RAL

DESIGN & DISCOVERY

Open Days July 1990

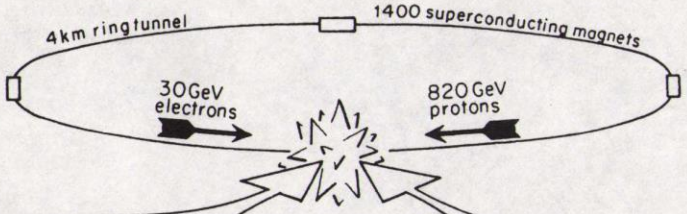
RUTHERFORD APPLETON LABORATORY

SCIENCE AND ENGINEERING RESEARCH COUNCIL

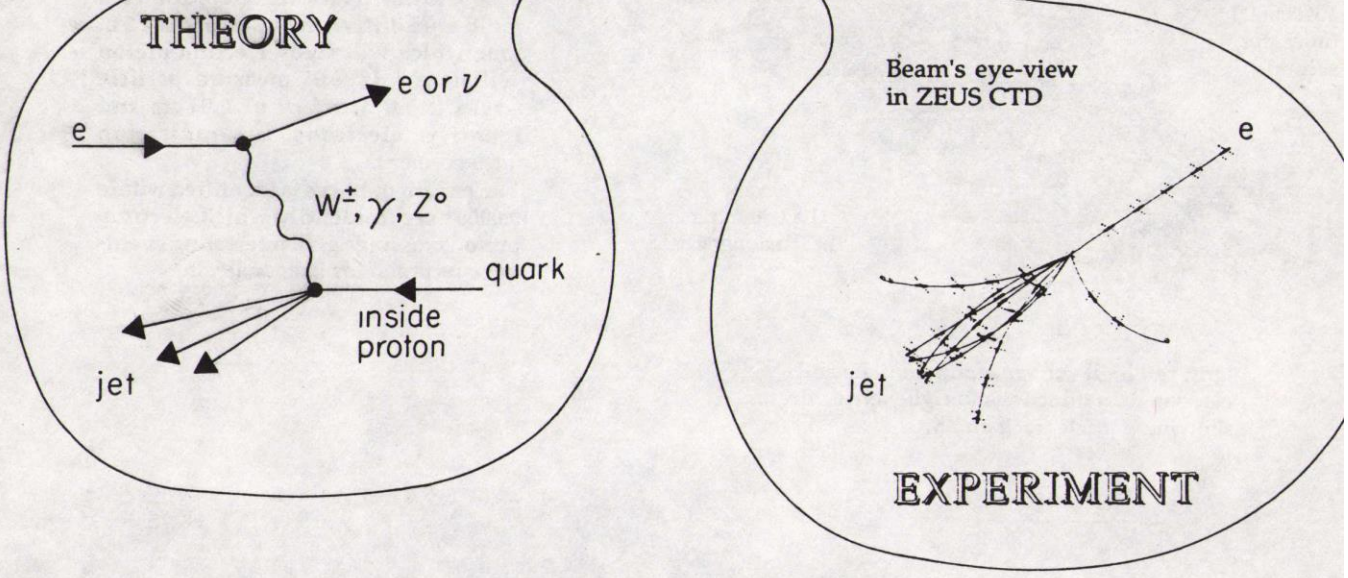
ZEUS Central Tracking Detector

The Physics need

To study electron-proton collisions at the HERA Storage Ring in DESY, Hamburg.



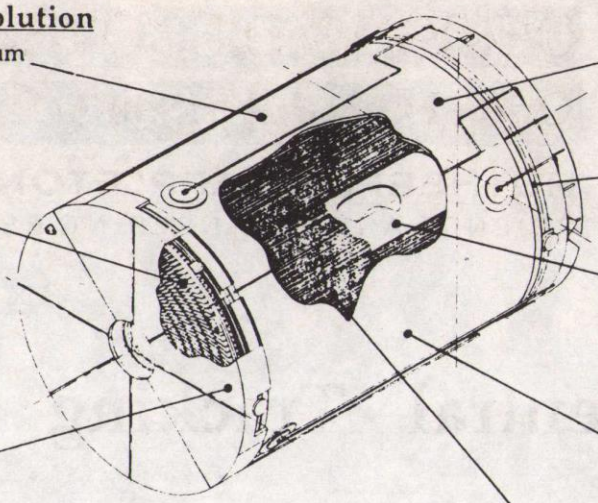
- What is the proton made of?
- Do we understand radioactivity?
- Are quarks elementary?
- New forces?
- New matter?



The Detector Requirement

- Measure particle tracks to 0.01 cm accuracy
- Identify electrons by ionisation measurement
- Ready for a new event after 96 ns
- Reliable track-finding in dense jet
- Easy rejection of spurious tracks
- Self-calibrating, minimal material
- Accurate momentum measurement using 18000 gauss magnet
- Identify interesting events for triggering

The Engineering Solution



Continuous outer aluminium cylinder for rigidity

Chamber leak tested. Below 1 cm^3/min from 4000 litre volume

24192 accurately positioned holes (0.0008 cm error)

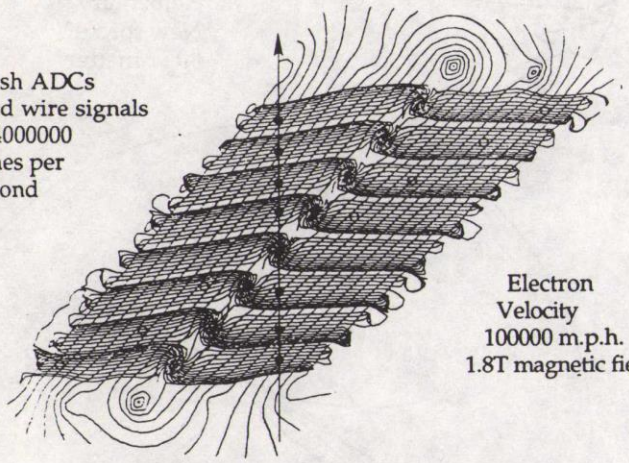
End plates aligned to 0.0005 cm

Composite low-mass Al - foam - Al inner tube - load tested over 3 months

Temperature controlled to ± 1°C. Vessel movement and strain continuously monitored

End plates predeflected under 5 ton load to maintain wire tensions to 2% accuracy

24192 wires held in High-Voltage insulated crimp pins

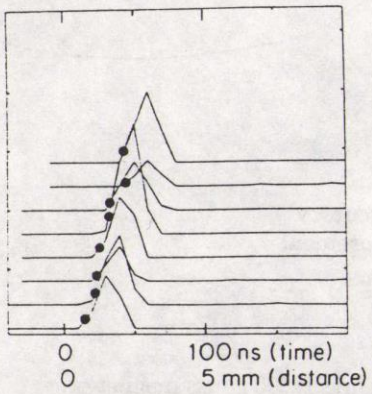


Flash ADCs read wire signals 104000000 times per second

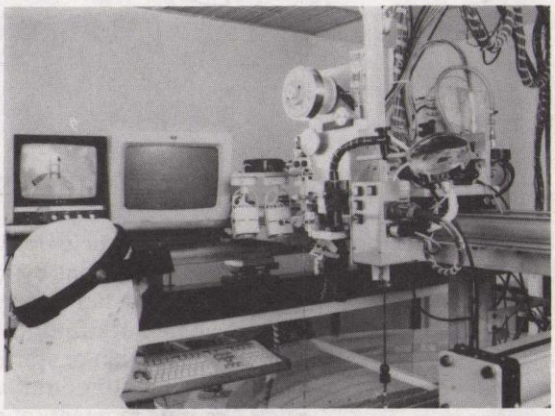
Electron Velocity 100000 m.p.h. 1.8T magnetic field

Drift cell high voltage equipotentials and electron drift directions to eight sense wires, showing particle track and hits.

The Central Tracking Detector is a multi-wire drift chamber 1.6 m dia x 2 m long which will study electron-proton collisions. It will measure particle tracks to an accuracy of 0.01 cm and identify electrons by ionisation measurement.
The pattern of tracks is identified within 0.00001 sec to identify which electron-proton crossings give interesting events to be recorded for later analysis.



Wire signal time profiles and reconstructed track positions



Computer-controlled wiring in progress

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