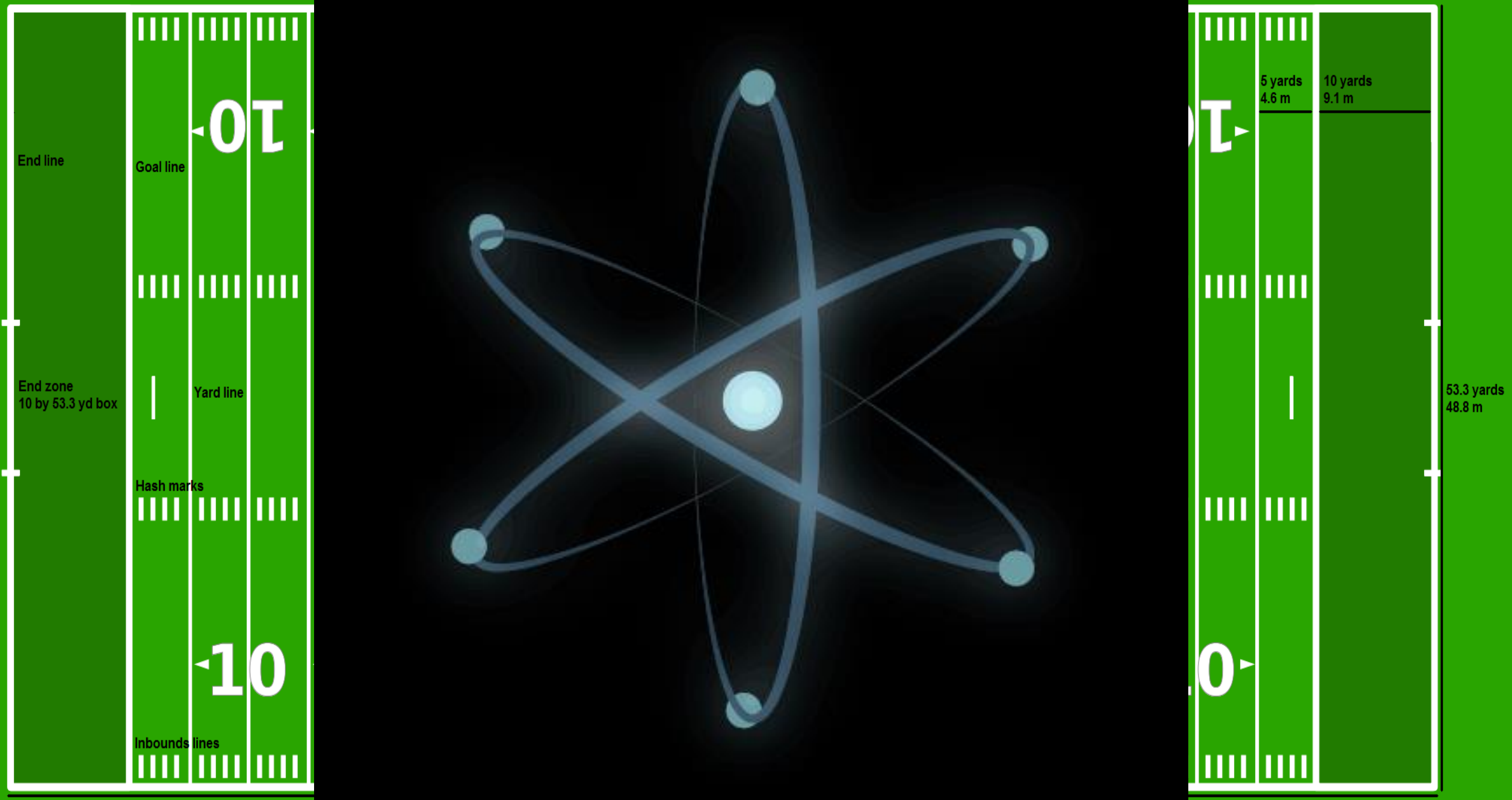
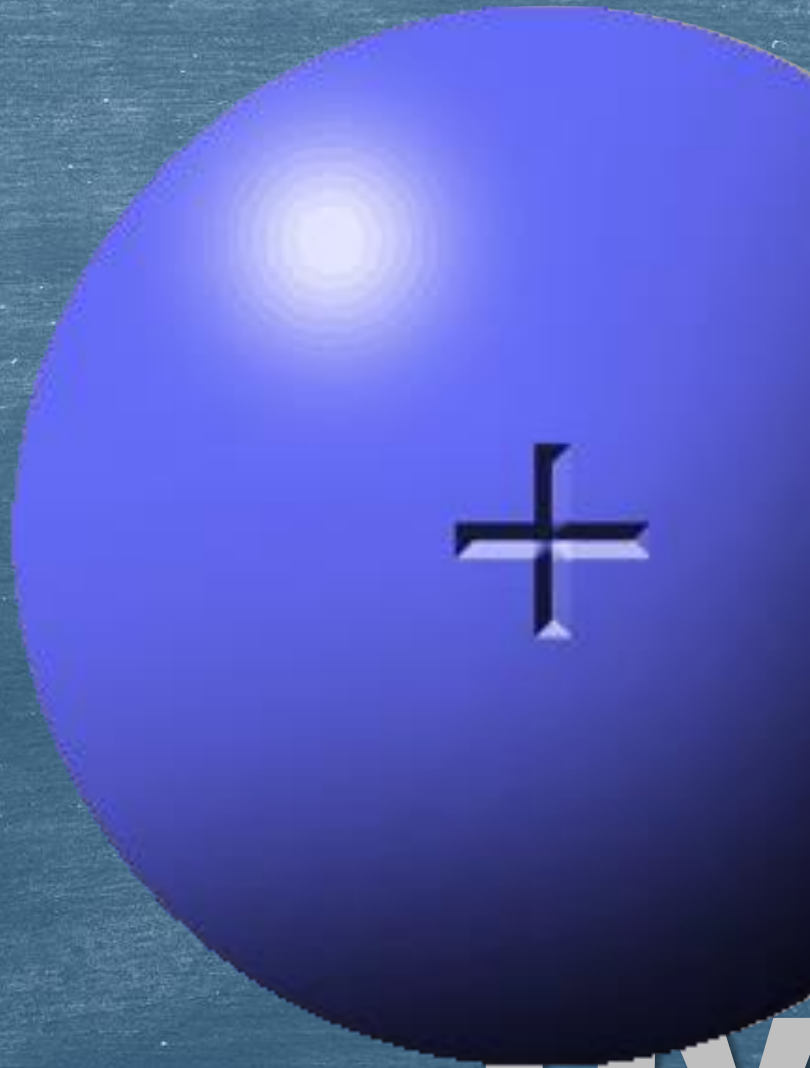
Dannie Griggs

Towards Solving the Mysteries of Pion and Kaon Mass


Mass.


End line
Goal line
10
End zone
10 by 53.3 yd box
Yard line
Hash marks
10
Inbounds lines
5 yards
4.6 m
10 yards
9.1 m
53.3 yards
48.8 m

Jefferson Lab
Thomas Jefferson National Accelerator Facility



QC

ntum

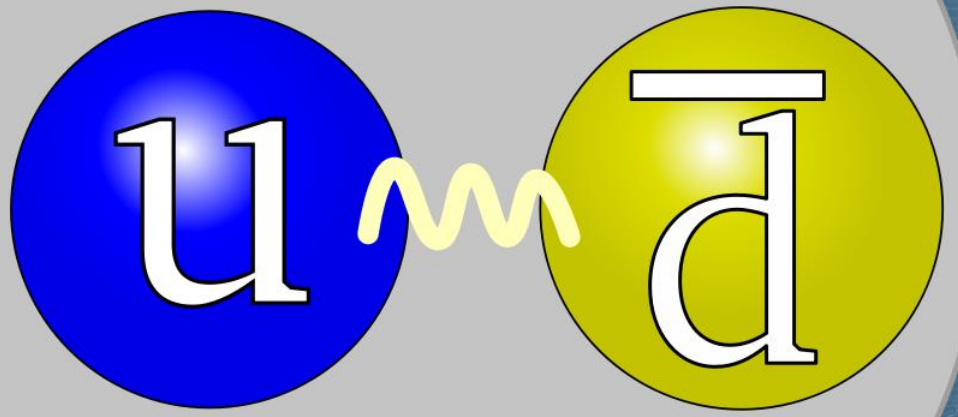
romo

Baryo Dynamics

Jefferson Lab
Thomas Jefferson National Accelerator Facility

#1

Pion



Meson

QC

QuDantum

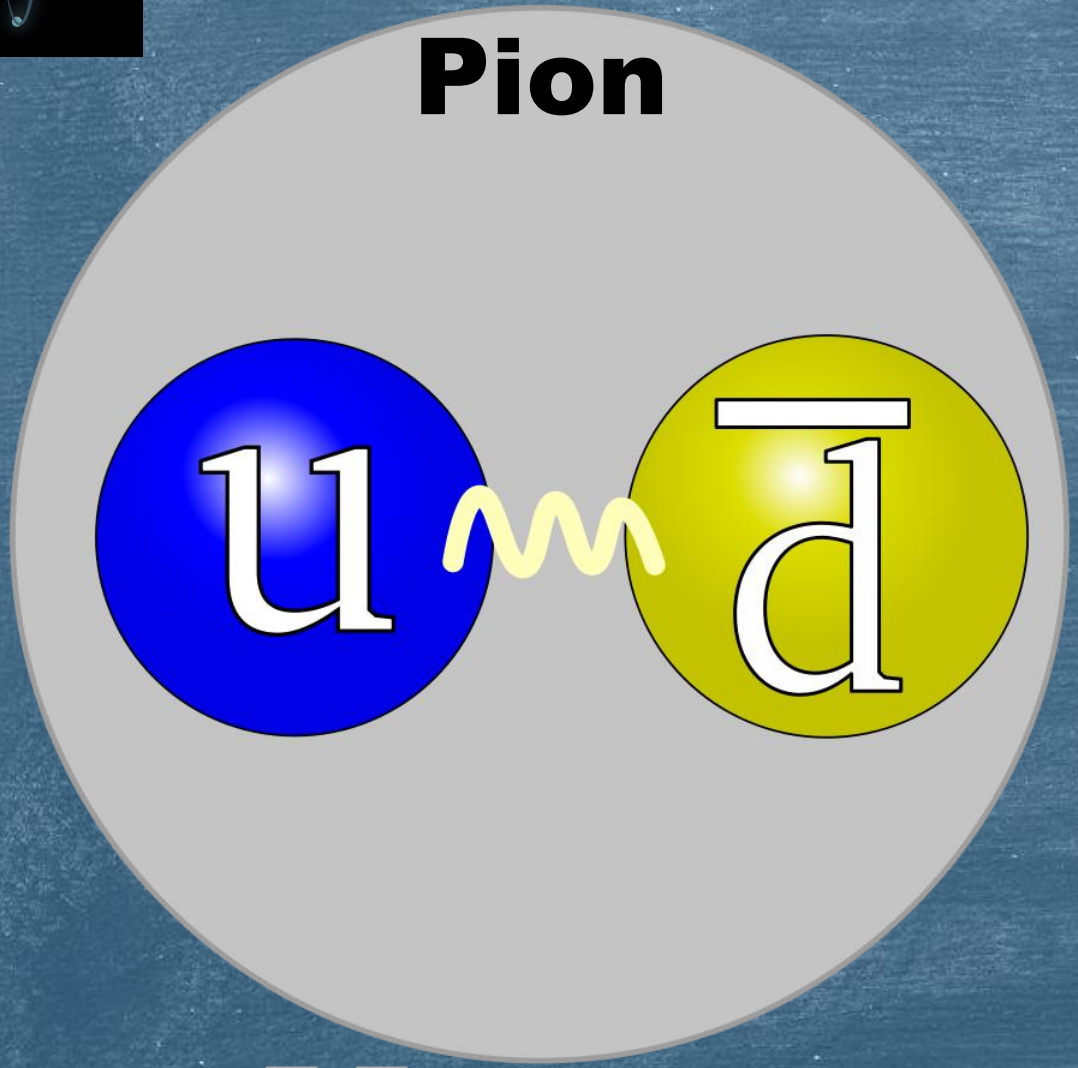
Chromo

Dynamics

Jefferson Lab
Thomas Jefferson National Accelerator Facility

#2

Pion



Meson

QCD

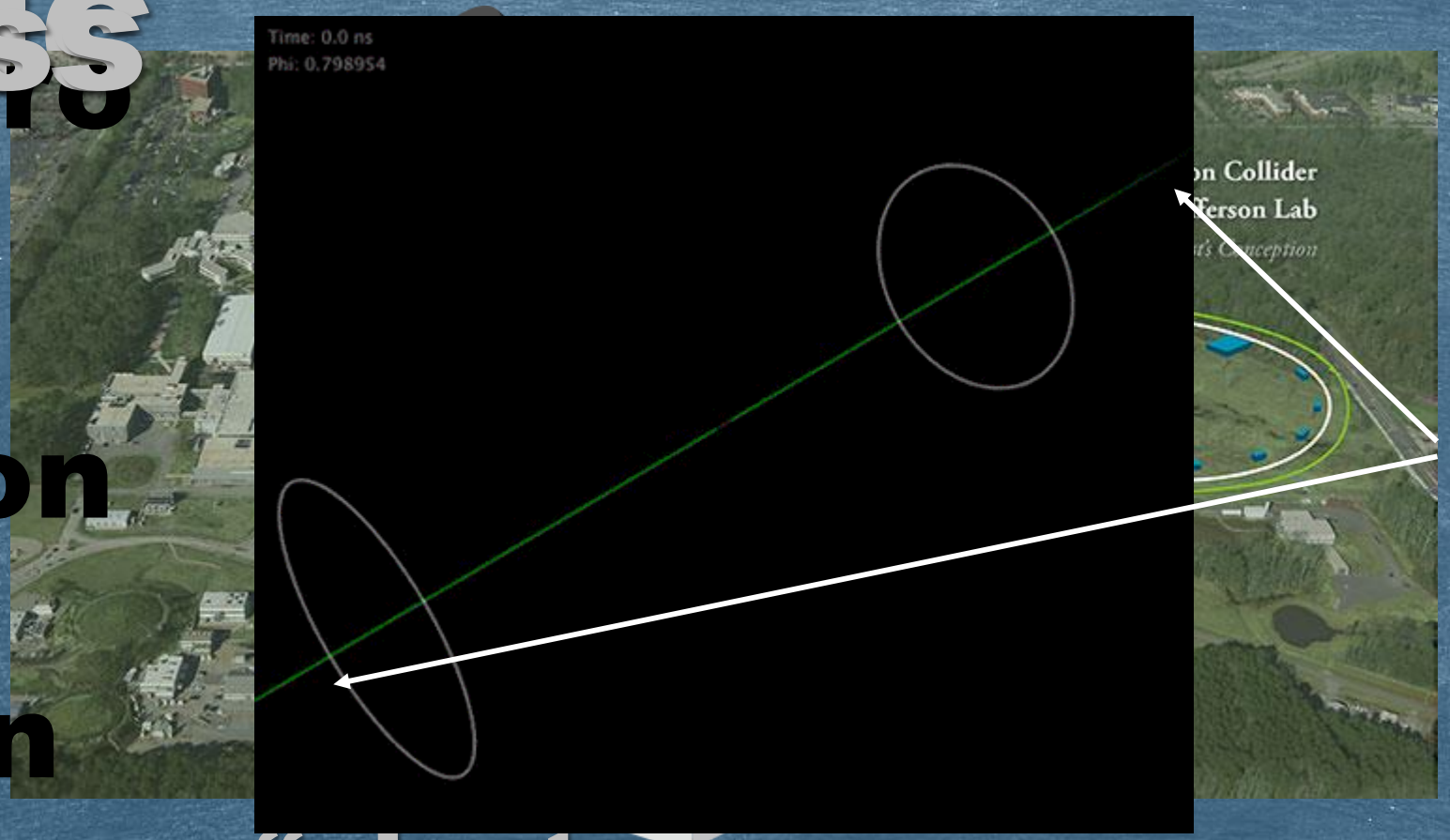
- Goldstone boson -- should be massless
- Measured mass< mass of constituent quarks

98% of <u>ALL</u> matter comes from interaction between quarks and massless gluons

Process Behind Probing Mass

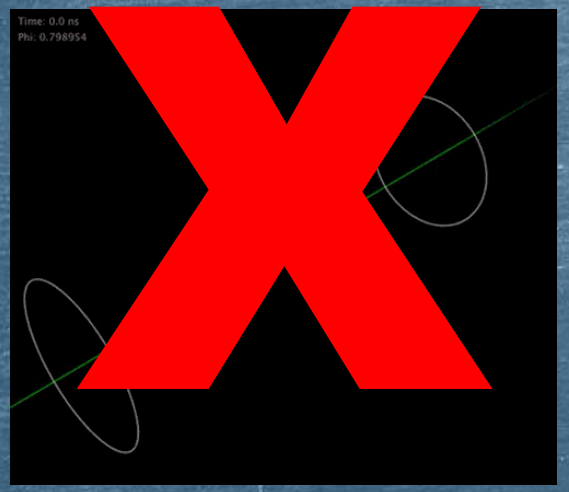
Electro
n
+
Proton

Pion
+
Neutro



"giant microscope"

My Role



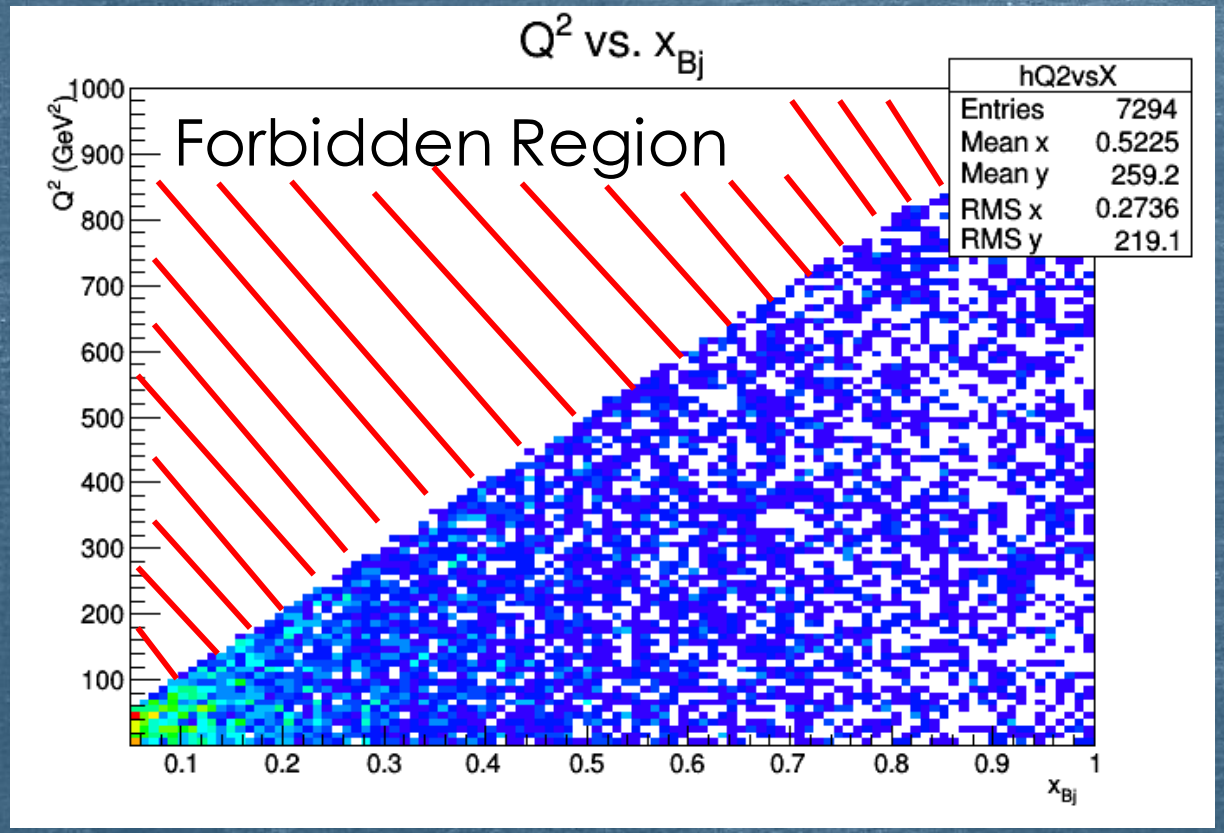
e+p=π +n

- Monte Carlo Simulation
  - Input given values (proton+ electron beam)
  - Random numbers are generated
  - Kinematic quantities calculated
  - The events that fall outside range
  - Graph Data

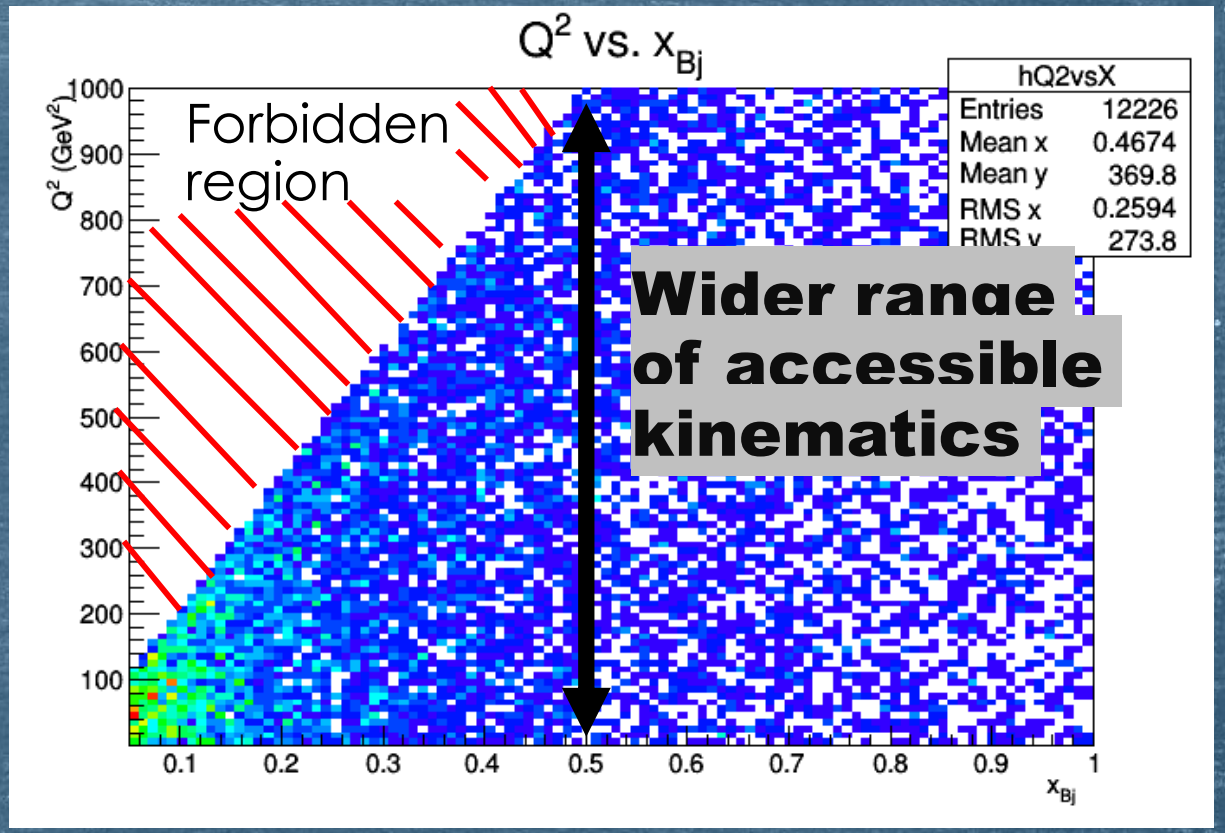
Variables

- X_{bj} = fractional momentum carried by the partons
- Q^2 = Energy (GeV)
- F2k/F2n= structure function
  - Mass is calculated from this
- i=cuts made on X_{bj}
- t_{pi} = 4-momentum transfer

Initial Feasibility

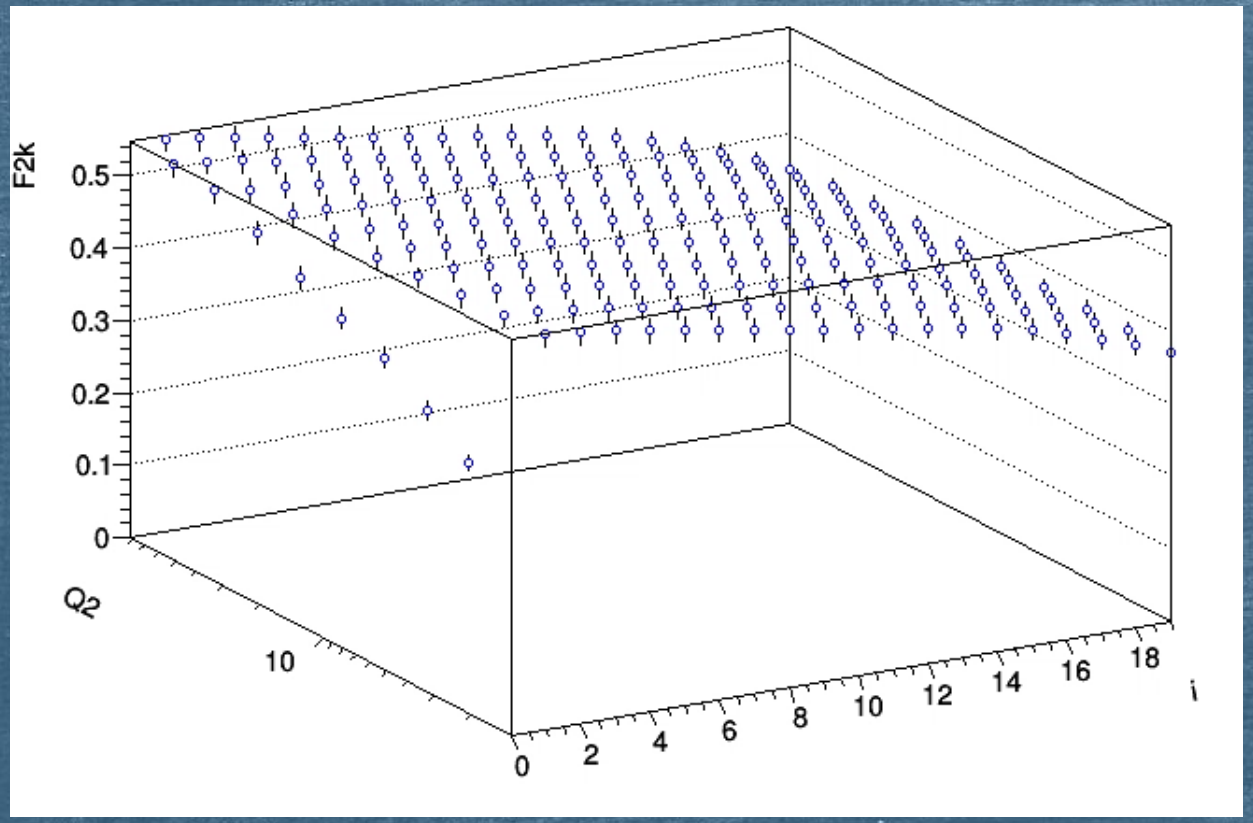


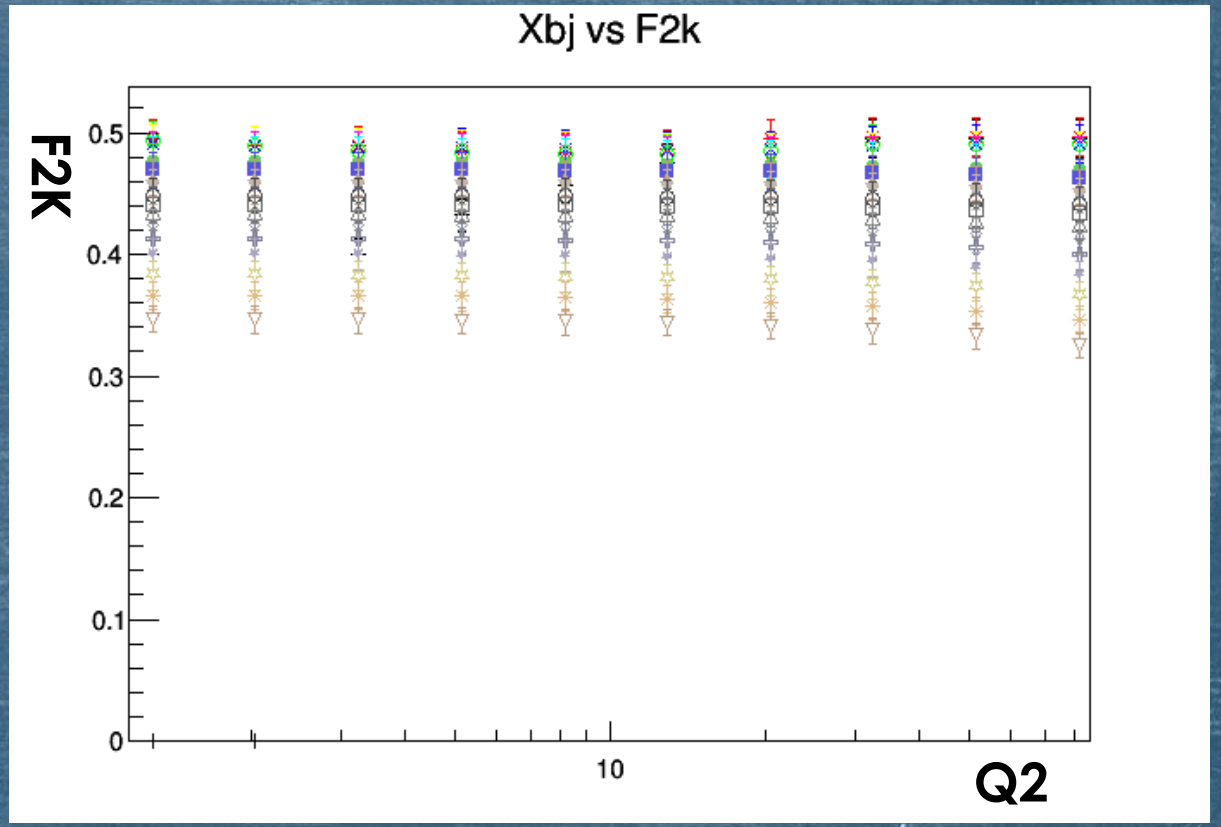
Proton beam: 50 GeV/c
Electron beam: 5 GeV/c



Proton beam: 100 GeV/c
Electron beam: 5 GeV/c

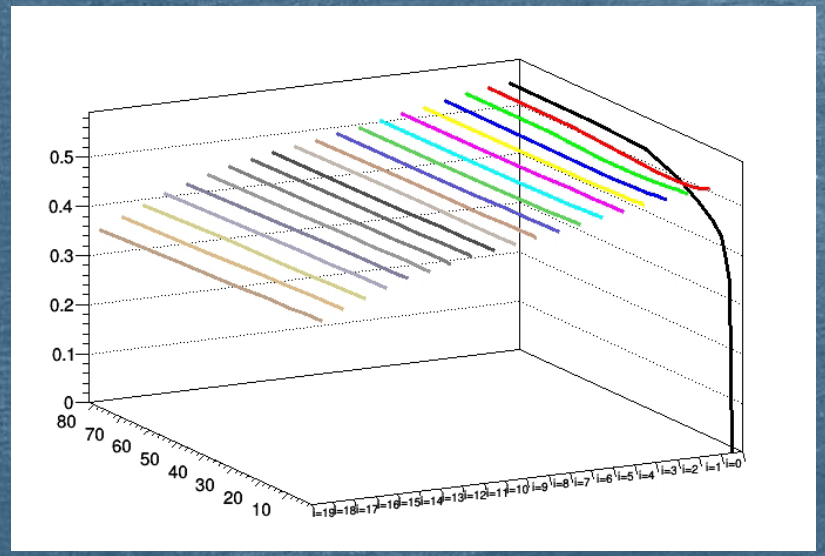
Feasibility Studies



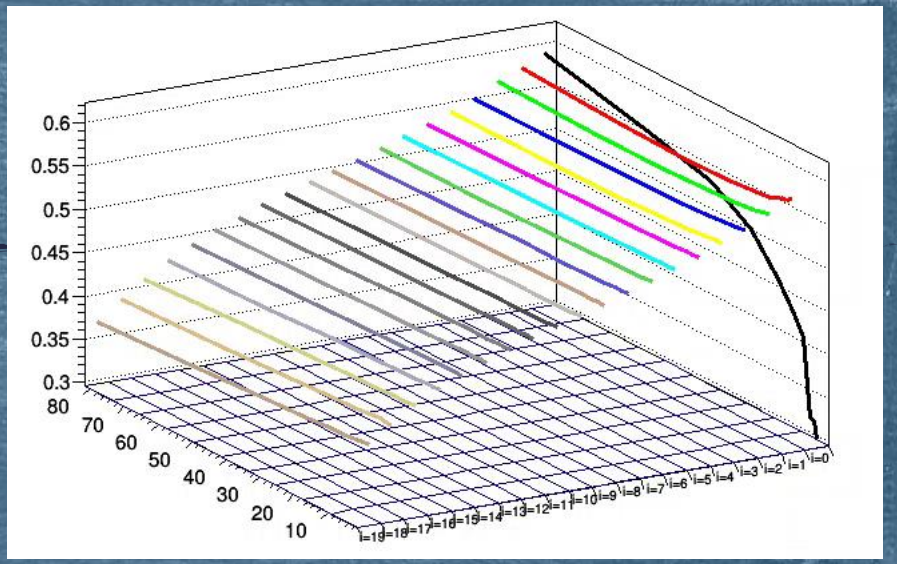


*Simulated running the experiment for a year

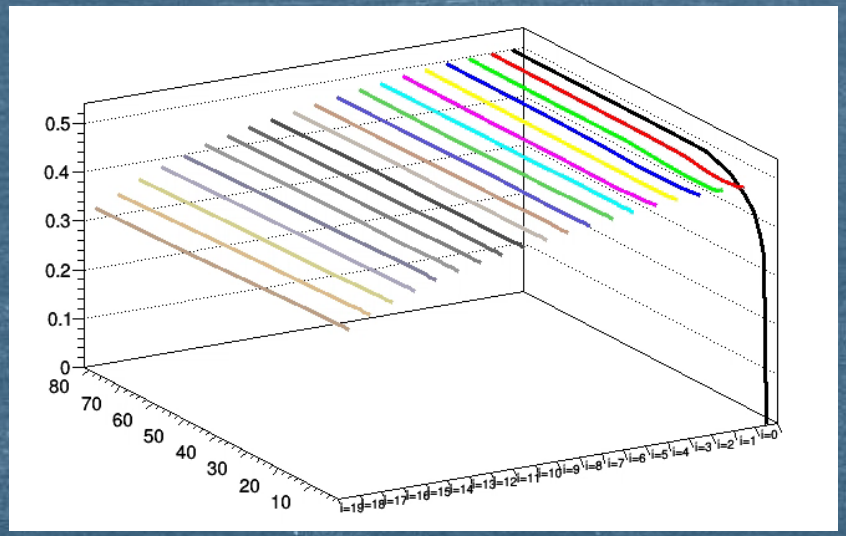
Kinematics



Proton beam: 100 GeV/c
Electron beam: 10 GeV/c

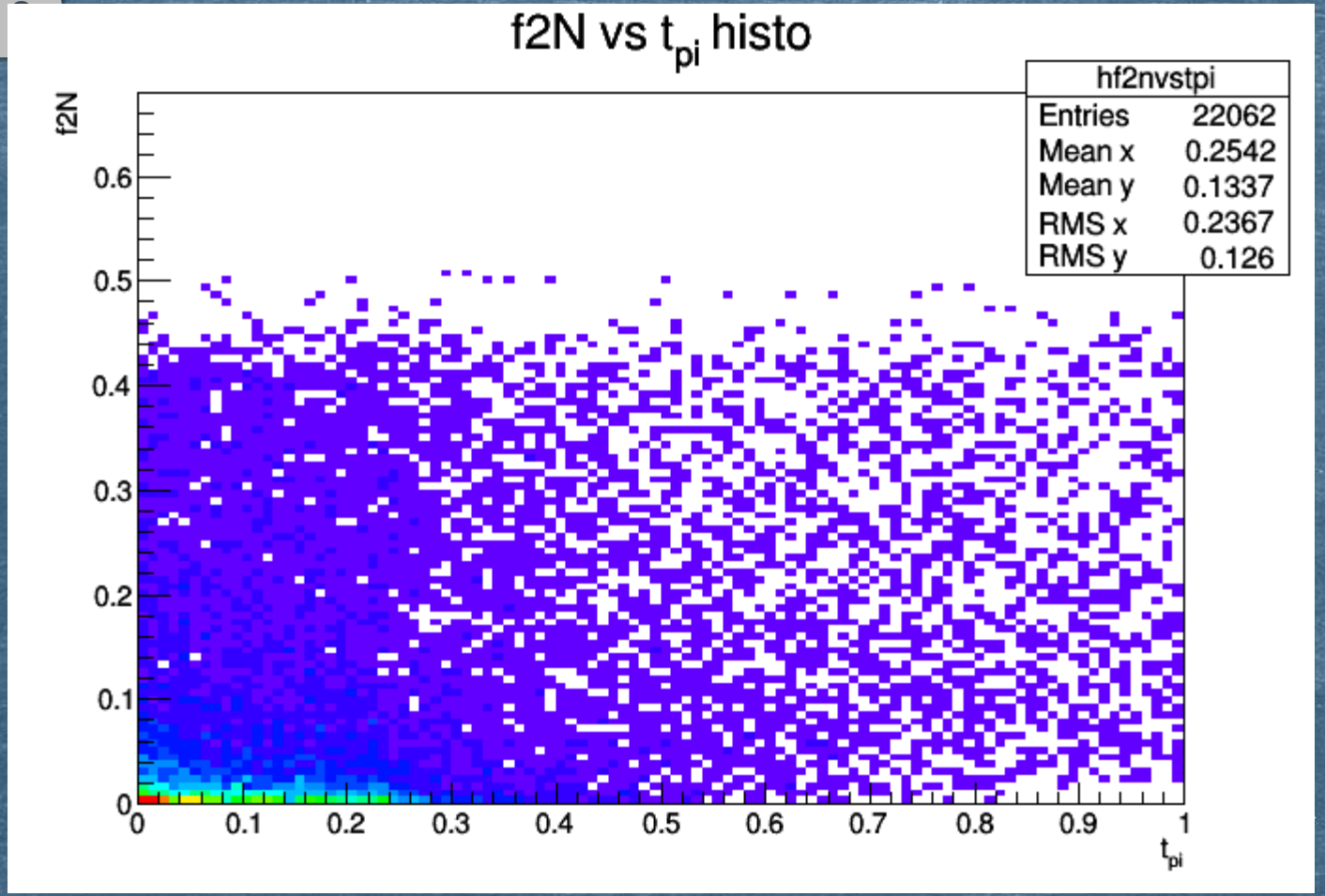


Proton beam: 100 GeV/c
Electron beam: 50 GeV/c

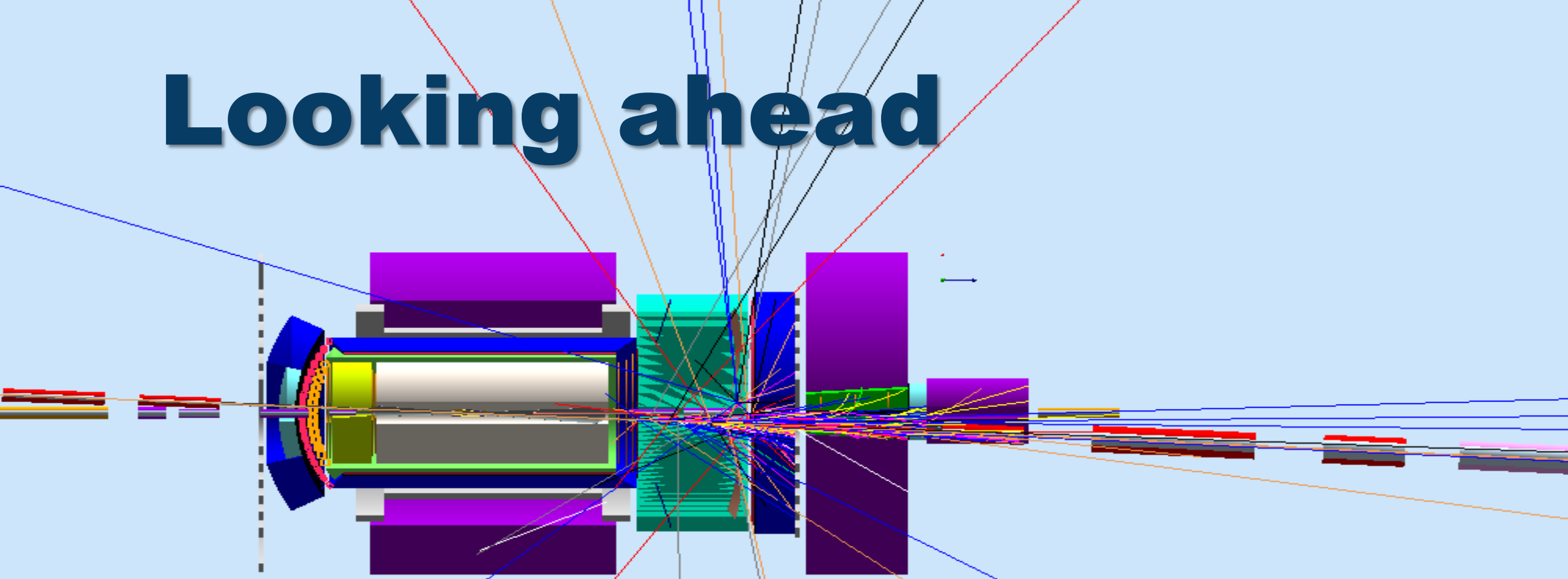


Proton beam: 100 GeV/c
Electron beam: 5 GeV/c

Confirmation of Virtual Pion



Looking ahead



- Complete study of virtual pion
- Determine more accuracy efficiency of detector
  - Currently assume 50%
- Optimization of detector design

- Run simulations for Kaons

THANKS

Dr. Horn
Marco
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Andres
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Salim
Casey