Jefferson Lab
Thomas Jefferson National Accelerator Facility

Charm production in e/p scattering

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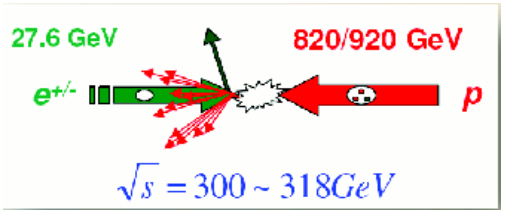
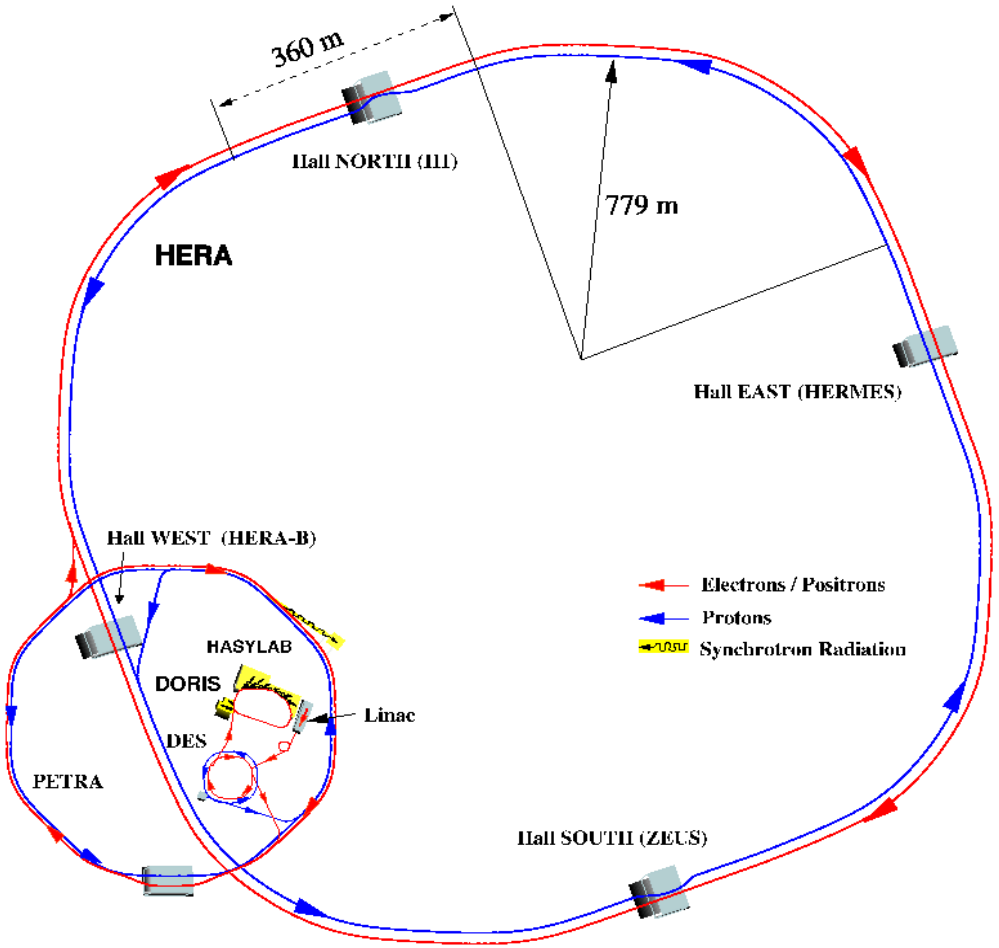
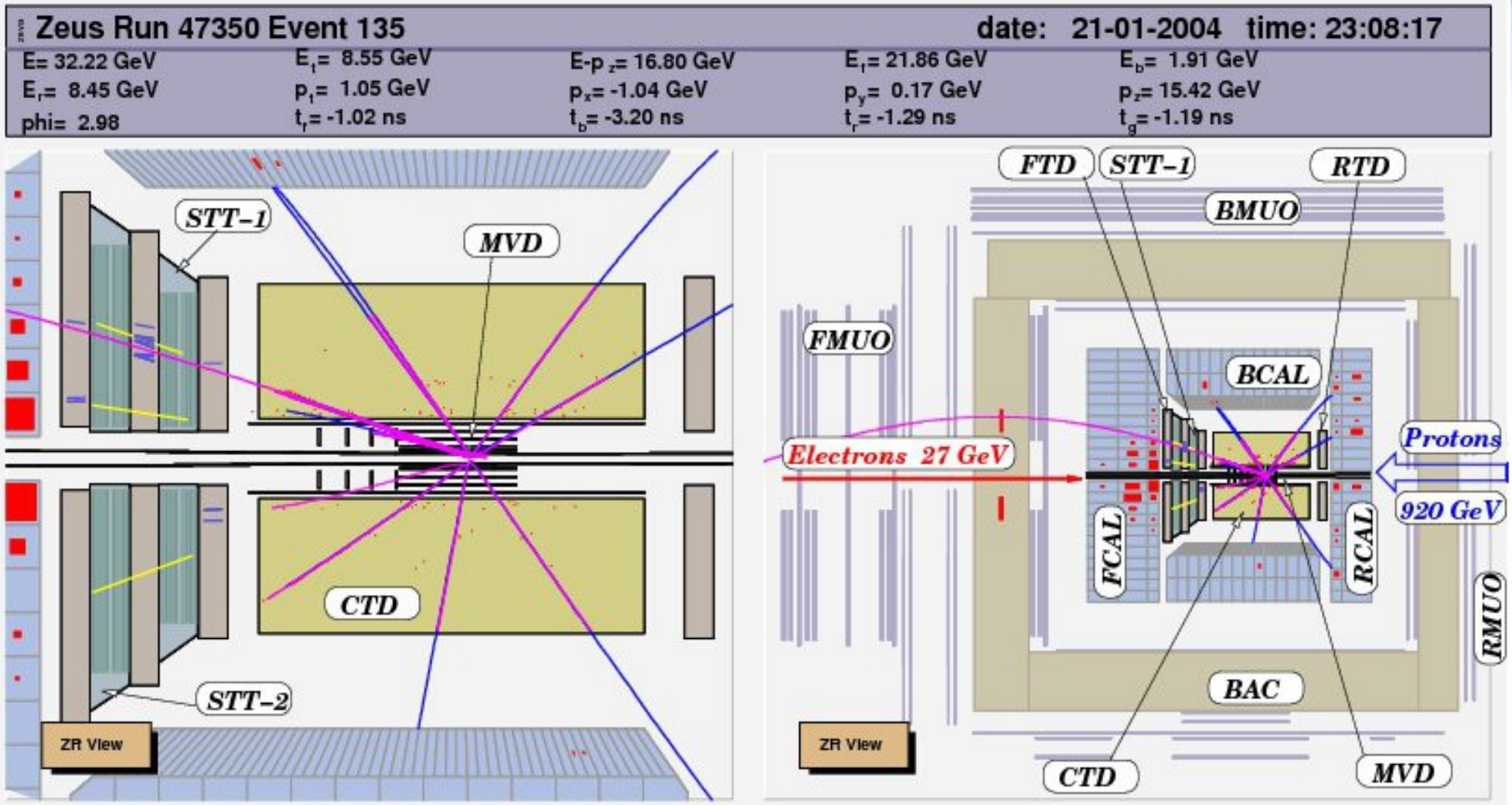
HERA and ZEUS





- *The HERA (Hadron-Electron Ring Anlage) machine is the world's first lepton-nucleon collider (Hamburg, Germany)*
  - ~6.3 km circumference
  - 27.5 GeV electrons
  - 920 GeV protons
  - sqrt(s)=318 GeV
  - 180 bunches,
  - Bunch crossing = 96 ns
  - Collected 0.5 fb^{-1} of data

ZEUS detector



HERA kinematics

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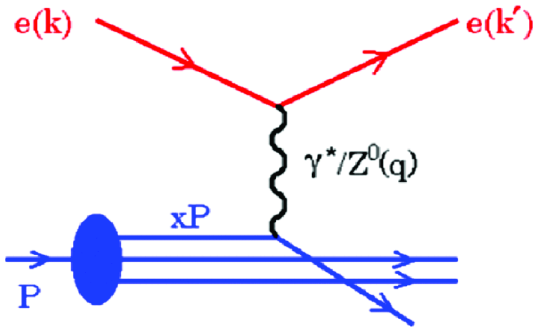
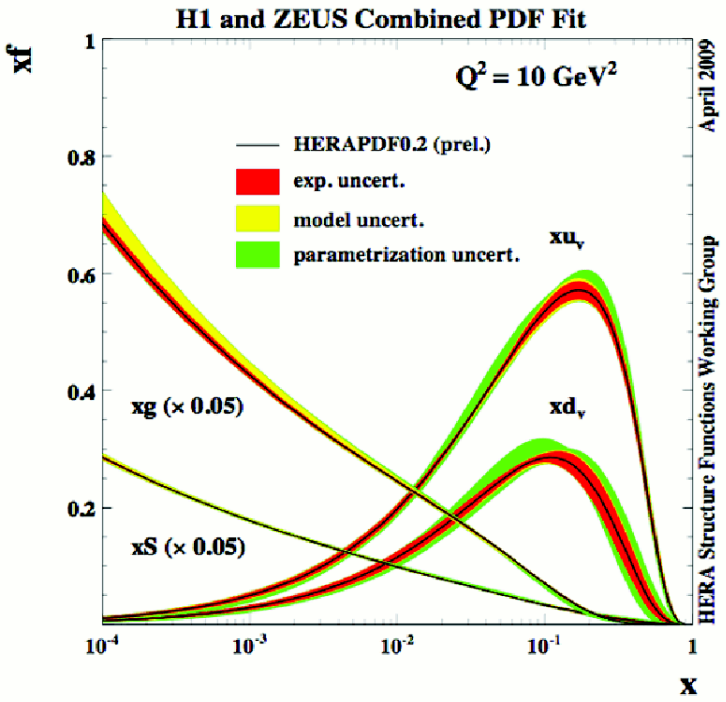
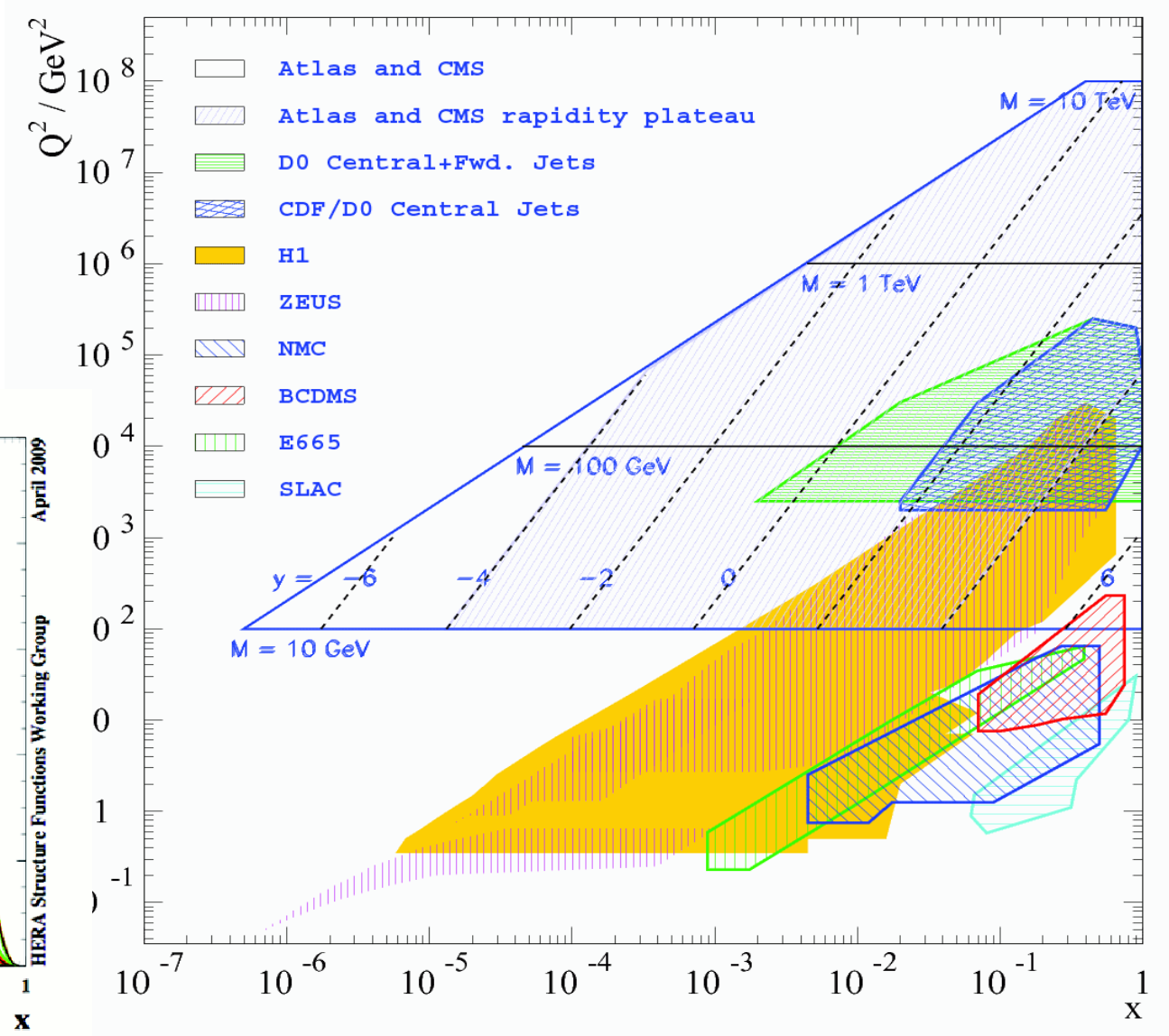
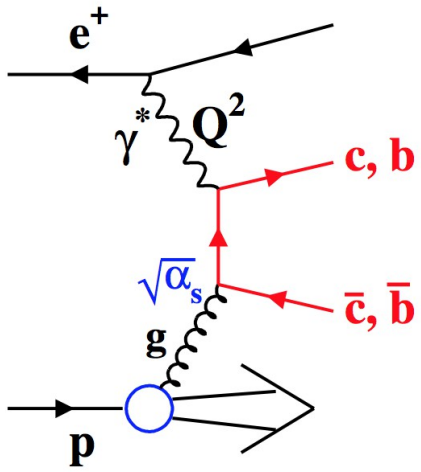






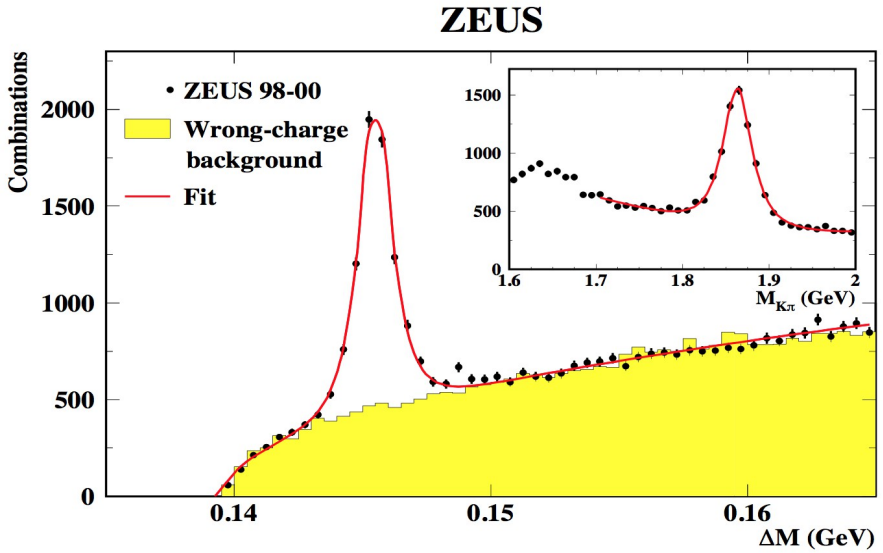
Charm production in DIS



The leading order diagram

- *BGF process provides direct sensitivity to the gluon density in the proton.*
- *Due to the large gluon density in the proton, the BGF processes gives large contributions to DIS*
-
-

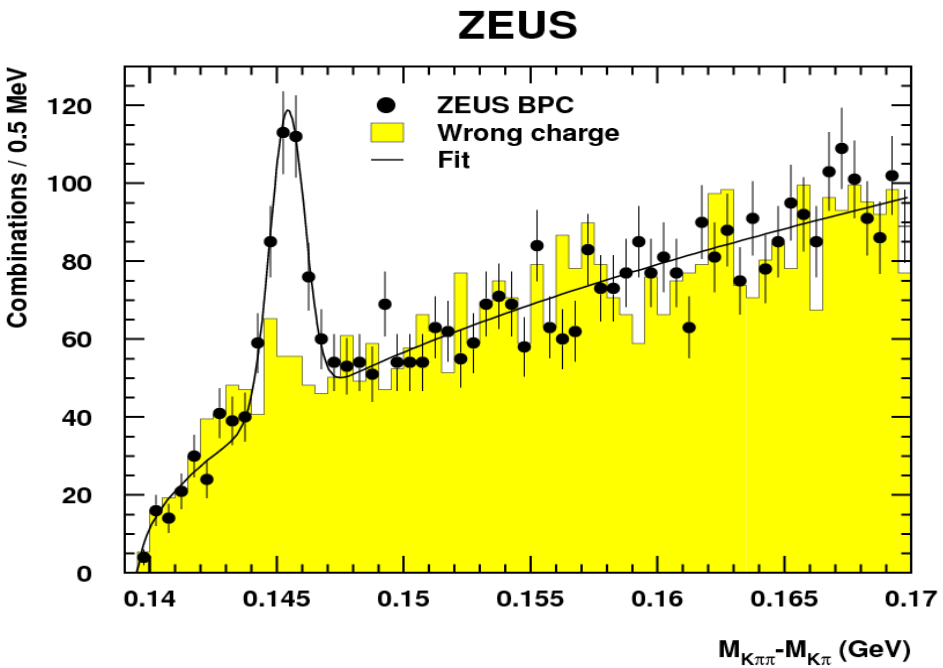
$$(D^{*+} \rightarrow D^0\ \pi_s^+ \rightarrow K^-\ \pi^+)$$

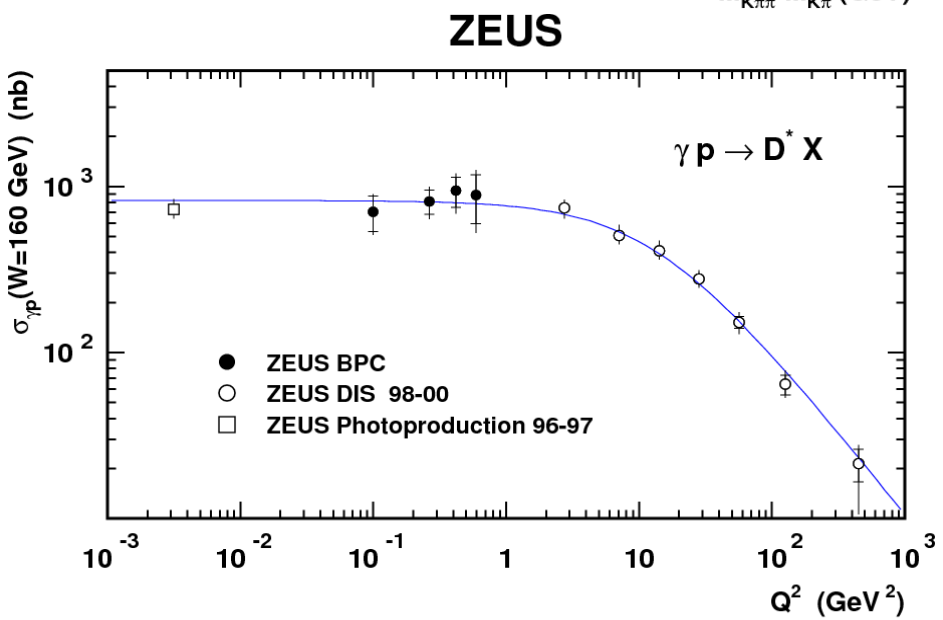


The measurement was performed in the kinematic range of
$1.5 < Q^2 < 1000\ \text{GeV}^2$
and
$0.02 < y < 0.7$

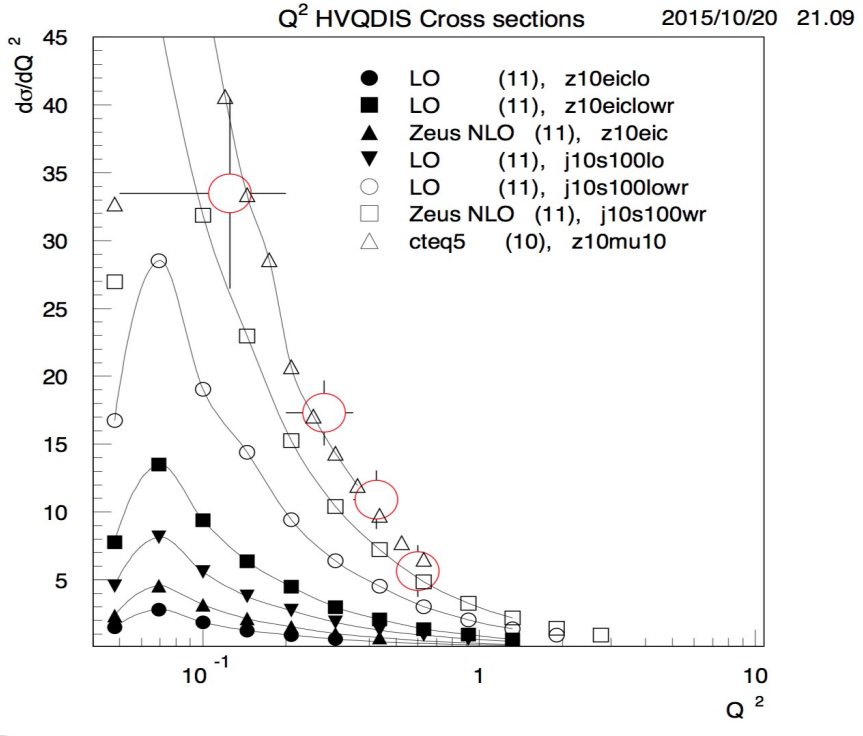
D* production in ep scattering at low Q2

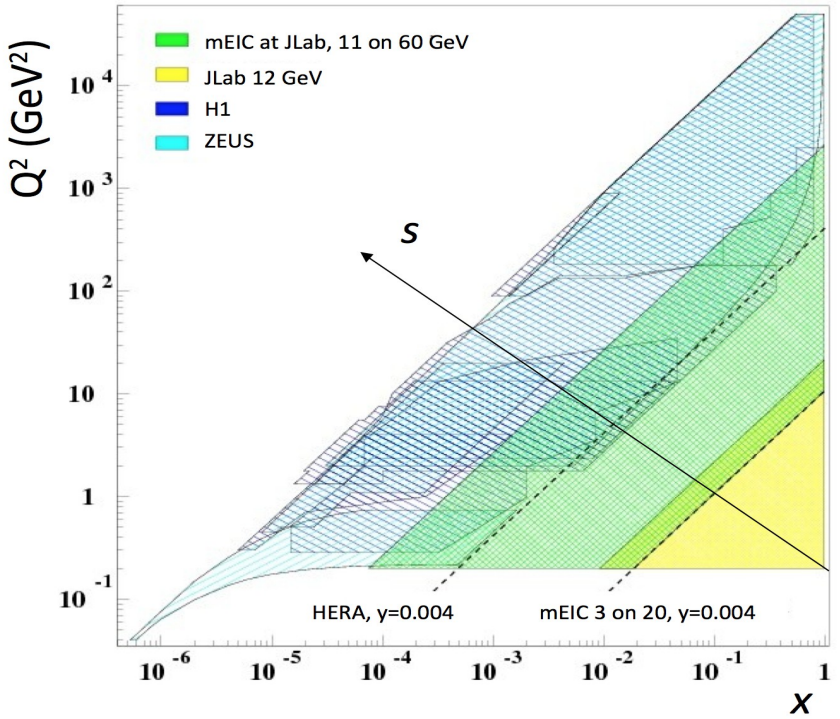
- *The decay channel : D*+ → D0 pi+, with D0 → K- pi+ , and corresponding antiparticle*
- *Previous measurements of D cross sections indicate that the production of charm quarks in DIS in the range (1 < Q2 < 1000 GeV2) is consistent with calculations in quantum chromodynamics QCD in which charm is produced through the boson-gluon-fusion (BGF) mechanism.*
- *Also inclusive photoproduction (Q2 ~ 0) of D mesons has been measured with the ZEUS detector at HERA using an integrated luminosity of 78:7 pb-1 and shows roughly consistent results with perturbative QCD predictions.*
- *A good addition to this measurements is the transition region (0:05<Q2 <0:7 GeV2) between photoproduction and DIS, which can be reached in ZEUS with the Beam Pipe Calorimeter (BPC) – a detector covers a small area near beam pipe, not reachable by the main Calorimeter.*
- *The measurement of charm in the transition region between DIS and photoproduction extends previous results in DIS to lower Q2*
- *The HVQDIS calculation produces a good description of the measured data. In particular, NLO QCD describes the dependence on Q2 of the data over four orders of magnitude in Q2 .*





HVQDIS calculations





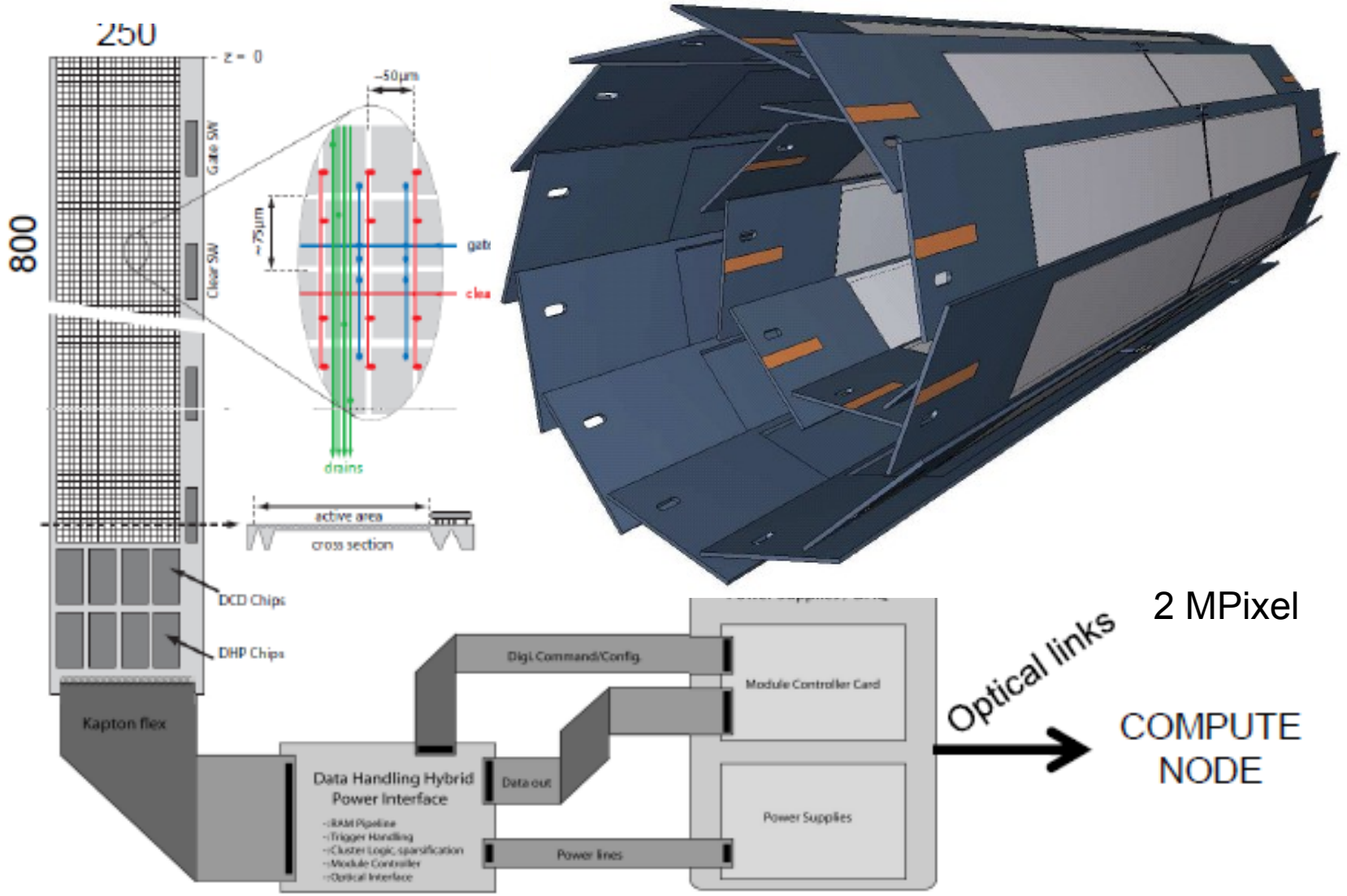
- *Kinematic range :*
  - e/p : 25 GeV / 100 GeV
  - 0.05 < Q2 <1000 GeV2 ,
  - 0.02 < y < 0.7 ,
- *Total cross section ~16 nb*

Backup Slides

DEPFET for Belle II

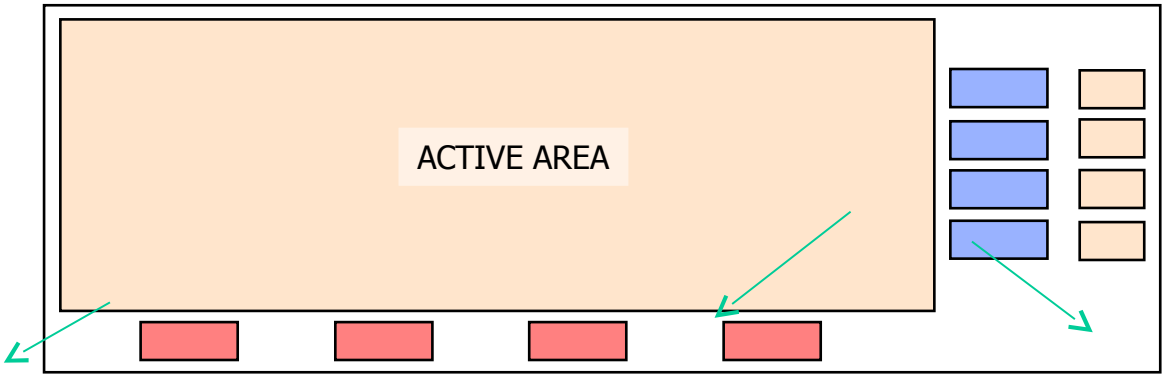
2 layers: @1.4(2.2) cm

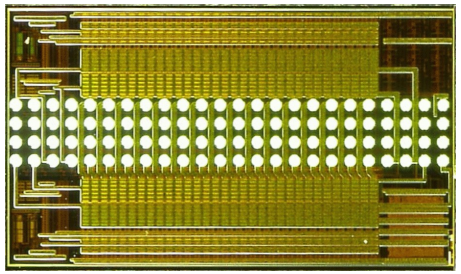
Pixels: 50 x 50(75) μm 75μm thick 0.18% X_0

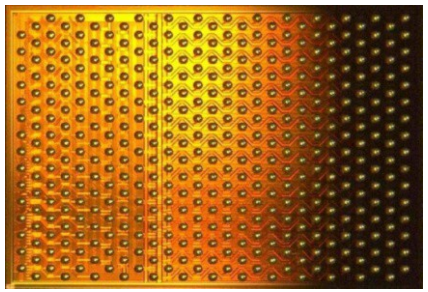


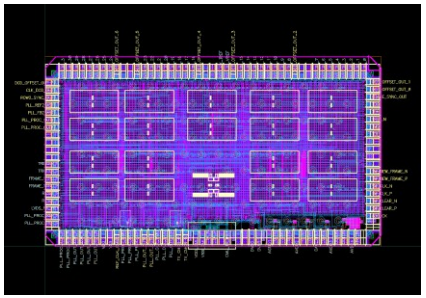
Power consumption in sensitive area: 0.1W/cm² => air-cooling sufficient

ASICs for control and readout









Switcher
Control of gate and clear
32 x 2 channels
Switches up to 30V
AMS 0.35 µm HV technology
Tested up to 36 Mrad

DCDB
Amplification and digitization
of DEPFET signals
256 input channels
8-bit ADC per channel
92 ns sampling time
UMC 189nm
Rad hard desiign

DHP
Signal processor
Common mode correction
Pedestal subtraction
0-supression
Timing and trigger control
IBM 90 nm
Rad hard design
½ size (32 channel) test chip

All three chips fabricated and tested