Friday 4^{th} July 2003

First Year Presentation

Development of HzTool and a new event display for ZEUS

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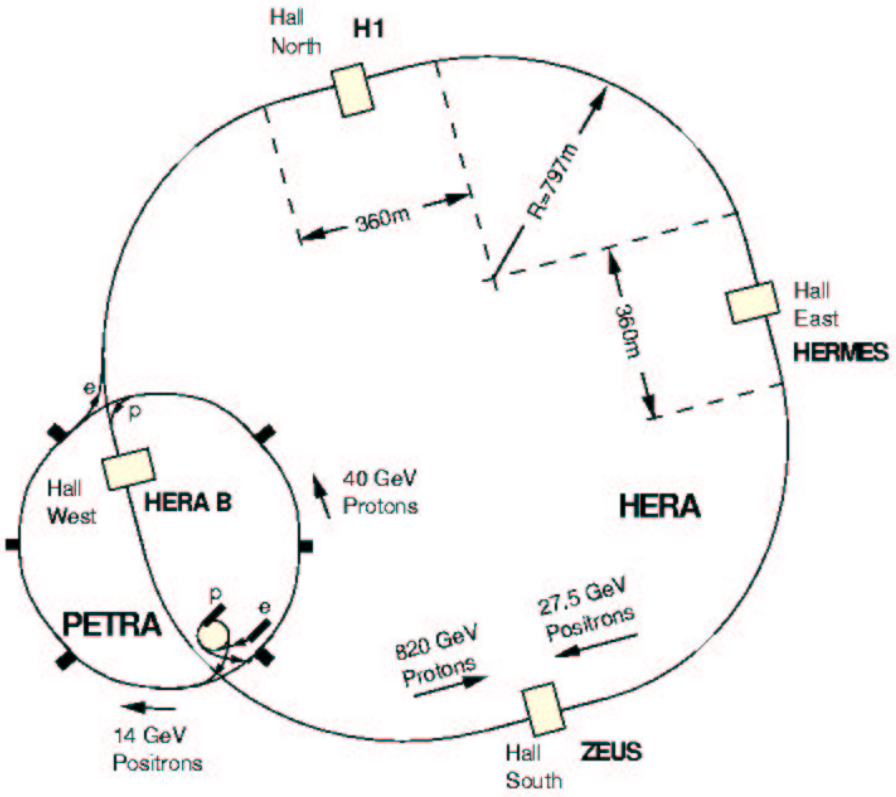
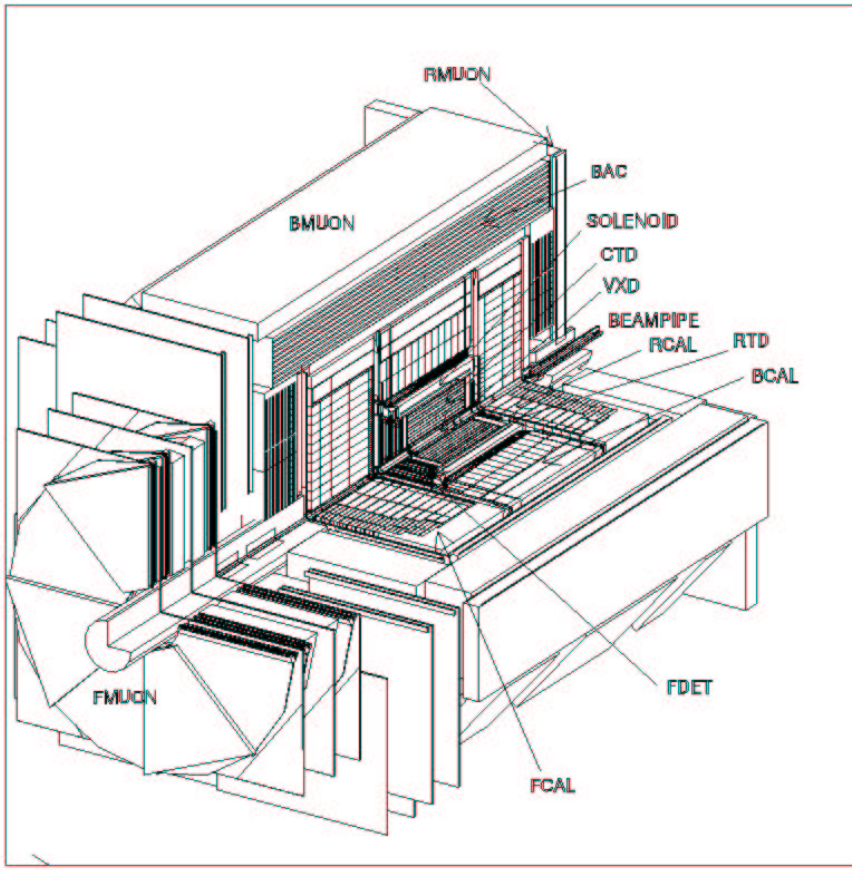
resentation outline .....

- Brief introduction to HERA and ZEUS
- Developments made to HzTool
  - ▷ Addition of a new routine in to the HERA Library
  - ▷ Incorporation of a *Next-to-leading order (NLO)* capability in to HzTool
- Developments made to the *Central Tracking Detector (CTD)* display of ZeVis, the new event display for the ZEUS experiment
- Plans for future project (phD) work
  - ▷ The extraction of more precise information about the high x_p gluon structure of the proton



- HERA (Hadron Elektron Ring Anlage) is the worlds first and only $e^{\pm}p$ collider
- Located in Hamburg, Germany
- Accelerates protons to 920GeV and electrons to 27.52GeV.



- The ZEUS experiment is one of two (along with H1) multi purpose experiments that are situated on the HERA ring
- The ZEUS detector is a general purpose magnetic detector with nearly hermetic calorimetric coverage
- More information on the experiment and detector is available from *www-zeus.desy.de*

evelopments made to HzTool

What is HzTool?

▷ Fortran based program which principally consists of a library of fortran routines

▷ Each routine is associated with a published paper

▷ Each routine contains the published data as well as information (i.e. cuts) neccessary to build MC comparisons with that data

▷ These routines can then be incorporated in to generator specific (HERWIG, PYTHIA etc) mother routines which generate the MC events

▷ As many user routines can be incorporated in to a mother program as one desires ⇒ MC comparisons for many different sets of published results, simultaneously ⇒ ideal for MC validation and tuning

And JetWeb?

▷ JetWeb is a WWW interface and database for Monte Carlo tuning and validation

▷ MC results from HzTool are stored in the JetWeb database

▷ *http://jetweb.hep.ucl.ac.uk/*

evelopments made to HzTool

Incorporation of a new ZEUS paper in to the HERA Library

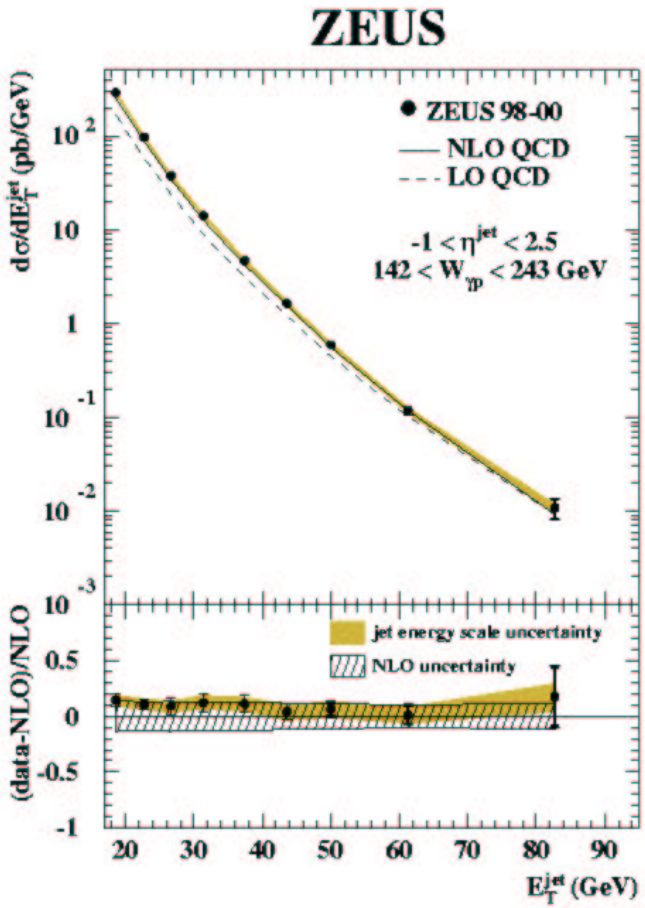
▷ The paper (DESY-02-228) detailed the first observation of scaling violations in γp interactions

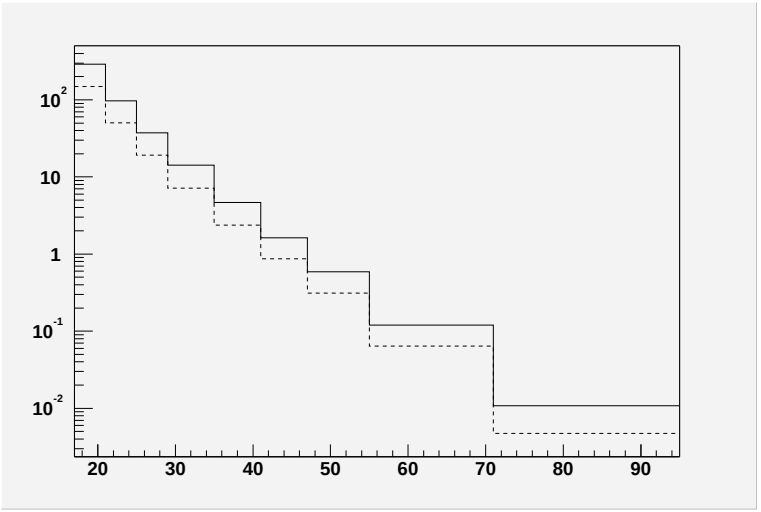
▷ This is now available to use in HzTool and JetWeb

▷ The following few pages show some reults from using HzTool and some search results form JetWeb

HzTool example

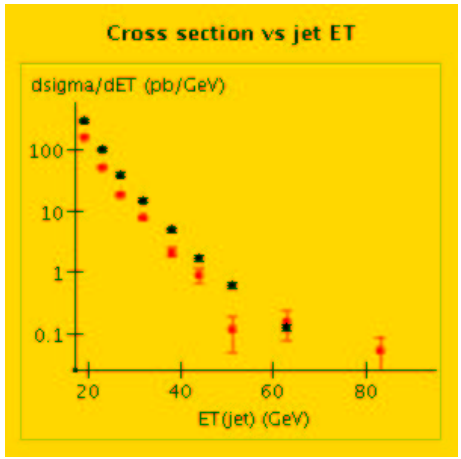
▷ An example of some HzTool ouput for the 'Scalings Violations paper' (DESY-02-228). For the sake of brevity I have only showed the main cross section plot from the paper.

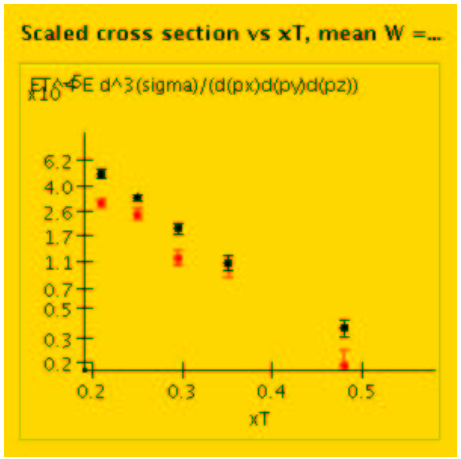


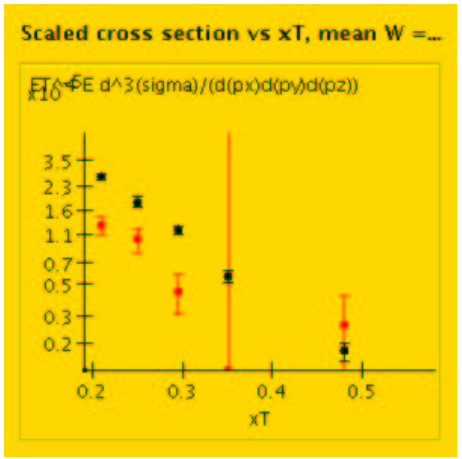


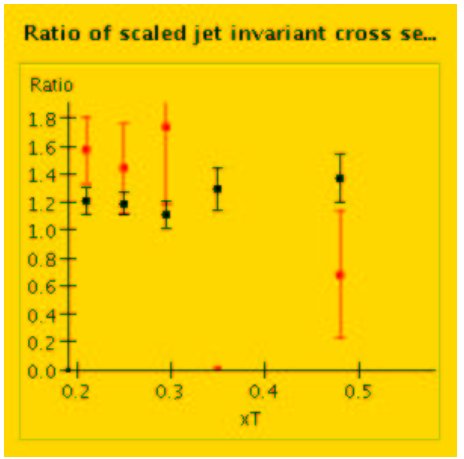
JetWeb example

Example of a JetWeb search result (Herwig) for the ZEUS paper DESY-02-228









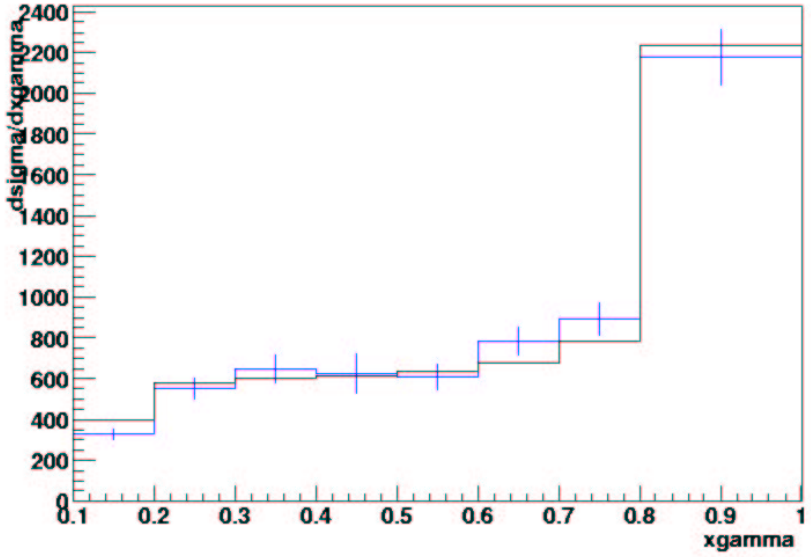
Incorporation of a NLO capability in to HzTool

▷ Currently, HzTool uses *Leading order* MC generators only

▷ We wish to incorporate a NLO generator in to HzTool. More specifically we wish to incorporate the NLO routines of Frixione and Ridolfi

▷ Much of the work incorporating the routines in to HzTool has already been done by JMB, but we still need to rigorously test the output of the HzTool NLO routines to make sure that they agree with the original *'stand alone'* code of the authors

▷ This work is ongoing. But the current scenario is .....

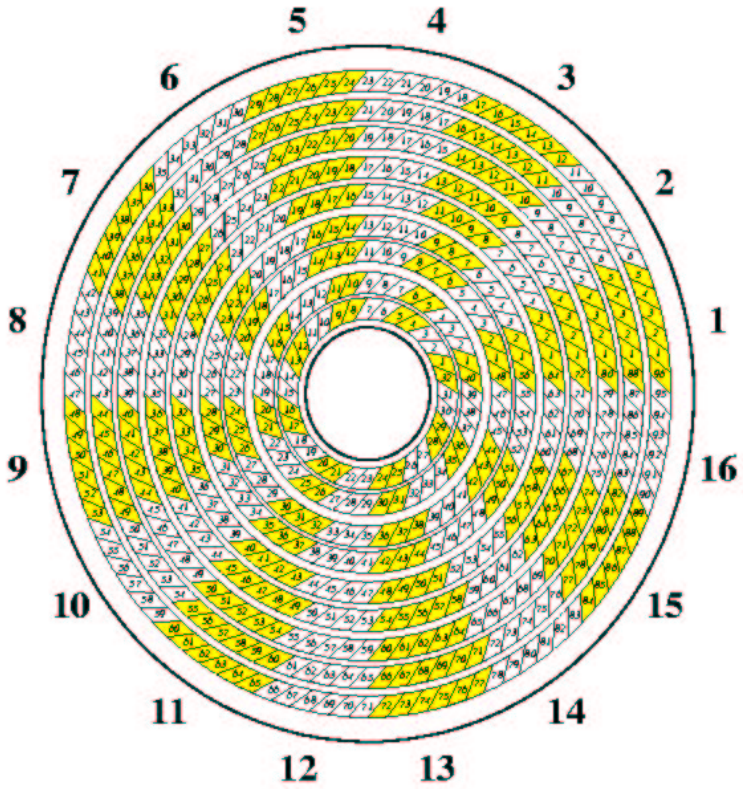


The blue (with errors) line is the HzTool output and the black is the 'stand alone'

Refinements of the display functionality of ZeVis

- ZeVis is the new ROOT based event display for the ZEUS experiment
- I have been responsible for developing the CTD display capabilities of the program

Brief introduction to the ZEUS *Central Tracking Detector*



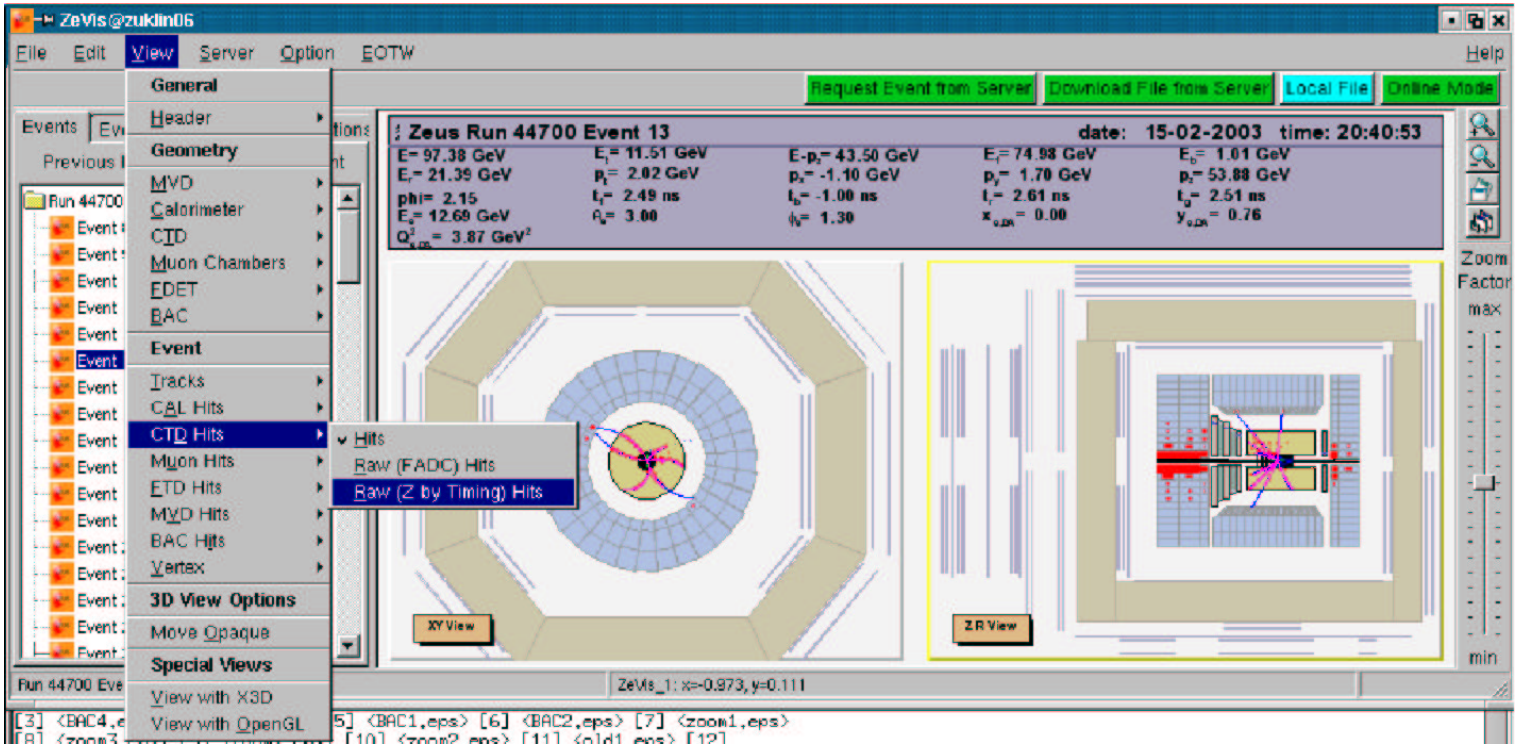
- Cylindrical drift chamber which operates with an Argon, Ethane and Carbon dioxide gas mixture
- Consists of 72 cylindrical drift chamber layers
- Organised in to 9 superlayers (each with between 32 and 96 drift cells)
- Each drift cell has 8 sense wires

- The odd numbered superlayers have wires parallel to the chamber axis
- The even numbered layers are orientated at a small stereo angle ($\pm 5^{\circ}$)
- Superlayers one, three and five are also equipped with a z-by-timing system for trigger purposes (determination of the z position of a hit is made by considering pulse arrival times at either end of the chamber)

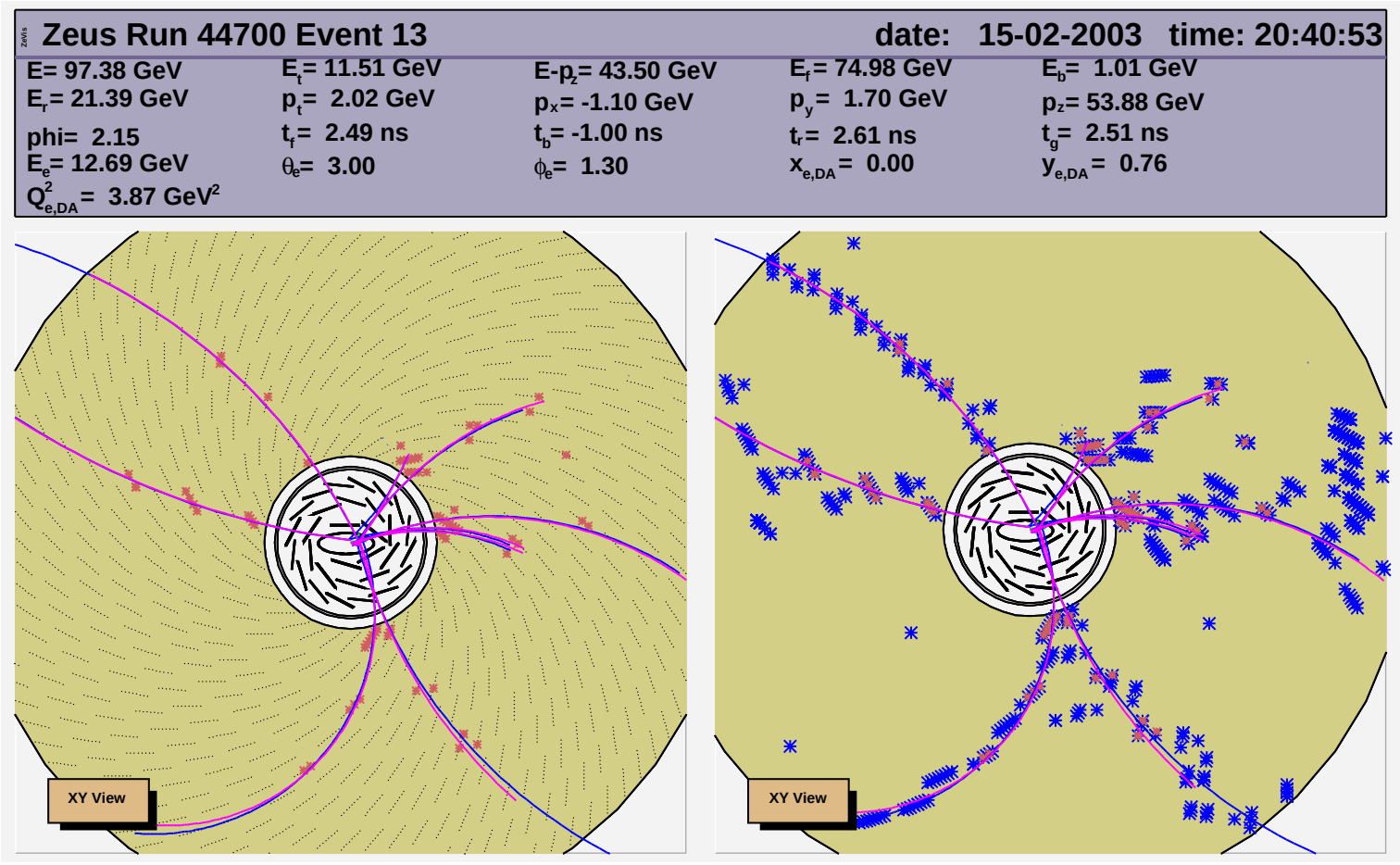
The display of Z-by-timing Raw Hits in ZeVis

- Generally a CTD Raw Hit is given in terms of superlayer, cell and wire numbers (no z information). Thus, CTD Raw Hits in general are 2D points which can only be displayed in a cross sectional view of the CTD
- Now I have refined the ZeVis CTD code so that the Z-by-timing information, available from superlayers 1, 3 and 5 can be drawn. These '3D' points can be drawn in all views

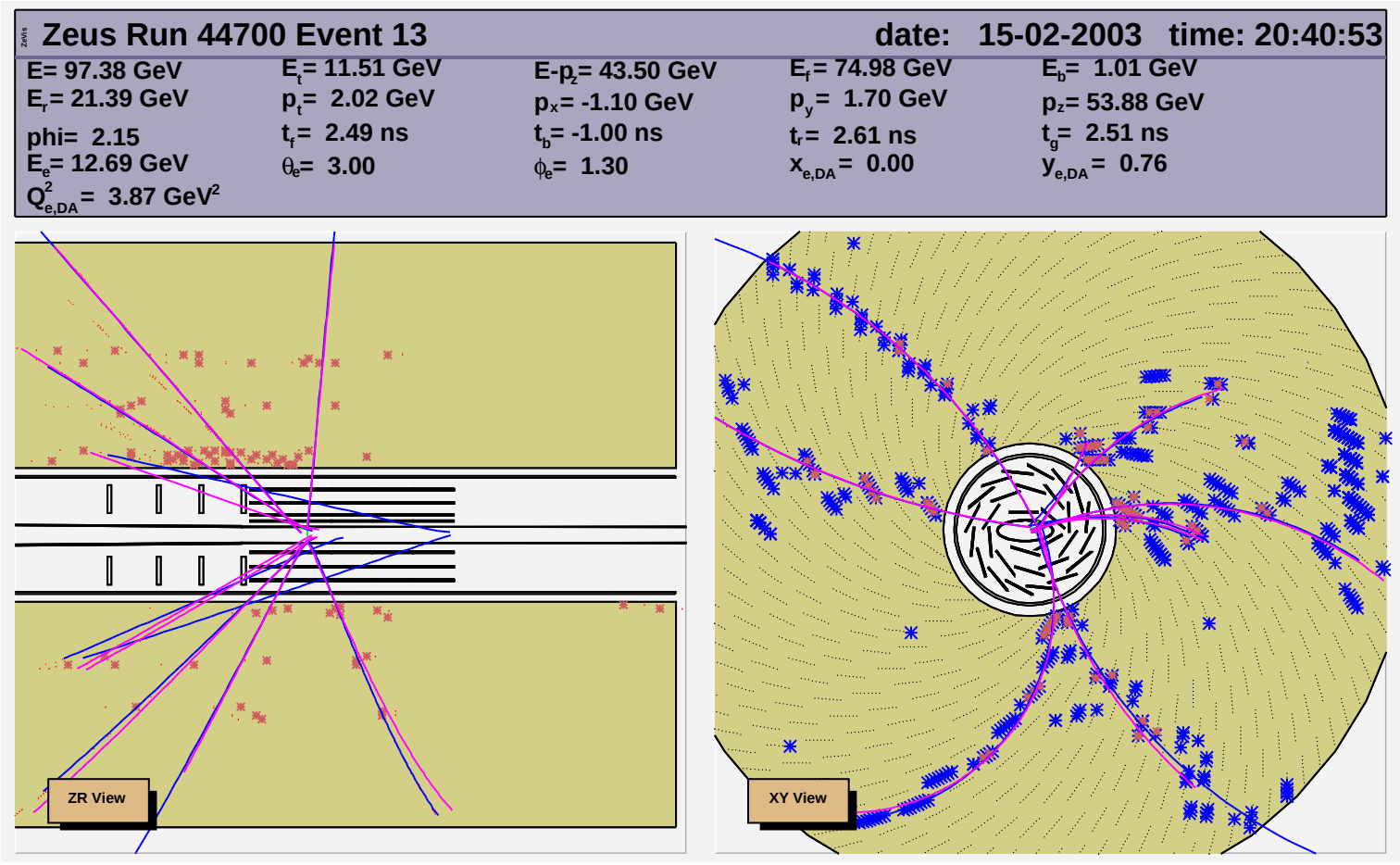
- The ZeVis event display .....



Here's examples of the Z by Timing Raw Hits in XY view .....



And here's an example in ZR view .....



The extraction of more precise information about the high x_p gluon structure of the proton

▷ Information about the *parton distributions functions* (pdf's) inside the proton can be obtained from fits to ZEUS data

▷ Last year ZEUS published such fits using data from the 96-97 running period. The so called ZEUS-S (ZEUS standard) fit used this data along with some fixed target data to extract gluon and sea distributions (as well as valence) with much improved precision compared to earlier work

▷ Look at the plots!

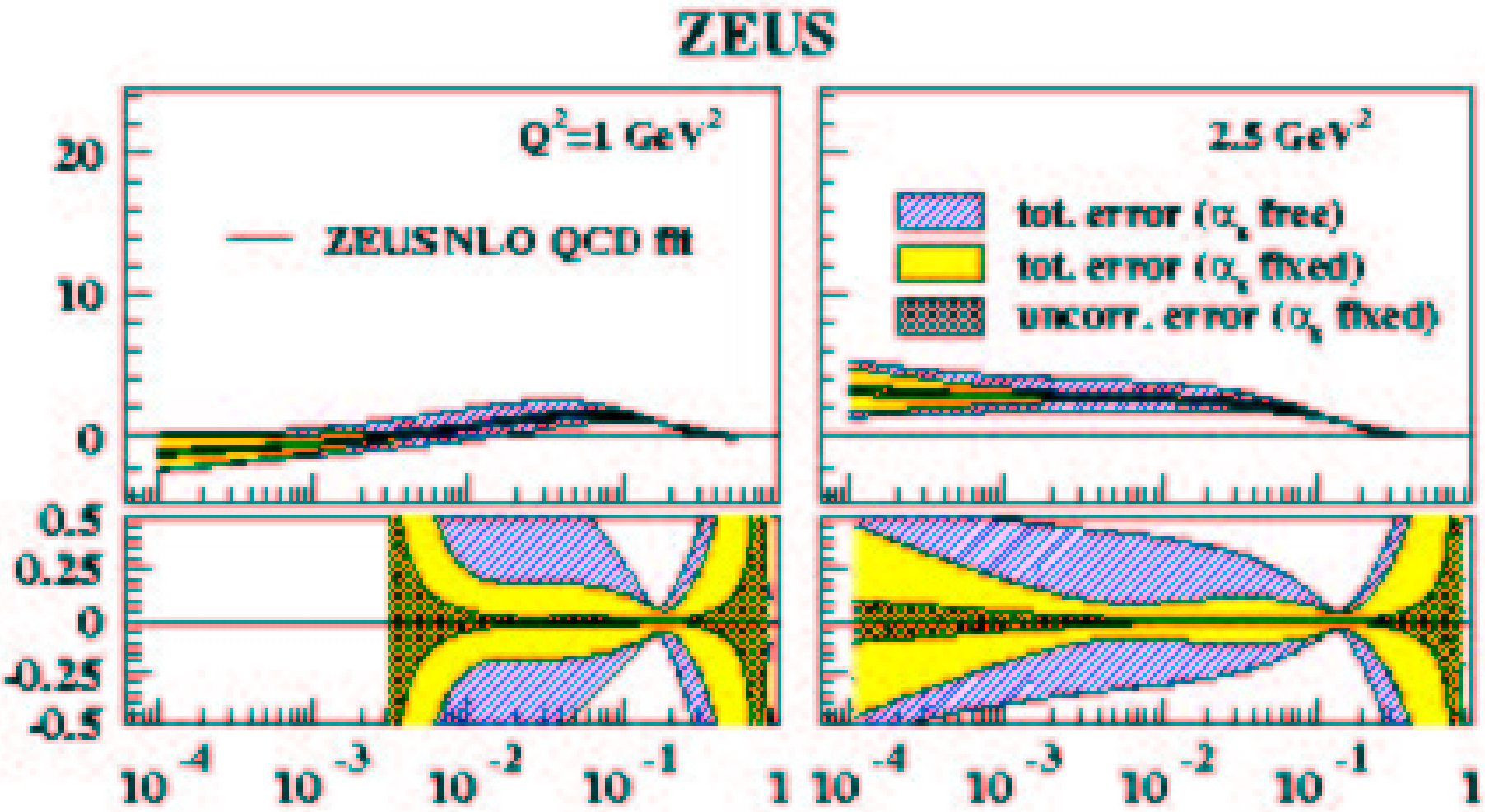
▷ Such fits have left the gluon distribution at high-x_p very poorly constrained

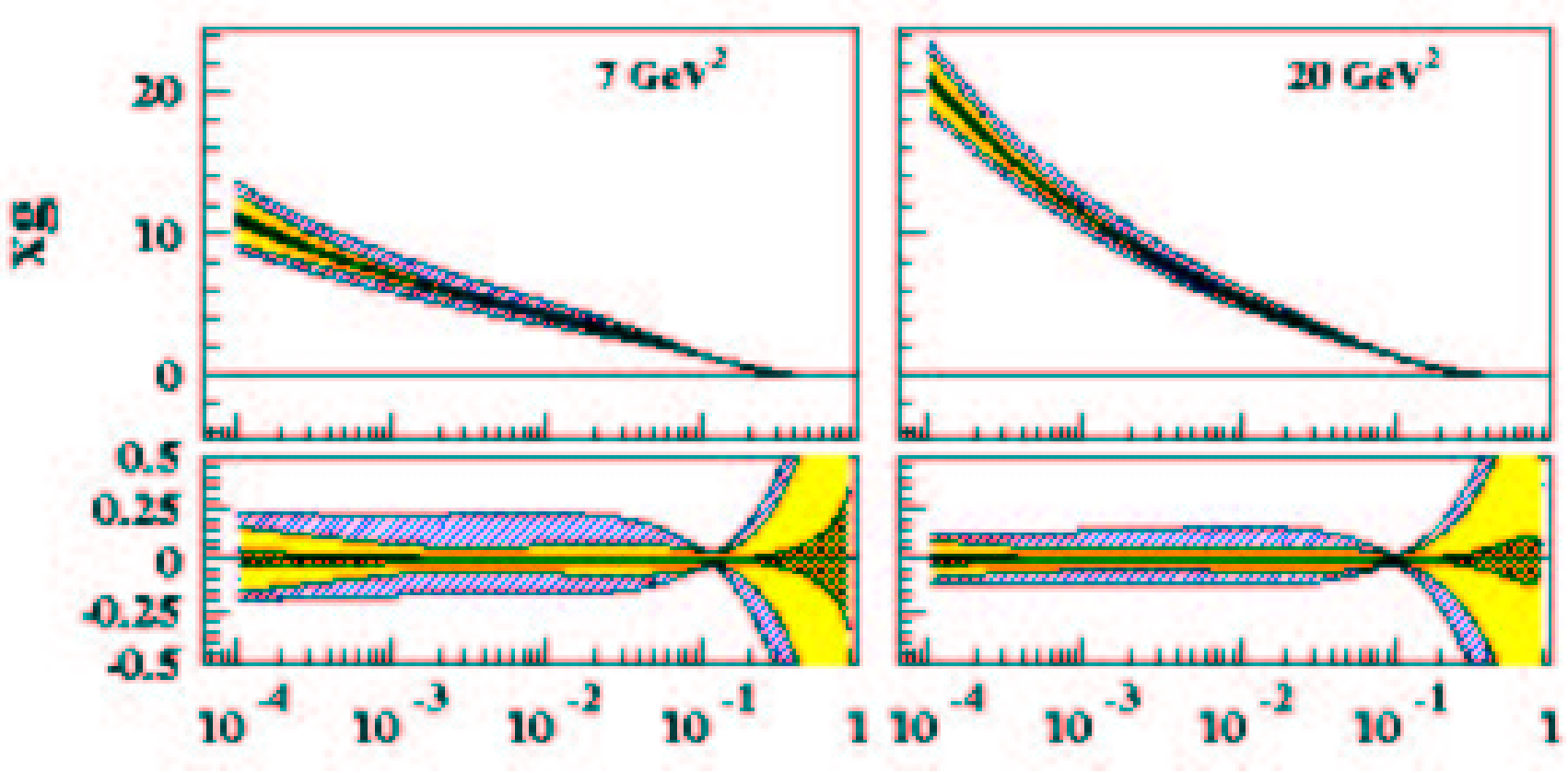
Solution(?)

▷ We plan to carry out new fits but this time we will incorporate the high precision jet data which has been measured in recent years

▷ Such cross sections are more sensitive to the gluon distribution inside the proton. This will (fingers crossed!!) better constrain the gluon distribution inside the proton

) The Gluon distribution from the ZEUS NLO QCD fit for different values of Q^2 .....




7 GeV²
20 GeV²
xF2
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10 -3
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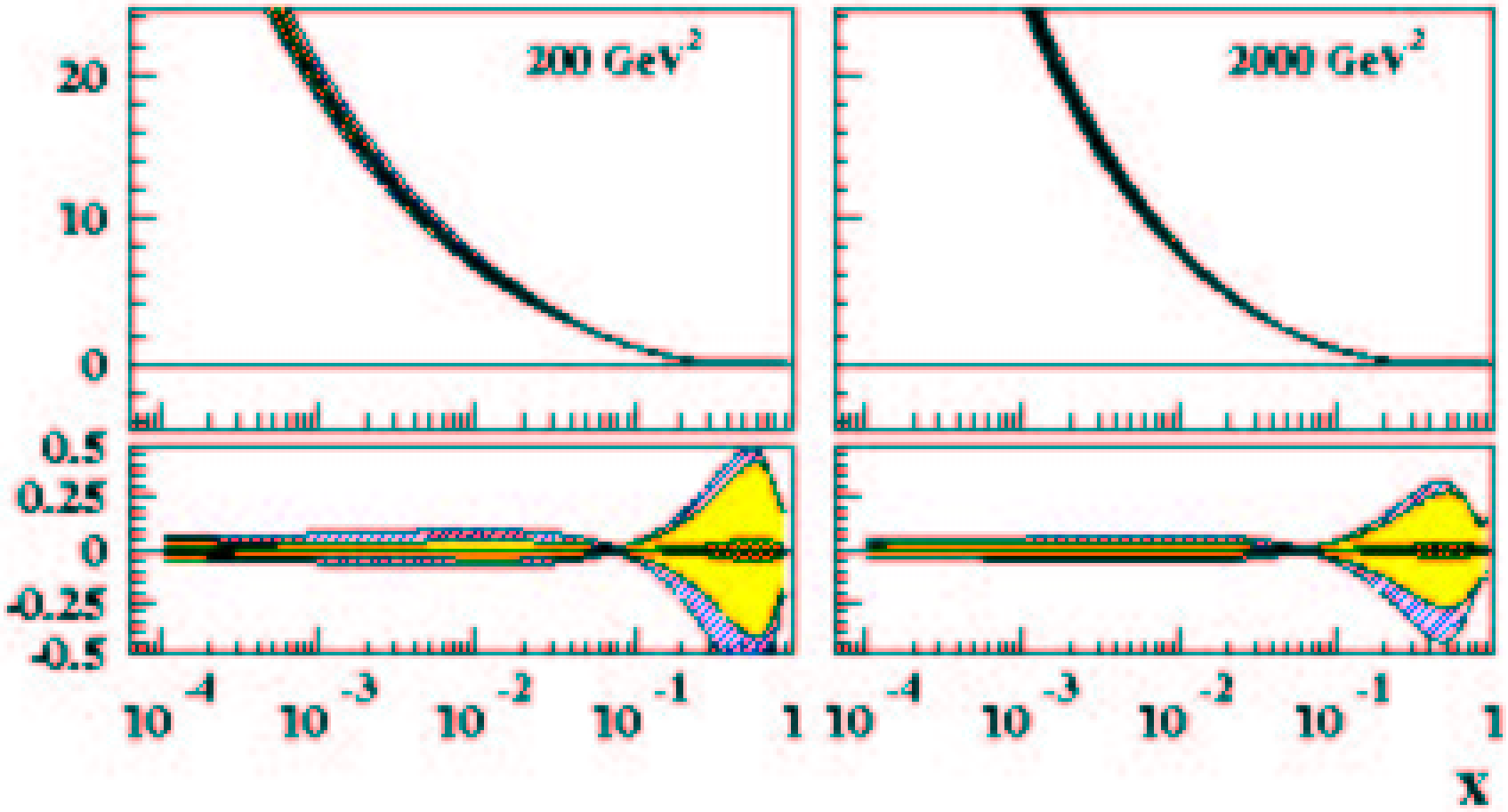
1


200 GeV^2
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