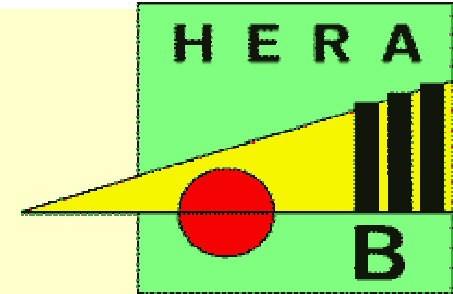


HERA-B Status Report

November 1999

B. Schmidt

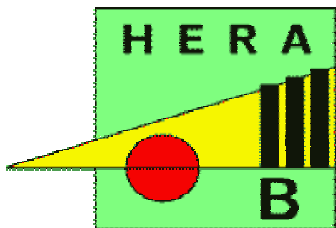
Univ. - Heidelberg



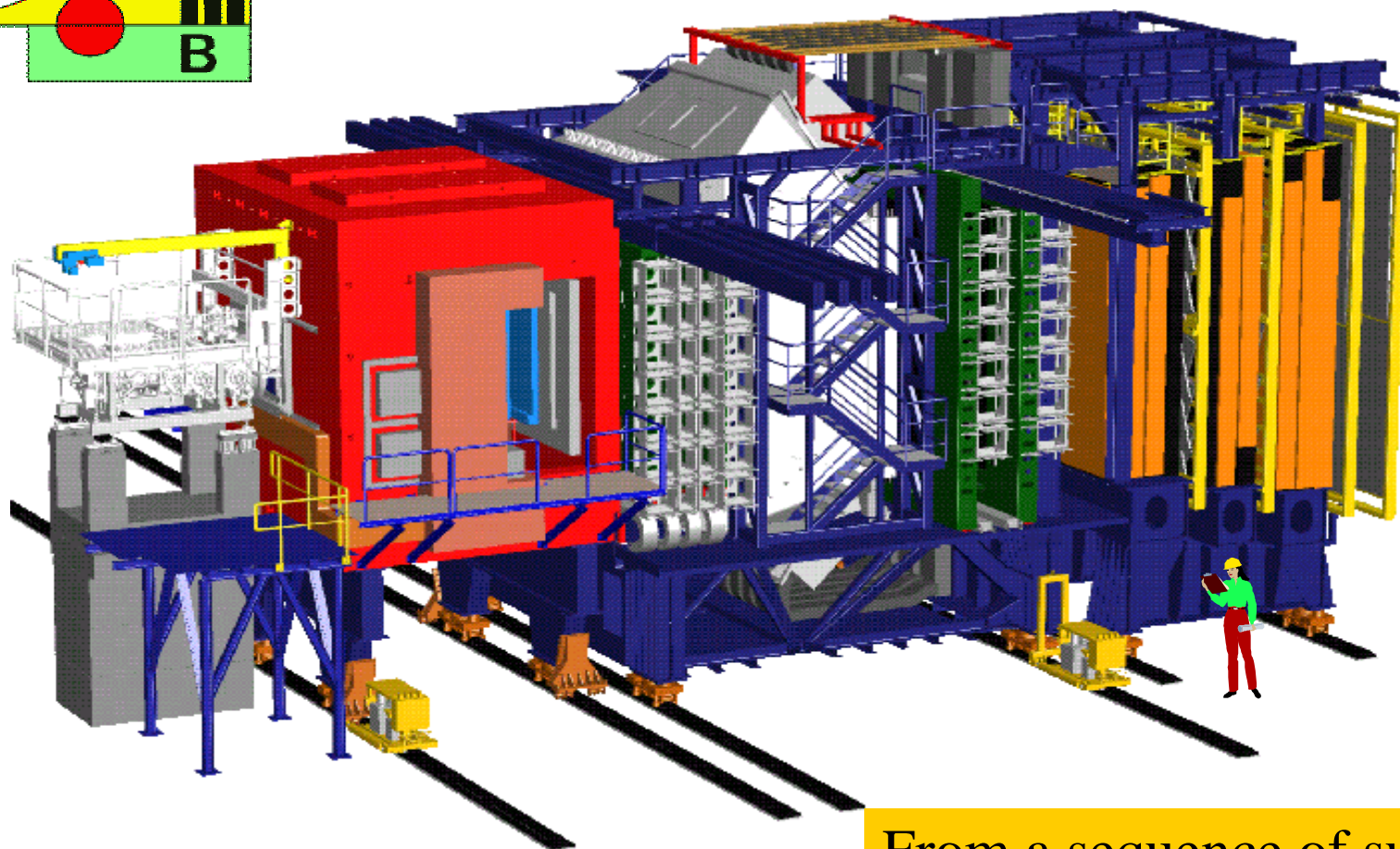
Progress since last PRC

Present Status

Outlook



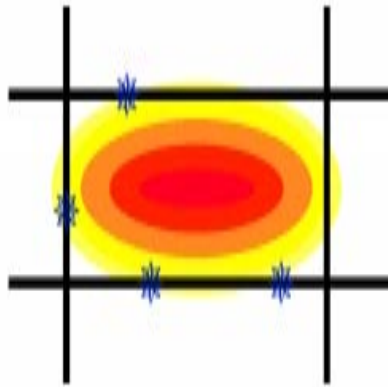
Present Detector Status as to be seen in Hall West



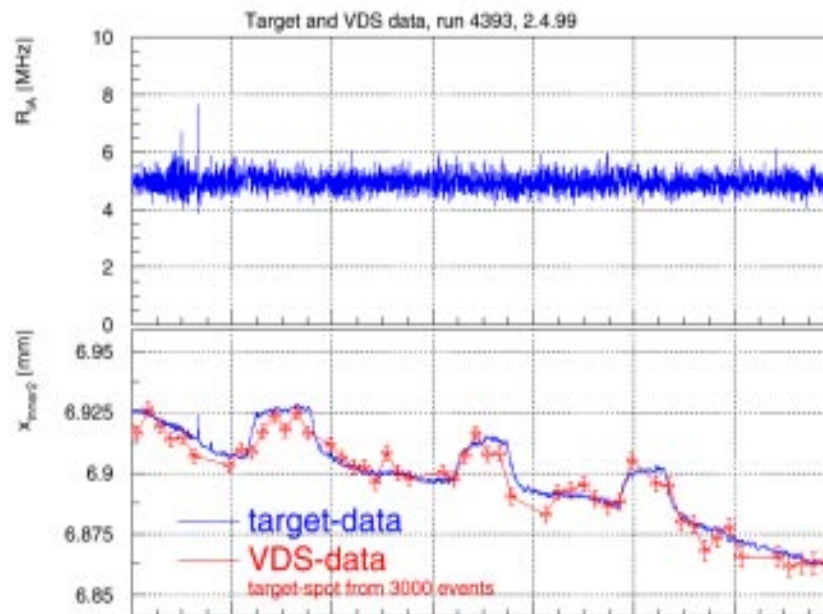
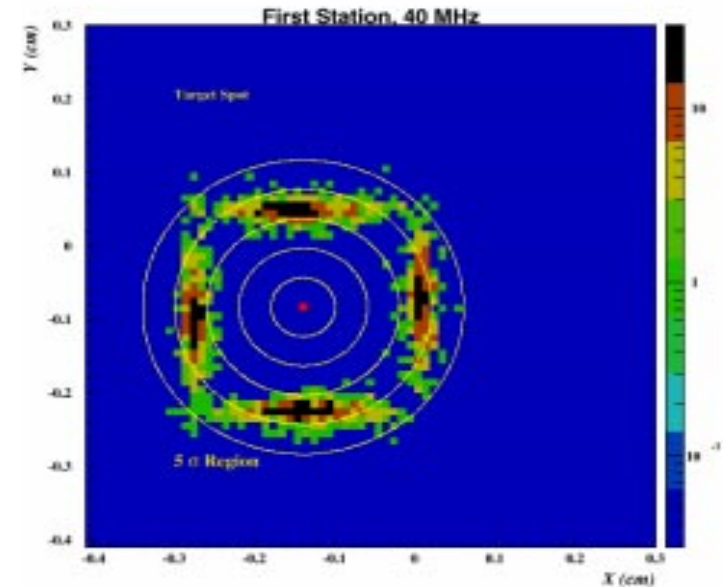
From a sequence of subsystems ..

to an *EXPERIMENT*

The Internal Wire Target



1 - 8 wires
Routinely operated

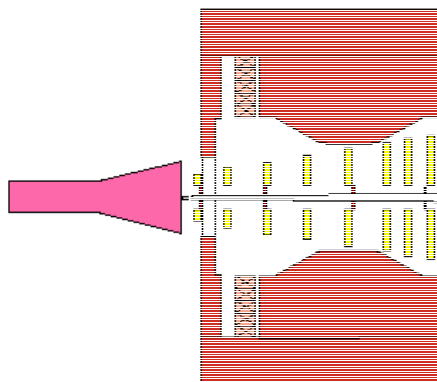


Remaining problems

- ‘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

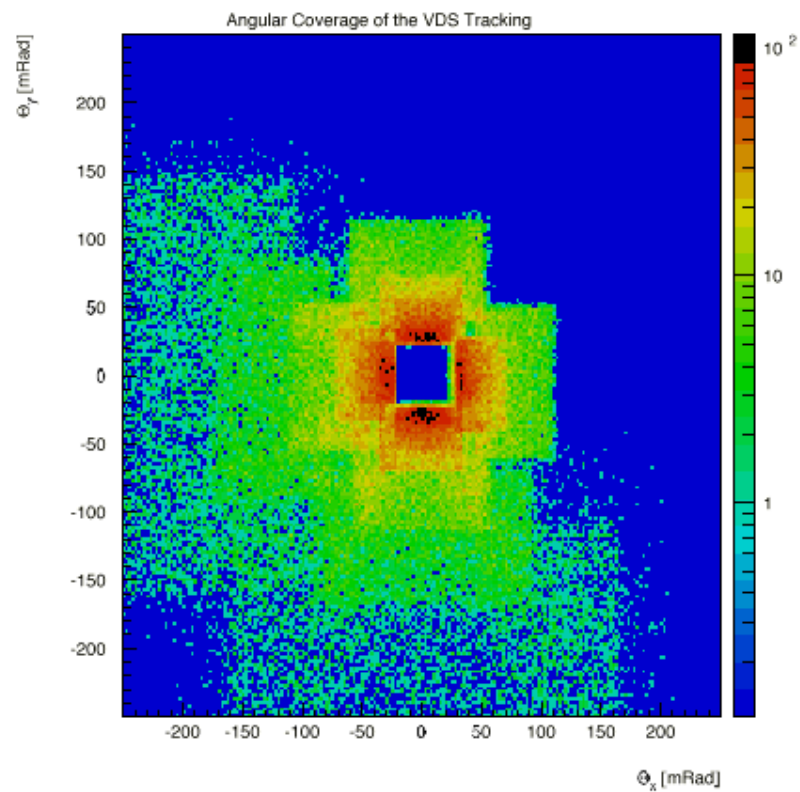
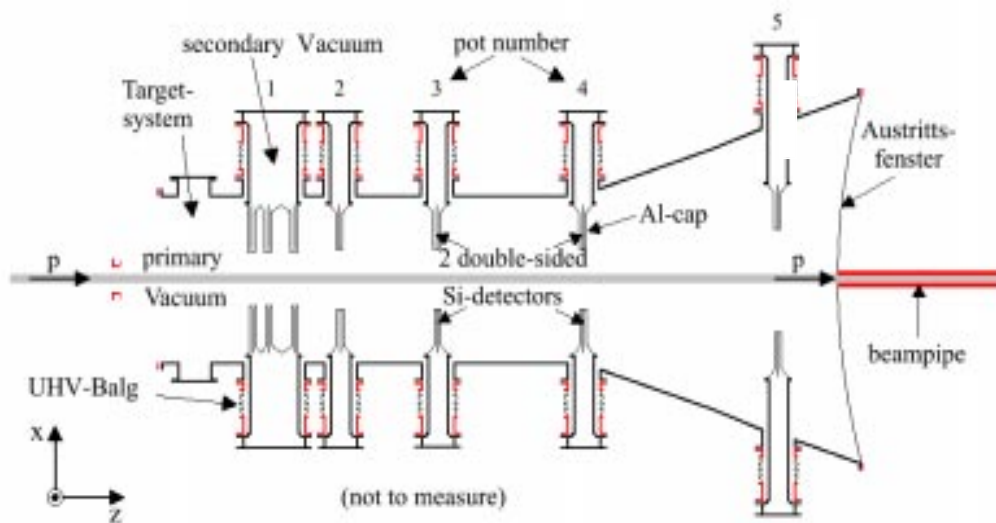
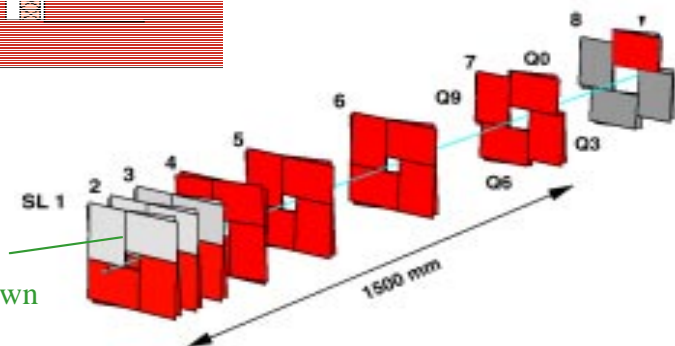
A task force has been reestablished to address these issues

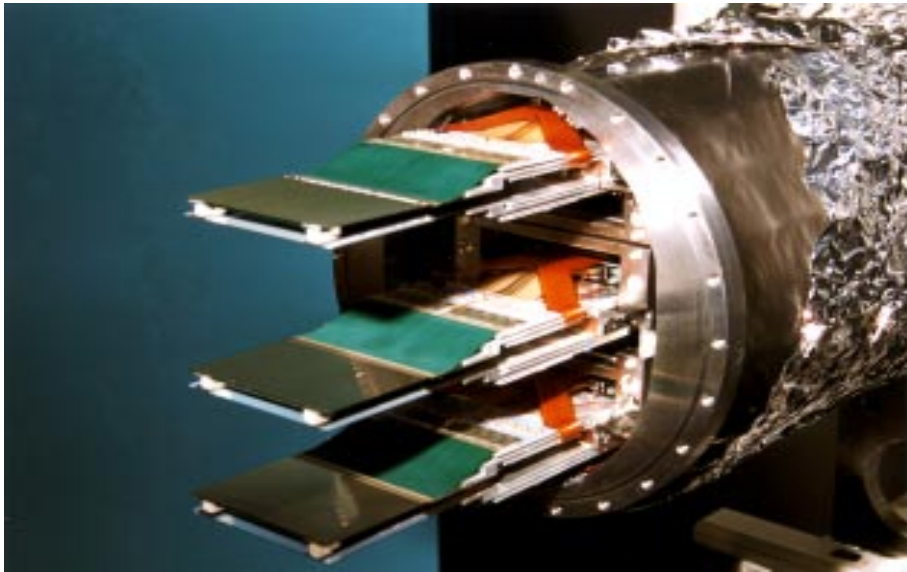
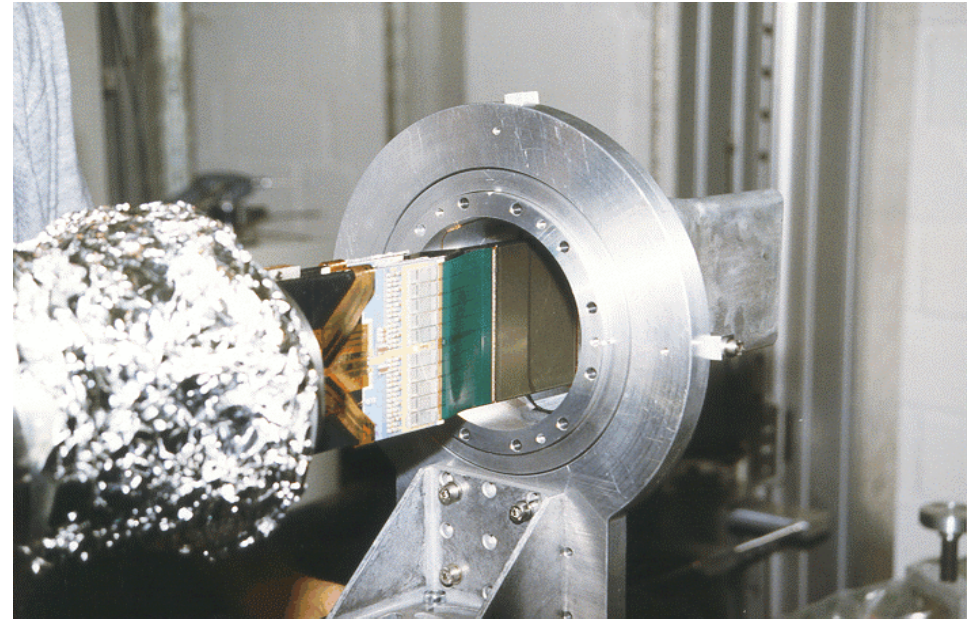
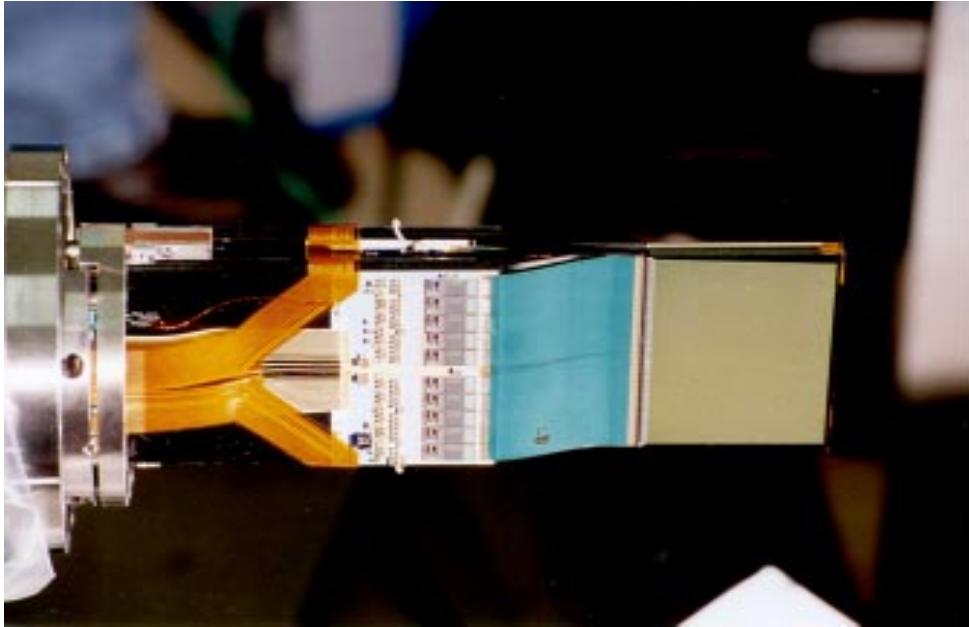


Silicon Vertex Detector

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

Will come
during
X-mas shutdown

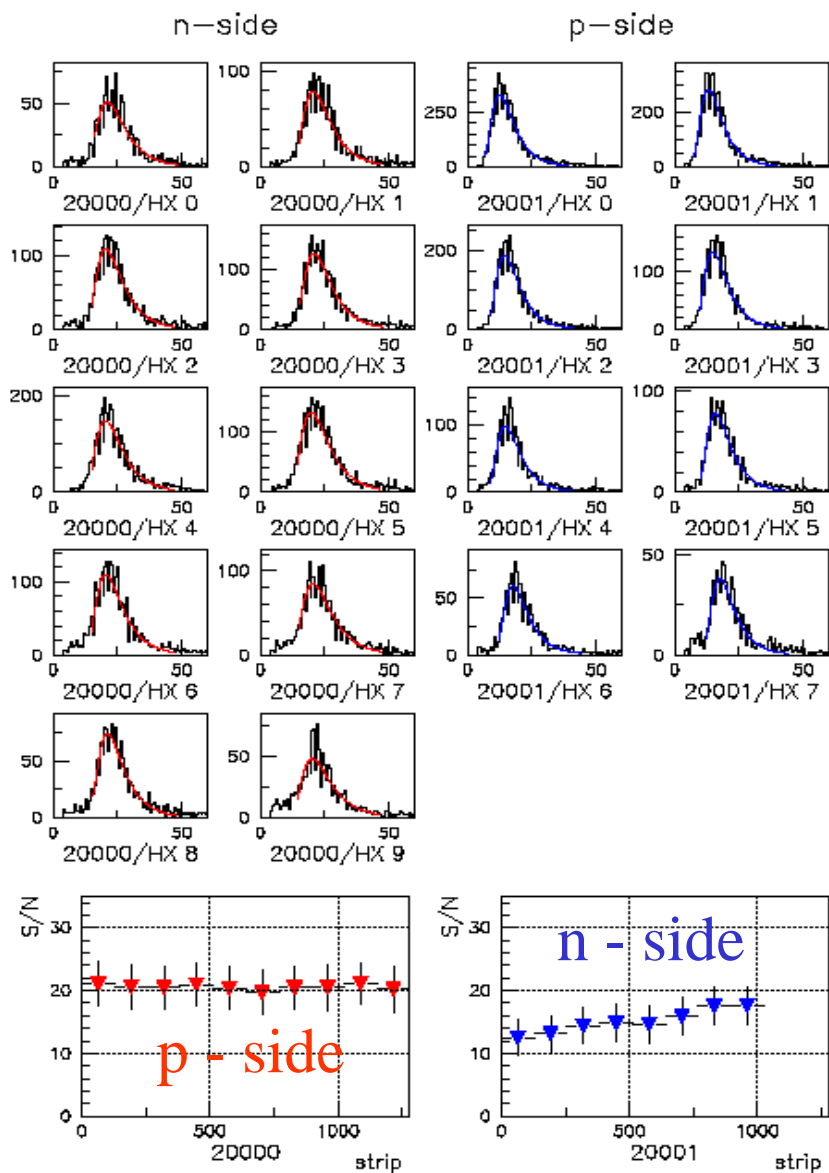




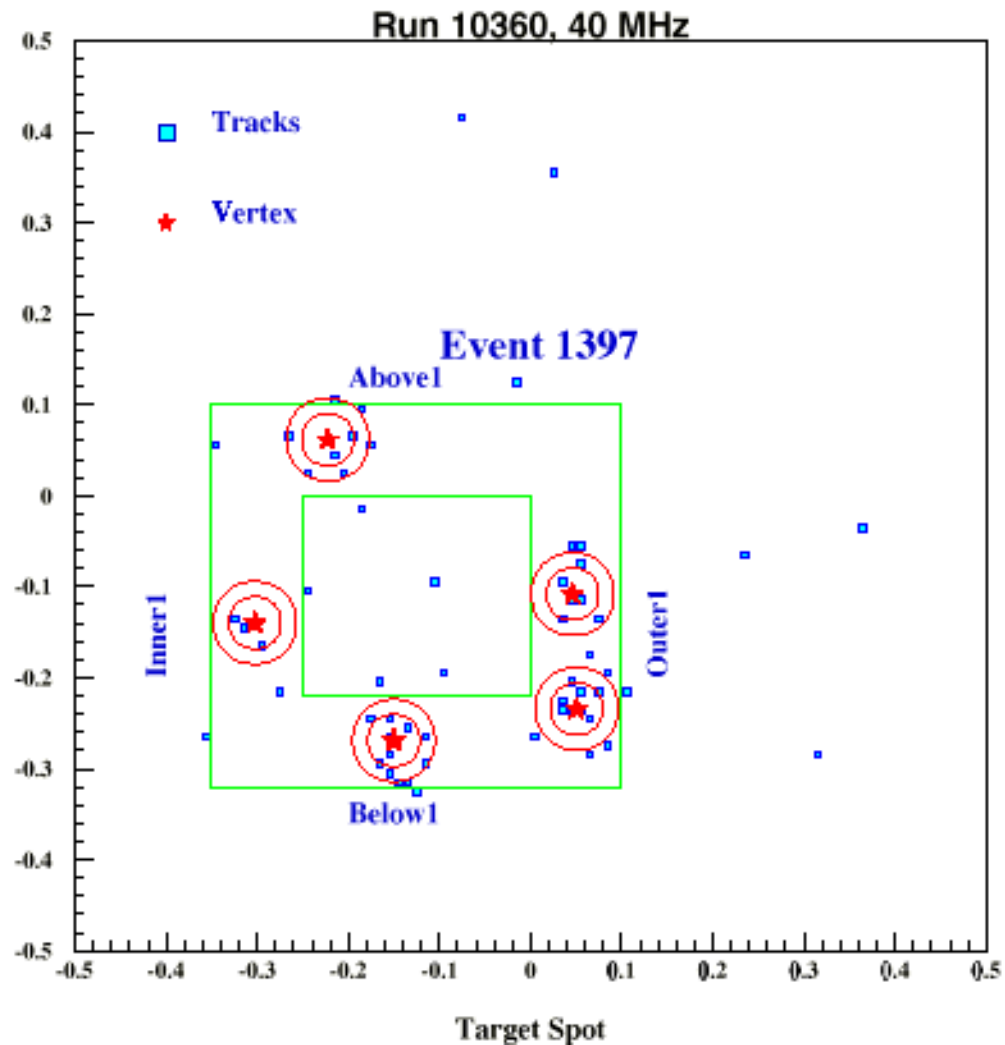
02.12.1999

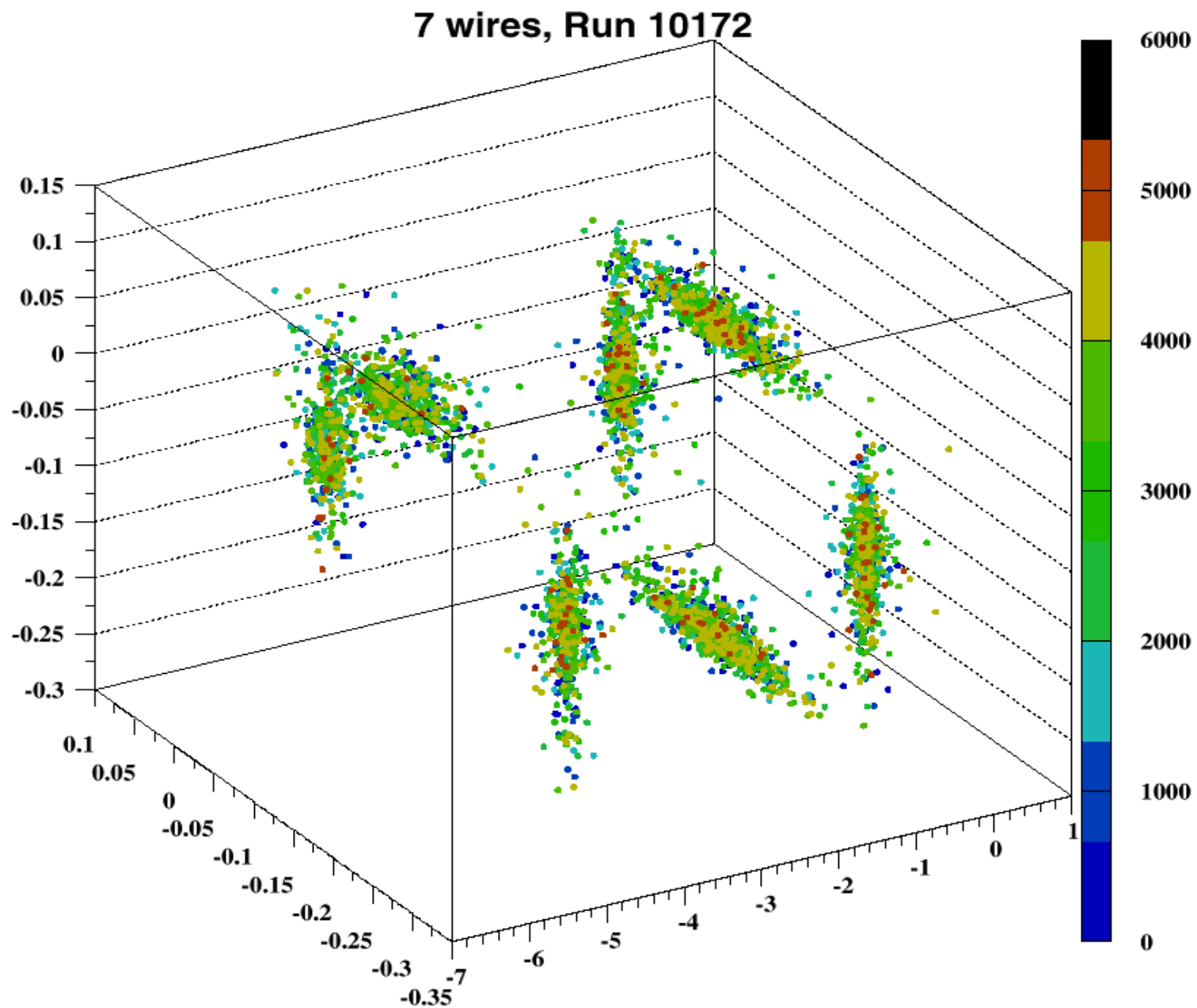
Bernhard Schmidt Talk at the DESY PRC Open Session, 18.11.1999

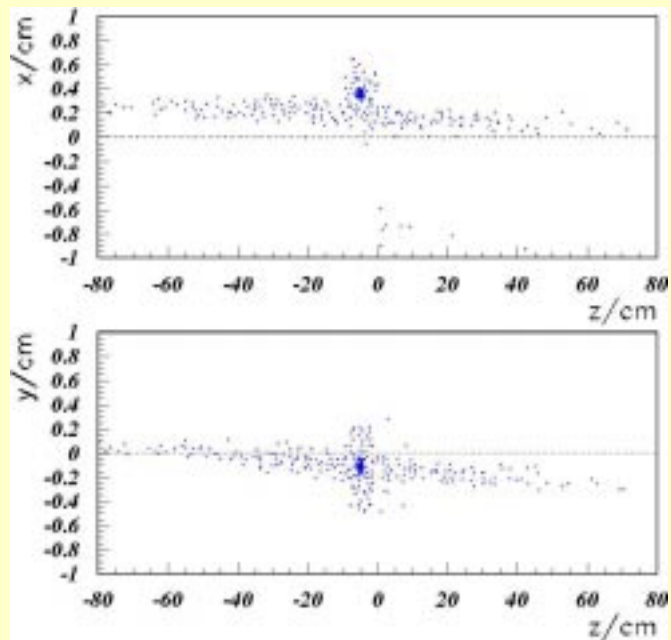
Signal to Noise as $f(\text{chip})$



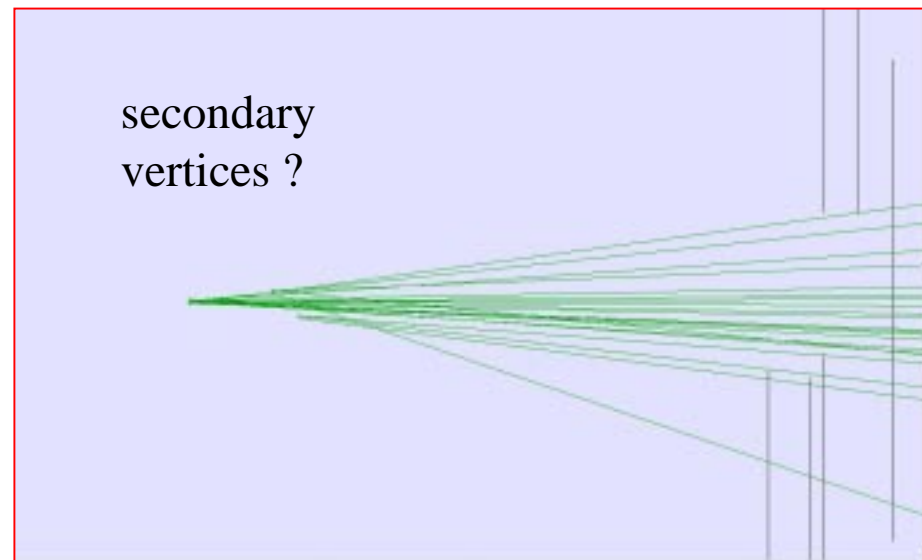
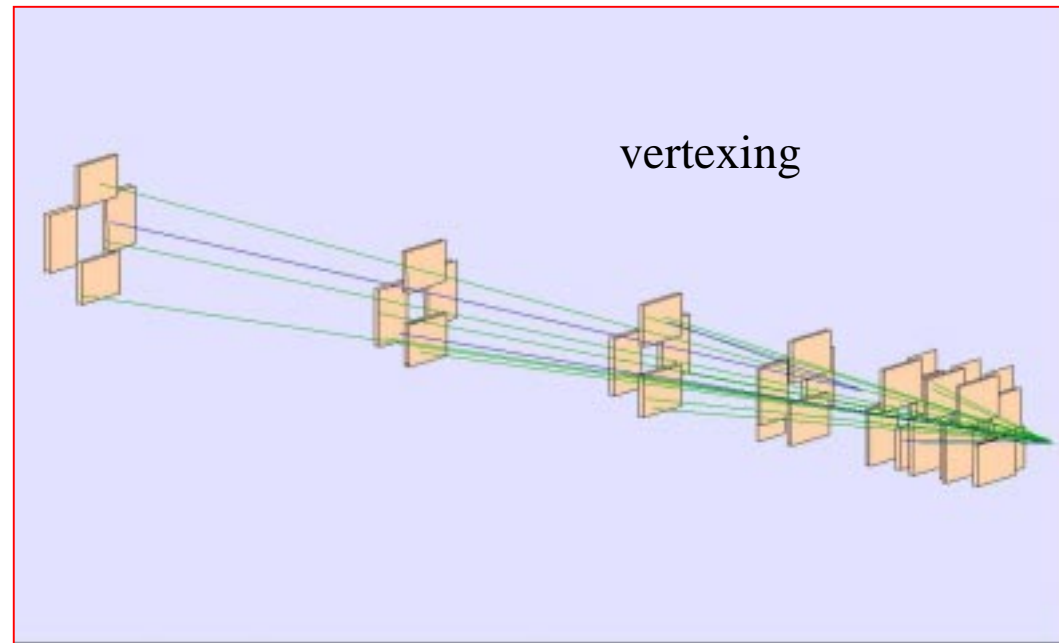
5 vertices in 1 bunch crossing



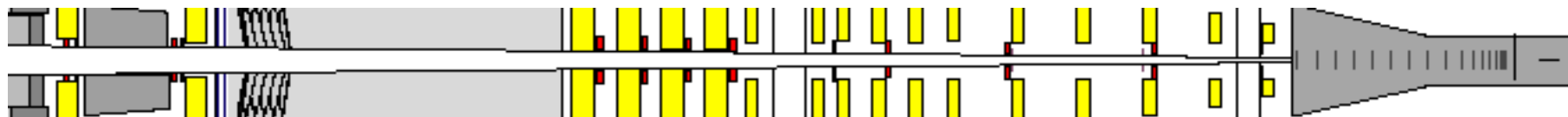




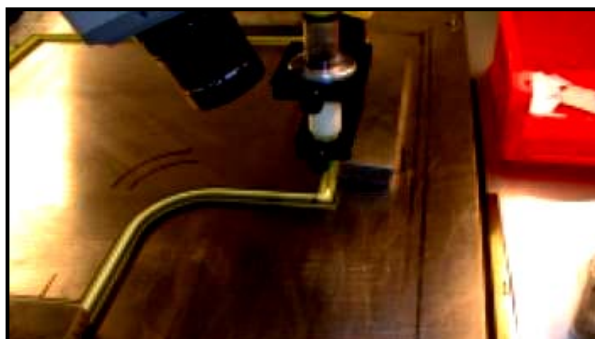
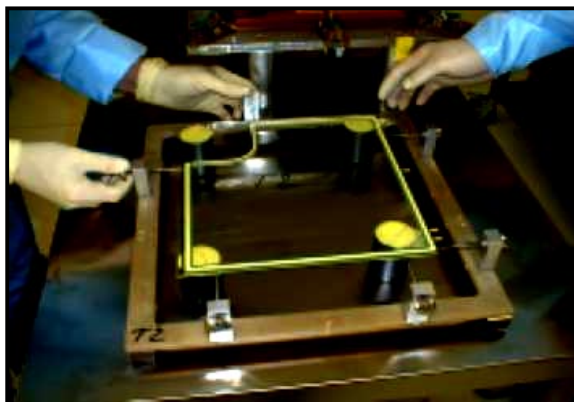
beam gas interactions
seen with the vertex
detector



Inner Tracker (MSGCs)



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



02.12.1999

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Present Status:

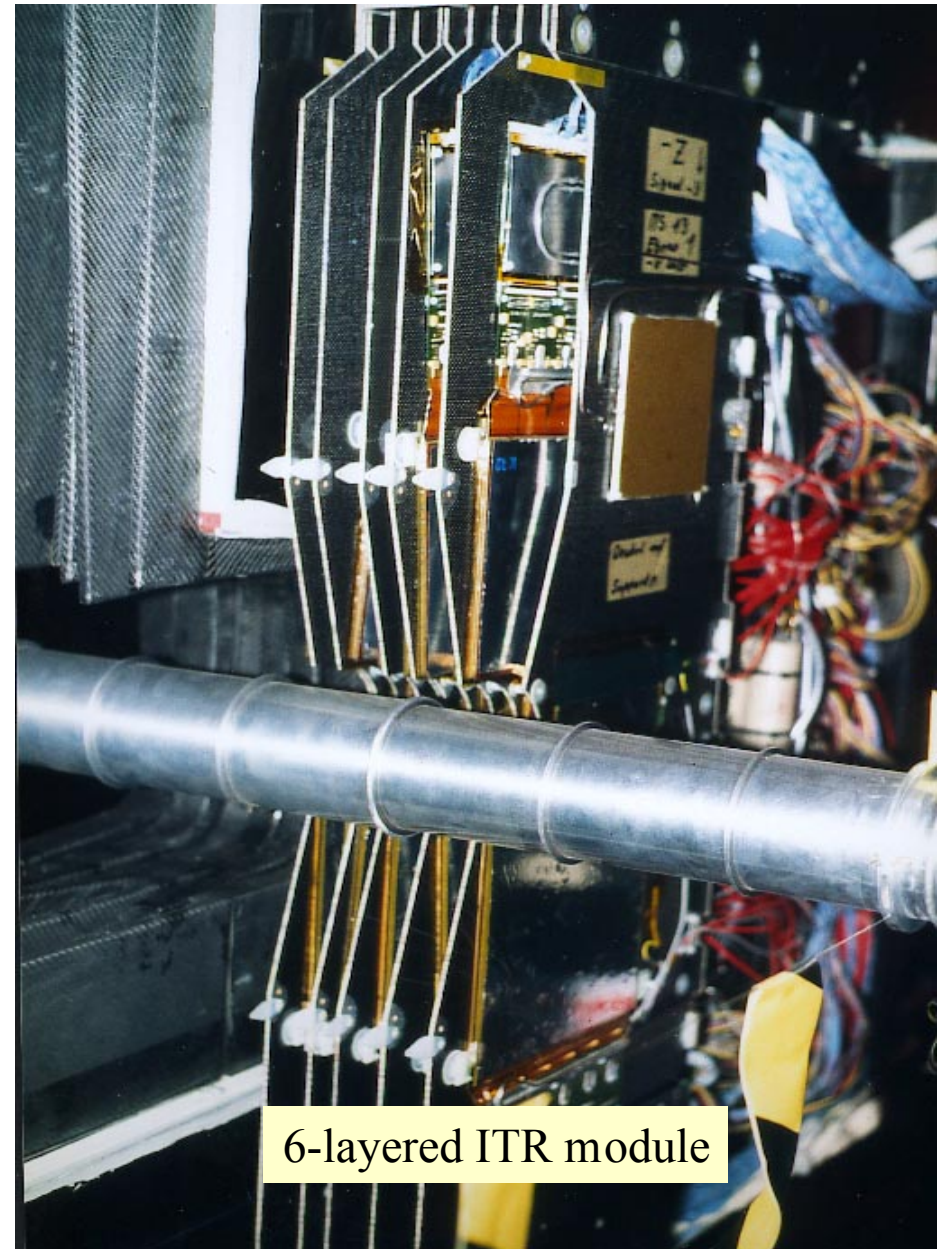
- mass production of chambers (almost) **finished**
- **bottleneck** : bonding, assembly of stations
- 6 (16) multilayer quadrants have been installed
- commissioning of chambers has started
- **Plans** : finish installation 9. Feb. 2000

Tight schedule !

Unsolved :

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

➡ (36% efficiency loss)



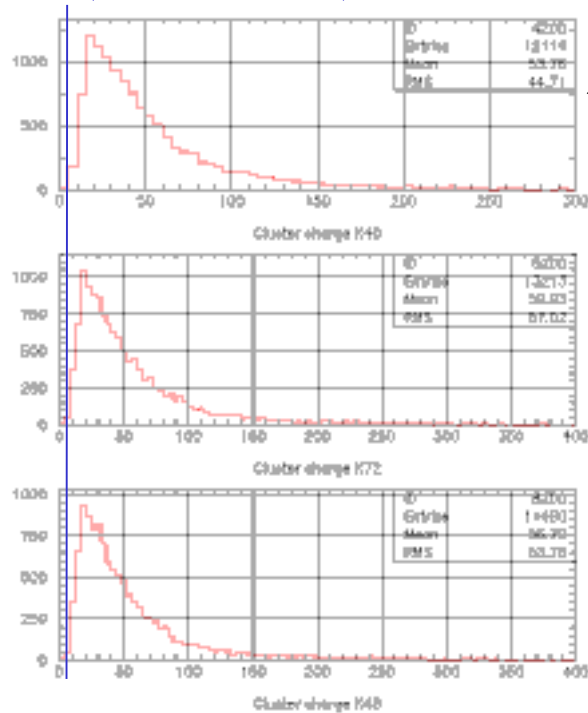
Running and commissioning

- 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

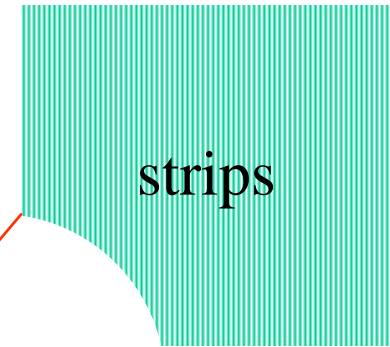
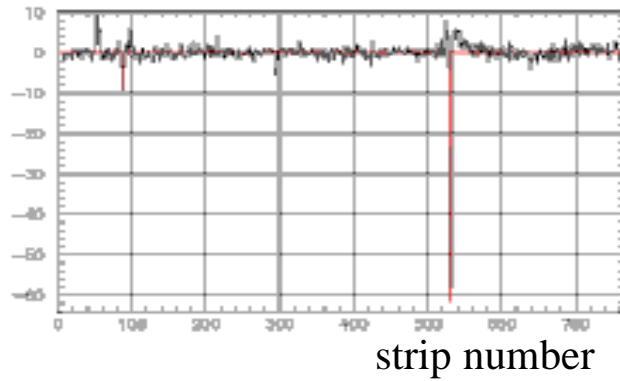
Considerable progress
but ITR is a critical item !

- there are hits..

charge distributions
(3 chambers)

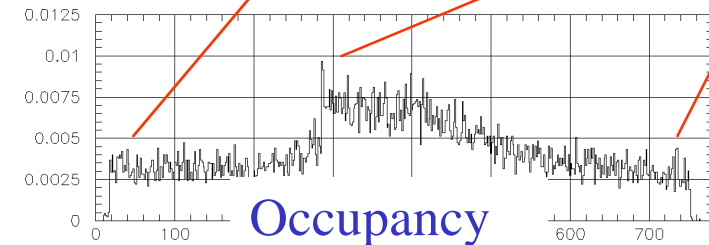


analog data

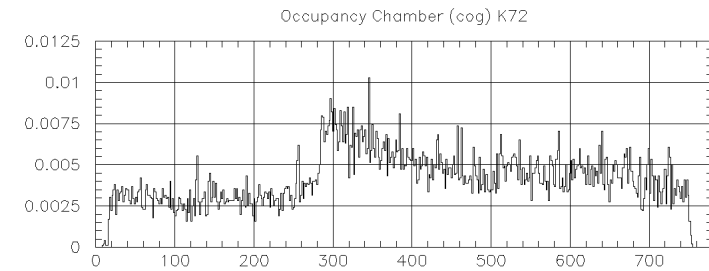
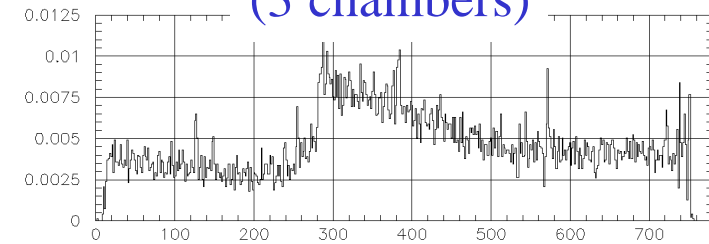


strips

strip number

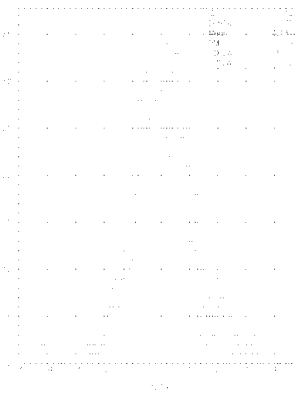


Occupancy
(3 chambers)



Occupancy Chamber (cog) K72
strip number

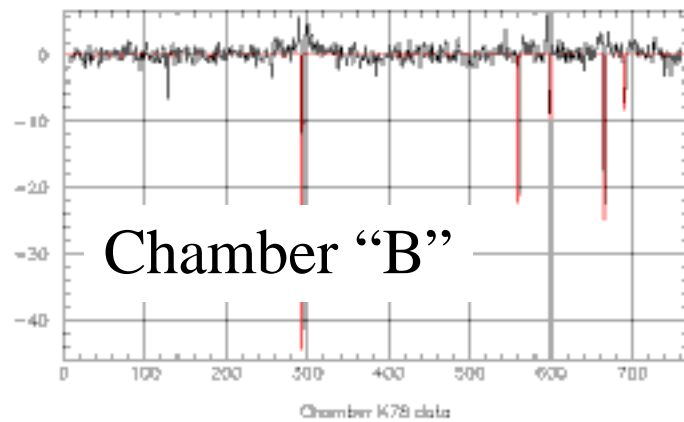
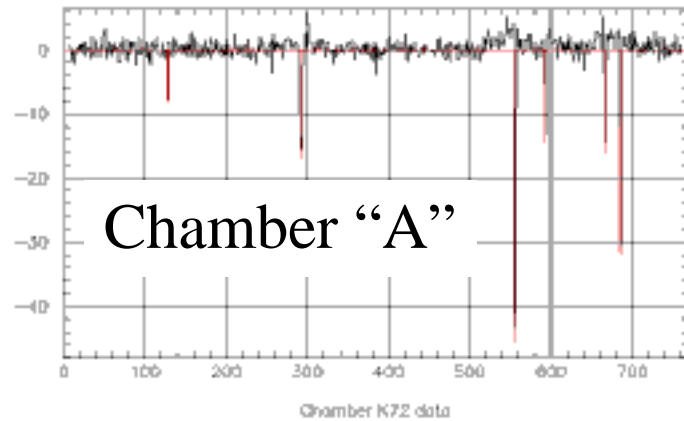
100 000 e^-
noise run
 $\sigma \sim 2700 e^-$



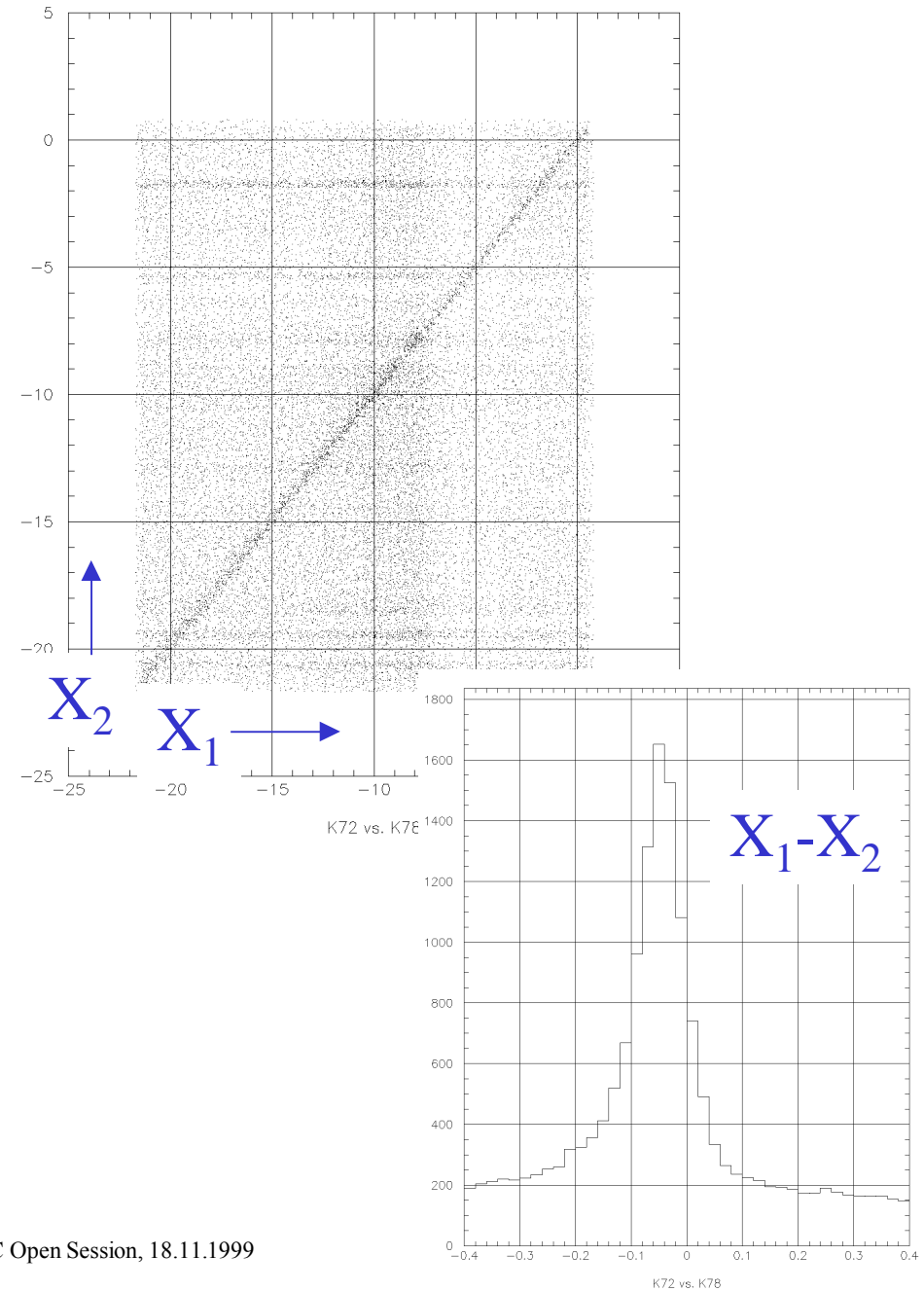
02.12.1999

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Correlated hits



Strip number

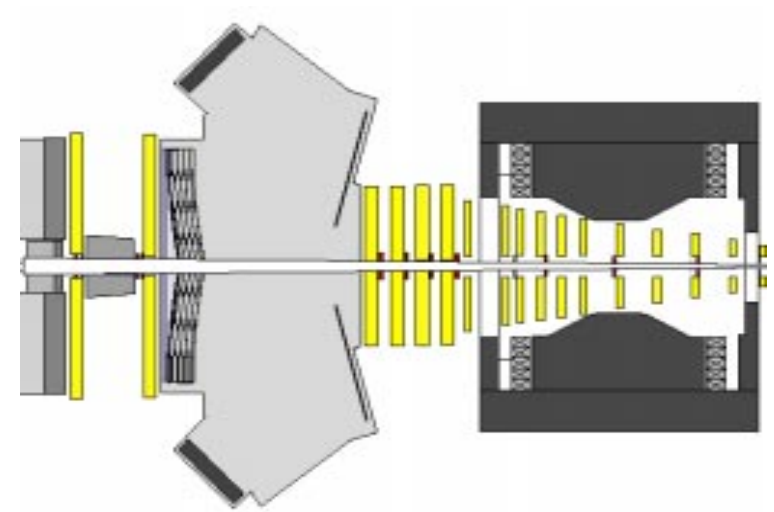
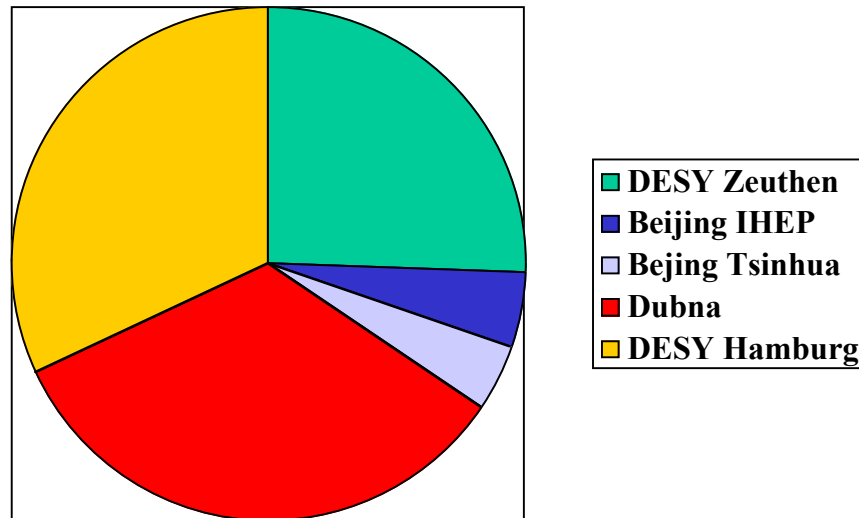


Outer Tracker System

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

➔ **Finished !**

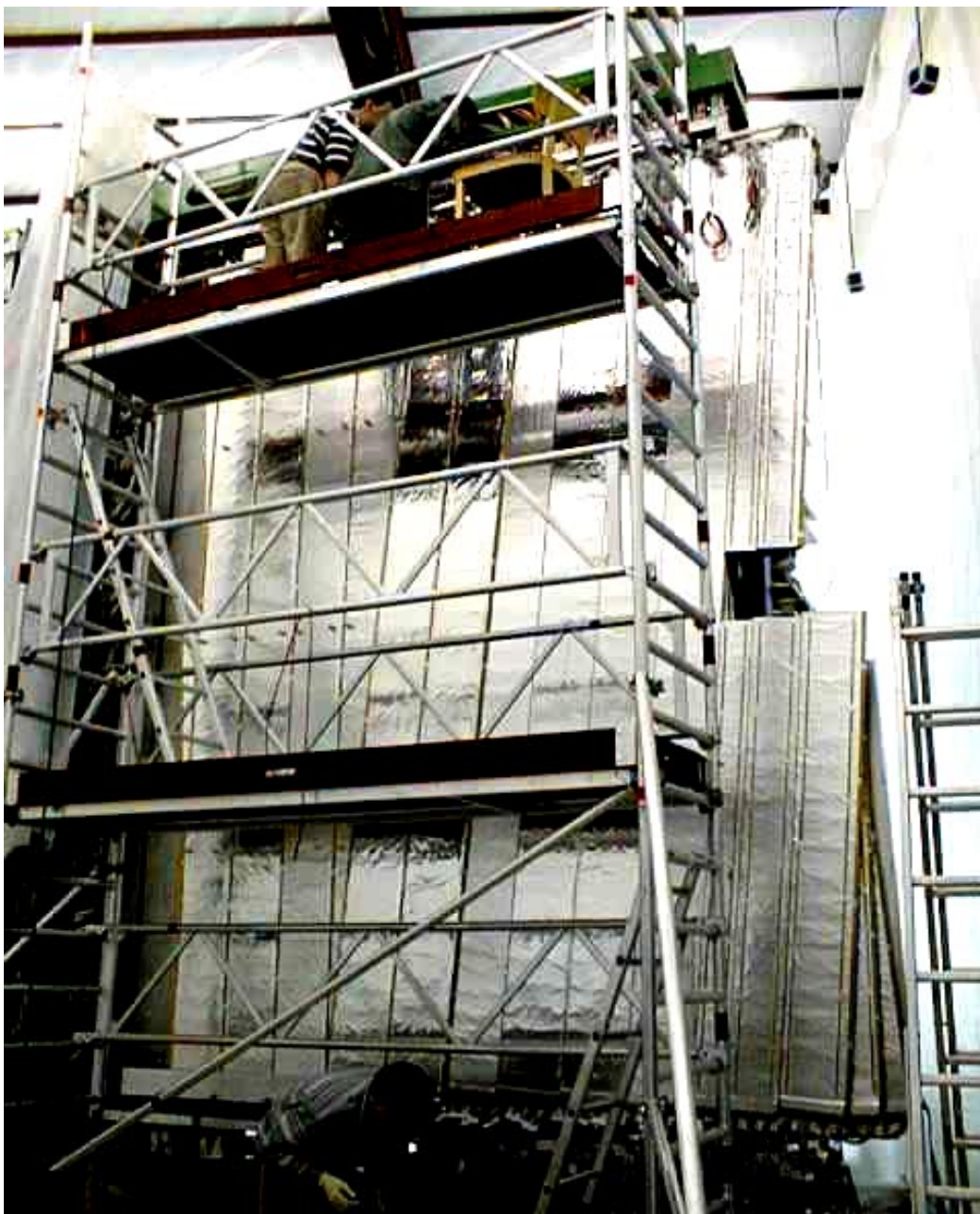
978 modules build
112 634 signal wires (193 km)



all channels tested after production

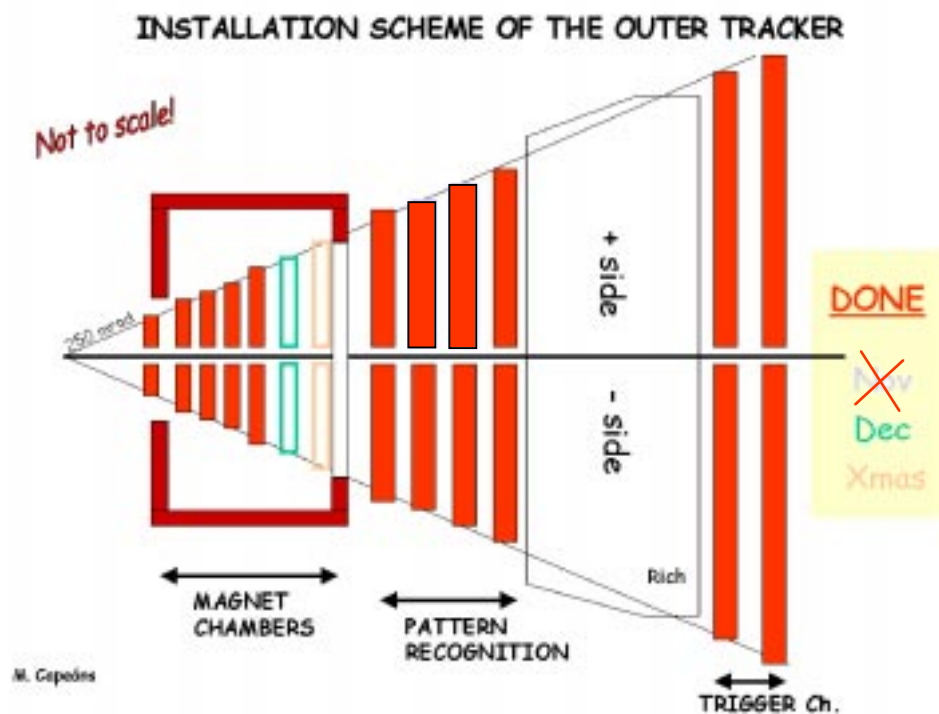
- 474 shorts (0.42 %)

- 397 hot (0.35 %)



Assembly and installation **ahead of schedule!**

Only two magnet chambers missing

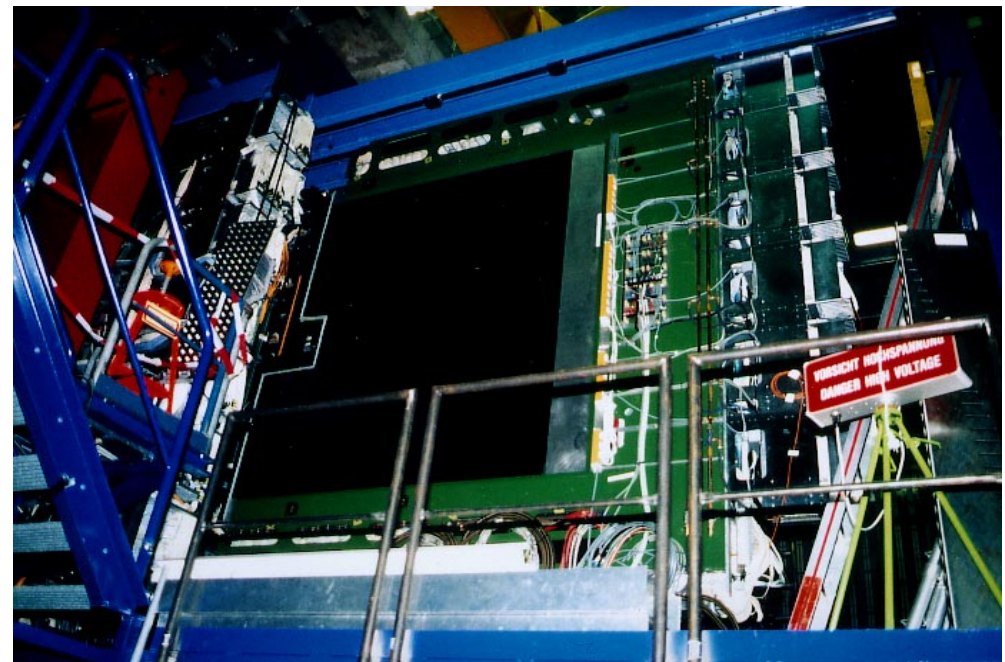
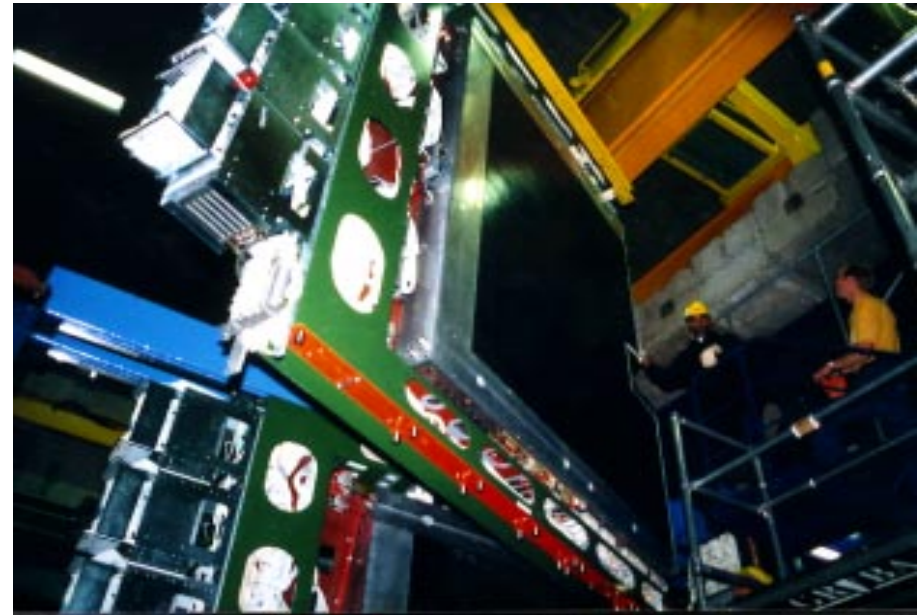


02.12.1999

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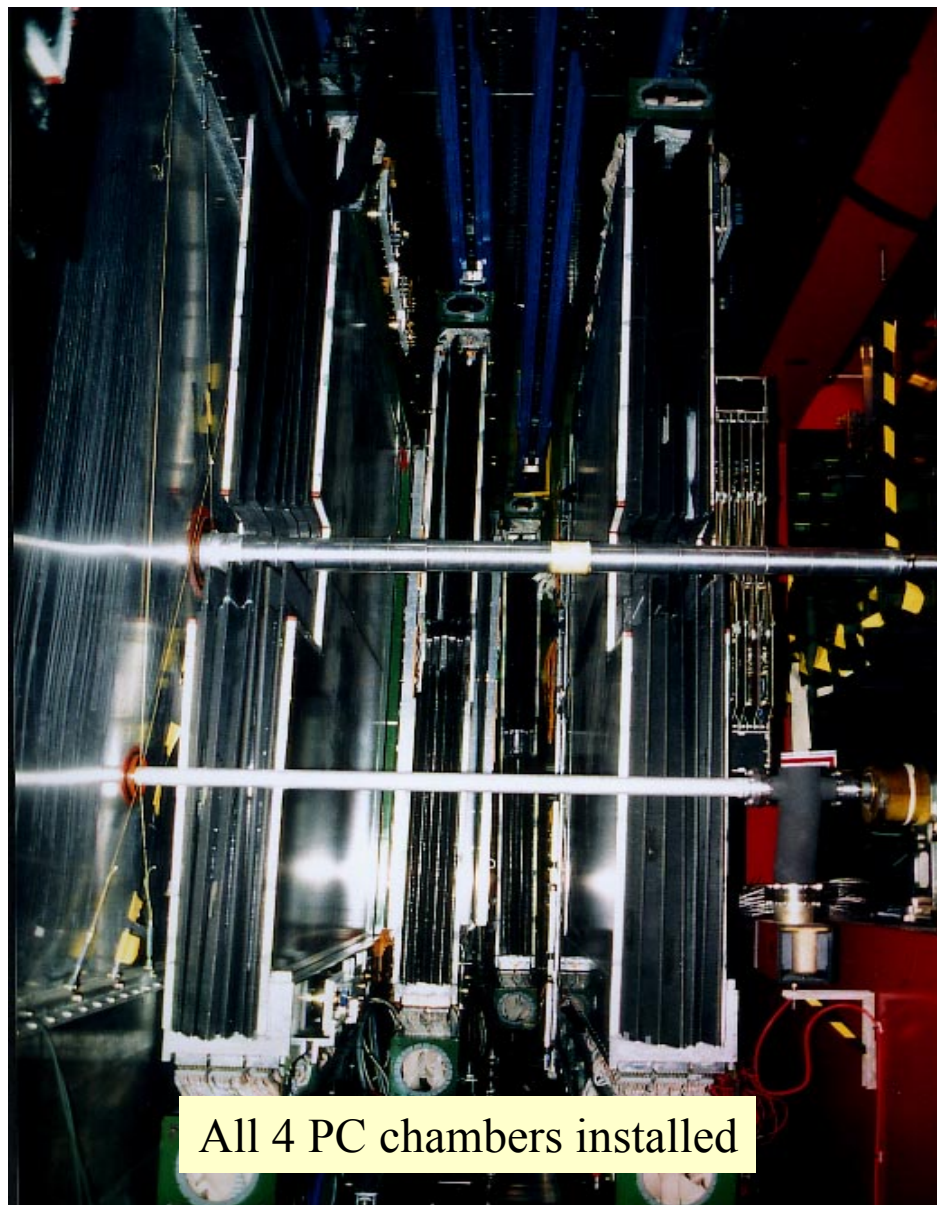
Transport and installation of PC chamber in one of the mini shutdowns



02.12.1999

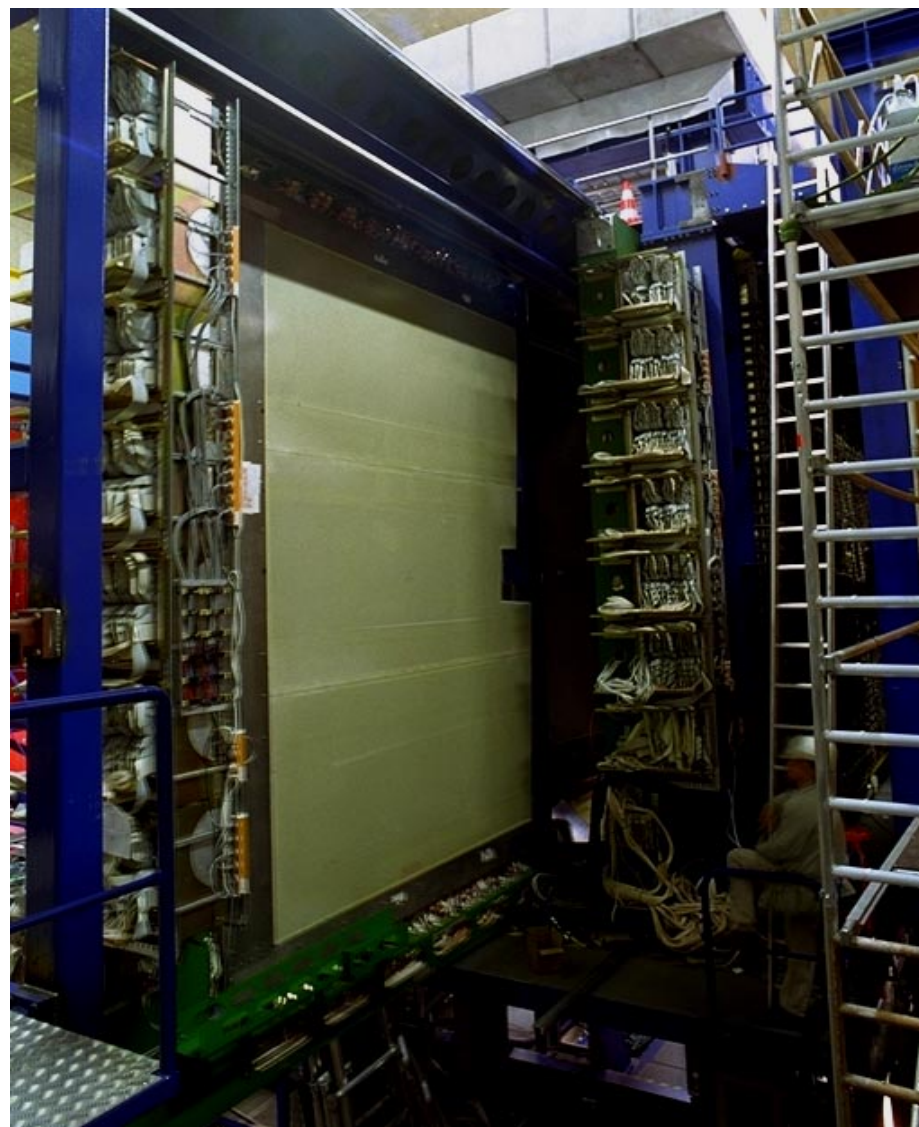
Bernhard Schmidt Talk at the DESY PRC Open Session, 18.11.1999

16



All 4 PC chambers installed

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 !

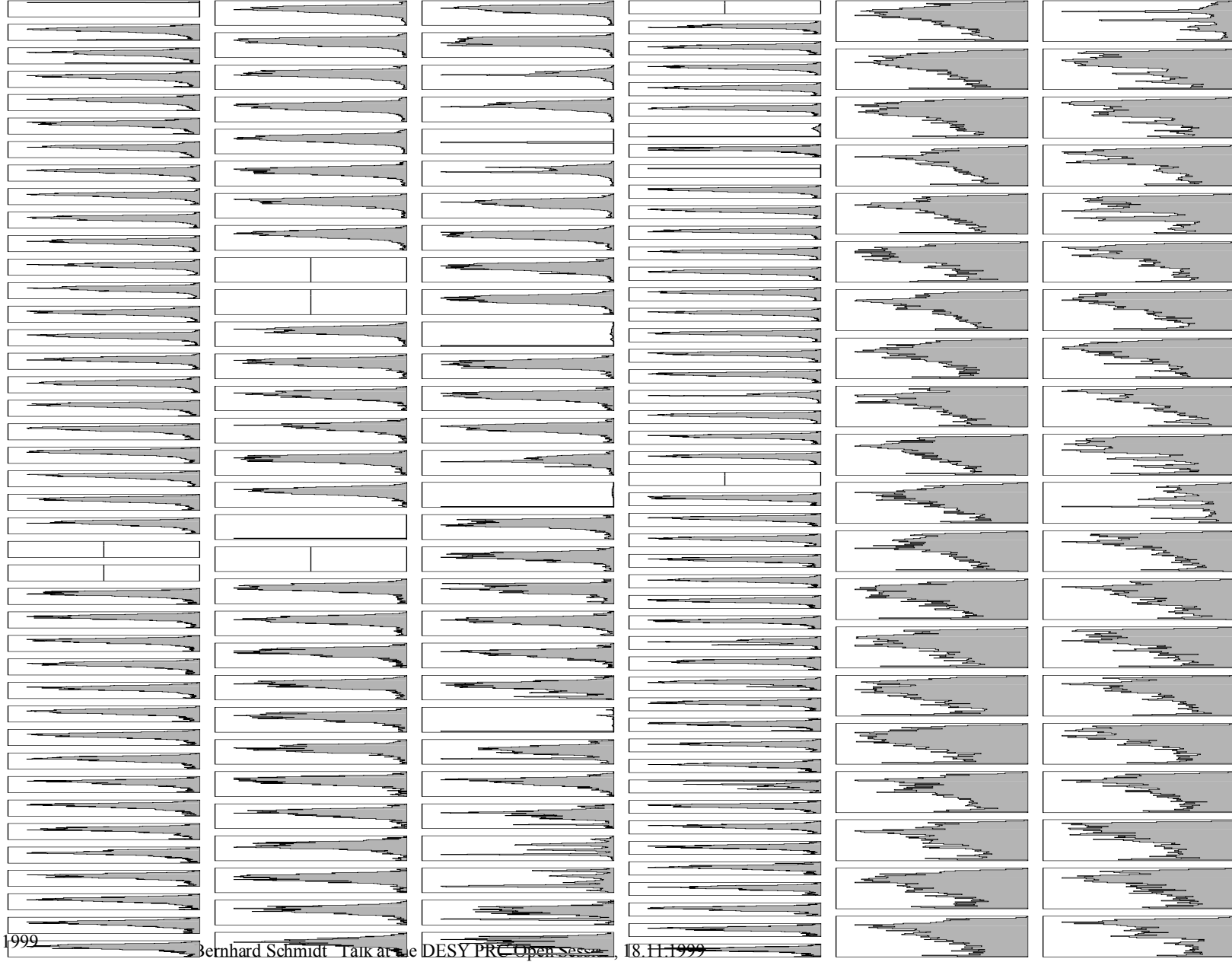
Software

- | | |
|--|--|
| <ul style="list-style-type: none">- slow control- hit preparation- quality control | <ul style="list-style-type: none">- calibration- alignment- 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

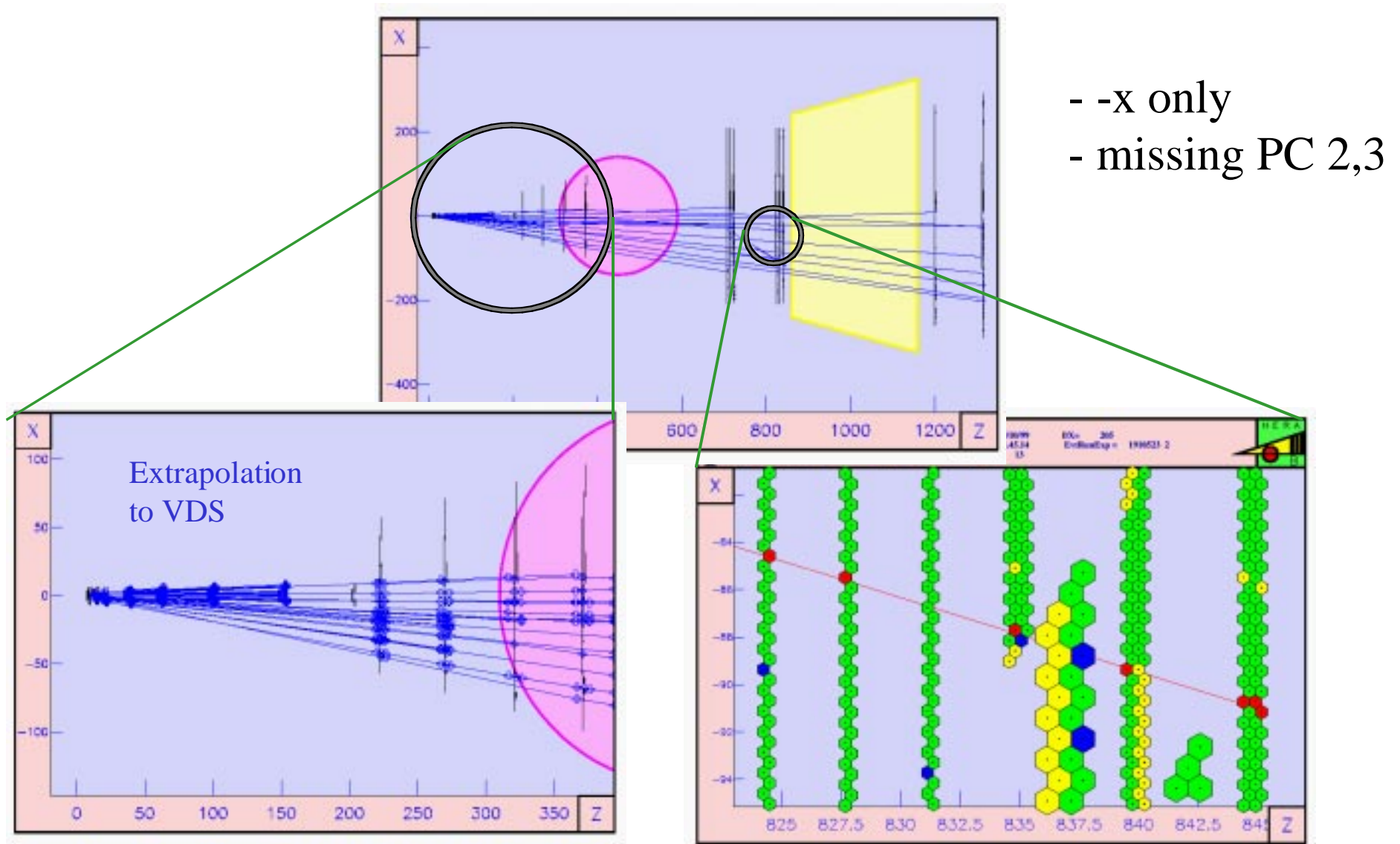
02.12.1999



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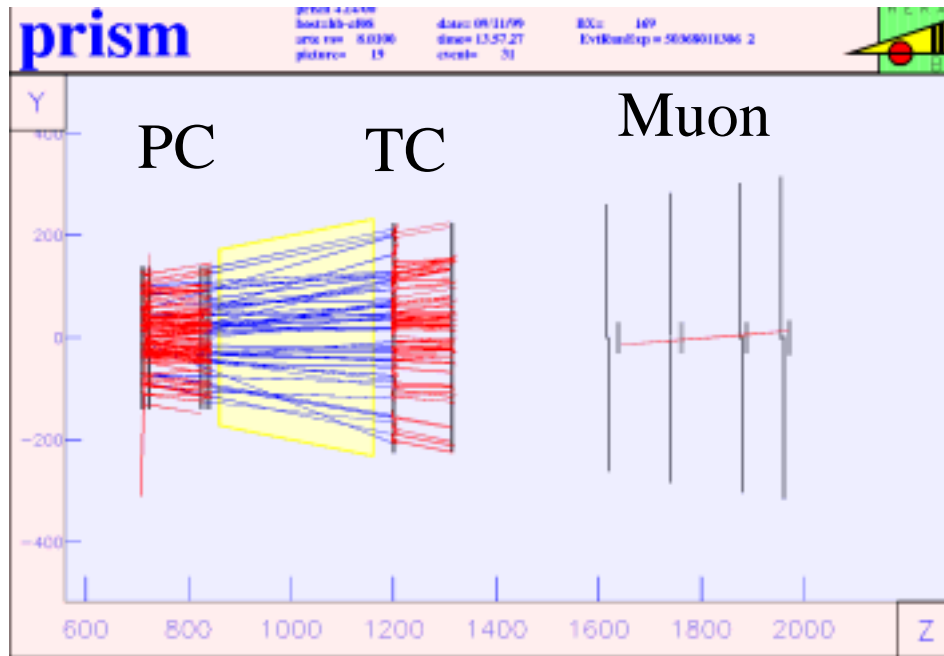
19

HERA-B starts to have a main tracker !

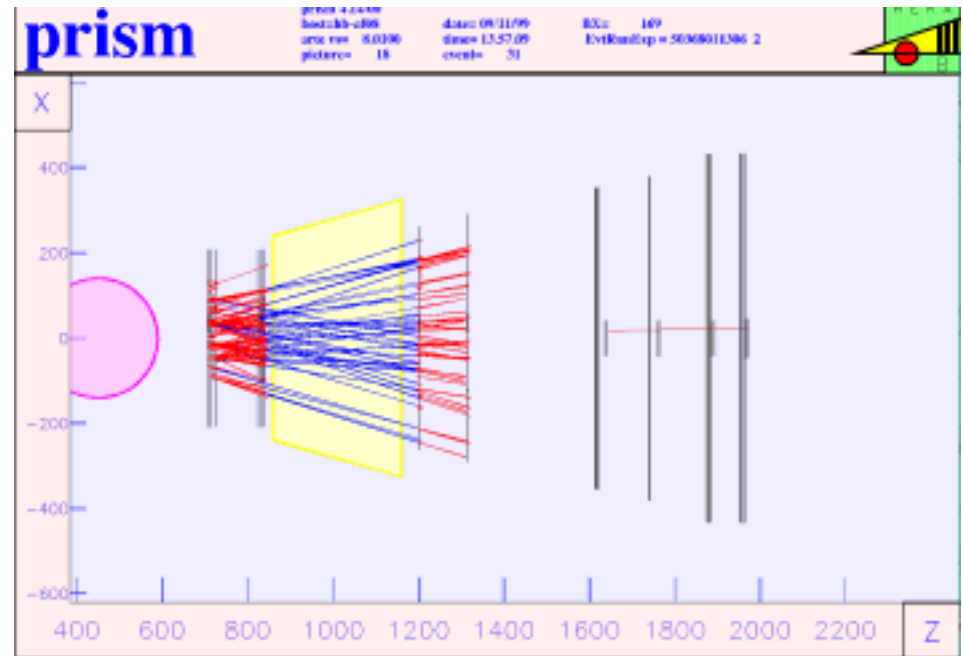


- tracking during μ -run (μ selection in SLT)

Y - Z



X - Z



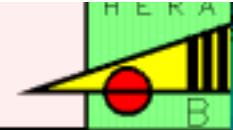
Now both, $\pm x$
Still no PC 2,3 used

prism

prism 4.14/00
host=hb-af08
arte vs= 8.0100
picture= 29

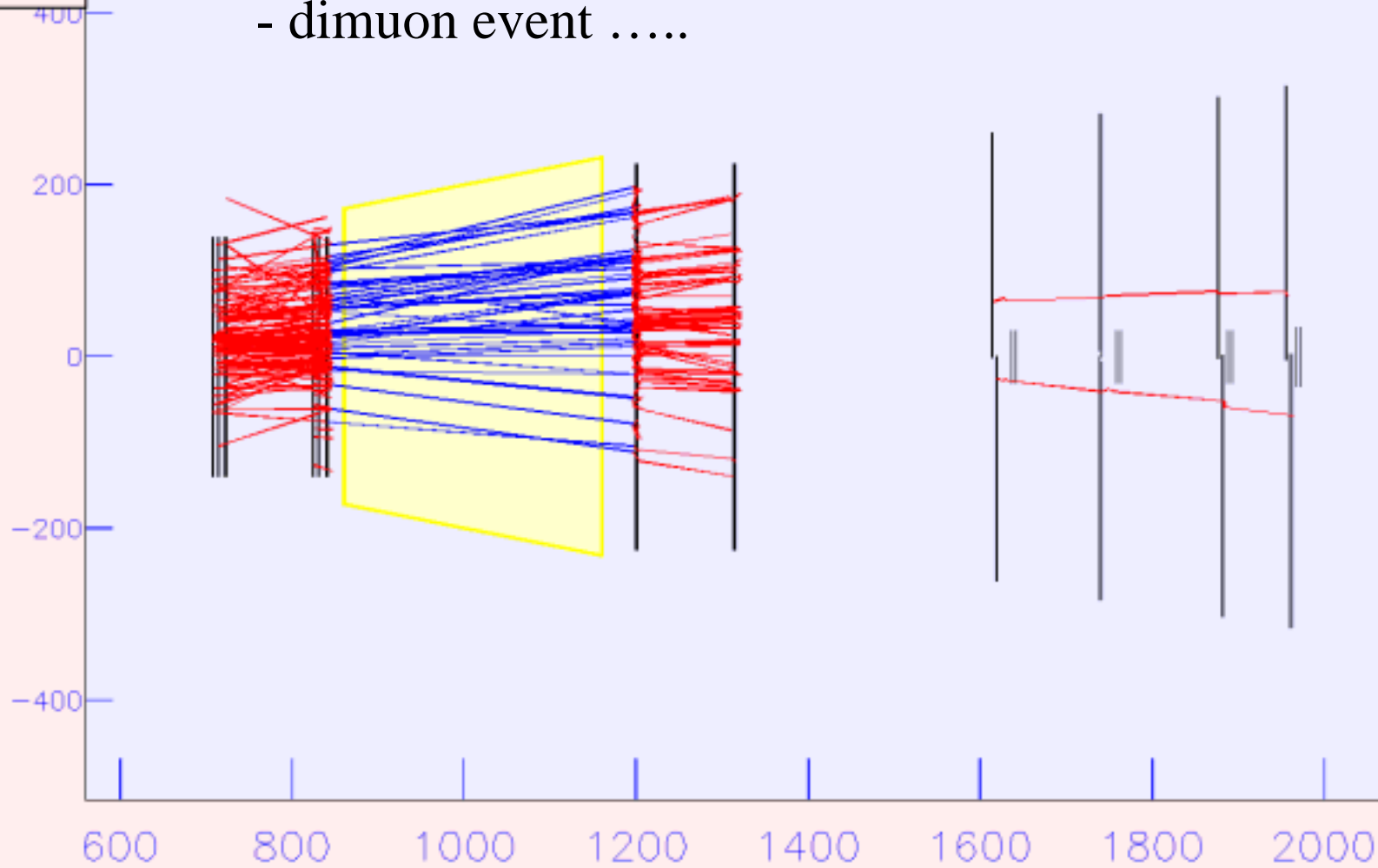
date= 09/11/99
time= 14.02.51
event= 83

BX= 16
EvtRunExp = 50373211306 2

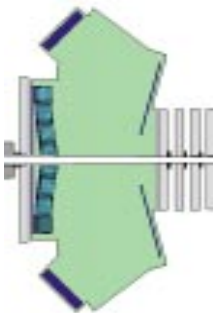


Y

- dimuon event

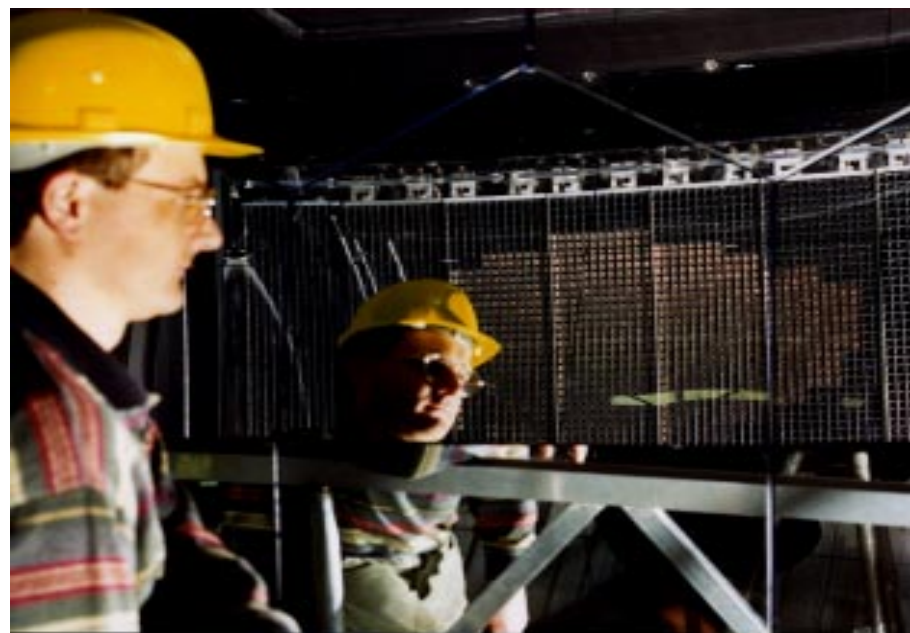
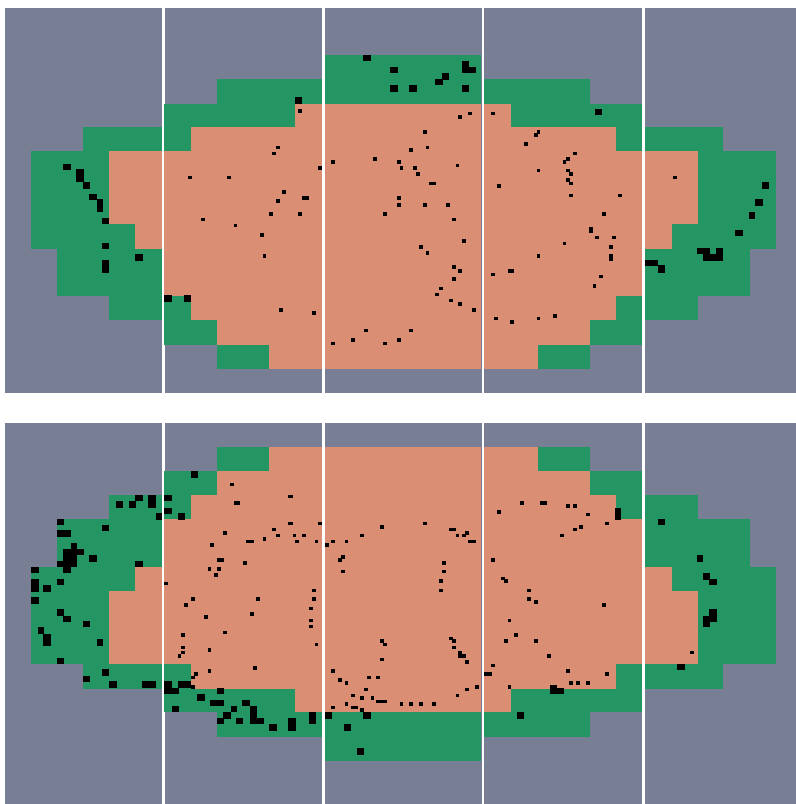


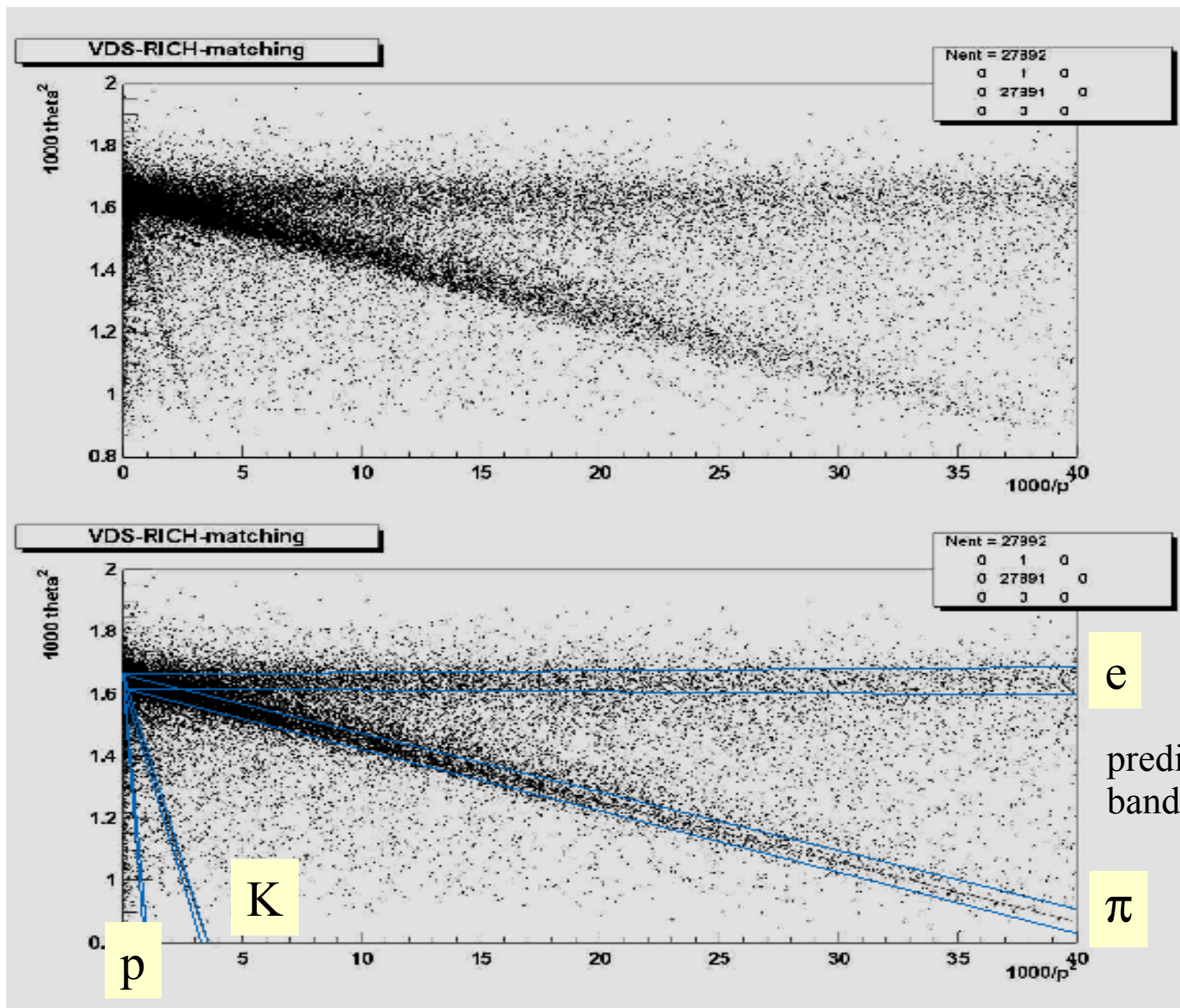
Z



RICH

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





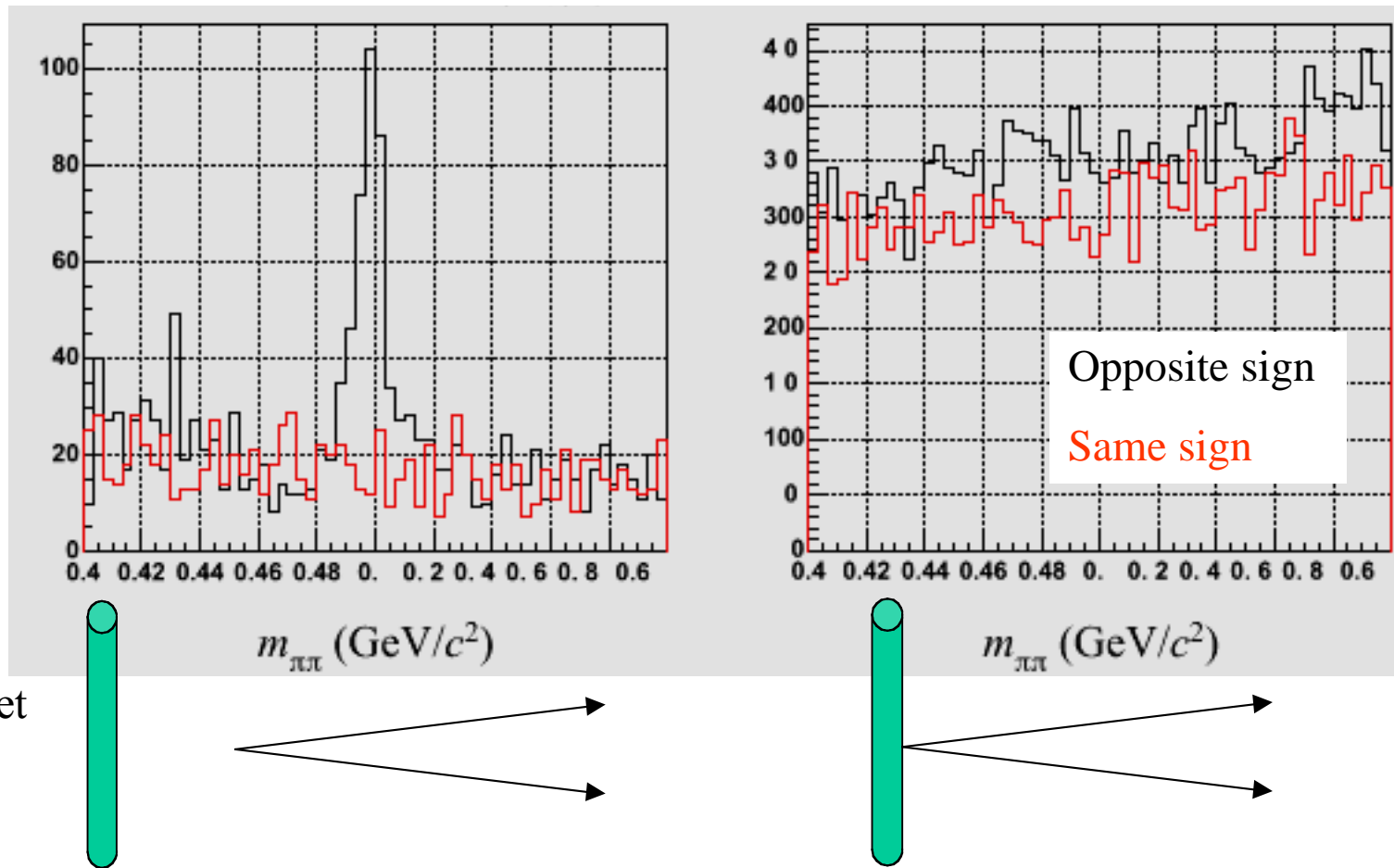
02.12.1999

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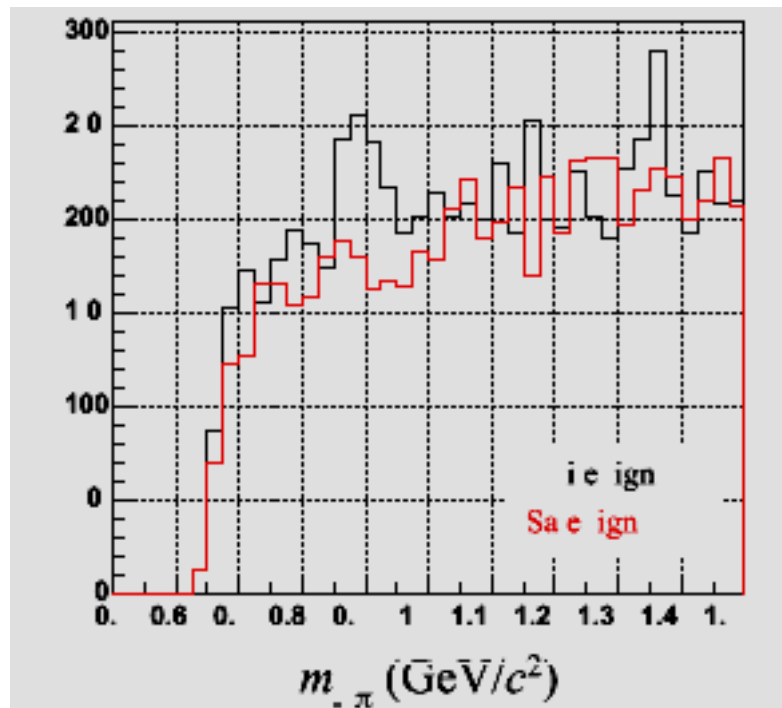
RICH information + Vertex detector: $K_s^0(498)$

$\pi - \pi$ mass

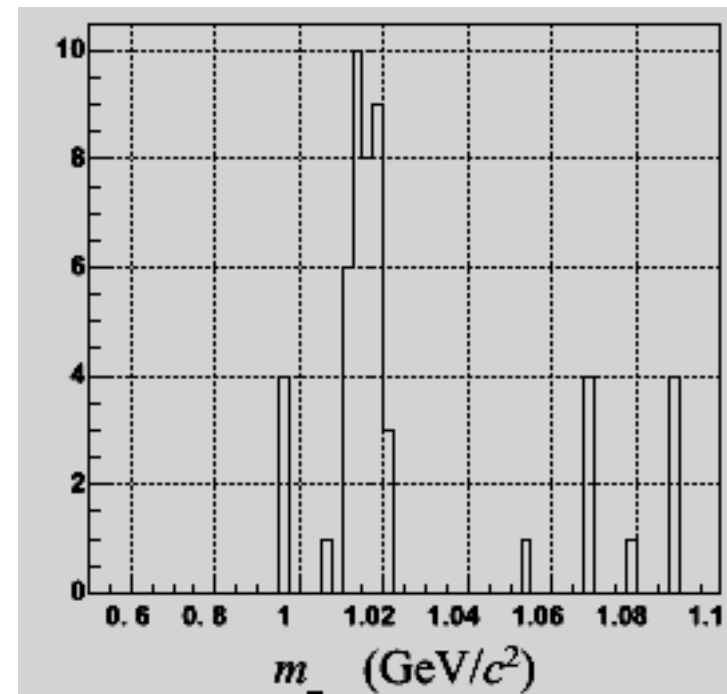


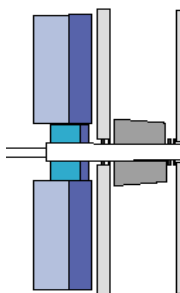
RICH information + Vertex detector:

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



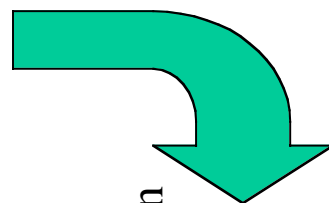
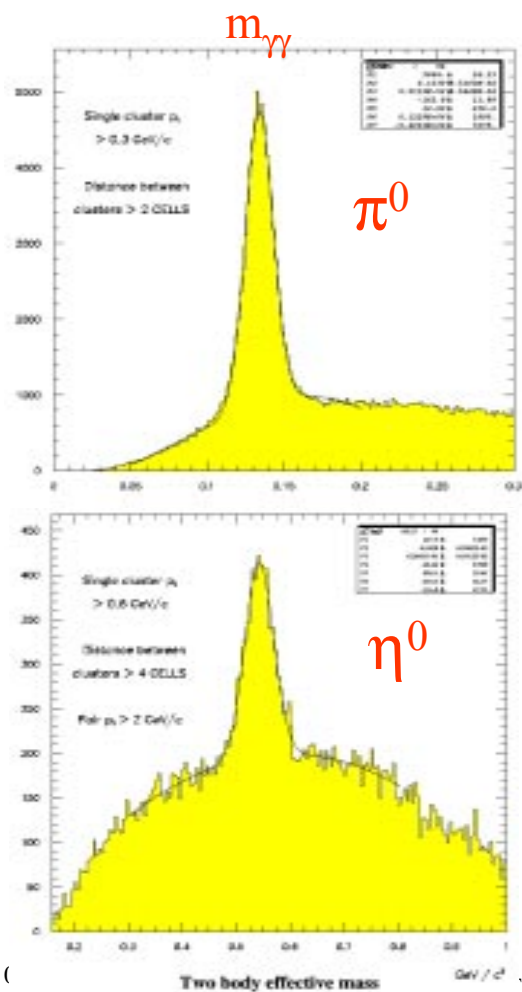
K+K- mass: the $\phi(1020)$





Electromagnetic Calorimeter

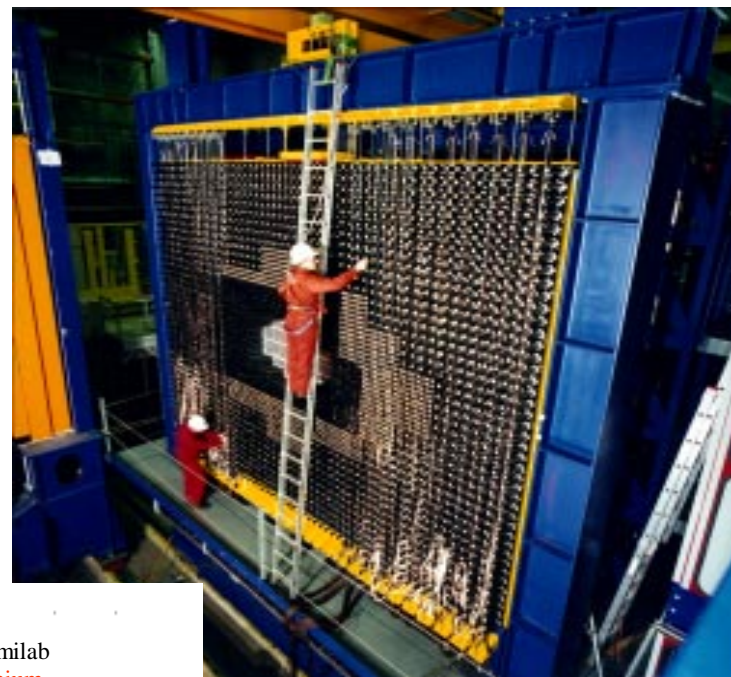
- system is **ready** (inner and middle)
- workhorse for pretrigger

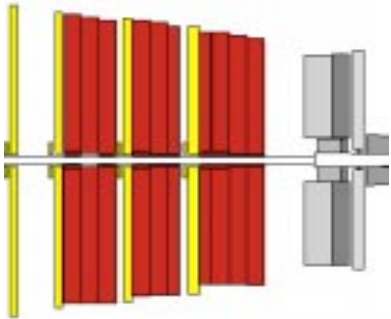


differential cross section

X : Fermilab
• : Titanium
• : Carbon

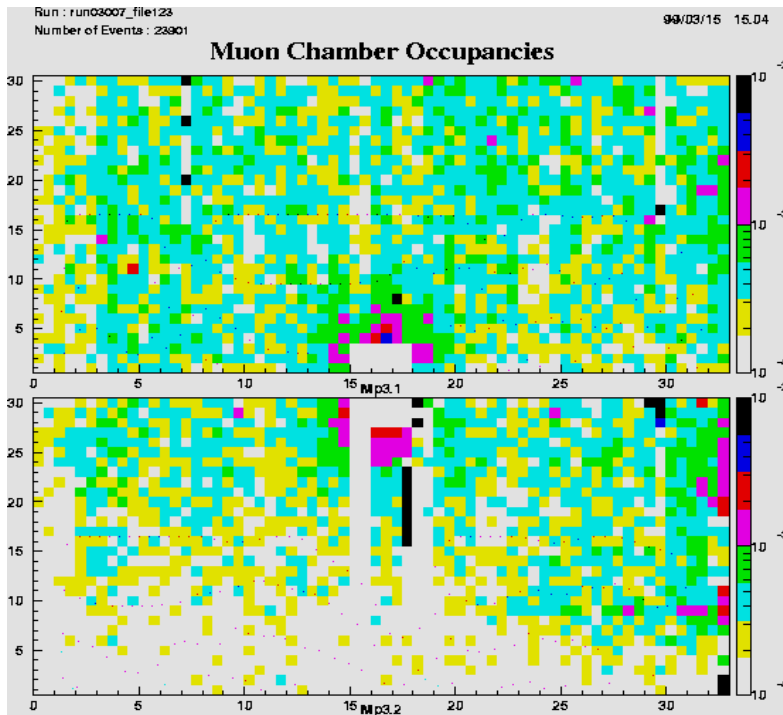
$p_T \text{ [GeV]}$





Muon System

2nd source for pretriggers



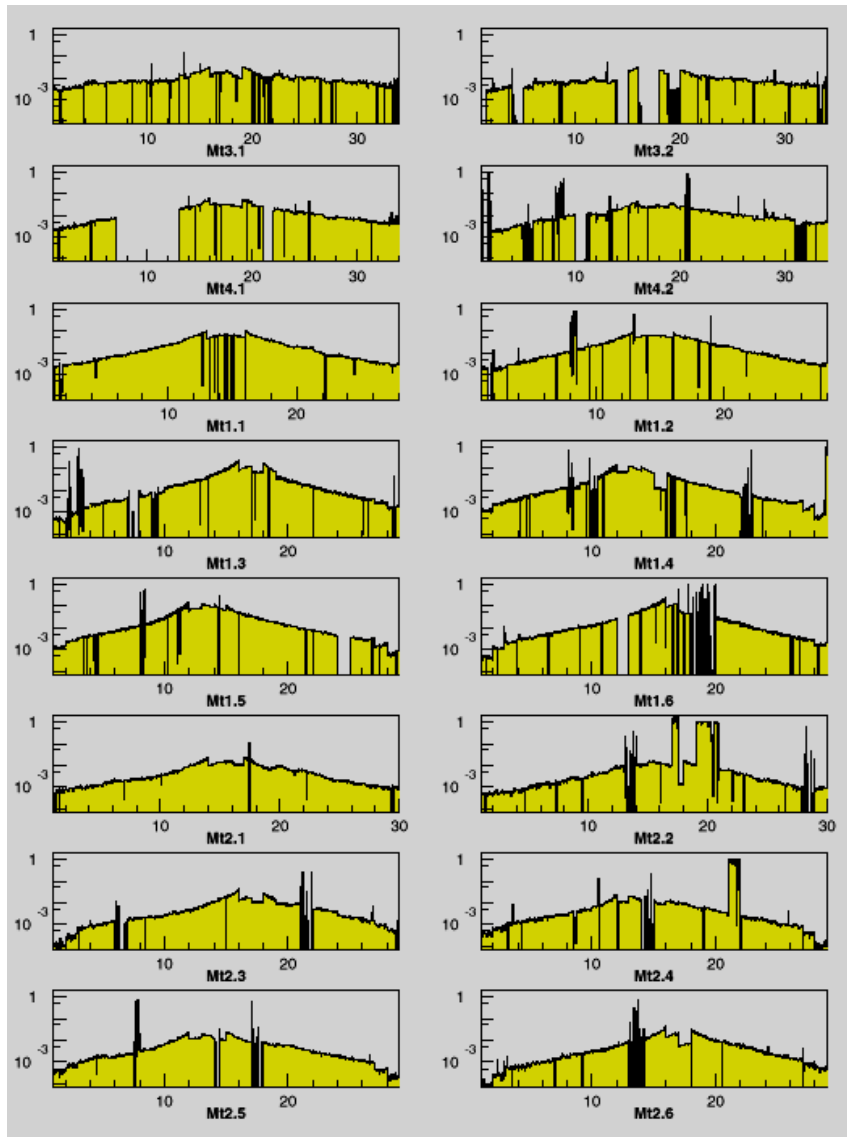
Tube chambers



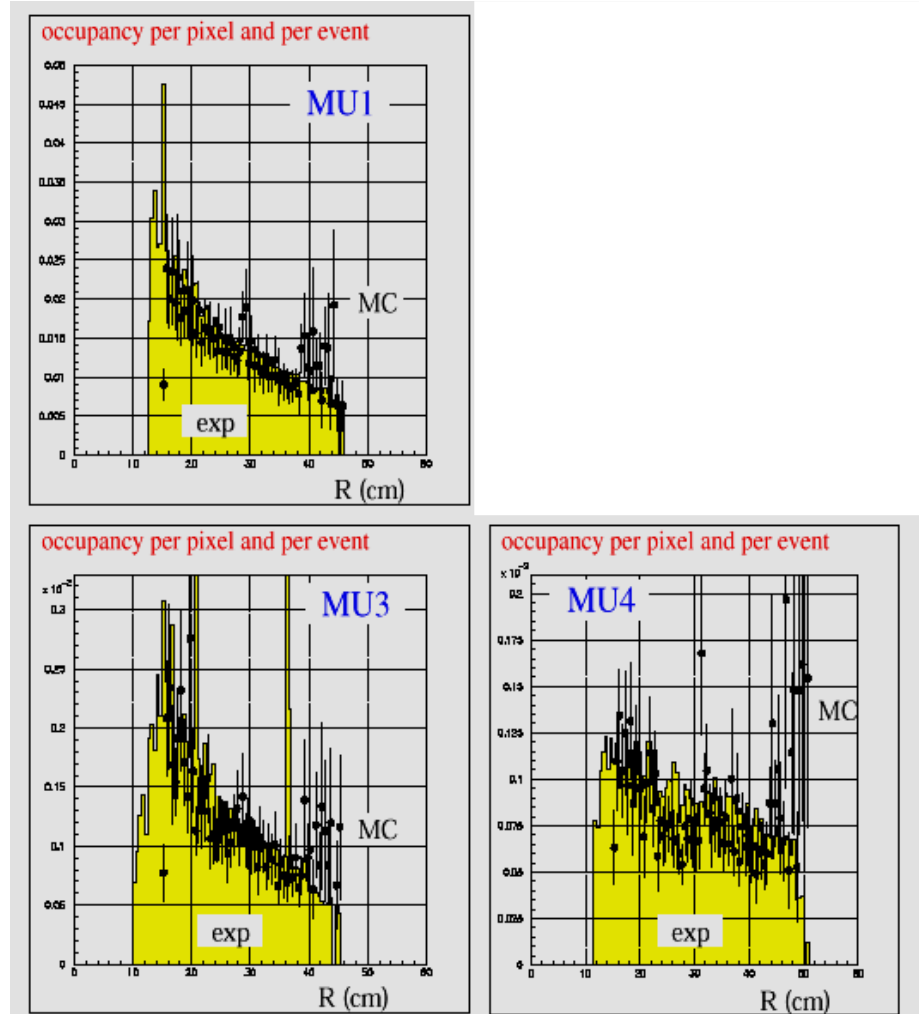
Pad chambers (used in trigger)

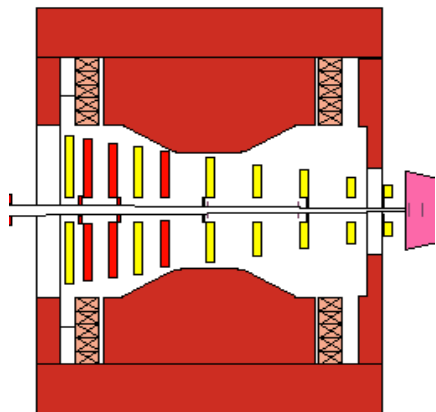
- detector system \approx ready
- still work on gas system needed

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

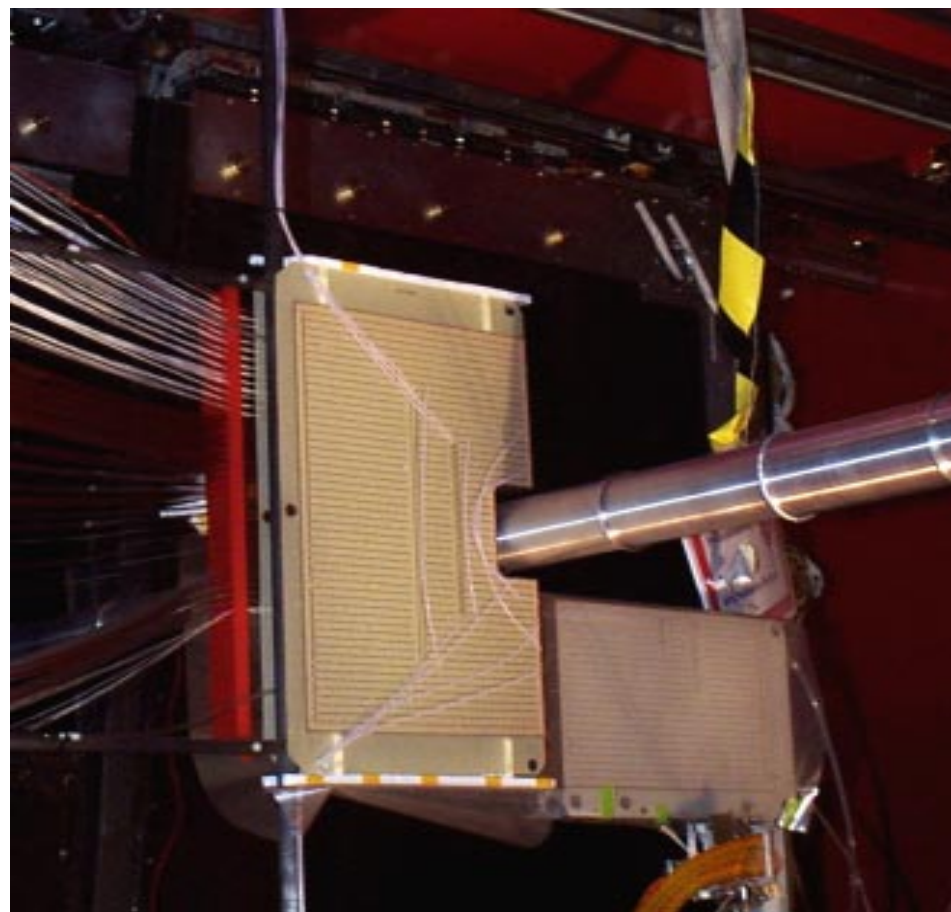
- all hardware procured

INNER : ITEP Moscow

OUTER : Cincinnati

- chambers and special cabling
- readout
- pretrigger

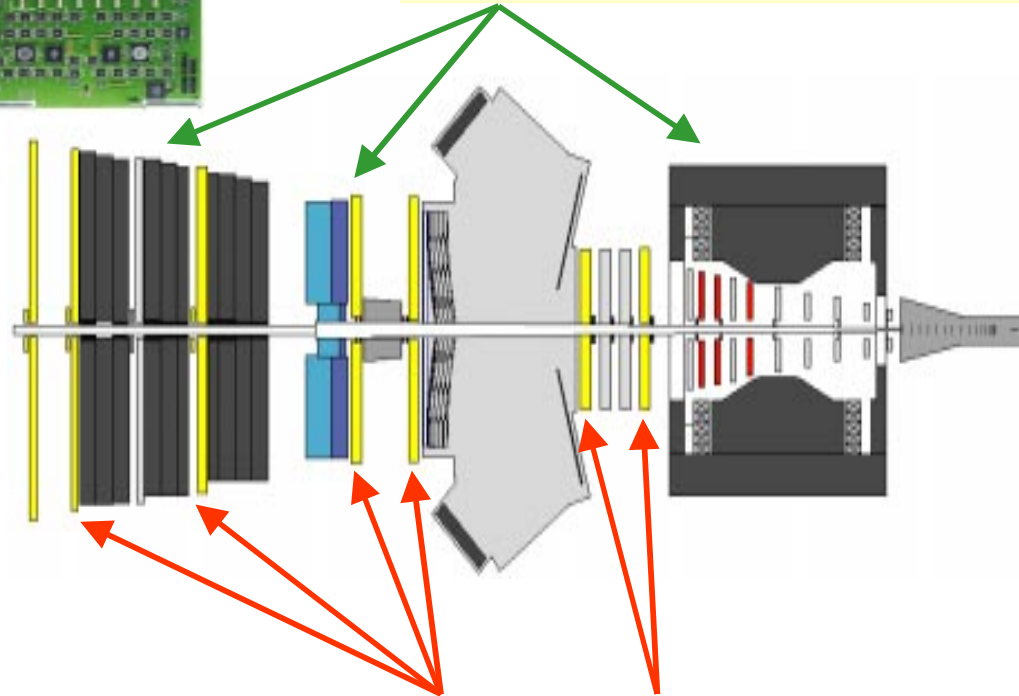
ready end February 2000?



Level 1 Trigger and DAQ

Pretriggers:

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



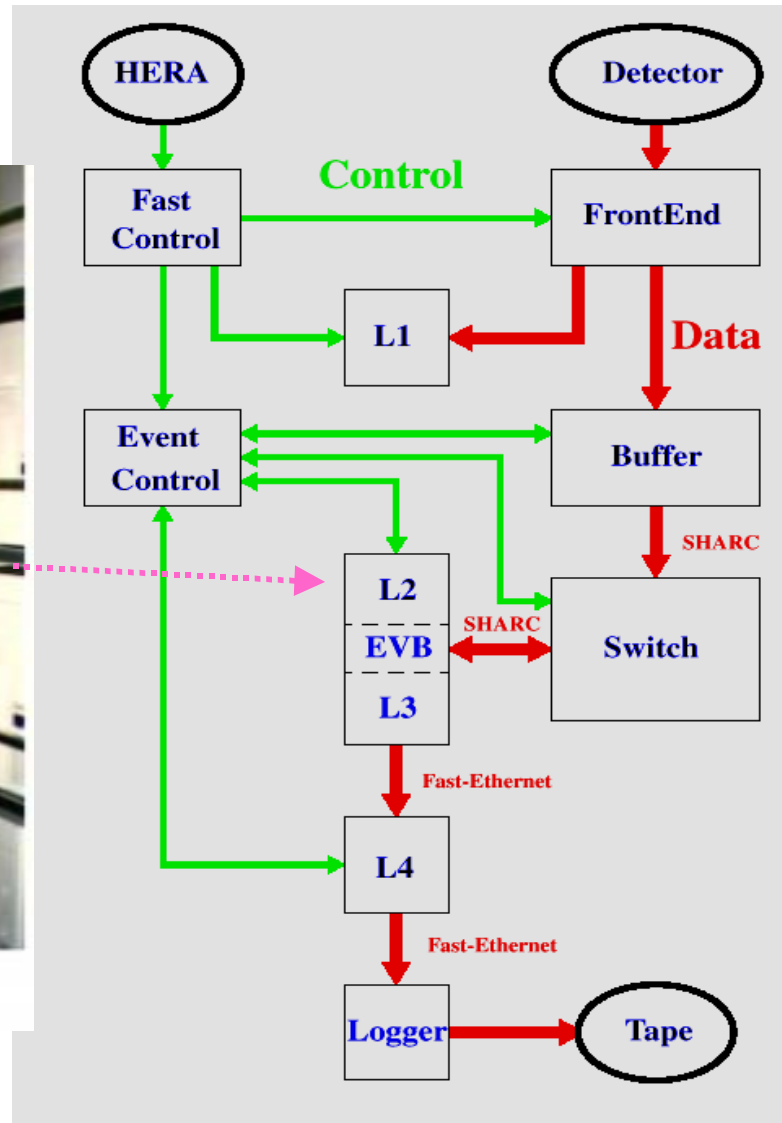
Track trigger (needs tracker hardware!):

- 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 !

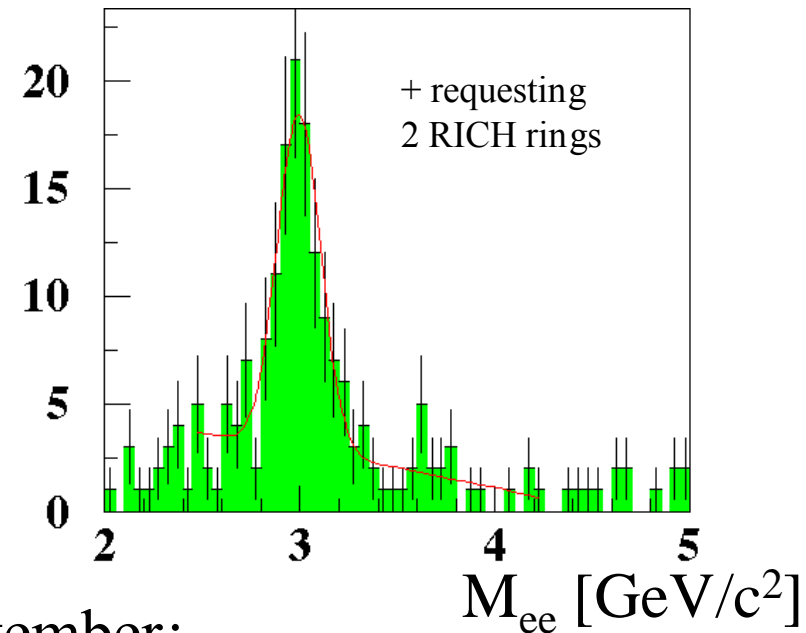
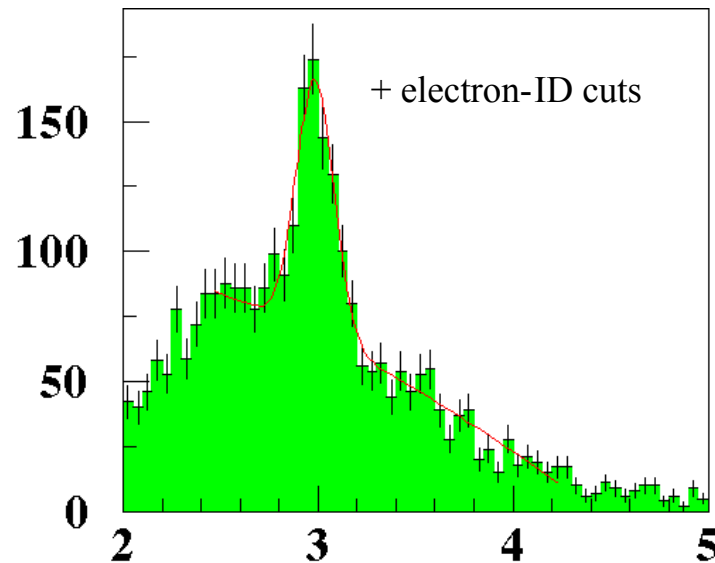
Calorimeter + VDS

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:

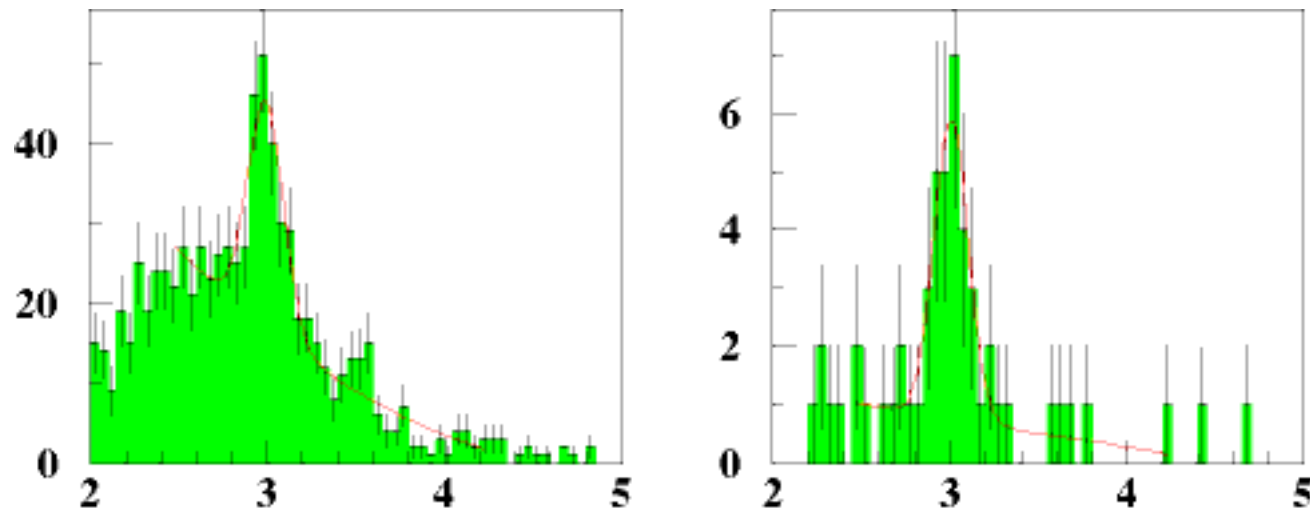
- 2 ECAL cluster

- p_T - cut

SLT:

- mass cut

- 1 VDS track match

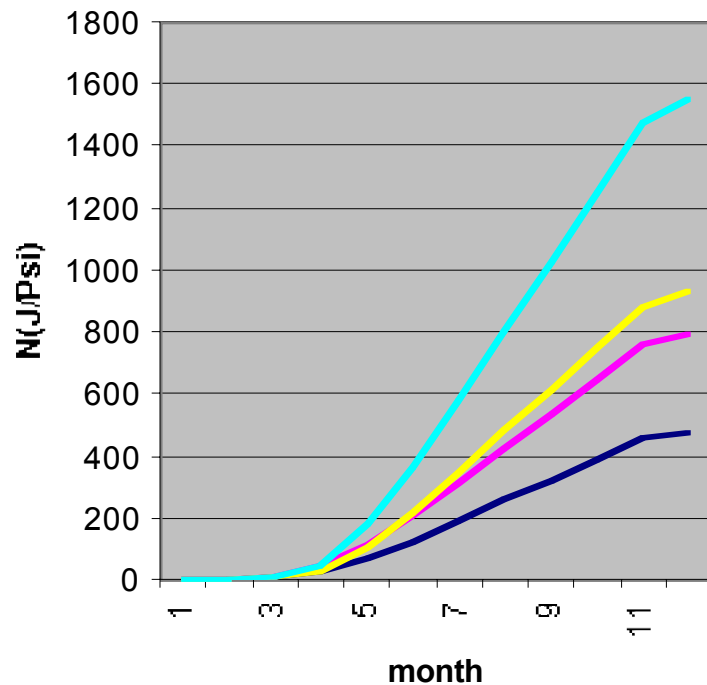


J/ψ enriched by factor ~ 5

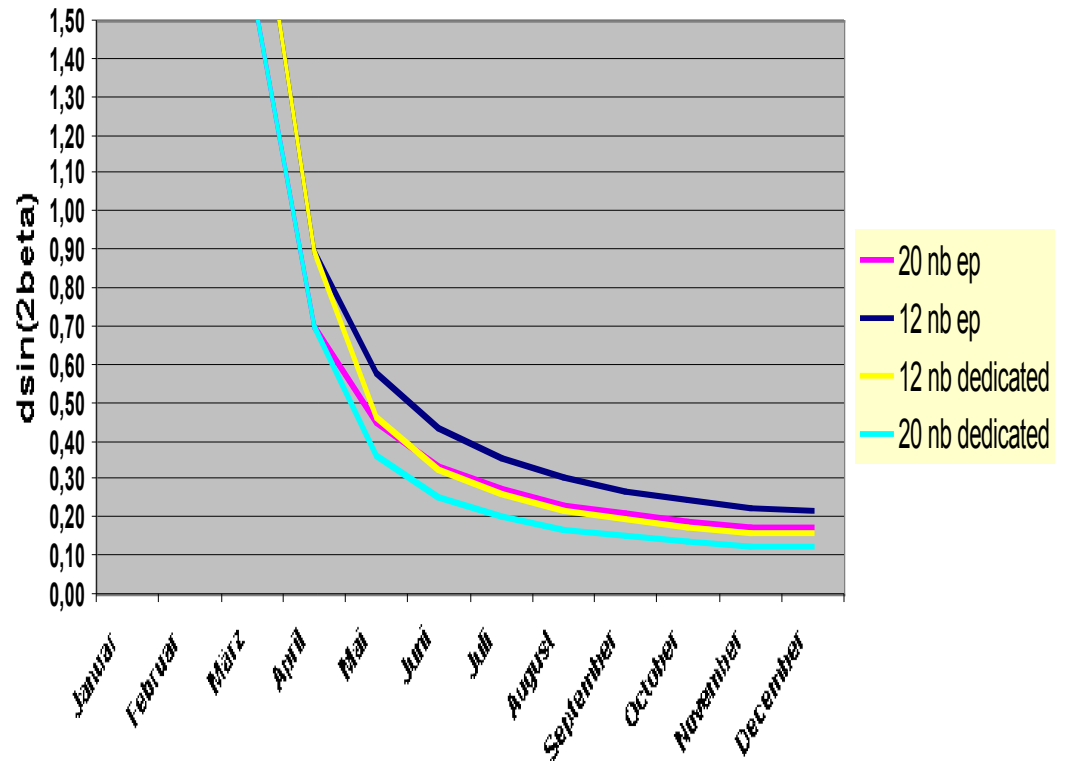
Prospects for Physics in 2000

- **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 !