Di-muon Selection

- Hunt for di-muon events in the forward muon detectors
  - forward di-muon trigger best understood and longest running
  - trigger requires both muons to lie in same forward region
- Run on 5.6M events from production farms
  - RECO version p10.07.01
  - Use ROOT-tuple files copied to CLuED0
  - Single CPU takes ~6-8 hours to run through entire dataset using local RAID array
  - I/O limited, not CPU (933MHz CPU at 30-70%)

Selection Criteria

- Initial selection criteria are:
  - Forward dimuon trigger fired
  - 2+ muons have hits in all three layers
- Events satisfying these criteria are written to a new file (ROOT tree)
  - 2,183 events pass criteria (from 5.6M)
- This file is the base for our analysis
  - New variables can be added using the ROOT feature "friend trees"
  - Stores data in a separate file so updates are easy
    - Making new friend trees takes ~5s

Is a Dimuon Stream Needed?

- Two reasons to stream
  - Reduce time taken to re-RECO raw data with bug-fix versions
  - Reduce time to perform initial event selection for analyses on thumbnail ROOT files
- Discuss second option only here
  - Our analysis starts with ROOT files
  - Interaction between RECO and streams more complex than with a single user analysis

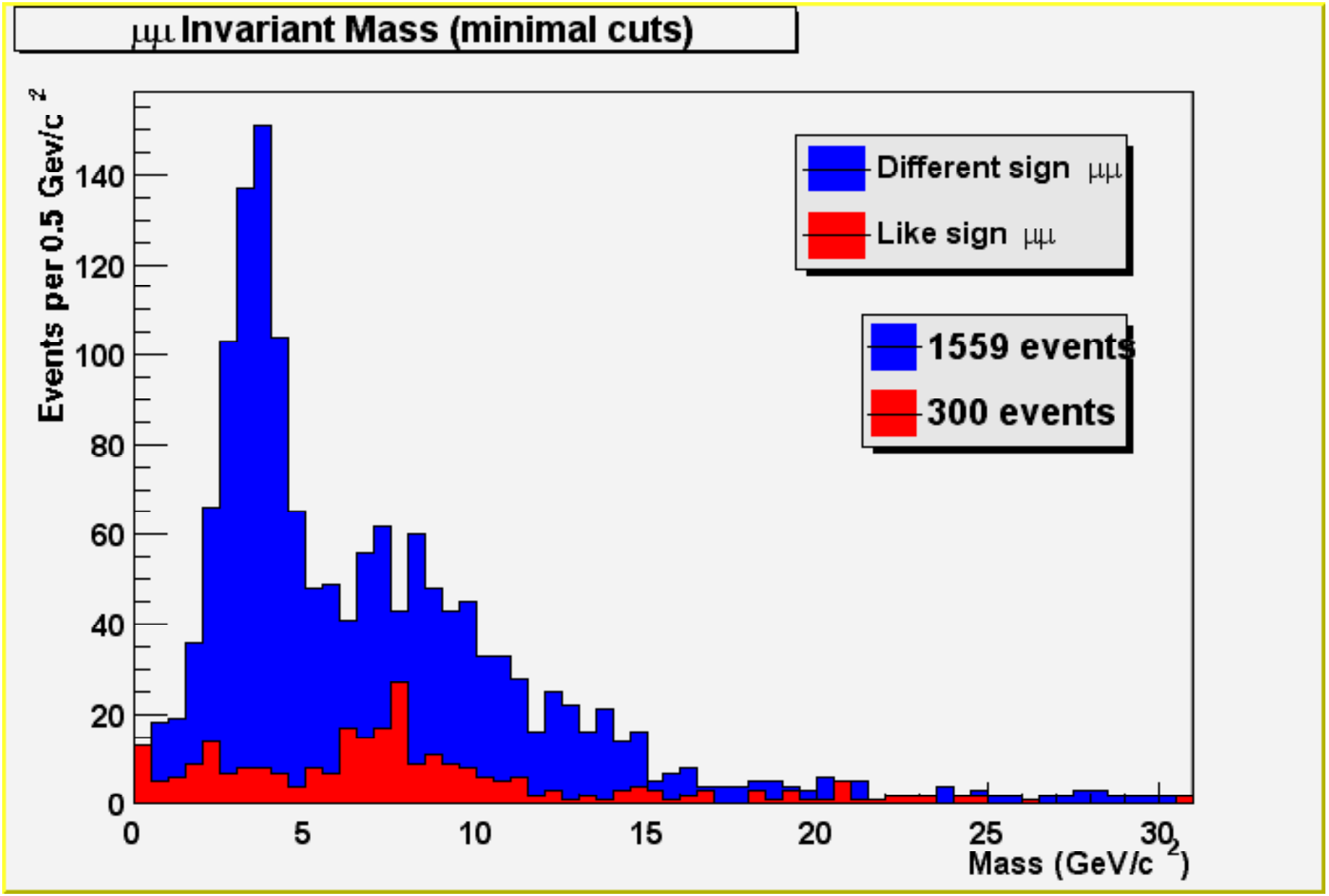
Selection Times

- Make some assumptions:
  - Remain I/O limited, not CPU i.e. data volume is important and not CPU or number of events
  - Thumbnail tuple equivalent to RecoAnalyze
- Time to select data:
  - 5.6M events=162GB and takes 8 hours to process
  - Selection rate ~20GB/hour/CPU
  - Full Run IIa thumbnail size 16TB (based on ORB reservation for D0mino)
- Estimated time taken to run over entire thumbnail dataset is:
  - 820 hours (34 days) / CPU

Other Considerations

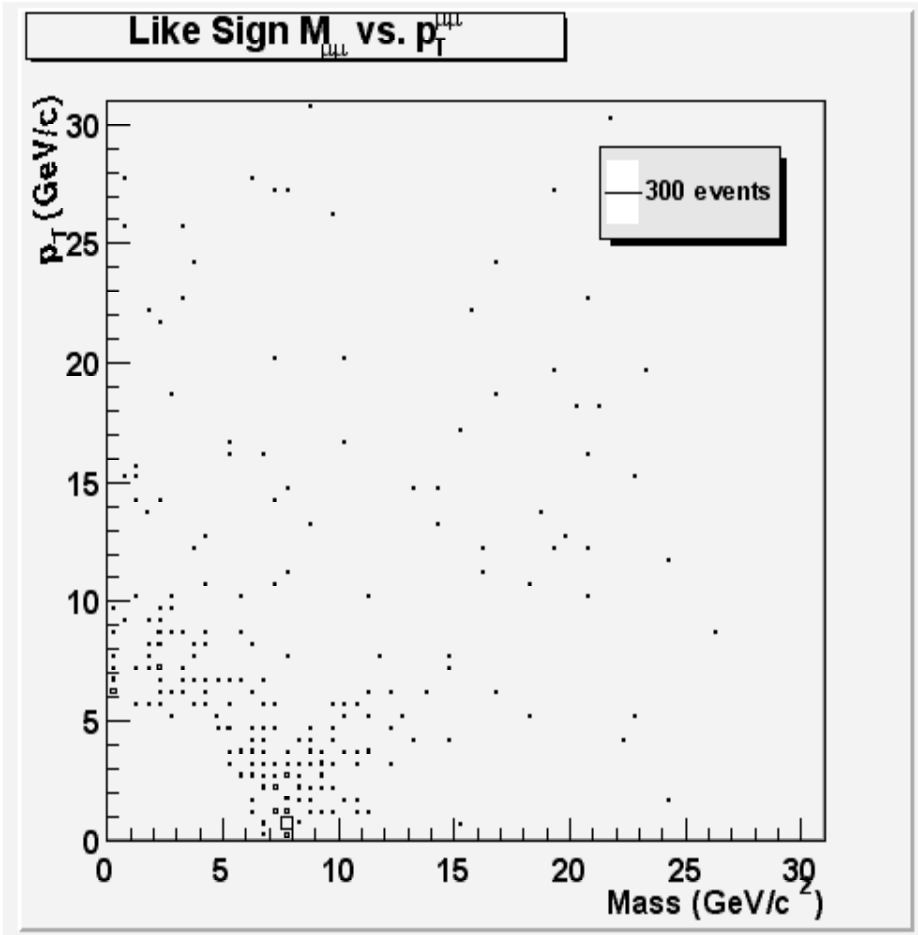
- D0mino may give a speed increase
  - CPU bad but I/O great!
  - Currently overloaded but selection takes very little memory (<64MB)
- Multiple CPUs can be used
  - File-level parallelism (easier when SAM works)
  - ROOT has 'PROOF' - parallel ROOT - server daemons
    - Can test this on CLuED0
- Share selection runs with other analyses
  - Running multiple cuts and writing out multiple files should not slow down process (I/O limited)

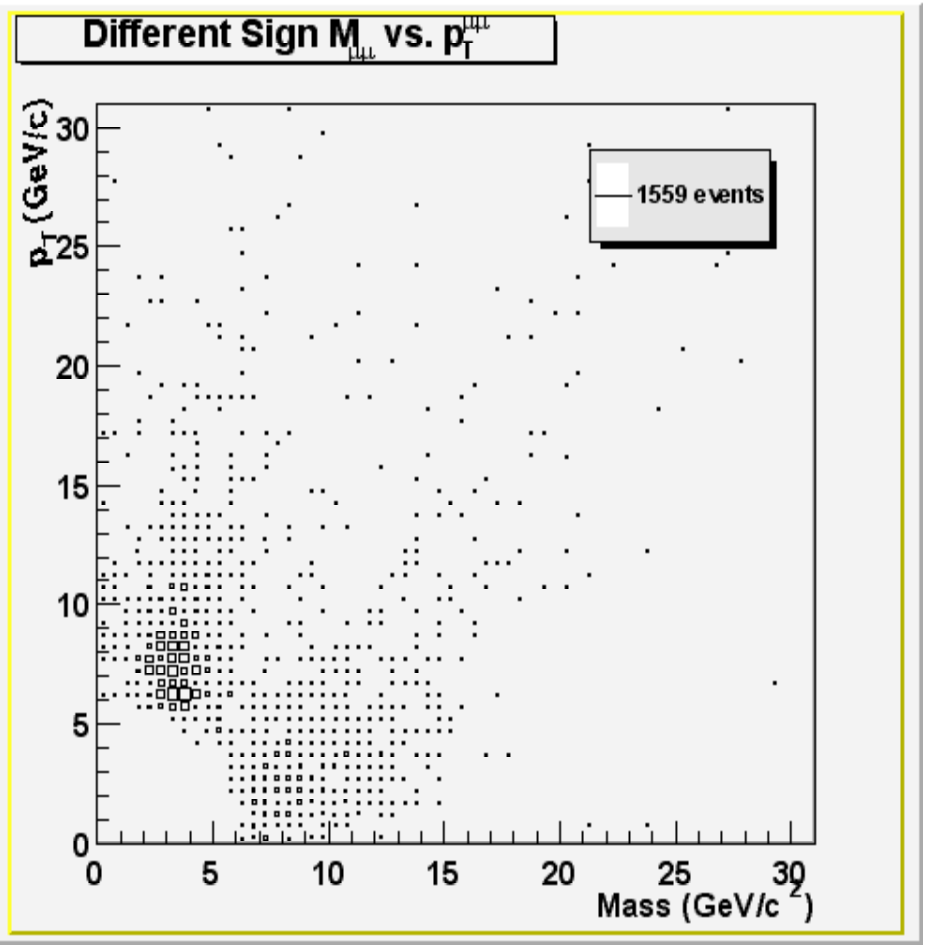
Examining the Data



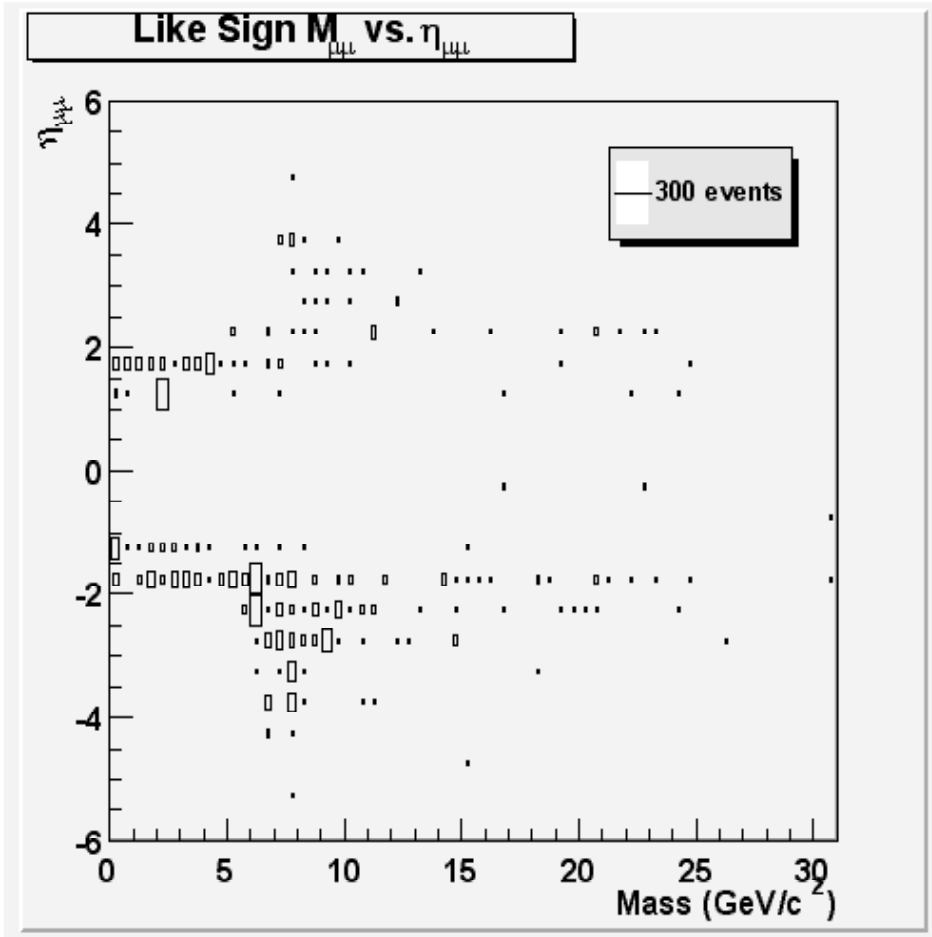
Cutting J/Psi Background

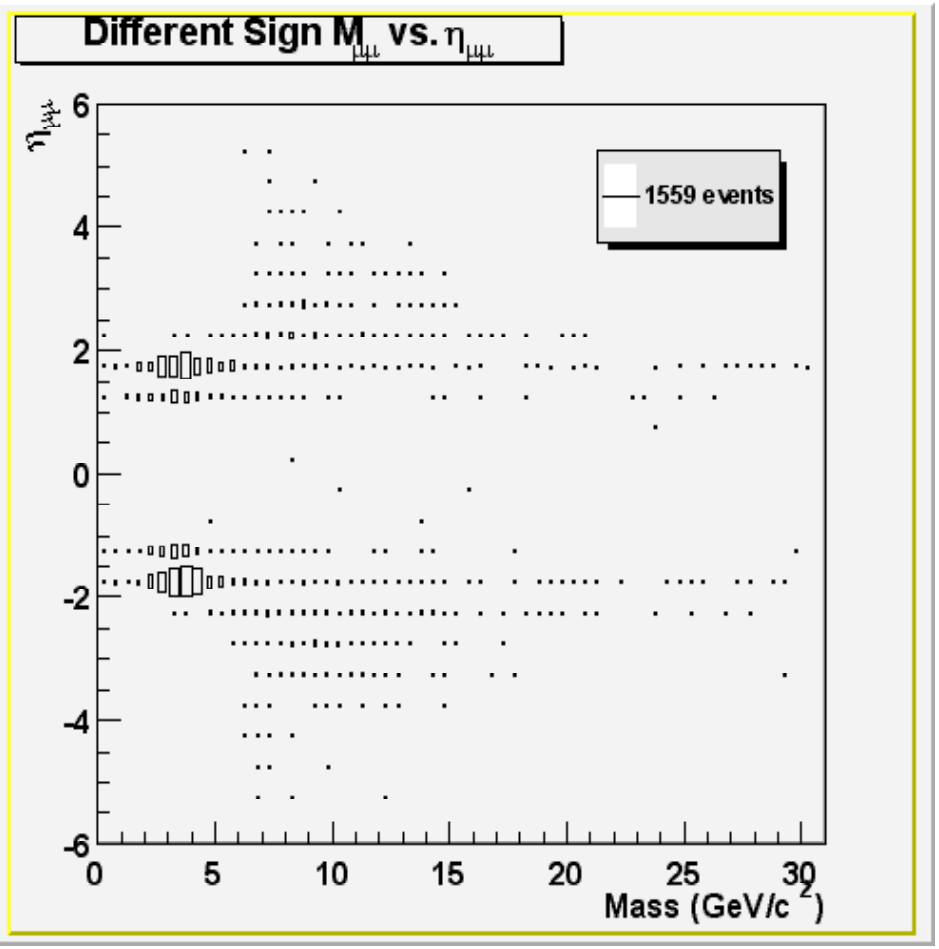
- Look at pT and eta distributions
  - Background reconstruct down beam line





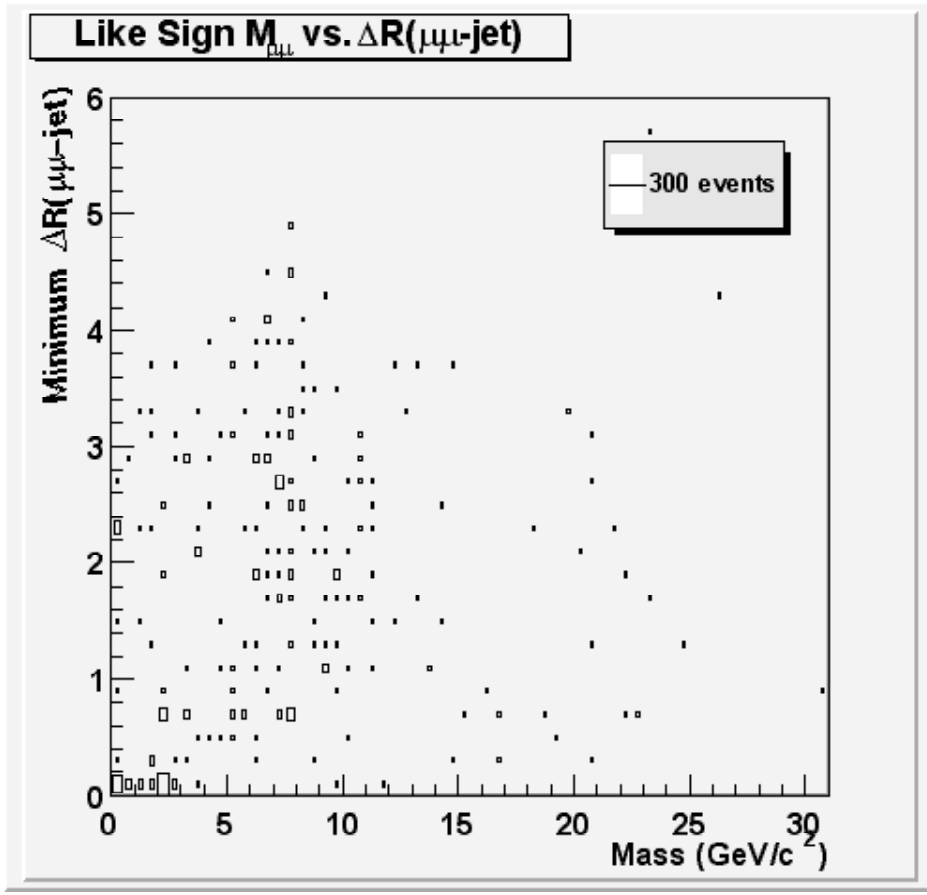
Eta vs. Mass

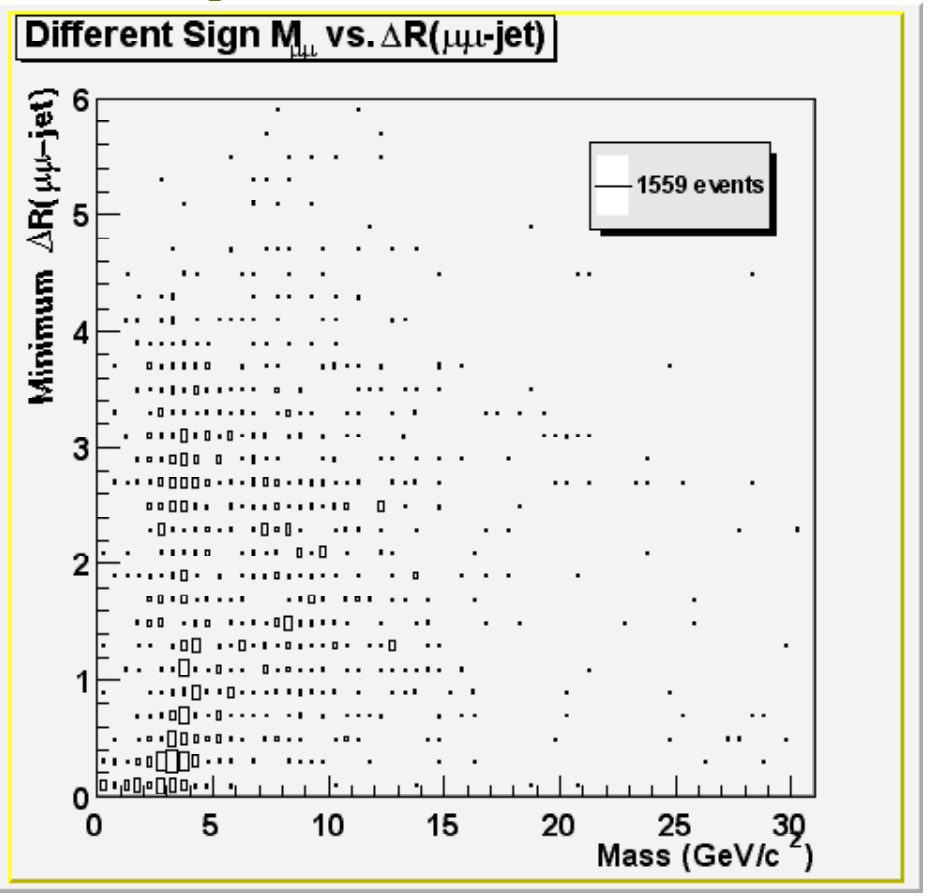

Like Sign $M_{\mu\mu}$ vs. $\eta_{\mu\mu}$
$\eta_{\mu\mu}$
300 events
Mass (GeV/c^2)


Different Sign $M_{\mu\mu}$ vs. $\eta_{\mu\mu}$
$\eta_{\mu\mu}$
1559 events
Mass (GeV/c^2)

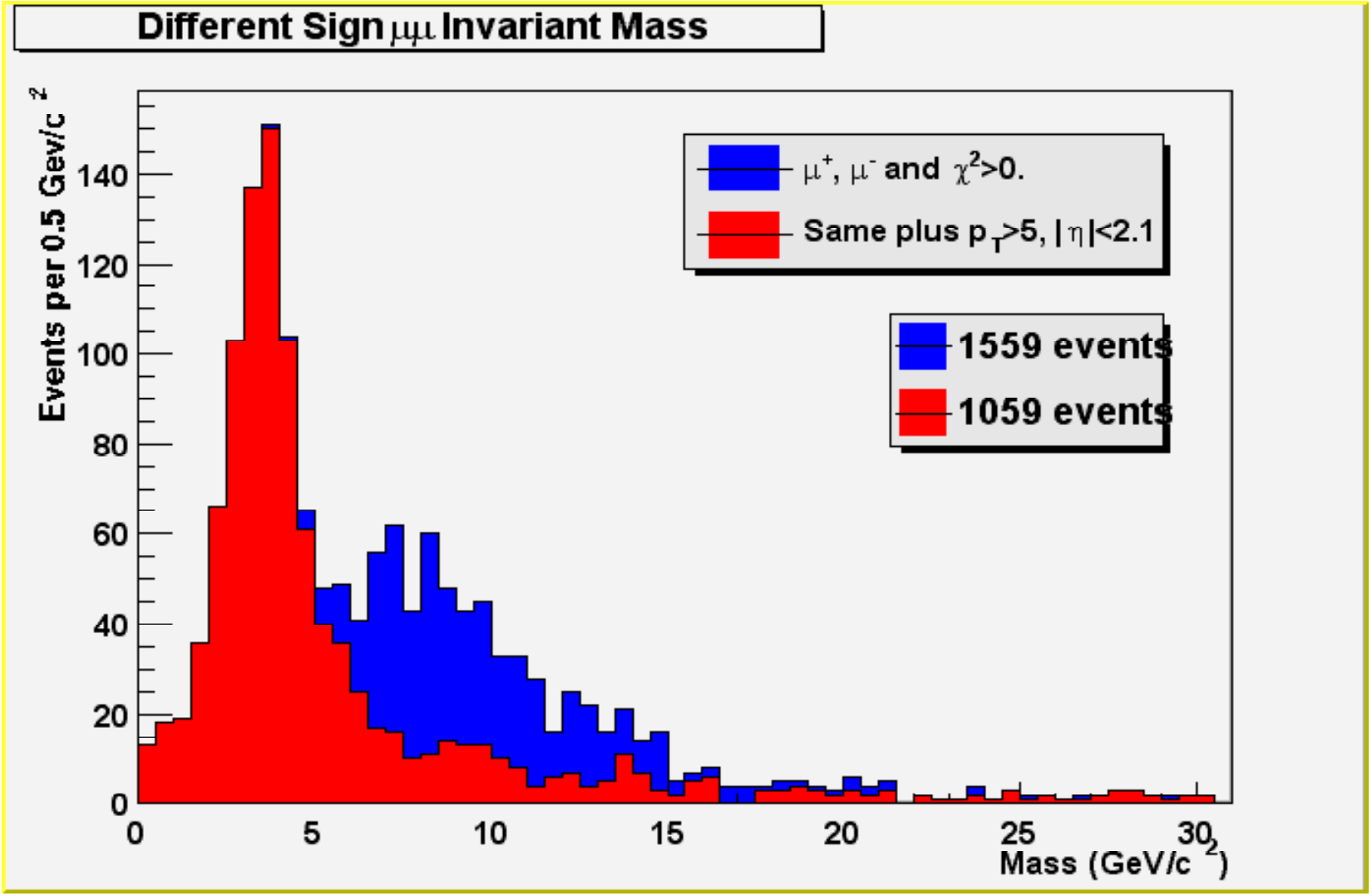
J/Psi from B decays

- Look at μμ-jet separation
  - Expect J/Psi from B to have a jet association

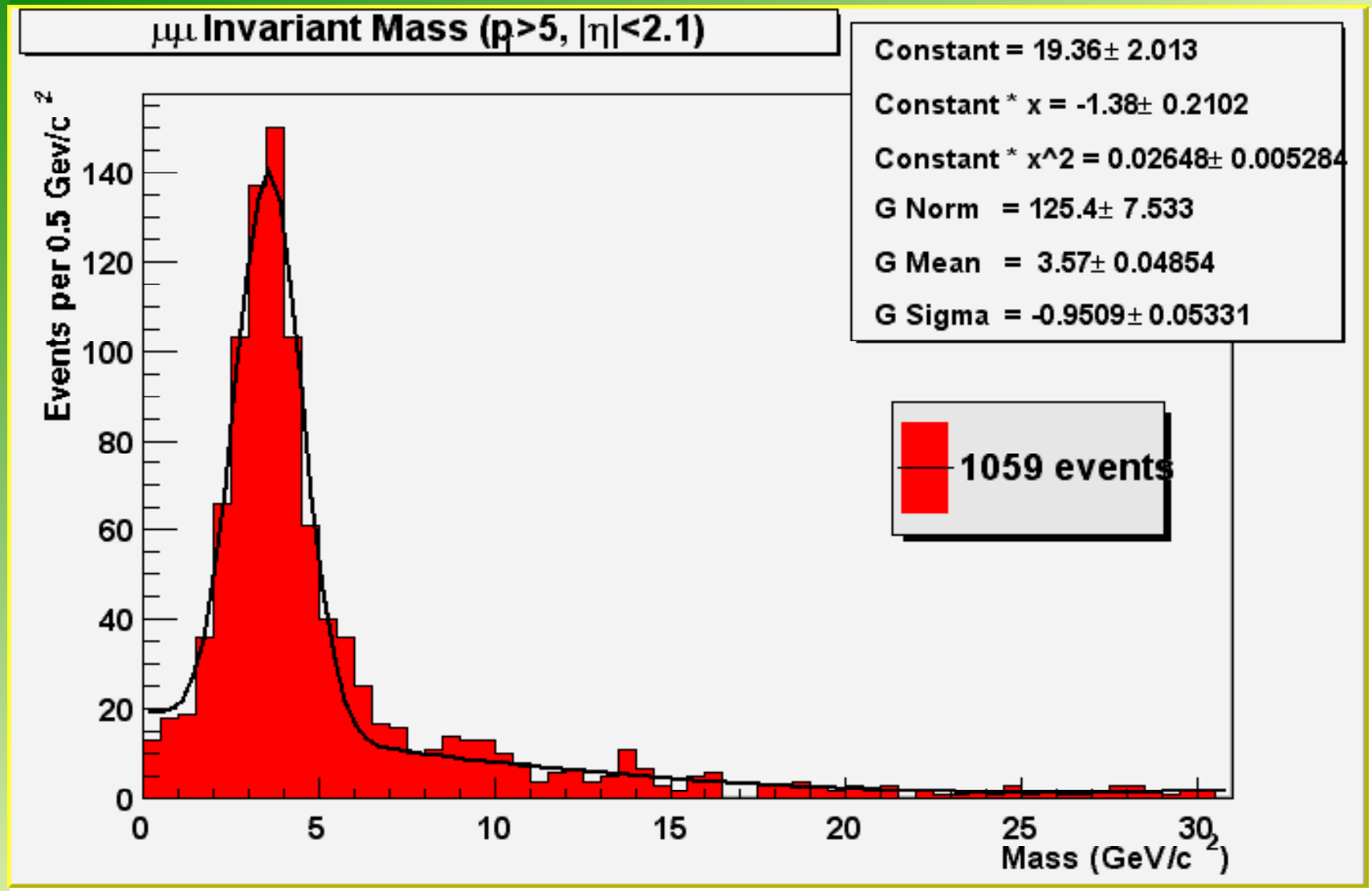




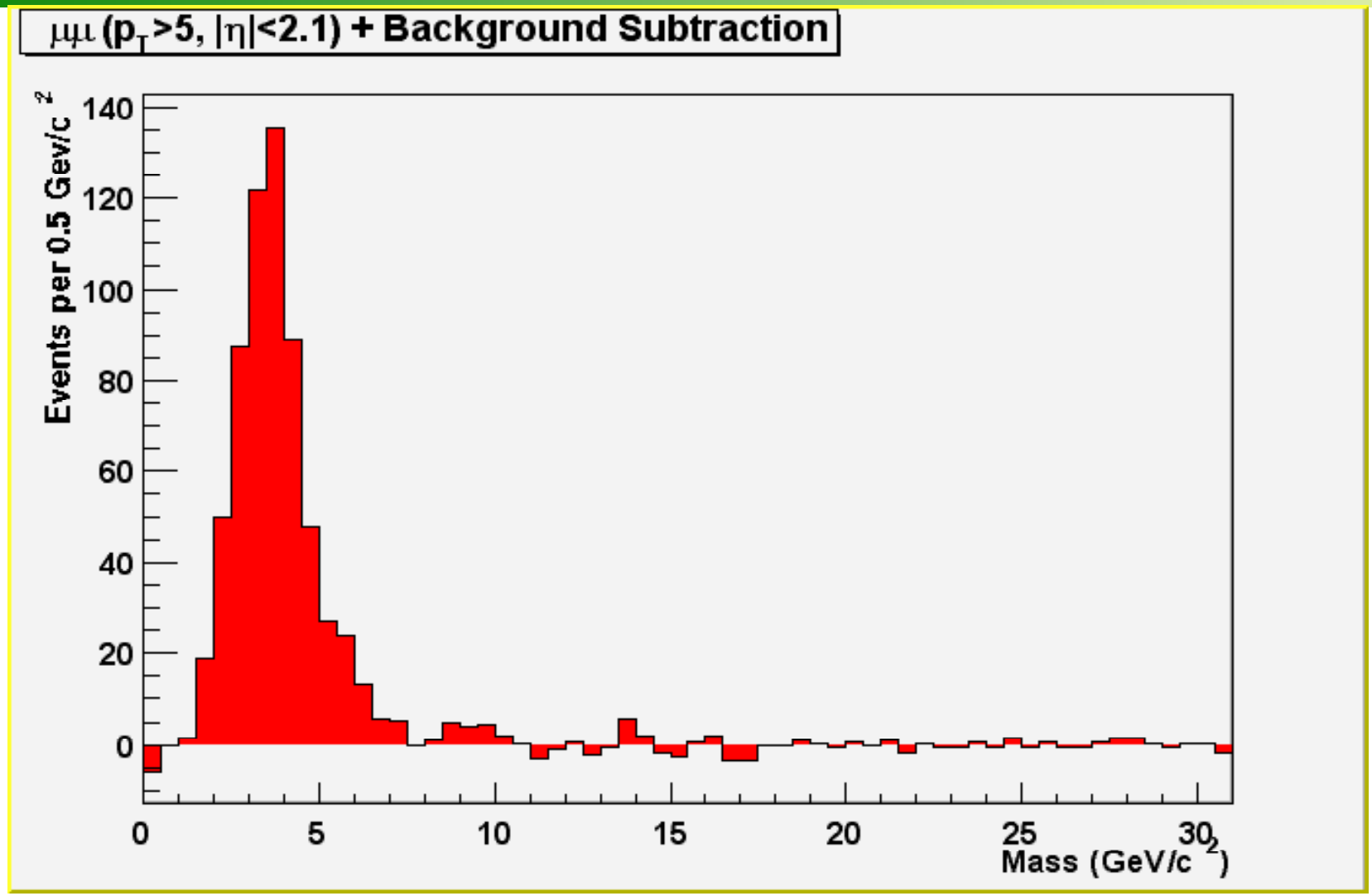
Cleanup Invariant Mass



Fitting the Mass Peak



Background Subtraction



Conclusions

- ~700 J/Psi found in data
  - more cleanup may be possible with central tracking
- Entire p10.07.01 ROOT-tuple dataset available on CLuED0:
  - /rooms/library/np/p107
- Selected event file available at:
  - /work/thwaite-clued0/dimuon-06-11-01.root
  - Contains 2183 events used in this analysis