

Better Statistics from a Pion Beam?

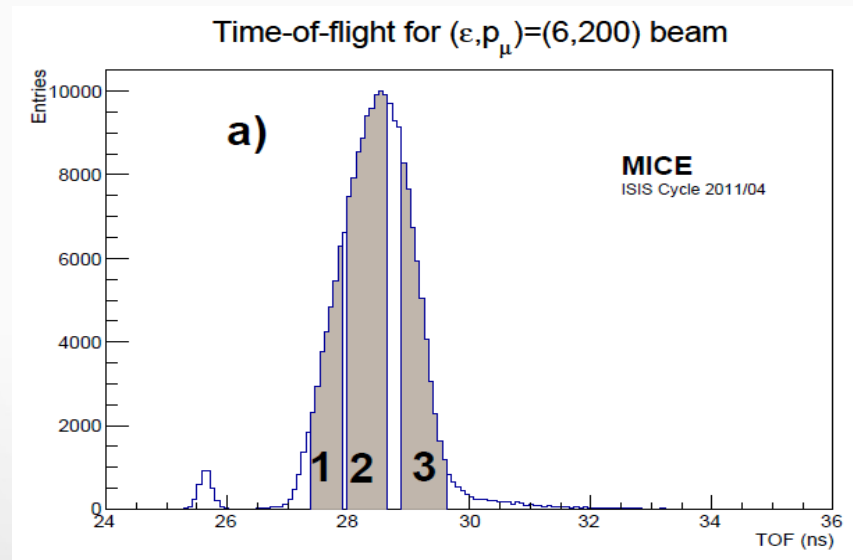
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Muon Mode

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- D2 set to half the momentum of D1
 - Selects muons which – in the pion rest frame – are backward-going
 - Produces almost pure muon beam as pions with enough momentum to not decay in the DS are filtered out by D2
 - Sub-1% pion contamination by TOF1 [Pion contamination paper]
 - PID aims to reduce this to $<0.1\%$

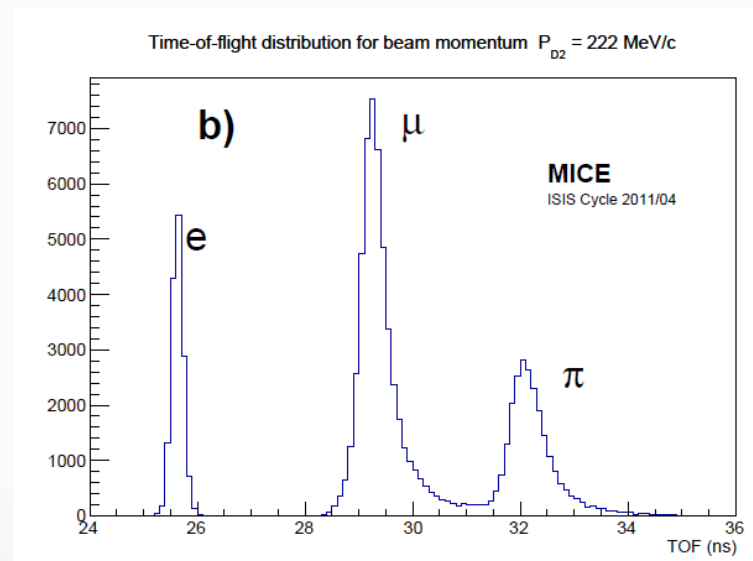


Calibration Mode

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- D2 is set \sim D1
 - Mixed beam
 - Relatively well-separated TOF peaks for pions, muons, and electrons



The Task

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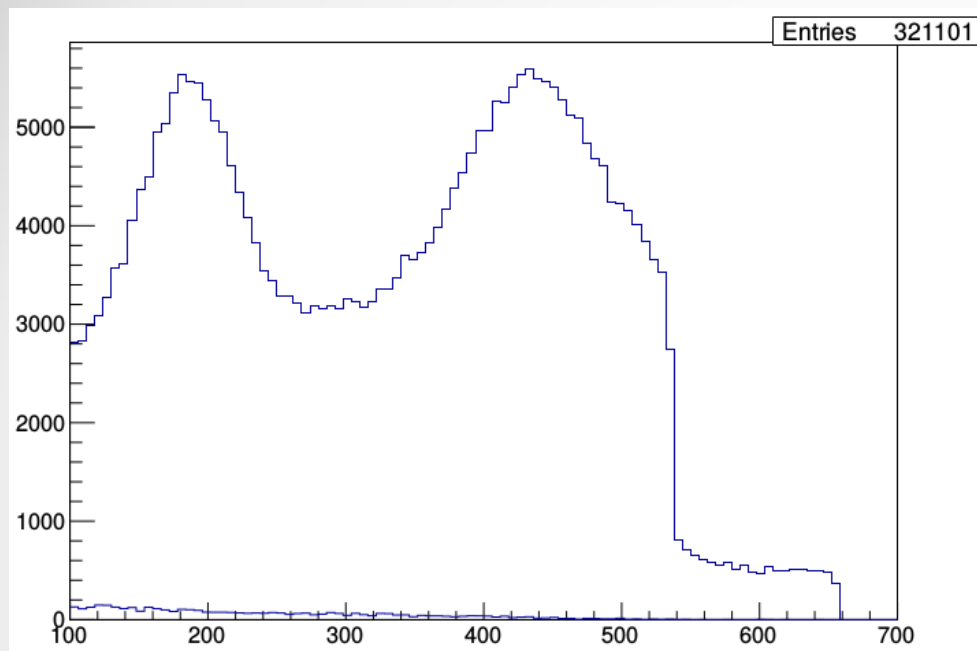
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- Determine whether we can get better muon statistics by running a pion beam
 - PID will have to filter out a much larger fraction of pions
- Run G4Beamline to look at numbers of muons and pions just before TOF0 for varying D1 field at fixed D2 field
- Run generated beams through PID to determine if PID will perform sufficiently for this

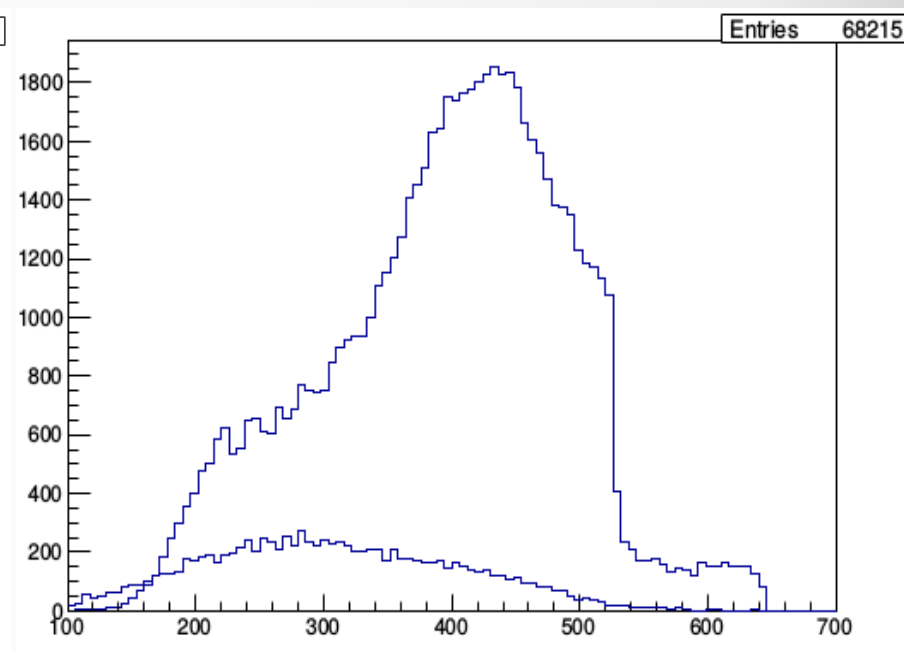
Momentum Distribution from Target

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Pion & Muon momentum dist. just after target

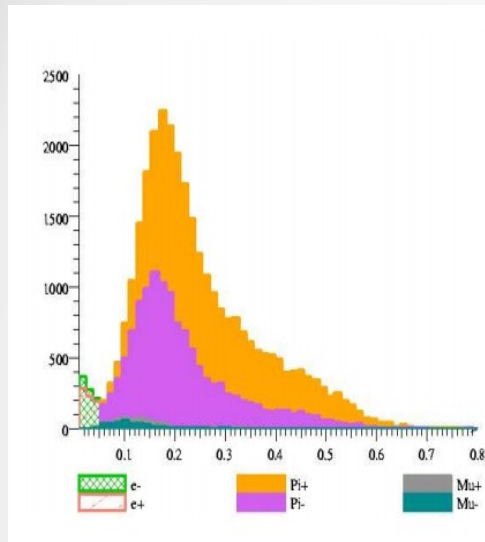


Pion & Muon momentum dist. after Q3

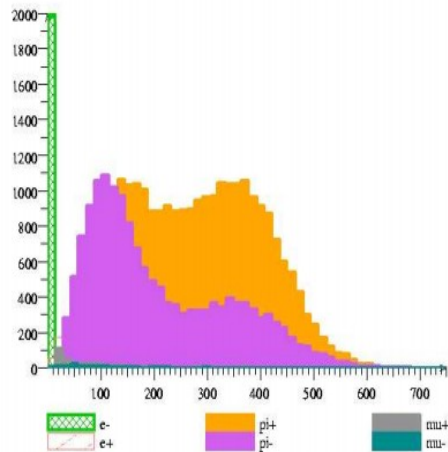
Distributions from Andrew Walaron (2007)

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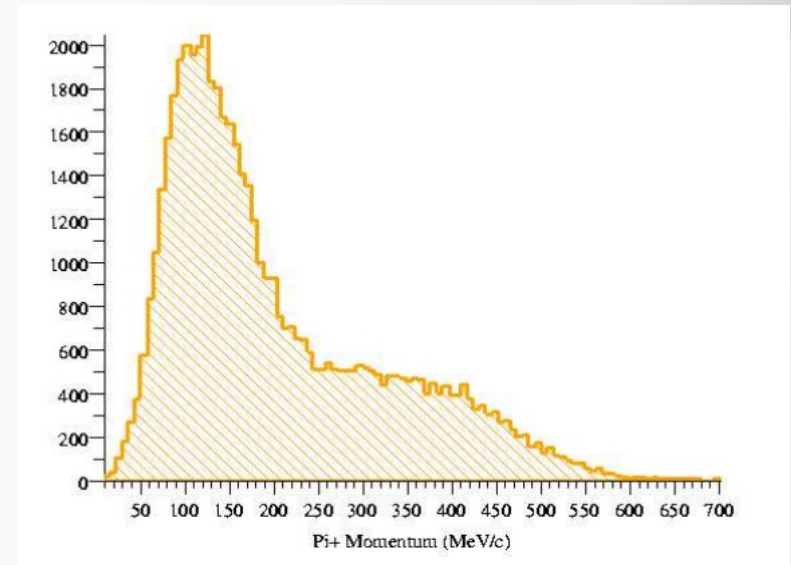
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MARS



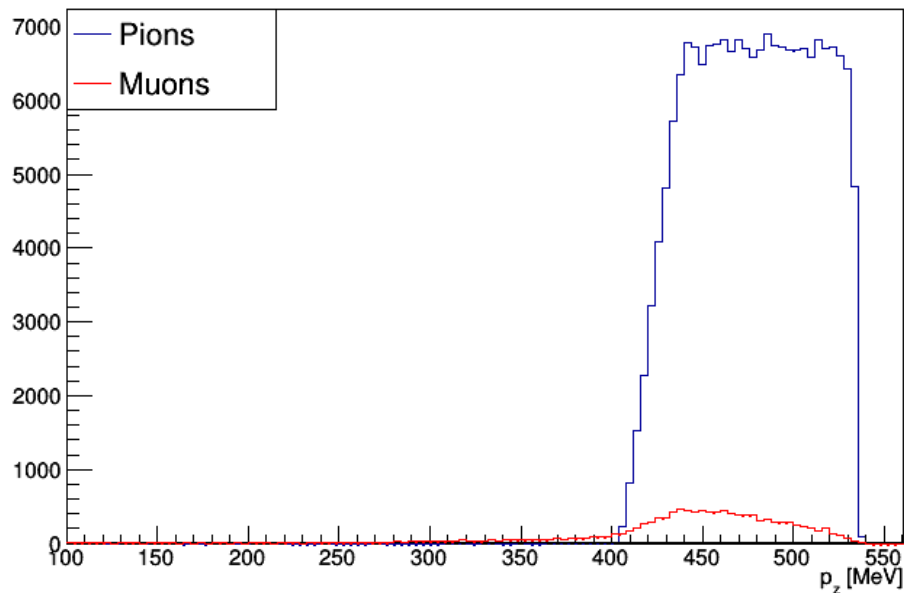
GEANT4



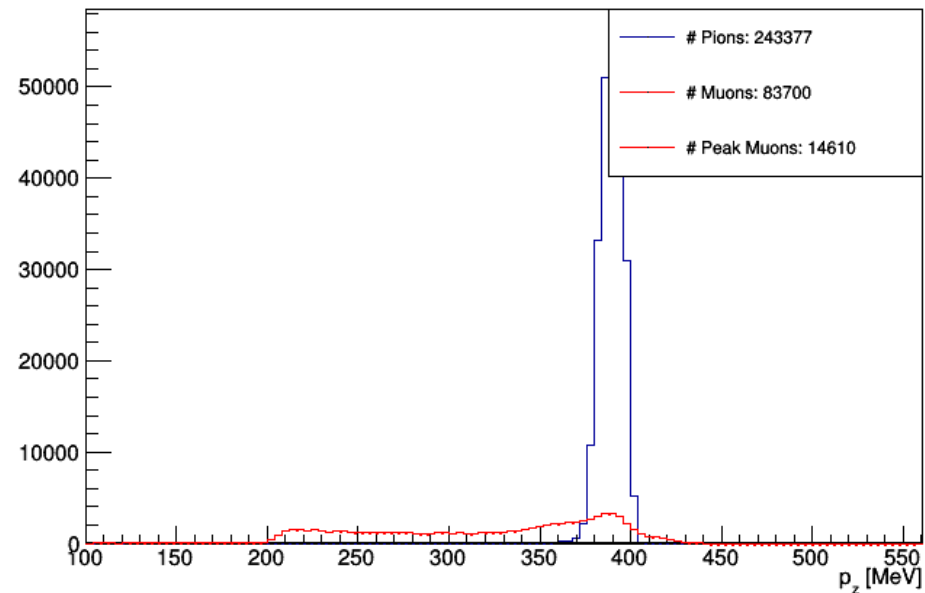
LAHET

408-238 Beam (Muon Mode)

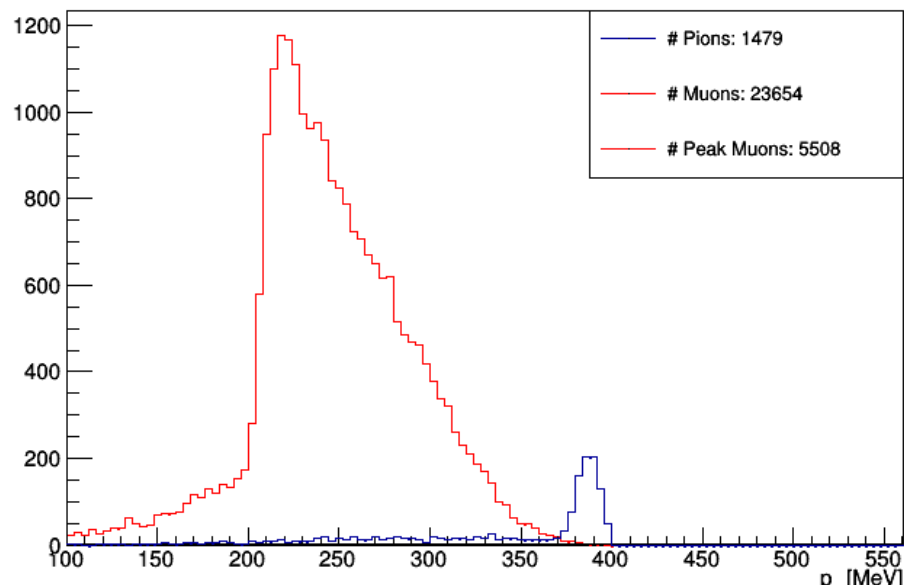
After D1



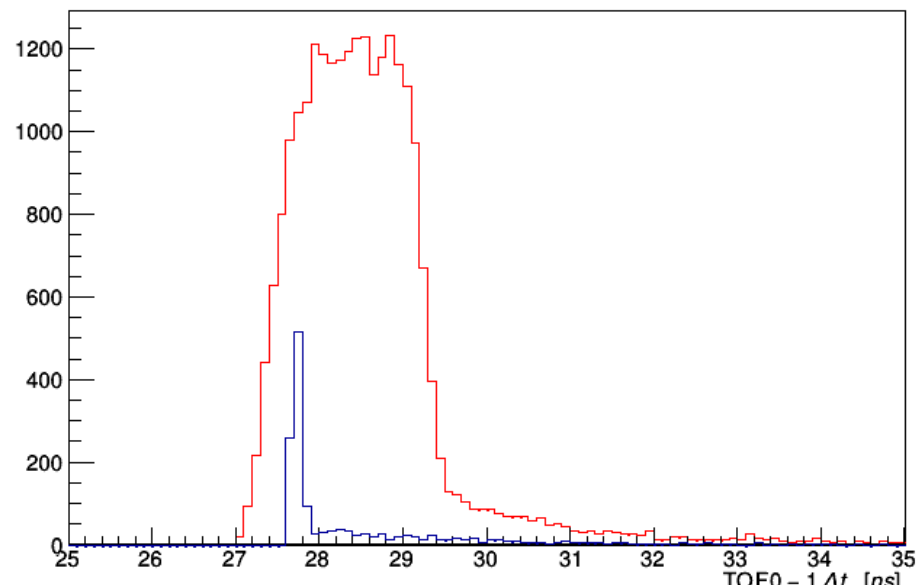
After DS



After D2

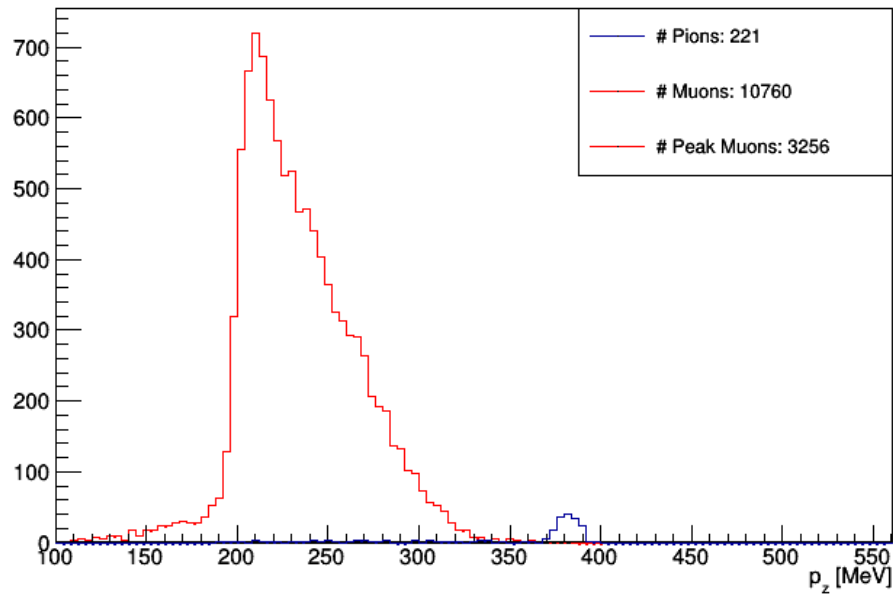


After D2 (estimated TOF deltaT)

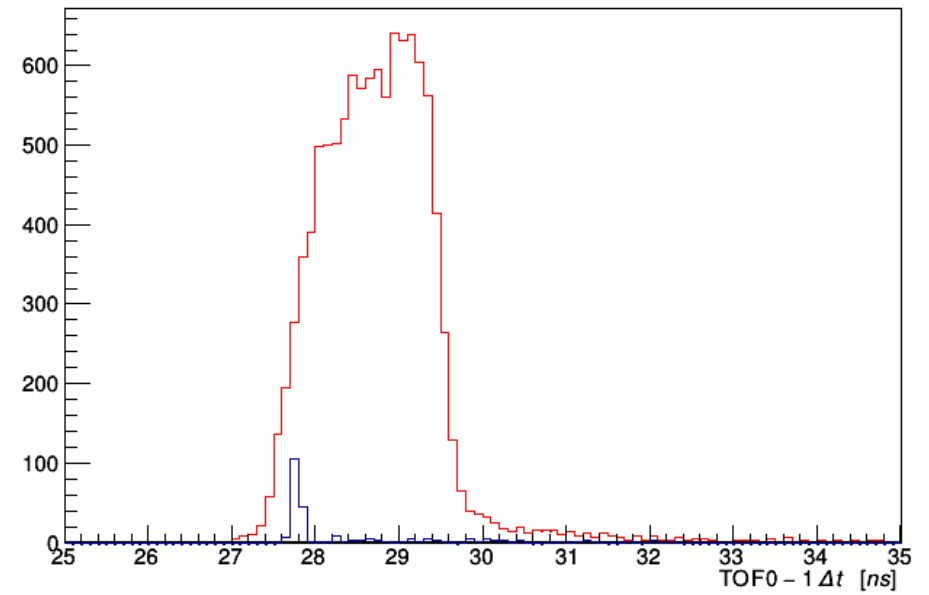


408-238 Beam (Muon Mode)

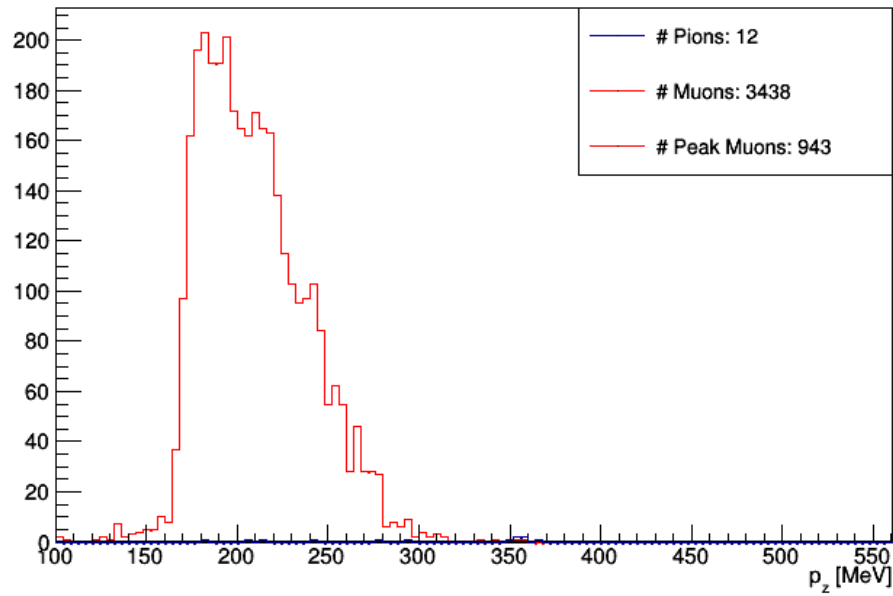
TOF0



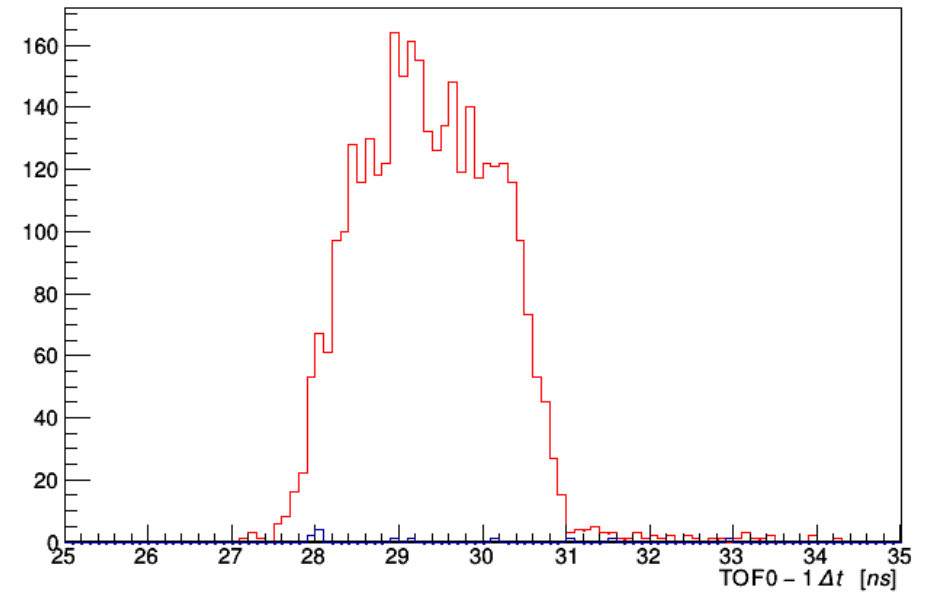
TOF0 (estimated TOF deltaT)



TOF1

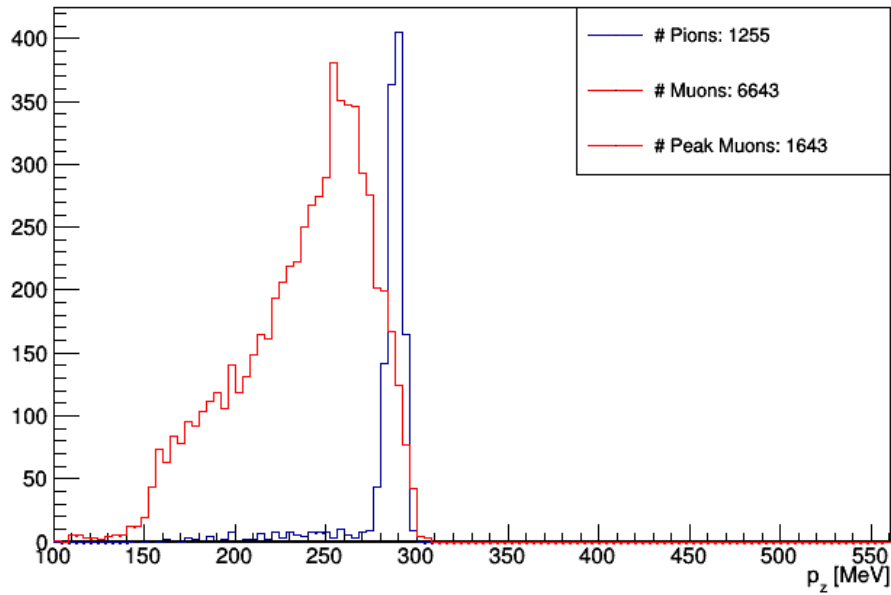


TOF1 (estimated TOF deltaT)

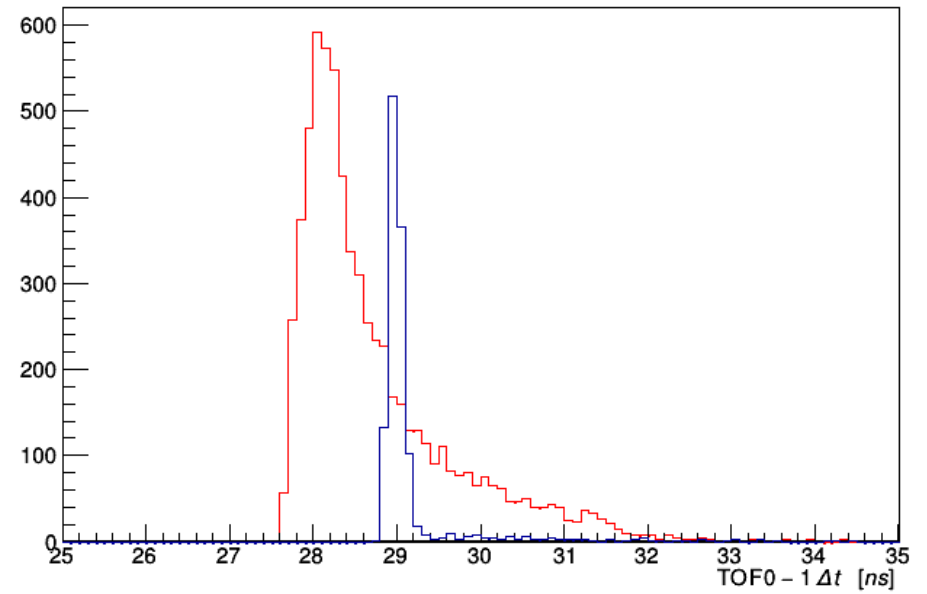


318-238 Beam

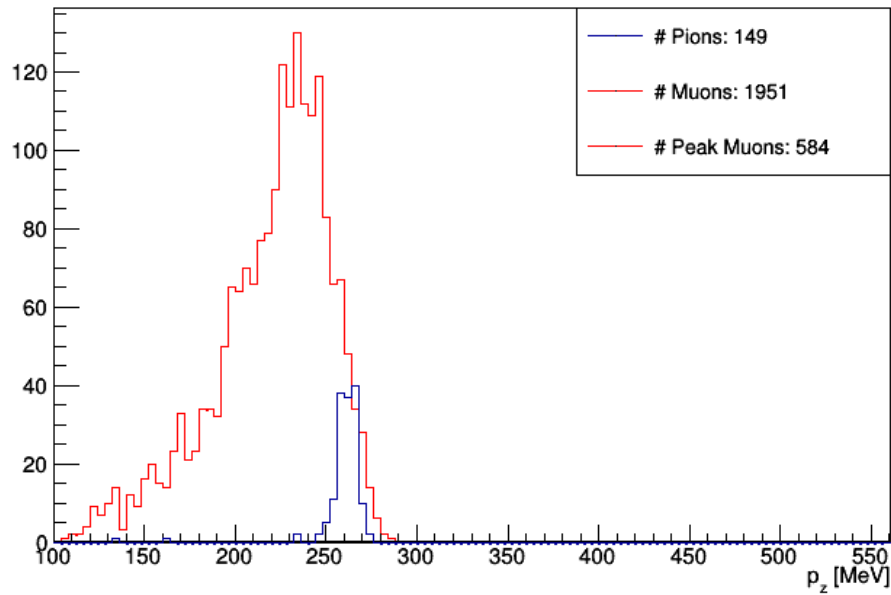
TOF0



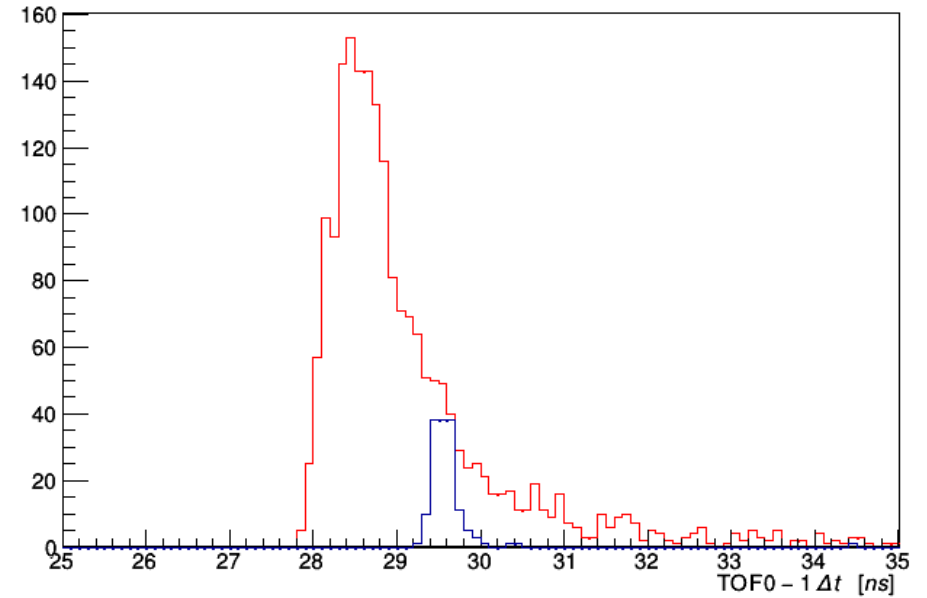
TOF0 (estimated TOF deltaT)



TOF1

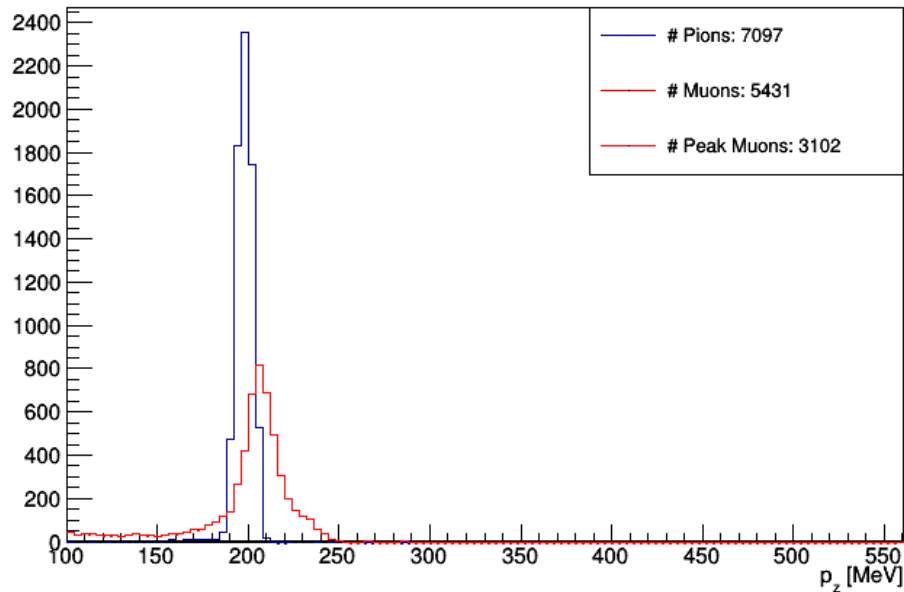


TOF1 (estimated TOF deltaT)

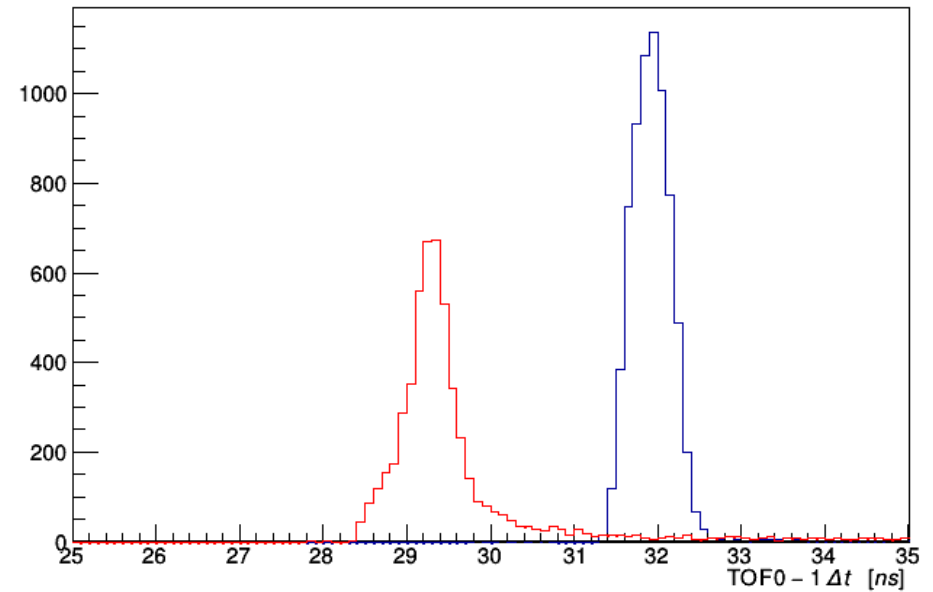


238-238 Beam (Pion Mode)

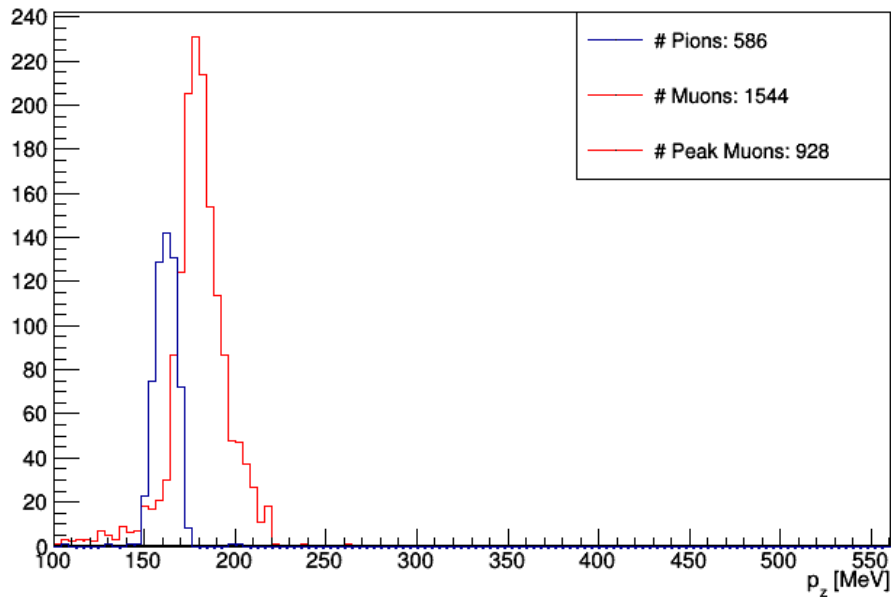
TOF0



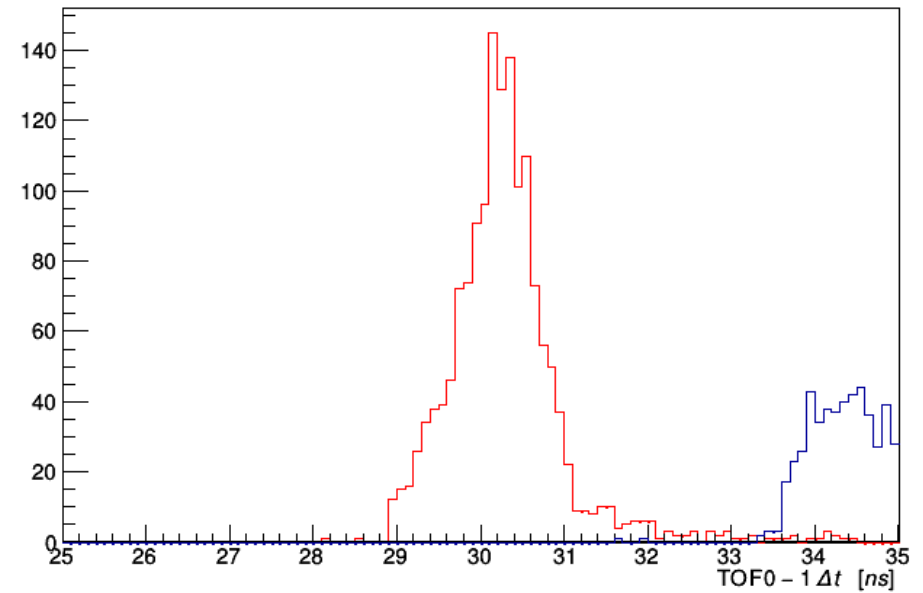
TOF0 (estimated TOF deltaT)



TOF1



TOF1 (estimated TOF deltaT)



Next Steps

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- Compare actual TOF0/1 Δt from MC Truth with p_z from MC truth to see how good parameter this is
- Get normalisation data for some of the settings to be able to normalise numbers of muons for each setting
- Run large MC studies with PID to check how effectively we can filter out the increased pion rates