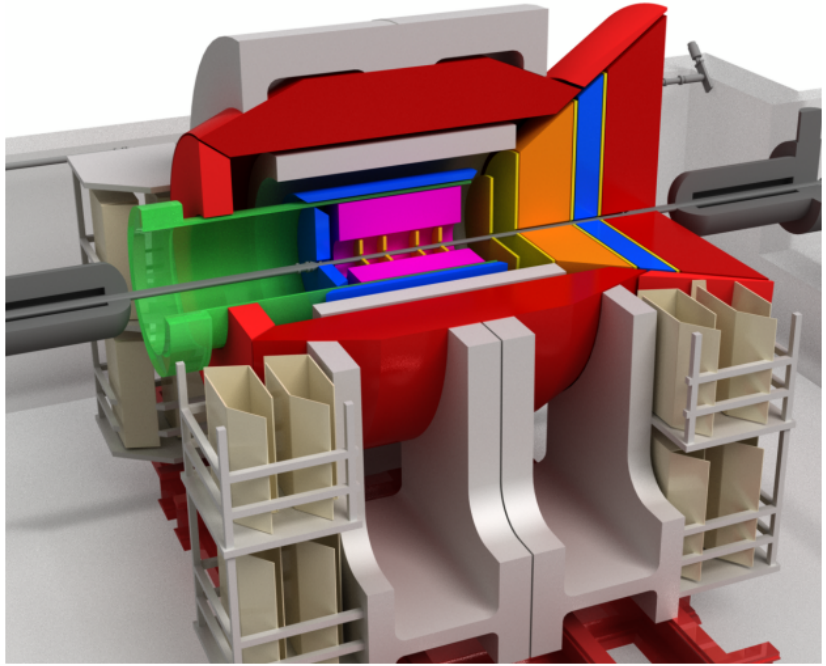
An EIC Detector Built Around the BaBar Solenoid

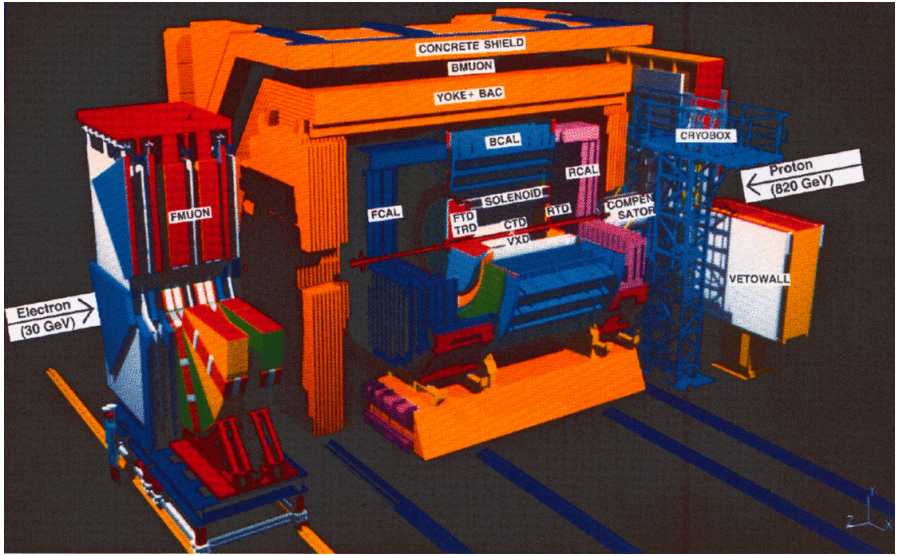
Pythia Studies

June 30, 2015

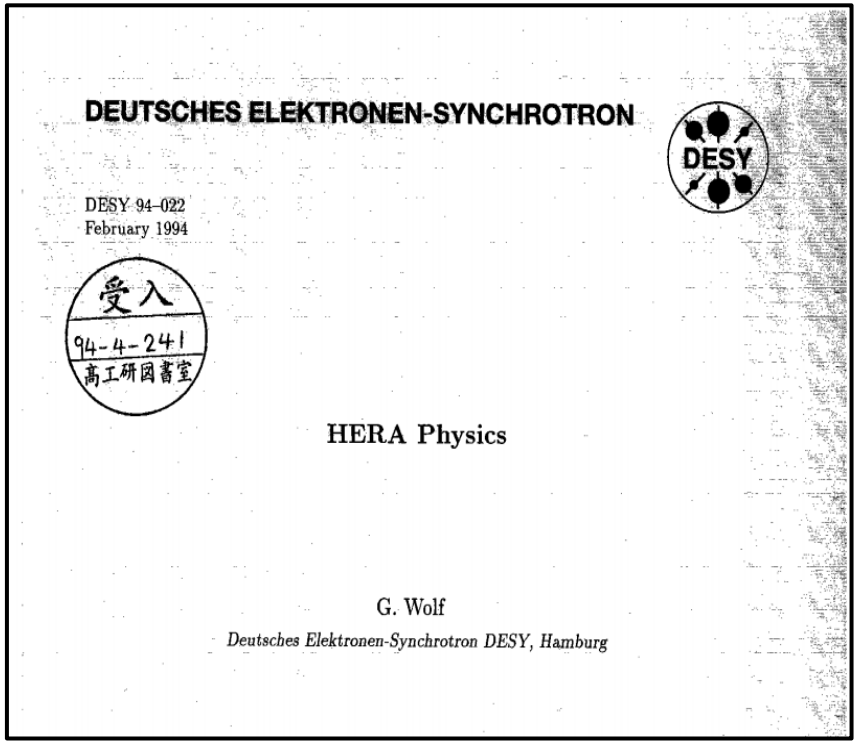


Thomas Krahulik (Stony Brook University)

HERA vs. EIC: x-Q^2 Dependence



ZEUS Detector from HERA



DEUTSCHES ELEKTRONEN-SYNCHROTRON

DESY

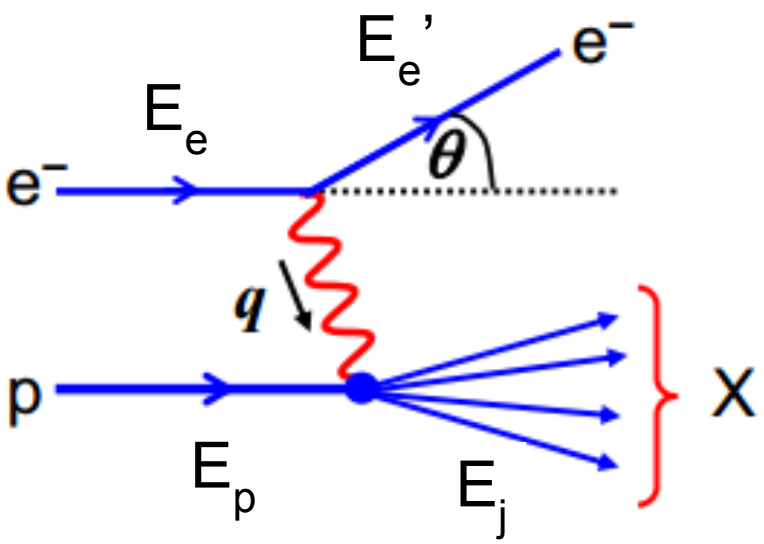
DESY 94-022
February 1994

受入
94-4-241
高工研図書室

HERA Physics

G. Wolf
Deutsches Elektronen-Synchrotron DESY, Hamburg

HERA vs. EIC: x-Q^2 Dependence



HERA Beam Energies:
26.7 GeV e- (E_e)
820 GeV p (E_p)

EIC Beam Energies:
10 GeV e- (E_e)
250 GeV p (E_p)

Scattered Lepton Kinematics:

$y = 1 - (E_e' / 2E_e)(1 - \cos(\theta_e'))$

$Q^2 = 2E_eE_e'(1 + \cos(\theta_e'))$

$x = E_e'(1 + \cos(\theta_e')) / (2yE_p)$

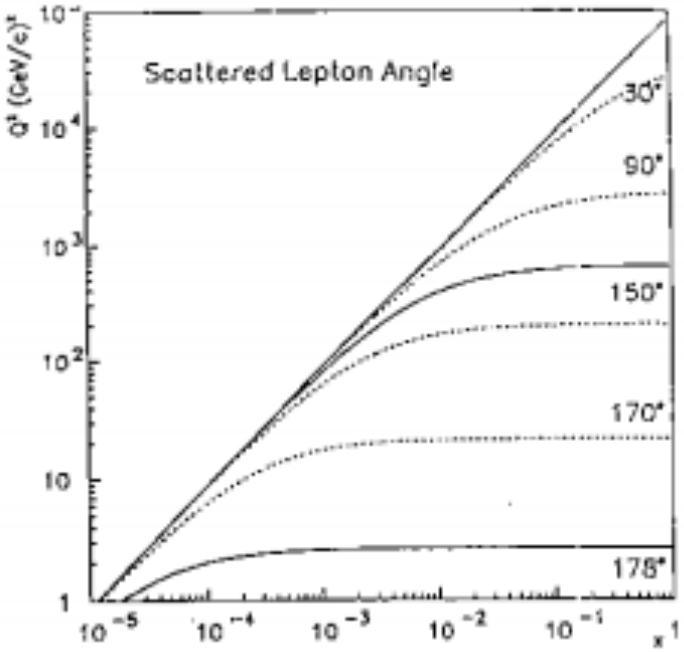
Jet Kinematics:

$y = (E_j / 2E_e)(1 - \cos(\theta_j))$

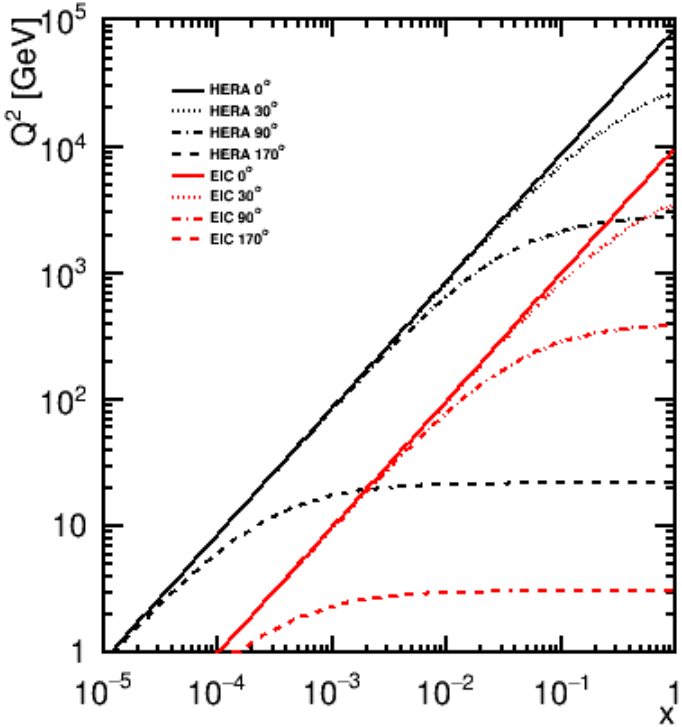
$Q^2 = E_j^2 \sin^2(\theta_j) / (1 - y)$

$x = E_j (1 + \cos(\theta_j)) / [(1 - y)(2E_p)]$

Lepton Angle

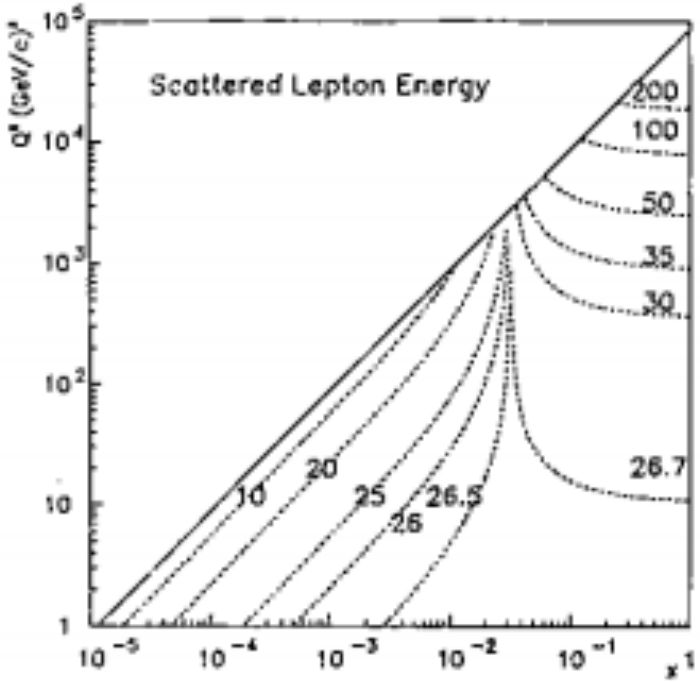


HERA Physics Figure 23 (Top Left)

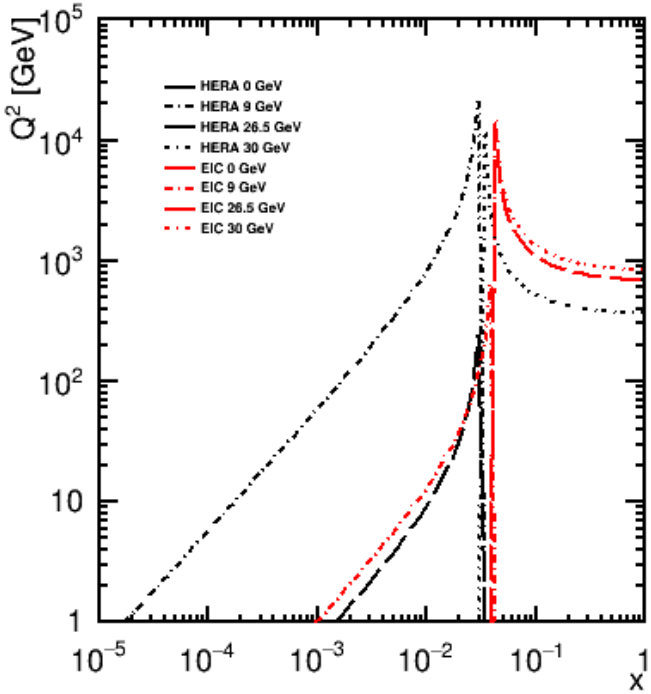


HERA (Black) vs. EIC (Red)

Lepton Energy

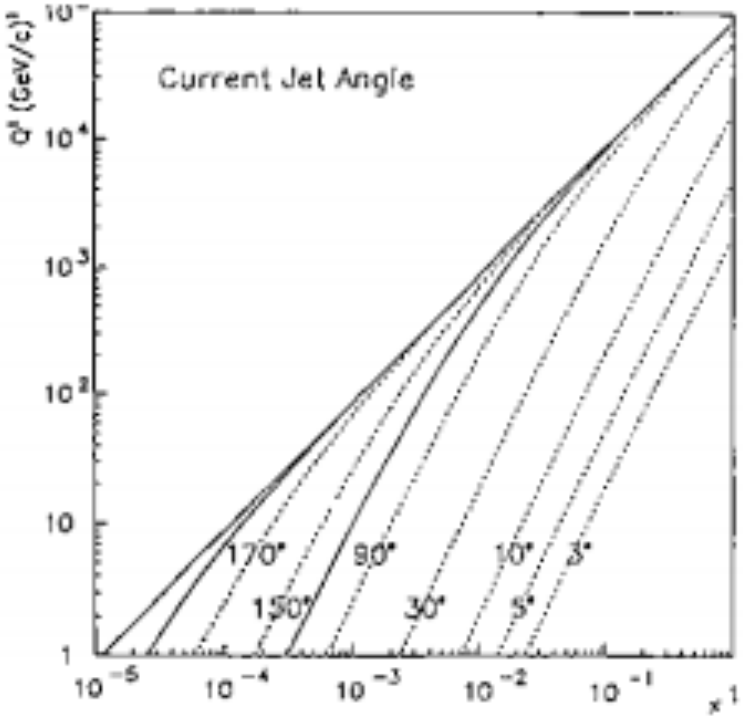


HERA Physics Figure 23 (Top Right)

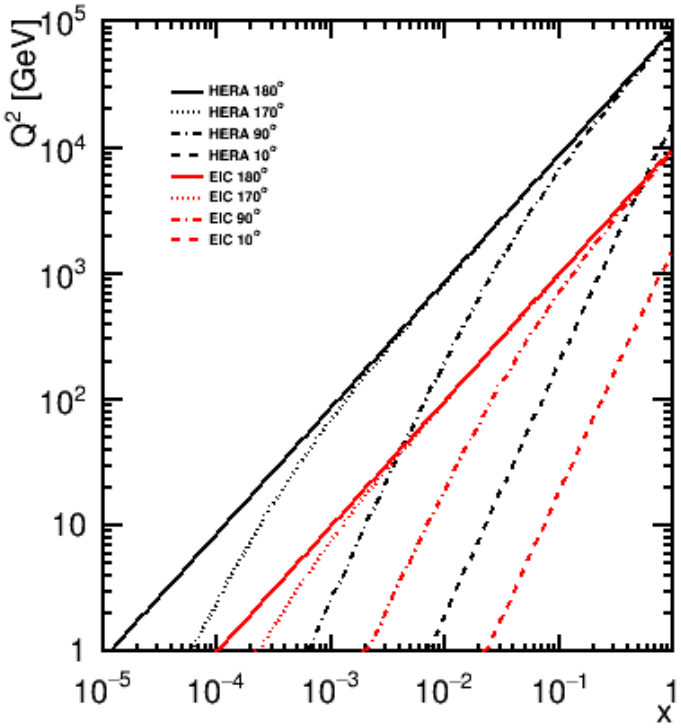


HERA (Black) vs. EIC (Red)

Jet Angle

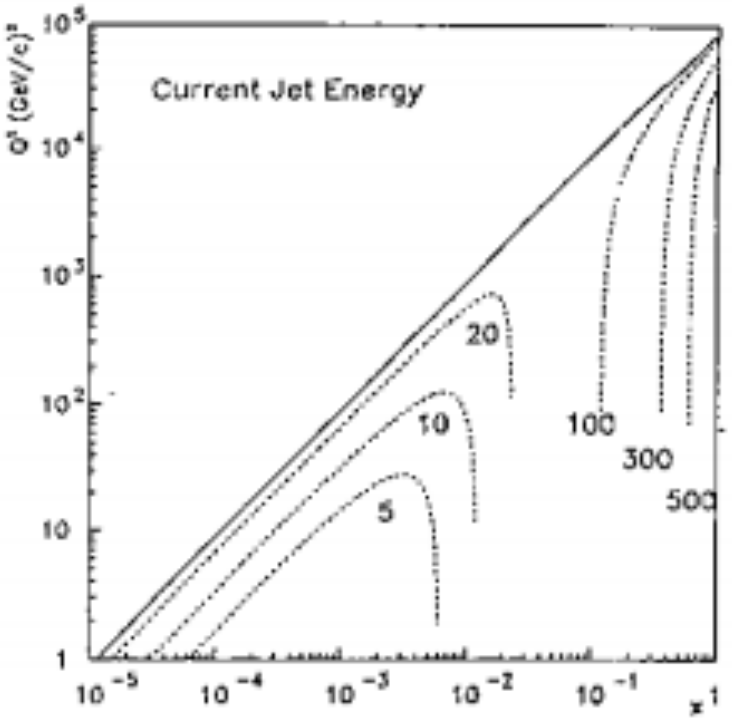


HERA Physics Figure 23 (Bottom Left)

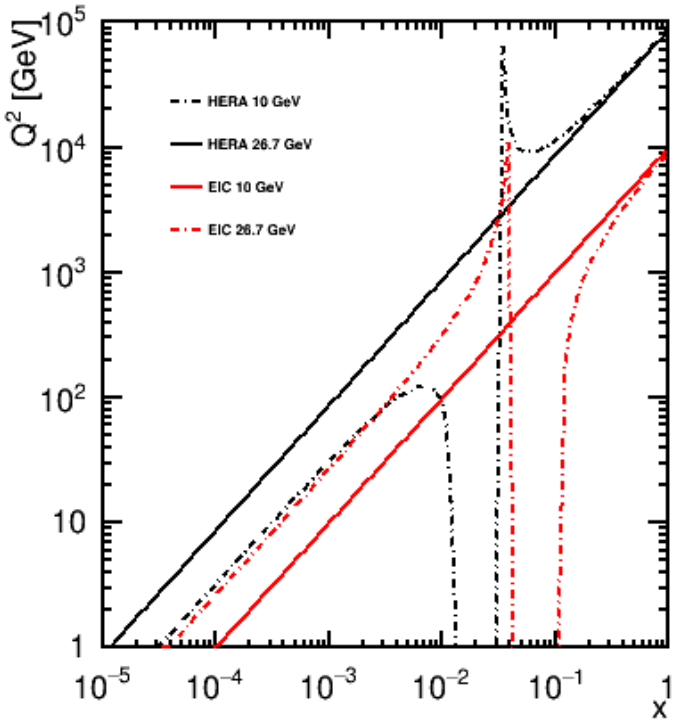


HERA (Black) vs. EIC (Red)

Jet Energy

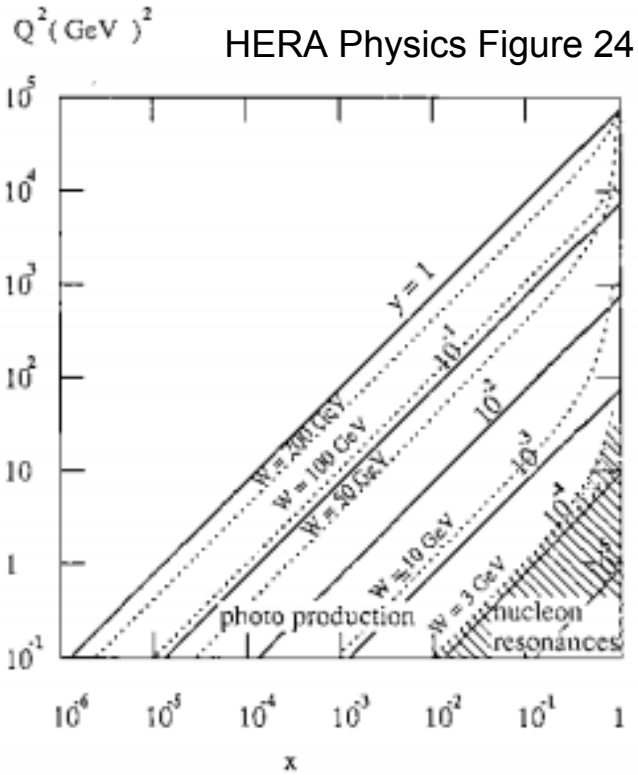


HERA Physics Figure 23 (Bottom Right)

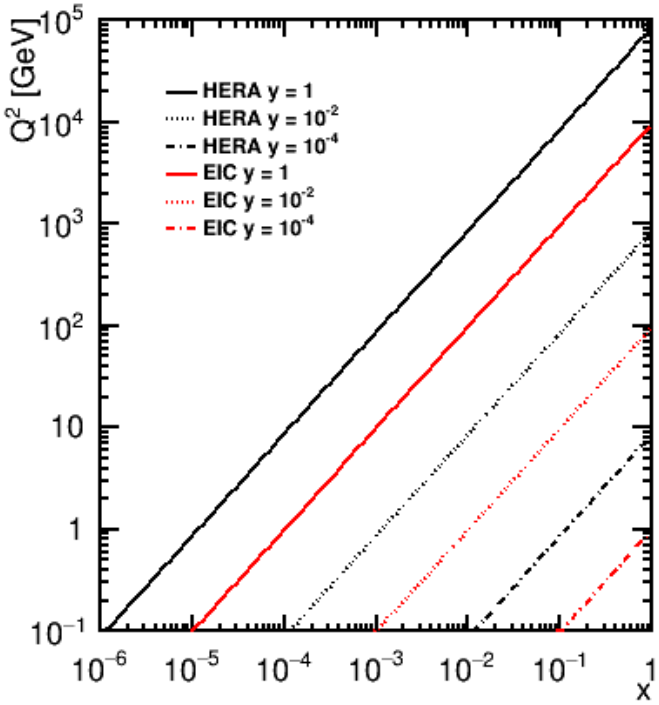


HERA (Black) vs. EIC (Red)

Inelasticity, y

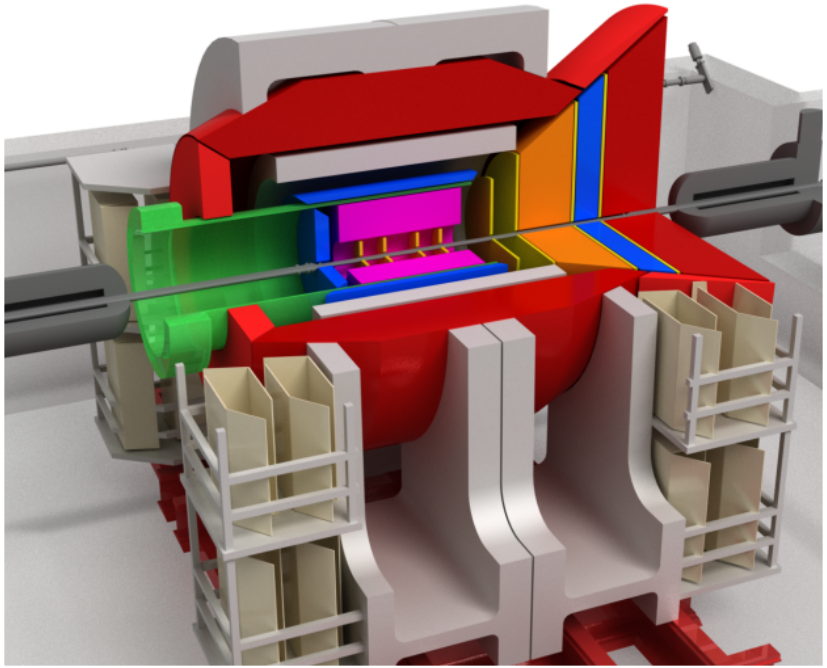


HERA Physics Figure 24



HERA (Black) vs. EIC (Red)

EIC Theory vs. Simulation



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**                                                                           **
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**      *::::::::!!::::::::::::::*       PPP  Y   Y TTTTT H   H III   A      **
**    *::::::::::!!::::::::::::::::*     P  P  Y Y    T   H   H  I   A A     **
**   *:::::::::::!!::::::::::::::::::*   PPP    Y     T   HHHHH  I  AAAAA    **
**   *:::::::::::!!::::::::::::::::::*   P      Y     T   H   H  I  A   A    **
**    *::::::::::!!::::::::::::::::::*!  P      Y     T   H   H III A   A    **
**      *::::::::!!::::::::::::::::* !!                                      **
**      !! *:::!!::::::::::::*    !!     This is PYTHIA version 6.428        **
**      !!     !* -><- *         !!     Last date of change:  5 Sep 2013    **
**      !!     !!                !!                                          **
**      !!     !!                !!     Now is  0 Jan 2000 at  0:00:00      **
**      !!                       !!                                          **
**      !!        lh             !!     Disclaimer: this program comes      **
**      !!                       !!     without any guarantees. Beware      **
**      !!                hh     !!     of errors and use common sense      **
**      !!    ll                 !!     when interpreting results.          **
**      !!                       !!                                          **
**      !!                                Copyright T. Sjostrand (2011)      **
**                                                                           **
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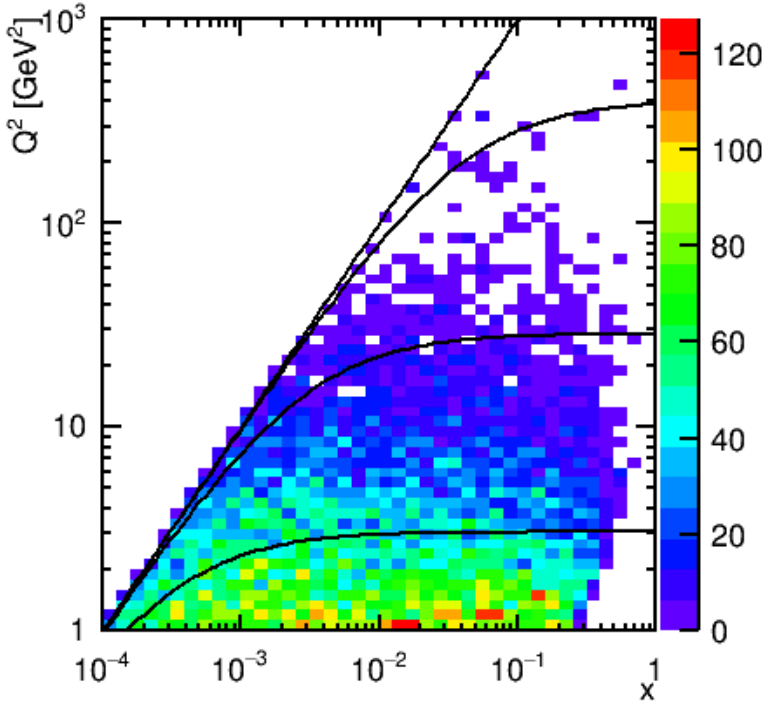
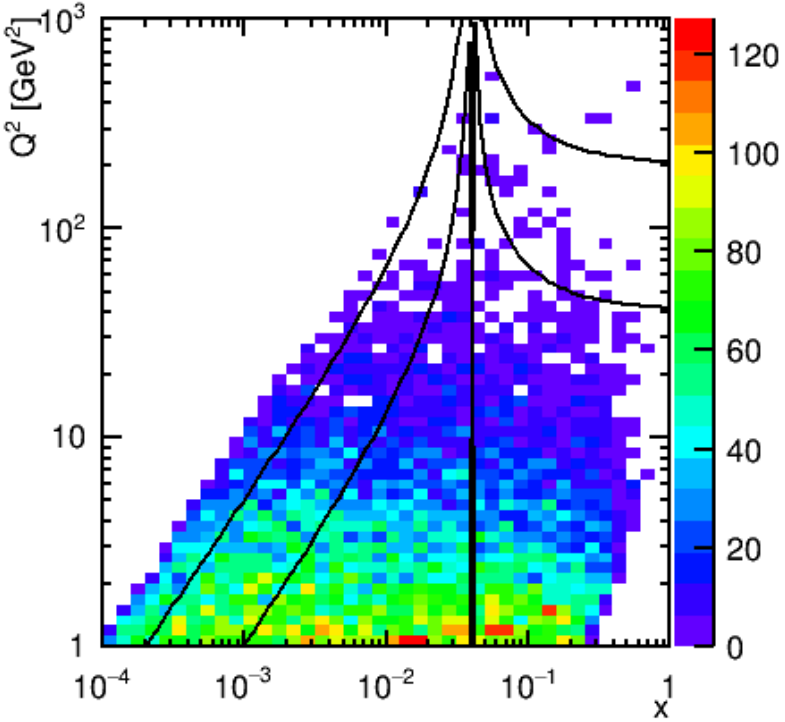
Lepton Kinematics

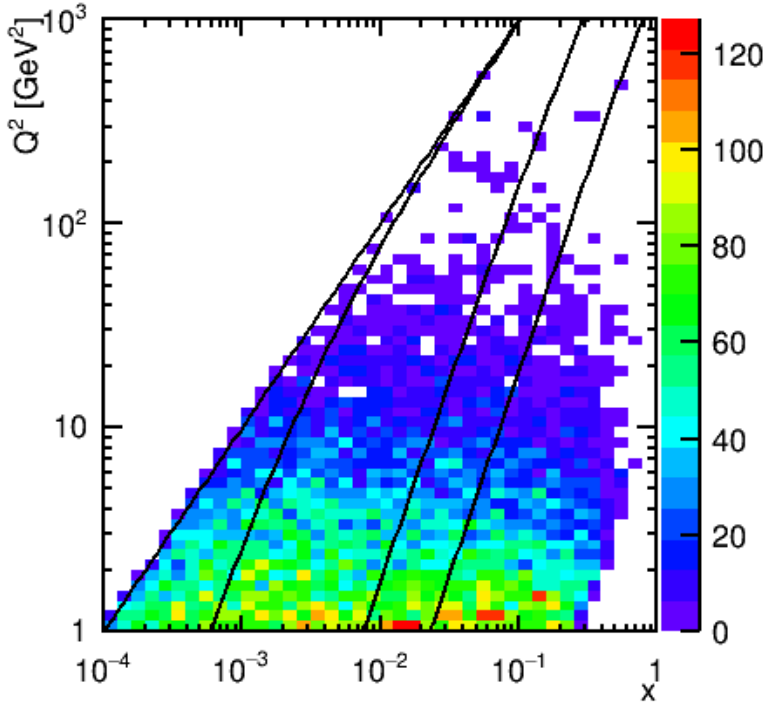


Lepton Angle (0º, 90º, 150º, 170º)

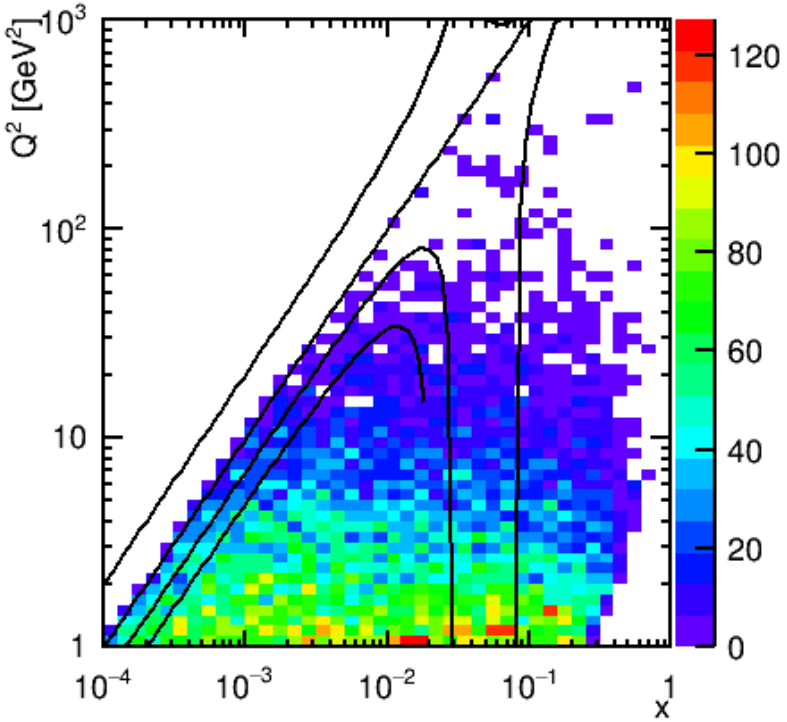


Lepton Energy (5 GeV, 9 GeV, 11 GeV, 15 GeV)

Jet Kinematics

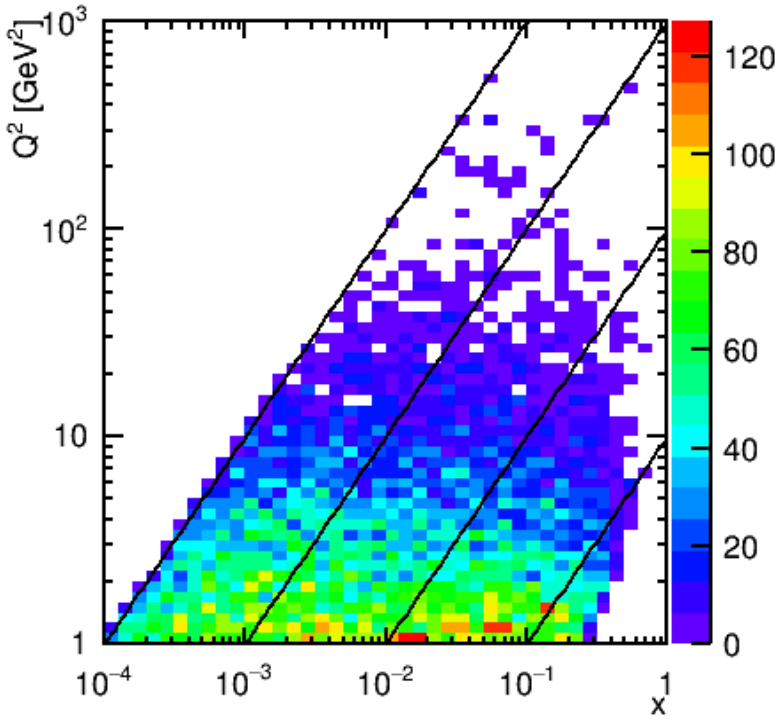


Jet Angle (180º, 150º, 30º, 10º)



Jet Energy (5 GeV, 7 GeV, 10 GeV, 20 GeV)

Inelasticity, y



y = 1 y = 10^{-1} y = 10^{-2} y = 10^{-3}

Next Steps...

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**                                                                           **
**                                                                           **
**              *......*                 Welcome to the Lund Monte Carlo!    **
**         *:::!!:::::::::::::*                                              **
**      *::::::!!::::::::::::::::*       PPP  Y   Y TTTTT H   H III   A      **
**    *:::::::::!!::::::::::::::::::*    P  P  Y Y    T   H   H  I   A A     **
**   *::::::::::!!::::::::::::::::::::*  PPP    Y     T   HHHHH  I  AAAAA    **
**   *::::::::::!!::::::::::::::::::::*  P      Y     T   H   H  I  A   A    **
**    *:::::::::!!::::::::::::::::::::*!P      Y     T   H   H III A   A    **
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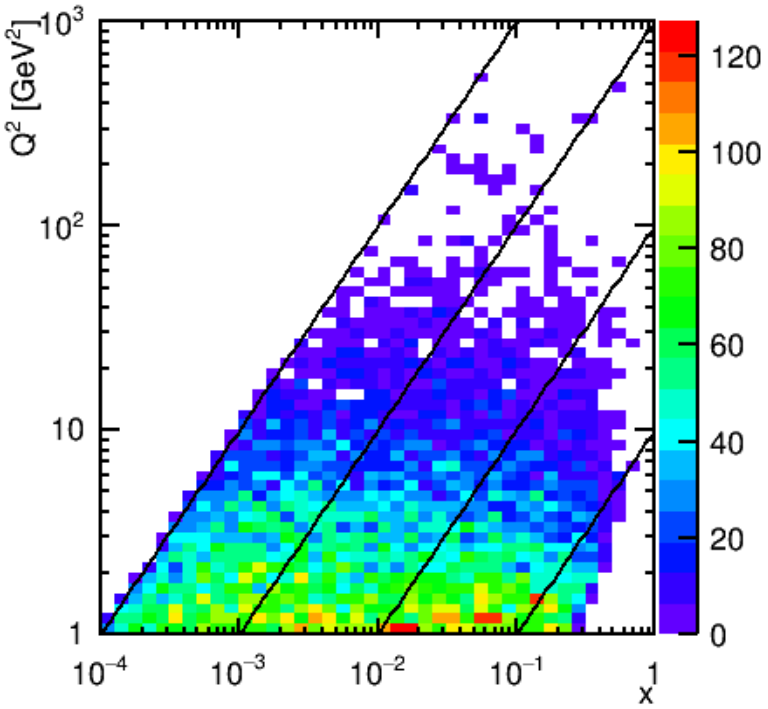
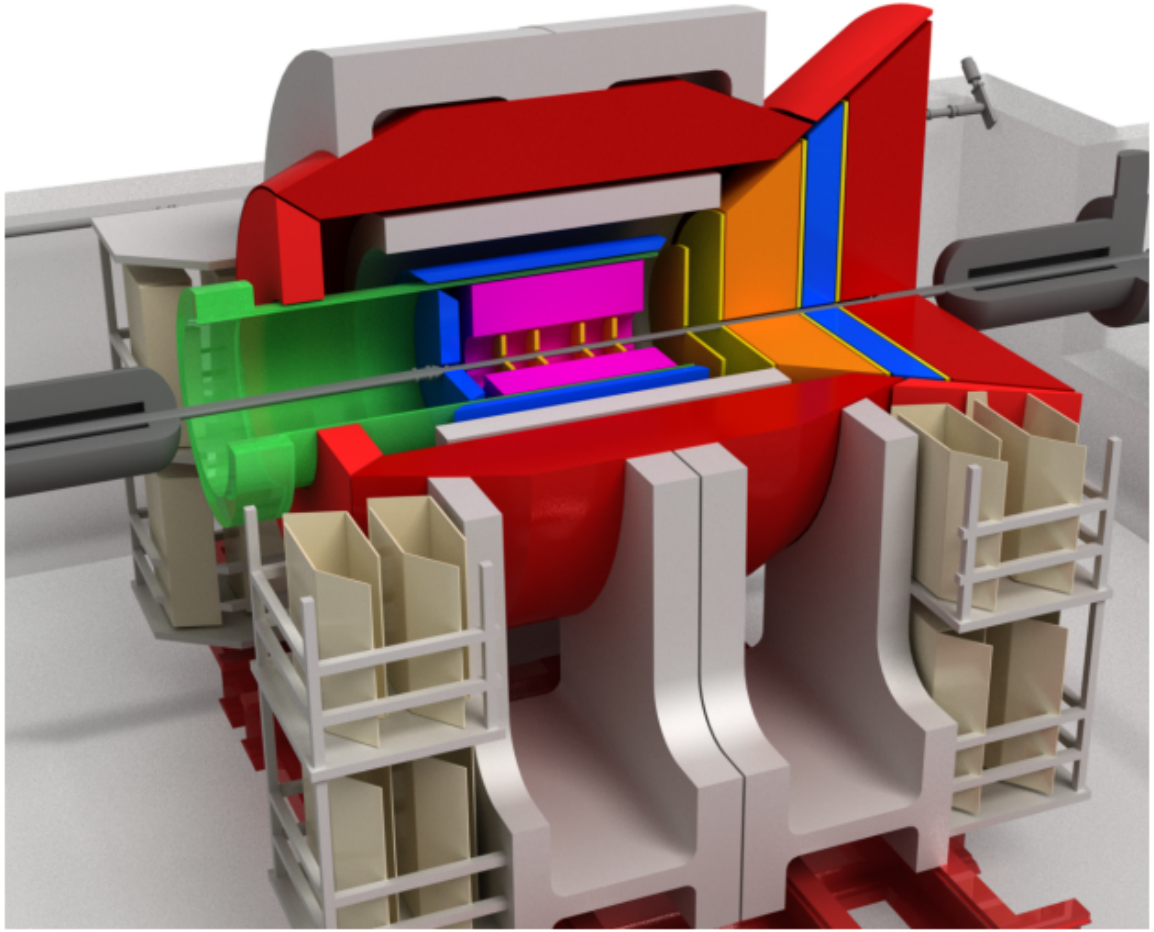


Questions?

References

Concept for an Electron Ion Collider (EIC) detector built around the BaBar solenoid
(EIC LoI 2014 arXiv:1402.1209v1)

HERA Physics, G. Wolf