

Charge Particles Spectrum In deep-inelastic ep scattering

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Supervisor
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Charge Particle Distribution

Outline

Part I Introduction

- Parton and Intrinsic Transverse Momentum
- Deep Inelastic Scattering
- The Physical Phenomena to Charge Particles Spectrum

Part II Simulation

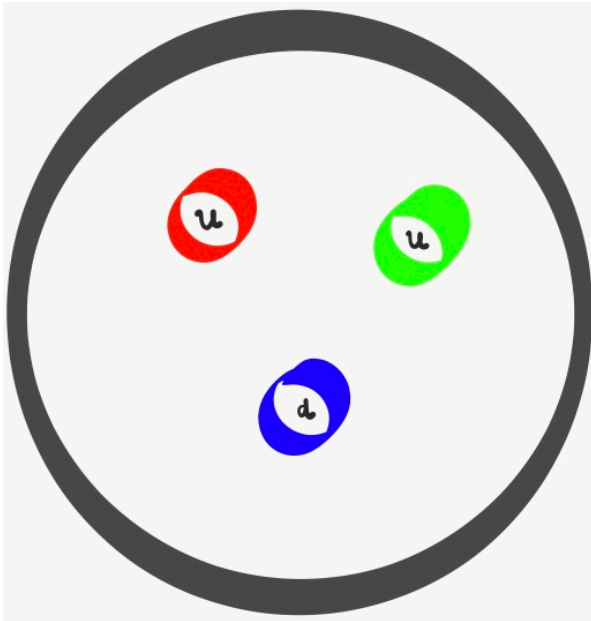
- Monte Carlo generators vs HERA data
- A higher Resolution Scale Q^2

Part III Conclusion

- Summary

Part I Introduction

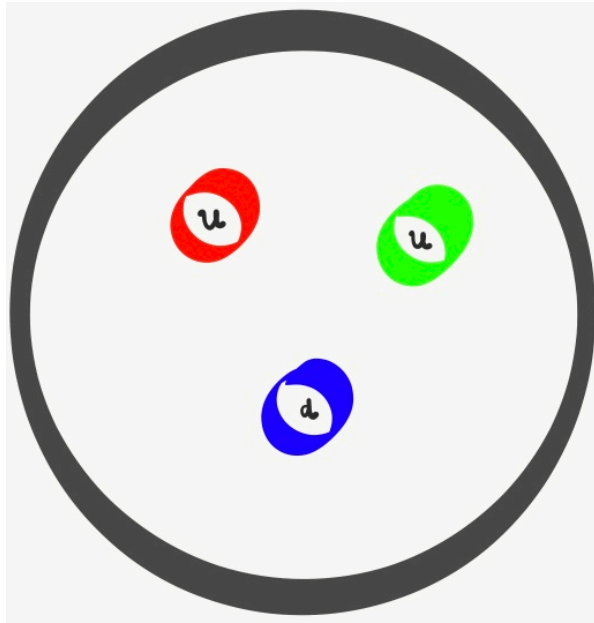
Parton and intrinsic transverse momentum



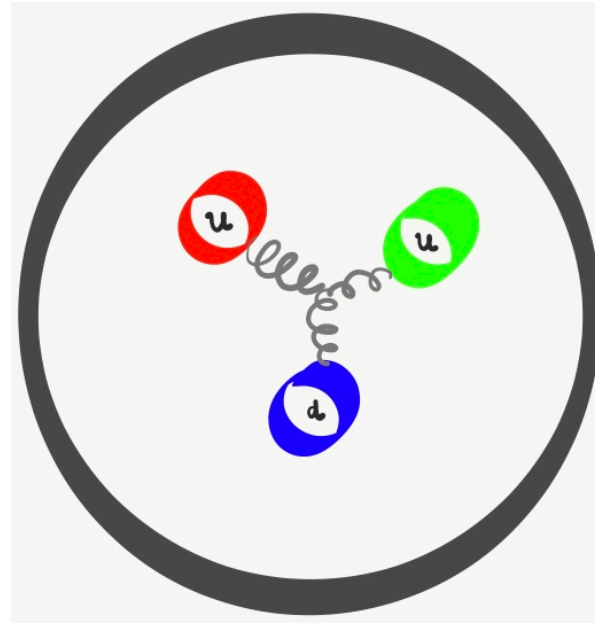
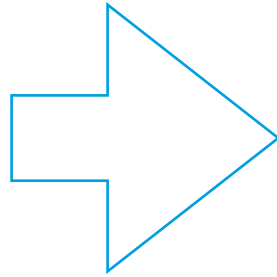
Quarks

Part I Introduction

Parton and intrinsic transverse momentum



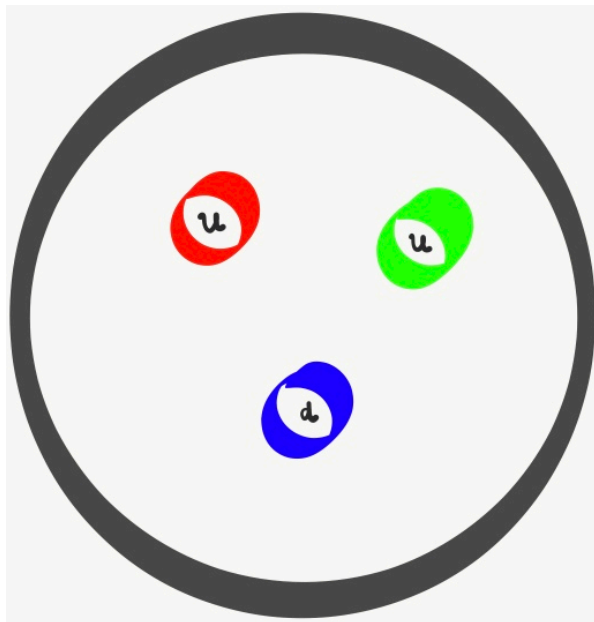
Quarks



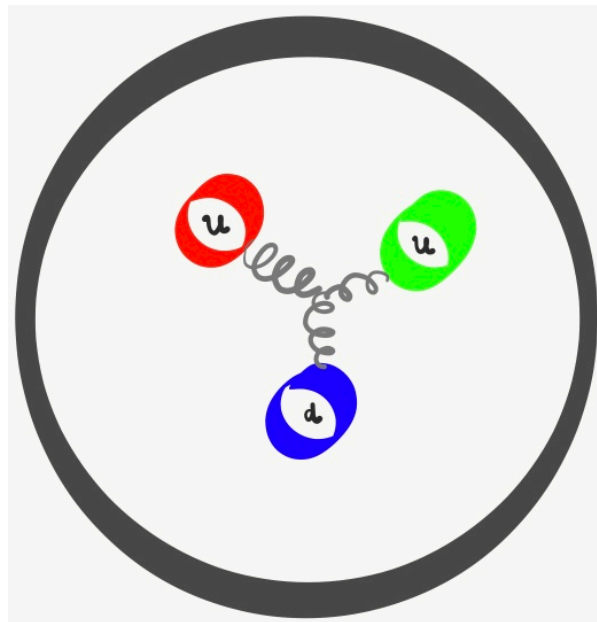
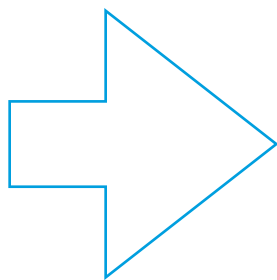
Parton

Part I Introduction

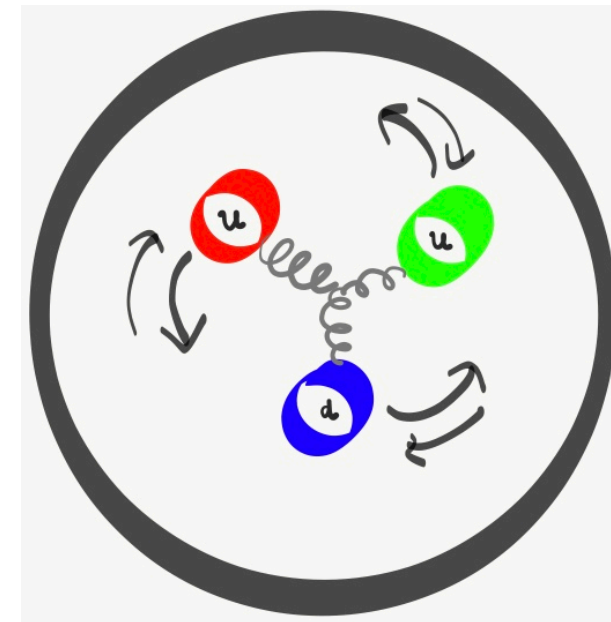
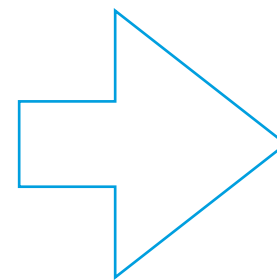
Parton and intrinsic transverse momentum



Quarks



Parton

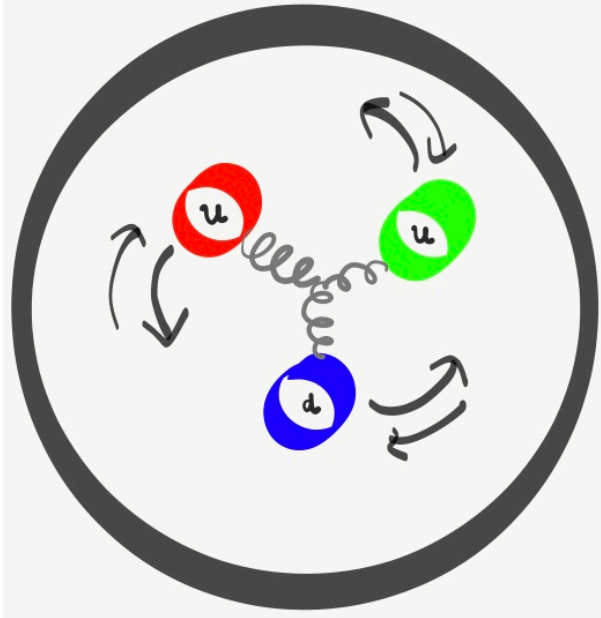
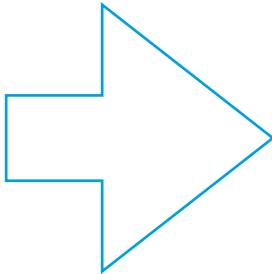
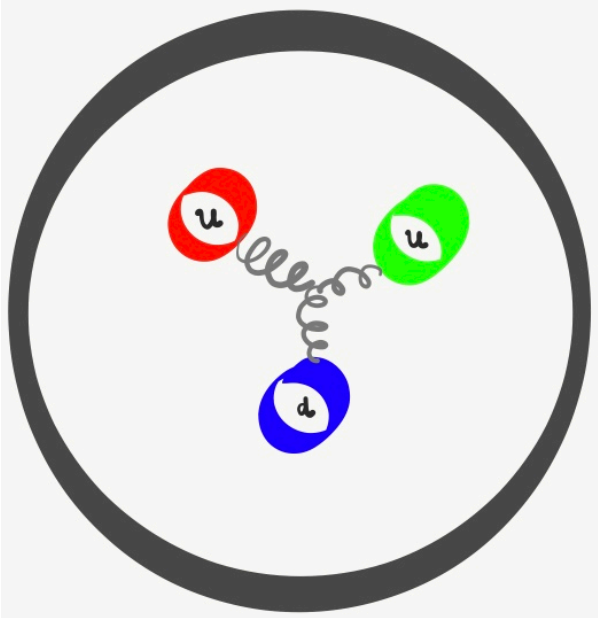
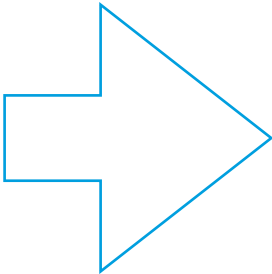
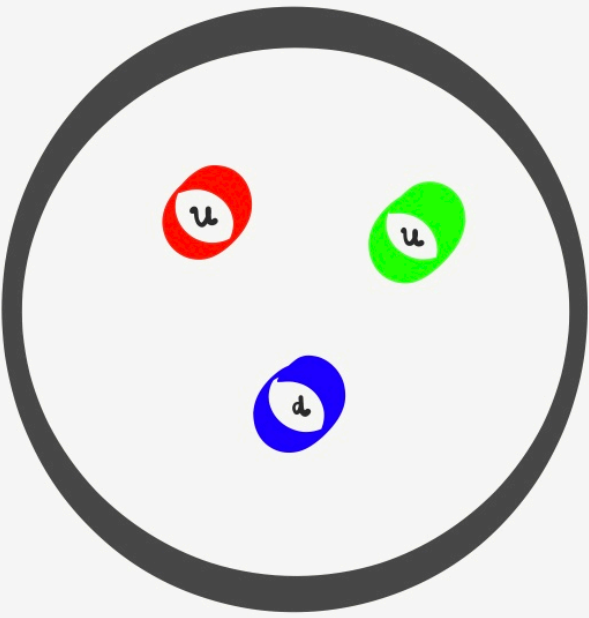


k_T

Part I Introduction

Parton and intrinsic transverse momentum

PDF, $f_i(x, Q^2)$



Quarks

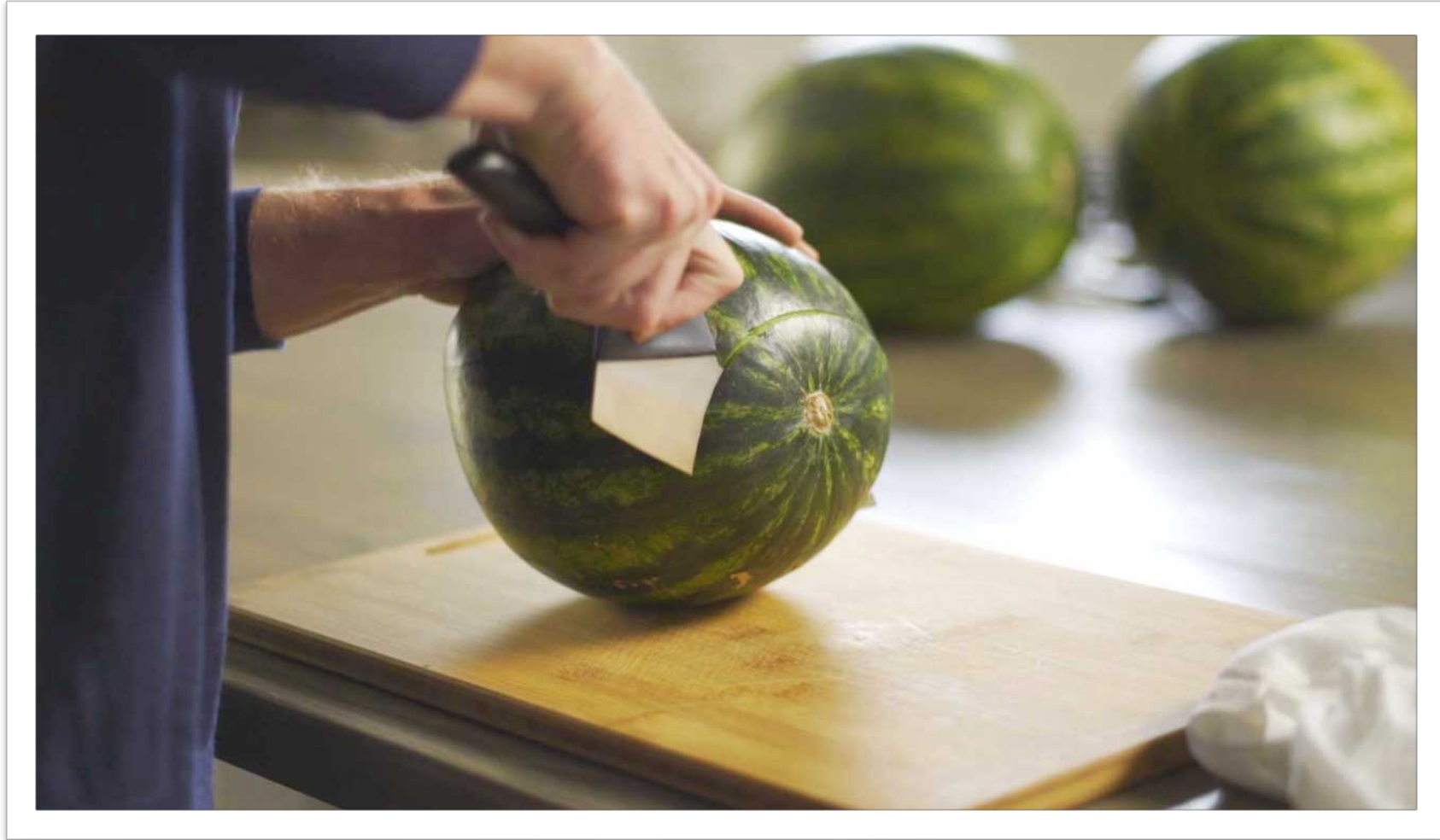
Parton

k_T

TMD, $A(x, k_T^2, Q^2)$

We want to understand it Better!!

Part I Introduction



https://www2.fiskars.com/var/fiskars_amer/storage/images/media/images/2017-project-images/fall-2017/cutting-watermelon/watermelon1/1092641-1-eng-US/Watermelon1.jpg

Part I Introduction



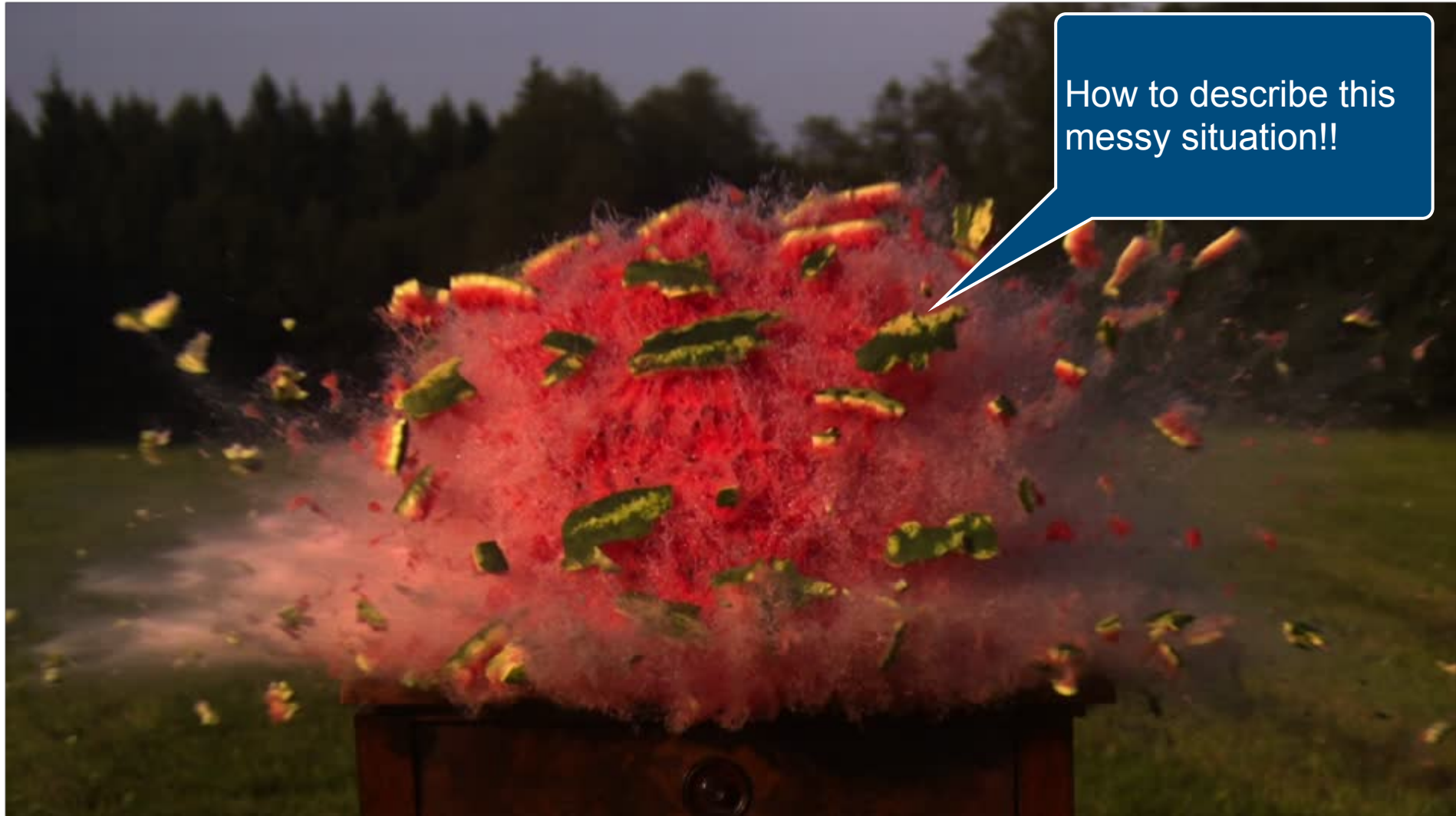
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Part I Introduction



http://www.cutwatersolutions.com/wp-content/uploads/2013/06/istock_000010510568medium.jpg

Part I Introduction

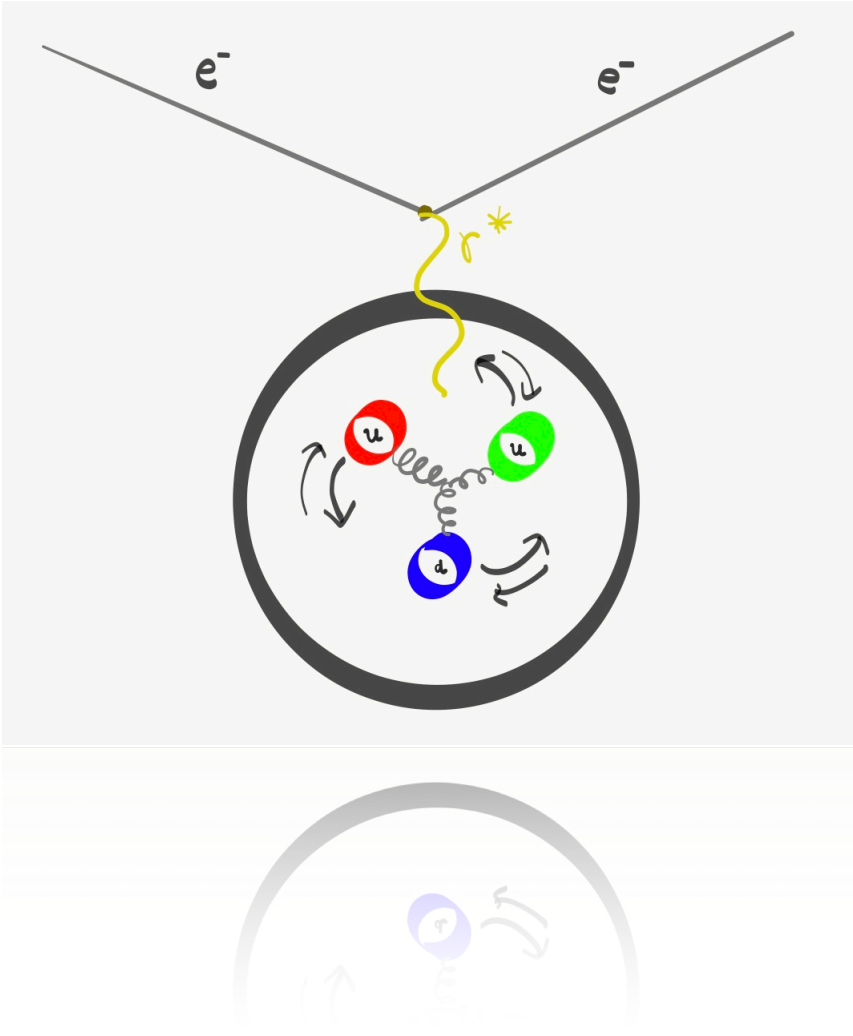


How to describe this messy situation!!

http://www.cutwatersolutions.com/wp-content/uploads/2013/06/istock_000010510568medium.jpg

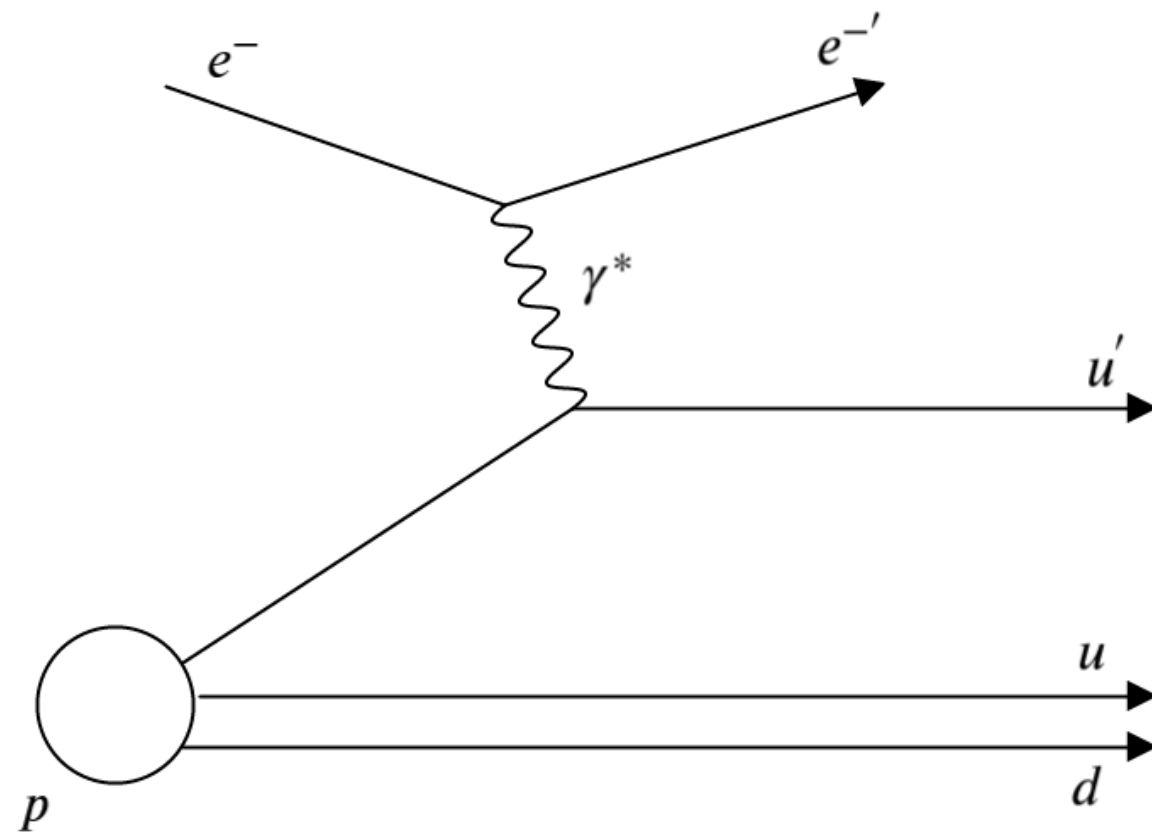
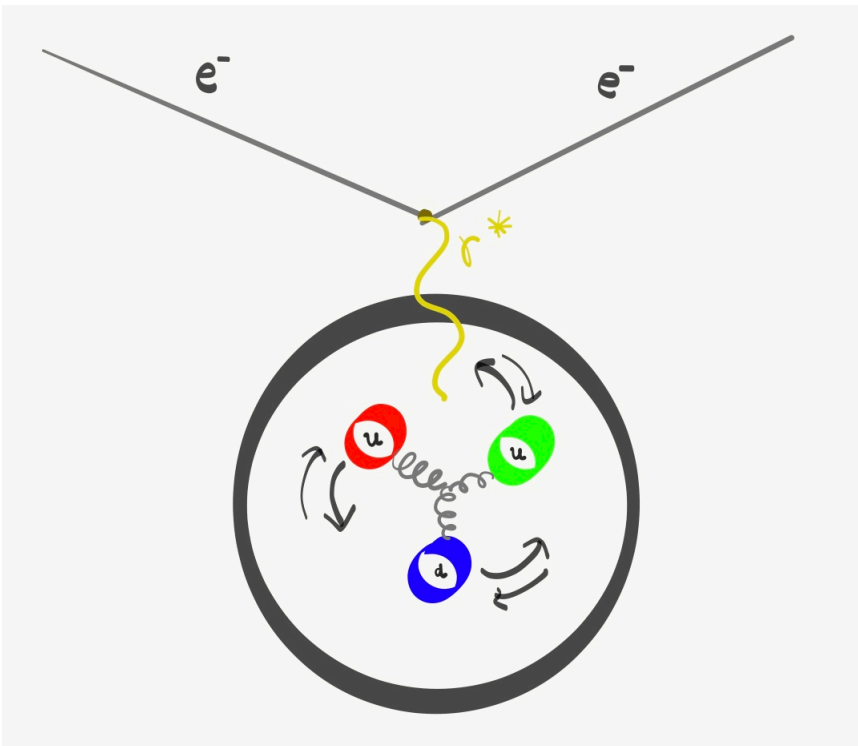
Part I Introduction

Deep Inelastic Scattering



Part I Introduction

Deep Inelastic Scattering



DIS



Part I Introduction

The Influence



http://www.cutwatersolutions.com/wp-content/uploads/2013/06/istock_000010510568medium.jpg



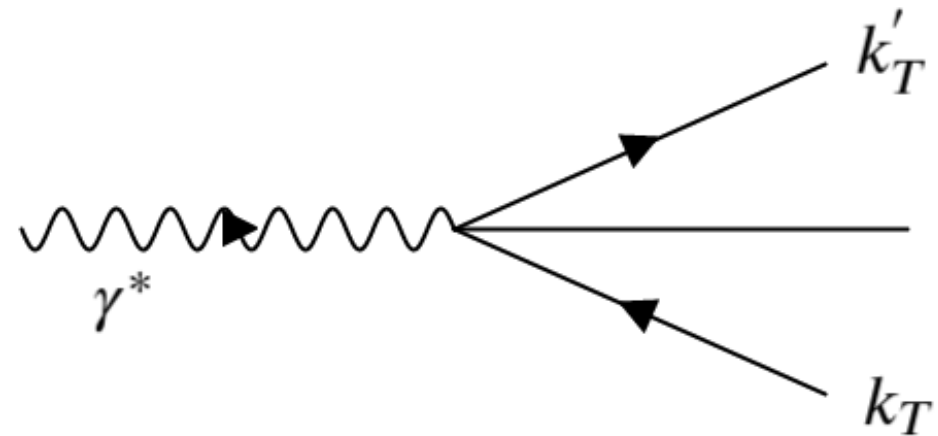
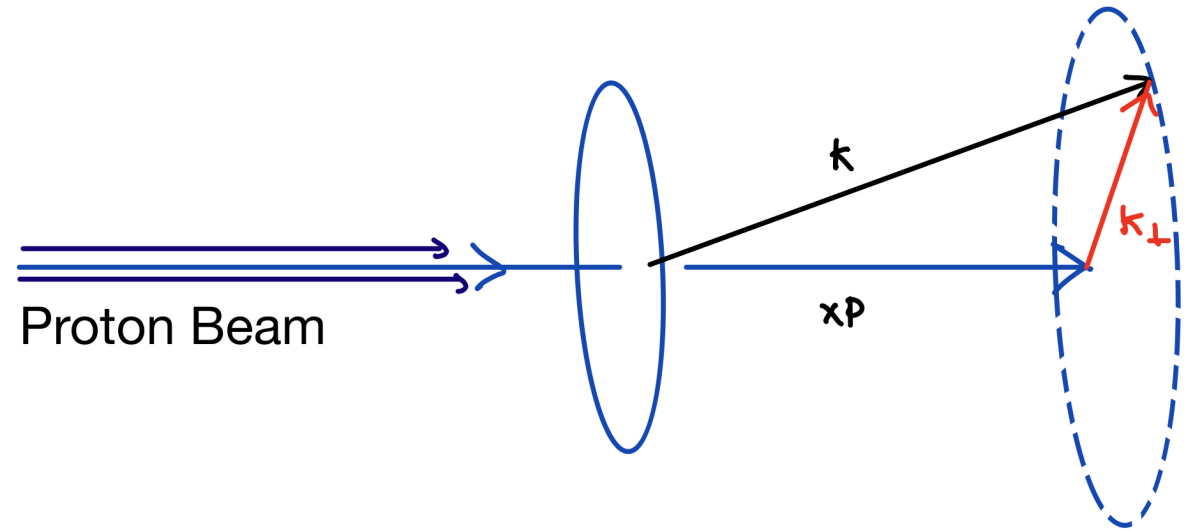
Part I Introduction

The Influence



http://www.cutwatersolutions.com/wp-content/uploads/2013/06/istock_000010510568medium.jpg

Intrinsic Kt



Part I Introduction

The Influence



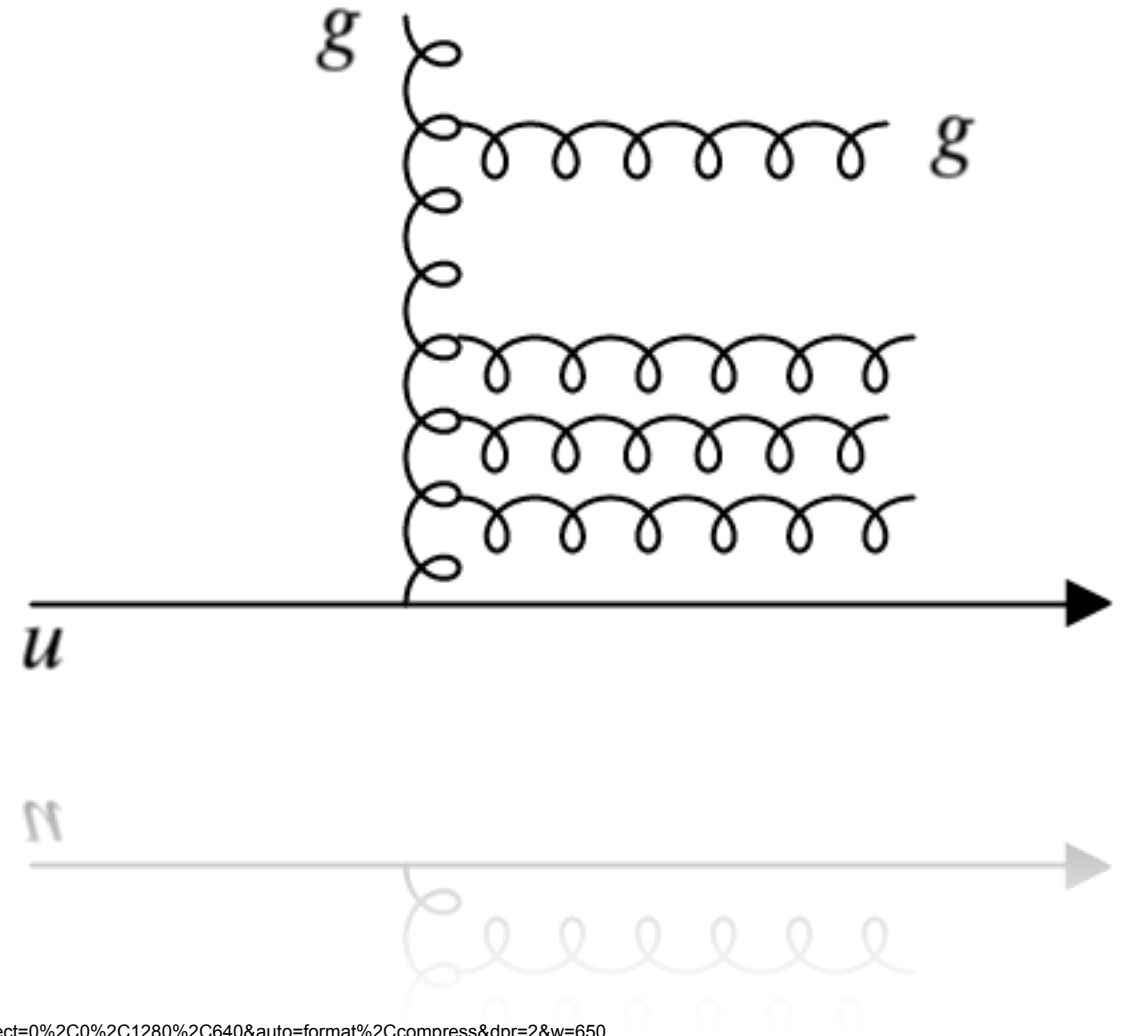
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Part I Introduction

The Influence



Parton Shower, QCD radiation



<https://fsmedia.imgix.net/28/8c/eb/ef/d418/4895/9bcb/ea28a339034a/an-illustration-shows-the-sound-wave-effect-around-a-supersonic-boom.jpeg?rect=0%2C0%2C1280%2C640&auto=format%2Ccompress&dpr=2&w=650>

Part I Introduction

The Influence



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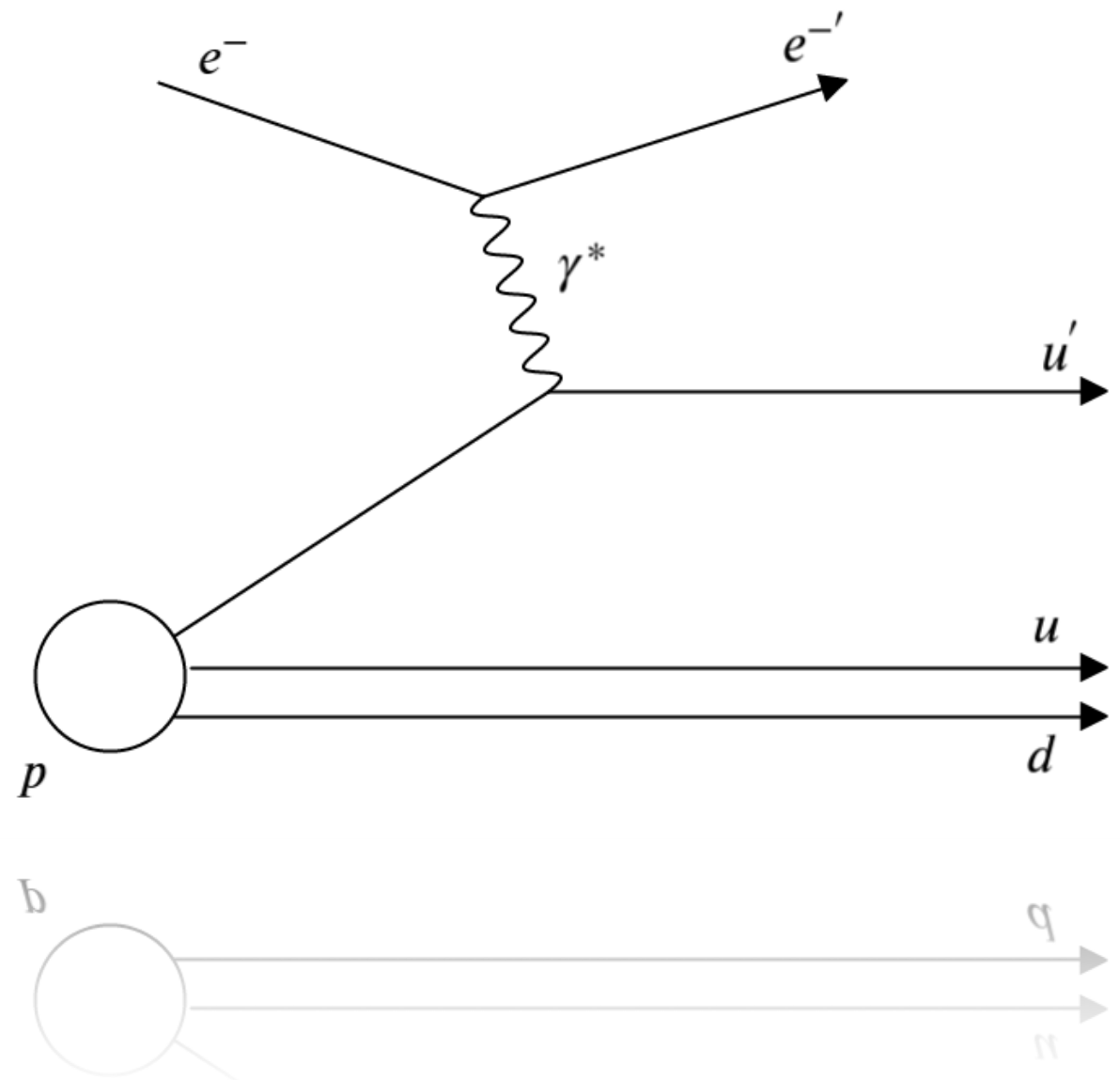
Part I Introduction

The Influence



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Fragmentation



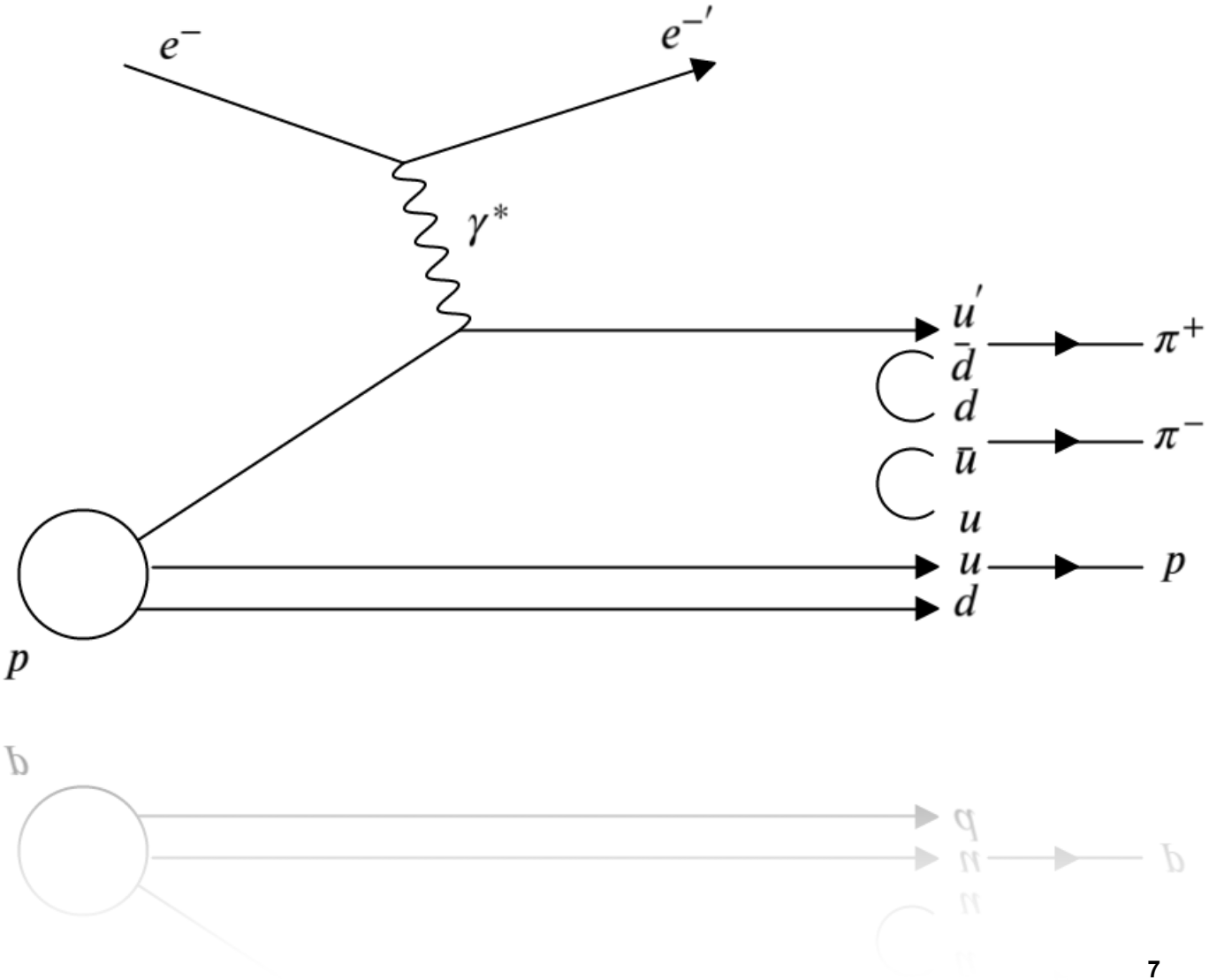
Part I Introduction

The Influence



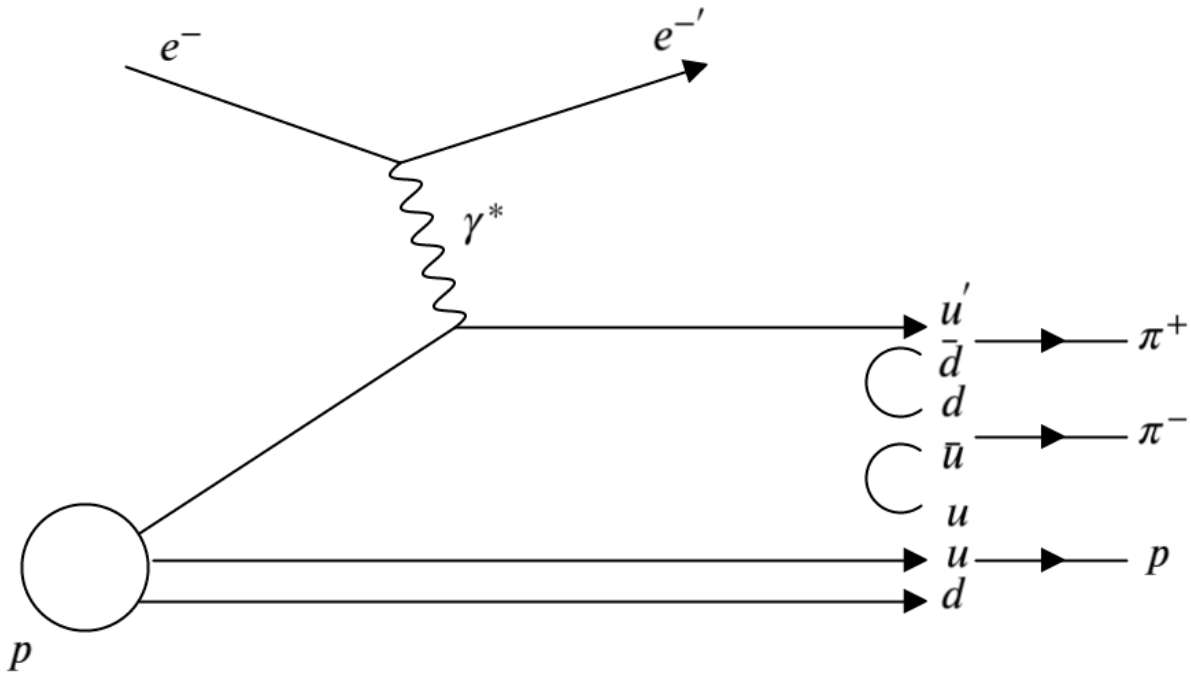
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Fragmentation

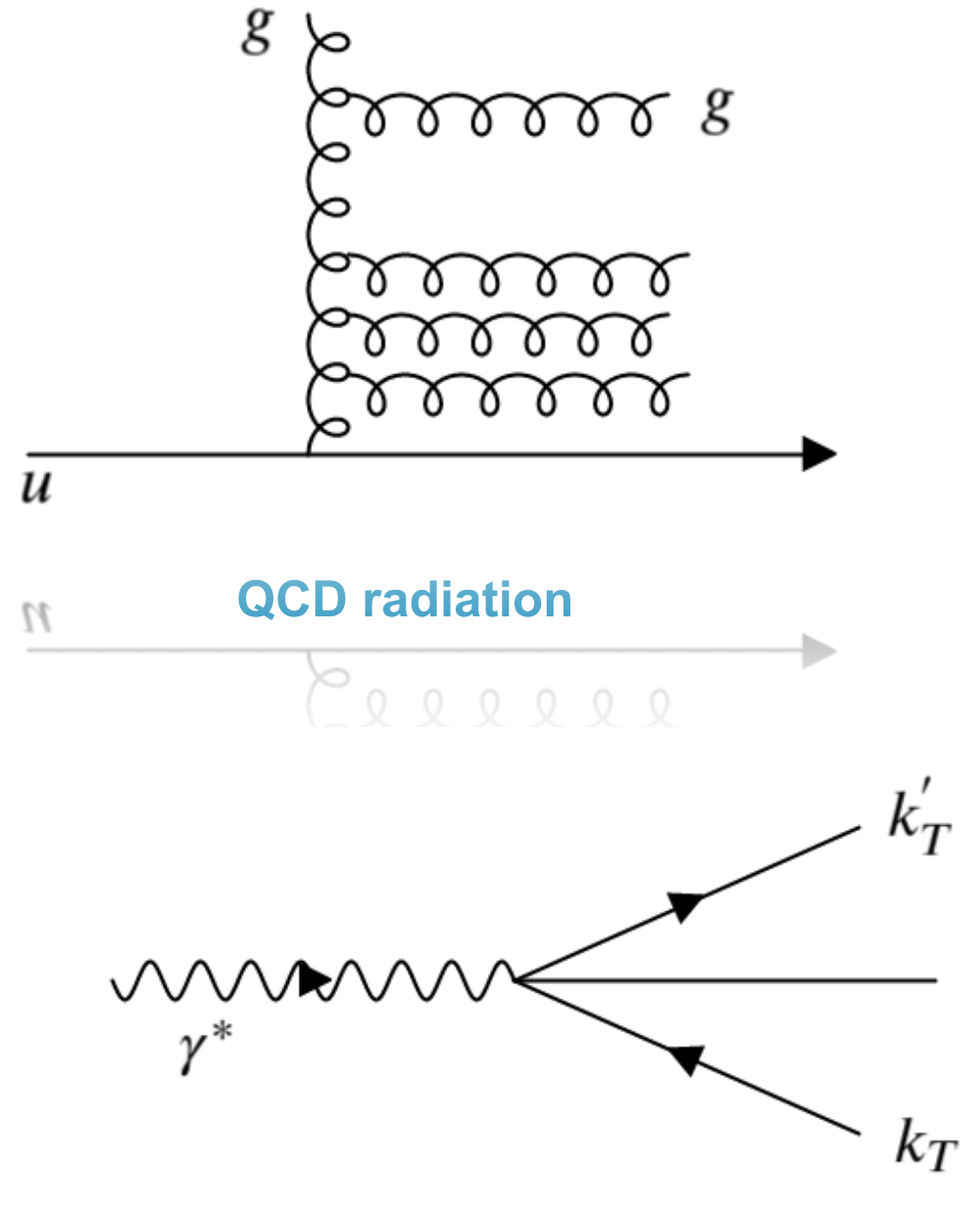
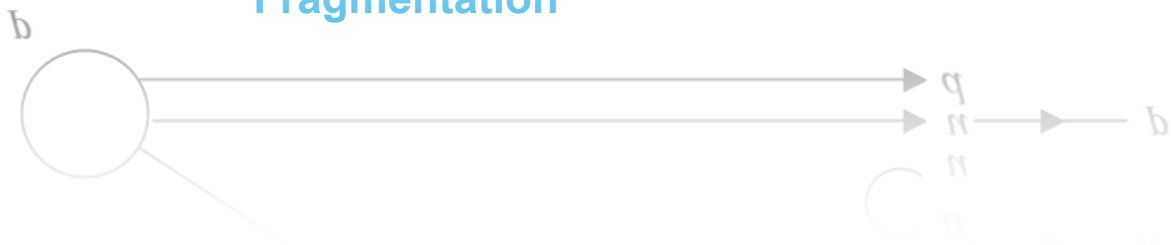


Part I Introduction

The Influence



Fragmentation

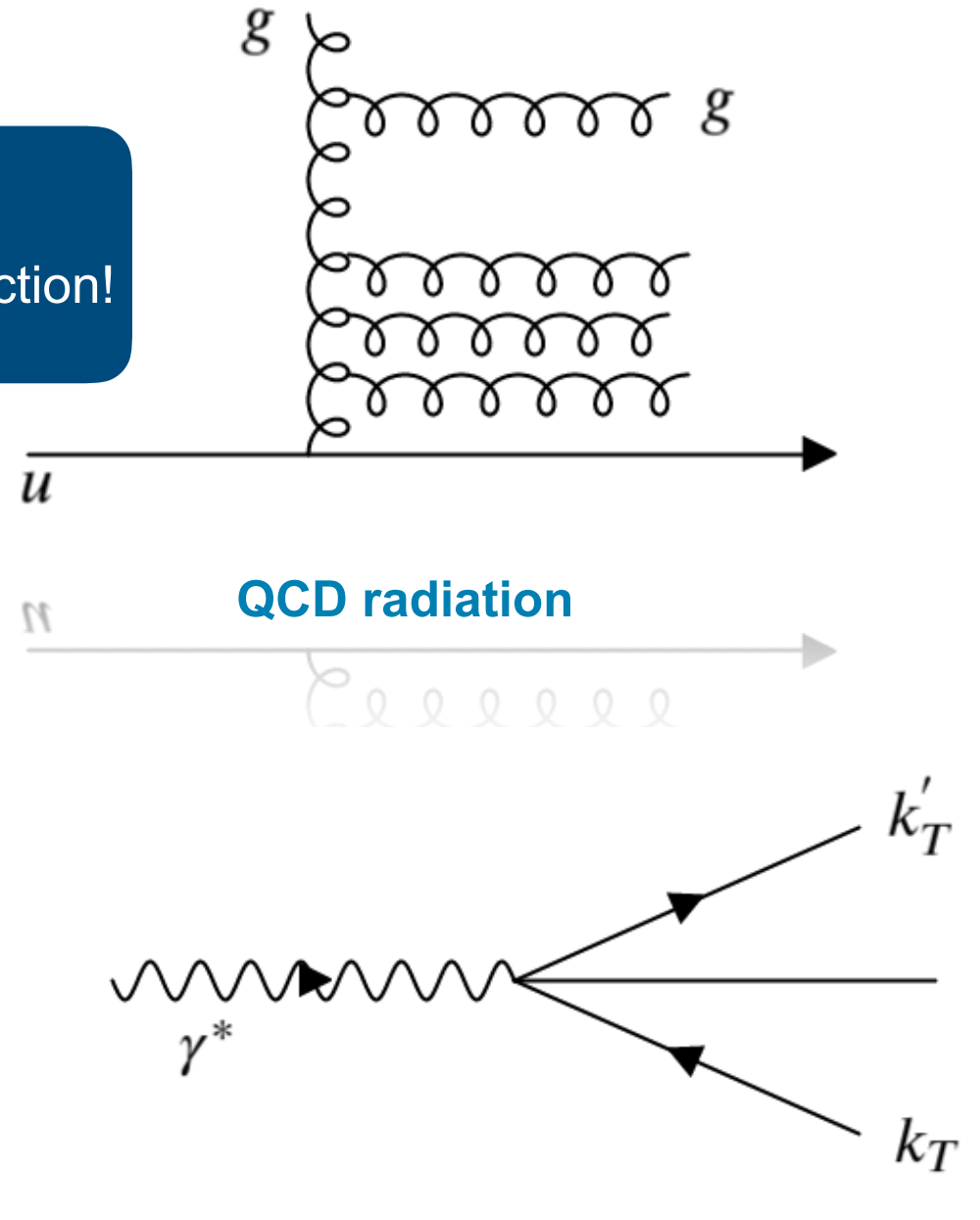
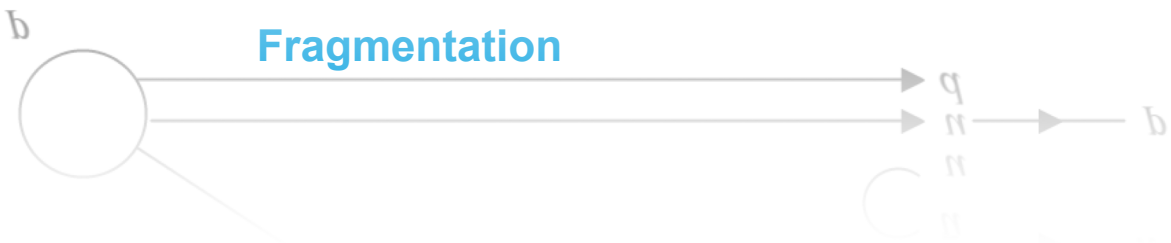
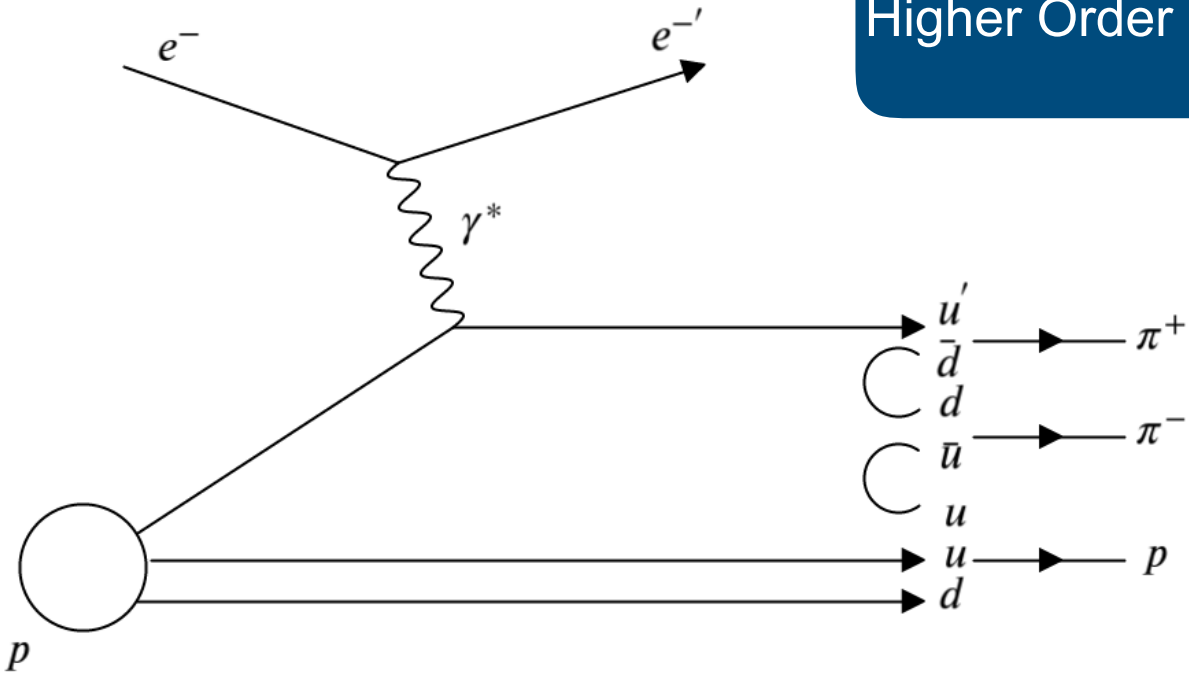


Intrinsic k_T

Part I Introduction

The Influence

Perturbative QCD,
Higher Order Correction!



Part II Simulation

Calculation by using RAPGAP

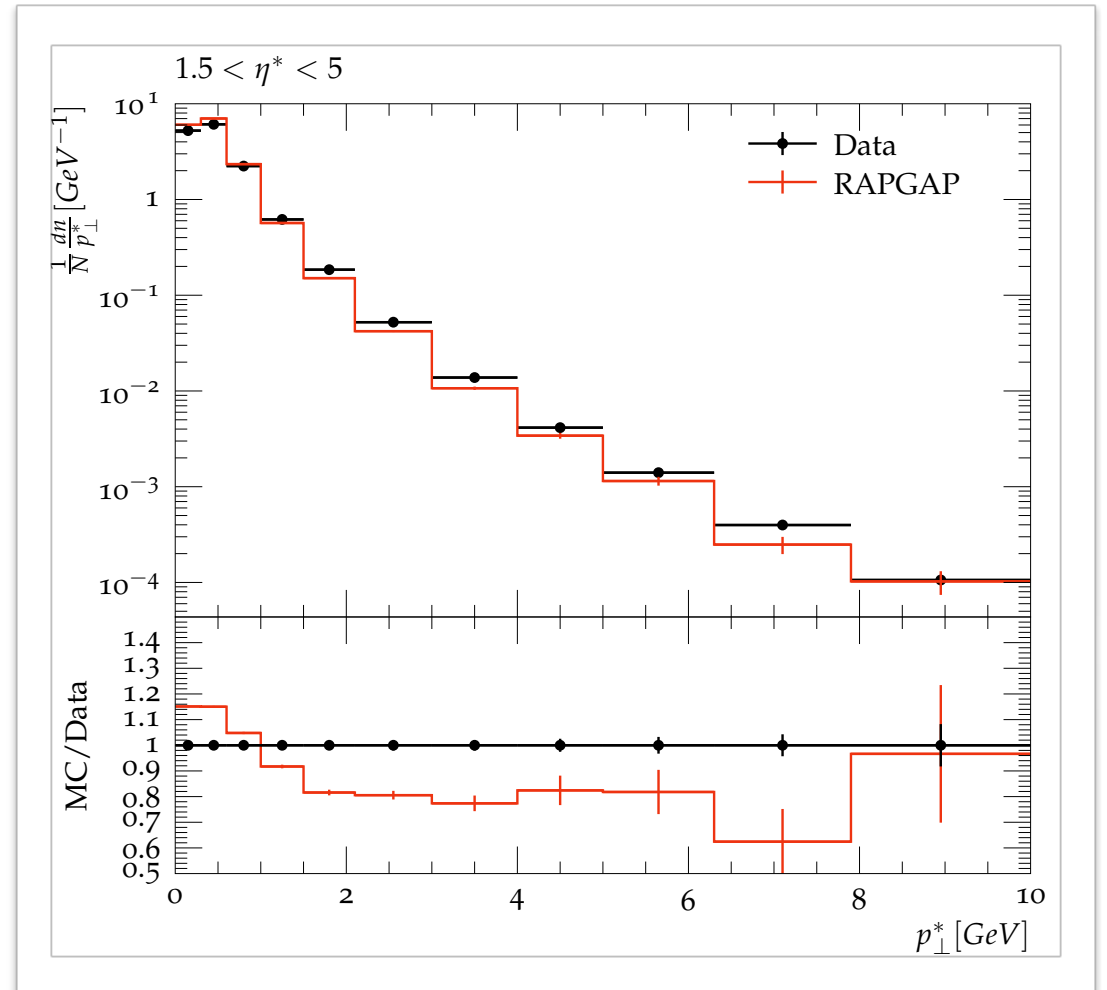
Resolution Scale : $5 < Q^2 < 100 \text{ GeV}^2$

Positron energy : 27.6 GeV^2

Proton energy : 300 GeV^2

PDF : CTEQ6L(LO)

Reference Data Eur.Phys.J.C (2013) 73:2406



Part II Simulation

Validation of different validations

Resolution Scale : $5 < Q^2 < 100 \text{ GeV}^2$

Positron energy : 27.6 GeV^2

Proton energy : 300 GeV^2

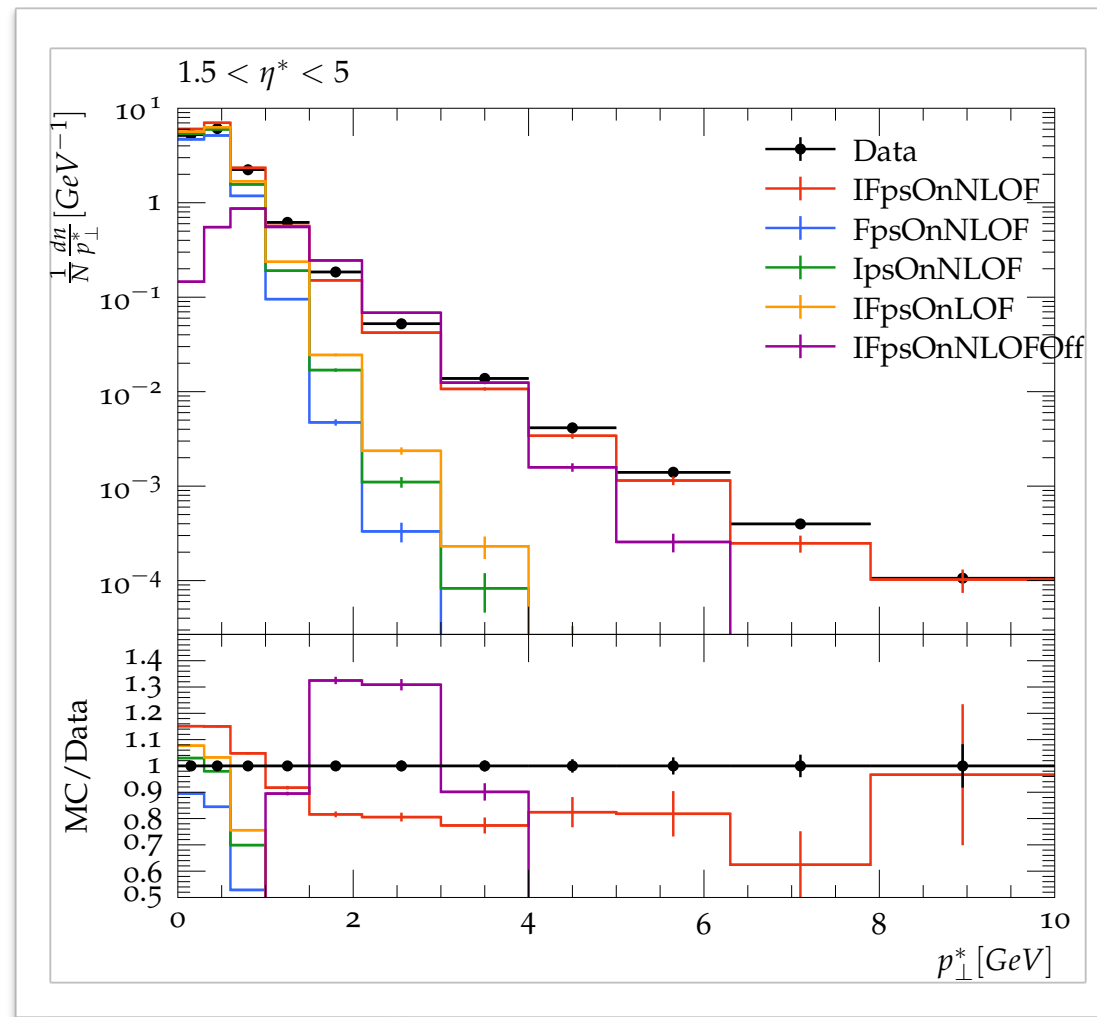
PDF : CTEQ6L(LO)

I : Initial state Parton Shower

F: Final state Parton Shower

NLO : Next Leading Order

F : Fragmentation or Hadronization



Part II Simulation

Validation of intrinsic k_T by using Pythia

Resolution Scale : $5 < Q^2 < 100 \text{ GeV}^2$

Positron energy : 27.6 GeV^2

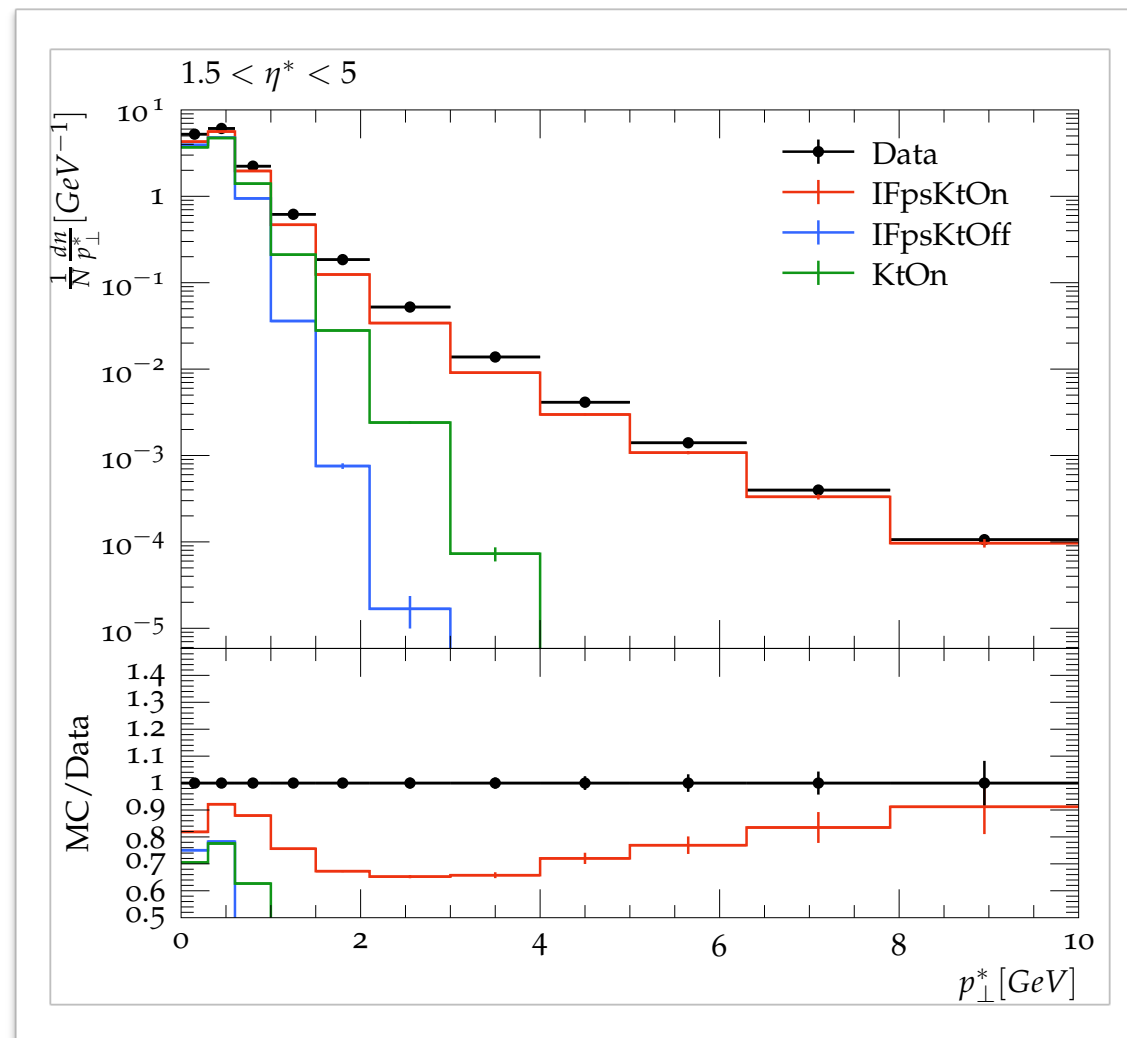
Proton energy : 300 GeV^2

PDF : CTEQ6L(LO)

I : Initial state Parton Shower

F: Final state Parton Shower

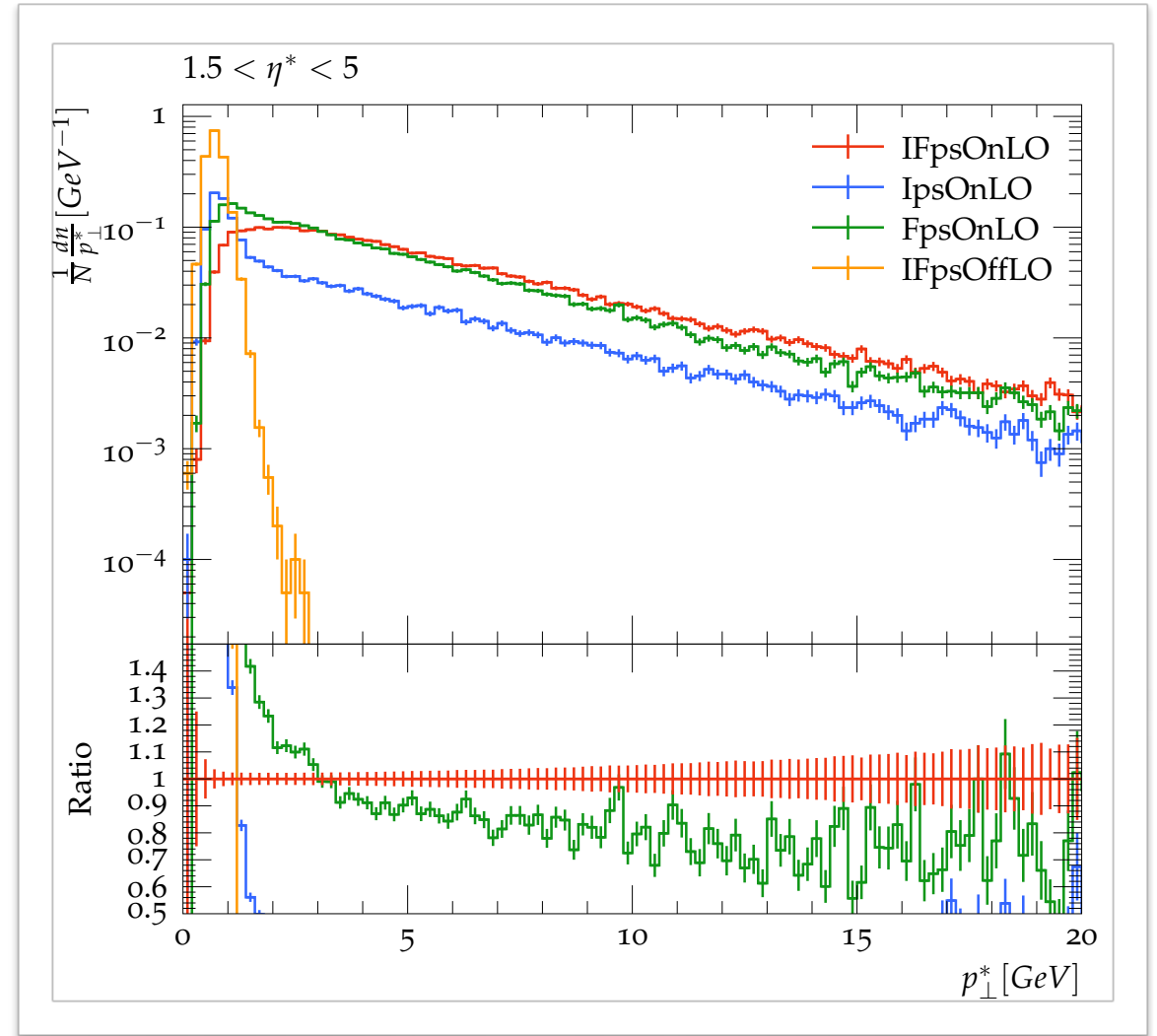
Kt : Intrinsic Transverse Momentum



Part II Simulation

A Higher Resolution by using RAPGAP

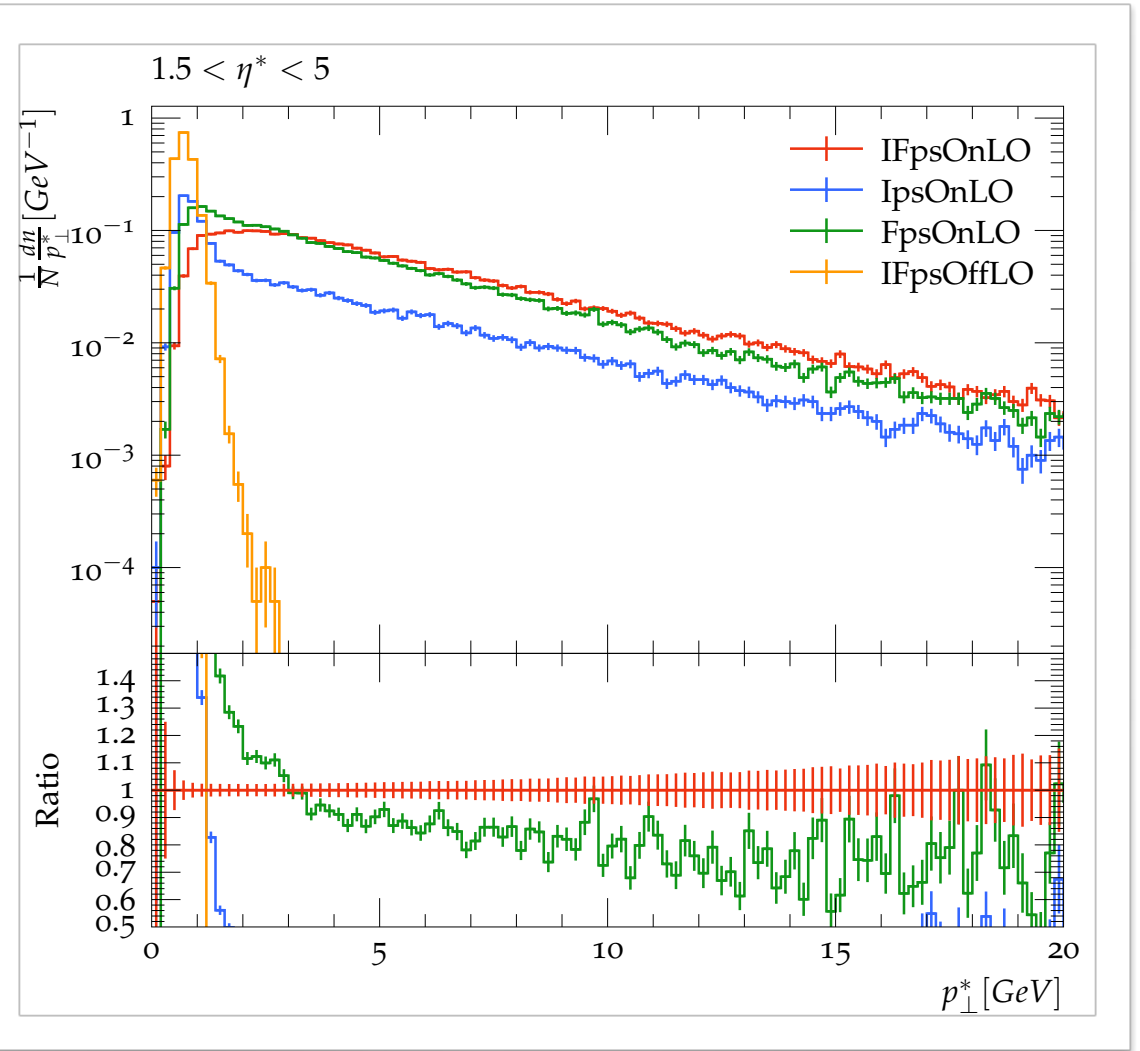
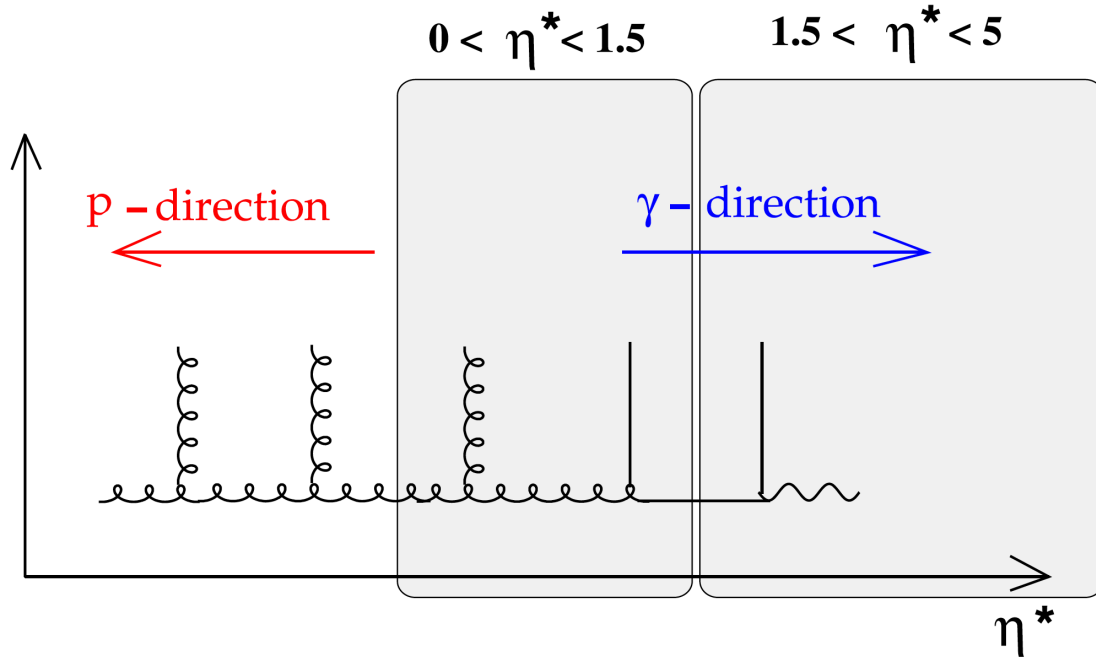
Resolution Scale : $10000 < Q^2 < 20000 \text{ GeV}^2$
Positron energy : 300 GeV^2
Proton energy : 8000 GeV^2
PDF : CTEQ6L(LO)



Part II Simulation

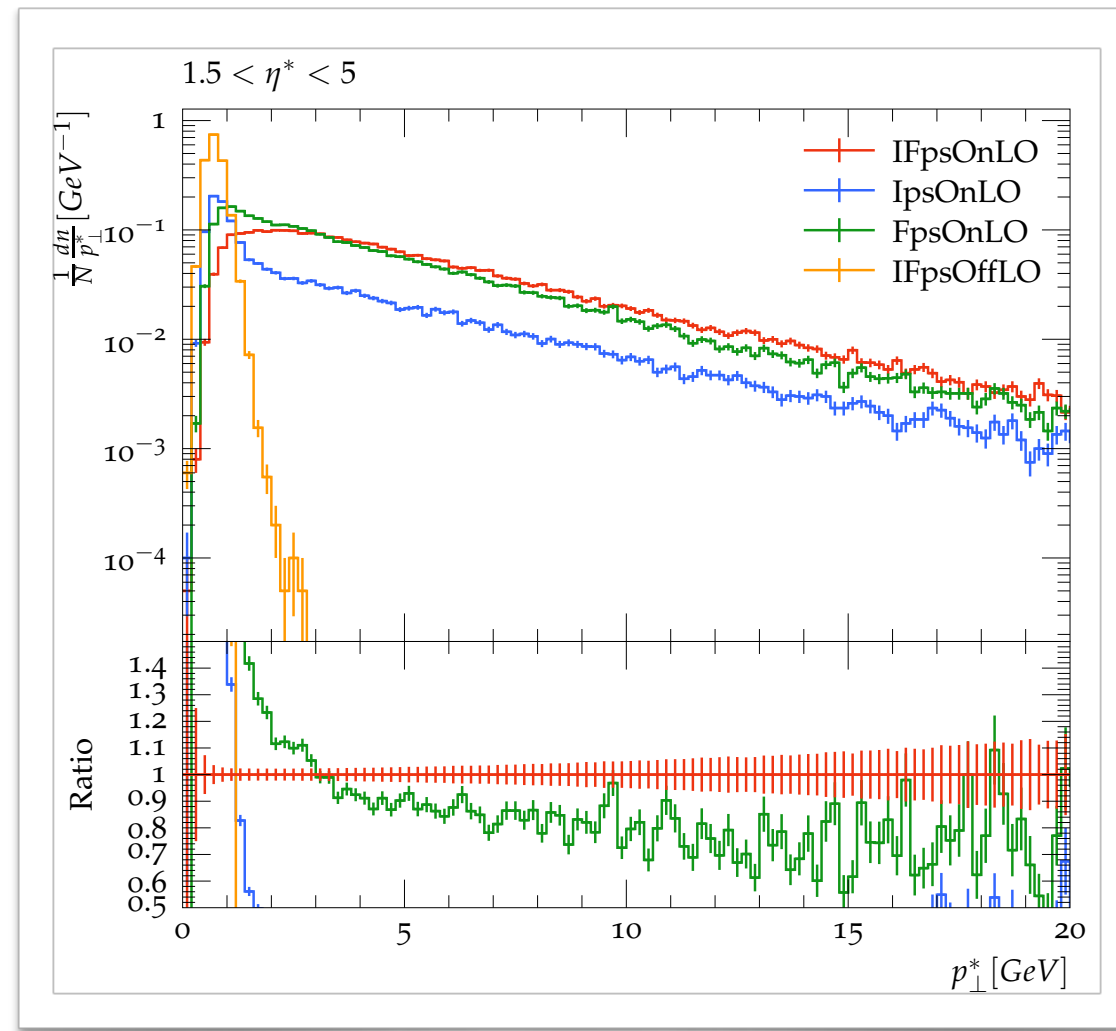
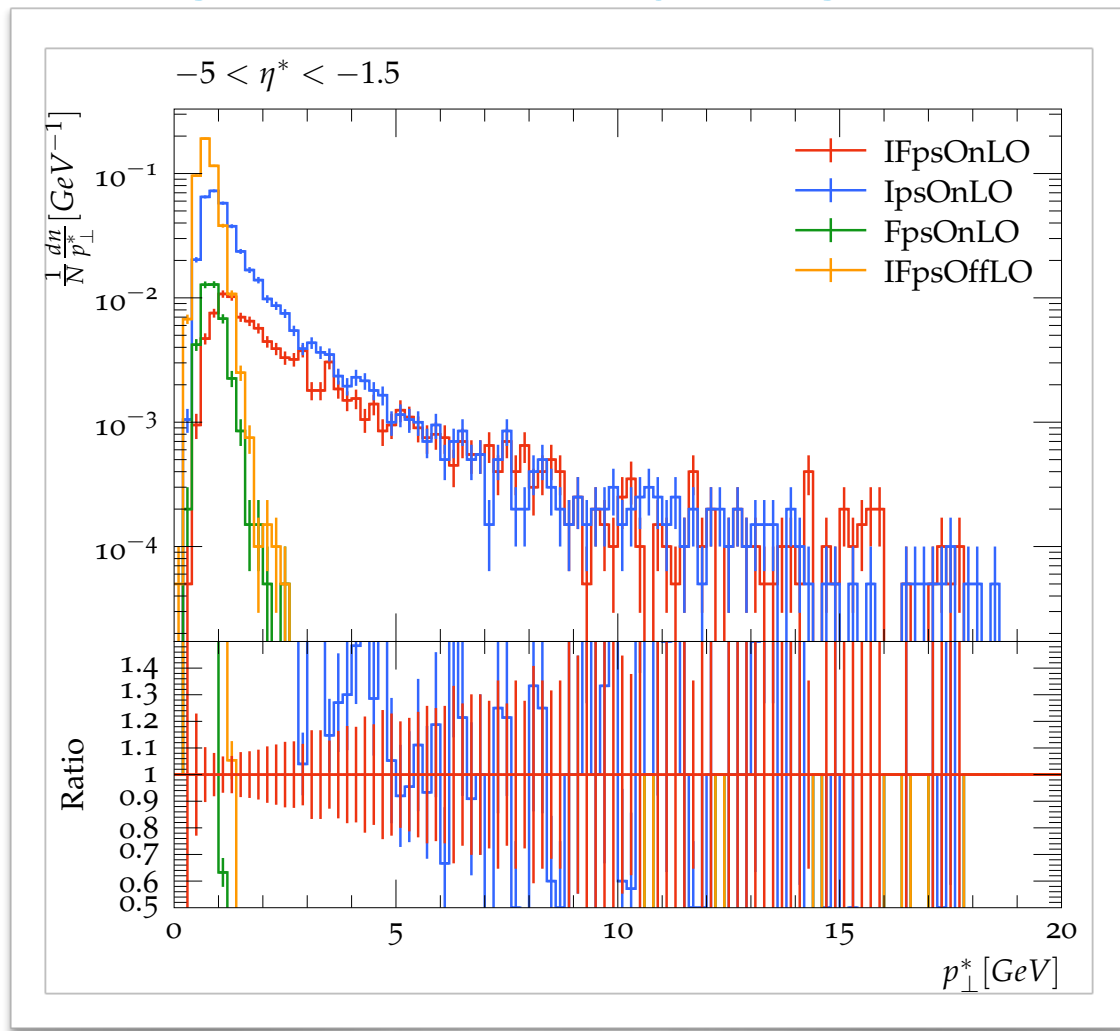
A Higher Resolution by using RAPGAP

Resolution Scale : $10000 < Q^2 < 20000 \text{ GeV}^2$
Positron energy : 300 GeV^2
Proton energy : 8000 GeV^2
PDF : CTEQ6L(LO)



Part II Simulation

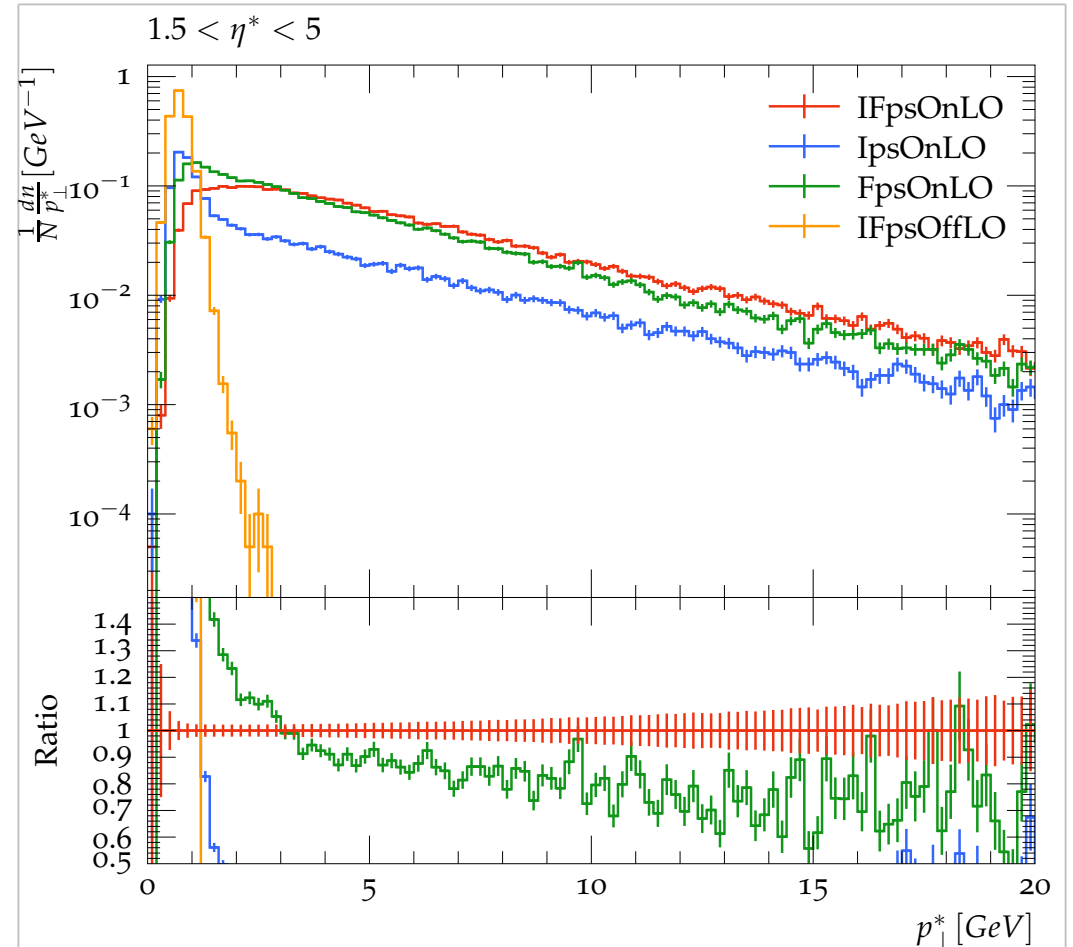
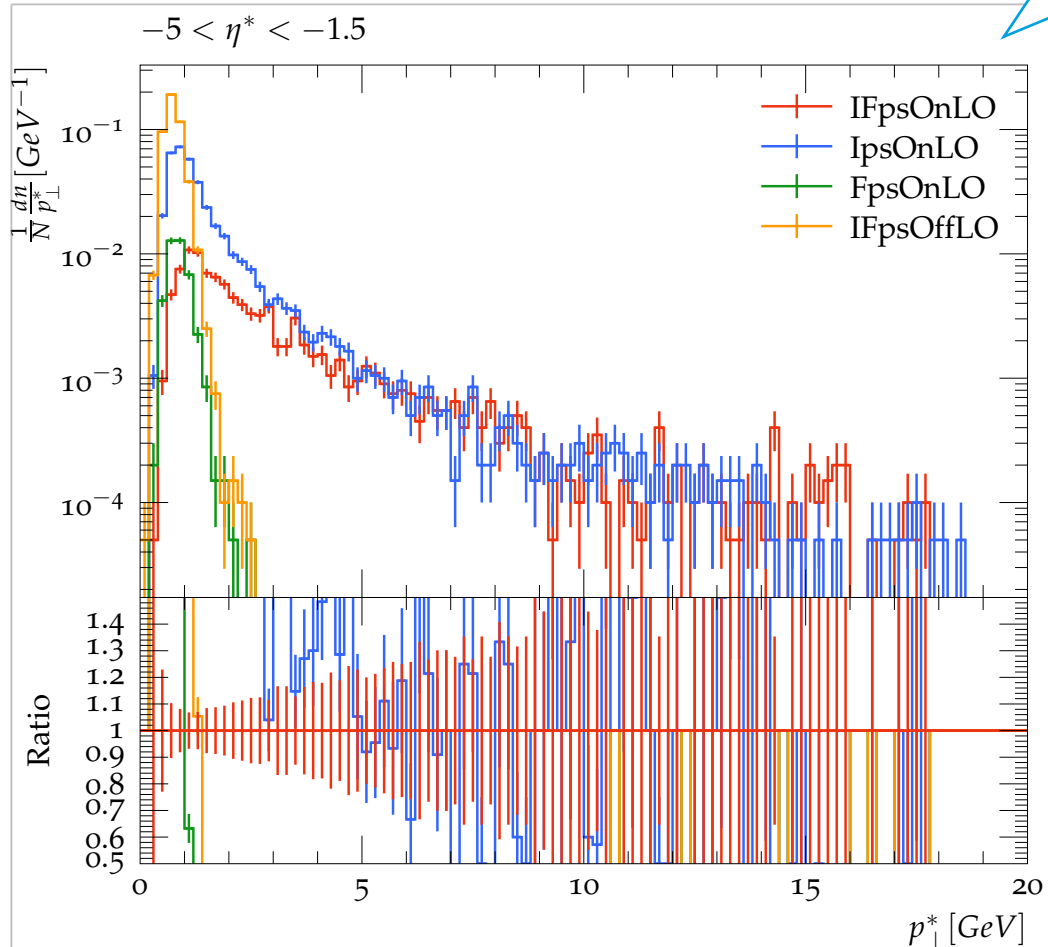
A Higher Resolution by using RAPGAP



Part II Simulation

A Higher Resolution by using Rapgag

This could not be observed by HERA



Part III Conclusion

Summary

We can reconstruct the charge particles spectrum by the effect of Intrinsic transverse momentum, Parton shower, and Fragmentation.

We see the behaviour of intrinsic K_t , Parton shower separately at large Q^2 .

We expect that we can study these behaviour at LHeC around 60 GeV and 7000GeV for electron and proton beam respectively.

Thank you for your

DESY. Deutsches
Elektronen-Synchrotron