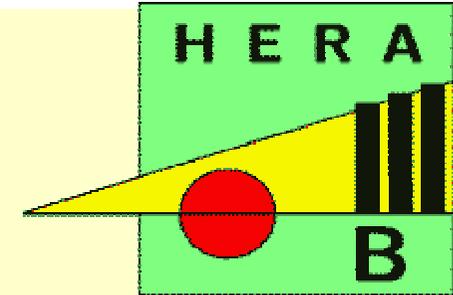


HERA-B Status Report

November 1999

B. Schmidt

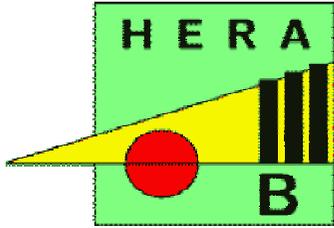
Univ. - Heidelberg



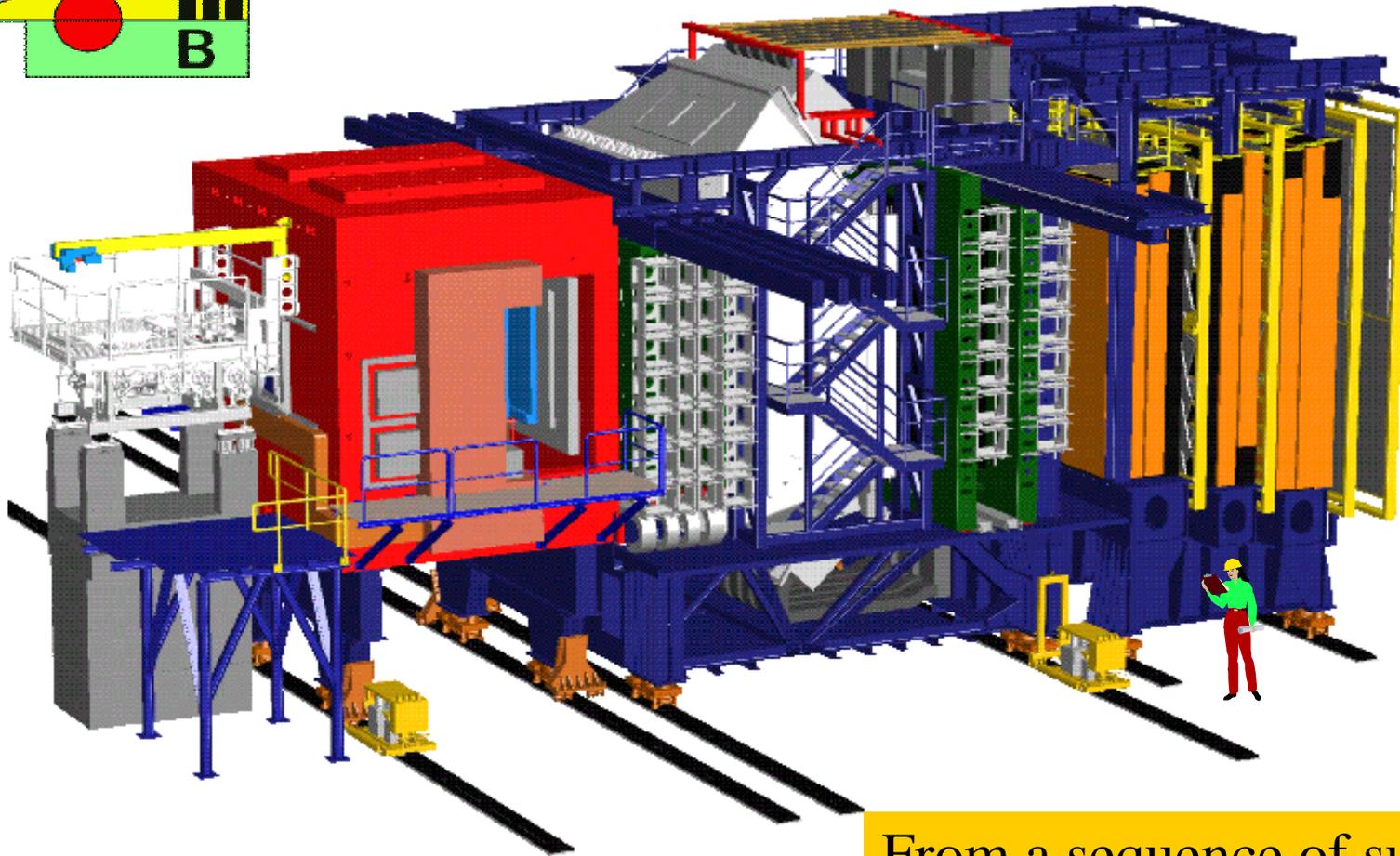
Progress since last PRC

Present Status

Outlook



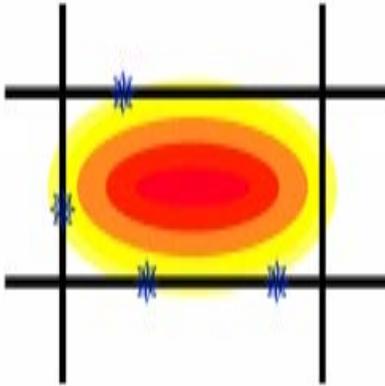
Present Detector Status as to be seen in Hall West



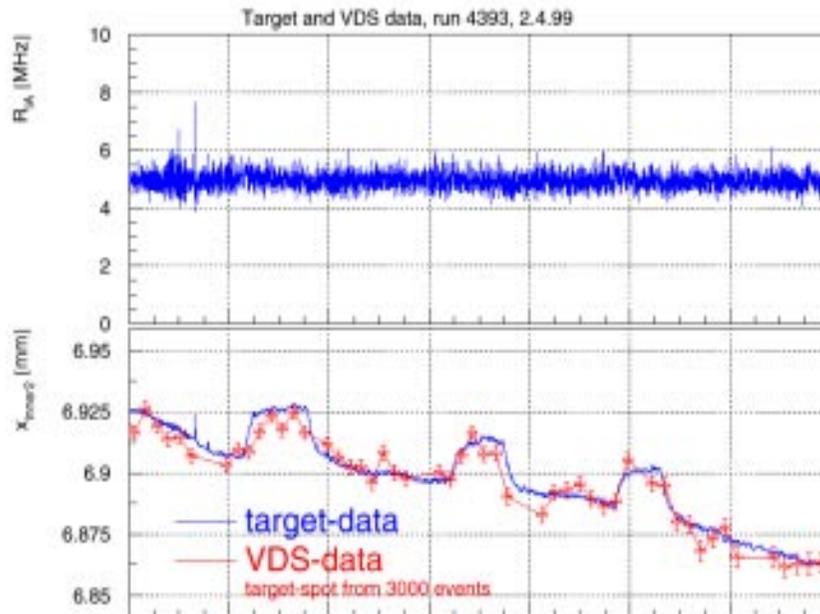
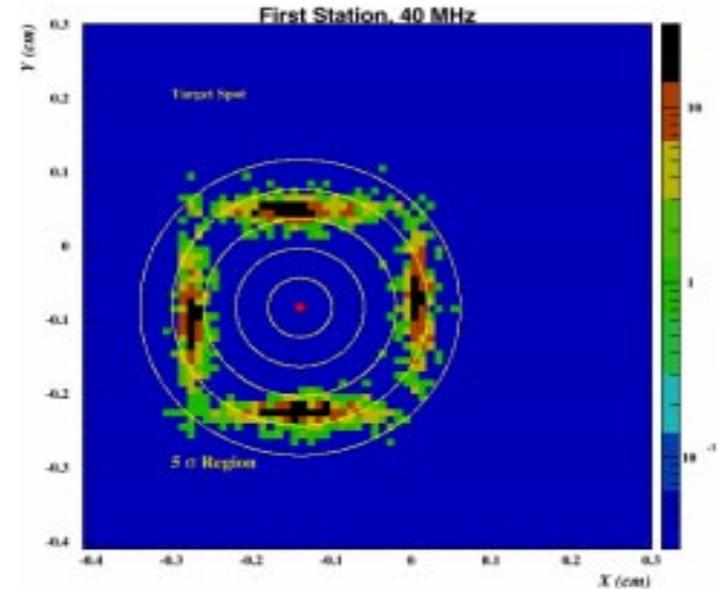
From a sequence of subsystems ..

to an *EXPERIMENT*

The Internal Wire Target



1 - 8 wires
Routinely operated



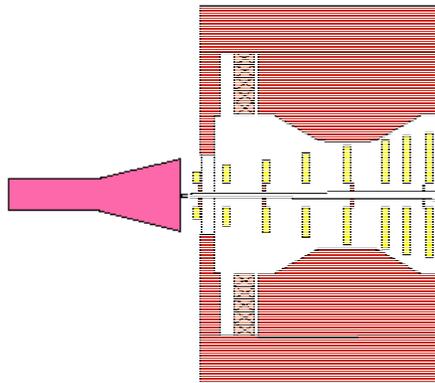
Remaining problems

- ‘coasting beam’ (out of time proton interactions)
- cohabitation with the other HERA experiments (especially ZEUS - LPS)

These issues have become more pressing since HERA-B has moved into its commissioning program

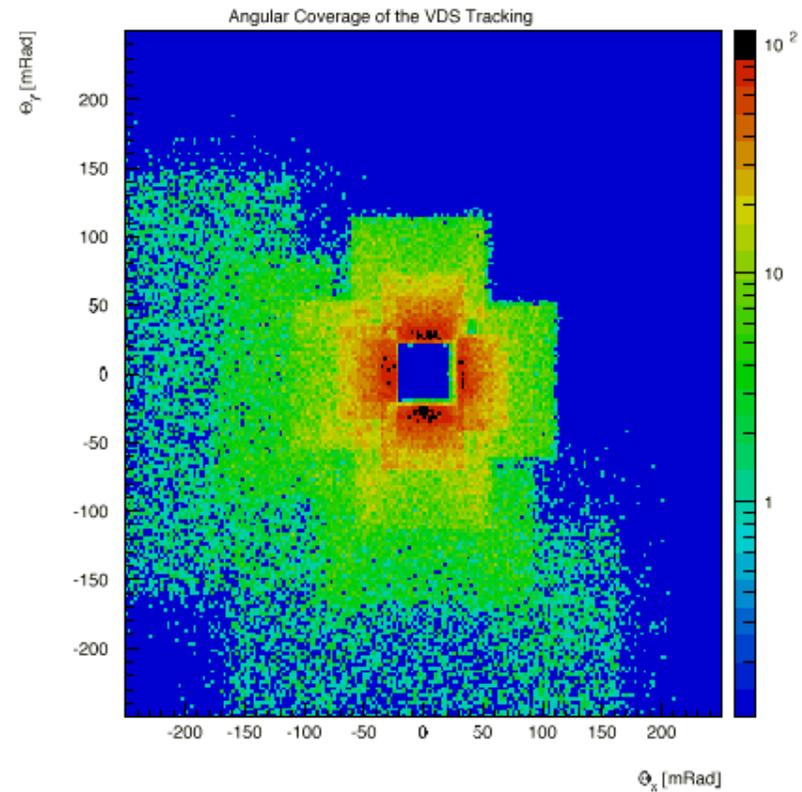
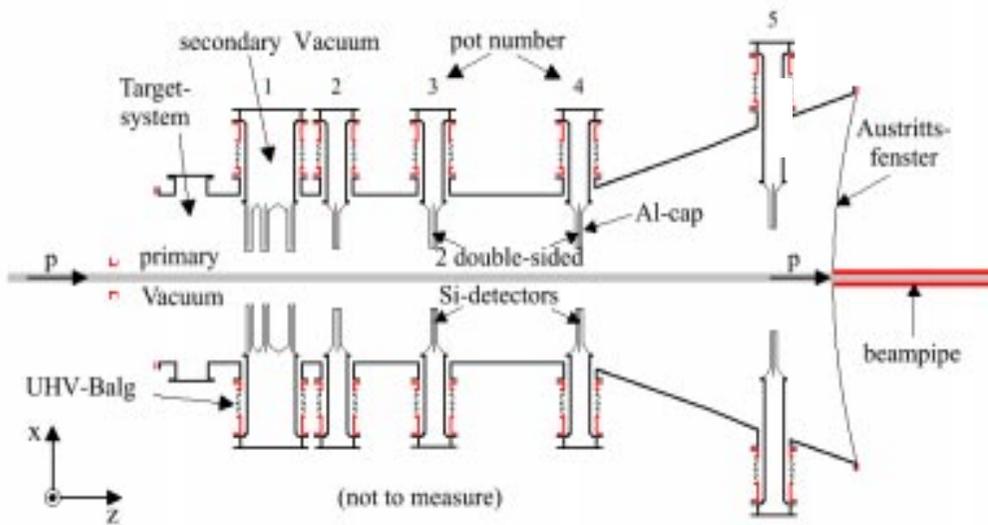
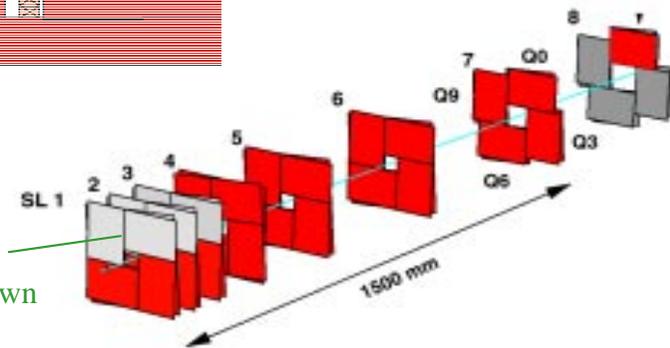
A task force has been reestablished to address these issues

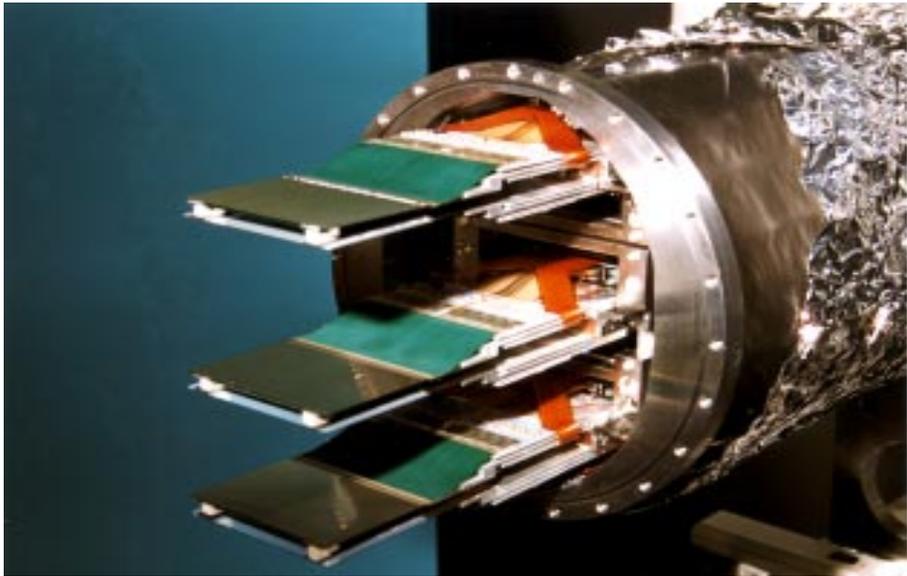
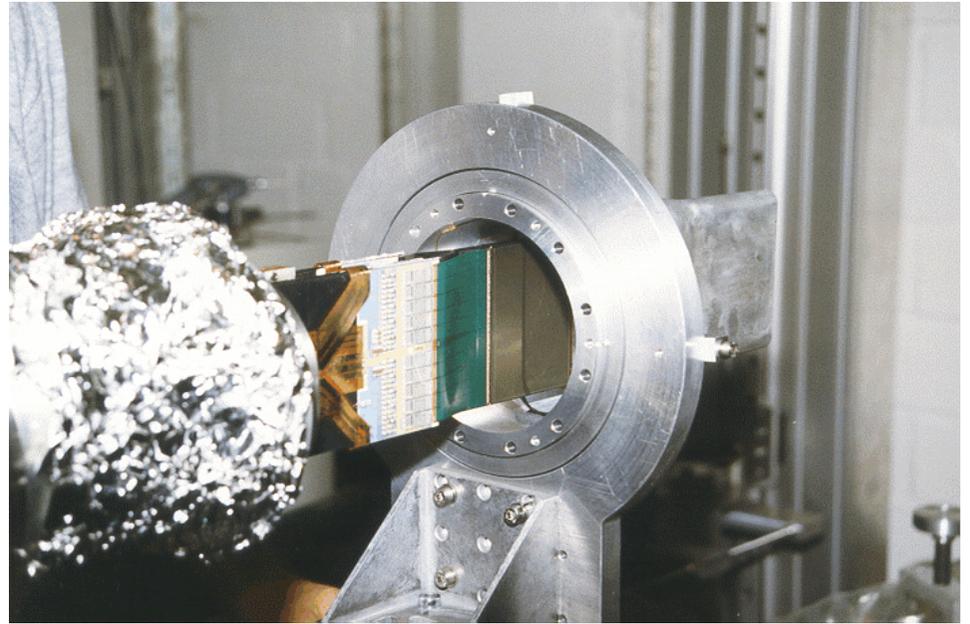
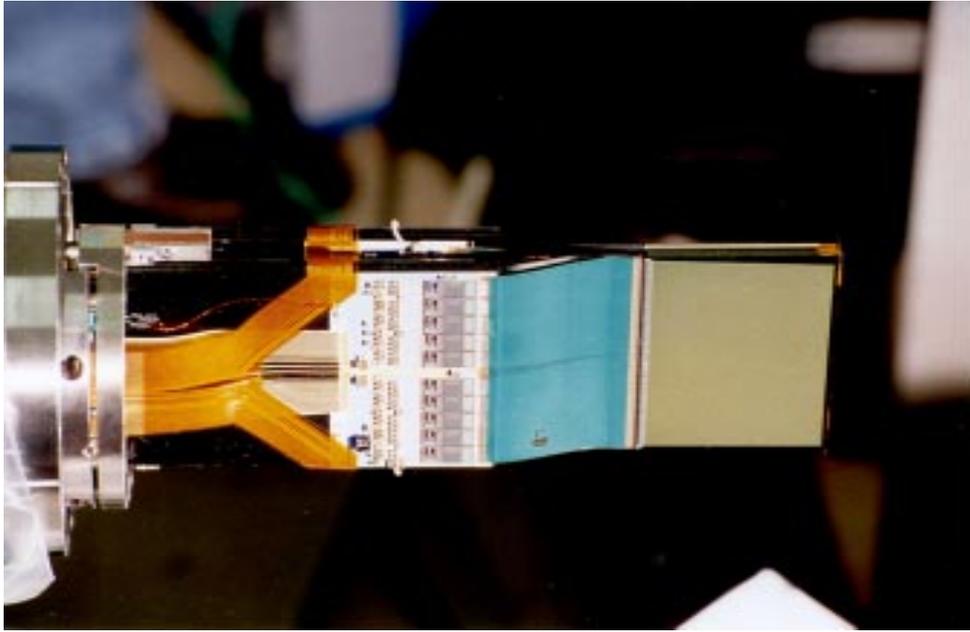
Silicon Vertex Detector



- Essentially **complete**
- excellent performance
- very low noise hit rates

Will come during X-mas shutdown



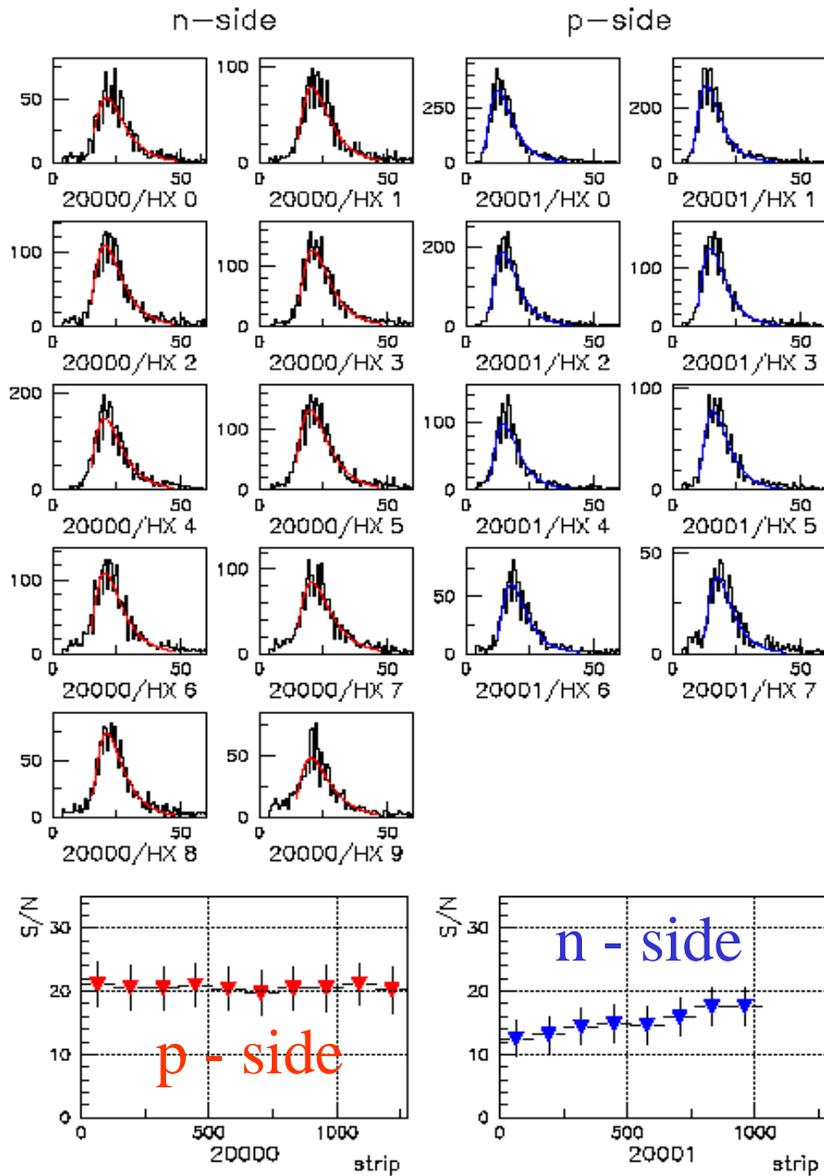


02.12.1999

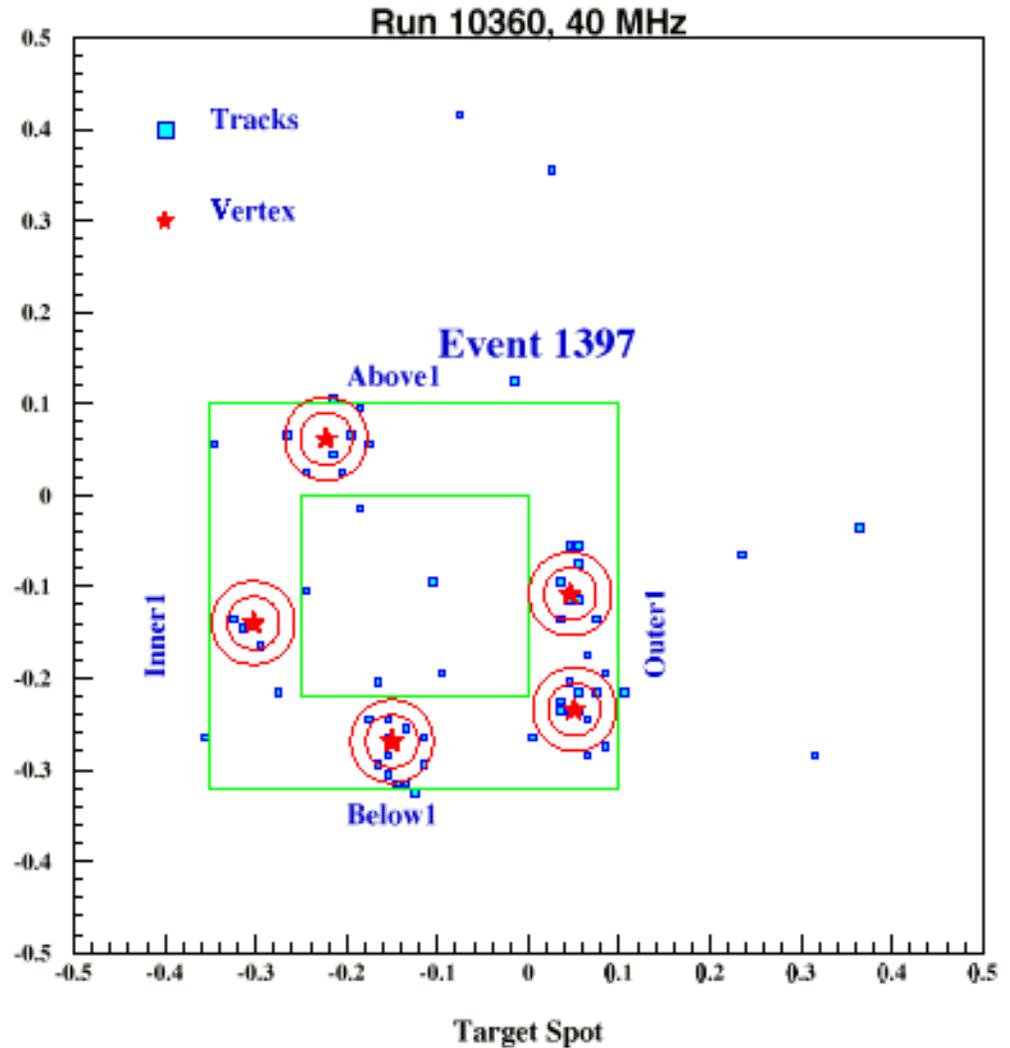
Bernhard Schmidt Talk at the DESY PRC Open Session, 18.11.1999

5

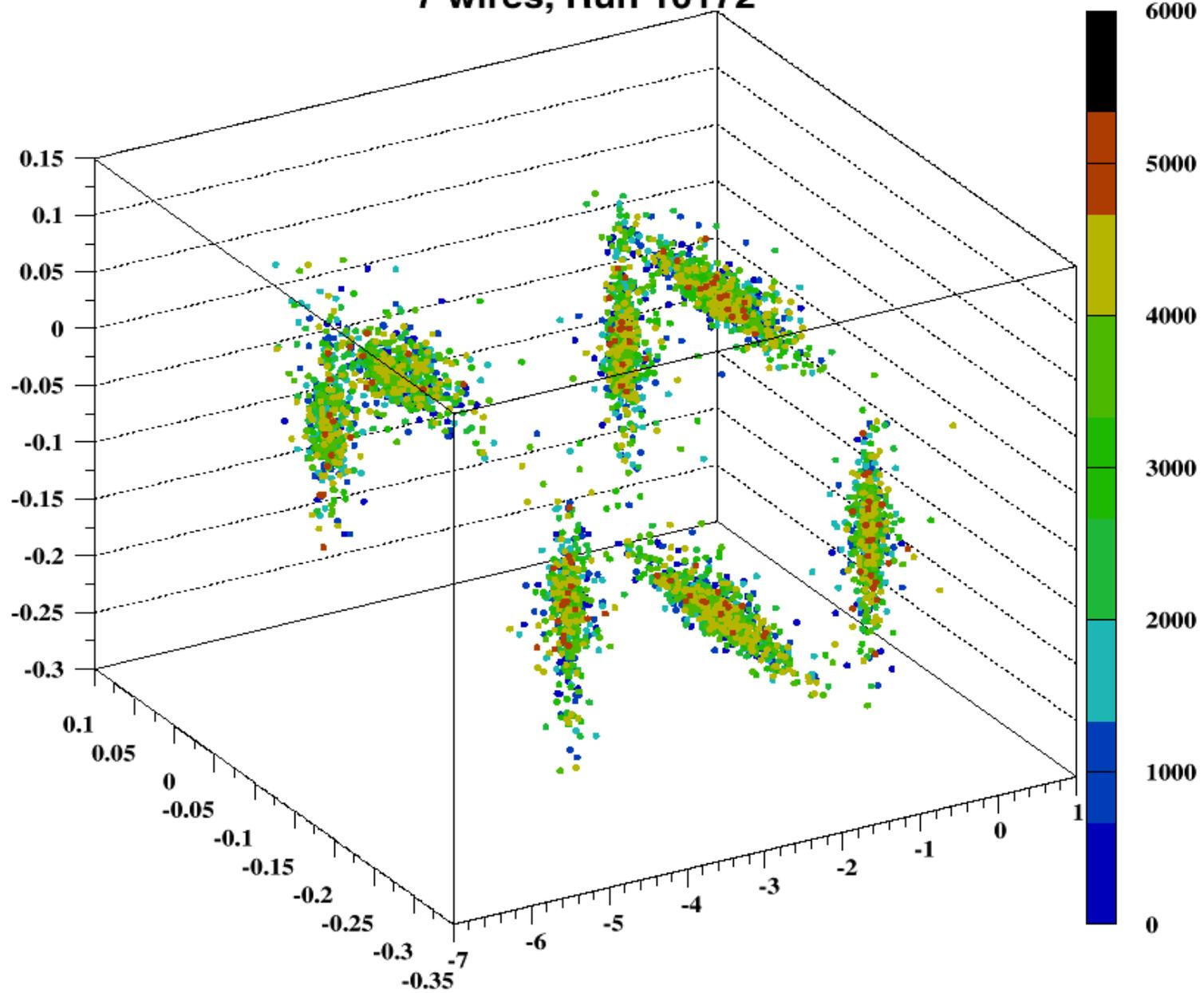
Signal to Noise as f(chip)

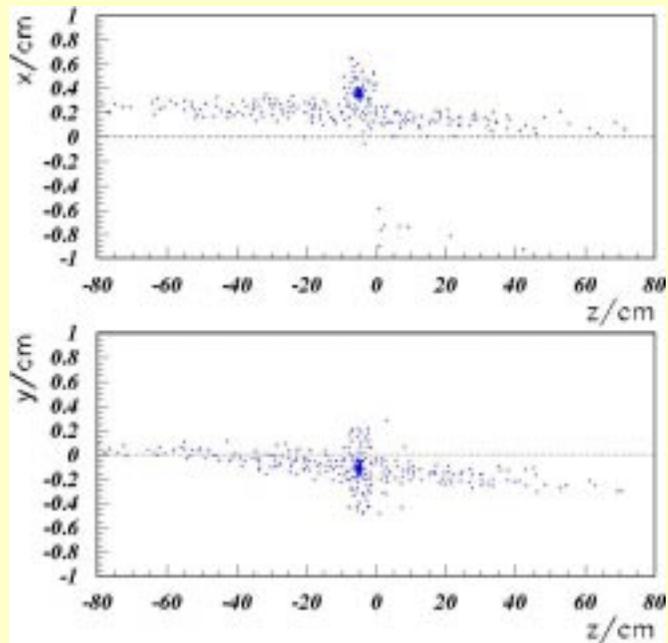


5 vertices in 1 bunch crossing

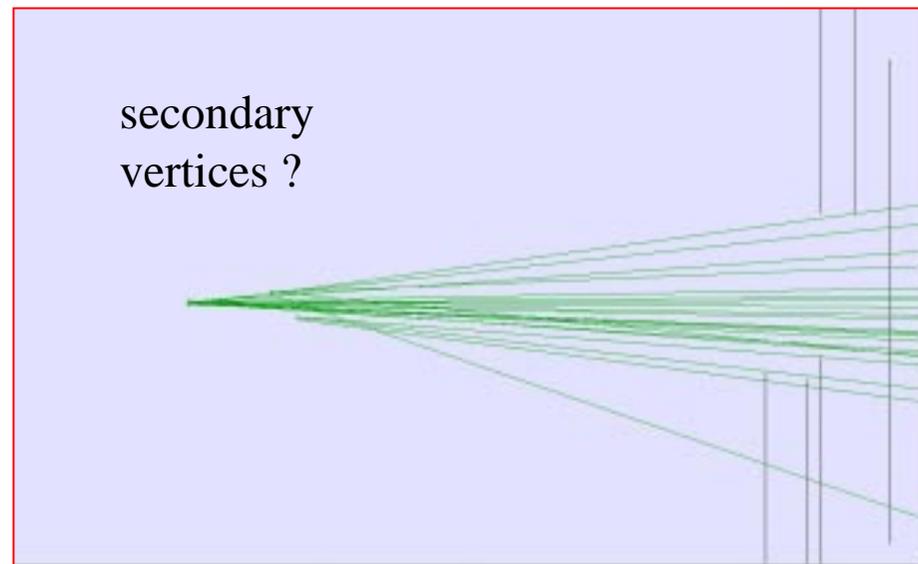
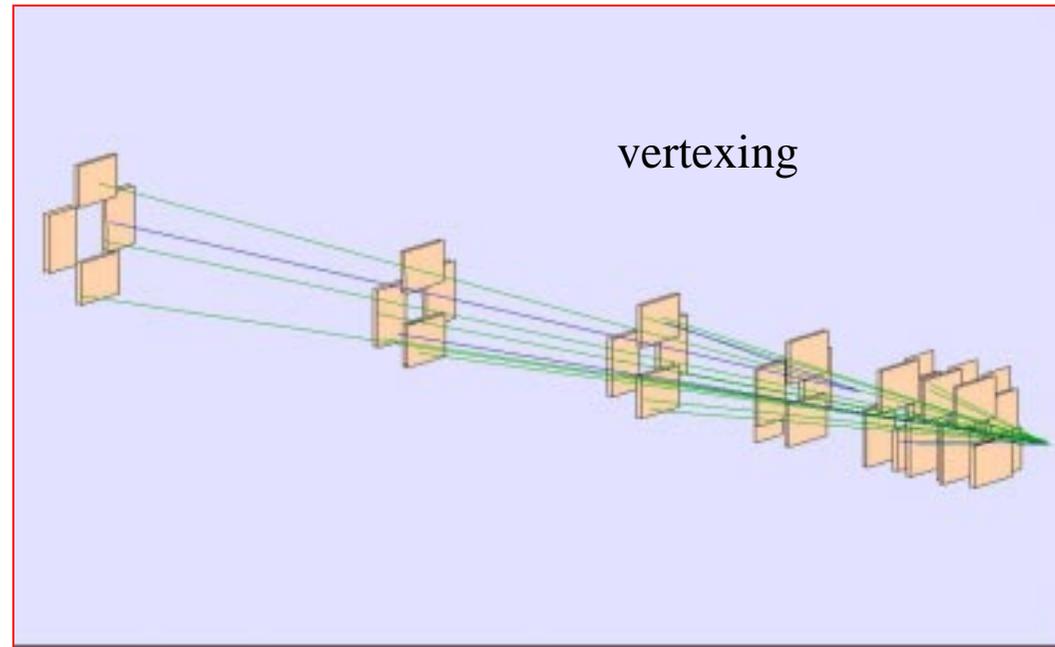


7 wires, Run 10172

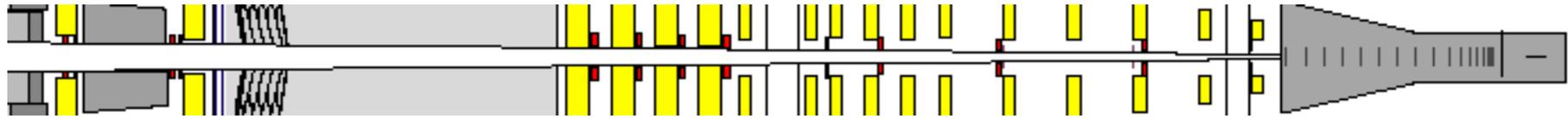




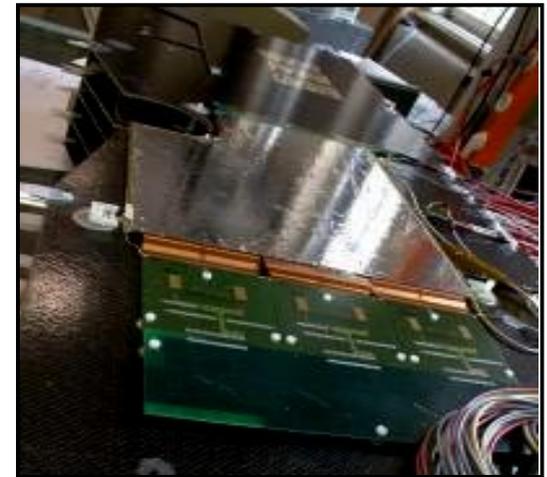
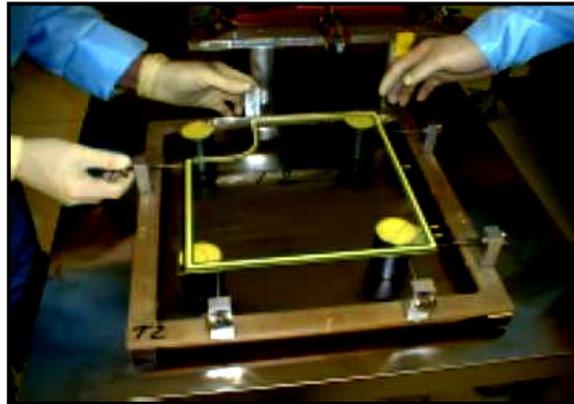
beam gas interactions
seen with the vertex
detector



Inner Tracker (MSGCs)



Mass production **resumed** after substantial delay due to delivery problems (PCBs)



02.12.1999

Bernhard Schmidt Talk at the DESY PRC Open Session, 18.11.1999

Present Status:

- mass production of chambers (almost) **finished**
- **bottleneck** : bonding, assembly of stations
- 6 (16) multilayer quadrants have been installed
- commissioning of chambers has started
- **Plans** : finish installation 9. Feb. 2000

Tight schedule !

Unsolved :

Safe trigger thresholds (ringing) too high
ITR will not contribute to FLT
in 2000 running

→ (36% efficiency loss)



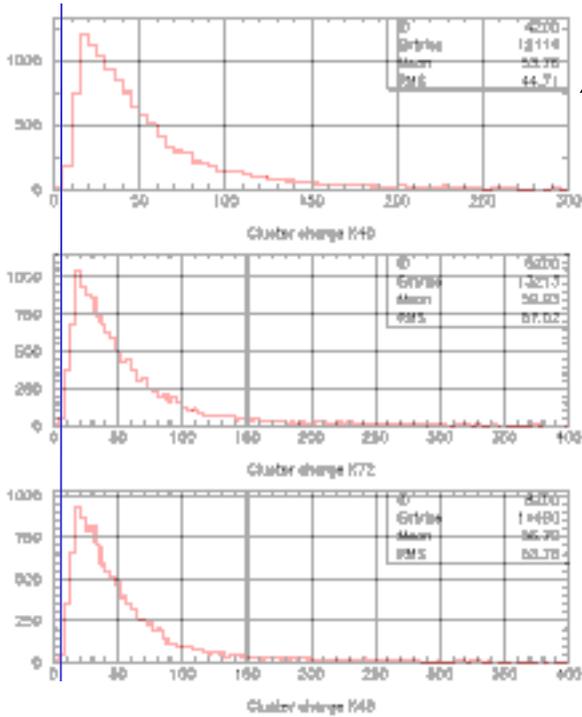
Running and commissioning

- initial loss of several chambers
 - improved HV steering, slow control developed
- some secondary problems after installation
(read out, low voltage, grounding)
 - repair work needed
- data read out though common DAQ established

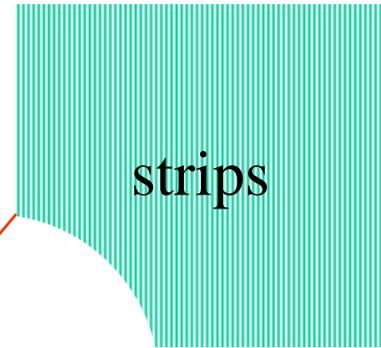
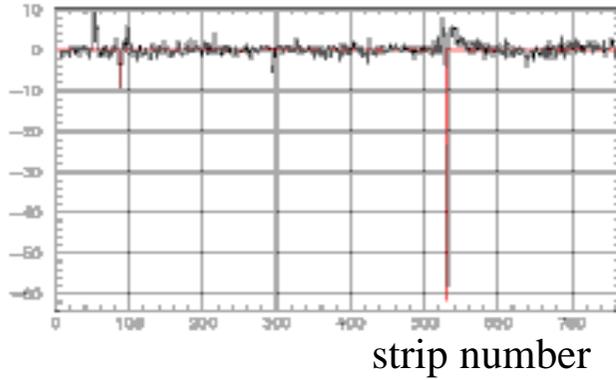
Considerable progress
but ITR is a critical item !

- there are hits..

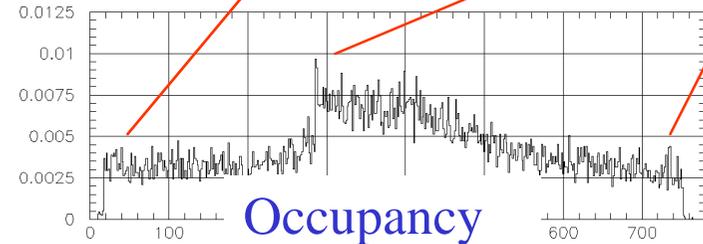
charge distributions
(3 chambers)



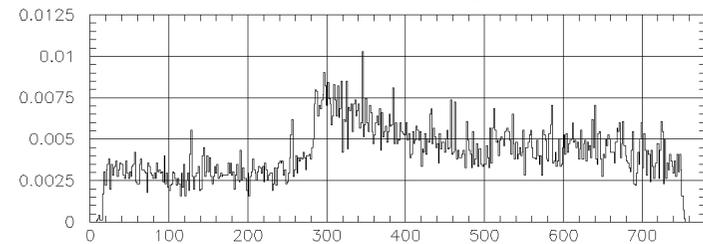
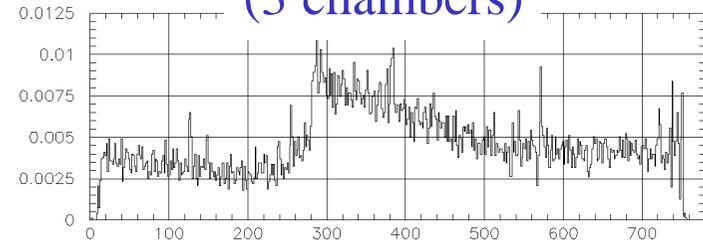
analog data



strips



Occupancy
(3 chambers)

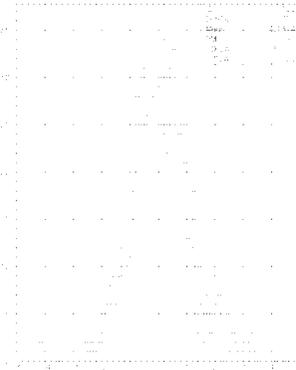


Occupancy Chamber (strip number

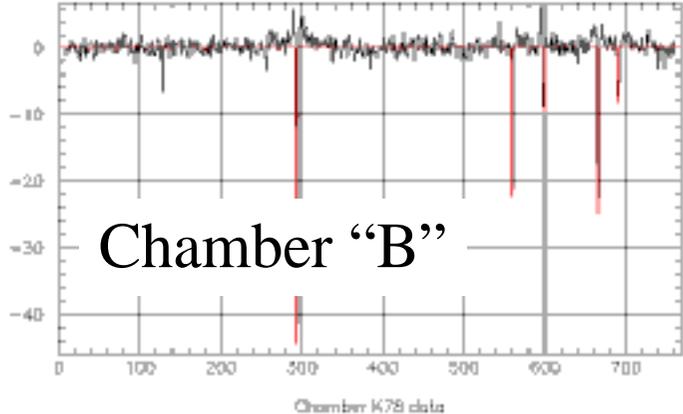
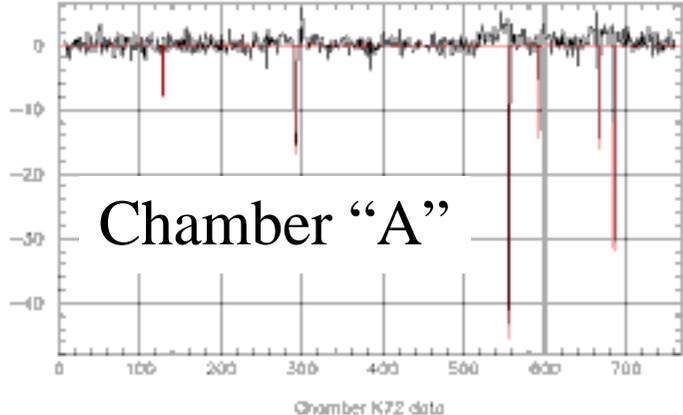
100 000 e⁻

noise
run

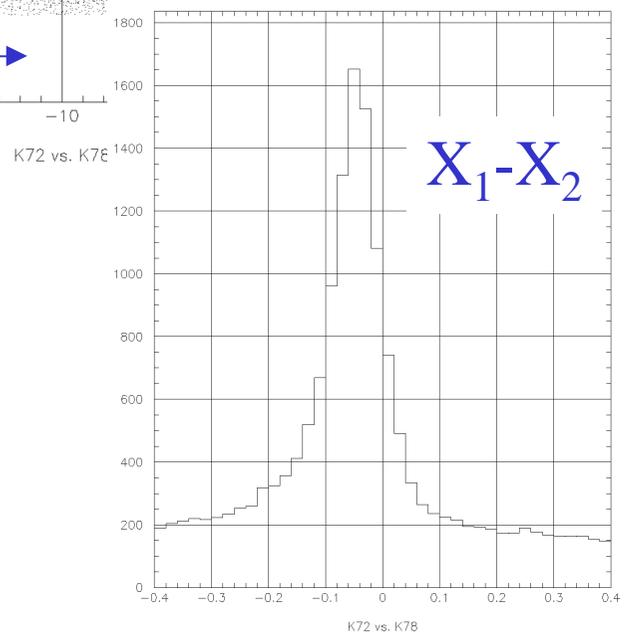
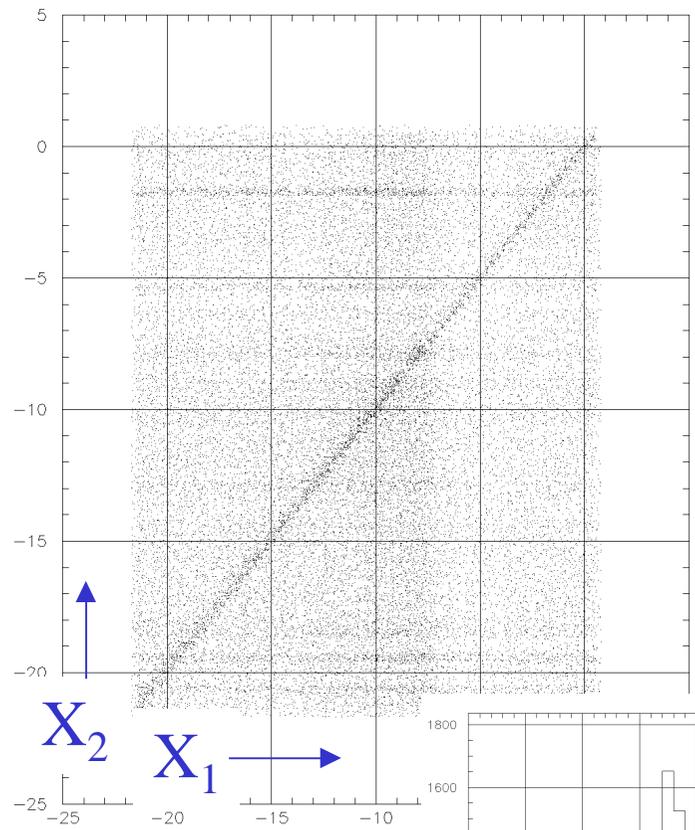
$\sigma \sim 2700 e^-$



Correlated hits



Strip number

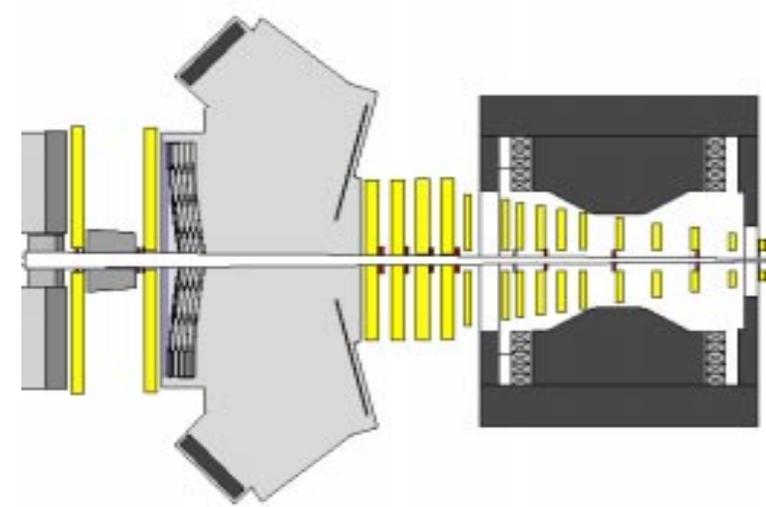
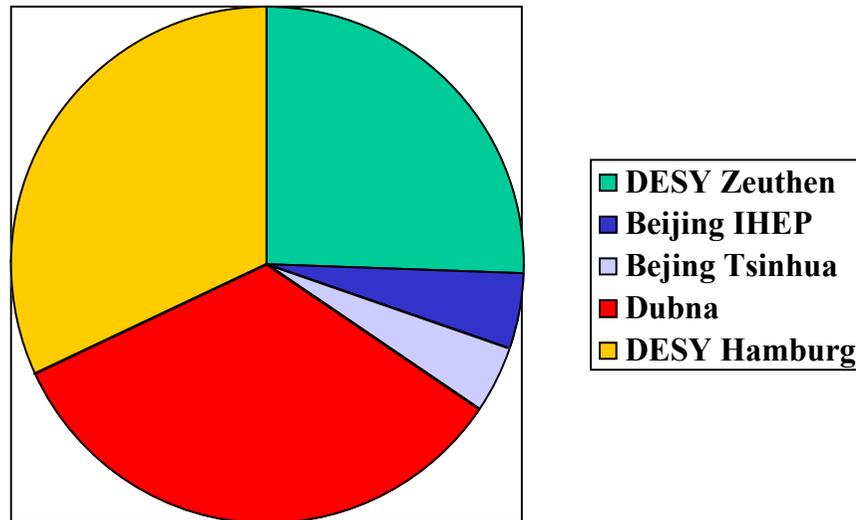


Outer Tracker System

5 labs (Beijing (2), Dubna, Berlin, Hamburg)
contributed to **module production**

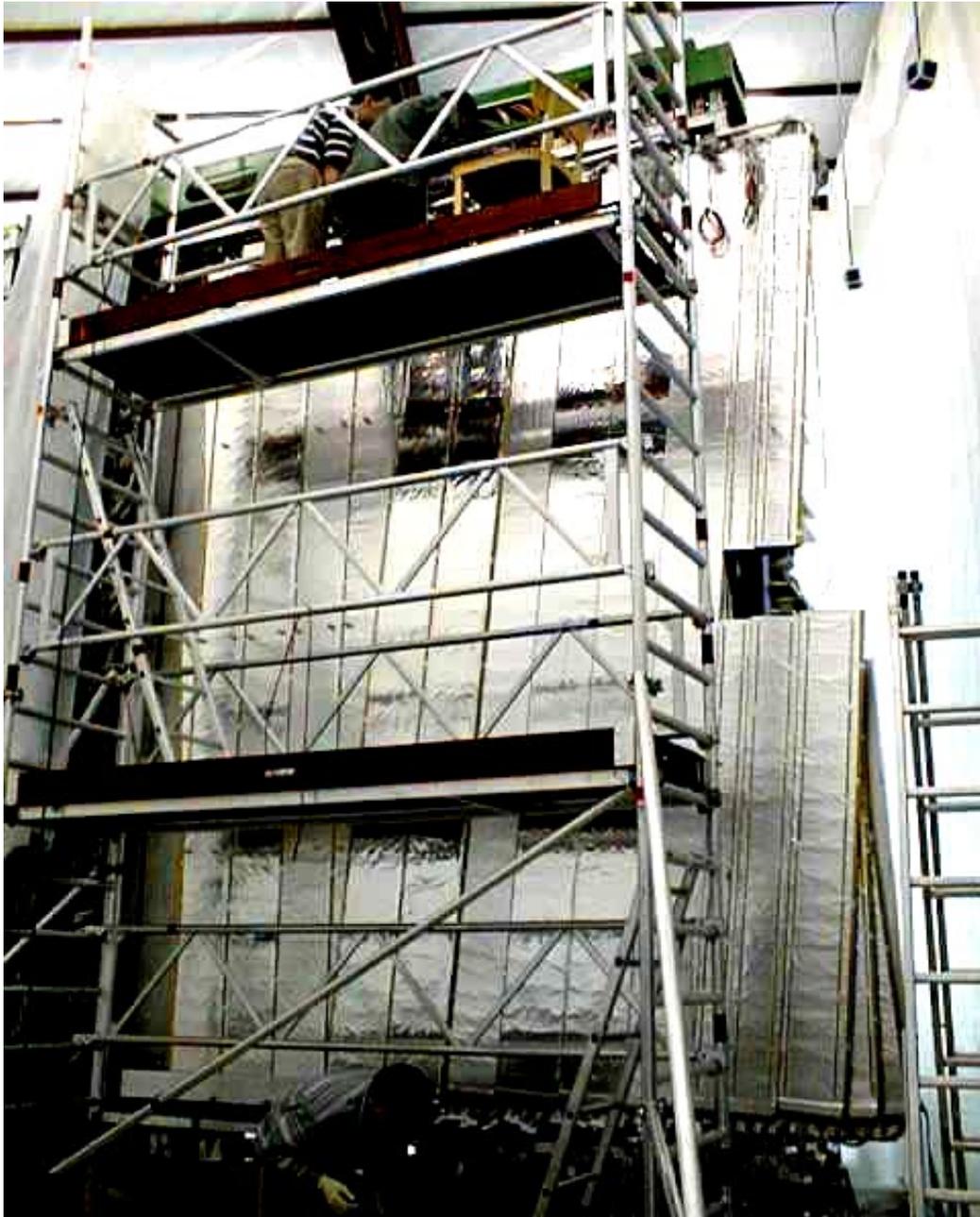
 **Finished !**

978 modules build
112 634 signal wires (193 km)



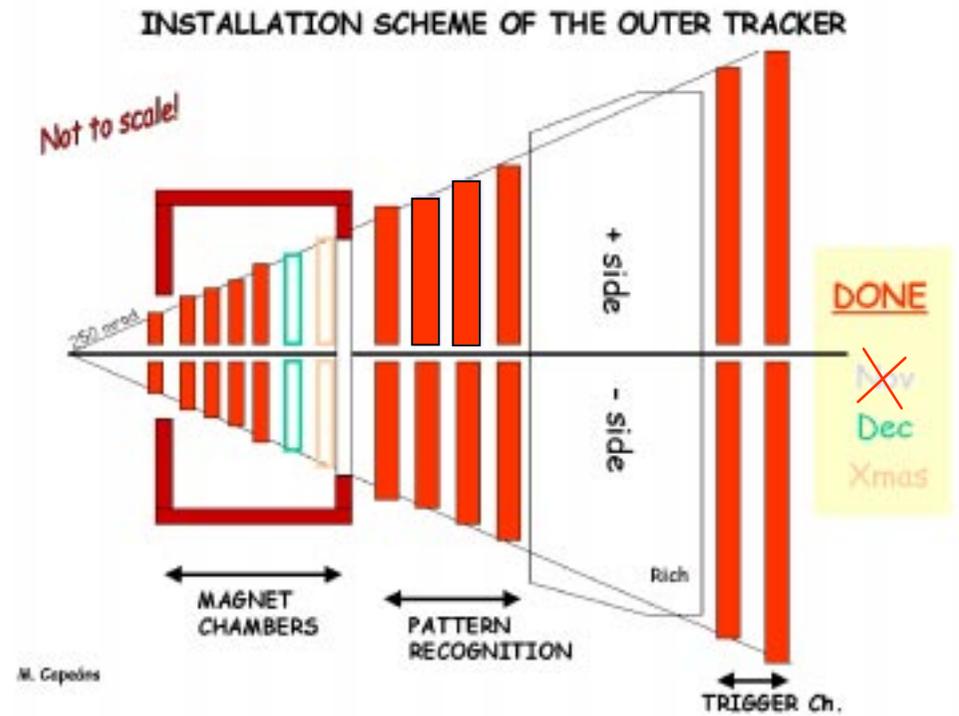
all channels tested after production

- 474 shorts (0.42 %)
- 397 hot (0.35 %)

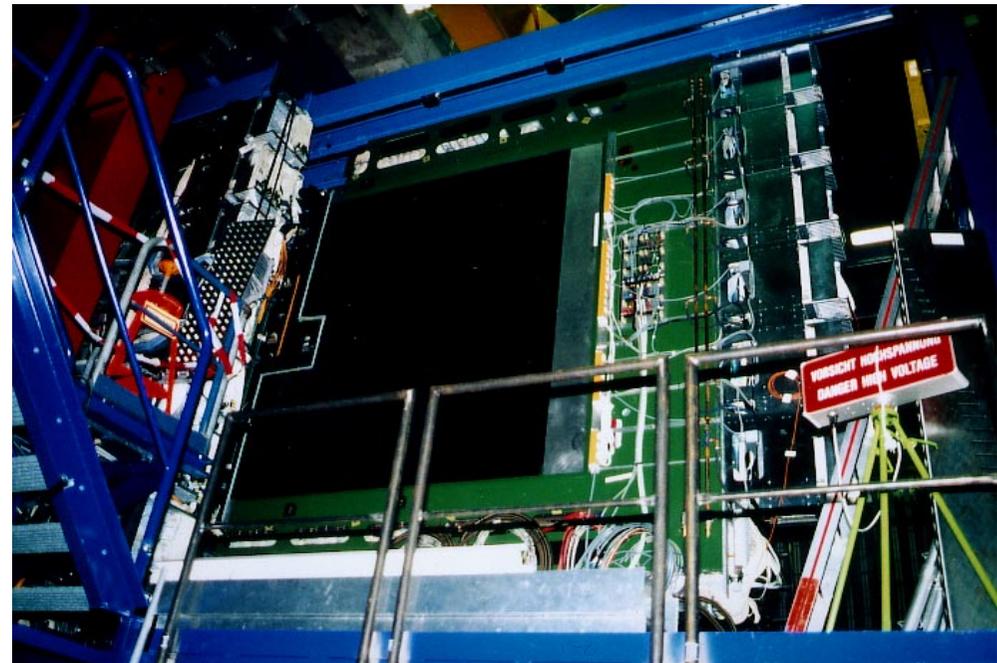
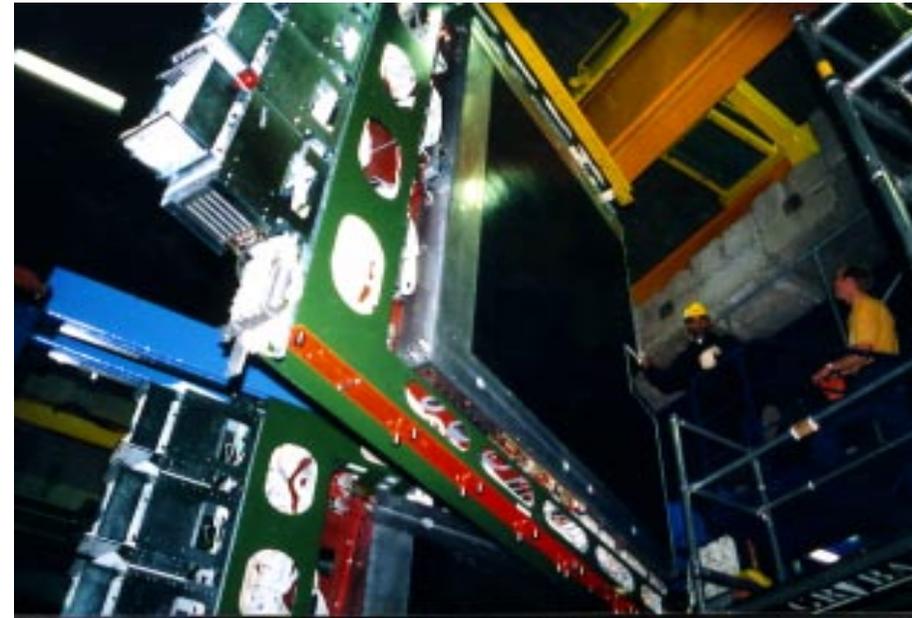


Assembly and installation **ahead of schedule!**

Only two magnet chambers missing



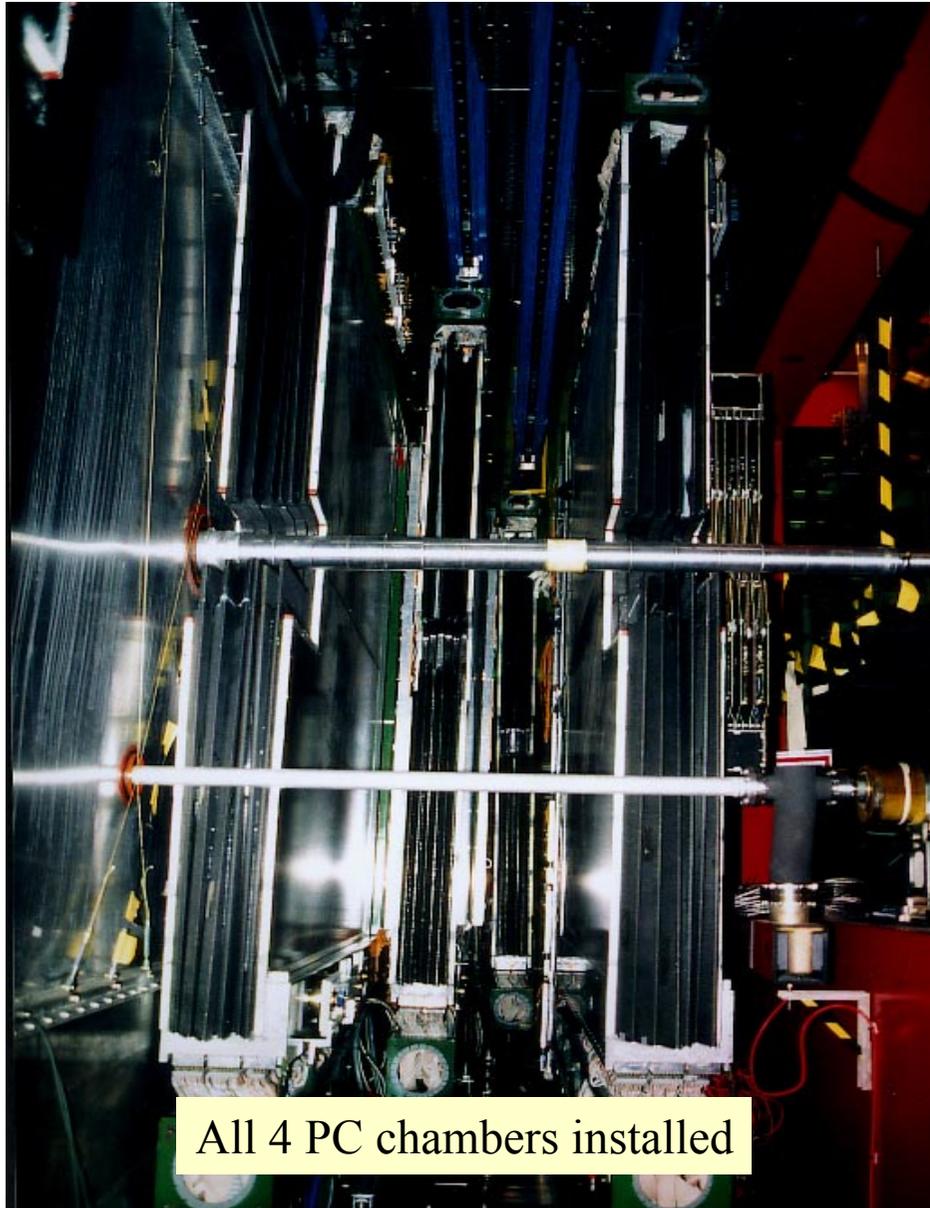
Transport and installation of PC chamber
in one of the mini shutdowns



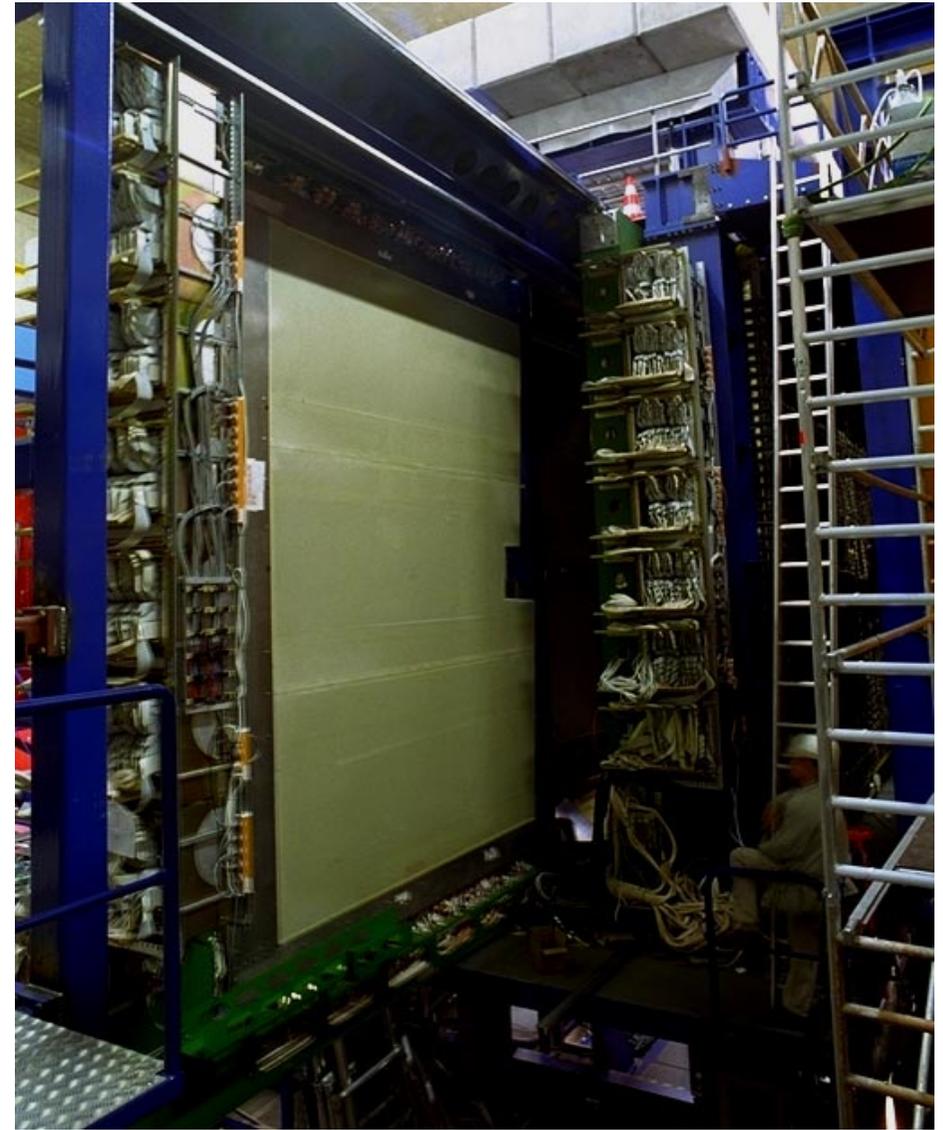
02.12.1999

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Installation of last TC chamber



Commissioning the OTR

Gas system (Ar - CF₄ - CO₂)

- all chambers have gas
- circulating, 3 - 5 % fresh gas
- quality monitoring
(~ 1000 ppm O₂, 200 ppm H₂O)
- missing : purification system (December)

HV training, commissioning

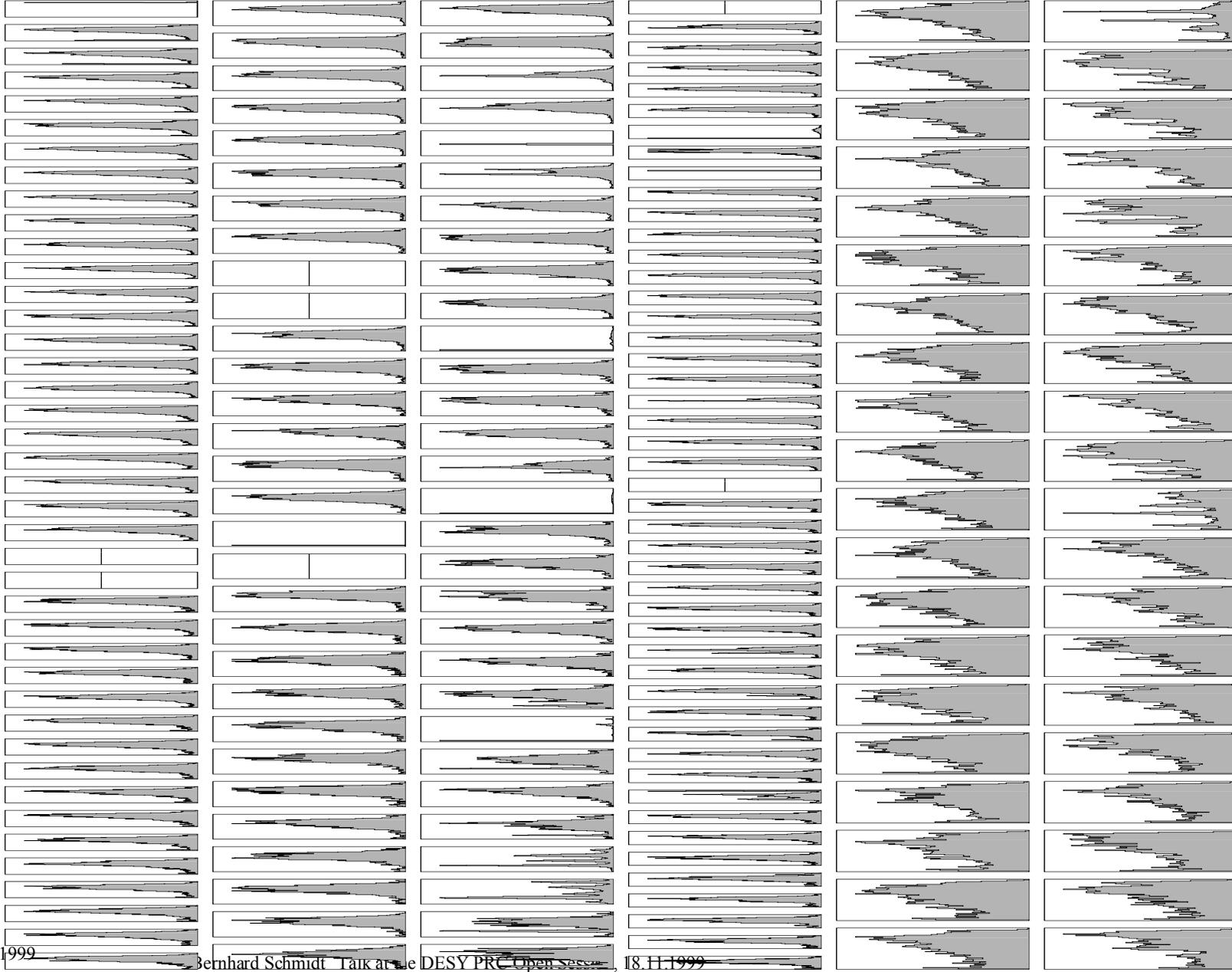
- all chambers trained
- 262 groups (3.6 %) disconnected
(131 in TC2-, repair in December!)
- smooth and stable running
hand over to shift crew soon !

Software

- | | |
|--|---|
| - slow control | - calibration |
| - hit preparation | - alignment |
| - quality control | - tracking |
|  good shape |  started |

TC1, Left half, Layer 2

Run 10523, taken on Mon Sep 20 00:34:27 1999, 4.7543MHz, 7 files, 16840 events

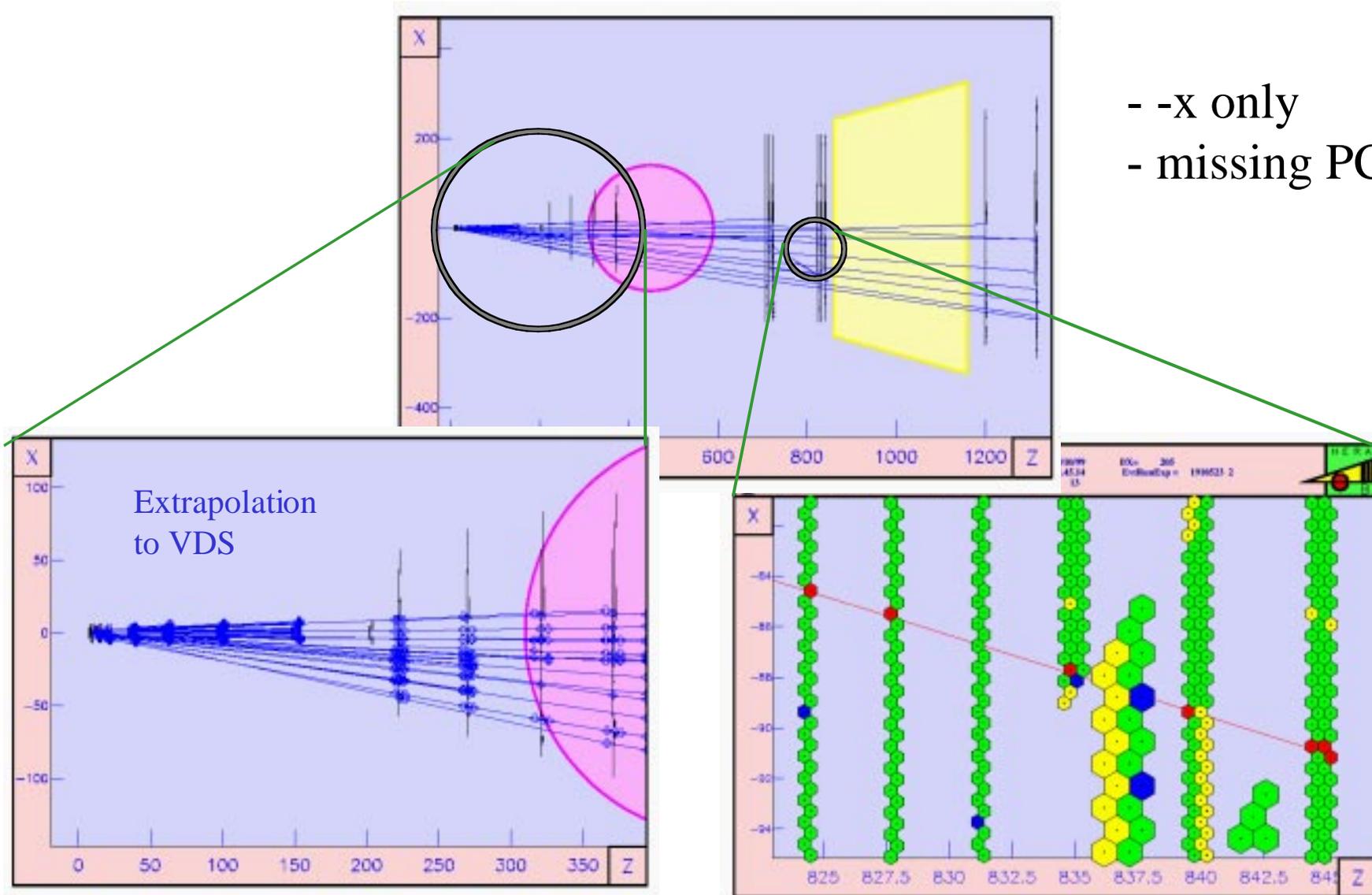


02.12.1999

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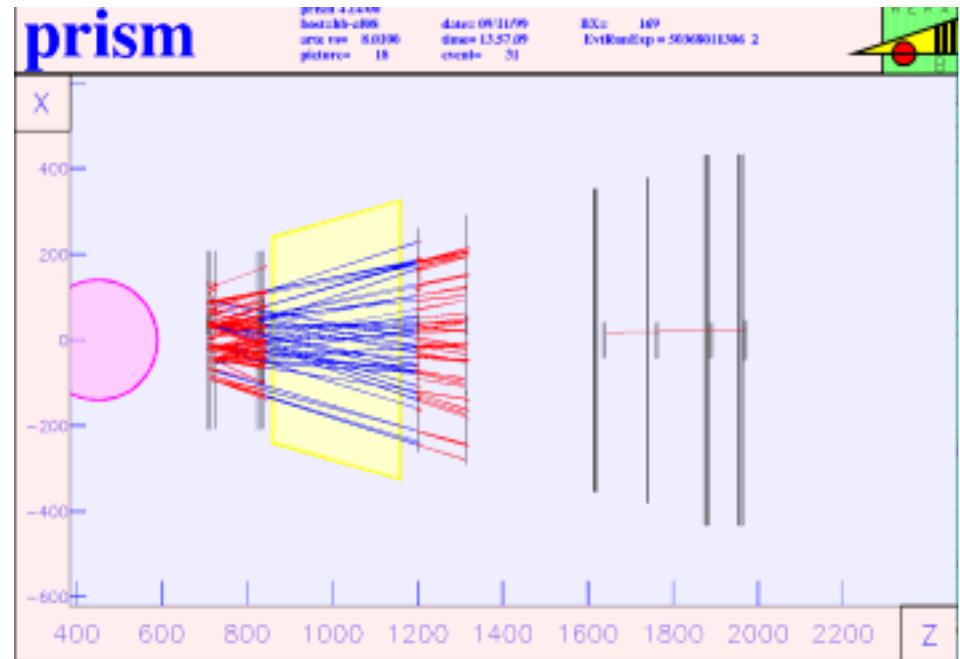
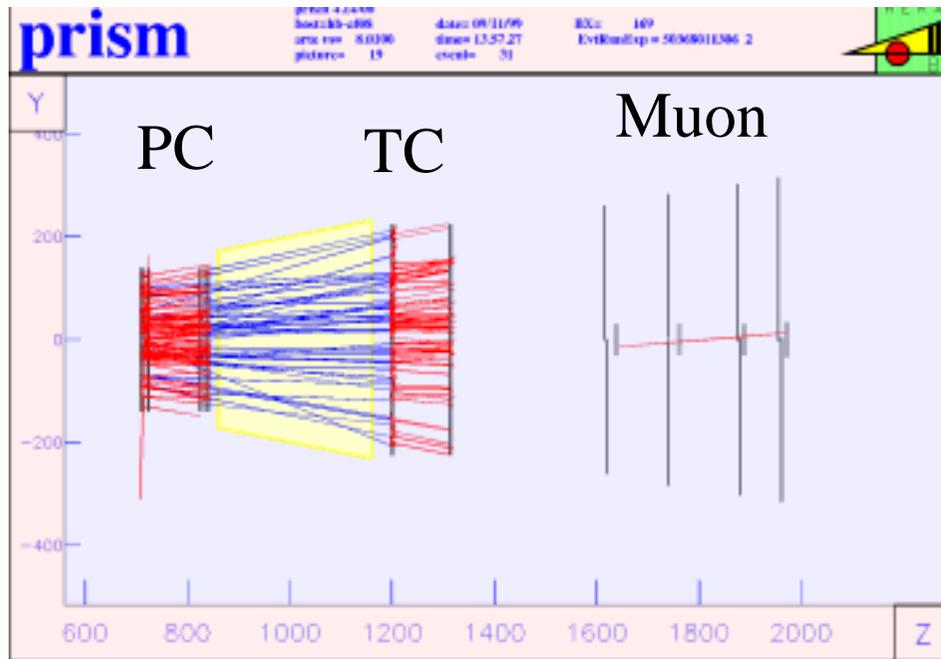
HERA-B starts to have a main tracker !



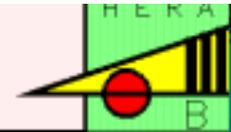
- tracking during μ -run (μ selection in SLT)

Y - Z

X - Z

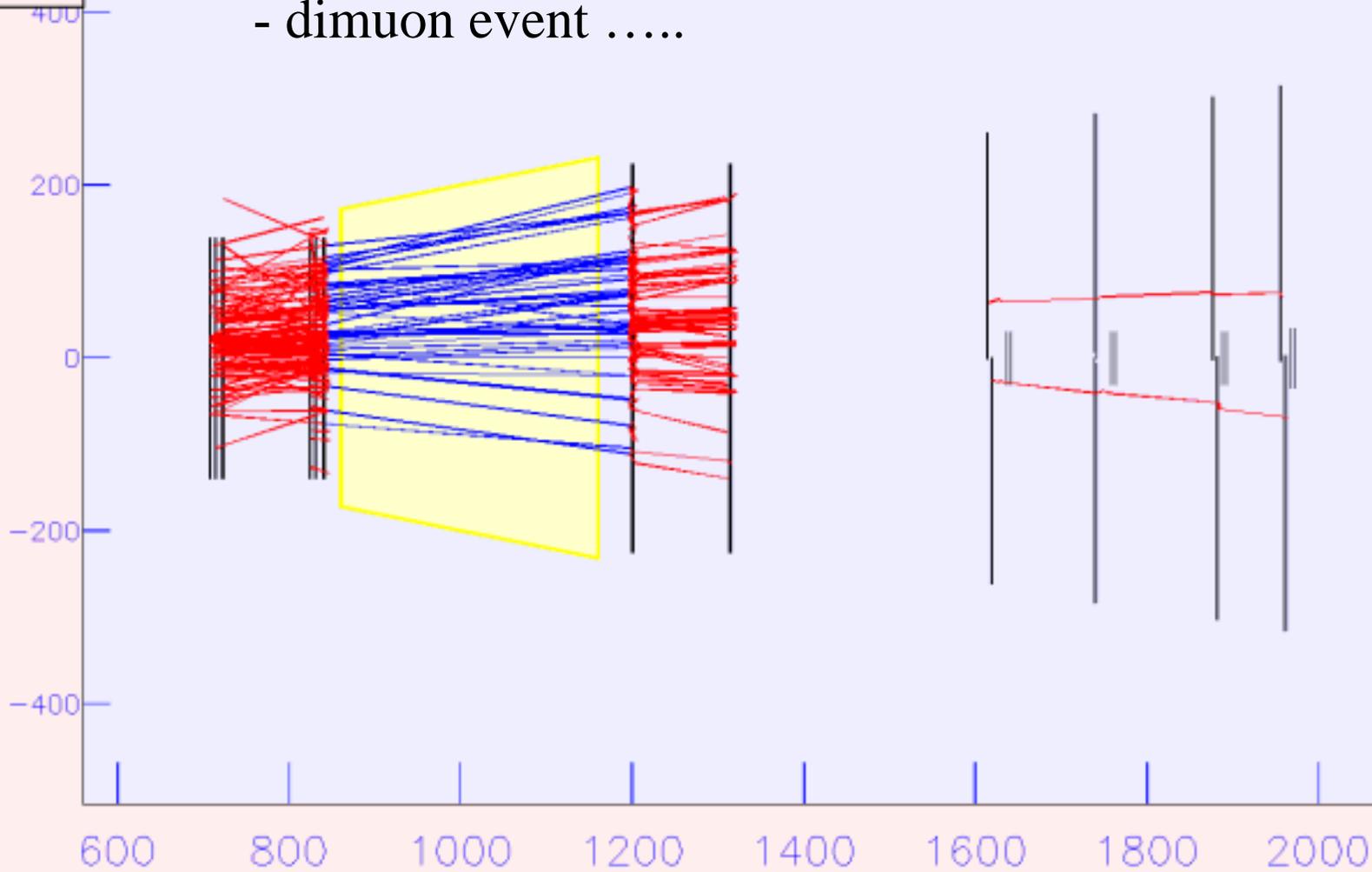


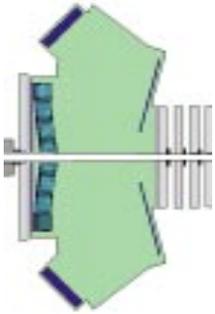
Now both, $\pm x$
Still no PC 2,3 used



Y

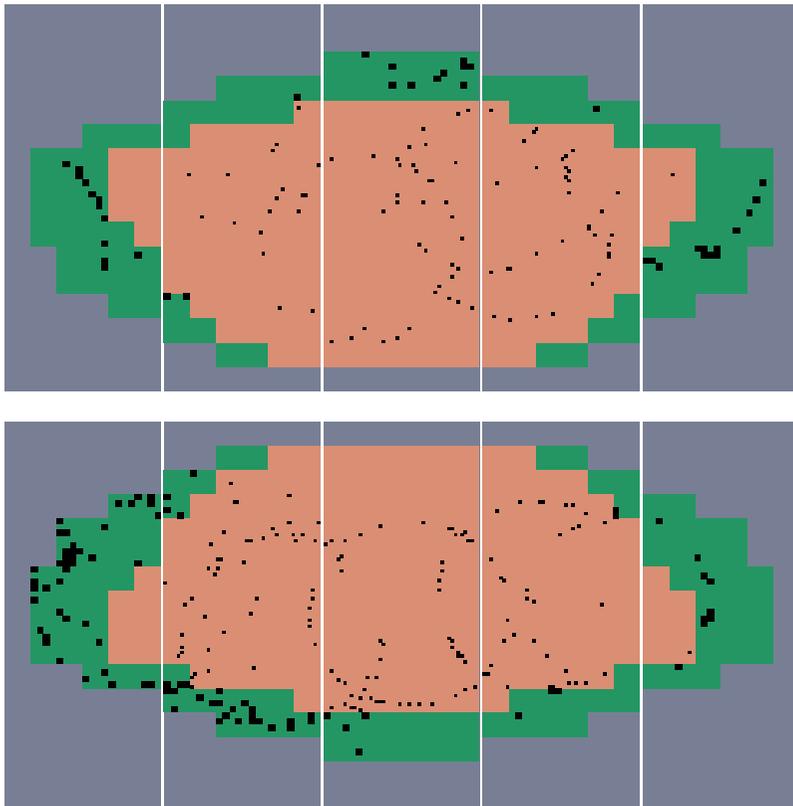
- dimuon event

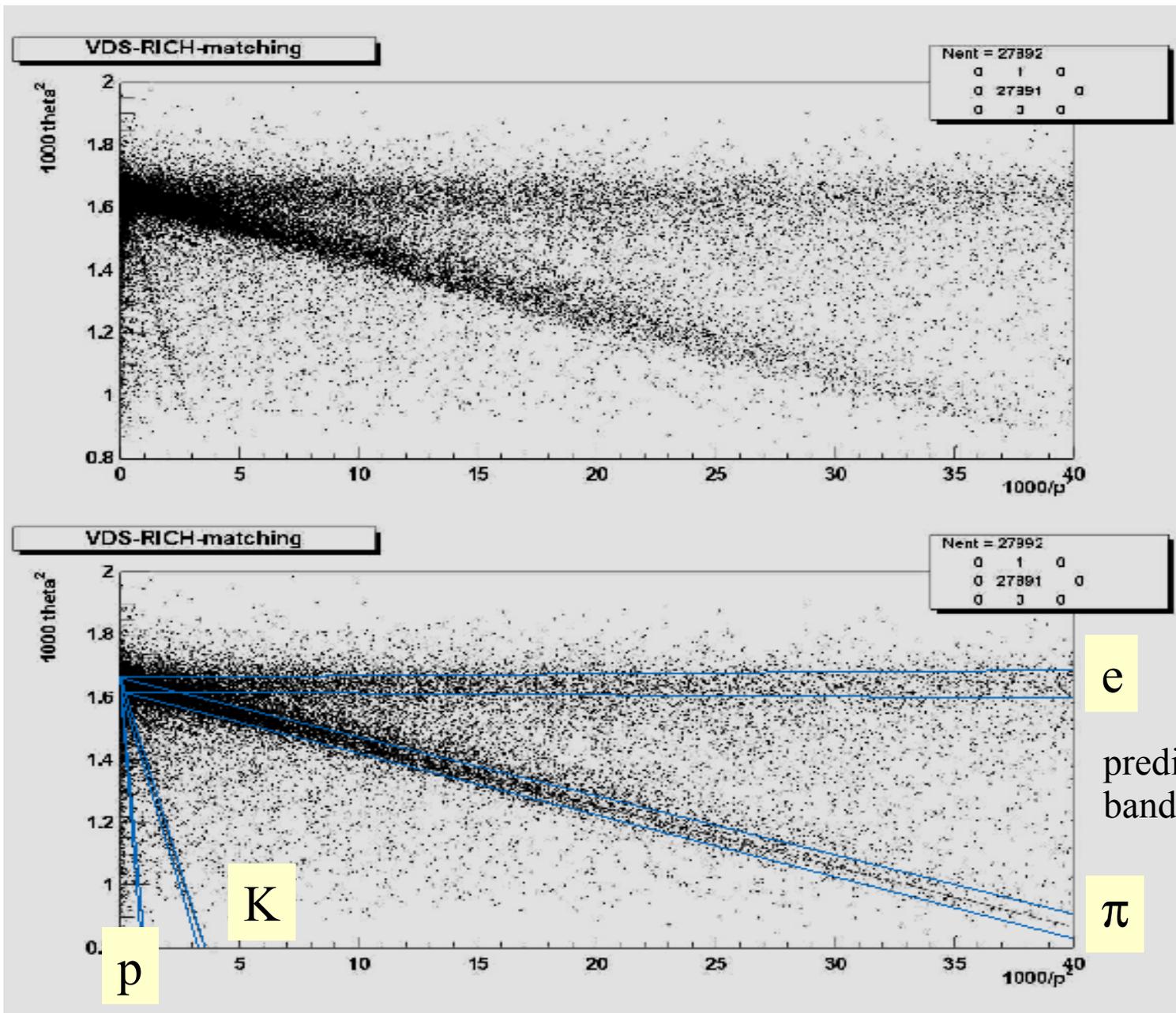




RICH

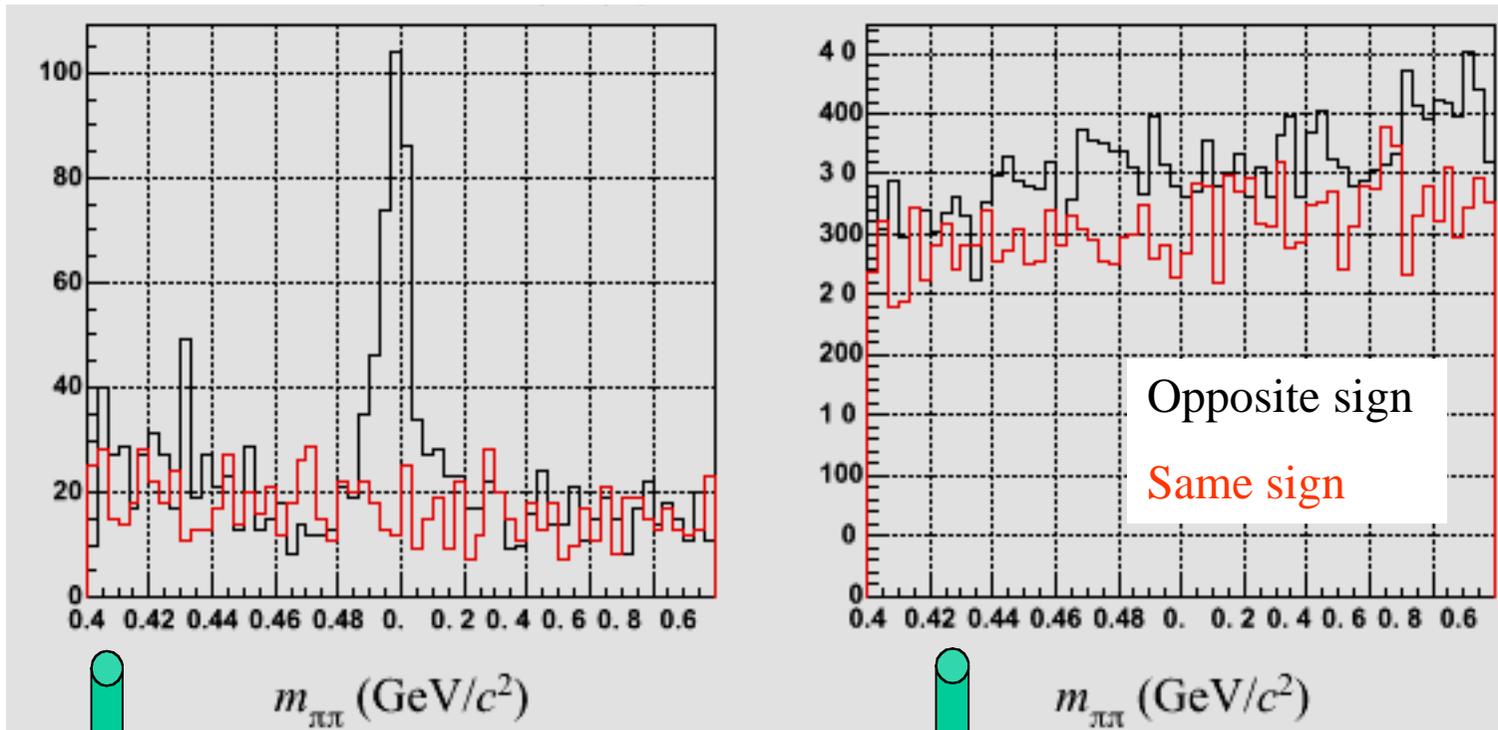
- system is ready
- waiting for tracking detectors
- high level of understanding reached



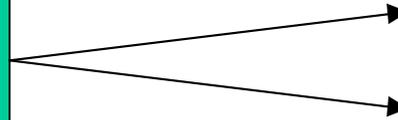
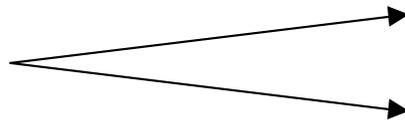


RICH information + Vertex detector: $K_S^0(498)$

$\pi - \pi$ mass

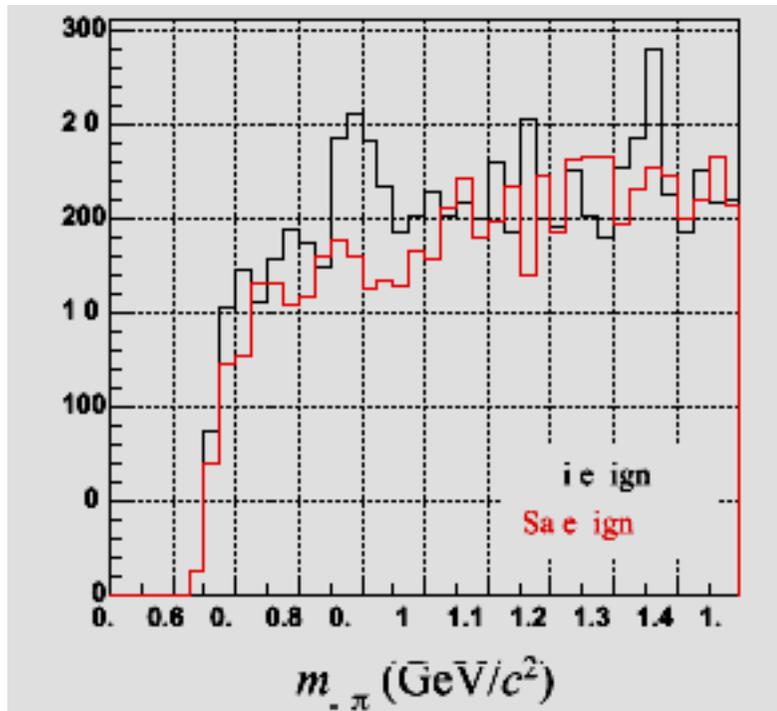


Target wire

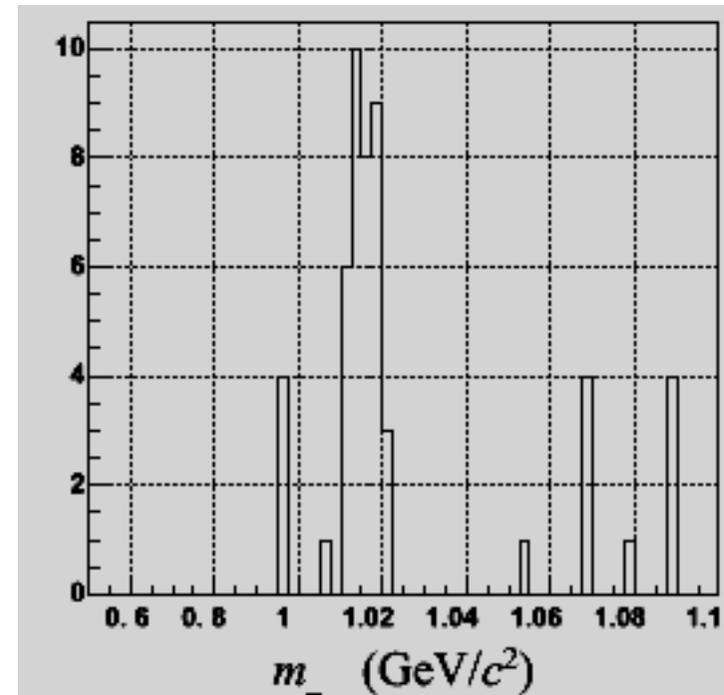


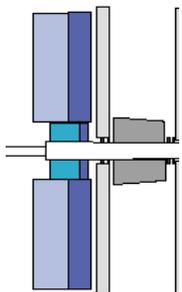
RICH information + Vertex detector:

K- π mass: evidence for the $K^*(892)$



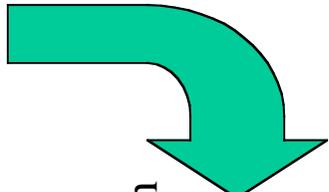
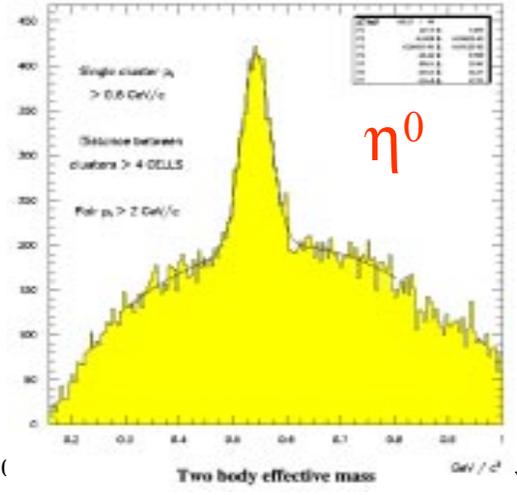
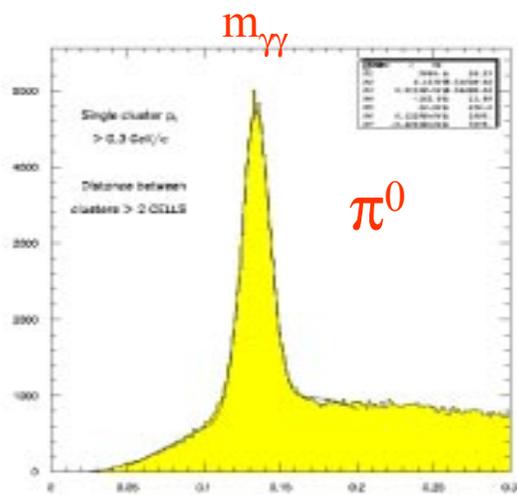
K+K- mass: the $\phi(1020)$



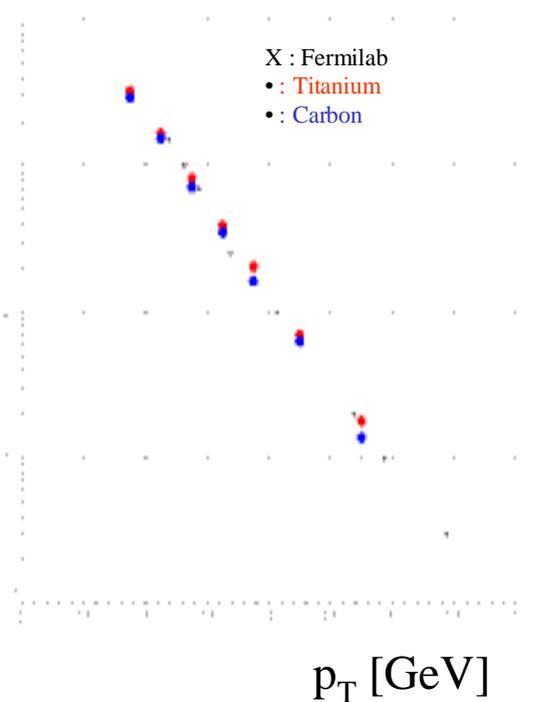


Electromagnetic Calorimeter

- system is ready (inner and middle)
- workhorse for pretrigger

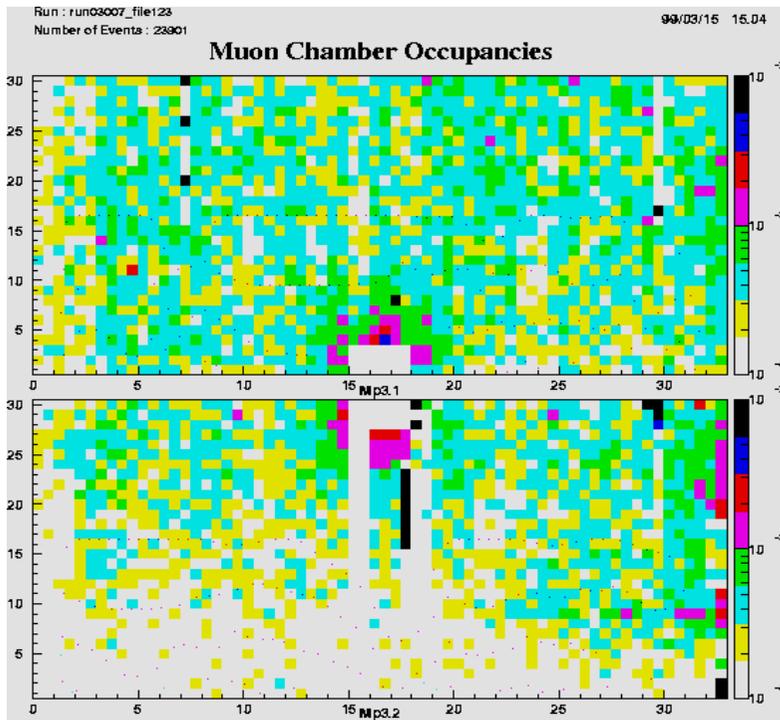
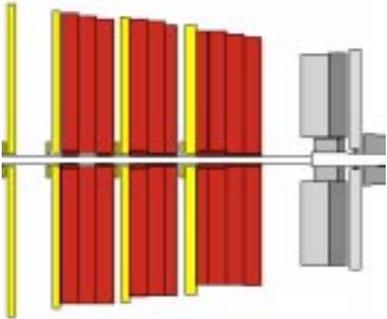


differential cross section



Muon System

2nd source for pretriggers



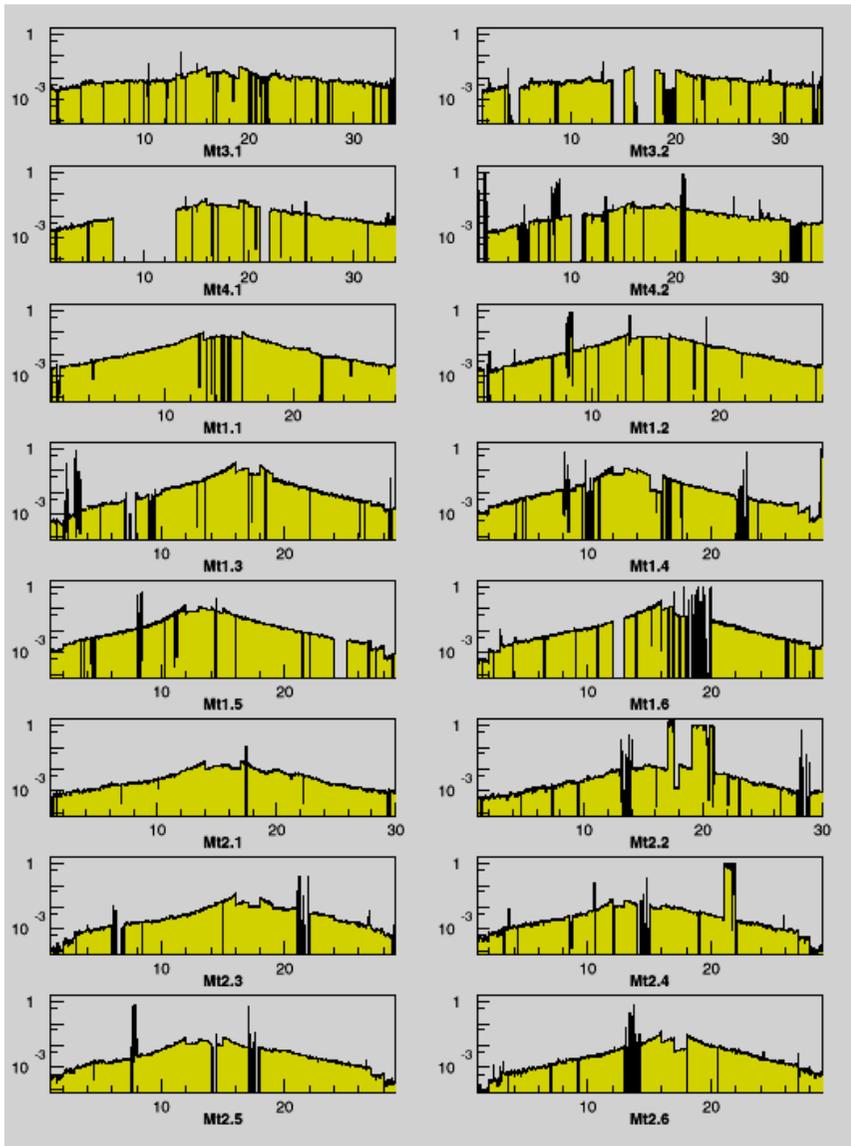
Tube chambers



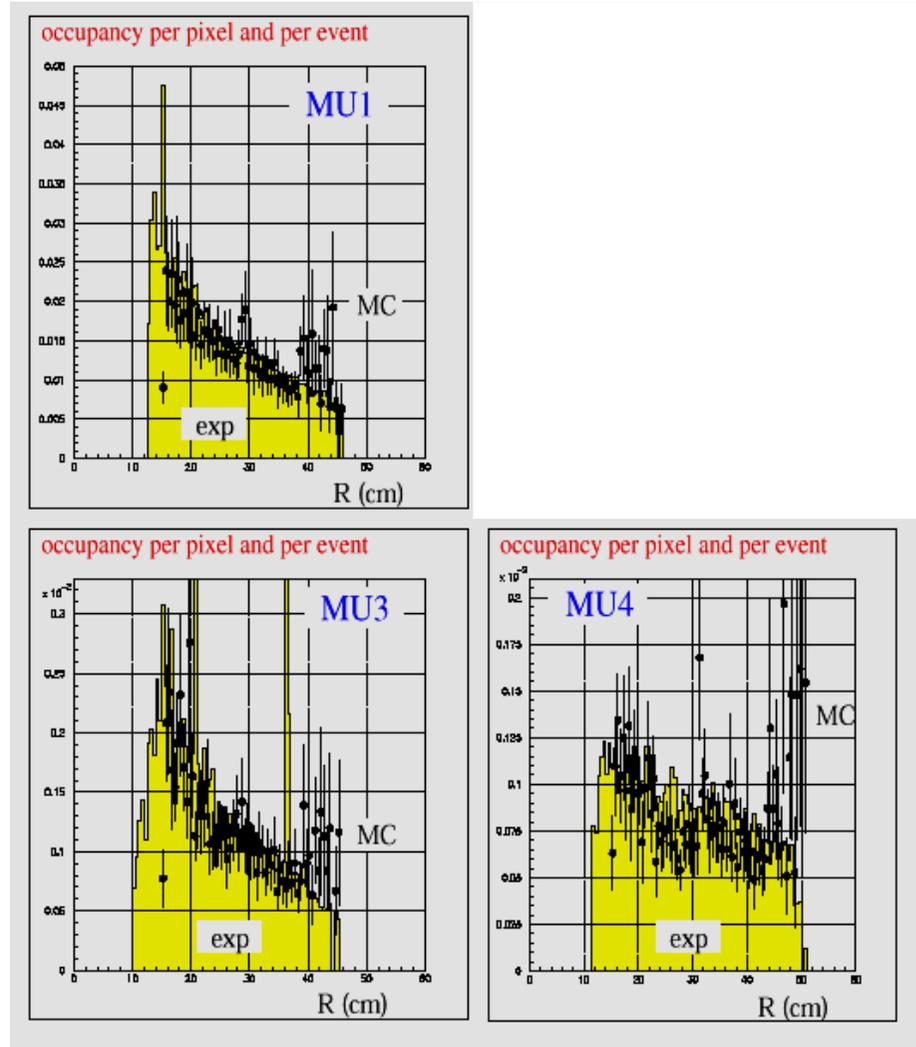
Pad chambers (used in trigger)

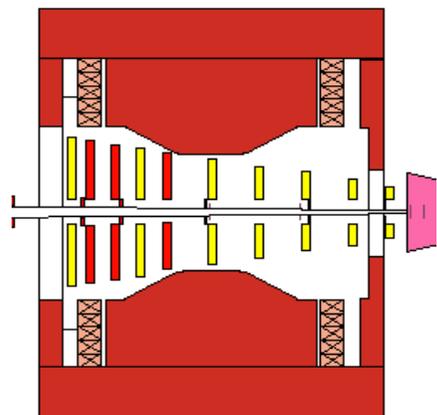
- detector system \approx ready
- still work on gas system needed

Muon tube chamber occupancies



Muon Pixel chamber occupancies





High-p_t System

3rd source for pretriggers

- very important for non-lepton triggers: broadens physics scope
- late due to lack of funding
- now sped up

- 1st chambers have been installed in magnet

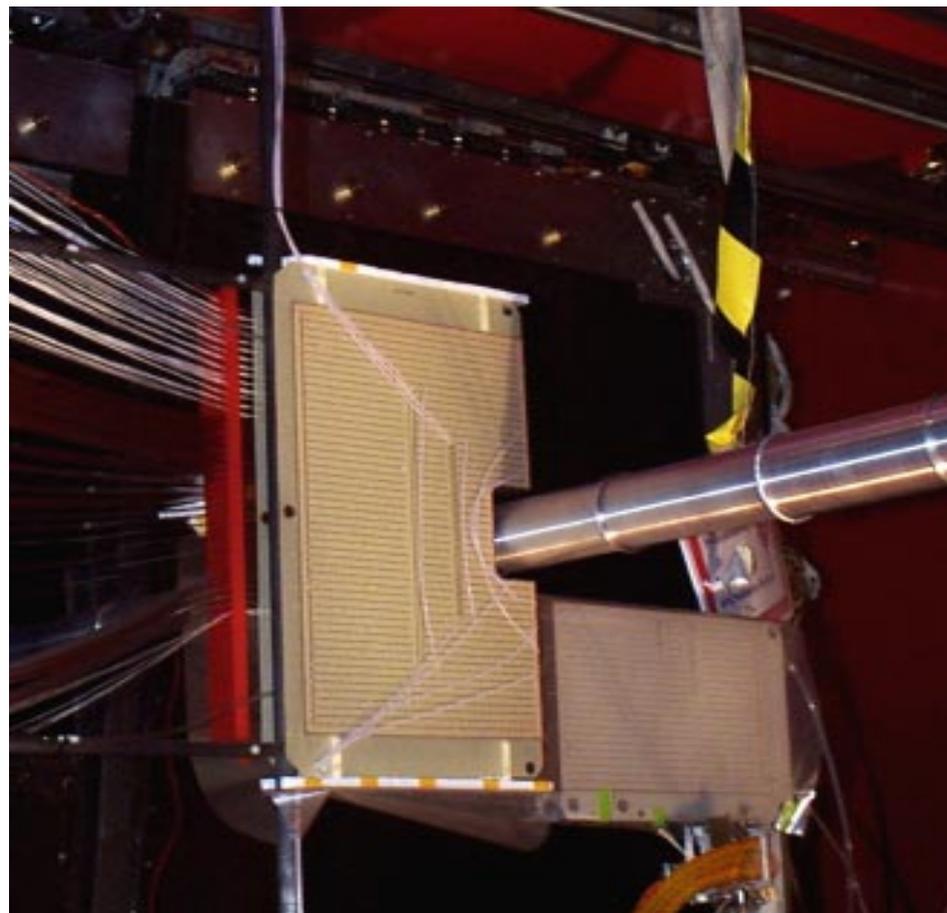
- all hardware procured

INNER : ITEP Moscow

OUTER : Cincinnati

- chambers and special cabling
- readout
- pretrigger

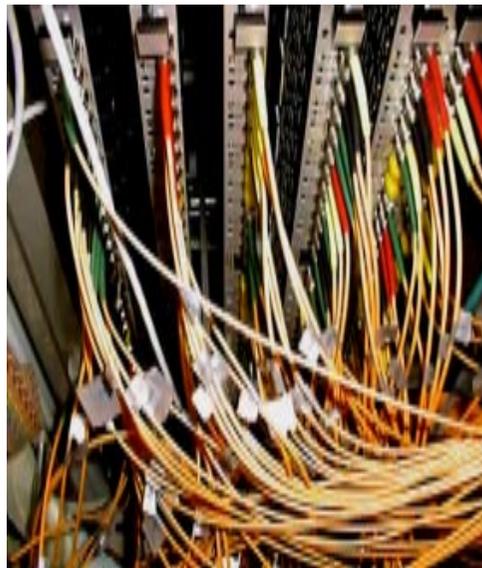
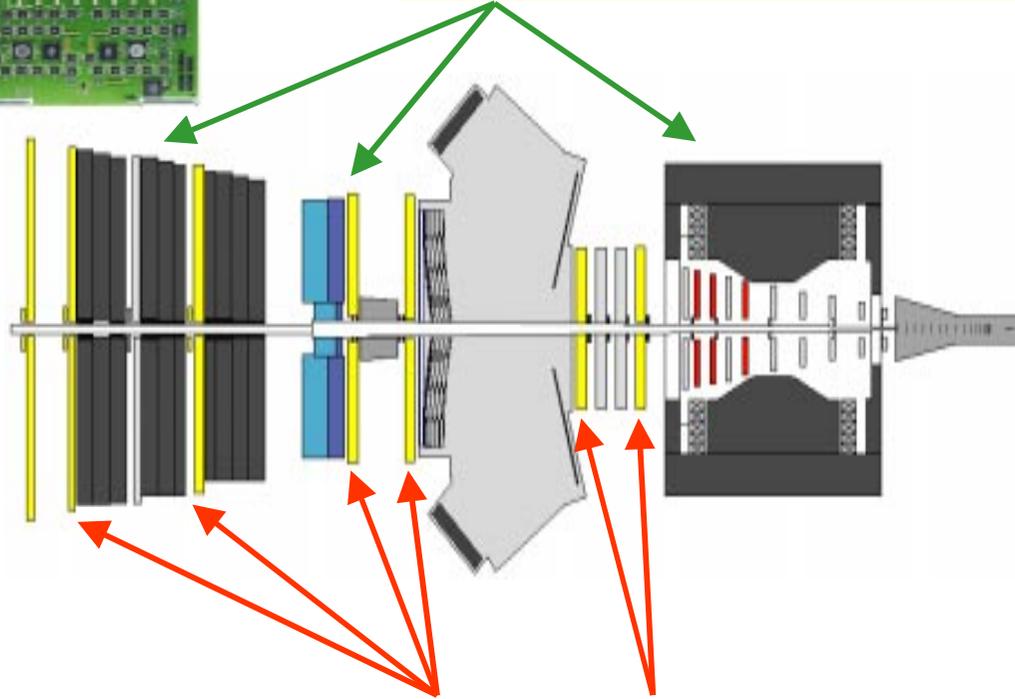
ready end February 2000?



Level 1 Trigger and DAQ

Pretriggers:

- electrons: — in place, used regularly
- muons — being tested/installed
- high pt hadrons — prototype tests underway



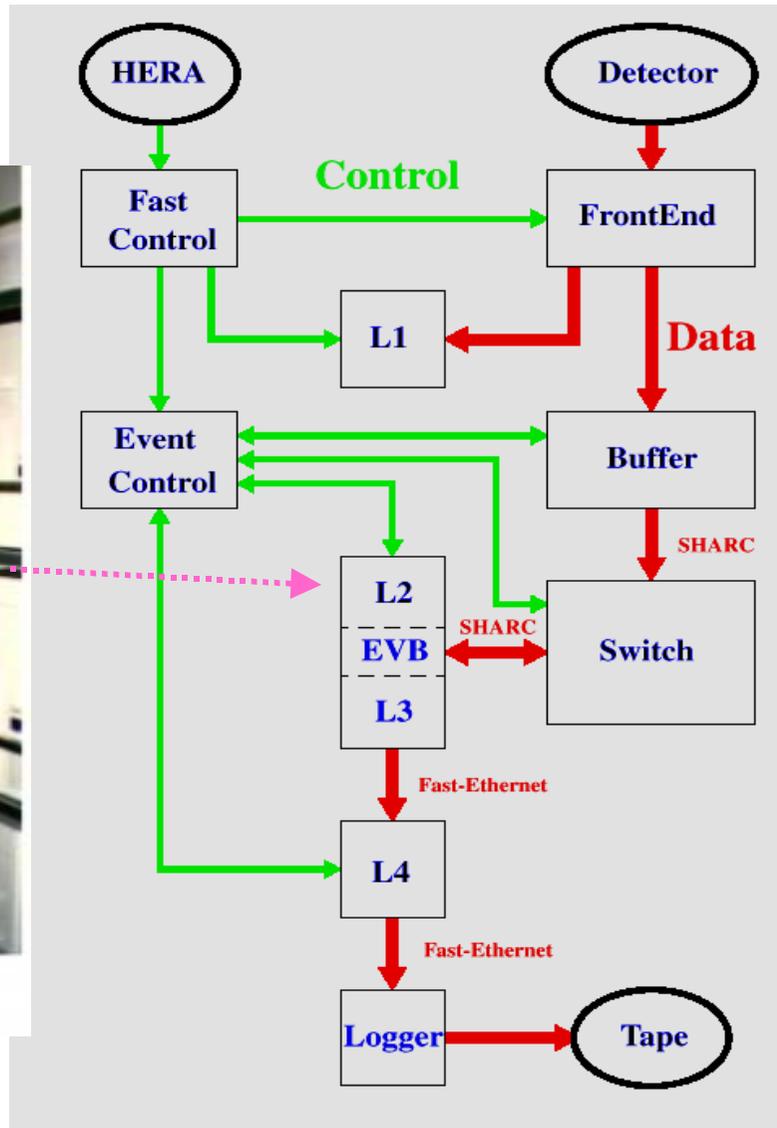
Track trigger (needs tracker hardware!):

- all the hardware for one complete slice has been set up
- commissioning has been started
- all hardware procured - should be at DESY in 1/2000

DAQ and Higher Level Triggers



Second Level Trigger Farm



- well advanced
- final data path
- running for production
- continually growing and stabilizing
- 211 (332) high speed SHARC switches running
- 950 processes on ~70 PC nodes !

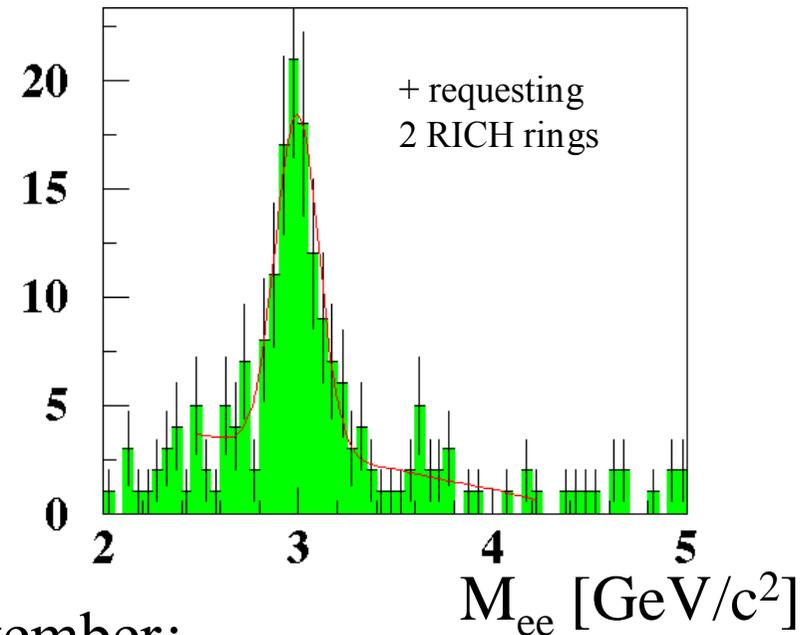
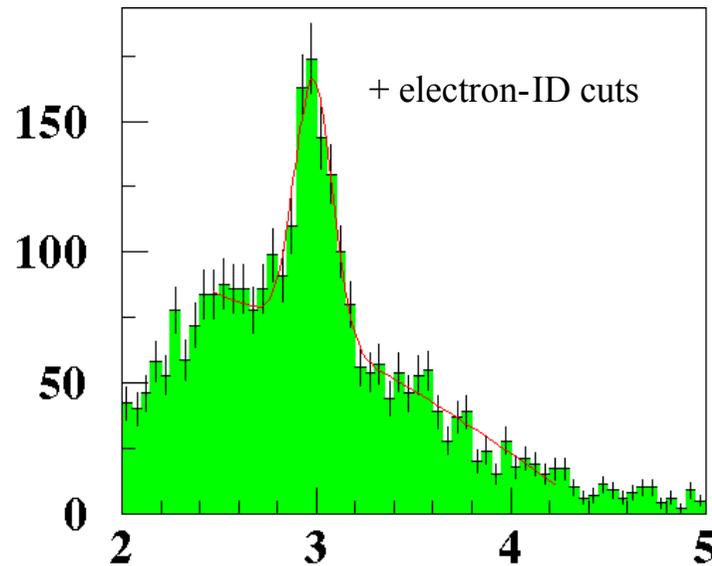
Calorimeter + VDS

FLT:

- 1 ECAL cluster
- p_T - cut (1.4 GeV)

SLT:

- second cluster
- mass cut (2 GeV)



Analysis of run taken end of September:

- target rate
- total duration
- # proton interactions
- events analyzed in Level-2 farm
- output rate to tape

4 MHz

36 hours

6×10^{11}

6×10^8

≈ 60 Hz

- **Still without Tracker!**
- **Essentially background-free!**

FLT:

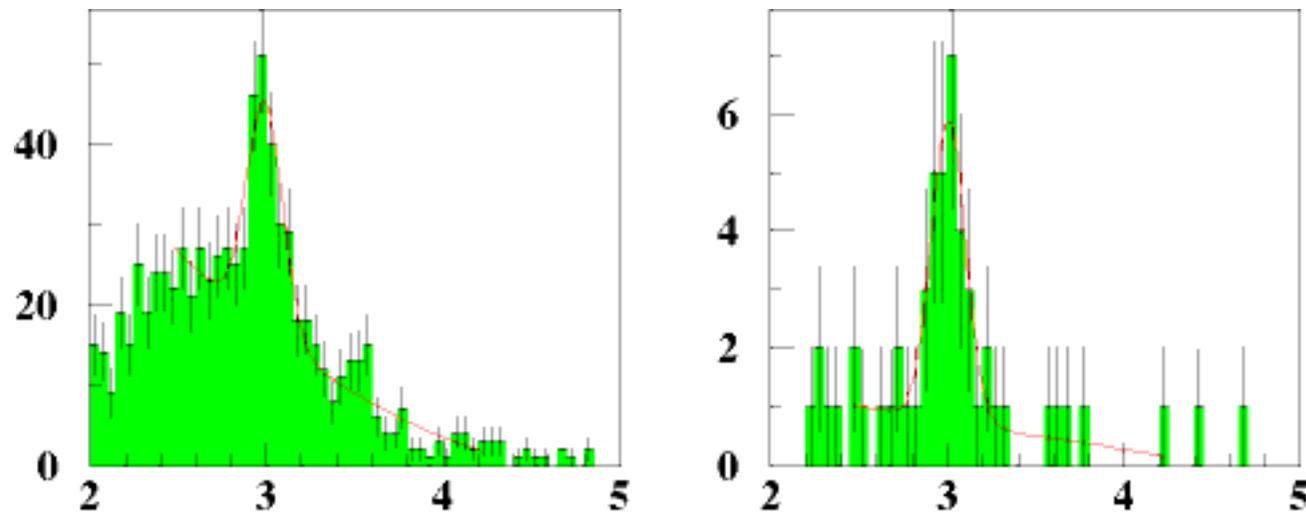
- 2 ECAL cluster

- p_T - cut

SLT:

- mass cut

- 1 VDS track match

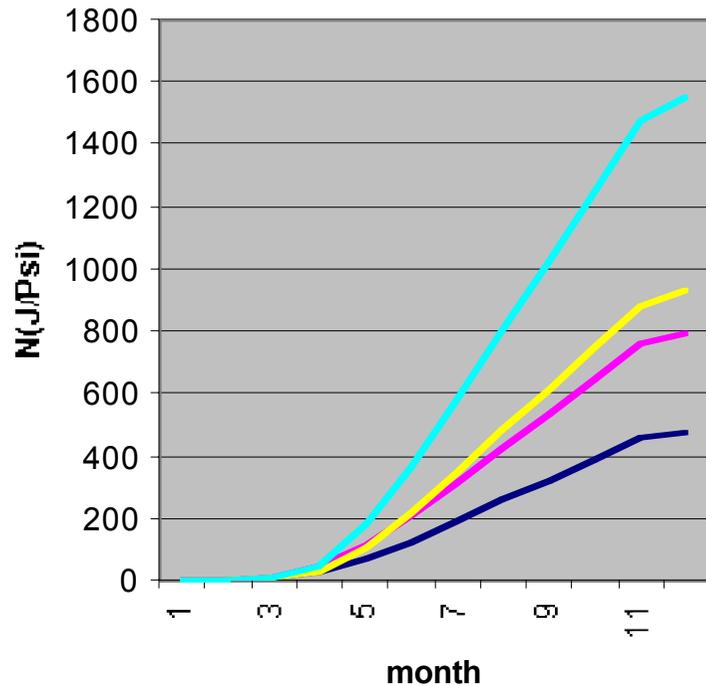


J/ψ enriched by factor ~ 5

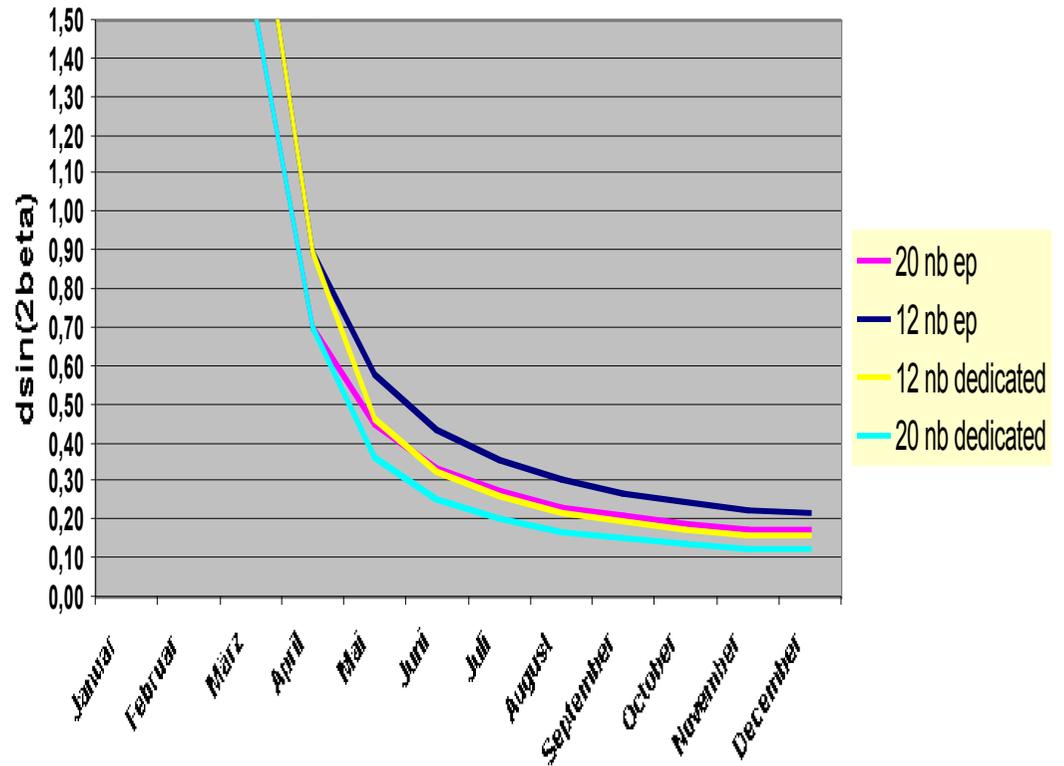
Prospects for Physics in 2000

- **HERA-B** has undergone a major **phase change** during 1999 and is **nearing completion**
- **Most critical:**
 - **Level 1 Track trigger:** does it work?
 - **Inner Tracker:** mass production, stability (robustness) of chambers
 - **Overall commissioning** and stability in data taking
- **Prime goals for 2000:**
 - establish J/Ψ trigger
 - measure $\sin(2\beta)$ in the decay asymmetry of $B^0 \rightarrow J/\Psi K_s^0$

$N(J/\Psi K_s^0)$ detected



HERA-B projected CP reach



Depends **critically** on detailed efficiency assumptions !

Summary/Conclusions

- During 1999 HERA-B preparation underwent a ‘phase change’: After ≈ 4.5 years of struggle, HERA-B is finally nearing completion
- With similar progress as achieved during the last 6 months, HERA-B should be ready for to start data taking early next year
- We believe that HERA-B has a chance to contribute competitively in the year 2000 with the e^+e^- B-factory laboratories in the measurement of $\sin 2\beta$
- Furthermore, HERA-B has a discovery potential in the year 2000 that is complementary to the e^+e^- machines ($B_s^0 \rightarrow J/\Psi\phi$)
- Every effort should be made in order for these measurements to become possible, HERA-B is willing and prepared to spend these efforts !