

# Charge Particles Spectrum

Jakkapat Seeyangnok  
Thailand, September 2nd 2019

Supervisor  
Hannes Jung, Patrick Connor, Radek Zlebcik

# Charge Particle Distribution

## Outline

### Part I Introduction

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

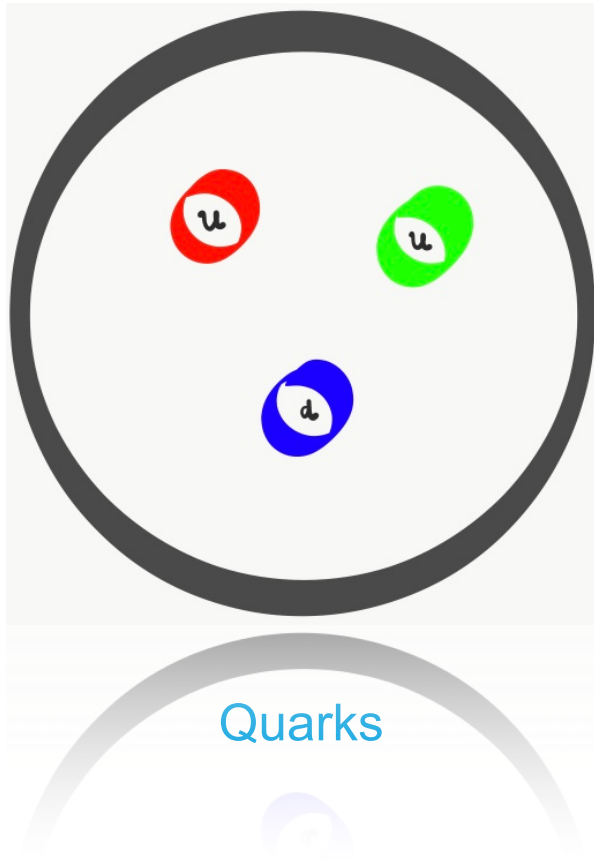
### Part II Simulation

- Parameters
- Monte Carlo generators vs HERA data
- A higher Resolution Scales

### Part III Conclusion

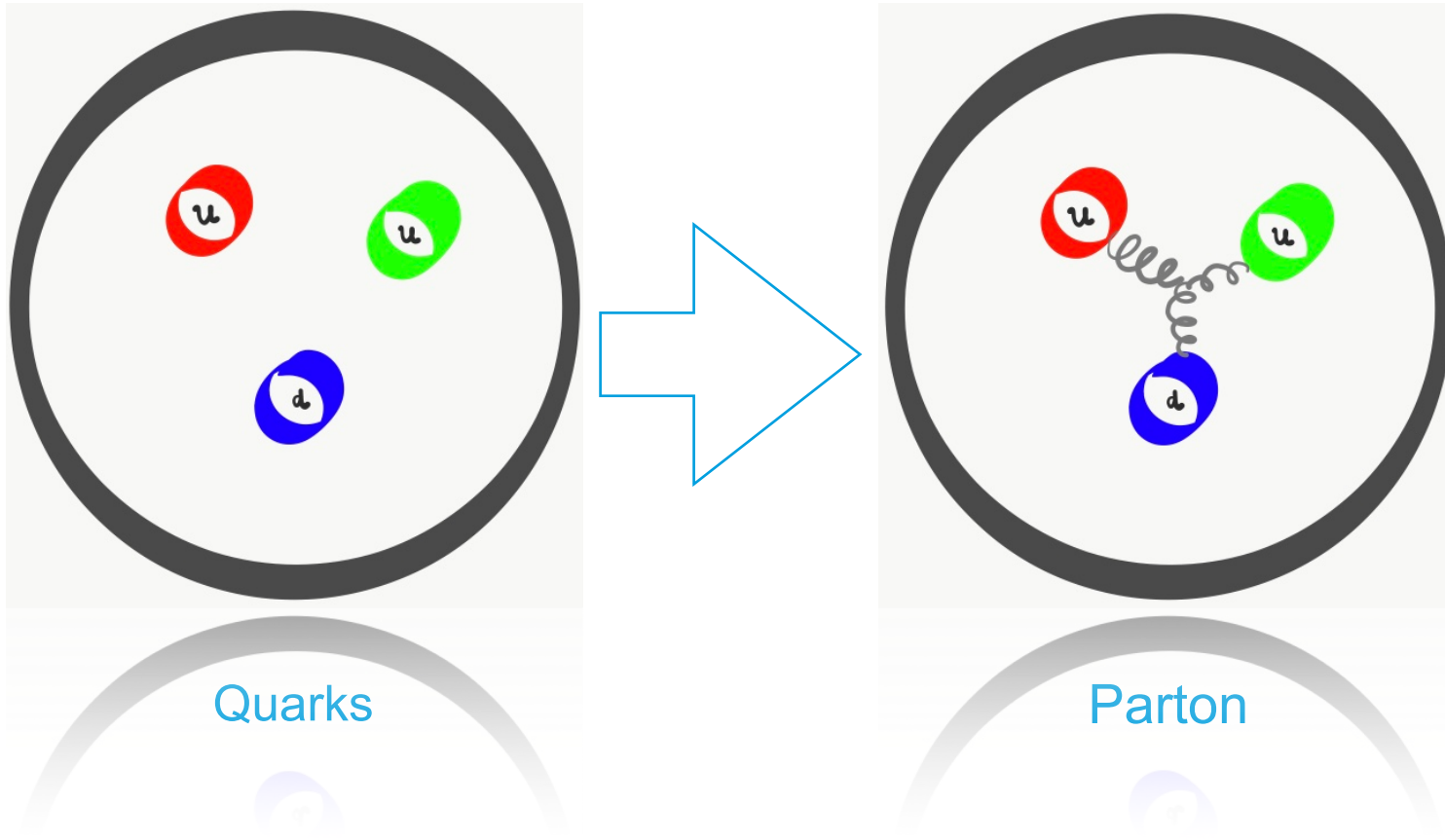
# Part I Introduction

## Parton and intrinsic transverse momentum



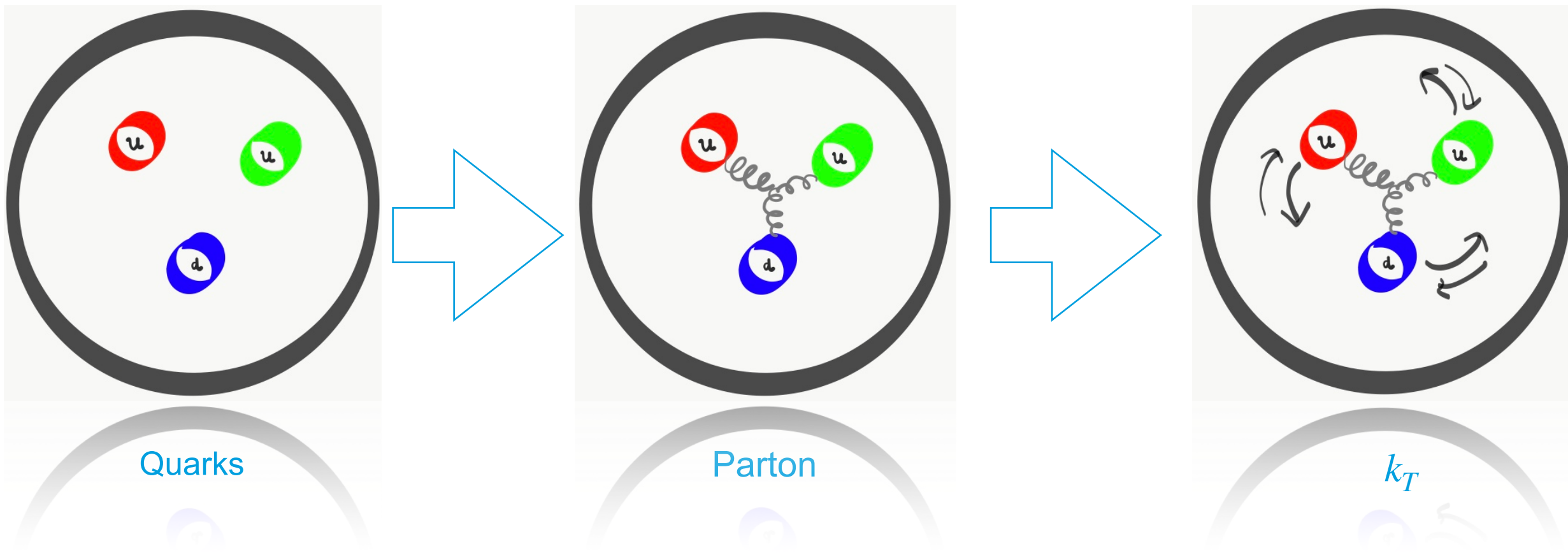
# Part I Introduction

## Parton and intrinsic transverse momentum



# Part I Introduction

## Parton and intrinsic transverse momentum

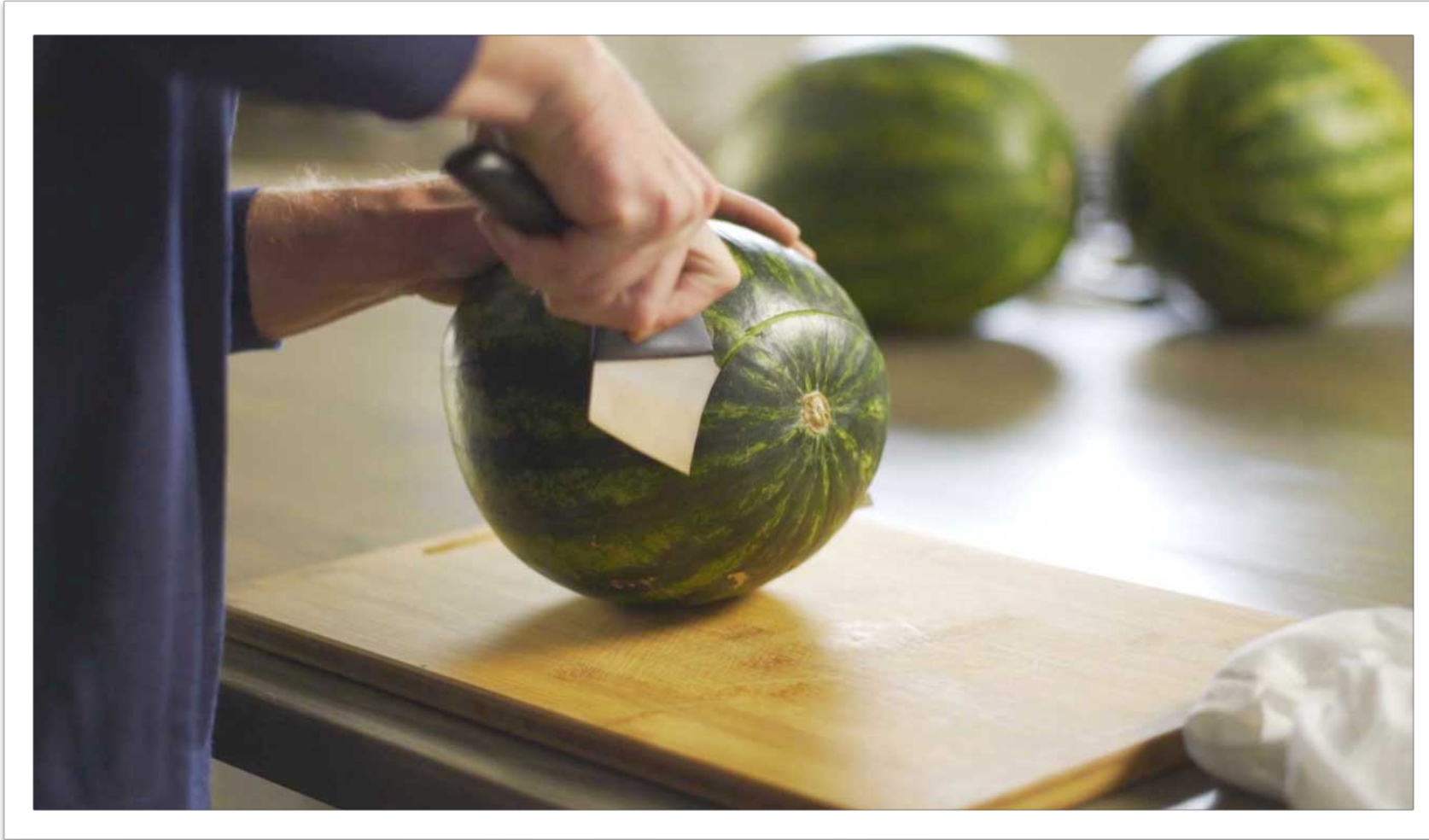


# Part I Introduction

## Parton and intrinsic transverse momentum

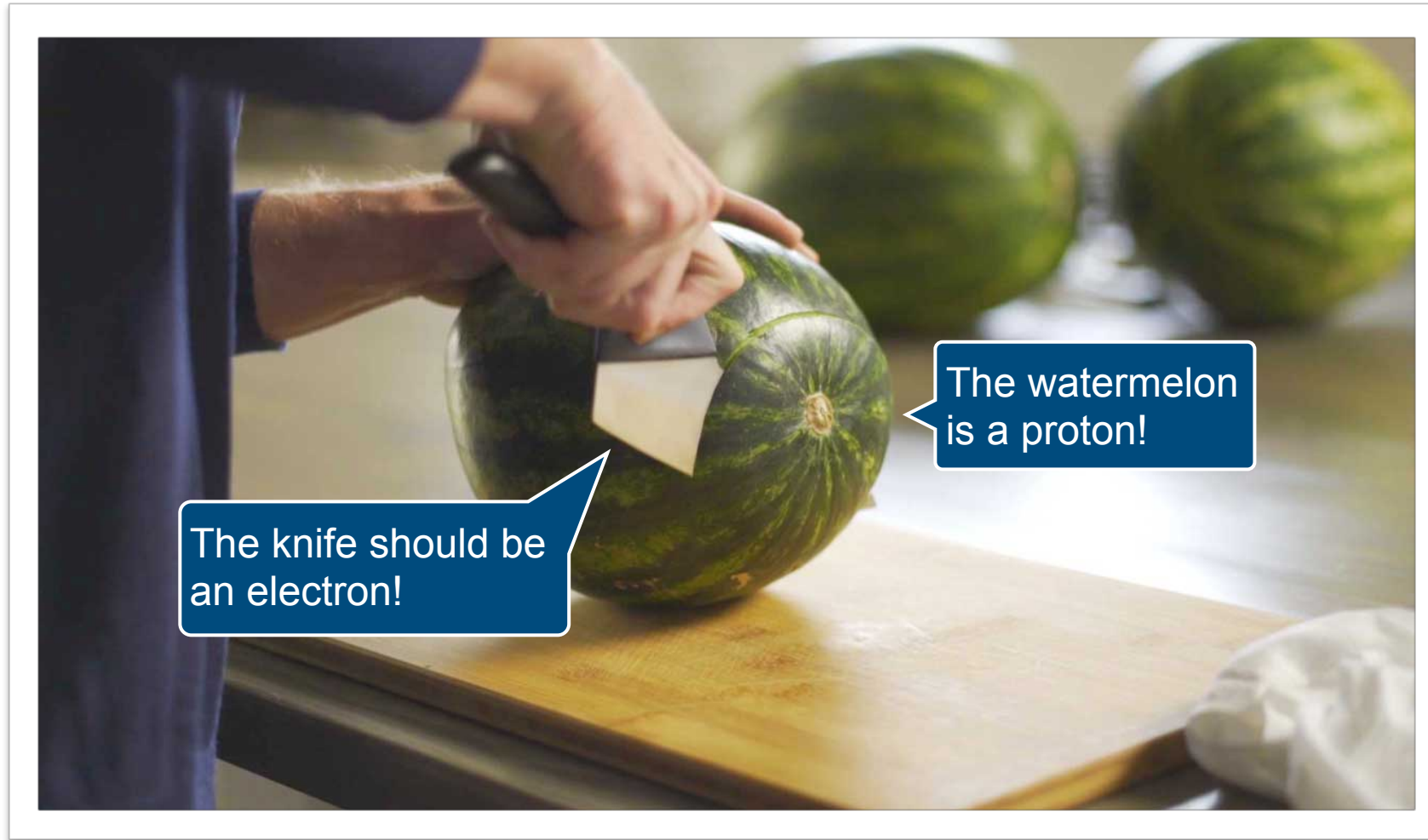


# Part I Introduction



[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](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

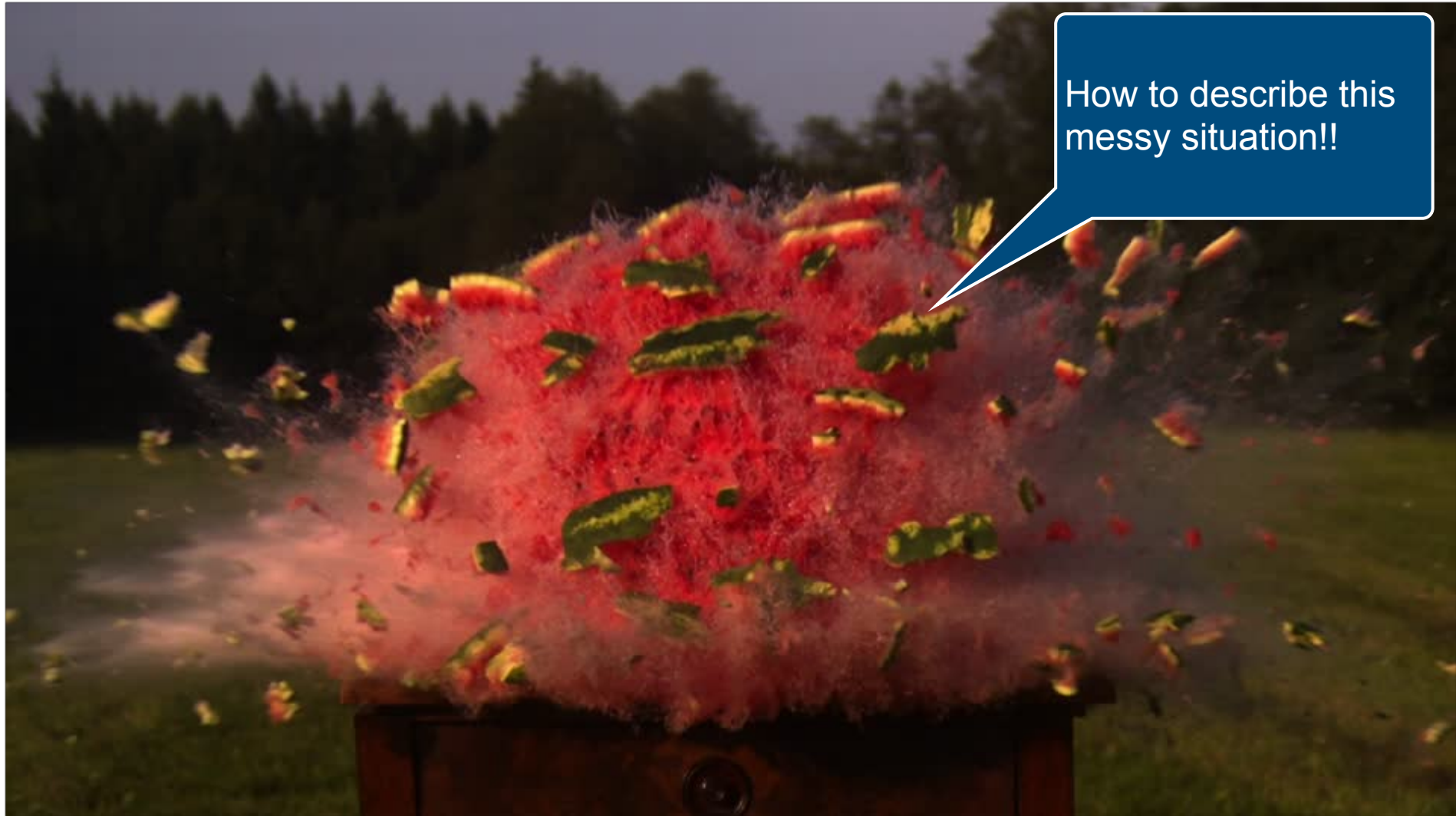


[https://www2.fiskars.com/var/fiskars\\_amer/storage/images/media/images/2017-project-images/fall-2017/cutting-watermelon/watermelon1/1092641-1-eng-US/Watermelon1.jpg](https://www2.fiskars.com/var/fiskars_amer/storage/images/media/images/2017-project-images/fall-2017/cutting-watermelon/watermelon1/1092641-1-eng-US/Watermelon1.jpg)

# Part I Introduction



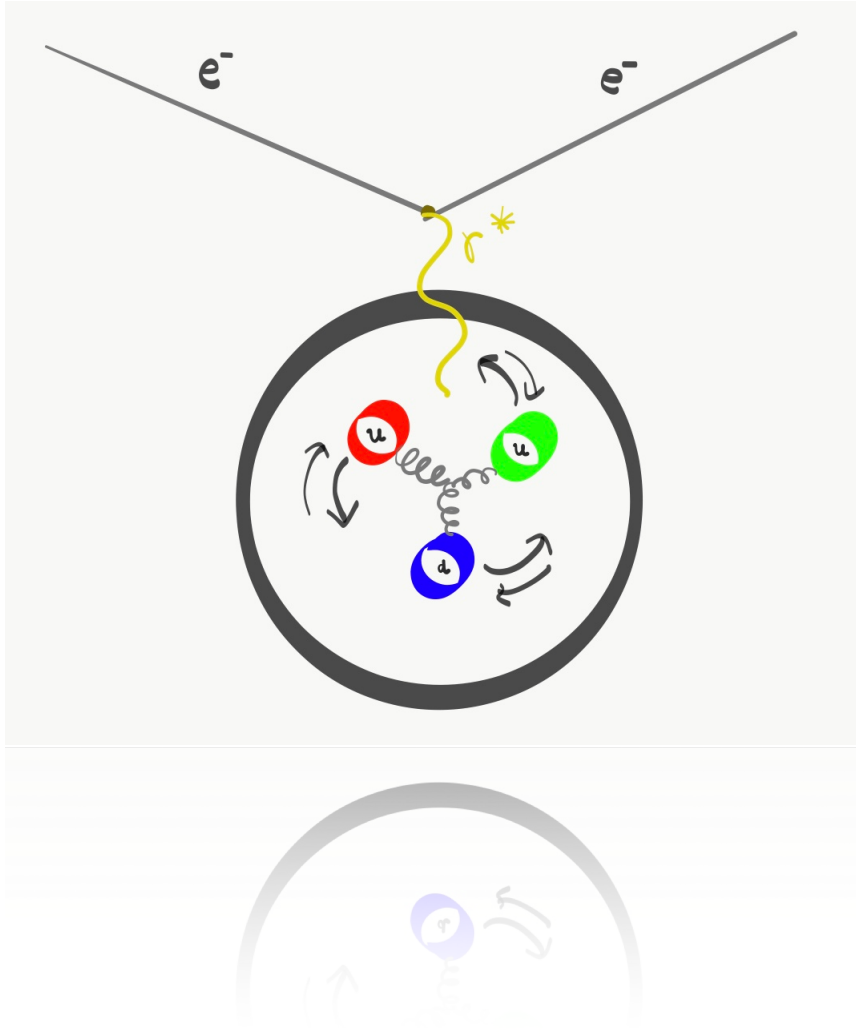
# Part I Introduction



How to describe this messy situation!!

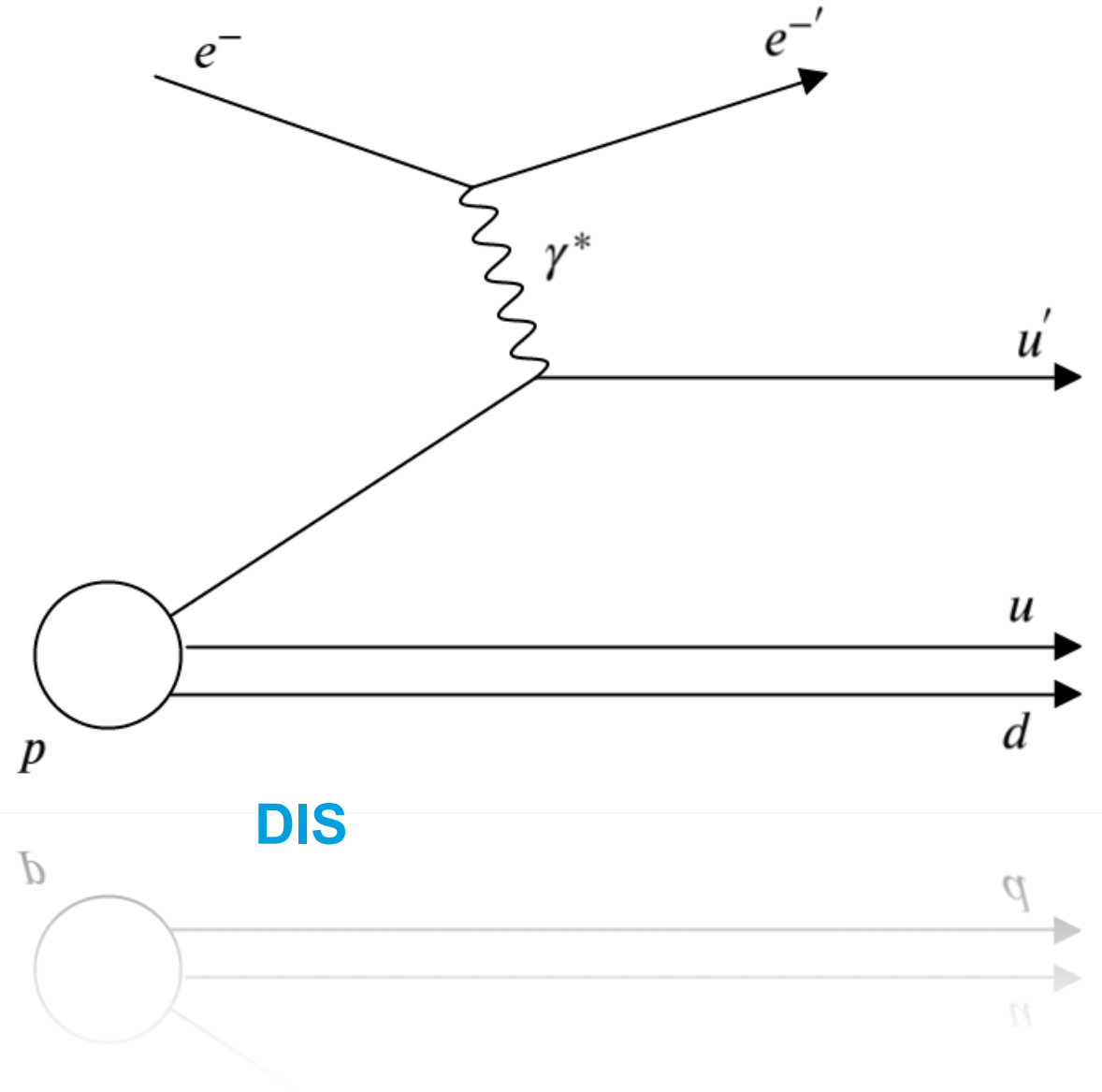
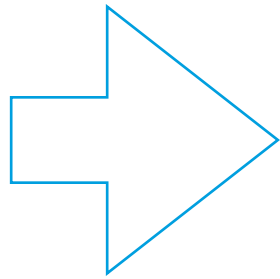
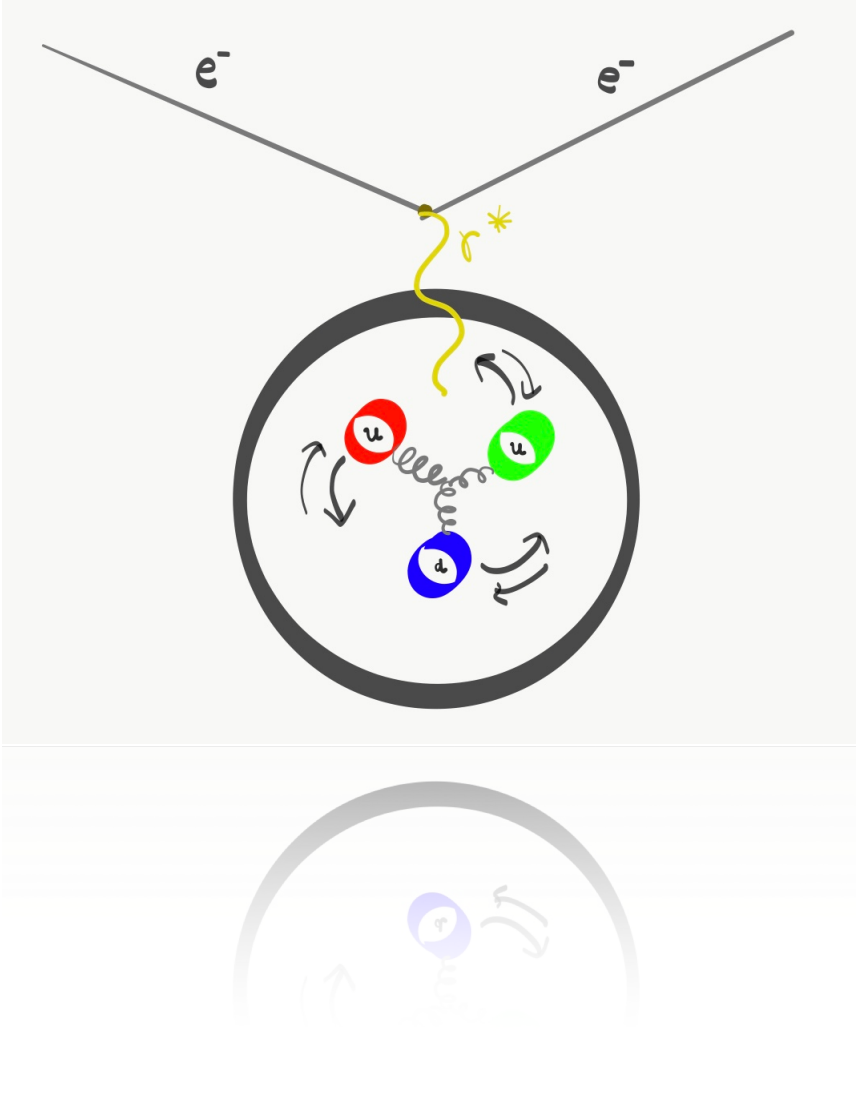
# Part I Introduction

## Deep Inelastic Scattering



## Part I Introduction

# Deep Inelastic Scattering



# Part I Introduction

## The Influence



[http://www.cutwatersolutions.com/wp-content/uploads/2013/06/istock\\_000010510568medium.jpg](http://www.cutwatersolutions.com/wp-content/uploads/2013/06/istock_000010510568medium.jpg)



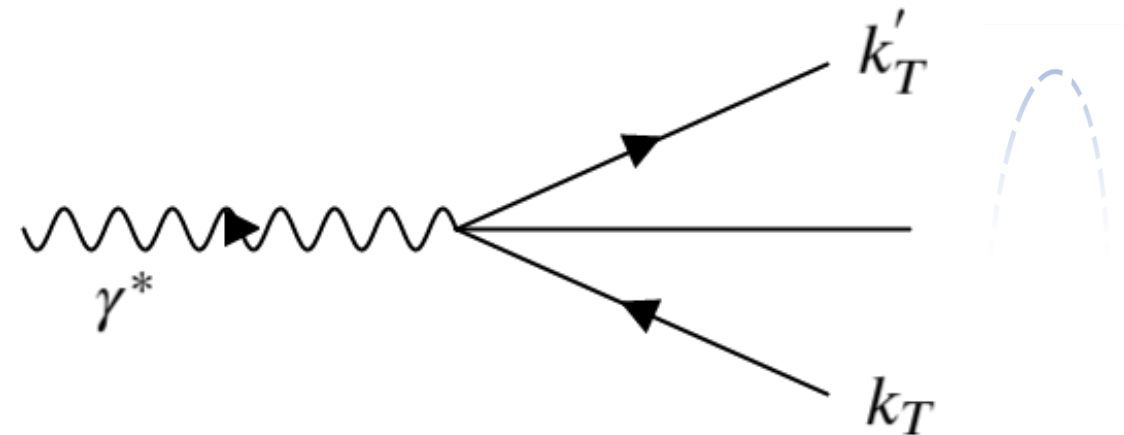
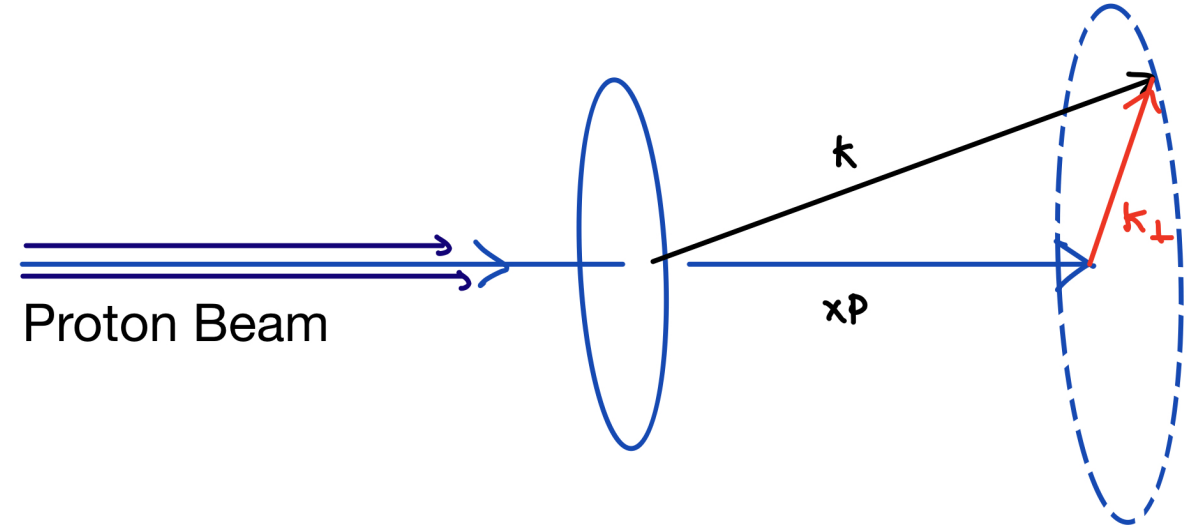
# Part I Introduction

## The Influence



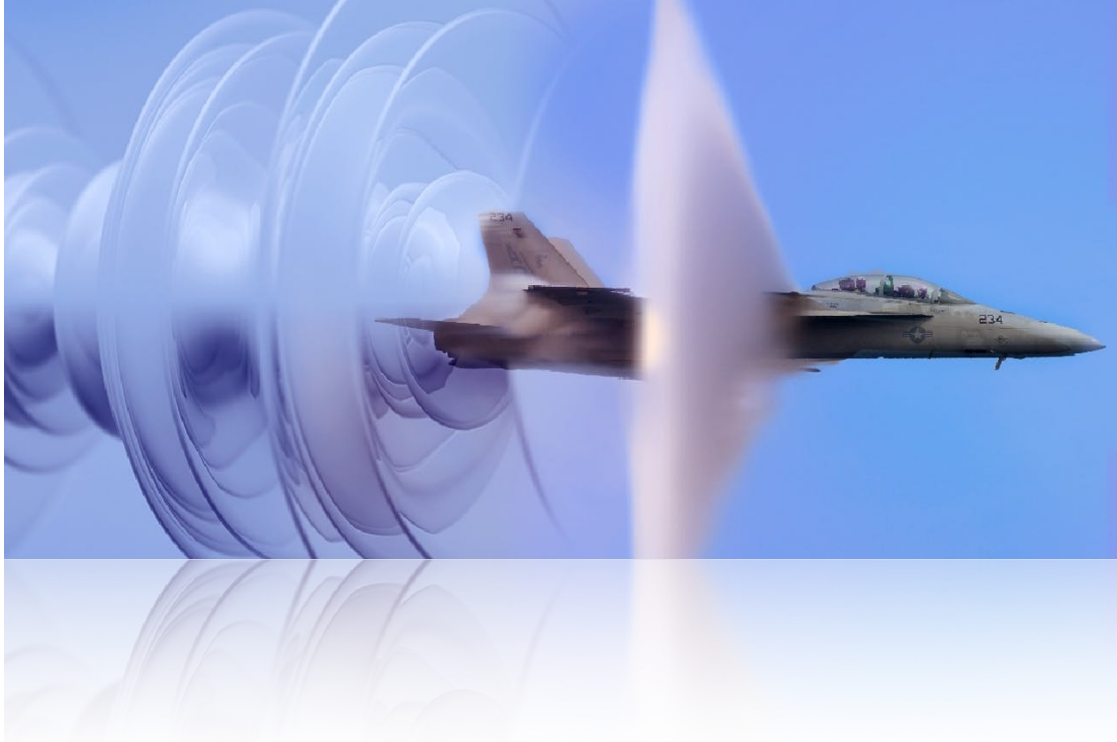
[http://www.cutwatersolutions.com/wp-content/uploads/2013/06/istock\\_000010510568medium.jpg](http://www.cutwatersolutions.com/wp-content/uploads/2013/06/istock_000010510568medium.jpg)

## Intrinsic Kt



# Part I Introduction

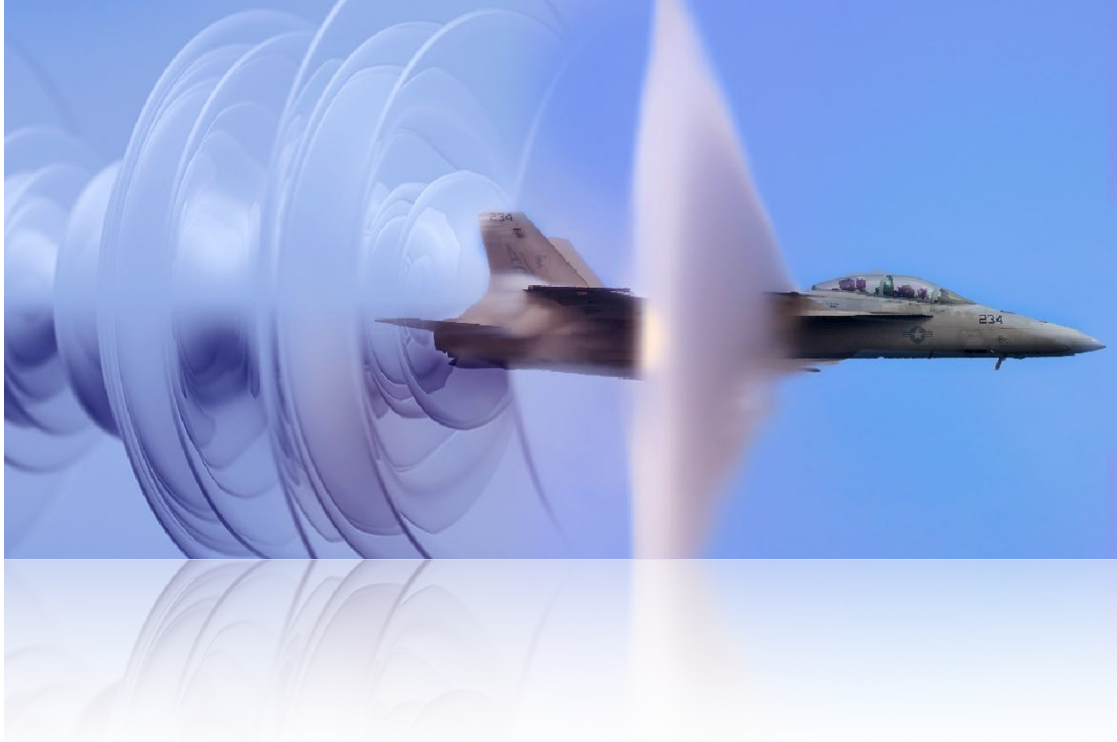
## The Influence



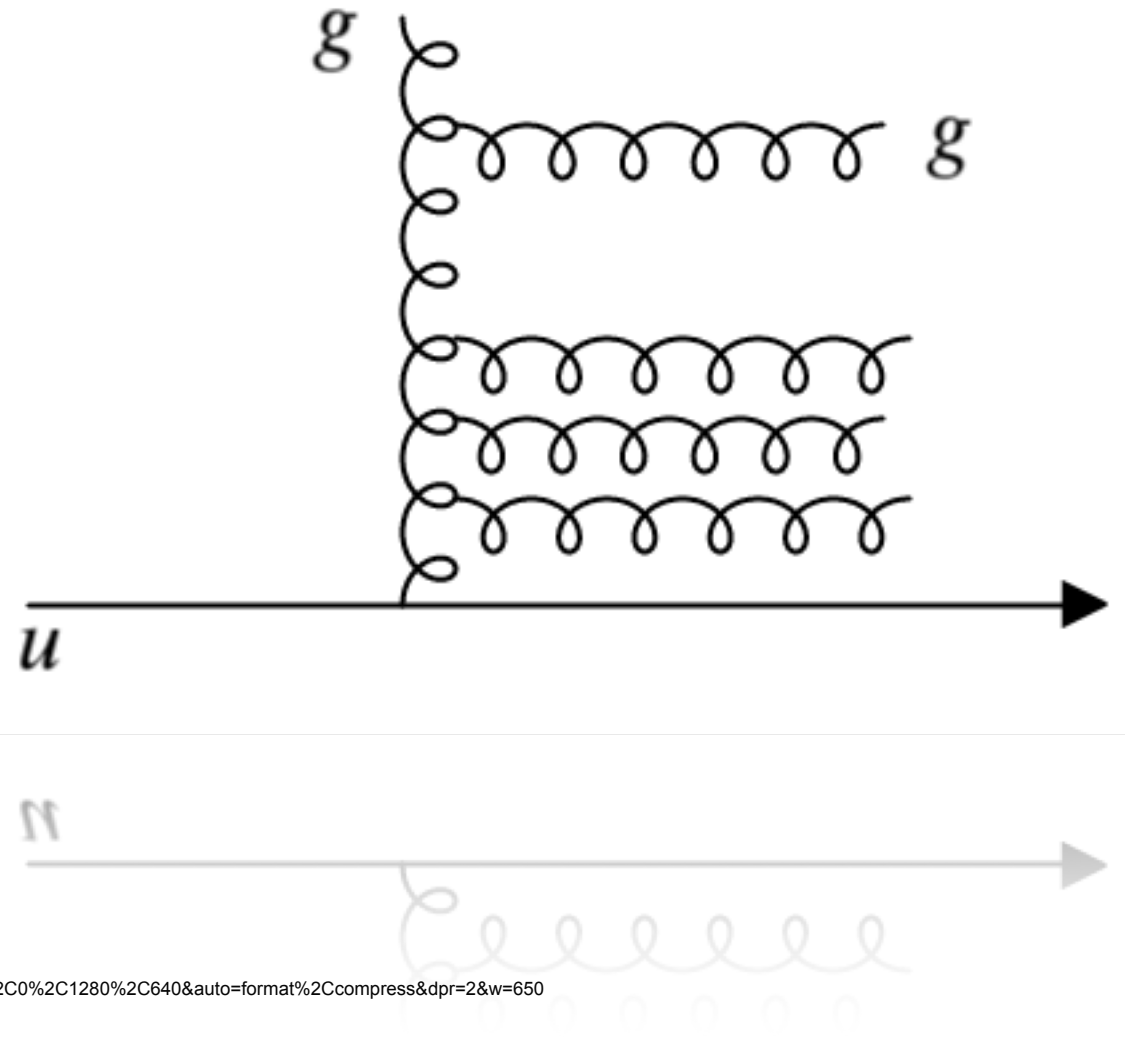
<https://fsmedia.imgix.net/28/8c/eb/ef/d418/4895/9bcb/ea28a339034a/an-illustration-shows-the-sound-wave-effect-around-a-supersonic-boom.jpeg?rect=0%2C0%2C1280%2C640&auto=format%2Ccompress&dpr=2&w=650>

# Part I Introduction

## The Influence



## 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



<https://s3.envato.com/files/133286970/590.jpg>

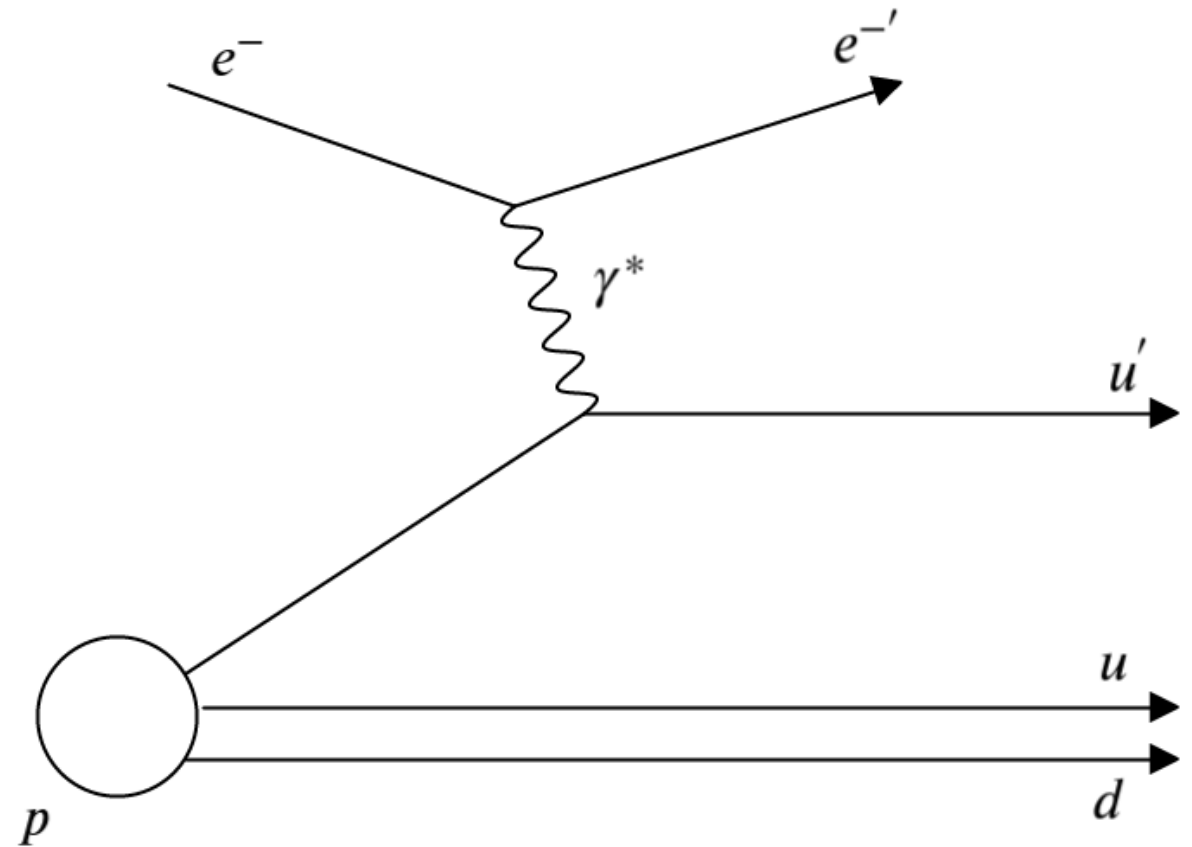
# Part I Introduction

## The Influence



<https://s3.envato.com/files/133286970/590.jpg>

### Fragmentation



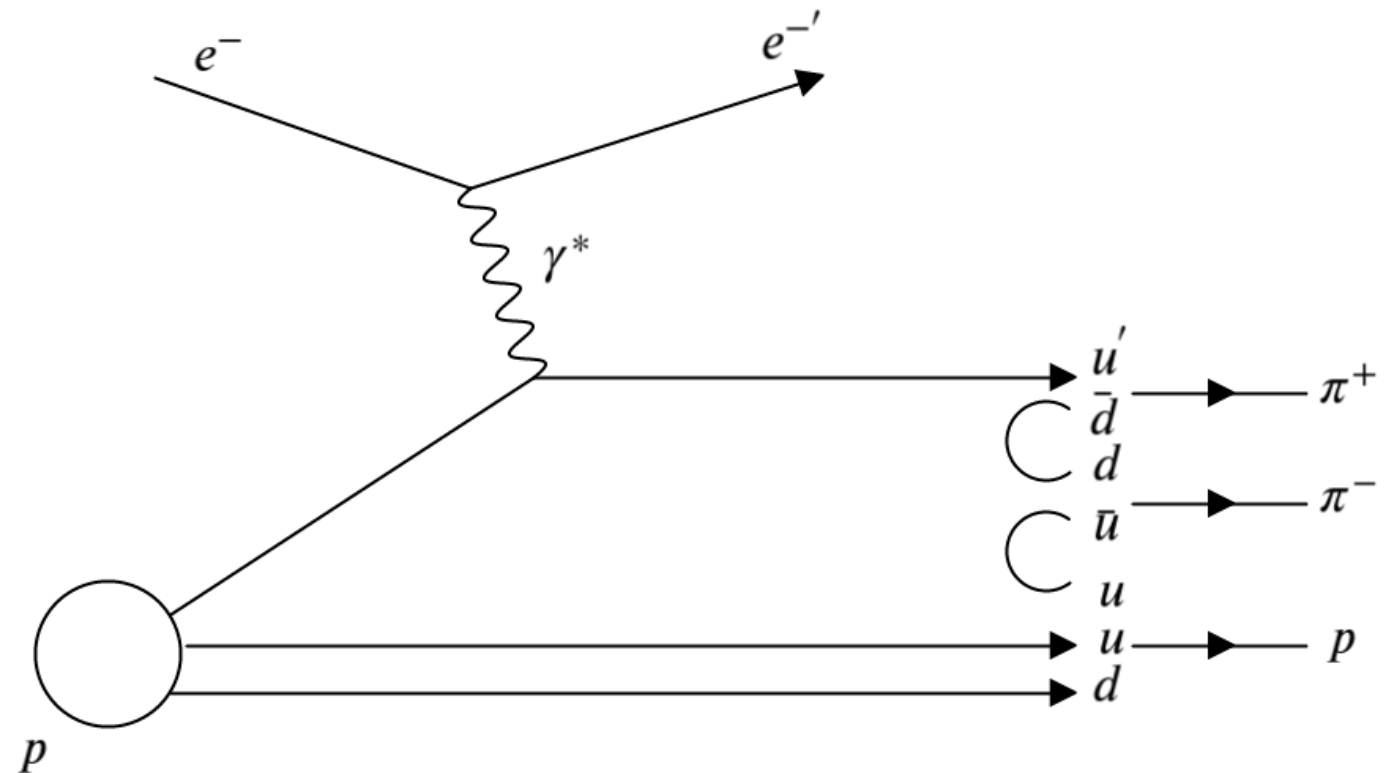
# Part I Introduction

## The Influence



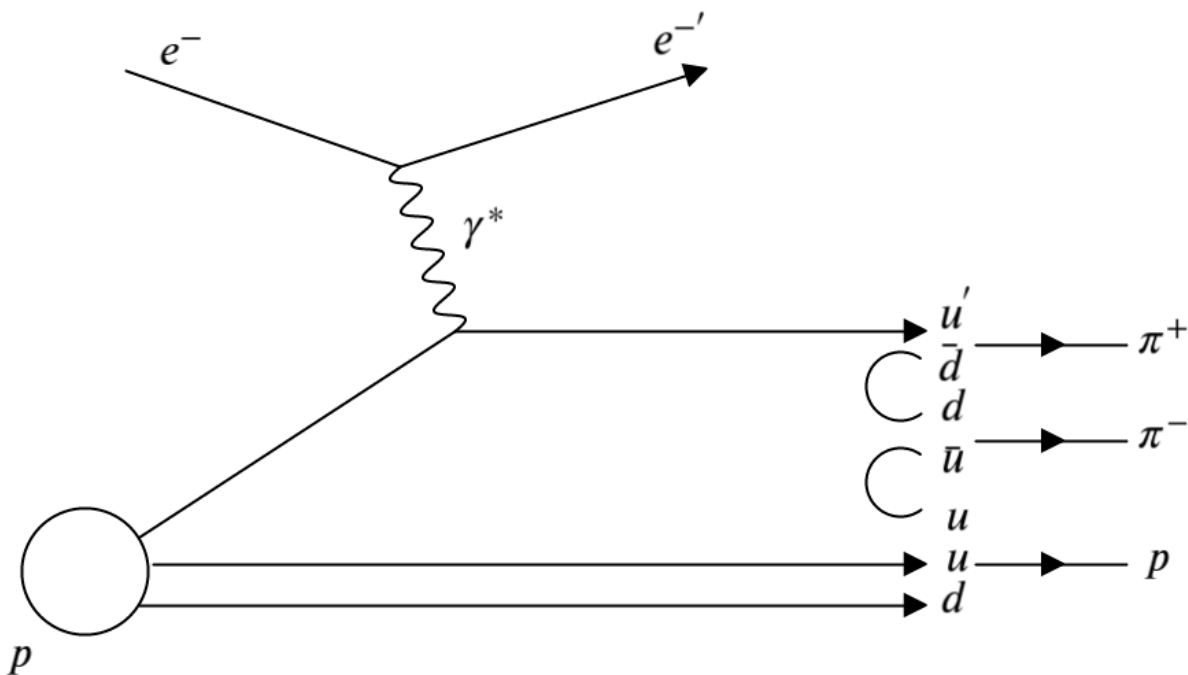
<https://s3.envato.com/files/133286970/590.jpg>

### Fragmentation

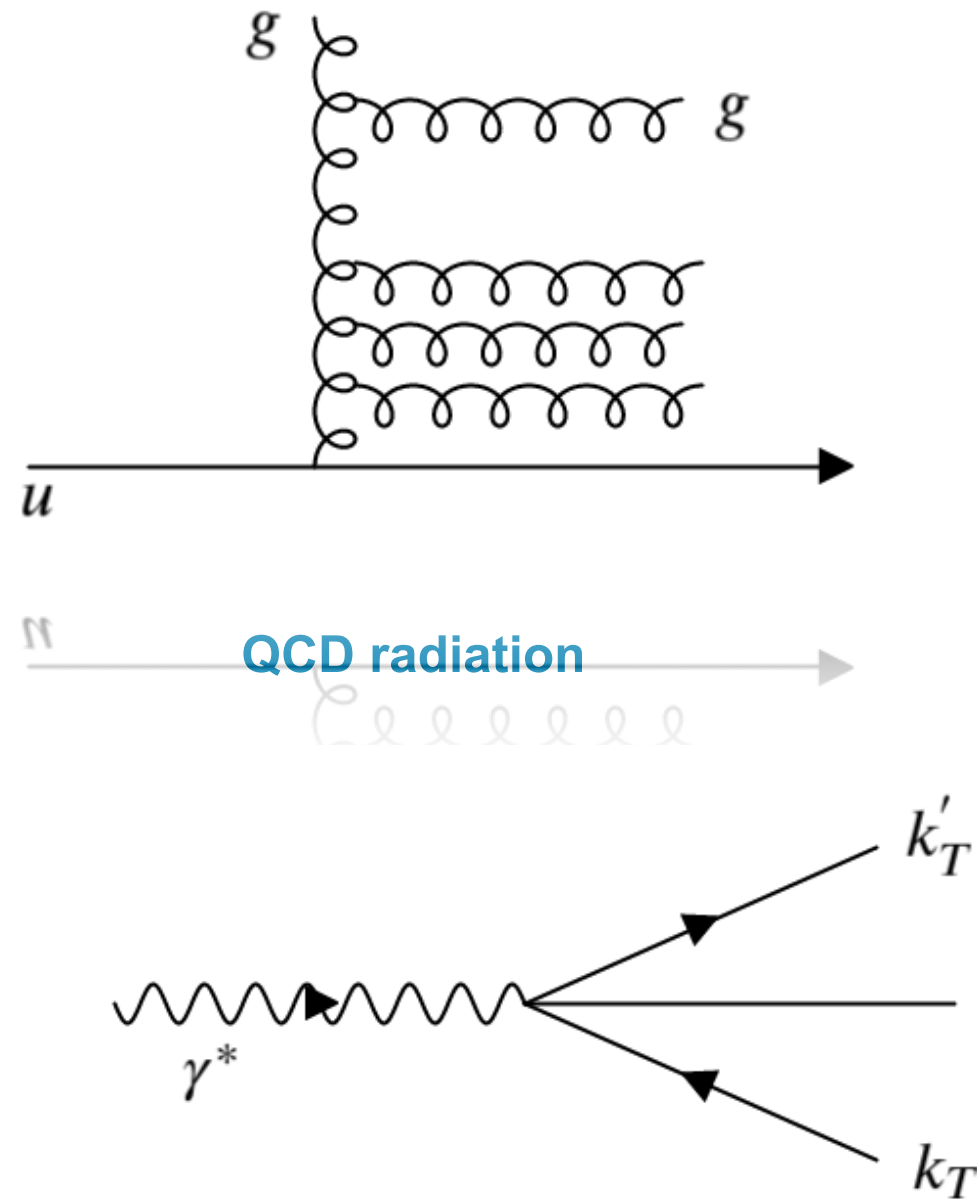
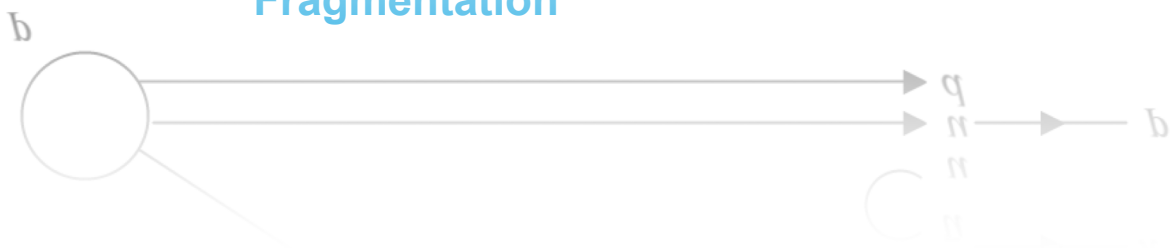


# Part I Introduction

## The Influence



Fragmentation



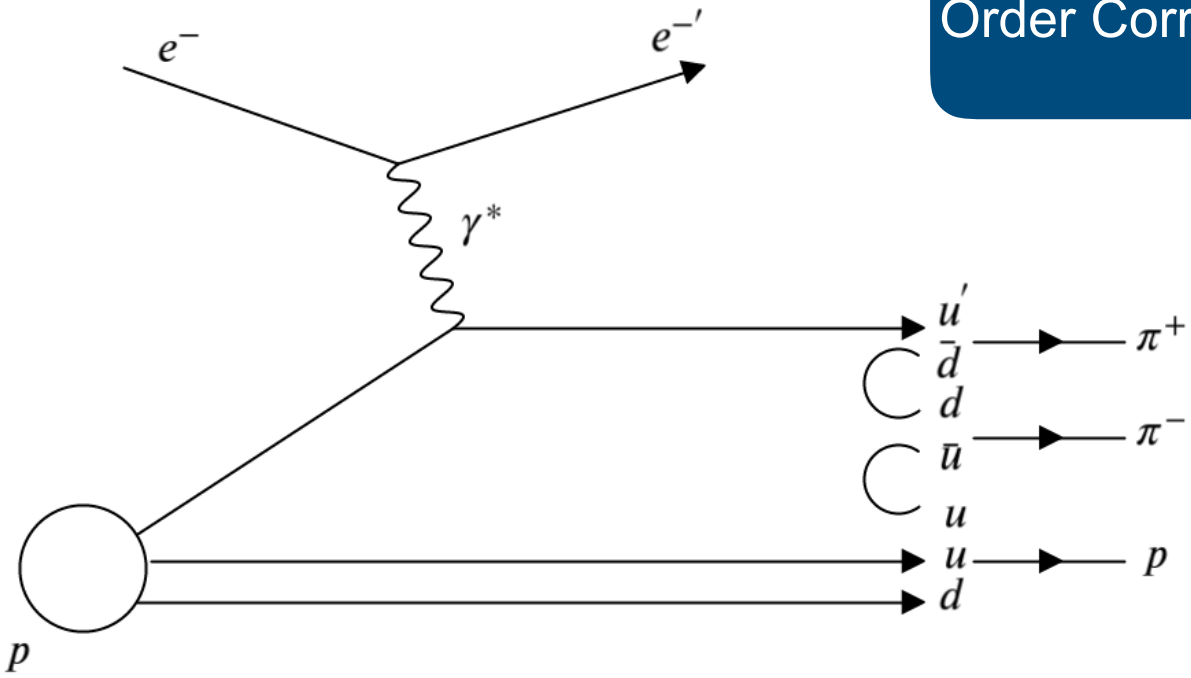
QCD radiation

Intrinsic  $k_T$

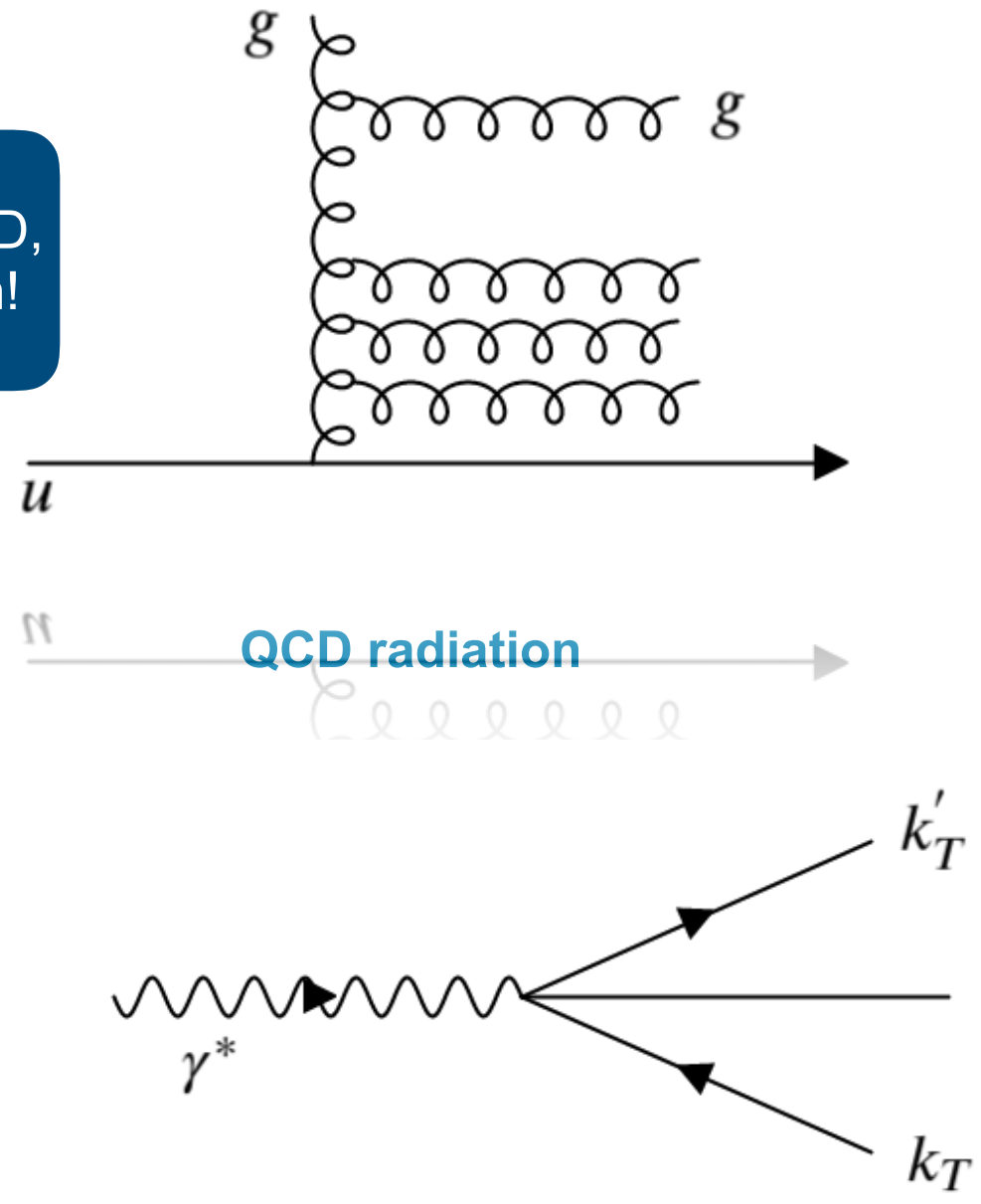
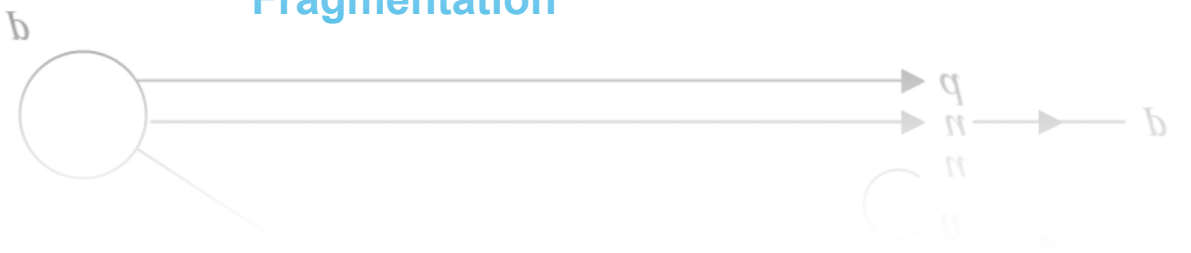
# Part I Introduction

## The Influence

Perturbative QCD,  
Order Correction!



Fragmentation

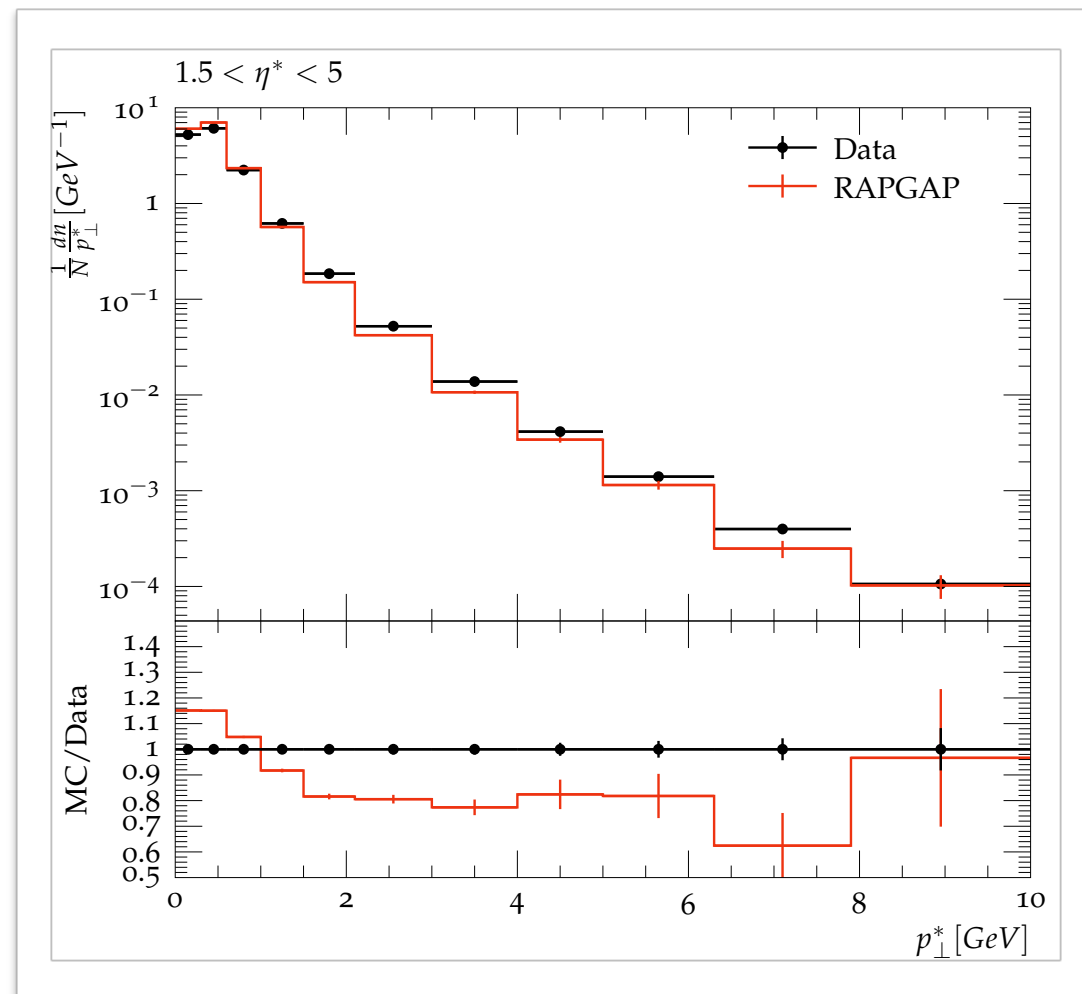
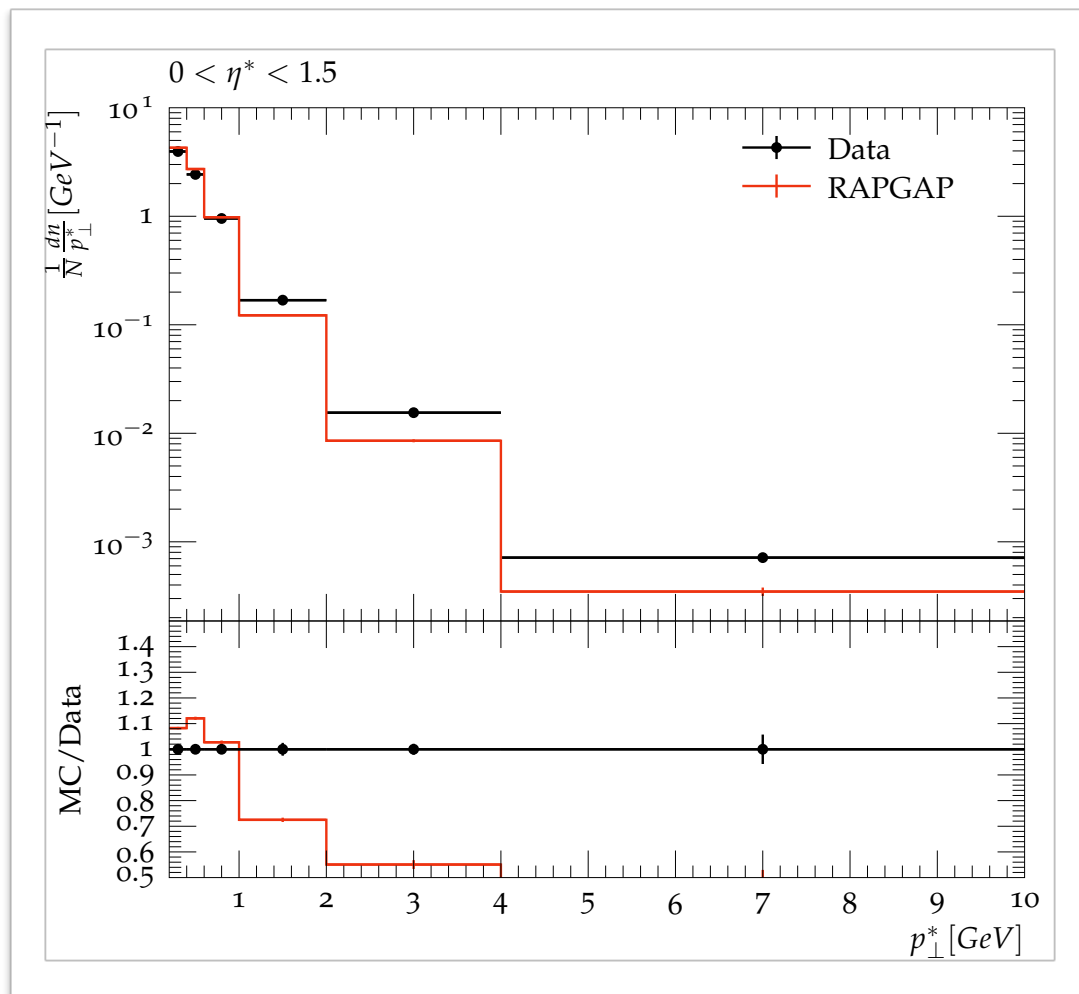


QCD radiation

Intrinsic  $K_t$

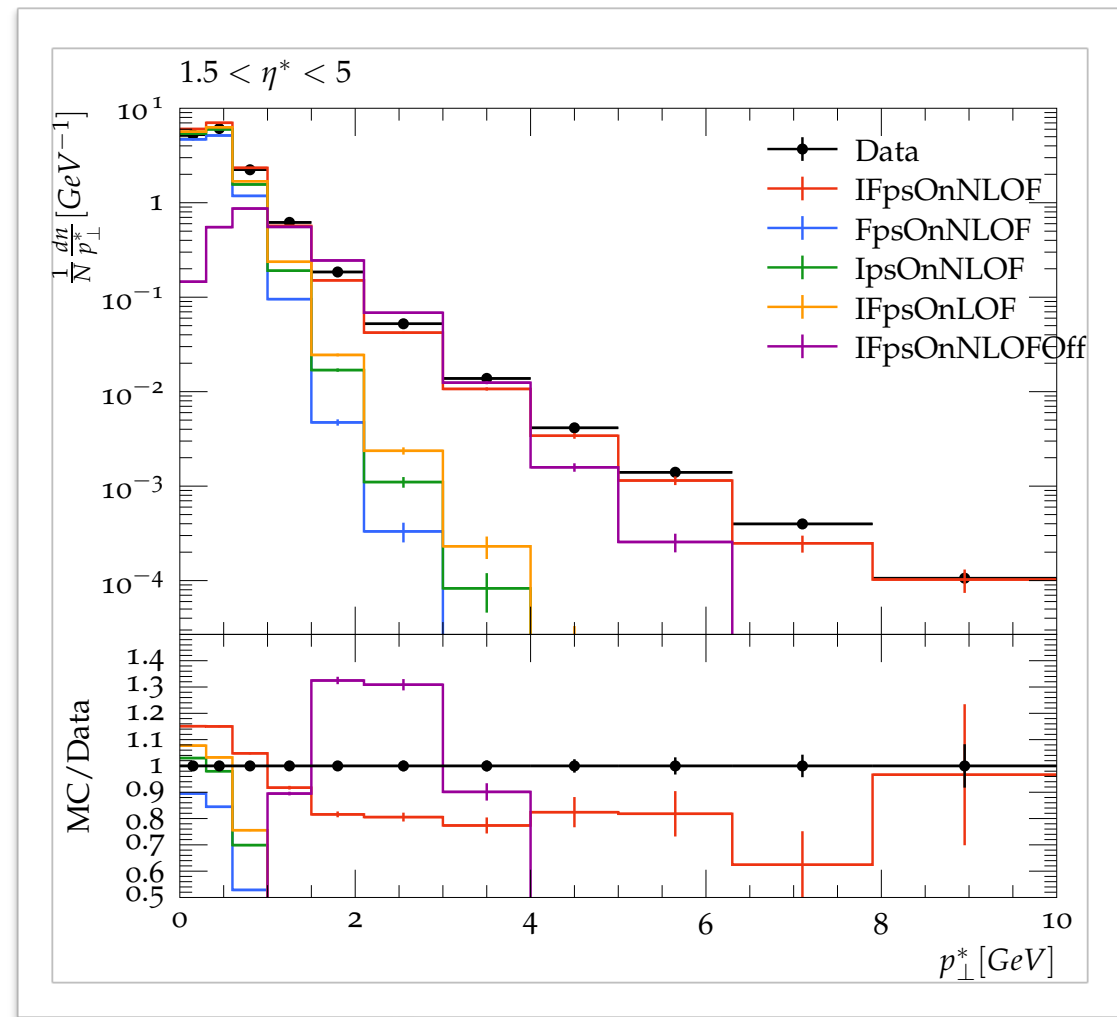
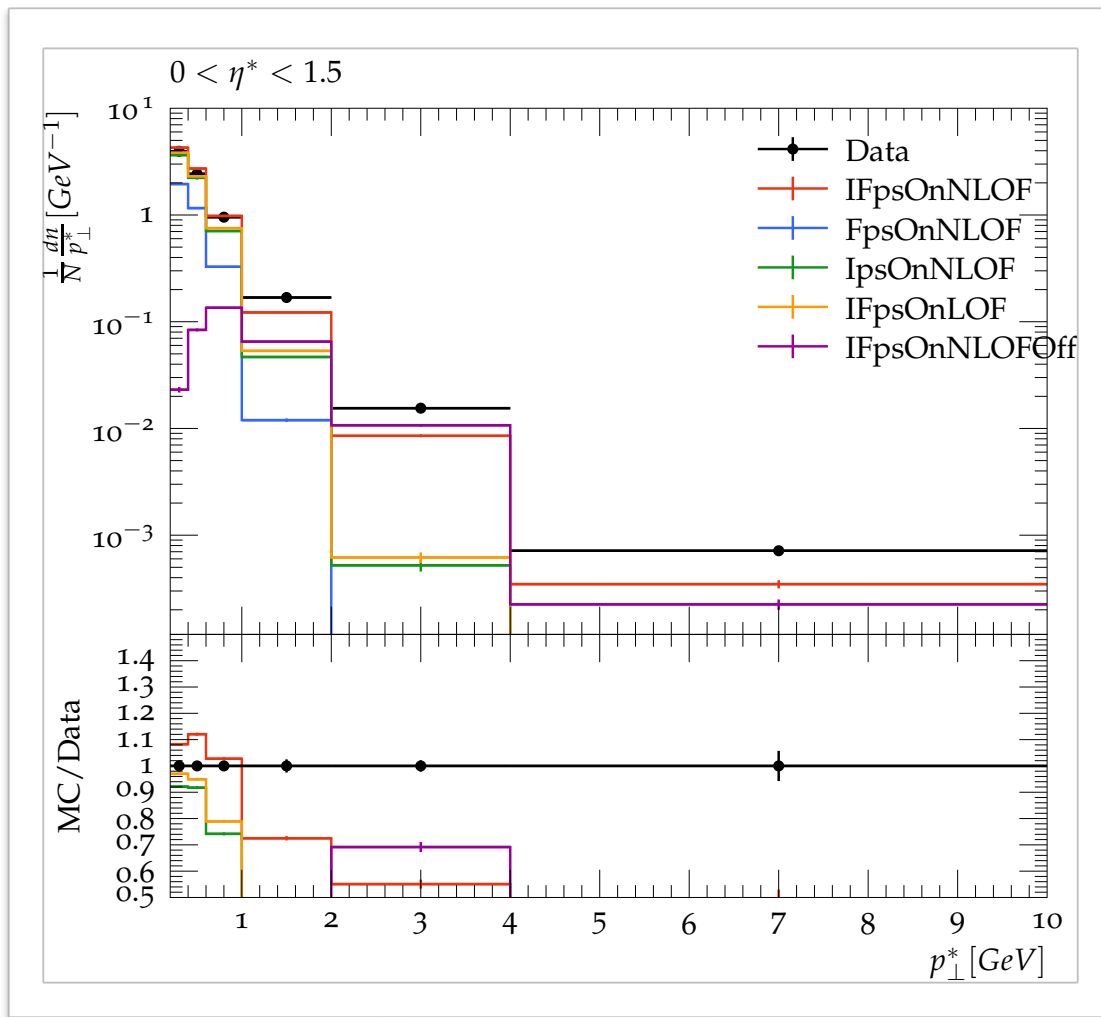
# Part II Simulation

## Calculation by using RAPGAP



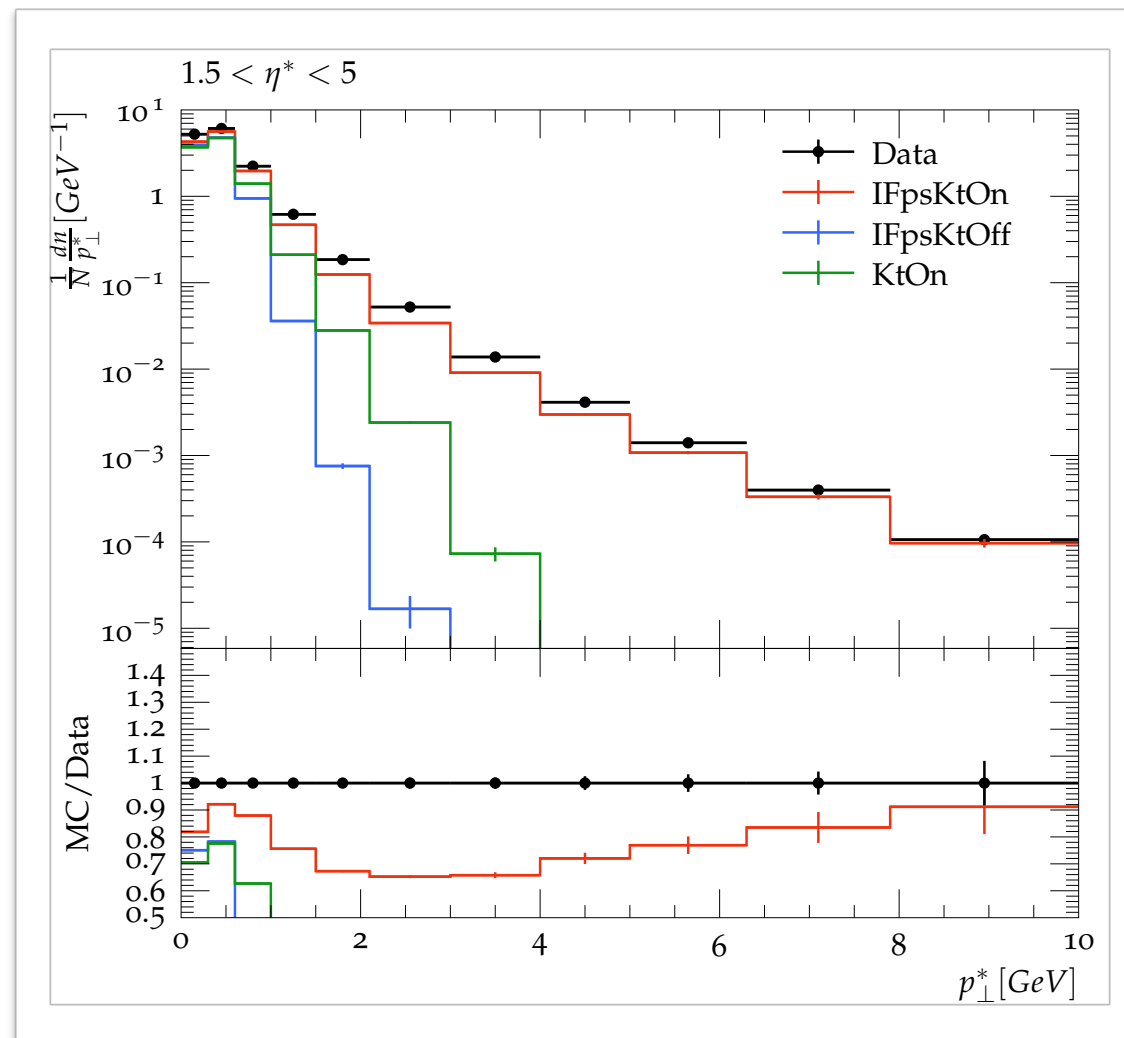
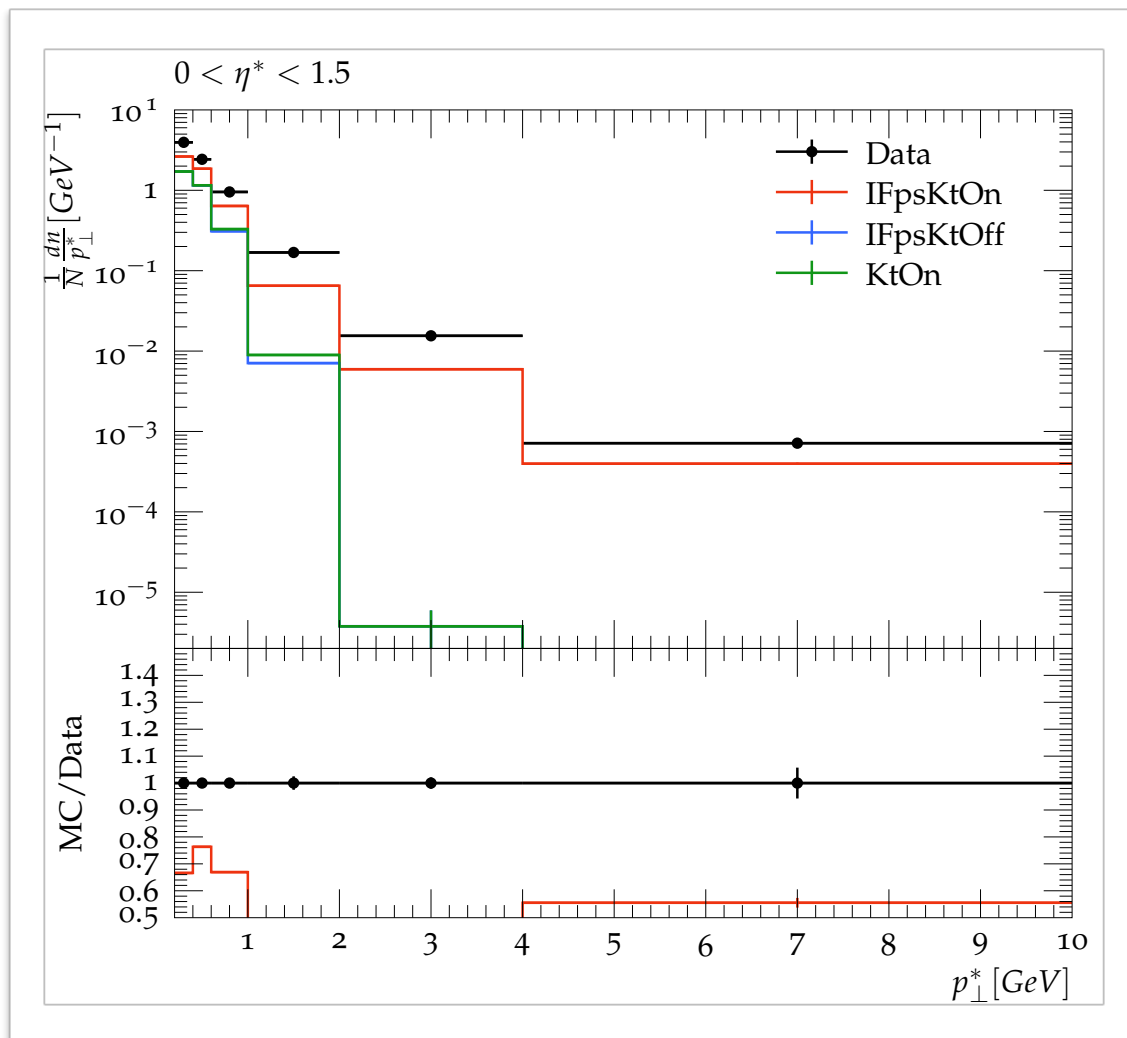
# Part II Simulation

## Validation of different validations



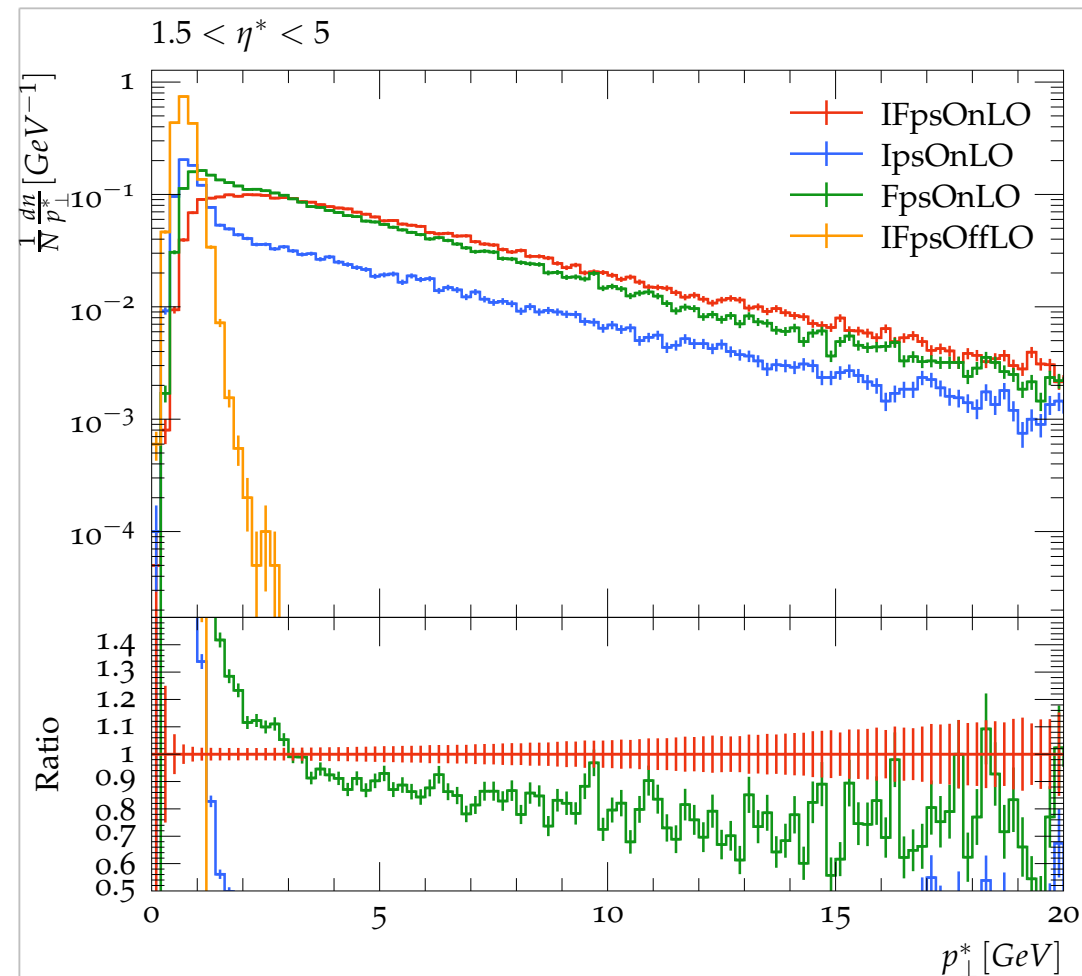
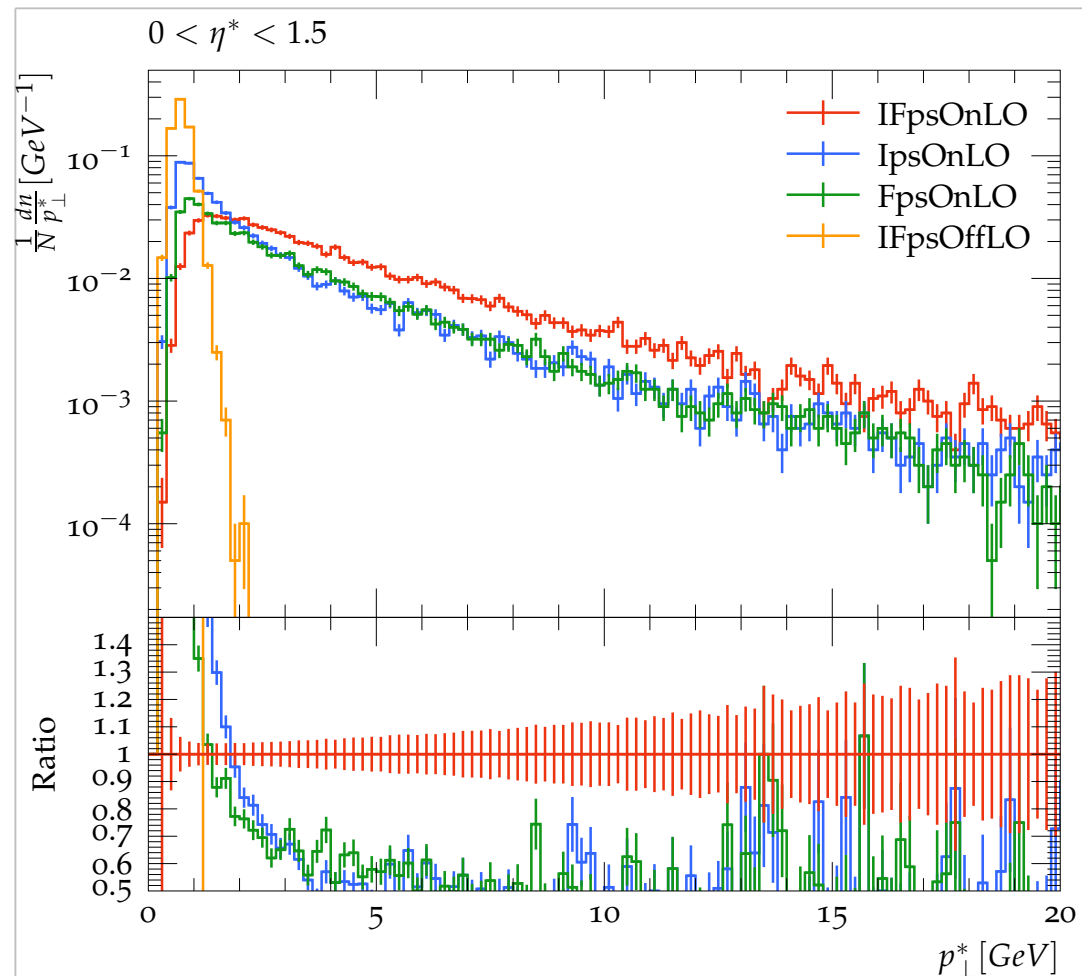
# Part II Simulation

## Validation of intrinsic kt by using Pythia



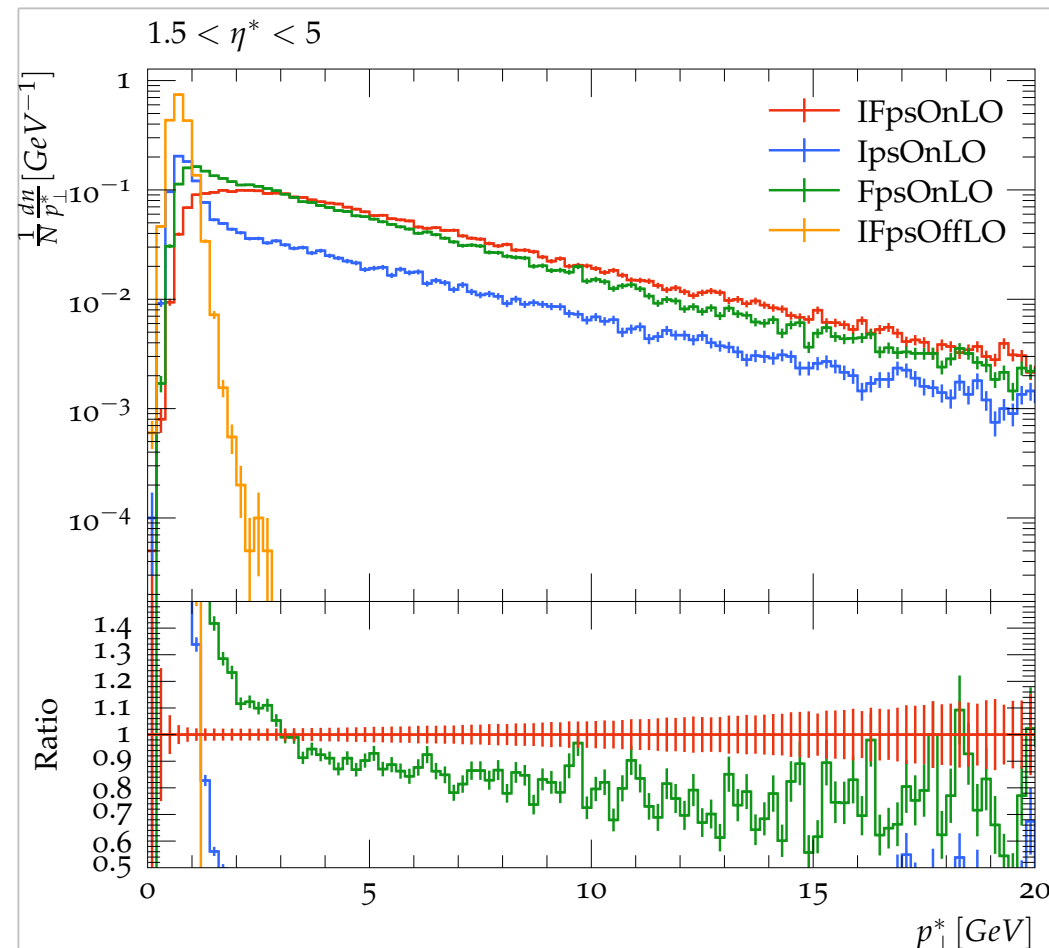
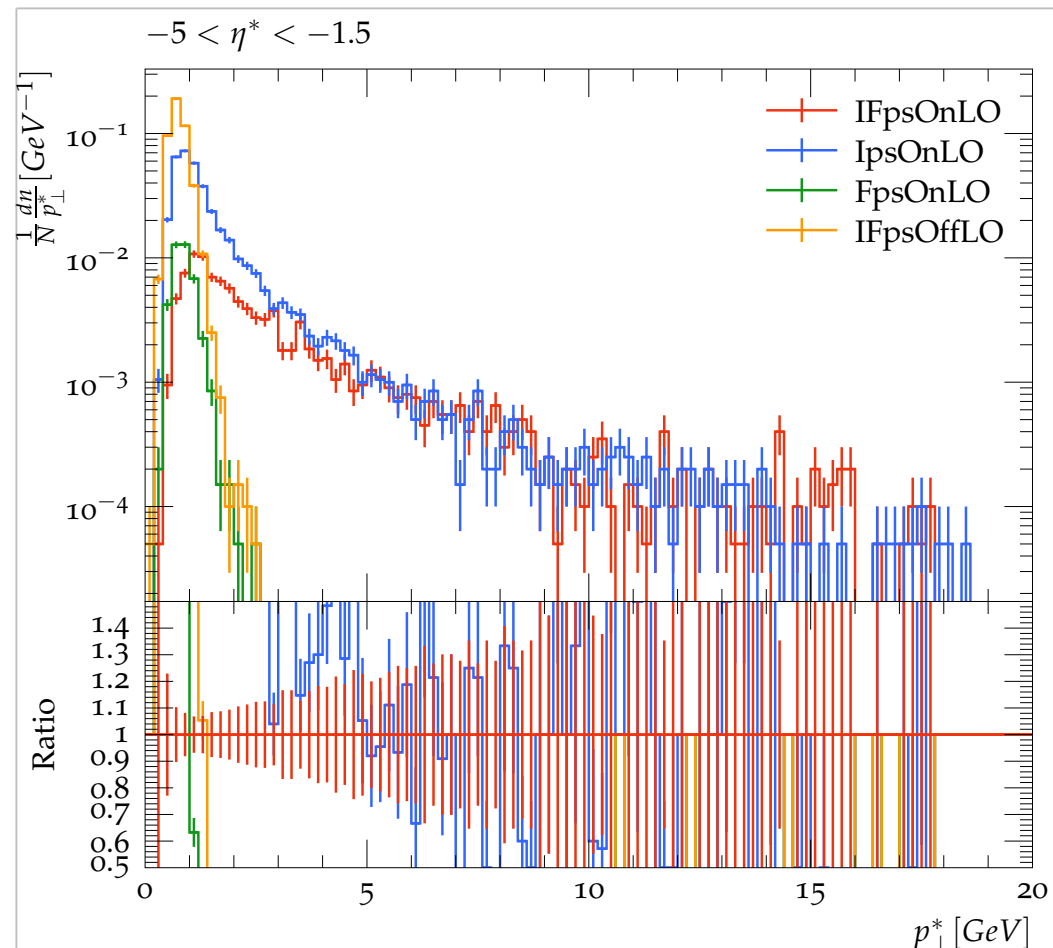
# Part II Simulation

## A Higher Resolution by using Rapgag



# Part II Simulation

## A Higher Resolution by using Rapgag



## Part III Conclusion

**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**

# Thank you for your attention