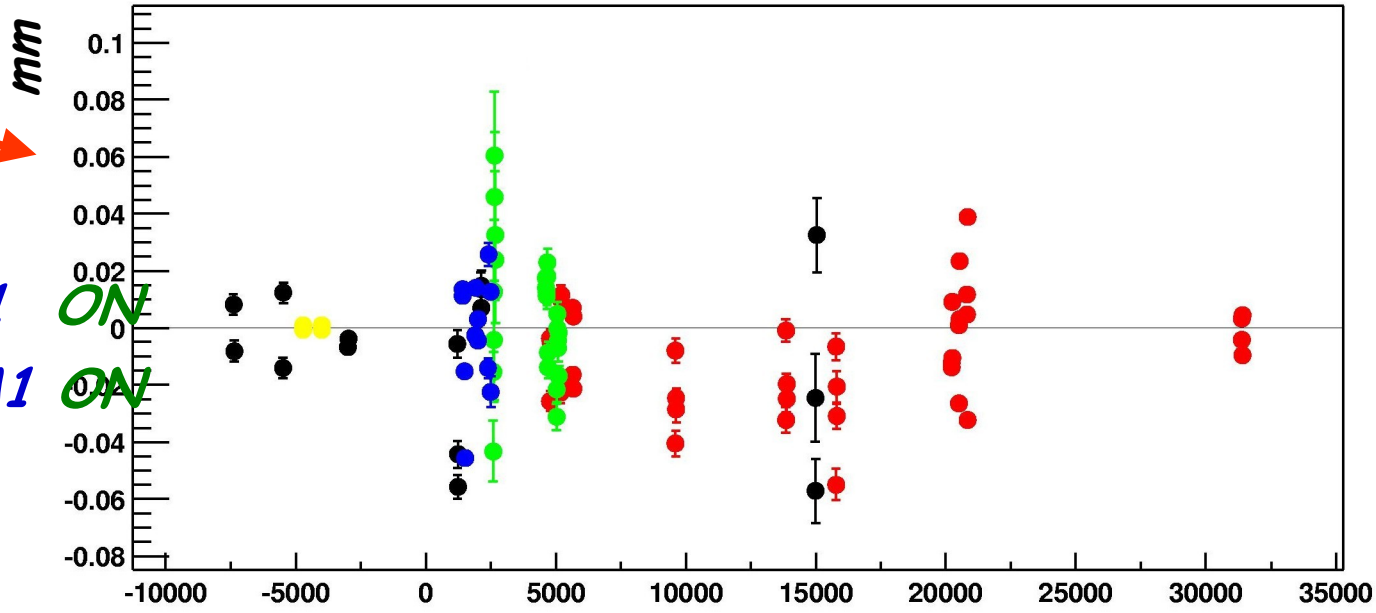
Alignment

mm

Alignment with SM1 OFF

Data displayed: SM1 ON

Scale!!

Alignment with SM1 ON

Data displayed: SM1 ON