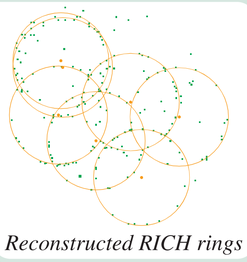
The HERA-B Experiment

Detector Details

RICH
Spherical mirror inside C_4F_{10} radiator, lens-enhanced multi-anode PMT focal plane



Reconstructed RICH rings

Muon System
4 superlayers of gas-pixel, tube & pad chambers; pad-coincidence pre-trigger

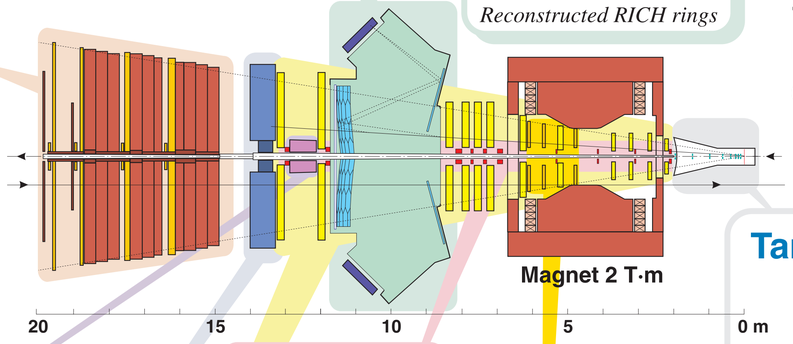
TRD
transition radiation detector; straws & fibers

Inner Tracker
10 superlayers of Micro Strip Gas Chambers with GEM-Foil

Electromagnetic Calorimeter
W/Pb scintillator sandwich, shashlik WLS readout with PMTs; energy-cluster pre-trigger

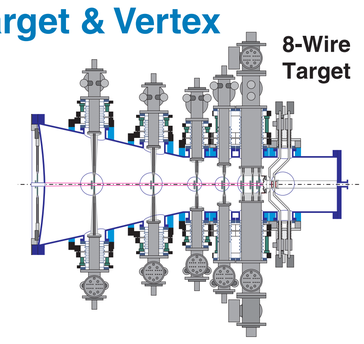
Outer Tracker
12 superlayers of honeycomb drift chambers, 5 and 10 mm cells

High p_T
3 superlayers gas-pixel and pad chambers; pre-trigger for high p_T tracks

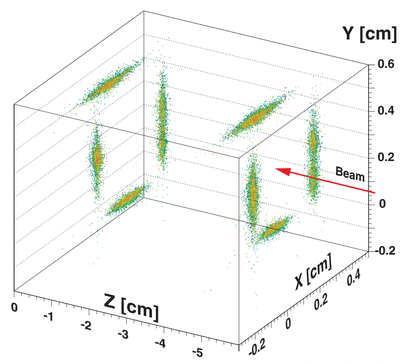


HERA-B is a large-aperture high-rate spectrometer built for studies of collisions of 920 GeV protons with the nuclei of target wires positioned in the halo of HERA's proton beam. HERA-B was optimized to measure CP-violation in decays of *B* mesons into the so-called "golden decay mode": $J/\psi\ K^0_S$. This ambitious goal required picking each golden-decay out from a background of 10^{11} hadronic events at an interaction rate of 40 MHz. This in turn required advances in radiation-hard technologies, the development of a sophisticated first level trigger and the construction of the first large integrated multi-level switch-based data acquisition and high-level trigger system.

Target & Vertex



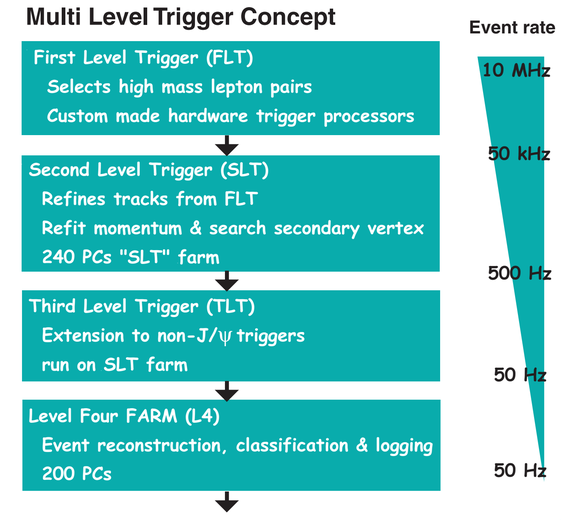
8 layers of double-sided Si-microstrips, movable on Roman-Pots



Primary vertices, reconstructed in the Si-vertex detector, from an 8-wire run

Trigger System

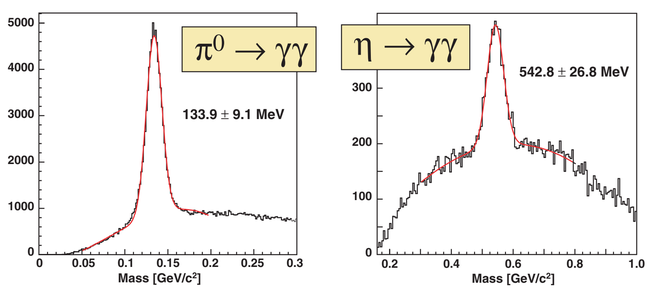
Multi Level Trigger Concept

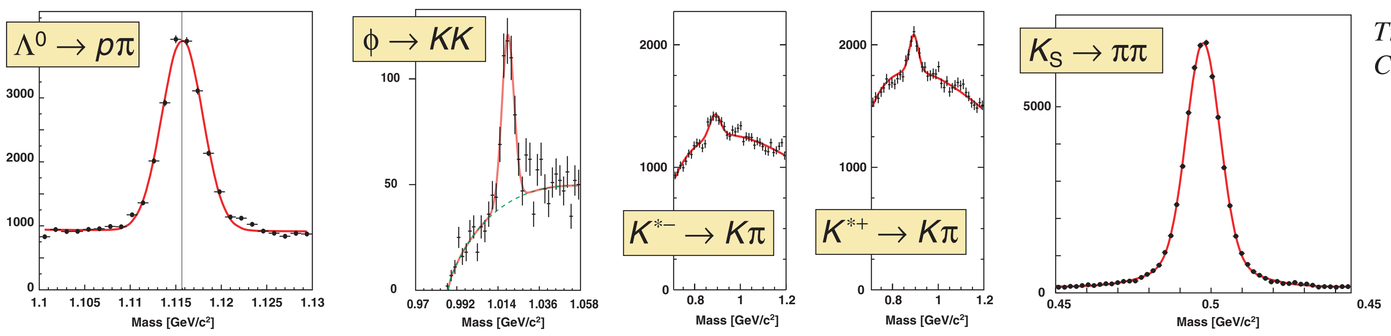


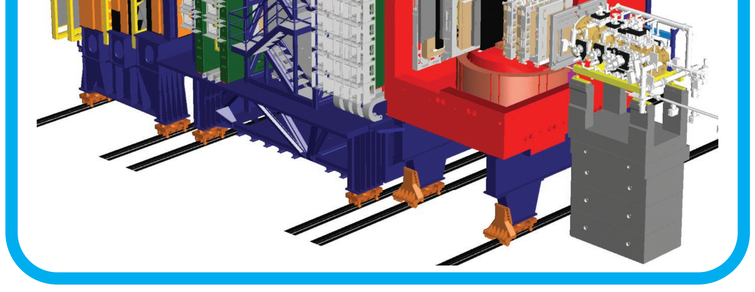
Performances

The spectrometer was largely completed in January 2000. Commissioning work carried on to the end of the HERA running period in August, 2000.

Two Body Resonances





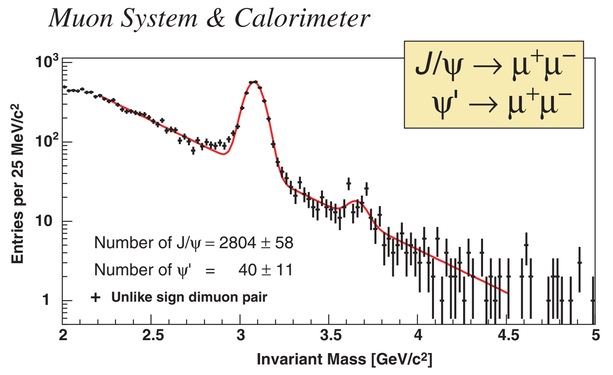


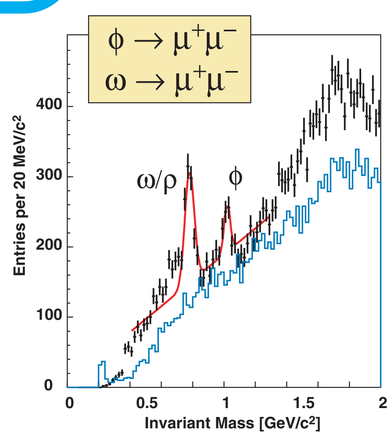
Electromagnetic Calorimeter

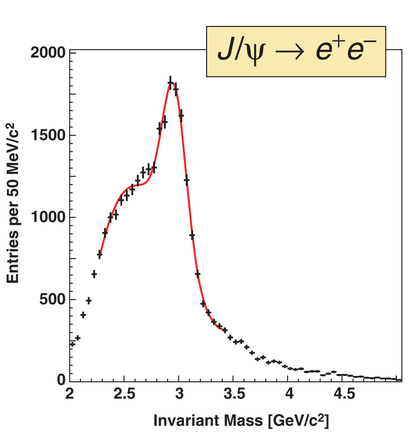
Tracking Chambers

Triggered Resonances

Muon System & Calorimeter







Future

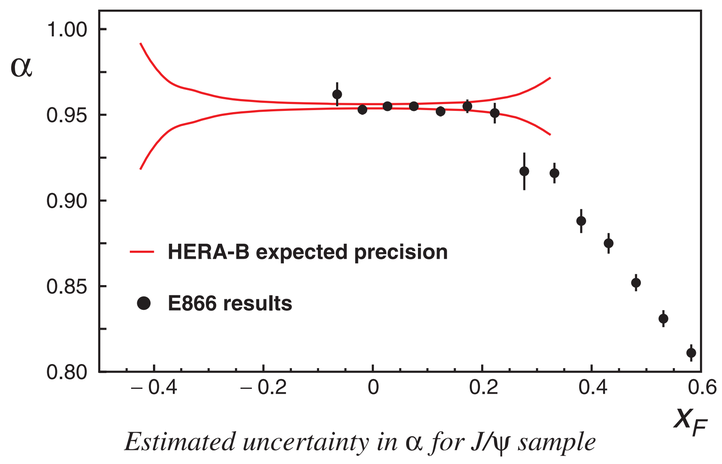
The detector and trigger commissioning will be completed at the beginning of the 2001/2 run. The remainder of the run will be devoted to measurements of the atomic number dependence of charmonium production and a measurement of the *B* production cross section at 920 GeV. HERA-B will extend existing measurements of J/ψ and ψ' suppression into the negative x_F hemisphere and will make a first measurement of χ_c suppression in nuclear matter. The physics program of HERA-B beyond 2002 depends on the level of sensitivity achieved in the upcoming run. Possible topics include further measurements of heavy flavor production in nuclear matter, studies of *B*-hadrons (e.g. *B*-baryon searches, B_s mixing, rare decays), charmonium spectroscopy (search for $h_c(^1P_1)$, $|c\bar{c}g\rangle$), studies of charm mesons (*D* mixing).

Charmonium Suppression

Precision measurements over a wide range of x_F will provide much needed new tests of the many existing models of nuclear suppression of charmonium. Suppression is parametrized as α in:

$$\sigma_{pA} = \sigma_{pN} A^{\alpha} \quad with\ \alpha = \alpha(x_F, p_T)$$

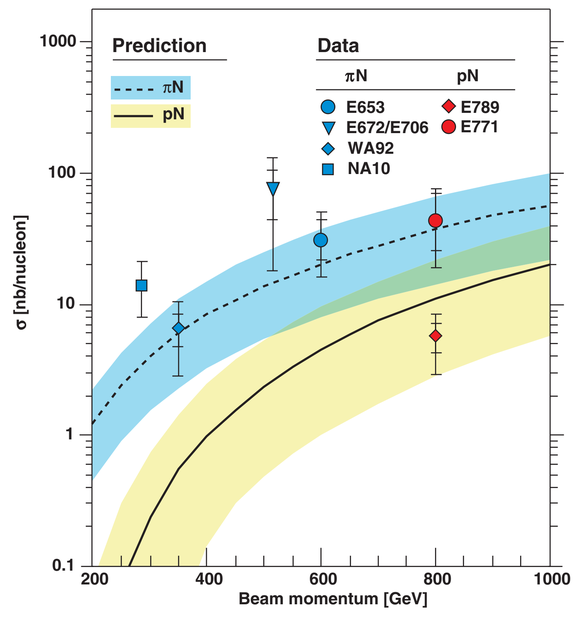
Different target materials in Hera-B yield values for α; Hera-B adds negative x_F acceptance, ψ', χ_c states



Estimated uncertainty in α for J/ψ sample

$B\bar{B}$ Cross Section

HERA-B will measure the B production cross section near threshold to better than 30%, a significant improvement over existing measurements.



Total Cross Section for Bottom Production

Deutsches Elektronen-Synchrotron
Hamburg, Germany

www-hera-b.desy.de