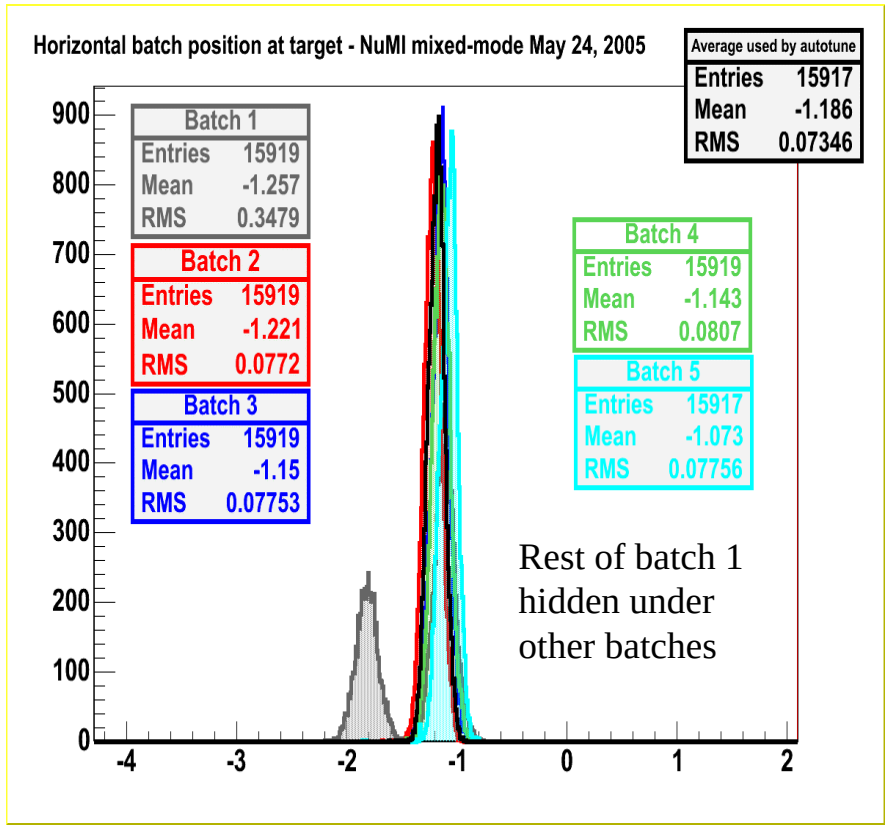
ν_μ CC Muon Spectrum vs Booster Batch Preliminary Study

Introduction

- Plot from **Mary Bishai**: batch 1 beam position in Mixed-Mode running:
  - Batch 1 has bifurcated position distribution
  - Caused by tail of Pbar Kicker



Study Muon Spectrum vs. Batch

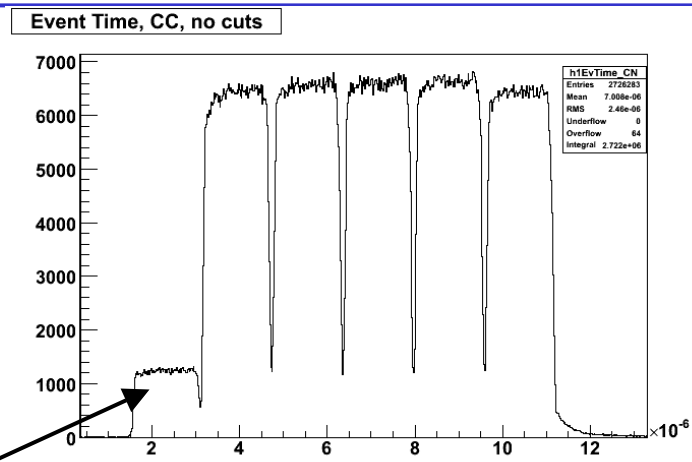
- Reject NuMI-only running
- Compare Muon (μ^-) spectrum for Batch 1 with goofy (low) beam position vs. other conditions
  - Other batches with low beam position, and batch 1 with normal (high) position
- Using June 2005 R1.16 NearDet Data Ntuples
- Fiducial cuts exclude rock muons

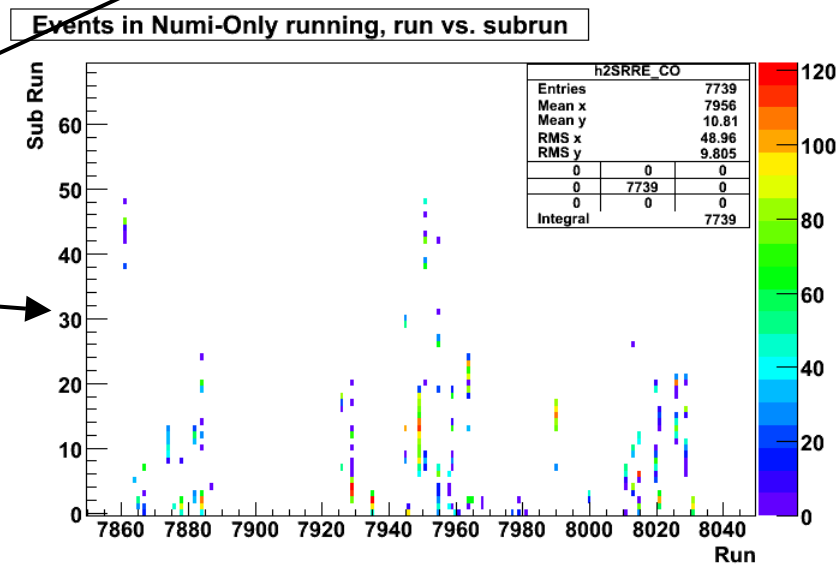
Caveats

- Effects from 1mm shift are few percent in E_ν, on high side of peak (Debbie)
  - Batch differences are worthwhile study, anyway
- Using muon fit momentum only
  - Resolution will improve using range
  - Not using shower infos

Mixed-mode Selection

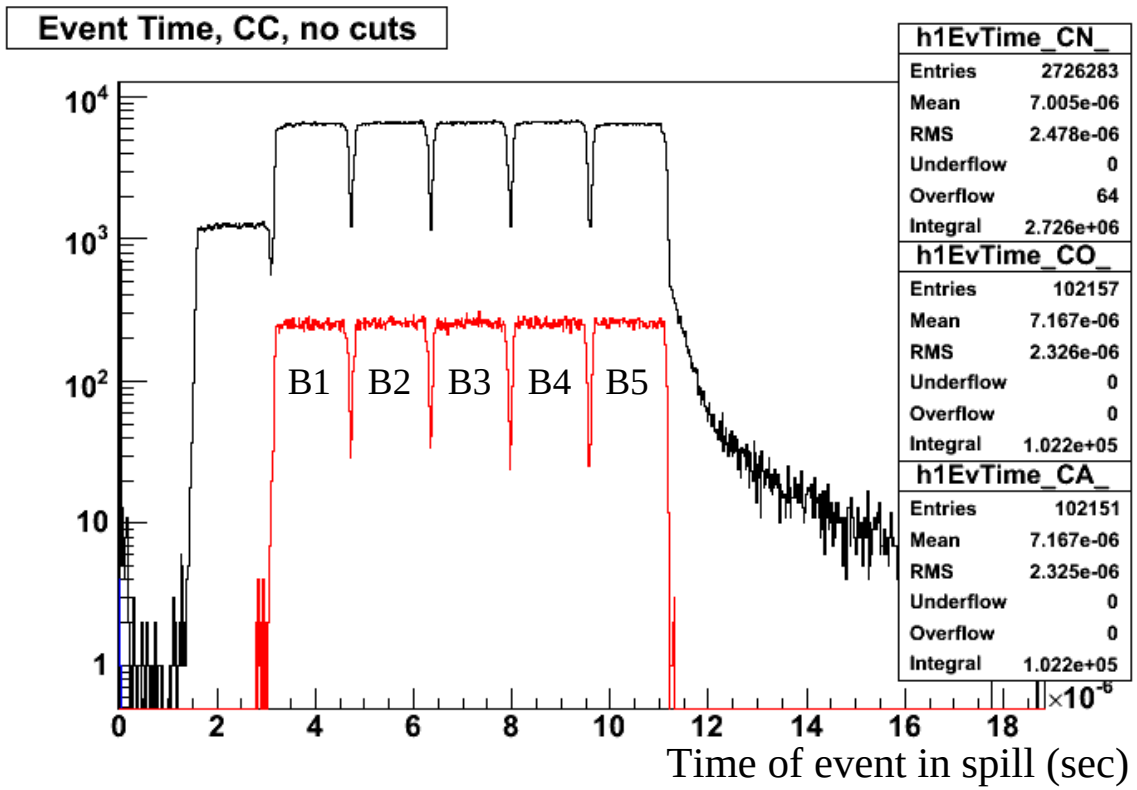
- Effect is in mixed-mode only.
  - Identify runs with "Batch 0" events
  - Remove from further analysis



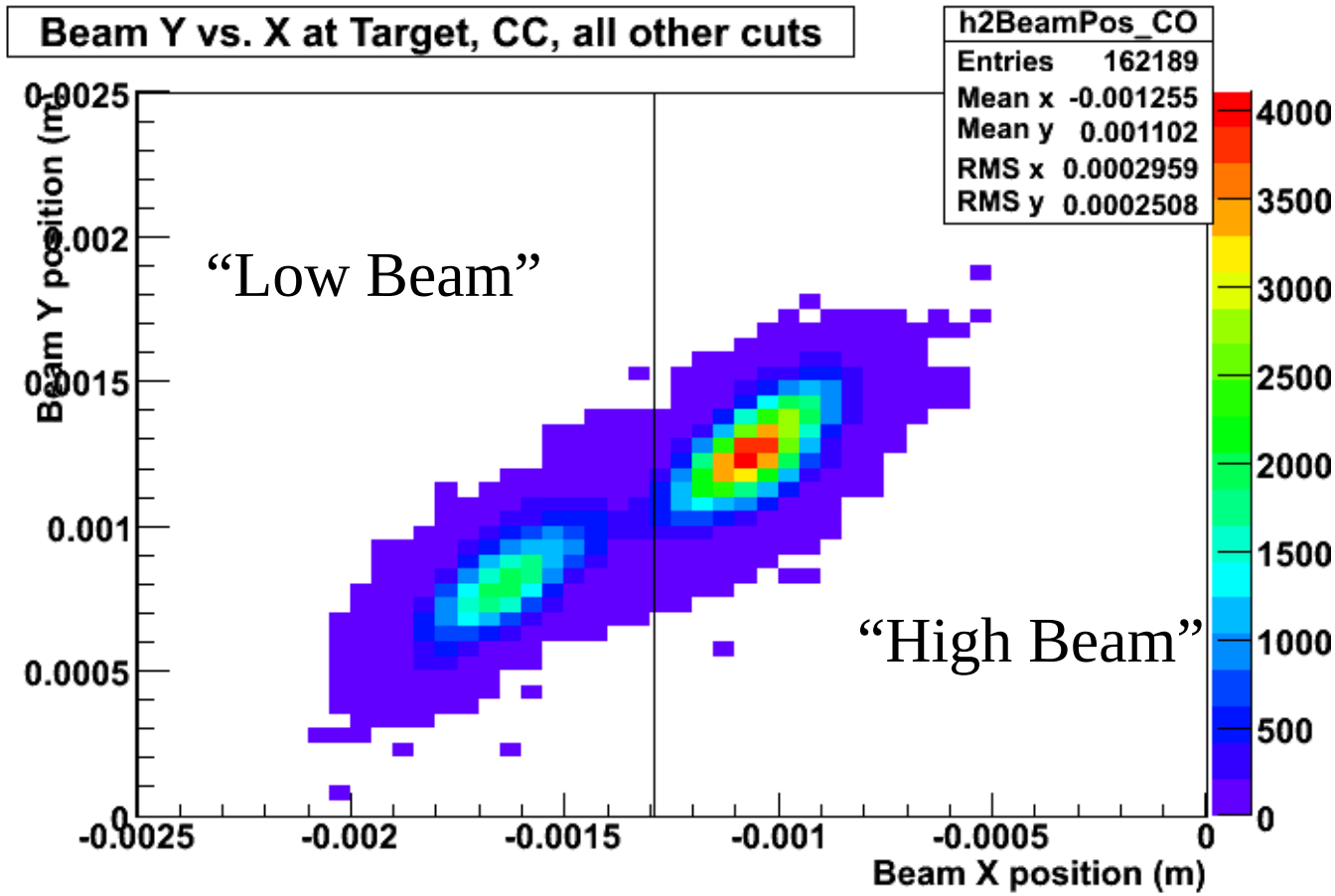


Resulting Event Timing

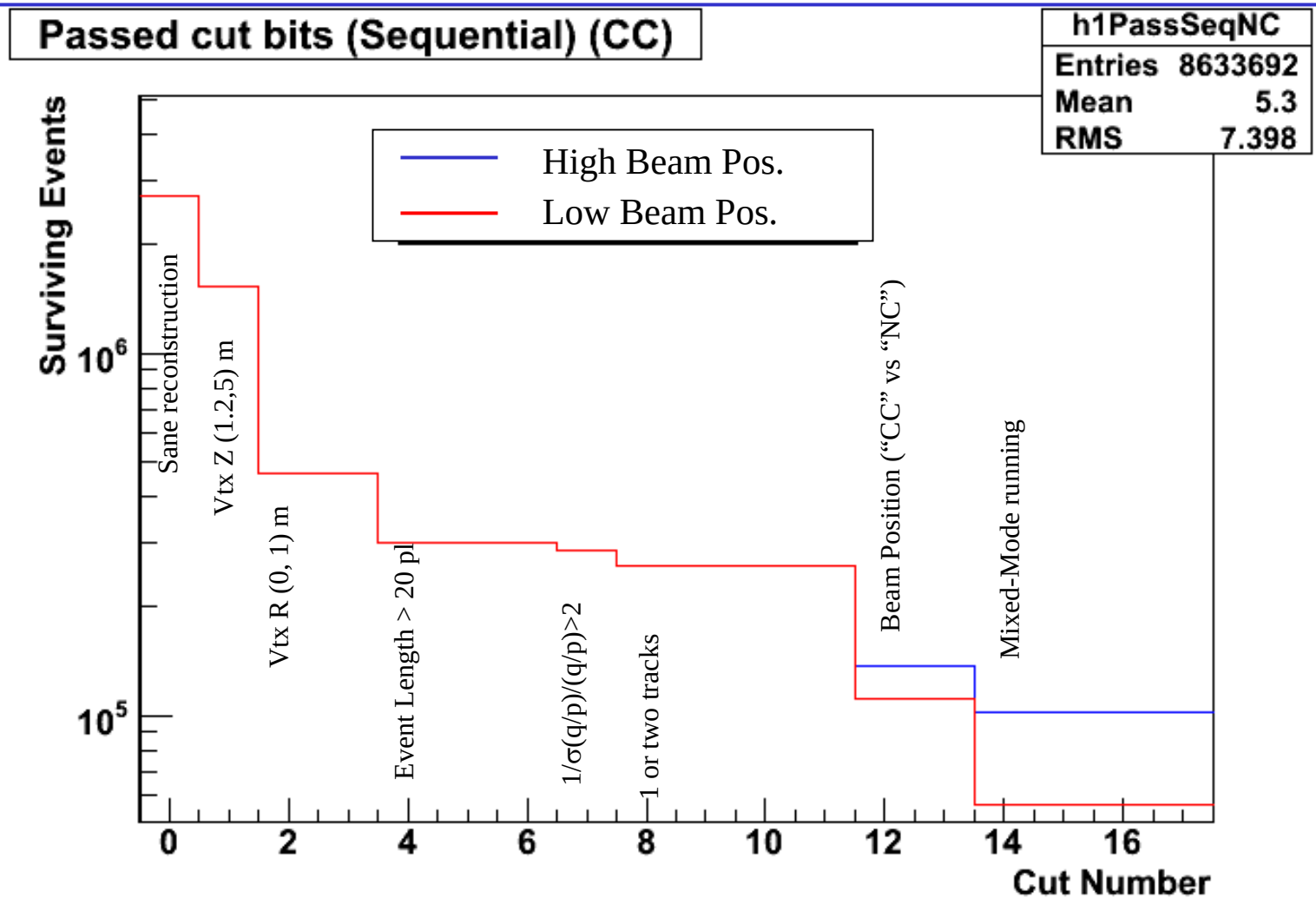
- Run-Subrun cut removes all NuMI-only running:



Beam Position Selection

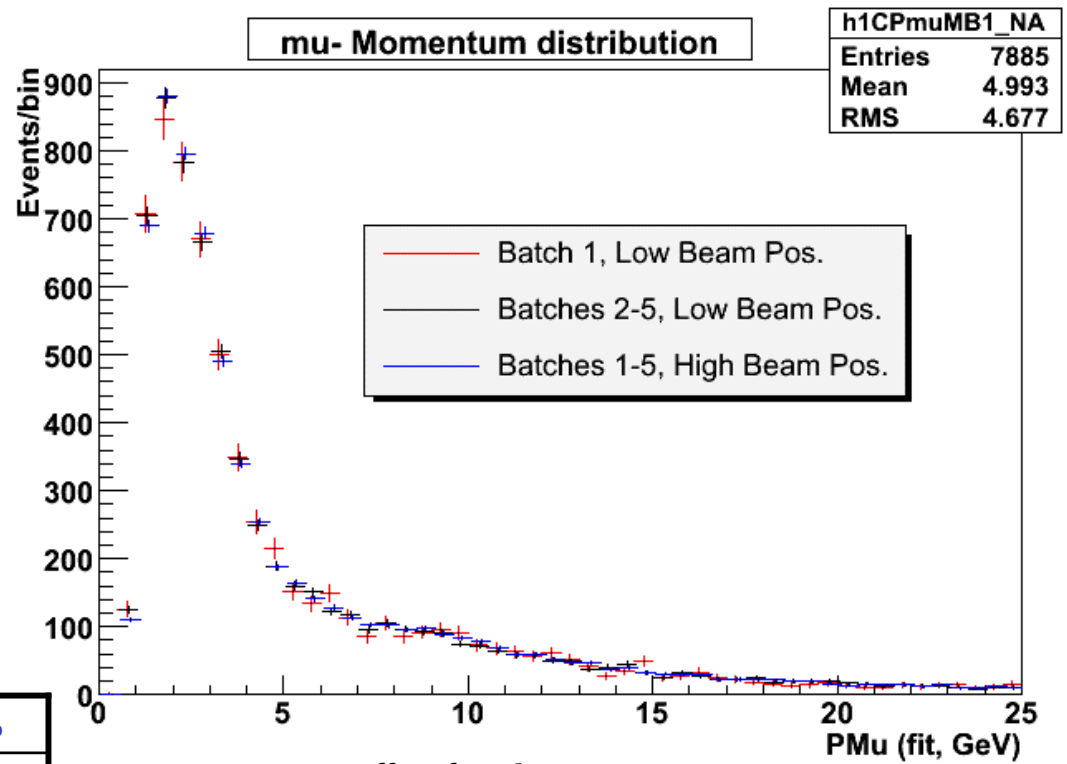


Other Cuts


Passed cut bits (Sequential) (CC)
h1PassSeqNC
Entries 8633692
Mean 5.3
RMS 7.398
High Beam Pos.
Low Beam Pos.
Surviving Events
10^6
10^5
Sane reconstruction
Vtx Z (1.2,5) m
Vtx R (0, 1) m
Event Length > 20 pl
1/σ(q/p)/(q/p)>2
1 or two tracks
Beam Position ("CC" vs "NC")
Mixed-Mode running
0
2
4
6
8
10
12
14
16
Cut Number

Results – μ^- Fit Momenta

- Compare Batch 1, Low X Beam, to
  - Batches 2-5, Low X Beam
  - Batches 1-5, High X Beam
- No significant differences

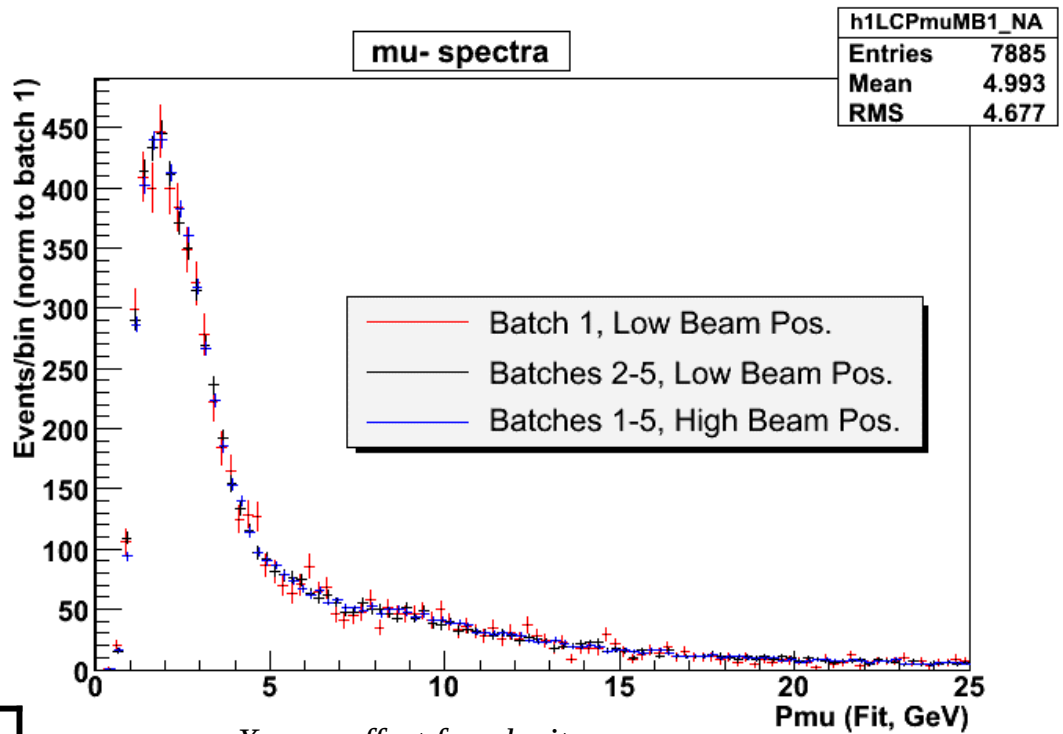


X axes offset for clarity

	Chi2	Dof	Prob %
L1 – L 2-5	42.3	50	68.5
L1 – H1-5	46.3	50	56.9
L2-5 – H1-5	42.2	50	68.8

χ^2 Test with Finer Binning

- Binning changes χ^2
  - Hard to optimize
    - Stats per bin vs. smearing out of real discrepancies



X axes offset for clarity

	Chi2	Dof	Prob %
L1 – L 2-5	99.5	99	44.2
L1 – H1-5	89.3	99	20.2
L2-5 – H1-5	89.3	99	64.9

Kolmogorov-Smirnov Test

- Use very fine binning
  - Binning on previous slides gave KS probabilities all above 90%
  - KS probability strictly for unbinned data
    - Try 50000 bins/0-25 GeV

	KS Prob
L1 – L 2-5	85%
L1 – H1-5	84%
L2-5 – H1-5	33%

- Still suspicious of high probabilities with coarse binnings
  - Examined data/code ad nauseam
    - No double filling, etc.
    - Error bars are correct.

Conclusions

- No hint of statistically significant μ^- spectrum difference for 1st batch when beam is low in X
  - As expected from PBEAM studies
- To Do
  - More stats
  - Include rock muons?
  - Use best momentum (range when stopping)
  - Compare all batches
  - Use infrastructure for Shower Energy reco effects vs. time in spill