

Rivet analyses for the EIC

By Akhil Mithran

Indian Institute of Technology, Mumbai
IISER Pune

Observation of the strange sea in the proton via inclusive ϕ -meson production in neutral current deep inelastic scattering at HERA

Observation of the strange sea in the proton via inclusive ϕ -meson production in neutral current deep inelastic scattering at HERA

➤ 9 Plots from **HEPDATA**

Observation of the strange sea in the proton via inclusive ϕ -meson production in neutral current deep inelastic scattering at HERA

- 9 Plots from **HEPDATA**
- arXiv:hep-ex/0211025v2

Observation of the strange sea in the proton via inclusive ϕ meson production in neutral current deep inelastic scattering at HERA

ZEUS Collaboration • S. Chekanov (Argonne) [Show All\(341\)](#)

Nov, 2002

20 pages

Published in: *Phys.Lett.B* 553 (2003) 141-158

e-Print: [hep-ex/0211025](#) [hep-ex]

DOI: [10.1016/S0370-2693\(02\)03206-9](#)

Report number: DESY-02-184

Experiments: [DESY-HERA-ZEUS](#)

View in: [ADS Abstract Service](#)



pdf



cite

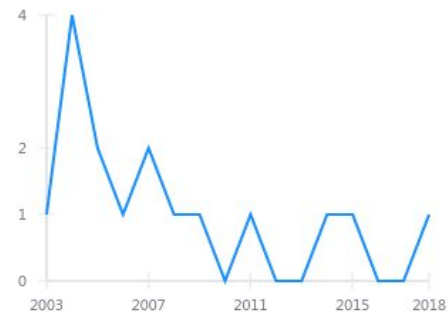


datasets



16 citations

Citations per year



Abstract:

Inclusive ϕ -meson production in neutral current deep inelastic $e+p$ scattering has been measured with the ZEUS detector at HERA using an integrated luminosity of 45 pb^{-1} . The ϕ mesons were studied in the range 10

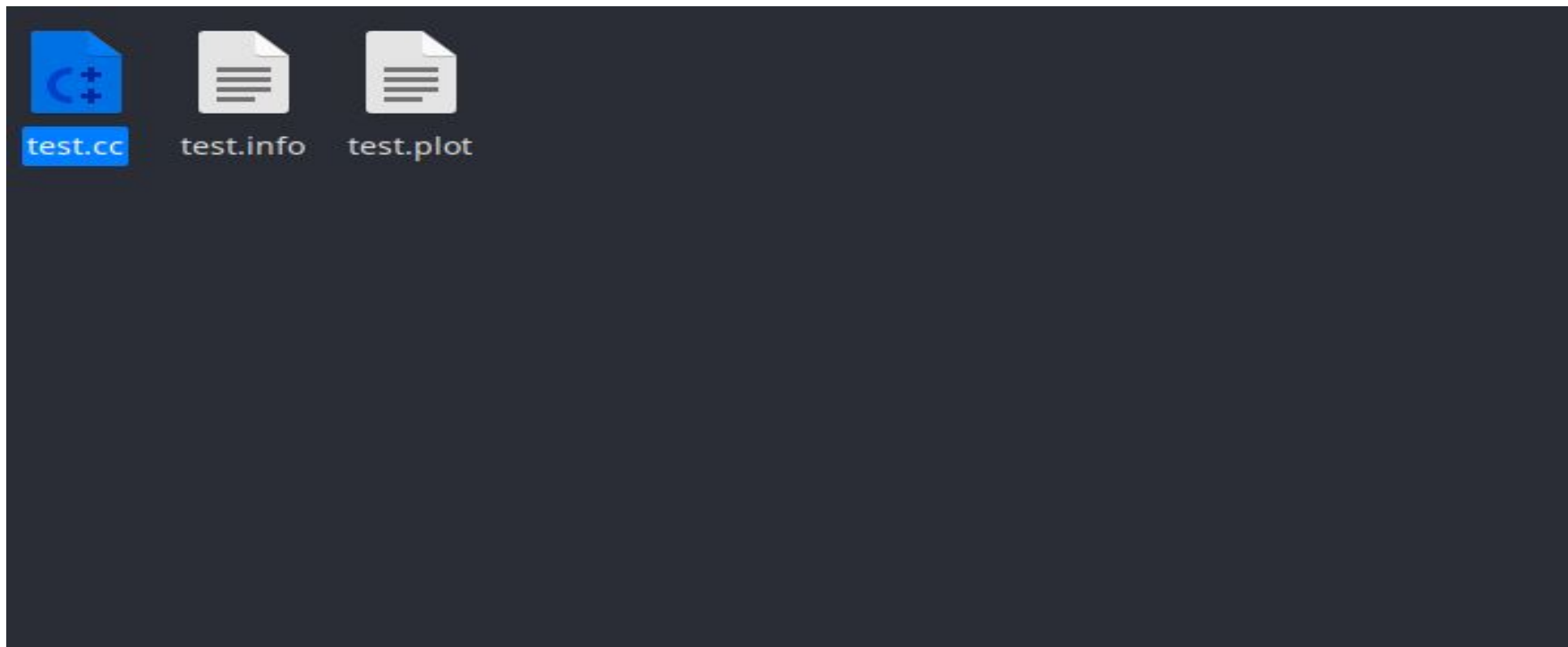
Note: 20 pages including 5 figures and 2 tables Report-no: DESY-02-184

Getting Started !

➤ `rivet-mkanalysis test`

Getting Started !

➤ `rivet-mkanalysis test`



Getting Started !

- `rivet-mkanalysis test`
- `'rivet-build Rivetest.so test.cc'`

Getting Started !

- `rivet-mkanalysis test`
- `'rivet-build Rivetest.so test.cc'`



Rivetest.so



test.cc



test.info



test.plot

BASE class for each analysis

- Every analysis includes `Rivet::Analysis`

BASE class for each analysis

- Every analysis includes `Rivet::Analysis`
- a minimum of three methods

BASE class for each analysis

- Every analysis includes `Rivet::Analysis`
- a minimum of three methods

```
virtual void init() { }
```

BASE class for each analysis

- Every analysis includes `Rivet::Analysis`
- a minimum of three methods

```
virtual void init() { }
```

```
virtual void analyze(const Event& event) = 0;
```

BASE class for each analysis

- Every analysis includes `Rivet::Analysis`
- a minimum of three methods

```
virtual void init() { }
```

```
virtual void analyze(const Event& event) = 0;
```

```
virtual void finalize() { }
```

Structure of c++ Class

Structure of rivet analysis script

Structure of c++ Class

Constructor

Structure of rivet analysis script

```
MyAnalysis() : Analysis("MYANALYSIS") { }
```

Structure of c++ Class

Constructor



Data Members

Structure of rivet analysis script

MyAnalysis() : Analysis("MYANALYSIS") { }



*Histo1DPtr _h1;
Profile1DPtr _p1;
CounterPtr c1;*

Structure of c++ Class

Constructor



Data Members



Members Functions

Structure of rivet analysis script

```
MyAnalysis() : Analysis("MYANALYSIS") { }
```



```
Histo1DPtr _h1;  
Profile1DPtr _p1;  
CounterPtr c1;
```



```
Void init() {} (1)  
Void analyze (const Event&  
event) {} (per event)  
void finalize() {} (1)
```

```
#include "Rivet/Analysis.hh"  
#include "Rivet/Projections/DISKinematics.hh"  
#include "Rivet/Projections/UnstableParticles.hh"
```

```
namespace Rivet {
```

```
class ZEUS_2002_I601697 : public Analysis {
```

```
public:
```

```
ZEUS_2002_I601697() : Analysis("ZEUS_2002_I601697")
```

```
{ }
```

```
/// Book histograms and initialise projections before the run
```

```
void init() {
```

```
  // Initialise and register projections
```

```
  declare(DISKinematics(), "Kinematics");
```

```
  // The phi mesons with cuts.
```

```
  Cut phiCuts = Cut((Cuts::abspid == PID::PHI) & (Cuts::eta > -1.7) &
```

```
    (Cuts::eta < 1.6) & (Cuts::pT > 1.7*GeV) & (Cuts::pT < 7.0*GeV));
```

```
  declare(UnstableParticles(phiCuts), "UFS");
```

```
  // Book histograms
```

```
  book(_h_pT, 2, 1, 1);
```

```
  book(_h_y, 3, 1, 1);
```

```
  book(_h_Q2, 4, 1, 1);
```

```
  book(_h_txp, 5, 1, 1);
```

```
  book(_h_cxp, 6, 1, 1);
```

```
  book(_h_X1c, 8, 1, 2);
```

```
  book(_h_X1t, 8, 1, 3);
```

```
  book(_h_X2c, 9, 1, 2);
```

```
  book(_h_X2t, 9, 1, 3);
```

```
}
```

Mandatory
base class
header

```
#include "Rivet/Analysis.hh"  
#include "Rivet/Projections/DISKinematics.hh"  
#include "Rivet/Projections/UnstableParticles.hh"  
  
namespace Rivet {  
  
  class ZEUS_2002_I601697 : public Analysis {  
  public:  
    ZEUS_2002_I601697() : Analysis("ZEUS_2002_I601697")  
    { }  
  
    /// Book histograms and initialise projections before the run  
    void init() {  
      // Initialise and register projections  
      declare(DISKinematics(), "Kinematics");  
      // The phi mesons with cuts.  
      Cut phiCuts = Cut((Cuts::abspid == PID::PHI) & (Cuts::eta > -1.7) &  
        (Cuts::eta < 1.6) & (Cuts::pT > 1.7*GeV) & (Cuts::pT < 7.0*GeV));  
      declare(UnstableParticles(phiCuts), "UFS");  
  
      // Book histograms  
      book(_h_pT, 2, 1, 1);  
      book(_h_y, 3, 1, 1);  
      book(_h_Q2, 4, 1, 1);  
      book(_h_txp, 5, 1, 1);  
      book(_h_cxp, 6, 1, 1);  
      book(_h_X1c, 8, 1, 2);  
      book(_h_X1t, 8, 1, 3);  
      book(_h_X2c, 9, 1, 2);  
      book(_h_X2t, 9, 1, 3);  
    }  
  }  
}
```

Constructor

```
#include "Rivet/Analysis.hh"
#include "Rivet/Projections/DISKinematics.hh"
#include "Rivet/Projections/UnstableParticles.hh"

namespace Rivet {

class ZEUS_2002_I601697 : public Analysis {
public:
  ZEUS_2002_I601697() : Analysis("ZEUS_2002_I601697")
  { }

  /// Book histograms and initialise projections before the run
  void init() {
    // Initialise and register projections
    declare(DISKinematics(), "Kinematics");
    // The phi mesons with cuts.
    Cut phiCuts = Cut((Cuts::abspid == PID::PHI) & (Cuts::eta > -1.7) &
      (Cuts::eta < 1.6) & (Cuts::pT > 1.7*GeV) & (Cuts::pT < 7.0*GeV));
    declare(UnstableParticles(phiCuts), "UFS");

    // Book histograms
    book(_h_pT, 2, 1, 1);
    book(_h_y, 3, 1, 1);
    book(_h_Q2, 4, 1, 1);
    book(_h_txp, 5, 1, 1);
    book(_h_cxp, 6, 1, 1);
    book(_h_X1c, 8, 1, 2);
    book(_h_X1t, 8, 1, 3);
    book(_h_X2c, 9, 1, 2);
    book(_h_X2t, 9, 1, 3);
  }
}
```

**Member
function**

```
#include "Rivet/Analysis.hh"
#include "Rivet/Projections/DISKinematics.hh"
#include "Rivet/Projections/UnstableParticles.hh"

namespace Rivet {

class ZEUS_2002_I601697 : public Analysis {
public:
  ZEUS_2002_I601697() : Analysis("ZEUS_2002_I601697")
  { }

  // Book histograms and initialise projections before the run
  void init() {
    // Initialise and register projections
    declare(DISKinematics(), "Kinematics");
    // The phi mesons with cuts.
    Cut phiCuts = Cut((Cuts::abspid == PID::PHI) & (Cuts::eta > -1.7) &
      (Cuts::eta < 1.6) & (Cuts::pT > 1.7*GeV) & (Cuts::pT < 7.0*GeV));
    declare(UnstableParticles(phiCuts), "UFS");

    // Book histograms
    book(_h_pT, 2, 1, 1);
    book(_h_y, 3, 1, 1);
    book(_h_Q2, 4, 1, 1);
    book(_h_txp, 5, 1, 1);
    book(_h_cxp, 6, 1, 1);
    book(_h_X1c, 8, 1, 2);
    book(_h_X1t, 8, 1, 3);
    book(_h_X2c, 9, 1, 2);
    book(_h_X2t, 9, 1, 3);
  }
}
```

Mandatory
base class
header

Constructor

**Member
function**

```
#include "Rivet/Analysis.hh"
#include "Rivet/Projections/DISKinematics.hh"
#include "Rivet/Projections/UnstableParticles.hh"

namespace Rivet {

class ZEUS_2002_I601697 : public Analysis {
public:
  ZEUS_2002_I601697() : Analysis("ZEUS_2002_I601697")
  { }

  // Book histograms and initialise projections before the run
  void init() {
    // Initialise and register projections
    declare(DISKinematics(), "Kinematics");
    // The phi mesons with cuts.
    Cut phiCuts = Cut((Cuts::abspid == PID::PHI) & (Cuts::eta > -1.7) &
      (Cuts::eta < 1.6) & (Cuts::pT > 1.7*GeV) & (Cuts::pT < 7.0*GeV));
    declare(UnstableParticles(phiCuts), "UFS");

    // Book histograms
    book(_h_pT, 2, 1, 1);
    book(_h_y, 3, 1, 1);
    book(_h_Q2, 4, 1, 1);
    book(_h_txp, 5, 1, 1);
    book(_h_cxp, 6, 1, 1);
    book(_h_X1c, 8, 1, 2);
    book(_h_X1t, 8, 1, 3);
    book(_h_X2c, 9, 1, 2);
    book(_h_X2t, 9, 1, 3);
  }
}
```

ZEUS_2002_I601697

ZEUS_2002_I601697

experiment name

experiment name

ZEUS_2002_I601697

Publication year

experiment name

ZEUS_2002_I601697

Inspire HEP
database ID

Publication year

<https://inspirehep.net/literature/601697>

experiment name

ZEUS_2002_I601697

Inspire HEP
database ID

Publication year

Projections

<https://inspirehep.net/literature/601697>

➤ *‘Observables calculator’*

experiment name

ZEUS_2002_I601697

Inspire HEP
database ID

Publication year

<https://inspirehep.net/literature/601697>

Projections

- *'Observables calculator'*
- Some important ones :
 - DISKinematics (DISLepton)
 - DISFinalState
 - FinalState
 - UnstableParticles

experiment name

ZEUS_2002_I601697

Inspire HEP
database ID

Publication year

<https://inspirehep.net/literature/601697>

Projections

- *'Observables calculator'*
- Some important ones :
 - DISKinematics (DISLepton)
 - DISFinalState
 - FinalState
 - UnstableParticles
- *'Rivet::Cuts'* namespace can be used to kinematic selection of particles. (projection level). Eg :- `Cuts::pT`, `Cuts::eta`, `Cuts::absrap`, `Cuts::pid`, `Cuts::pid`

Phase Space Selection

- Virtuality, Q^2 in range (10 , 100)
- Bjorken x in range (0.0002 , 0.01)
- Scaled momentum in Breit frame
- Longitudinal momentum in Breit frame

Phase Space Selection

- `declare(DISKinematics(), "Kinematics");`
- `const DISKinematics& kin = apply<DISKinematics>(event, "Kinematics");`
- `Q2(), W2(), y(), x(), boostBreit(), boostHCM() [beamLepton (), scatteredLepton ()]`
- `Rivet::FourMomentum Class`

`[ eta(), phi(), pT(), Et(), E(), px(), py(), pz() & mass() ]`

(https://rivet.hepforge.org/code/dev/classRivet_1_1DISKinematics.html)

(https://rivet.hepforge.org/code/dev/classRivet_1_1FourMomentum.html)

(<https://rivet.hepforge.org/code/dev/classes.html>)

```

/// Perform the per-event analysis
void analyze(const Event& event) {

    // DIS kinematics.
    const DISKinematics& kin = apply<DISKinematics>(event, "Kinematics");
    const double disQ2 = kin.Q2()/GeV2;
    const double disQ = sqrt(disQ2);
    const double disX = kin.x();
    if ( kin.failed() ) vetoEvent;
    const LorentzTransform breitboost = kin.boostBreit();

    // Event selection cuts.
    if (!inRange(disQ2, 10., 100.)) vetoEvent;
    if (!inRange(disX, 0.0002, 0.01)) vetoEvent;

    // Particle loop, fill phi histograms. All particle
    // level cuts defined in projection.
    const UnstableParticles& phis = apply<UnstableParticles>(event, "UFS");
    for (const Particle& phi : phis.particles()) {
        const FourMomentum phiBreitMom = breitboost.transform(phi.momentum());
        const double pmodBreit = phiBreitMom.p();
        const double xP = (2*pmodBreit)/disQ;
        const double pzBreit = phiBreitMom.pz();
        _h_pT->fill(phi.pT()/GeV);
        _h_Q2->fill(disQ2);
        _h_y->fill(phi.eta());
        if(pzBreit < 0 ) {
            _h_cxp->fill(xP);
            if( inRange(disQ2, 10., 35.) ) _h_X1c->fill(disX);
            if( inRange(disQ2, 35., 100.) ) _h_X2c->fill(disX);
        }
        if(pzBreit > 0 ) {
            _h_txp->fill(xP);
            if( inRange(disQ2, 10., 35.) ) _h_X1t->fill(disX);
            if( inRange(disQ2, 35., 100.) ) _h_X2t->fill(disX);
        }
    }
}
}

```


Kinematic Selection

```
/// Perform the per-event analysis
void analyze(const Event& event) {

    // DIS kinematics.
    const DISKinematics& kin = apply<DISKinematics>(event, "Kinematics");
    const double disQ2 = kin.Q2()/GeV2;
    const double disQ = sqrt(disQ2);
    const double disX = kin.x();
    if ( kin.failed() ) vetoEvent;
    const LorentzTransform breitboost = kin.boostBreit();

    // Event selection cuts.
    if (!inRange(disQ2, 10., 100.)) vetoEvent;
    if (!inRange(disX, 0.0002, 0.01)) vetoEvent;

    // Particle loop, fill phi histograms. All particle
    // level cuts defined in projection.
    const UnstableParticles& phis = apply<UnstableParticles>(event, "UFS");
    for (const Particle& phi : phis.particles()) {
        const FourMomentum phiBreitMom = breitboost.transform(phi.momentum());
        const double pmodBreit = phiBreitMom.p();
        const double xP = (2*pmodBreit)/disQ;
        const double pzBreit = phiBreitMom.pz();
        _h_pT->fill(phi.pT()/GeV);
        _h_Q2->fill(disQ2);
        _h_y->fill(phi.eta());
        if(pzBreit < 0 ) {
            _h_cxp->fill(xP);
            if( inRange(disQ2, 10., 35.) ) _h_X1c->fill(disX);
            if( inRange(disQ2, 35., 100.) ) _h_X2c->fill(disX);
        }
        if(pzBreit > 0 ) {
            _h_txp->fill(xP);
            if( inRange(disQ2, 10., 35.) ) _h_X1t->fill(disX);
            if( inRange(disQ2, 35., 100.) ) _h_X2t->fill(disX);
        }
    }
}
```

```

/// Perform the per-event analysis
void analyze(const Event& event) {

    // DIS kinematics.
    const DISKinematics& kin = apply<DISKinematics>(event, "Kinematics");
    const double disQ2 = kin.Q2()/GeV2;
    const double disQ = sqrt(disQ2);
    const double disX = kin.x();
    if ( kin.failed() ) vetoEvent;
    const LorentzTransform breitboost = kin.boostBreit();

    // Event selection cuts.
    if (!inRange(disQ2, 10., 100.)) vetoEvent;
    if (!inRange(disX, 0.0002, 0.01)) vetoEvent;

    // Particle loop, fill phi histograms. All particle
    // level cuts defined in projection.
    const UnstableParticles& phis = apply<UnstableParticles>(event, "UFS");
    for (const Particle& phi : phis.particles()) {
        const FourMomentum phiBreitMom = breitboost.transform(phi.momentum());
        const double pmodBreit = phiBreitMom.p();
        const double xP = (2*pmodBreit)/disQ;
        const double pzBreit = phiBreitMom.pz();
        _h_pT->fill(phi.pT()/GeV);
        _h_Q2->fill(disQ2);
        _h_y->fill(phi.eta());
        if(pzBreit < 0 ) {
            _h_cxp->fill(xP);
            if( inRange(disQ2, 10., 35.) ) _h_X1c->fill(disX);
            if( inRange(disQ2, 35., 100.) ) _h_X2c->fill(disX);
        }
        if(pzBreit > 0 ) {
            _h_txp->fill(xP);
            if( inRange(disQ2, 10., 35.) ) _h_X1t->fill(disX);
            if( inRange(disQ2, 35., 100.) ) _h_X2t->fill(disX);
        }
    }
}

```

‘fill()’
histograms

*Kinematic
Selection*

```
/// Perform the per-event analysis
void analyze(const Event& event) {

    // DIS kinematics.
    const DISKinematics& kin = apply<DISKinematics>(event, "Kinematics");
    const double disQ2 = kin.Q2()/GeV2;
    const double disQ = sqrt(disQ2);
    const double disX = kin.x();
    if ( kin.failed() ) vetoEvent;
    const LorentzTransform breitboost = kin.boostBreit();

    // Event selection cuts.
    if (!inRange(disQ2, 10., 100.)) vetoEvent;
    if (!inRange(disX, 0.0002, 0.01)) vetoEvent;
```

*'fill()'
histograms*

```
    // Particle loop, fill phi histograms. All particle
    // level cuts defined in projection.
    const UnstableParticles& phis = apply<UnstableParticles>(event, "UFS");
    for (const Particle& phi : phis.particles()) {
        const FourMomentum phiBreitMom = breitboost.transform(phi.momentum());
        const double pmodBreit = phiBreitMom.p();
        const double xP = (2*pmodBreit)/disQ;
        const double pzBreit = phiBreitMom.pz();
        _h_pT->fill(phi.pT()/GeV);
        _h_Q2->fill(disQ2);
        _h_y->fill(phi.eta());
        if(pzBreit < 0 ) {
            _h_cxp->fill(xP);
            if( inRange(disQ2, 10., 35.) ) _h_X1c->fill(disX);
            if( inRange(disQ2, 35., 100.) ) _h_X2c->fill(disX);
        }
        if(pzBreit > 0 ) {
            _h_txp->fill(xP);
            if( inRange(disQ2, 10., 35.) ) _h_X1t->fill(disX);
            if( inRange(disQ2, 35., 100.) ) _h_X2t->fill(disX);
        }
    }
}
```

‘finalize()’

- Scale our plots
- Use cross-section measure

```
// Scale histograms etc., after the run
void finalize() {
    // Normalize to cross section.
    const double xSecNB = crossSection()/nanobarn/sumOfWeights() ;
    scale(_h_pT, xSecNB );
    scale(_h_Q2, xSecNB );
    scale(_h_y, xSecNB );
    scale(_h_cxp, xSecNB );
    scale(_h_txp, xSecNB );
    scale(_h_X1c, xSecNB );
    scale(_h_X1t, xSecNB );
    scale(_h_X2c, xSecNB );
    scale(_h_X2t, xSecNB );
}
```

Data members

private:

```
// Histograms
Histo1DPtr _h_y, _h_pT, _h_Q2;
Histo1DPtr _h_cxp, _h_txp;
Histo1DPtr _h_X1c, _h_X2c, _h_X1t, _h_X2t ;
};
```



```
Scatter2DPtr _histC2[5];  
Scatter2DPtr _histC3[5];  
Scatter2DPtr _histC4[5];  
Histo1DPtr _Test;  
Scatter2DPtr _histMM2[3];  
Scatter2DPtr _histAM[3];
```

```
Scatter2DPtr _histDM2[3];  
Scatter2DPtr _histDM3[3];  
Scatter2DPtr _histDM4[3];
```

```
Scatter2DPtr _histCM2[3];  
Scatter2DPtr _histCM3[3];  
Scatter2DPtr _histCM4[3];
```

```
Profile1DPtr _histENf[5];  
Profile1DPtr _histENp[5];
```

```
const size_t s = 20;  
vector<double> mn = vector<double>(s);  
vector<double> a{vector<double>(s)};  
vector<vector<double>> n{vector<vector<double>>(s)}, d2{vector<vector<double>>(s)}, d3{vector<vector<double>>(s)},  
    d4{vector<vector<double>>(s)}, c2{vector<vector<double>>(s)}, c3{vector<vector<double>>(s)}, c4{vector<vector<double>>(s)} ;
```

```
const size_t r = 12;  
vector<double> mm = vector<double>(r);  
vector<double> am{vector<double>(r)};  
vector<vector<double>> m{vector<vector<double>>(r)}, dm2{vector<vector<double>>(r)}, dm3{vector<vector<double>>(r)},
```

```
Scatter2DPtr _histC2[5];  
Scatter2DPtr _histC3[5];  
Scatter2DPtr _histC4[5];  
Histo1DPtr _Test;  
Scatter2DPtr _histMM2[3];  
Scatter2DPtr _histAM[3];
```

```
Scatter2DPtr _histDM2[3];  
Scatter2DPtr _histDM3[3];  
Scatter2DPtr _histDM4[3];
```

```
Scatter2DPtr _histCM2[3];  
Scatter2DPtr _histCM3[3];  
Scatter2DPtr _histCM4[3];
```

```
Profile1DPtr _histENf[5];  
Profile1DPtr _histENp[5];
```

```
const size_t s = 20;  
vector<double> mn = vector<double>(s);  
vector<double> a{vector<double>(s)};  
vector<vector<double>> n{vector<vector<double>>(s)}, d2{vector<vector<double>>(s)}, d3{vector<vector<double>>(s)},  
    d4{vector<vector<double>>(s)}, c2{vector<vector<double>>(s)}, c3{vector<vector<double>>(s)}, c4{vector<vector<double>>(s)} ;
```

```
const size_t r = 12;  
vector<double> mm = vector<double>(r);  
vector<double> am{vector<double>(r)};  
vector<vector<double>> m{vector<vector<double>>(r)}, dm2{vector<vector<double>>(r)}, dm3{vector<vector<double>>(r)},
```

```
Scatter2DPtr _histC2[5];  
Scatter2DPtr _histC3[5];  
Scatter2DPtr _histC4[5];  
Histo1DPtr _Test;  
Scatter2DPtr _histMM2[3];  
Scatter2DPtr _histAM[3];
```

```
Scatter2DPtr _histDM2[3];  
Scatter2DPtr _histDM3[3];  
Scatter2DPtr _histDM4[3];
```

```
Scatter2DPtr _histCM2[3];  
Scatter2DPtr _histCM3[3];  
Scatter2DPtr _histCM4[3];
```

```
Profile1DPtr _histENf[5];  
Profile1DPtr _histENp[5];
```

```
const size_t s = 20;  
vector<double> mn = vector<double>(s);  
vector<double> a{vector<double>(s)};  
vector<vector<double>> n{vector<vector<double>>(s)}, d2{vector<vector<double>>(s)}, d3{vector<vector<double>>(s)},  
    d4{vector<vector<double>>(s)}, c2{vector<vector<double>>(s)}, c3{vector<vector<double>>(s)}, c4{vector<vector<double>>(s)} ;
```

```
const size_t r = 12;  
vector<double> mm = vector<double>(r);  
vector<double> am{vector<double>(r)};  
vector<vector<double>> m{vector<vector<double>>(r)}, dm2{vector<vector<double>>(r)}, dm3{vector<vector<double>>(r)},
```

```
Scatter2DPtr _histC2[5];  
Scatter2DPtr _histC3[5];  
Scatter2DPtr _histC4[5];  
Histo1DPtr _Test;  
Scatter2DPtr _histMM2[3];  
Scatter2DPtr _histAM[3];
```

```
Scatter2DPtr _histDM2[3];  
Scatter2DPtr _histDM3[3];  
Scatter2DPtr _histDM4[3];
```

```
Scatter2DPtr _histCM2[3];  
Scatter2DPtr _histCM3[3];  
Scatter2DPtr _histCM4[3];
```

```
Profile1DPtr _histENf[5];  
Profile1DPtr _histENp[5];
```

```
const size_t s = 20;  
vector<double> mn = vector<double>(s);  
vector<double> a{vector<double>(s)};  
vector<vector<double>> n{vector<vector<double>>(s)}, d2{vector<vector<double>>(s)}, d3{vector<vector<double>>(s)},  
    d4{vector<vector<double>>(s)}, c2{vector<vector<double>>(s)}, c3{vector<vector<double>>(s)}, c4{vector<vector<double>>(s)} ;
```

```
const size_t r = 12;  
vector<double> mm = vector<double>(r);  
vector<double> am{vector<double>(r)};  
vector<vector<double>> m{vector<vector<double>>(r)}, dm2{vector<vector<double>>(r)}, dm3{vector<vector<double>>(r)},
```



```
Scatter2DPtr _histC2[5];  
Scatter2DPtr _histC3[5];  
Scatter2DPtr _histC4[5];  
Histo1DPtr _Test;  
Scatter2DPtr _histMM2[3];  
Scatter2DPtr _histAM[3];
```

```
Scatter2DPtr _histDM2[3];  
Scatter2DPtr _histDM3[3];  
Scatter2DPtr _histDM4[3];
```

```
Scatter2DPtr _histCM2[3];  
Scatter2DPtr _histCM3[3];  
Scatter2DPtr _histCM4[3];
```

```
Profile1DPtr _histENf[5];  
Profile1DPtr _histENp[5];
```

```
const size_t s = 20;  
vector<double> mn = vector<double>(s);  
vector<double> a{vector<double>(s)};  
vector<vector<double>> n{vector<vector<double>>(s)}, d2{vector<vector<double>>(s)}, d3{vector<vector<double>>(s)},  
    d4{vector<vector<double>>(s)}, c2{vector<vector<double>>(s)}, c3{vector<vector<double>>(s)}, c4{vector<vector<double>>(s)} ;
```

```
const size_t r = 12;  
vector<double> mm = vector<double>(r);  
vector<double> am{vector<double>(r)};  
vector<vector<double>> m{vector<vector<double>>(r)}, dm2{vector<vector<double>>(r)}, dm3{vector<vector<double>>(r)},
```

1) *arXiv:hep-ex/0211025v2*

Search on 9486 publications and 100153 data tables.



Search for a paper, author, experiment, reaction

Search

Advanced

e.g. reaction $P P \rightarrow L Q L Q X$, title has "photon collisions", collaboration is LHCf or D0.

1) *arXiv:hep-ex/0211025v2*

2) *Observation of the strange sea in the proton via inclusive ϕ -meson production in neutral current deep inelastic scattering at HERA*

Search on 9486 publications and 100153 data tables.



Search for a paper, author, experiment, reaction

Search

Advanced

e.g. reaction $P P \rightarrow L Q L Q X$, title has "photon collisions", collaboration is LHCf or D0.

[Hide Publication Information](#)

Observation of the strange sea in the proton via inclusive phi meson production in neutral current deep inelastic scattering at HERA

The ZEUS collaboration

Chekanov, S. , Krakauer, D. , Magill, S. , Musgrave, B. ,
Repond, J. , Yoshida, R. , Mattingly, M.C.K. , Antoniolli, P.
, Bari, G. , Basile, M.

Phys.Lett.B 553 (2003) 141-158, 2003.

<https://doi.org/10.17182/hepdata.46535>

Journal

INSPIRE

Abstract (data abstract)

Download All

Filter 9 data tables

Table 7

Data from T1F

10.17182/hepdata.46535.v1/t7

Differential PHI cross section as a
function of the scaled momentum in
the current region of the Breit frame
for...

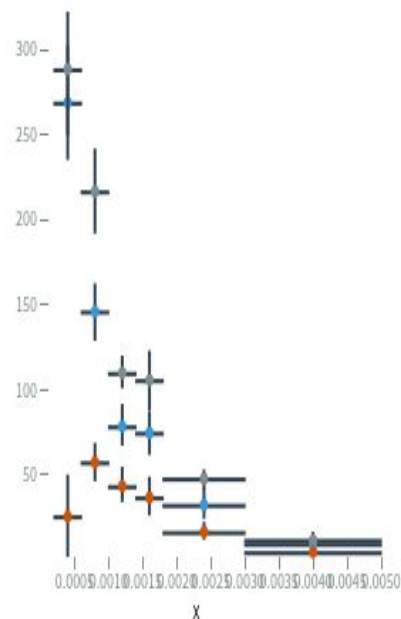
Table 8

Data from T2,F4A_C

10.17182/hepdata.46535.v1/t8

Differential PHI meson cross section
as a function of X for the Q**2
interval 10 to 35 GeV**2. Data are...

ETARAP(P=4)	-1.70 TO 1.60		
PT(P=4)	1.7 TO 7.0 GEV		
Q**2	10 TO 35 GEV**2		
RE	E+ P --> E+ PHI X		
REGION	X	CURRENT	TARGET
SQRT(S)	0.0 GeV		
X	D(SIG)/DX [NB]		
0.0002 - 0.0006	288.6 $\pm$ 33.0 stat $+7.5$ -20.8 sys	25.6 $\pm$ 23.4 stat $+7.6$ -4.7 sys	269.0 $\pm$ 33.4 stat $+2.8$ -4.7 sys
0.0006 - 0.001	216.7 $\pm$ 24.8 stat $+4.6$ -0.5 sys	57.4 $\pm$ 9.9 stat $+5.9$ -5.2 sys	146.1 $\pm$ 16.6 stat $+0.5$ -4.7 sys
0.001 - 0.0014	110.0 $\pm$ 8.5 stat $+5.6$ -5.6 sys	43.4 $\pm$ 9.4 stat $+6.6$ -6.6 sys	78.5 $\pm$ 11.3 stat $+6.9$ -6.9 sys

Sum errors ☒ Log Scale (X) ☐Log Scale (Y) ☐

[Hide Publication Information](#)

Observation of the strange sea in the proton via inclusive phi meson production in neutral current deep inelastic scattering at HERA

The ZEUS collaboration

Chekanov, S. , Krakauer, D. , Magill, S. , Musgrave, B. ,
Repond, J. , Yoshida, R. , Mattingly, M.C.K. , Antoniolli, P.
, Bari, G. , Basile, M.

Phys.Lett.B 553 (2003) 141-158, 2003.

<https://doi.org/10.17182/hepdata.46535>

Journal

INSPIRE

Abstract (data abstract)

Download All

Filter 9 data tables

Table 7

Data from T1F

10.17182/hepdata.46535.v1/t7

Differential PHI cross section as a
function of the scaled momentum in
the current region of the Breit frame for...

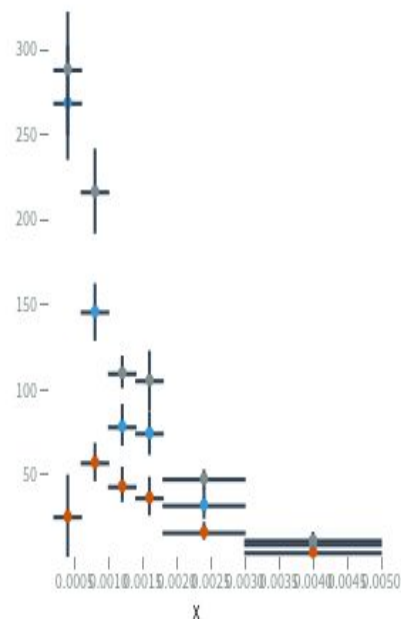
Table 8

Data from T2,F4A_C

10.17182/hepdata.46535.v1/t8

Differential PHI meson cross section
as a function of X for the Q**2
interval 10 to 35 GeV**2. Data are...

ETARAP(P=4)	-1.70 TO 1.60		
PT(P=4)	1.7 TO 7.0 GEV		
Q**2	10 TO 35 GEV**2		
RE	E+ P --> E+ PHI X		
REGION	X	CURRENT	TARGET
X1 SQRT(S)	0.0 GeV		
X	D(SIG)/DX [NB]		
0.0002 - 0.0006	288.6 $\pm$ 33.0 stat $+7.5$ -20.8 sys	25.6 $\pm$ 23.4 stat $+7.6$ -4.7 sys	269.0 $\pm$ 33.4 stat $+2.8$ -4.7 sys
0.0006 - 0.001	216.7 $\pm$ 24.8 stat $+4.6$ -0.5 sys	57.4 $\pm$ 9.9 stat $+5.9$ -5.2 sys	146.1 $\pm$ 16.6 stat $+0.5$ -4.7 sys
0.001 - 0.0014	110.0 $\pm$ 8.5 stat $+5.6$ -5.6 sys	43.4 $\pm$ 9.4 stat $+6.6$ -6.6 sys	78.5 $\pm$ 11.3 stat $+6.9$ -6.9 sys

Sum errors ☒ Log Scale (X) ☐Log Scale (Y) ☐

[Hide Publication Information](#)

Observation of the strange sea in the proton via inclusive phi meson production in neutral current deep inelastic scattering at HERA

The ZEUS collaboration

Chekanov, S. , Krakauer, D. , Magill, S. , Musgrave, B. ,
Repond, J. , Yoshida, R. , Mattingly, M.C.K. , Antoniolli, P.
, Bari, G. , Basile, M.

Phys.Lett.B 553 (2003) 141-158, 2003.

<https://doi.org/10.17182/hepdata.46535>

Journal

INSPIRE

Abstract (data abstract)

Download All

Filter 9 data tables

Table 7

Data from T1F

10.17182/hepdata.46535.v1/t7

Differential PHI cross section as a function of the scaled momentum in the current region of the Breit frame for...

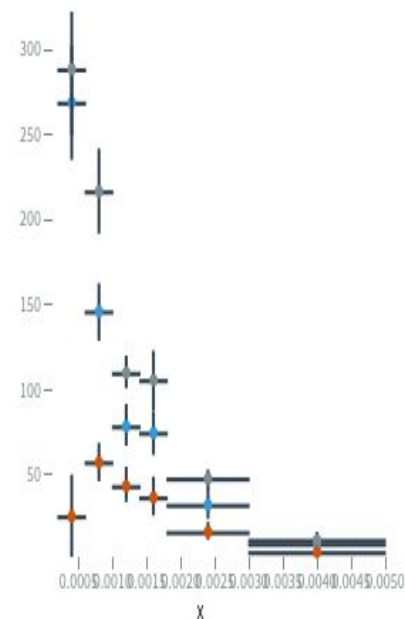
Table 8

Data from T2,F4A_C

10.17182/hepdata.46535.v1/t8

Differential PHI meson cross section as a function of X for the Q**2 interval 10 to 35 GeV**2. Data are...

ETARAP(P=4)	-1.70 TO 1.60		
PT(P=4)	1.7 TO 7.0 GEV		
Q**2	10 TO 35 GEV**2		
RE	E+ P --> E+ PHI X		
REGION	X	CURRENT	TARGET
X1 SQRT(S)	0.0 GeV		
X	D(SIG)/DX [NB]		
0.0002 - 0.0006	288.6 $\pm$ 33.0 stat +7.5 sys -20.8	25.6 $\pm$ 23.4 stat +7.6 sys -4.7	269.0 $\pm$ 33.4 stat +2.8 sys -4.7
0.0006 - 0.001	216.7 $\pm$ 24.8 stat +4.6 sys -0.5	57.4 $\pm$ 9.9 stat +5.9 sys -5.2	146.1 $\pm$ 16.6 stat +0.5 sys -4.7
0.001 - 0.0014	110.0 $\pm$ 8.5 stat +5.6 sys	43.4 $\pm$ 9.4 stat +6.6 sys	78.5 $\pm$ 11.3 stat +6.9 sys

Sum errors ☒ Log Scale (X) ☐Log Scale (Y) ☐

[Hide Publication Information](#)

Observation of the strange sea in the proton via inclusive phi meson production in neutral current deep inelastic scattering at HERA

The ZEUS collaboration

Chekanov, S. , Krakauer, D. , Magill, S. , Musgrave, B. ,
Repond, J. , Yoshida, R. , Mattingly, M.C.K. , Antoniolli, P.
, Bari, G. , Basile, M.

Phys.Lett.B 553 (2003) 141-158, 2003.

<https://doi.org/10.17182/hepdata.46535>

Journal

INSPIRE

Abstract (data abstract)

Download All

Filter 9 data tables

Table 7

Data from T1F

10.17182/hepdata.46535.v1/t7

Differential PHI cross section as a function of the scaled momentum in the current region of the Breit frame for...

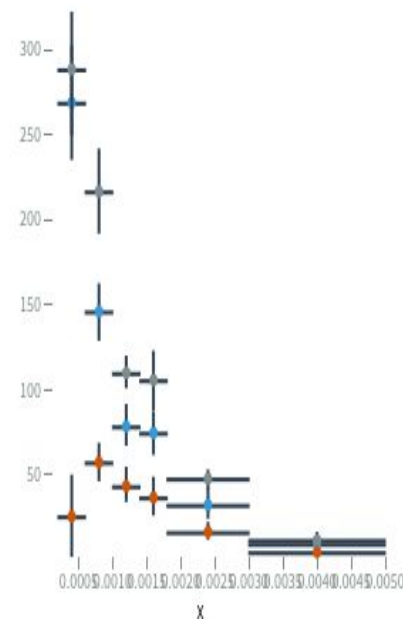
Table 8

Data from T2,F4A_C

10.17182/hepdata.46535.v1/t8

Differential PHI meson cross section as a function of X for the Q**2 interval 10 to 35 GeV**2. Data are...

ETARAP(P=4)	-1.70 TO 1.60		
PT(P=4)	1.7 TO 7.0 GEV		
Q**2	10 TO 35 GEV**2		
RE	E+ P --> E+ PHI X Y1 Y2		
REGION	X	CURRENT	TARGET
X1 SQRT(S)	0.0 GeV		
X	D(SIG)/DX [NB]		
0.0002 - 0.0006	288.6 $\pm$ 33.0 stat +7.5 sys -20.8	25.6 $\pm$ 23.4 stat +7.6 sys -4.7	269.0 $\pm$ 33.4 stat +2.8 sys -4.7
0.0006 - 0.001	216.7 $\pm$ 24.8 stat +4.6 sys -0.5	57.4 $\pm$ 9.9 stat +5.9 sys -5.2	146.1 $\pm$ 16.6 stat +0.5 sys -4.7
0.001 - 0.0014	110.0 $\pm$ 8.5 stat +5.6 sys	43.4 $\pm$ 9.4 stat +6.6 sys	78.5 $\pm$ 11.3 stat +6.9 sys

Sum errors ☒ Log Scale (X) ☐Log Scale (Y) ☐

```
/// Book histograms and initialise projections before the run
void init() {
    // Initialise and register projections
    declare(DISKinematics(), "Kinematics");
    // The phi mesons with cuts.
    Cut phiCuts = Cut((Cuts::abspid == PID::PHI) & (Cuts::eta > -1.7)
        (Cuts::eta < 1.6) & (Cuts::pT > 1.7*GeV) & (Cuts::pT < 7.0*GeV)
    declare(UnstableParticles(phiCuts), "UFS");

    // Book histograms
    book(_h_pT, 2, 1, 1);
    book(_h_y, 3, 1, 1);
    book(_h_Q2, 4, 1, 1);
    book(_h_txp, 5, 1, 1);
    book(_h_cxp, 6, 1, 1);
    book(_h_X1c, 8, 1, 2);
    book(_h_X1t, 8, 1, 3);
    book(_h_X2c, 9, 1, 2);
    book(_h_X2t, 9, 1, 3);
}
```



d08-x01-y02

[Hide Publication Information](#)

Observation of the strange sea in the proton via inclusive phi meson production in neutral current deep inelastic scattering at HERA

The ZEUS collaboration

Chekanov, S. , Krakauer, D. , Magill, S. , Musgrave, B. ,
Repond, J. , Yoshida, R. , Mattingly, M.C.K. , Antonioli, P.
, Bari, G. , Basile, M.

Phys.Lett.B 553 (2003) 141-158, 2003.

<https://doi.org/10.17182/hepdata.46535>

Journal

INSPIRE

Abstract (data abstract)

Download All

Filter 9 data tables

Table 7

Data from T1F

10.17182/hepdata.46535.v1/t7

Differential PHI cross section as a function of the scaled momentum in the current region of the Breit frame for...

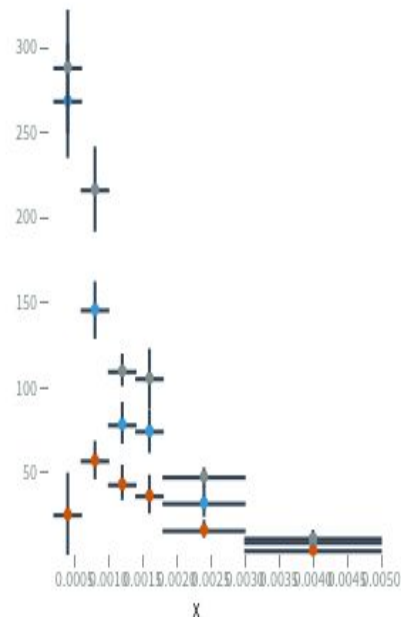
Table 8

Data from T2,F4A_C

10.17182/hepdata.46535.v1/t8

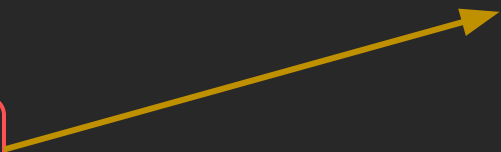
Differential PHI meson cross section as a function of X for the Q**2 interval 10 to 35 GeV**2. Data are...

ETARAP(P=4)	-1.70 TO 1.60		
PT(P=4)	1.7 TO 7.0 GEV		
Q**2	10 TO 35 GEV**2		
RE	E+ P --> E+ PHI X		
	Y1	Y2	Y3
REGION	X	CURRENT	TARGET
X1 SQRT(S)	0.0 GeV		
X	D(SIG)/DX [NB]		
0.0002 - 0.0006	288.6 $\pm$ 33.0 stat +7.5 sys -20.8	25.6 $\pm$ 23.4 stat +7.6 sys -4.7	269.0 $\pm$ 33.4 stat +2.8 sys -4.7
0.0006 - 0.001	216.7 $\pm$ 24.8 stat +4.6 sys -0.5	57.4 $\pm$ 9.9 stat +5.9 sys -5.2	146.1 $\pm$ 16.6 stat +0.5 sys -4.7
0.001 - 0.0014	110.0 $\pm$ 8.5 stat +5.6 sys	43.4 $\pm$ 9.4 stat +6.6 sys	78.5 $\pm$ 11.3 stat +6.9 sys

Sum errors ☒ Log Scale (X) ☐Log Scale (Y) ☐

```
/// Book histograms and initialise projections before the run
void init() {
    // Initialise and register projections
    declare(DISKinematics(), "Kinematics");
    // The phi mesons with cuts.
    Cut phiCuts = Cut((Cuts::abspid == PID::PHI) & (Cuts::eta > -1.7)
        (Cuts::eta < 1.6) & (Cuts::pT > 1.7*GeV) & (Cuts::pT < 7.0*GeV)
    declare(UnstableParticles(phiCuts), "UFS");

    // Book histograms
    book(_h_pT, 2, 1, 1);
    book(_h_y, 3, 1, 1);
    book(_h_Q2, 4, 1, 1);
    book(_h_txp, 5, 1, 1);
    book(_h_cxp, 6, 1, 1);
    book(_h_X1c, 8, 1, 2);
    book(_h_X1t, 8, 1, 3);
    book(_h_X2c, 9, 1, 2);
    book(_h_X2t, 9, 1, 3);
}
```



d08-x01-y02
d08-x01-y03

```
BEGIN YODA_SCATTER2D_V2 /REF/ZEUS_2002_I601697/d08-x01-y02
ErrorBreakdown: {0: {stat: {dn: -23.4, up: 23.4}, sys: {dn: -4.7, up: 7.6}}, 1: {stat: {dn: -9.9, up: 9.9}, sys: {dn:
{stat: {dn: -9.4, up: 9.4}, sys: {dn: -0.3, up: 6.6}}, 3: {stat: {dn: -9.5, up: 9.5}, sys: {dn: -4.7, up: 7.7}}, 4: {s
3.3}, sys: {dn: -3.0, up: 5.0}}, 5: {stat: {dn: -1.7, up: 1.7}, sys: {dn: -0.7, up: 2.2}}}
IsRef: 1
Path: /REF/ZEUS_2002_I601697/d08-x01-y02
Title: doi:10.17182/hepdata.46535.v1/t8
Type: Scatter2D
---
```

#	xval	xerr-	xerr+	yval	yerr-	yerr+	
4.000000e-04		2.000000e-04		2.000000e-04	2.560000e+01	2.386734e+01	2.460325e+01
8.000000e-04		2.000000e-04		2.000000e-04	5.740000e+01	1.118258e+01	1.152476e+01
1.200000e-03		2.000000e-04		2.000000e-04	4.340000e+01	9.404786e+00	1.148564e+01
1.600000e-03		2.000000e-04		2.000000e-04	3.670000e+01	1.059906e+01	1.222865e+01
2.400000e-03		6.000000e-04		6.000000e-04	1.640000e+01	4.459821e+00	5.990826e+00
4.000000e-03		1.000000e-03		1.000000e-03	4.500000e+00	1.838478e+00	2.780288e+00

```
END YODA_SCATTER2D_V2
```

```
BEGIN YODA_SCATTER2D_V2 /REF/ZEUS_2002_I601697/d08-x01-y03
ErrorBreakdown: {0: {stat: {dn: -33.4, up: 33.4}, sys: {dn: -4.7, up: 2.8}}, 1: {stat: {dn: -16.6, up: 16.6}, sys: {dn:
{stat: {dn: -11.3, up: 11.3}, sys: {dn: -0.7, up: 6.9}}, 3: {stat: {dn: -9.2, up: 9.2}, sys: {dn: -9.2, up: 8.9}}, 4:
6.6}, sys: {dn: -4.9, up: 7.5}}, 5: {stat: {dn: -5.2, up: 5.2}, sys: {dn: -2.6, up: 4.8}}}
IsRef: 1
Path: /REF/ZEUS_2002_I601697/d08-x01-y03
Title: doi:10.17182/hepdata.46535.v1/t8
Type: Scatter2D
---
```



```
BEGIN YODA_SCATTER2D_V2 /REF/ZEUS_2002_I601697/d08-x01-y02
ErrorBreakdown: {0: {stat: {dn: -23.4, up: 23.4}, sys: {dn: -4.7, up: 7.6}}, 1: {stat: {dn: -9.9, up: 9.9}, sys: {dn:
{stat: {dn: -9.4, up: 9.4}, sys: {dn: -0.3, up: 6.6}}, 3: {stat: {dn: -9.5, up: 9.5}, sys: {dn: -4.7, up: 7.7}}, 4: {s
3.3}, sys: {dn: -3.0, up: 5.0}}, 5: {stat: {dn: -1.7, up: 1.7}, sys: {dn: -0.7, up: 2.2}}}
IsRef: 1
Path: /REF/ZEUS_2002_I601697/d08-x01-y02
Title: doi:10.17182/hepdata.46535.v1/t8
Type: Scatter2D
---
```

#	xval	xerr-	xerr+	yval	yerr-	yerr+
4.000000e-04	2.000000e-04	2.000000e-04	2.560000e+01	2.386734e+01	2.460325e+01	
8.000000e-04	2.000000e-04	2.000000e-04	5.740000e+01	1.118258e+01	1.152476e+01	
1.200000e-03	2.000000e-04	2.000000e-04	4.340000e+01	9.404786e+00	1.148564e+01	
1.600000e-03	2.000000e-04	2.000000e-04	3.670000e+01	1.059906e+01	1.222865e+01	
2.400000e-03	6.000000e-04	6.000000e-04	1.640000e+01	4.459821e+00	5.990826e+00	
4.000000e-03	1.000000e-03	1.000000e-03	4.500000e+00	1.838478e+00	2.780288e+00	

```
END YODA_SCATTER2D_V2
```

```
BEGIN YODA_SCATTER2D_V2 /REF/ZEUS_2002_I601697/d08-x01-y03
ErrorBreakdown: {0: {stat: {dn: -33.4, up: 33.4}, sys: {dn: -4.7, up: 2.8}}, 1: {stat: {dn: -16.6, up: 16.6}, sys: {dn:
{stat: {dn: -11.3, up: 11.3}, sys: {dn: -0.7, up: 6.9}}, 3: {stat: {dn: -9.2, up: 9.2}, sys: {dn: -9.2, up: 8.9}}, 4:
6.6}, sys: {dn: -4.9, up: 7.5}}, 5: {stat: {dn: -5.2, up: 5.2}, sys: {dn: -2.6, up: 4.8}}}
IsRef: 1
Path: /REF/ZEUS_2002_I601697/d08-x01-y03
Title: doi:10.17182/hepdata.46535.v1/t8
Type: Scatter2D
---
```

Resources

1. <https://bierlich.net/files/rivet-ep-note.pdf>
2. <https://gitlab.com/hepcedar/rivet/-/tree/release-3-1-x/doc/tutorials/eic-basic-tutorial>
3. <https://www.youtube.com/watch?v=ysQJqPYHILY>
4. <https://gitlab.com/hepcedar/rivet>

