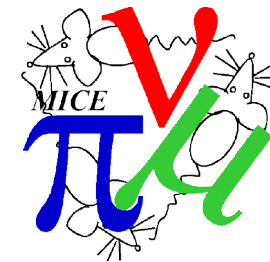


# Diffuser Analysis

## Work In Progress

**M. A. Uchida**

# Last Time..

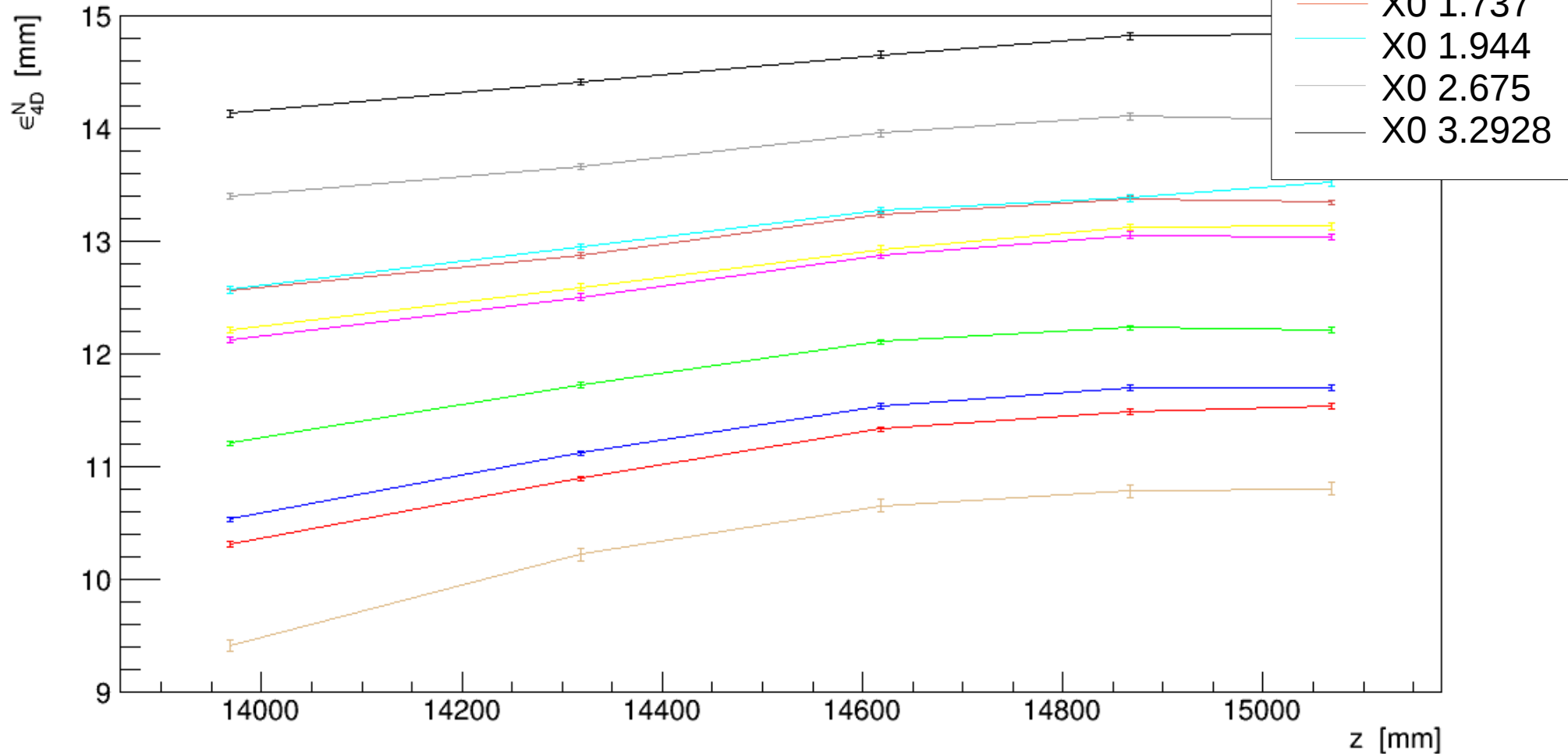


- Looked at 240 and 170MeV runs
  - Emittance
  - Alpha
  - Beta
- But no cuts implemented
- Needed proper pz binning

# Recap 240 MeV Emittance

## No Beam Selection or Momentum Binning

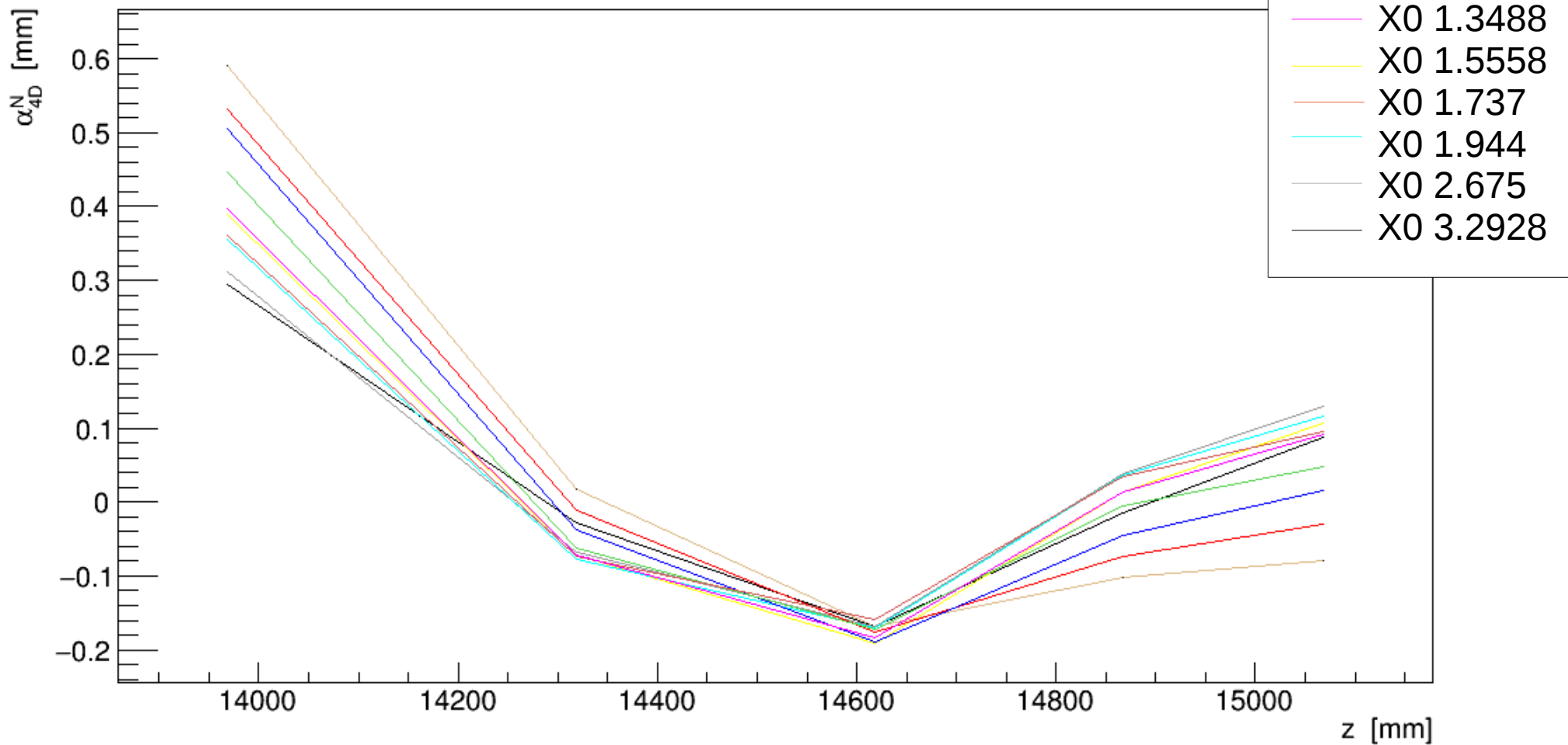
Reconstructed Normalised 4D Emittance



# Recap 240 MeV Alpha – No Beam Selection or Momentum Binning



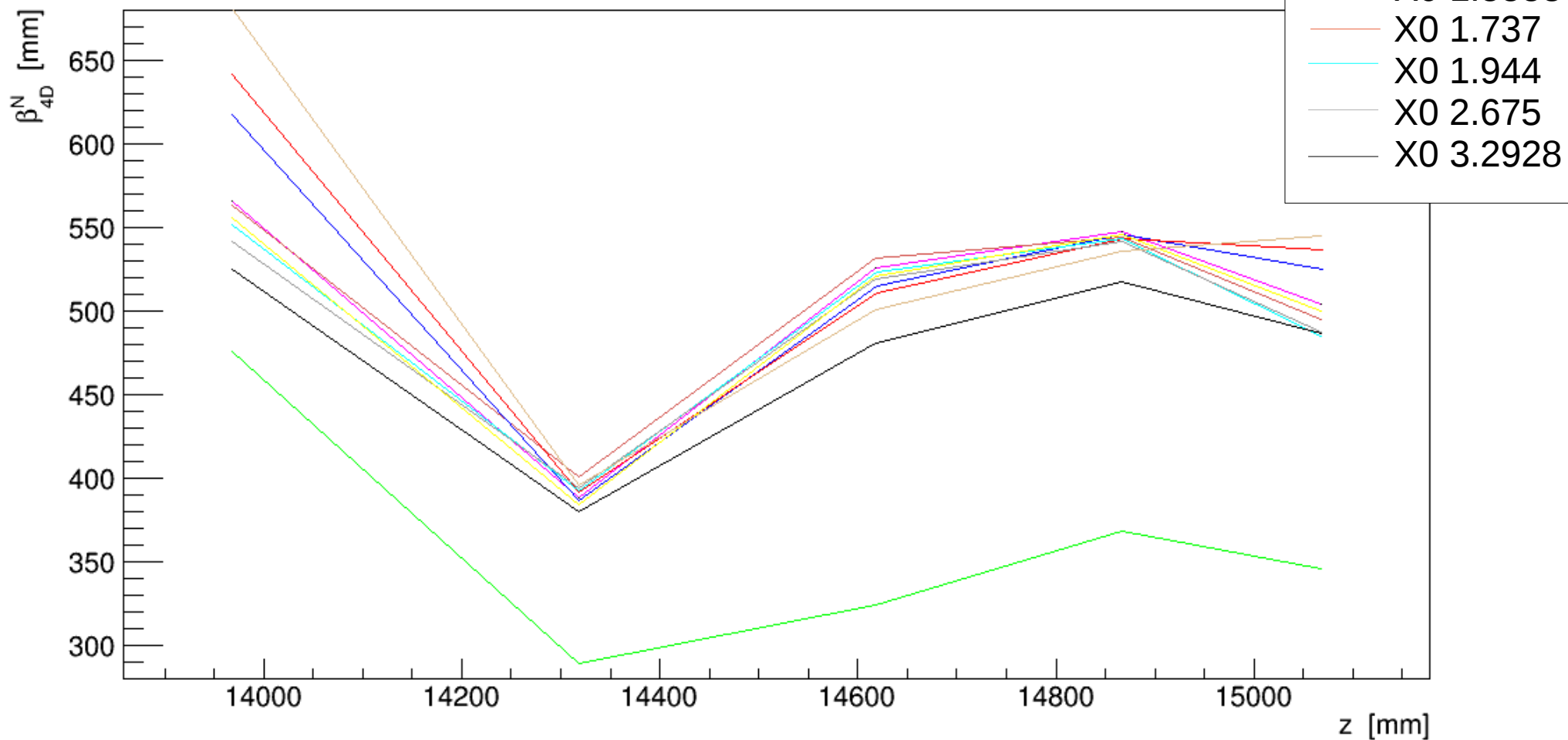
Reconstructed Normalised 4D Alpha



# Recap 240 MeV Beta – No Momentum Binning



Reconstructed Normalised 4D Beta

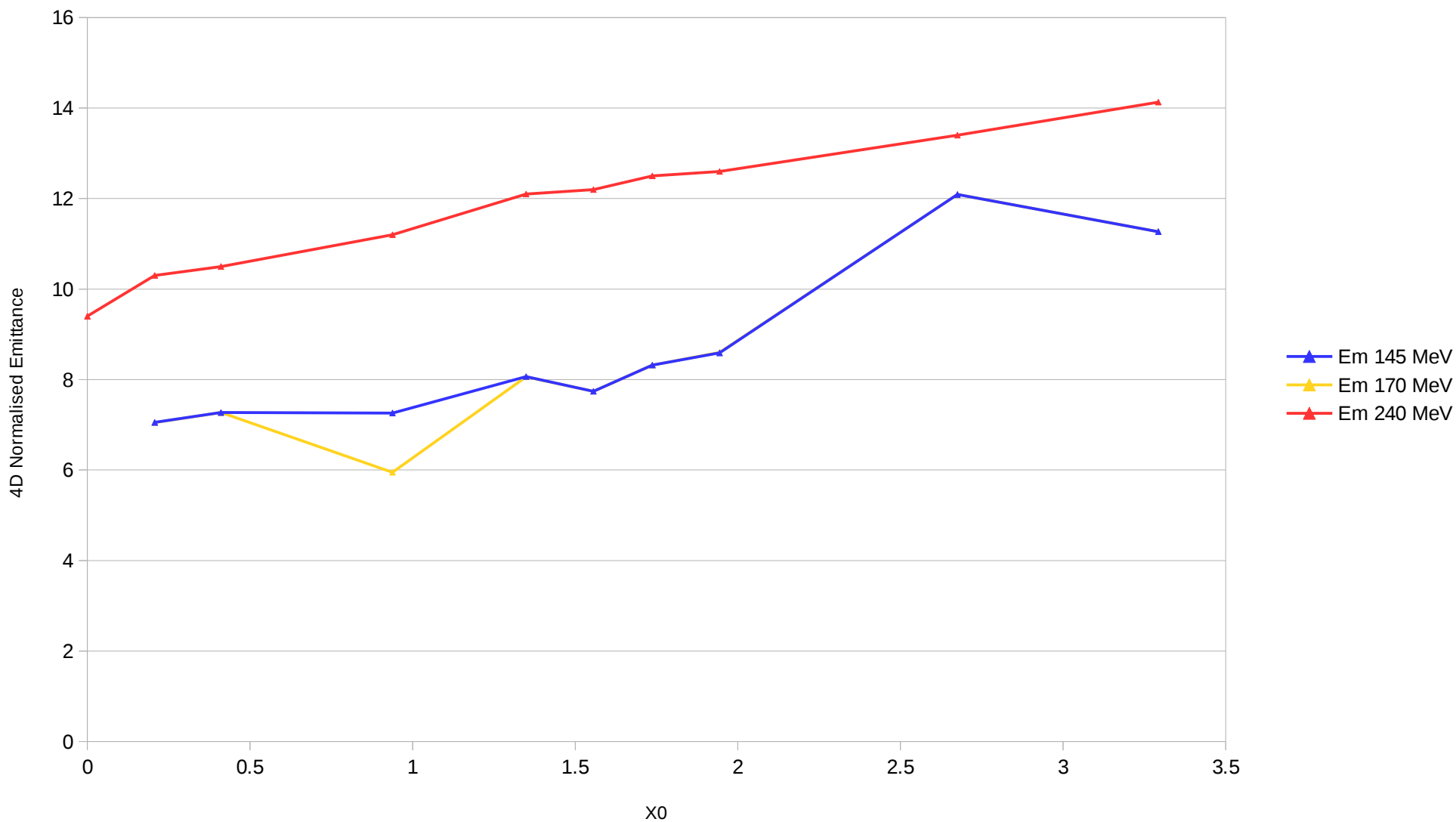


# Recap 4D Emittance at Ref Plane

## No Beam Selection

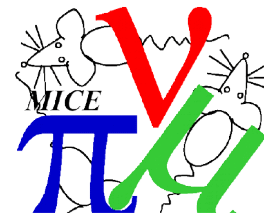


4D Emittance Vs Diffuser X0 At Ref Plane

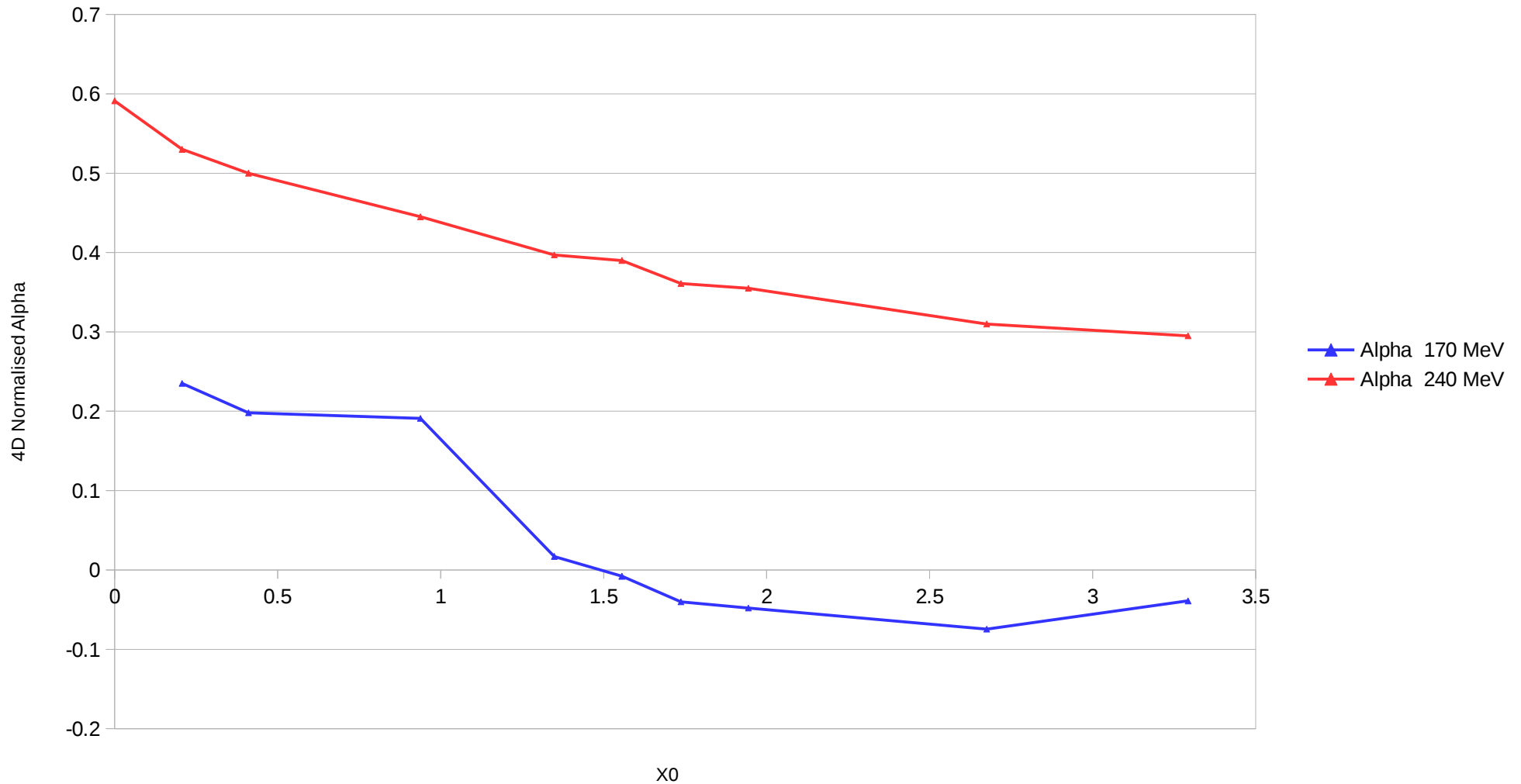


# Recap 4D Alpha at Ref Plane

## No Beam Selection

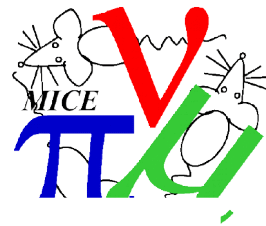


4D Alpha Vs Diffuser X0 At Ref Plane

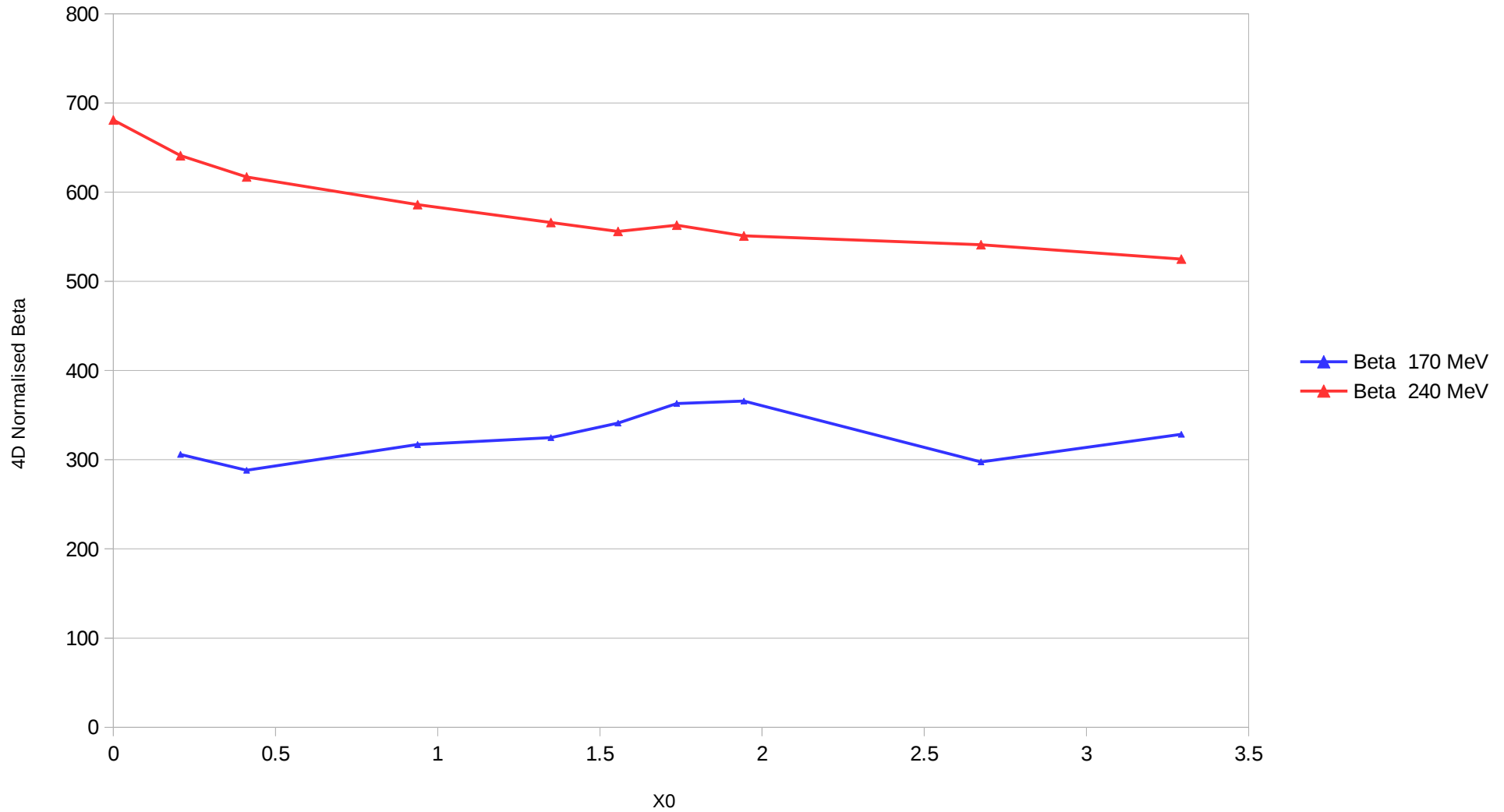


# Recap 4D Beta at Ref Plane

## No Beam Selection

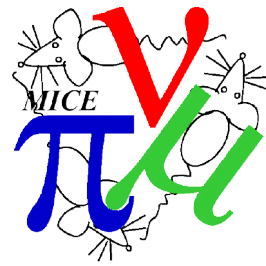


4D Beta Vs Diffuser X0 At Ref Plane



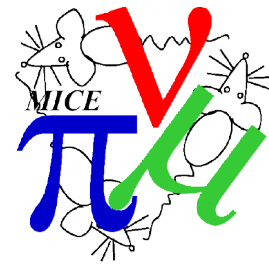


# New: Cuts



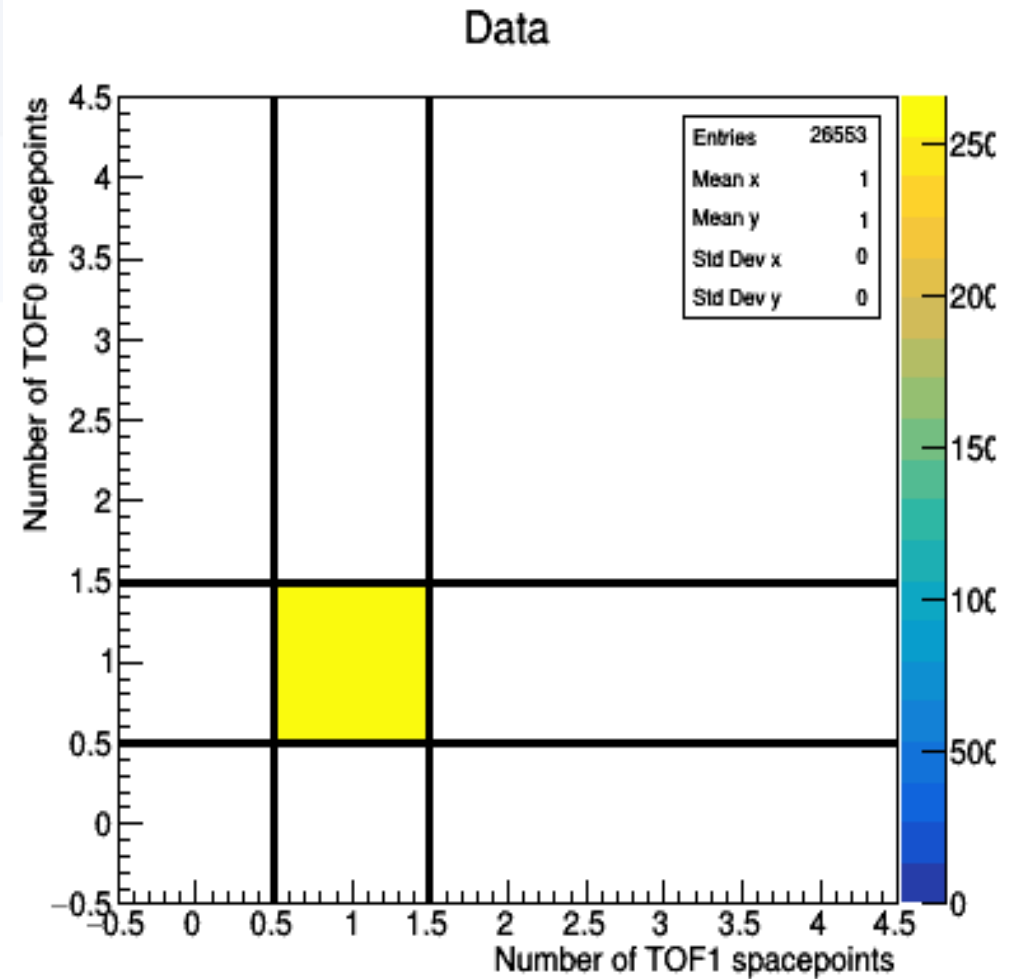
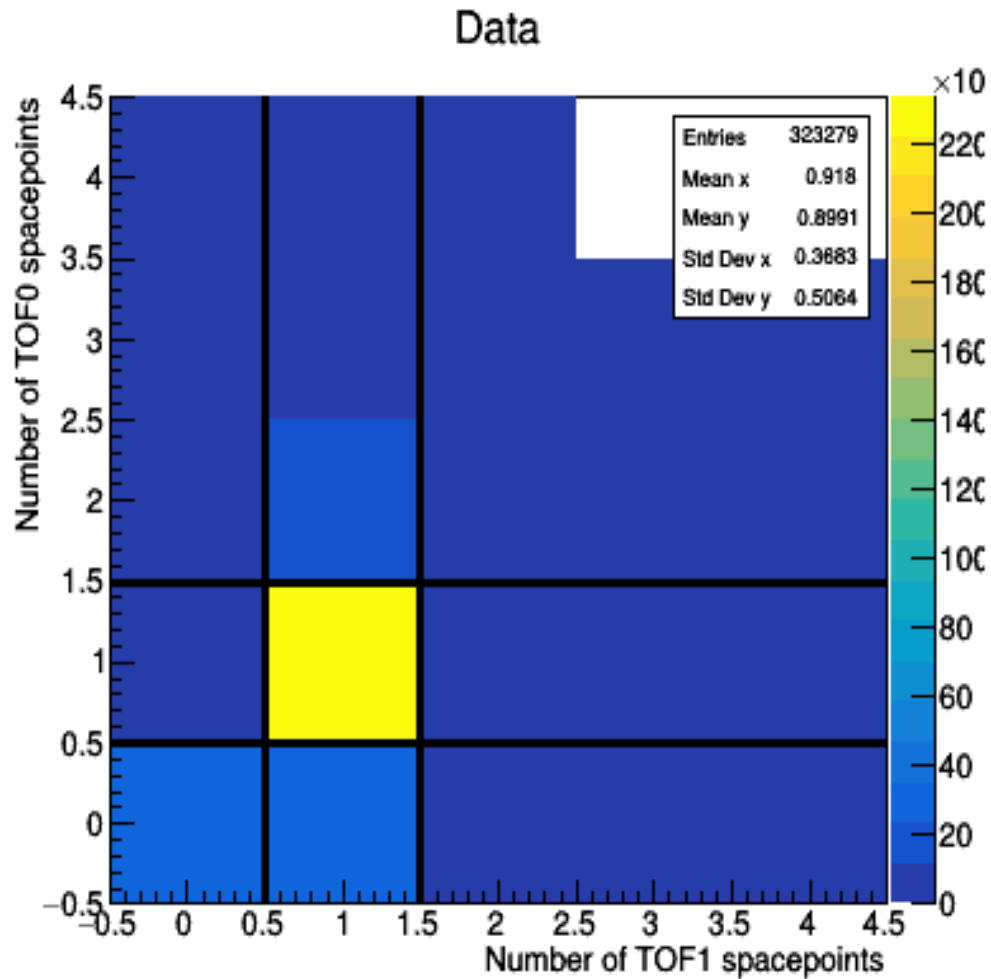
- 1 TOF spacepoint TOF0 and TOF1
  - Time of flight in range 27—33 ns
  - Single reconstructed track with  $\chi^2/N_{\text{DOF}} < 4$
  - Track within fiducial volume (150mm) of tracker
  - One track in TKU
  - Muon Hypothesis
  - (No diffuser cut)
- 
- Comparing All cuts Passed Vs No Cuts passed for each cut.
  - All Plots for Diffuser 2, 240MeV, Run 8497
  - No Cuts = **323279** events, All Cuts = **28,553** events

# TOF SP Cut

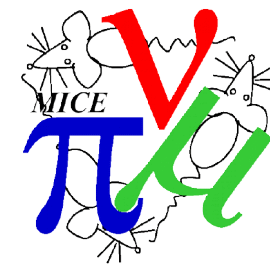


## No Cuts

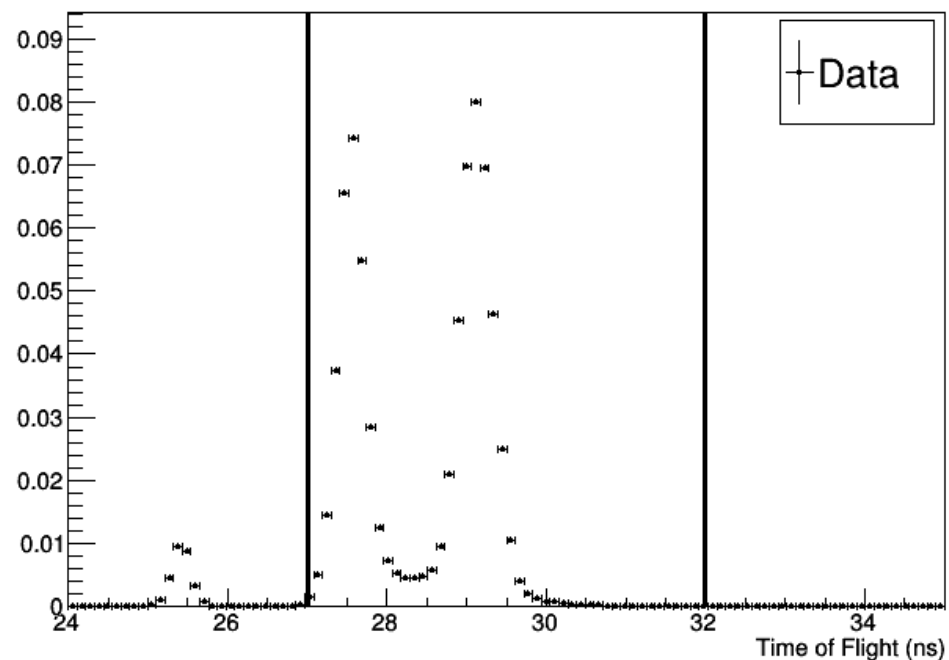
## All Cuts



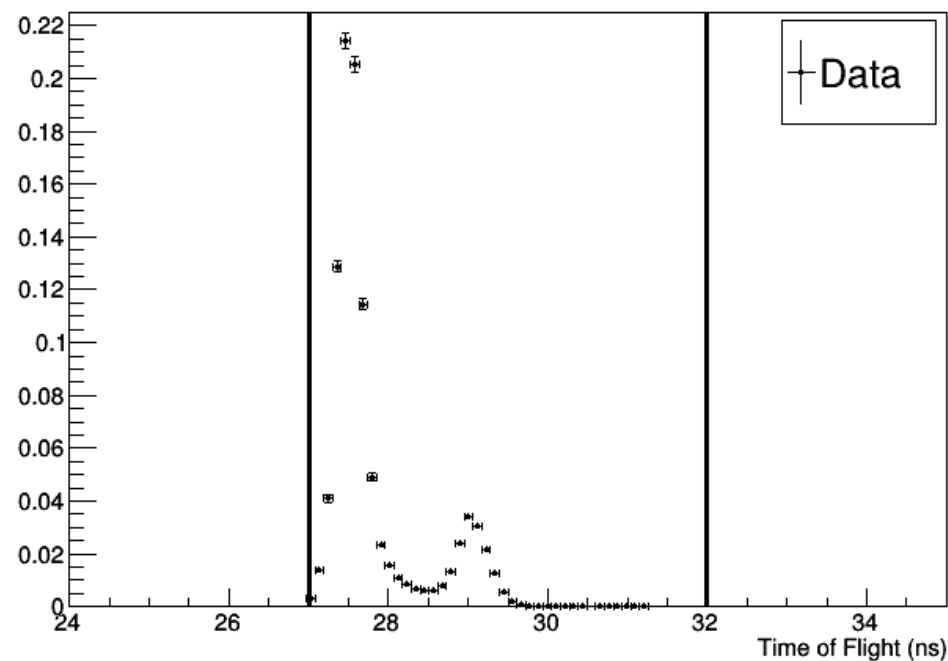
# Time of Flight Cut 27-33ns



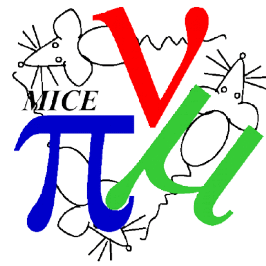
## No Cuts



## All Cuts

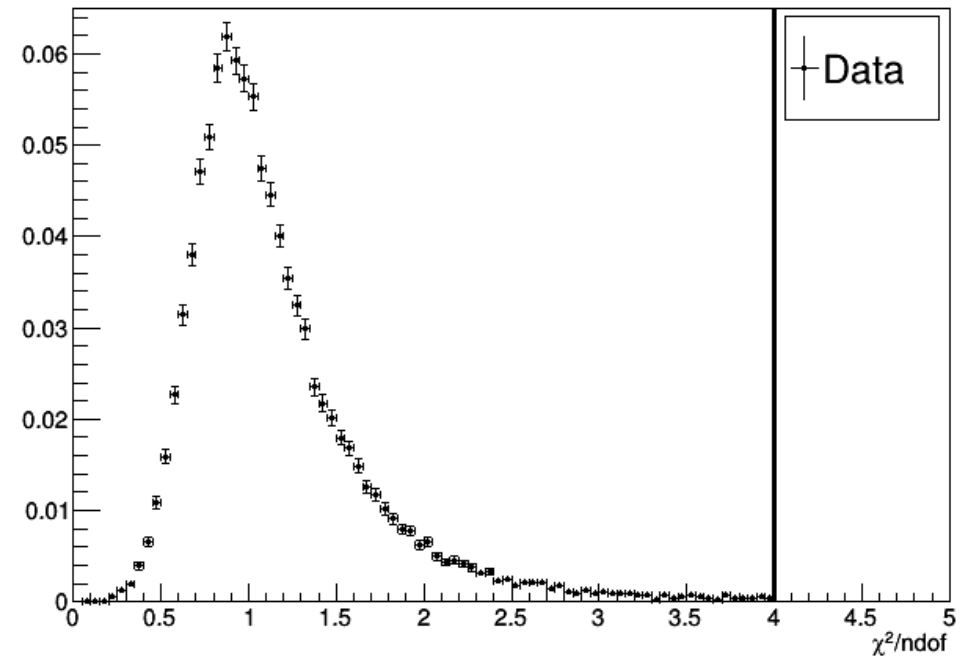
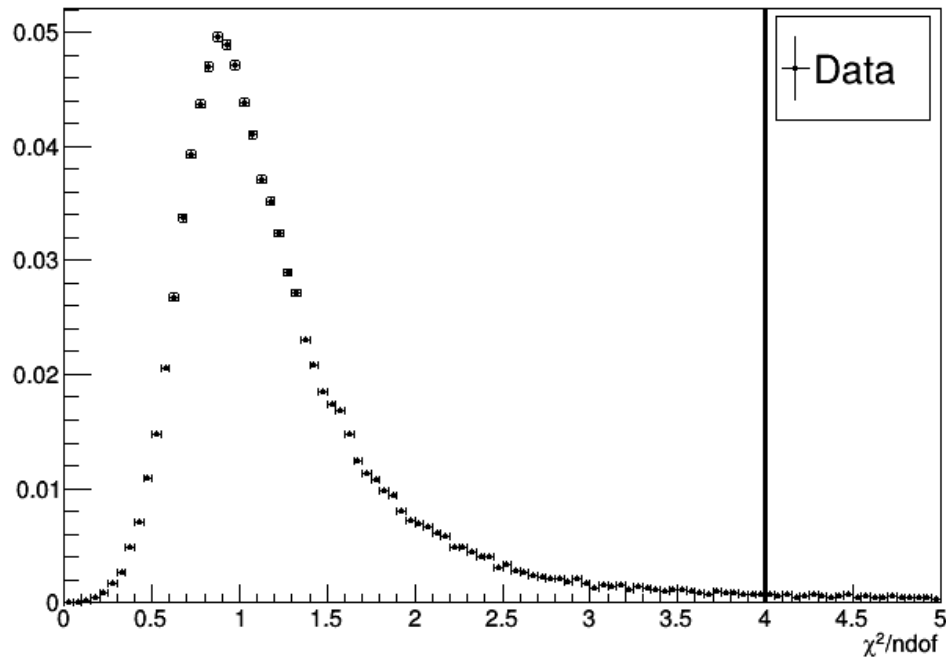


$$\chi^2/N_{\text{DOF}} < 4$$

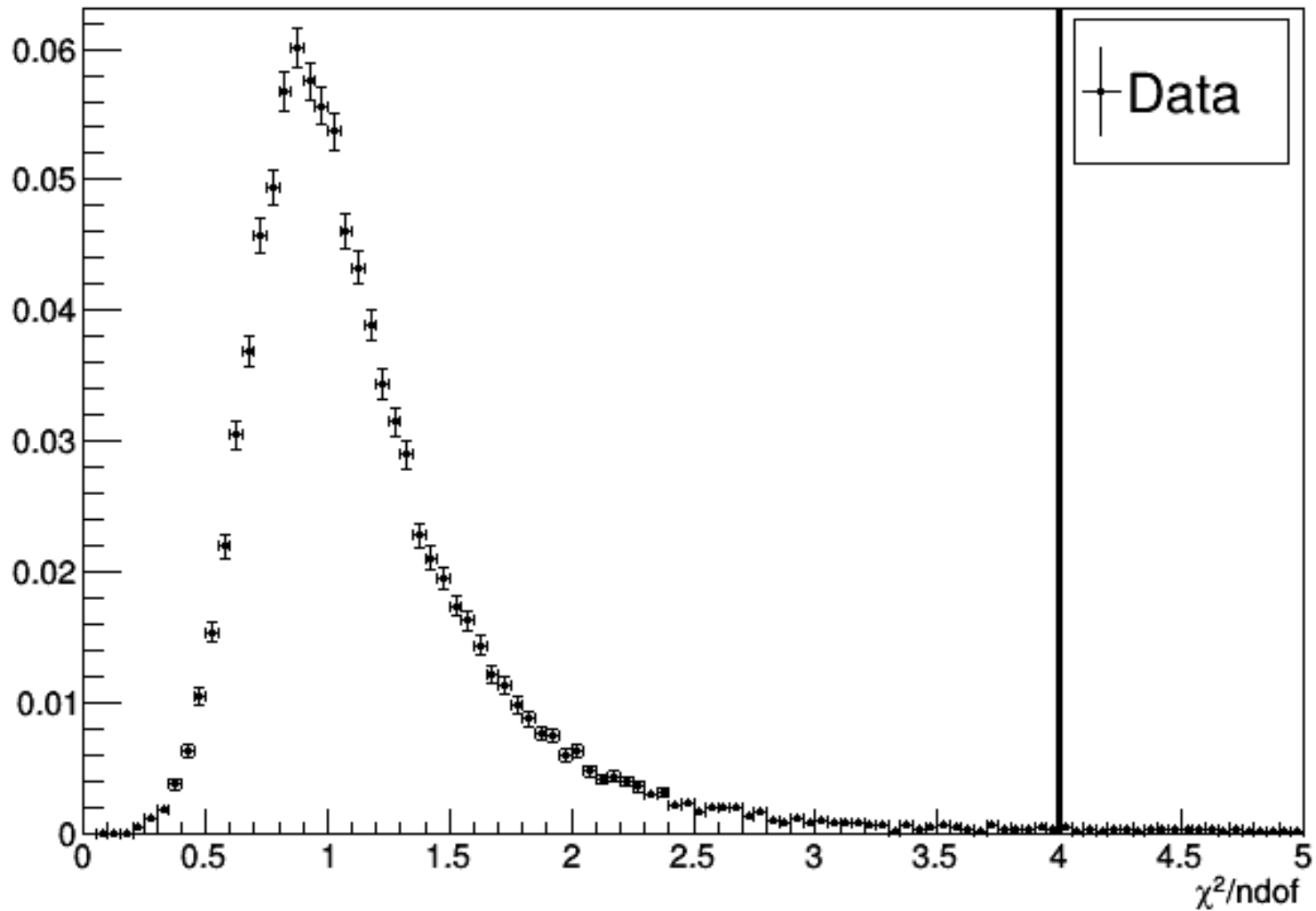
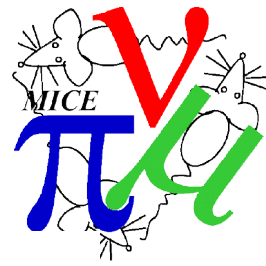


# No Cuts

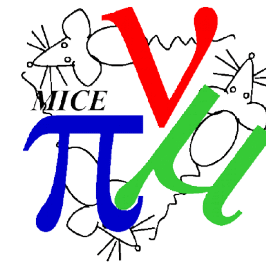
# All Cuts



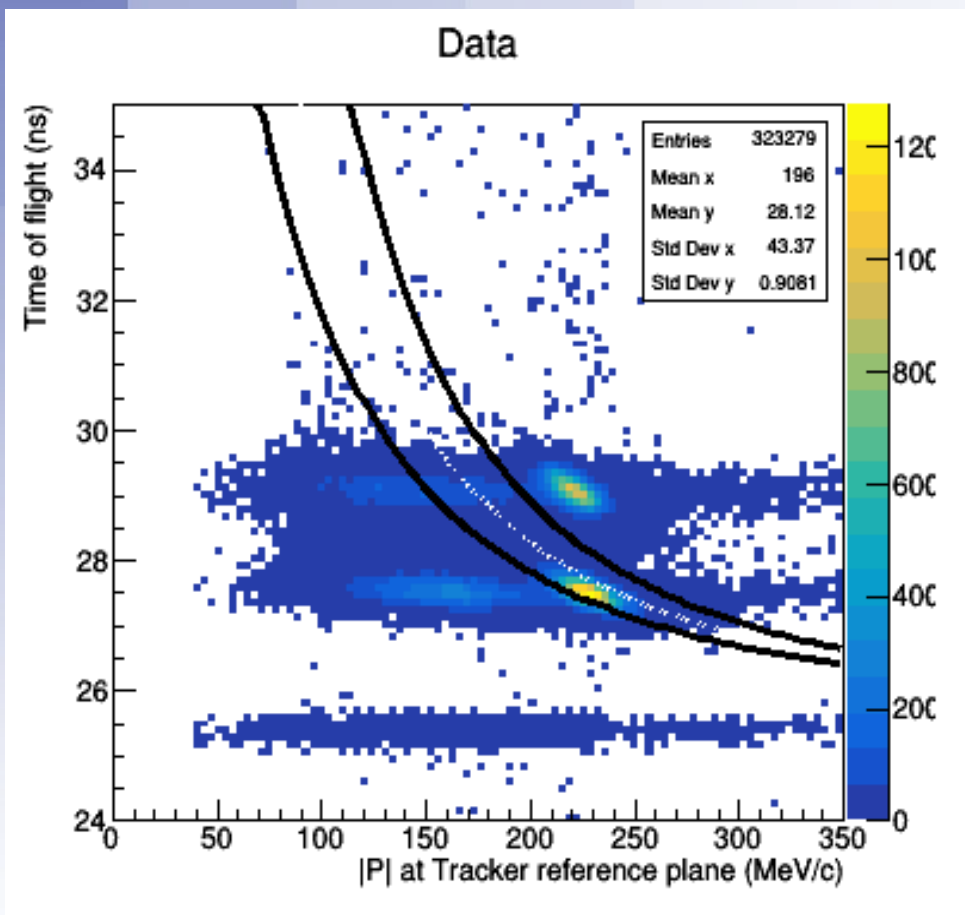
All Except  $\chi^2/N_{\text{DOF}} < 4$



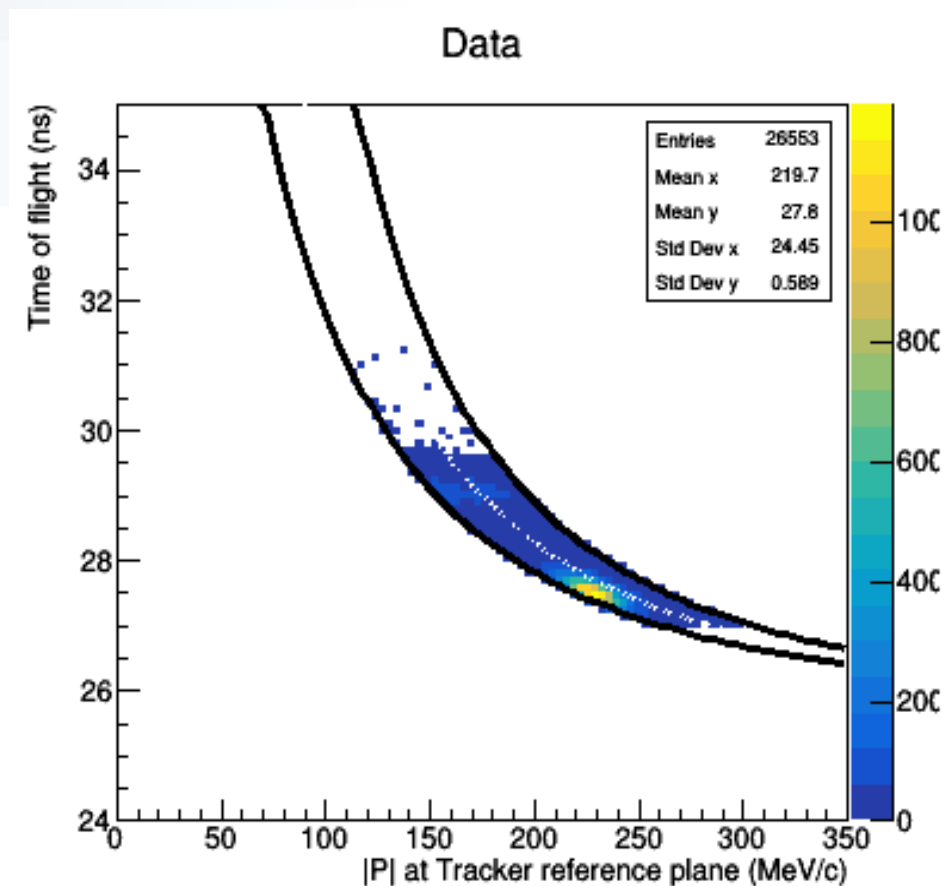
# Muon Hypothesis



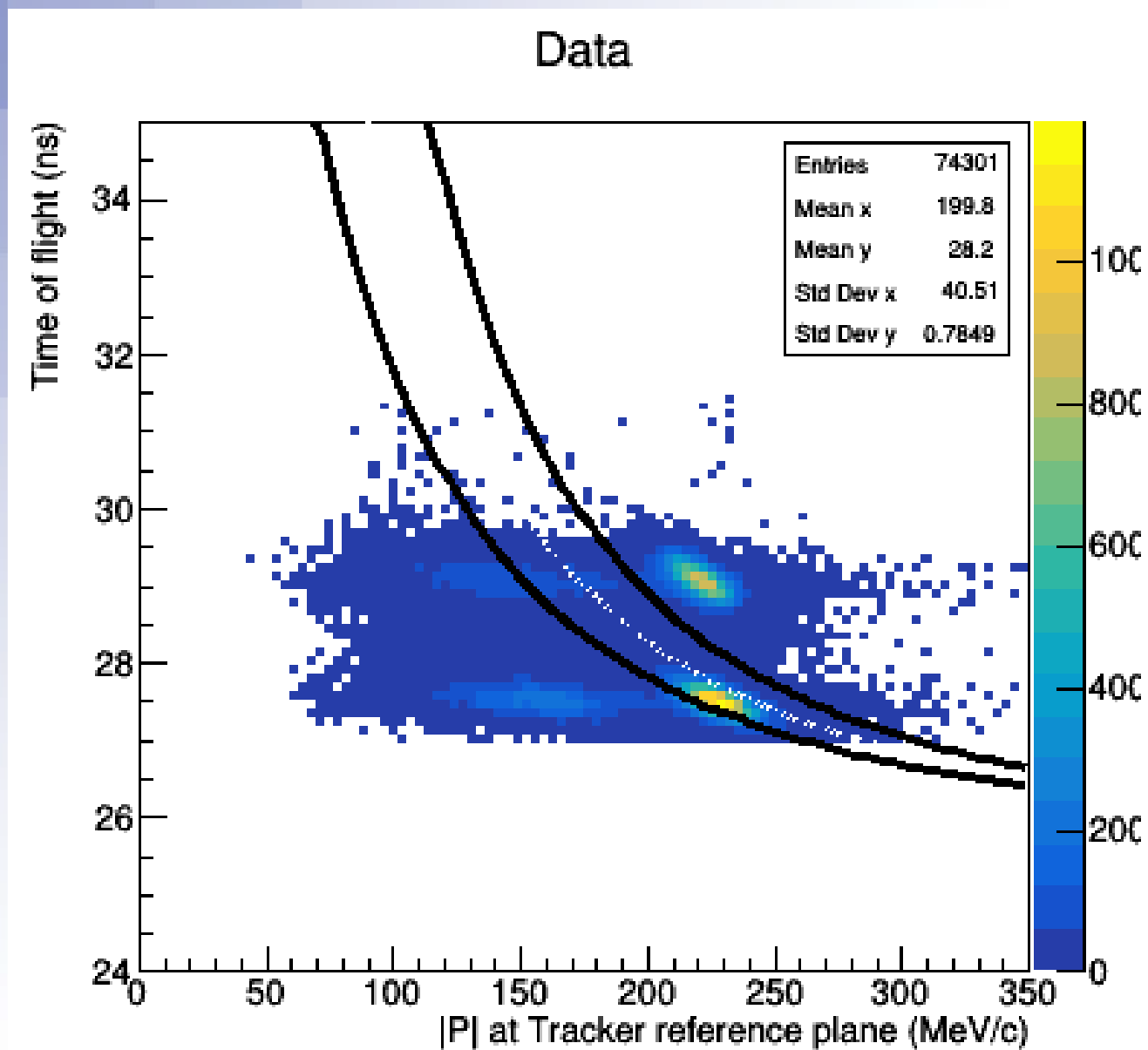
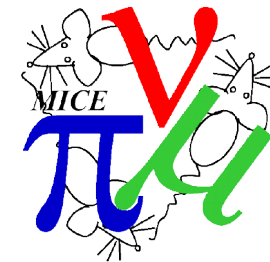
## No Cuts

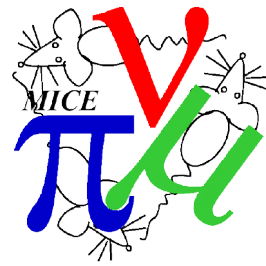


## All Cuts

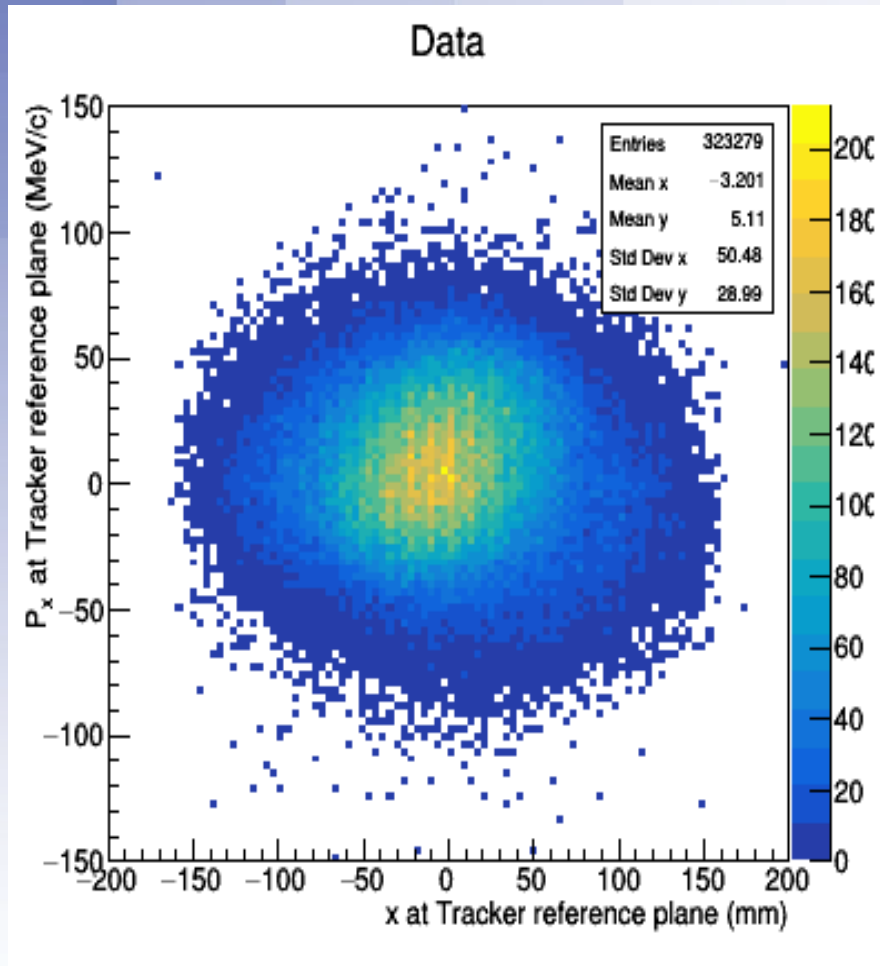


# All Except Muon Hypothesis

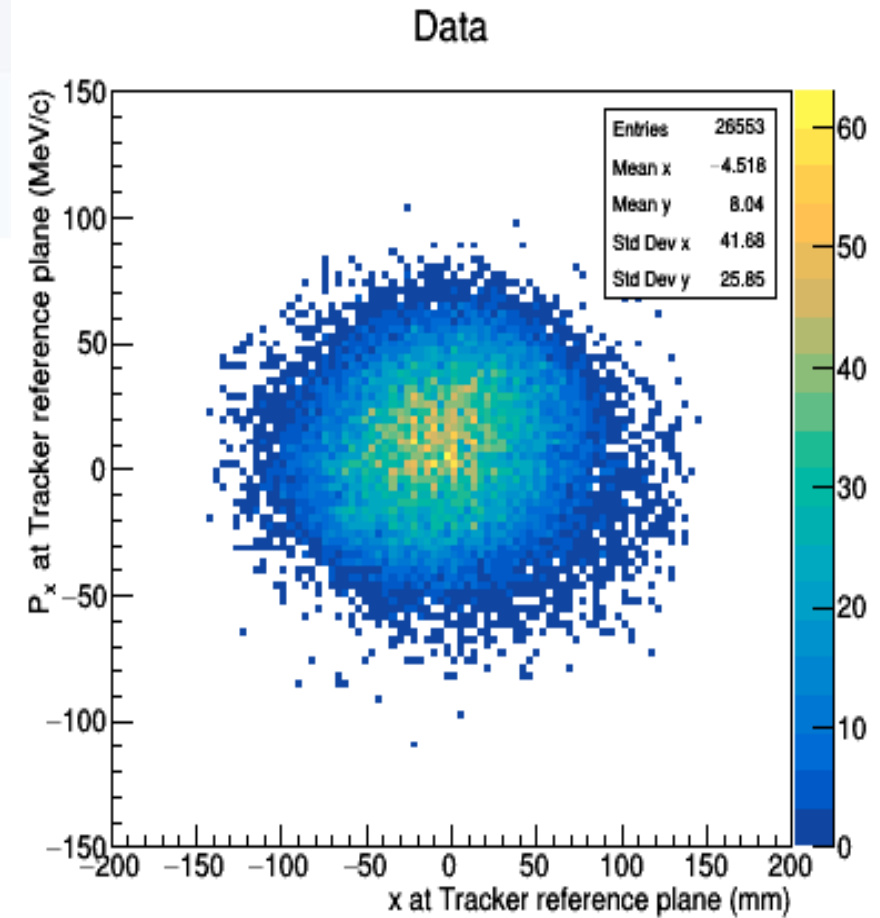




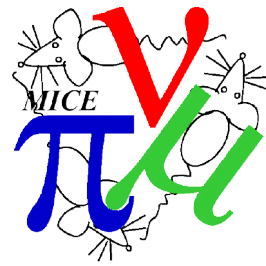
## No Cuts



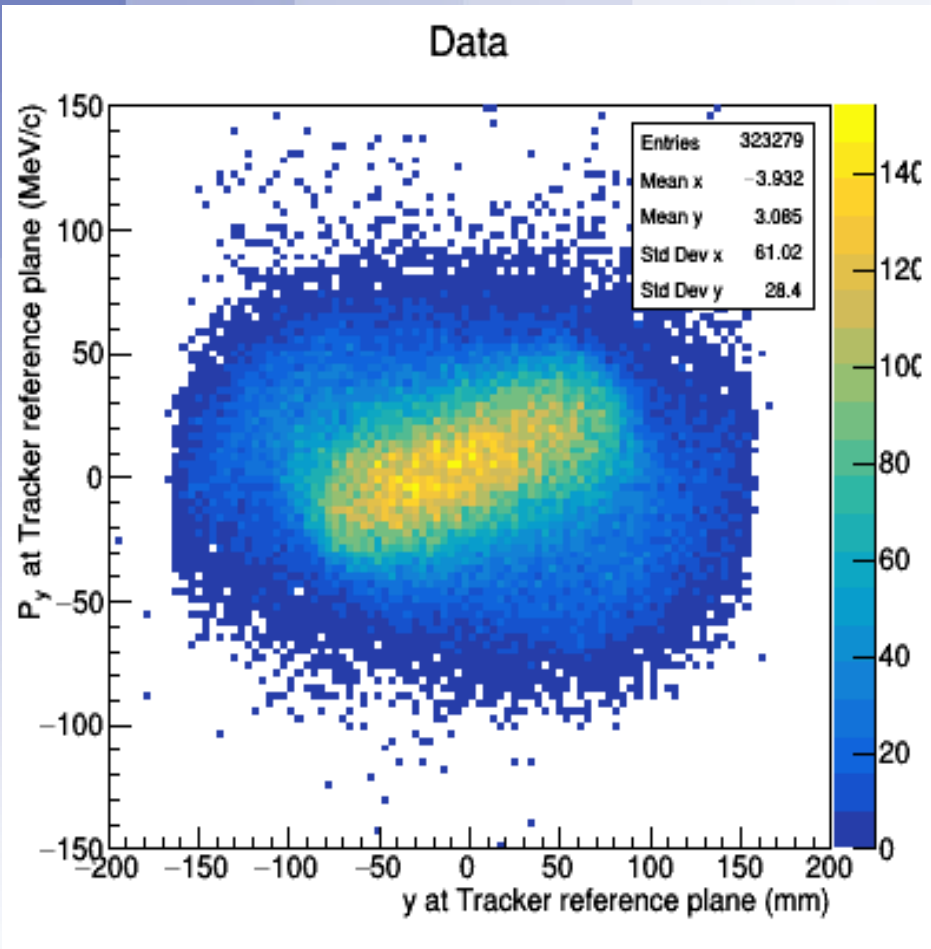
## All Cuts



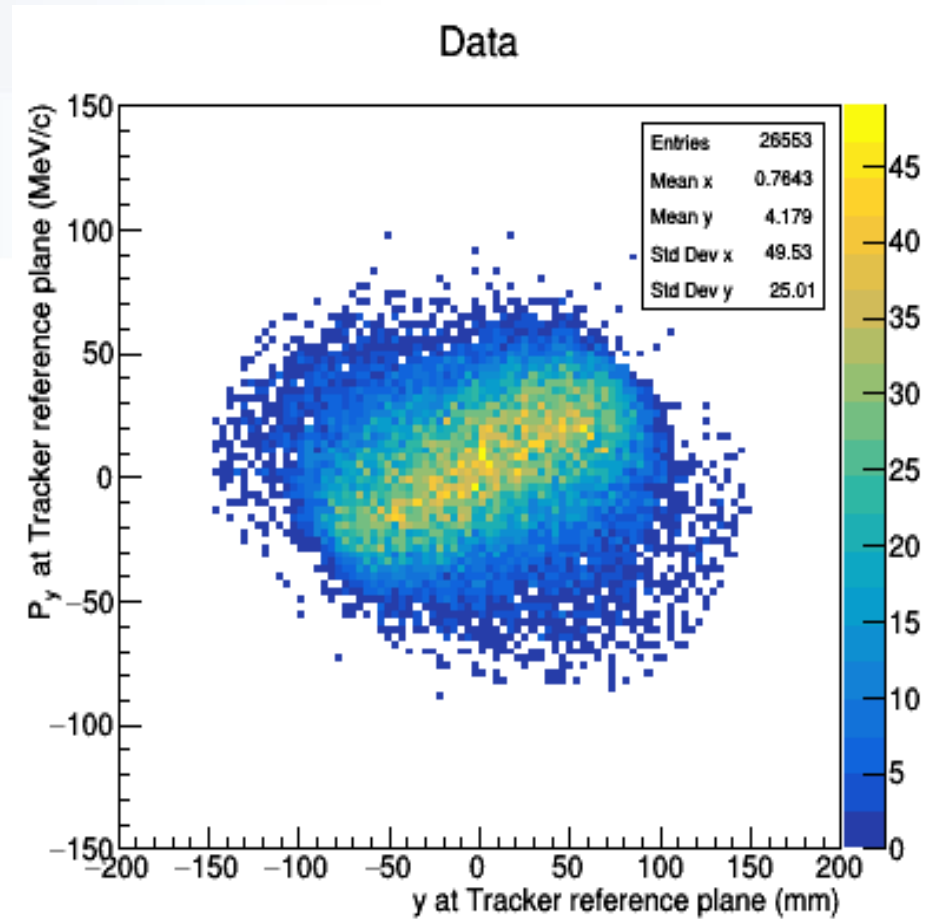


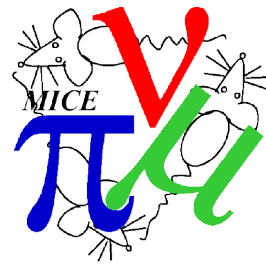


## No Cuts



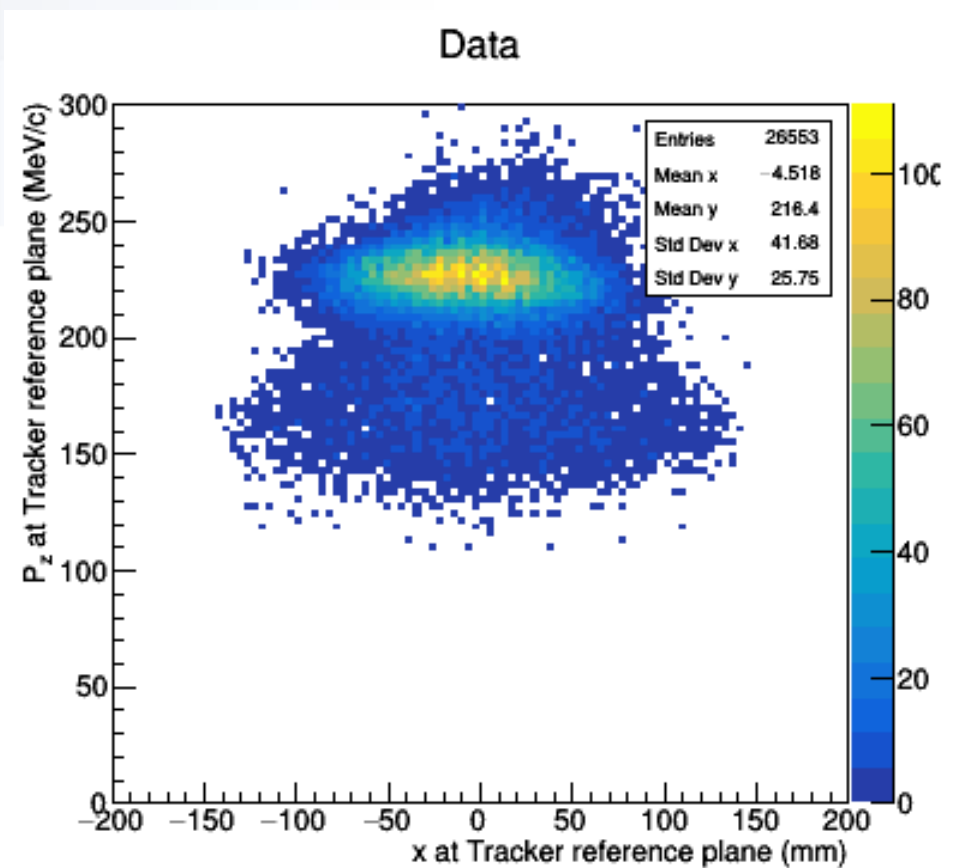
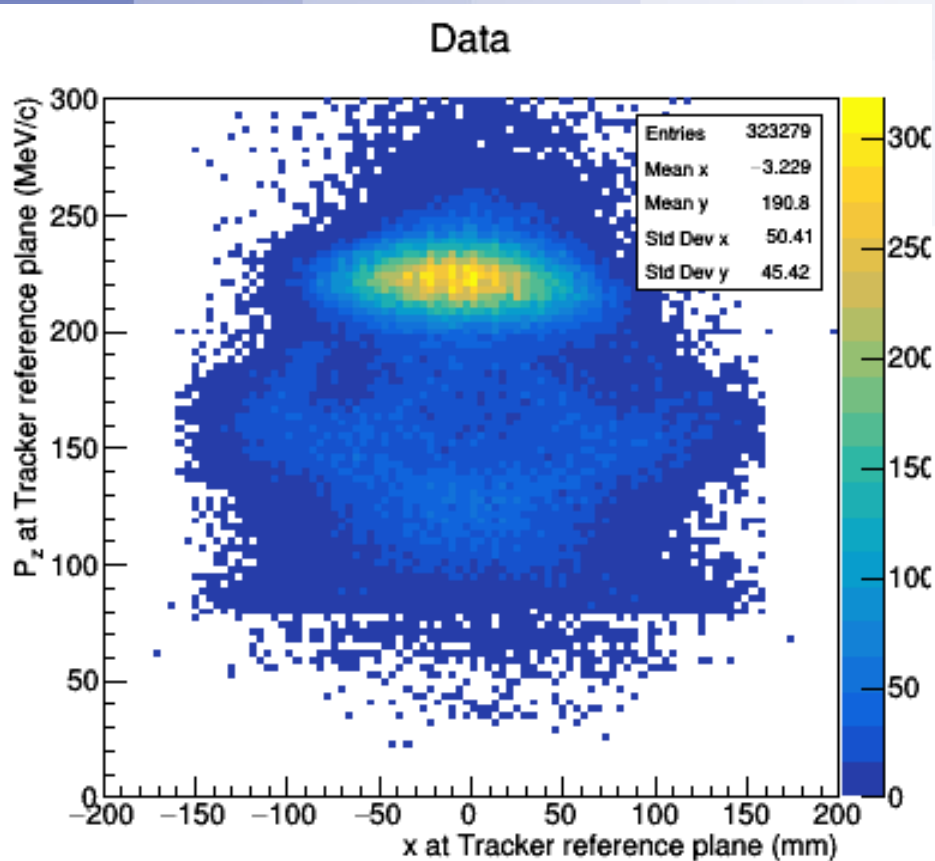
## All Cuts



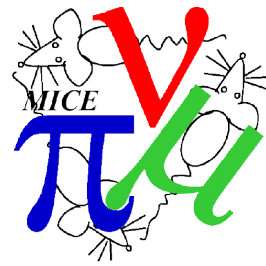


No Cuts

All Cuts

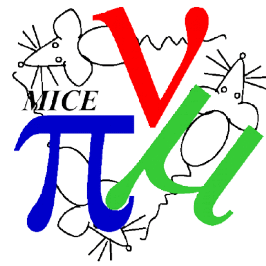


# Diffuser Analysis Plan

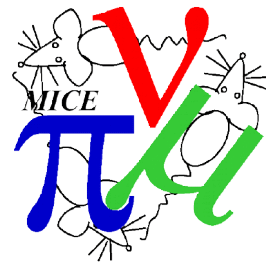


- ✓ • Emittance US as a function of diffuser  $X_0$
- ✓ • Alpha US as a function of diffuser  $X_0$
- ✓ • Beta US as a function of diffuser  $X_0$
- Beam Selection:
  - ✓ • Implement all agreed cuts from emittance measurement paper.
  - ✓ • Look at 8MeV momentum slices (not enough data to get down to 4)
- Compare to theory (emittance growth as a function of  $X_0$ )
- Higher granularity emittance change measurement US to DS looking at the 10 input emittances and comparing to cooling formula.

# Next Steps

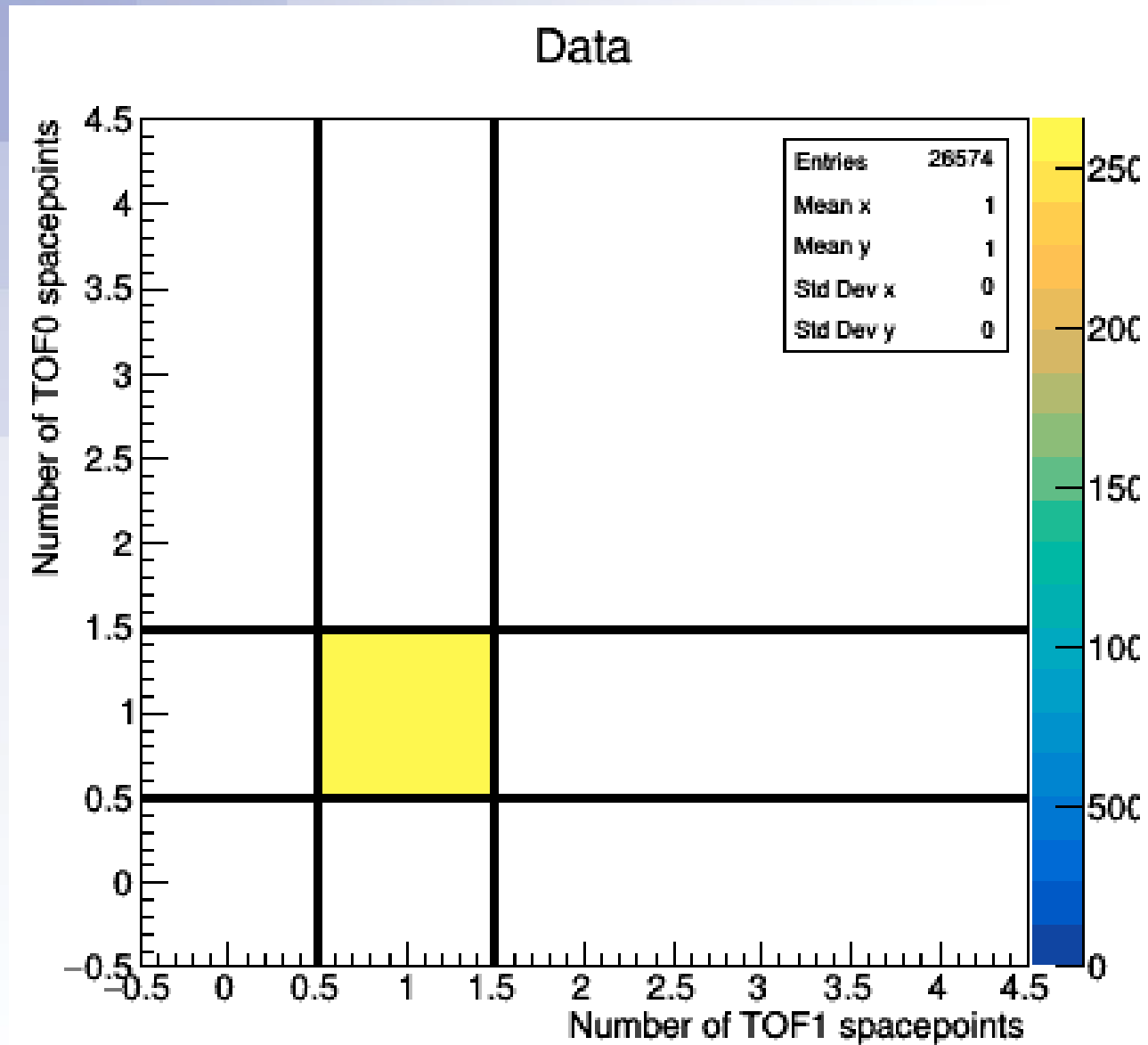
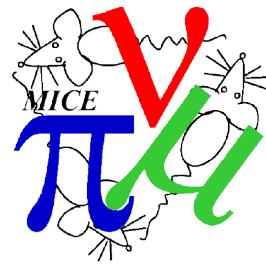


- Beam Selection:
  - Look at 8MeV momentum slices (not enough data to get down to 4)
- Redo all plots shown here.
- $dE/dx$
- Compare to theory (emittance growth as a function of  $X_0$ )
- Higher granularity emittance change measurement US to DS looking at the 10 input emittances and comparing to cooling formula.



Thank you

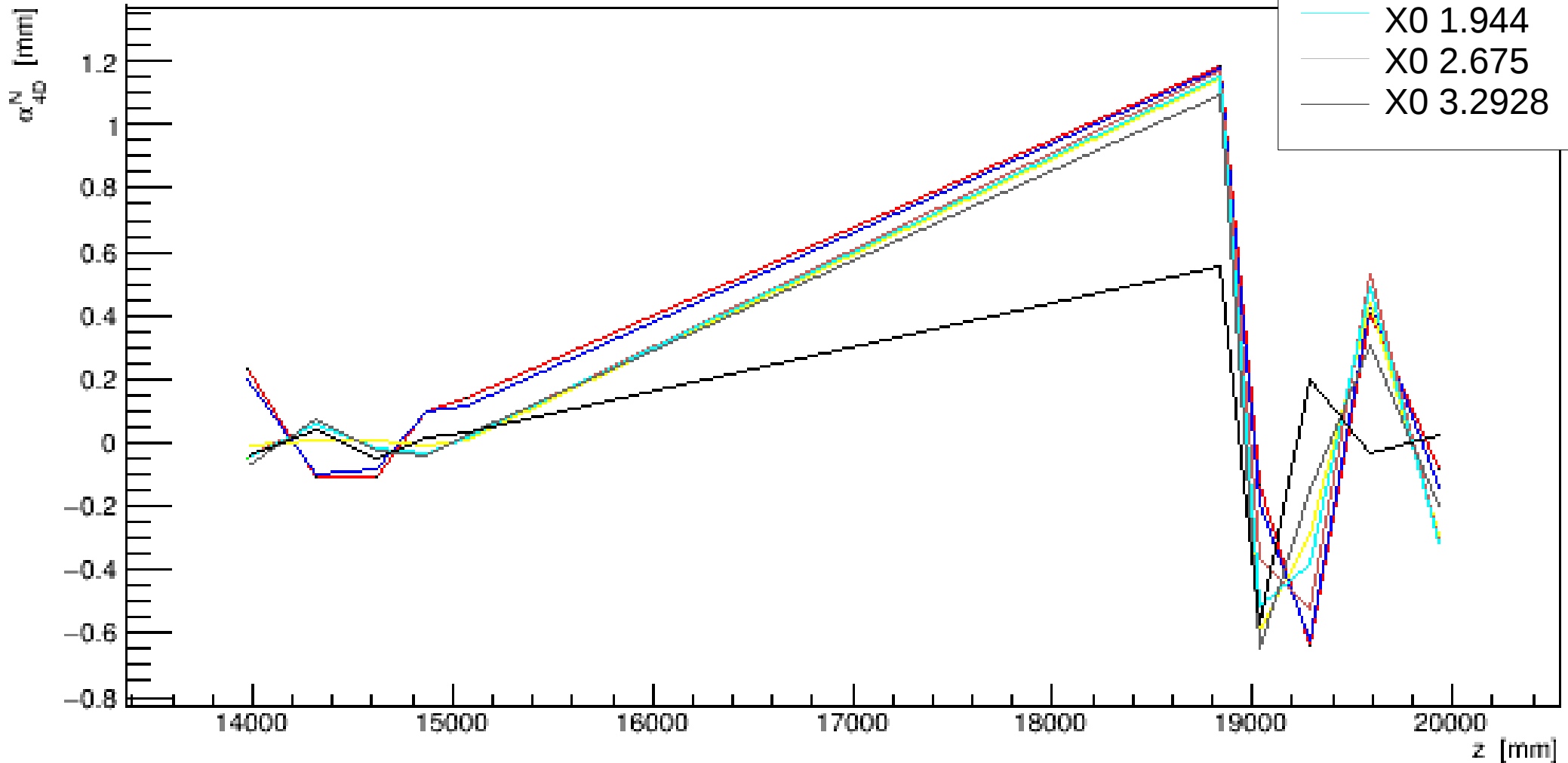
# All Cuts Other than TOF SP Cut





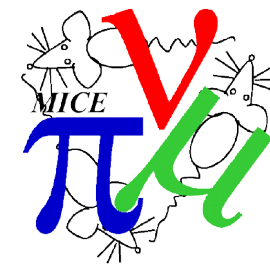
# 170 MeV Alpha – No Beam Selection or Momentum Binning

Reconstructed Normalised 4D Alpha





# 170 MeV Beta – No Beam Selection or Momentum Binning



Reconstructed Normalised 4D Beta

