LHRS Analysis for d_2^n

Data Quality

D. Flay

Hadronic & Nuclear Physics Group
Temple University Physics Department

9/30/10

Outline

Data Quality (1)

Identifying Beam Trips: Method

- Plot the beam current:

$$I = \frac{\omega - a}{m} \; [\mu\mathrm{A}]$$

  - These values are obtained from Diana's BCM calibration
    - $\omega =$ scaler rate $[\mathrm{Hz}]$ (we use the upstream $\times 3$ variable, `u3r`)
    - $a =$ offset $[\mathrm{Hz}]$
    - $m =$ slope $[\mathrm{Hz}/\mu\mathrm{A}]$
- We then fit this histo, obtaining the mean M and the width σ
  - These are then used to determine (event-by-event) whether or not the beam current falls within $M \pm \ell$
    - If $5\sigma > 1\mu\mathrm{A}$, $\ell = 5\sigma\mu\mathrm{A}$
    - If $5\sigma < 1\mu\mathrm{A}$, $\ell = 1\mu\mathrm{A}$
- A flag f is assigned to each event for each possible condition:
  - $f = 1$ if $I > M + \ell$
  - $f = -1$ if $I < M - \ell$
  - $f = 0$ if neither of the above are satisfied

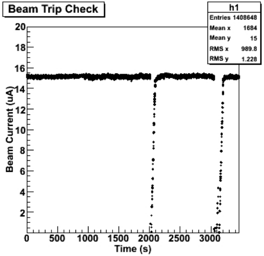
Data Quality (2)

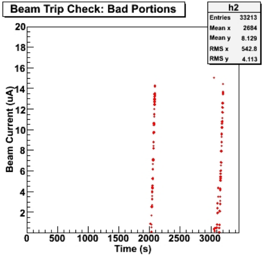
Identifying Beam Trips: Method

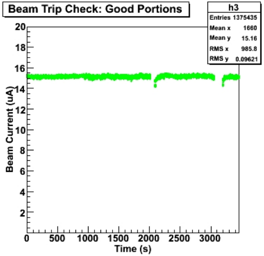
- Based on whether or not $f \neq 0$, the corresponding $103.7\ \mathrm{kHz}$ clock time is stored to an array – this array will serve as the cuts
  - A check is inserted that makes sure a cut is not imposed for consecutive events that have the same f. For instance:
    - If $f_i \times f_{i-1} = 0$ and $f_i = 0$ $(f_i \neq f_{i-1})$, then the clock time corresponding to event i is stored for the cut
    - It is clear that if $f_i \times f_{i-1} \neq 0$, or $f_i = f_{i-1}$, then no cut is stored
    - Therefore, the code essentially looks for a discontinuity in the data and places the cut at the point where the beam current deviates from the allowed region of $M \pm \ell$ or returns to the allowed region
- The procedure was carried out for the $p = 0.60\ \mathrm{GeV}$, 4-pass kinematic [negative polarity]
  - Runs: 20675–20680, 20682, 20718–20720
  - Created a beam trip database which has the cut positions (for the clock) stored to each file, labeled by run number

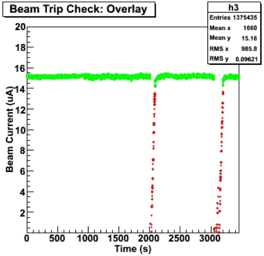
Data Quality (3)

Sample Plots: Run 20675



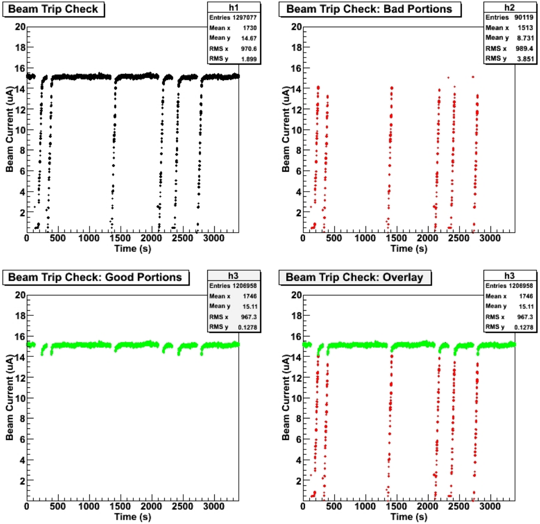






Data Quality (4)

Sample Plots: Run 20679



Data Quality (5)

Beam Quality Statistics

$p = 0.60$ GeV, $E = 4.73$ GeV		
Run	Beam Current (μA)	Beam Charge (C)
20675	15.12	0.0457
20676	15.17	0.0500
20677	15.15	0.0453
20678	15.12	0.0450
20679	15.13	0.0458
20680	15.15	0.0458
20682	15.19	0.0057
20718	15.16	0.0628
20719	15.13	0.0626
20720	15.16	0.0141

- $I_{\text{avg}} = 15.15\ \mu\text{A}$
    - Beam trips are removed in this calculation
- $Q_{\text{tot.}} = 0.4228$ C
    - Beam trips not removed *yet*...

Data Quality (6)

Skim ROOTfiles: Stages

- The beam trip code is largely based on Xin's code
- He also imposes some other nice ideas which 'clean up' the data: skim ROOTfiles
  - Multiple stages
  - Stage 1: remove beam trip
  - Stage 2: remove detector trips, etc.
  - At each stage, the fixes are applied to existing ROOTfiles, and a skim ROOTfile is the output
- I think this is a good idea, and would be useful to utilize
  - Stages 1 and 2 above are a good starting point
  - As I complete each stage, we can talk about what should be added (more checks, stages, etc.)

Summary

- Data Quality
  - Beam trips have been identified for the $p = 0.60$ GeV, 4-pass kinematic [negative polarity]
  - Beam trip database has been created
    - Allows for the removal of beam trips from ROOTfiles

What's Next?

- Data Quality
  - Skim ROOTfiles: Stage 1
    - Implement beam trip removal into replays – process each ROOTfile, outputting a beam trip free ROOTfile
    - At least get the code written and working – we may want to do the 'stages' when all the code is ready to go
  - Negative Polarity
    - Extend beam trip check to more momentum bins
  - Positive Polarity
    - Implement beam trip code
    - Extend checks to more momentum bins
- SAMC
  - Finish gathering quantities for input file
    - For H and ^{3}He targets: Fermi momentum k_F, average nucleon interaction energy $\bar{\epsilon}$
- LHRS β
  - S1, S2m TDC raw times: understand sharp peaks at large times. . .