BigBite Analysis

Nitrogen Dilution Revisited,Pion Contamination and Live-Times

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Outline

Current Nitrogen Dilution

- Investigate the trend difference between the 4 and 5 pass data?
  - 4-Pass: N_2 fill densities (currently used constant fill density)
  - 5-Pass: Trigger changes (Pre-Shower in/out of trigger)

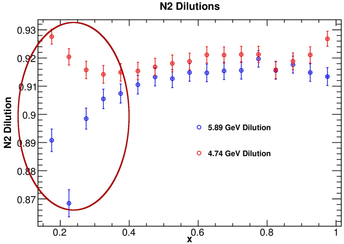

Figure: Current 4/5 pass nitrogen dilution factors. Red circle shows largest trend difference between the two energies.

Nitrogen Pressure Changes

Table: 4.74 GeV nitrogen reference cell pressures for runs used in current 4-pass analysis.

Run	Pressure [Psig]	Temperature [°C]	Pressure [amg]	Uncertainty [amg]
2055	119	41.65	7.89	0.166
2132	-	-	-	-
2186	116	42.20	7.70	0.162

- Current analysis used above 3 runs with pressure of 116 psig for all runs
- No pressure information for run 2132 so was not used in analysis to follow

Comparison of 4-Pass Nitrogen Dilution Factors

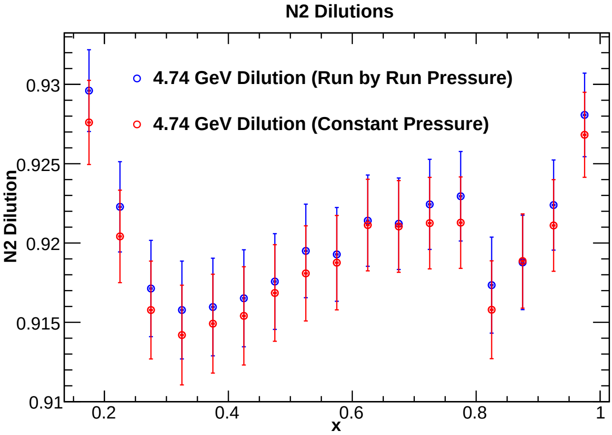

Figure: Comparison of 4-pass nitrogen dilution factors computed with constant (red markers) and varying pressures (blue markers).

Trigger Changes

- There was a large change in the e+/e- ratio when looking at data before and after the pre-shower was added to the trigger
- See if the change in the trigger has any affect on the nitrogen dilution factor during the 5-pass running...

Before Trigger Change

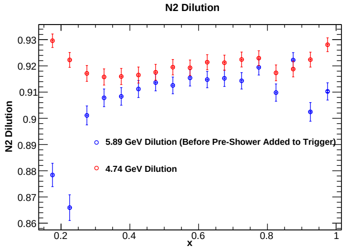

Figure: Shows the 5.89 GeV nitrogen dilution factors before the pre-shower was added to the trigger (blue markers), compared to the 4.74 nitrogen dilution factors (red markers).

After Trigger Change

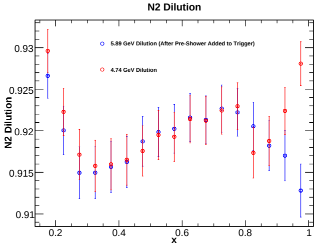

Figure: Shows the 5.89 GeV nitrogen dilution factors after the pre-shower was added to the trigger (blue markers), compared to the 4.74 nitrogen dilution factors (red markers).

Summary: Nitrogen Dilution

- There is not much change in the 4-pass nitrogen dilution factors when accounting for non-constant fill pressures
- The difference in nitrogen dilution factors between the 4 and 5 pass data is due to the pre-shower being added into the trigger
- We should divide the 5-pass asymmetries into two sets (before/after pre-shower trigger change)

Pion Contamination Procedure

- Ideally select all electrons using all cuts except pre-shower
- Fit both hadron and electron peaks
- When applying all electron cuts but per-shower, there is not much of a peak to fit

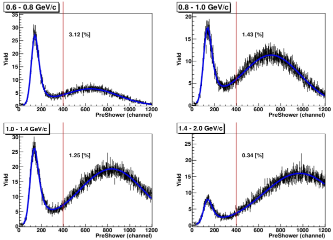

Figure: Shows ideal contamination procedure. Plots from Kalyan Allada's PhD thesis.

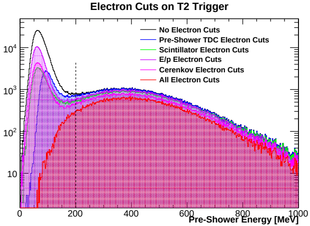

Figure: Applying all electron cut other than per-shower to d2n data.

New Contamination Procedure

1. Use pion PID cuts to select pions and fit pre-shower curve ($f_\pi(ps)$),where ps is pre-shower energy
2. Use electron cuts to select electrons and fit pre-shower curve ($f_e(ps)$)
3. π/e ratio =

$$\frac{\int_0^\infty f_\pi(ps)}{\int_0^\infty f_e(ps)}$$

4. π/e contamination ratio =

$$\frac{\int_{200}^\infty f_\pi(ps)}{\int_{200}^\infty f_e(ps)}$$

Pion Contamination

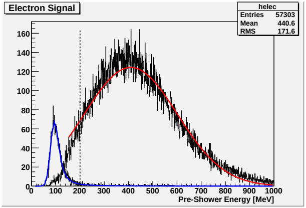

Figure: Pion (blue) and electron (red) fits to pre-shower energy for run 1650 and all x.

- Run 1650, All x
- $\frac{\pi}{e}(0->1000MeV) \sim 6.0\%$
- $\frac{\pi}{e}(200->1000MeV) \sim 0.4\%$

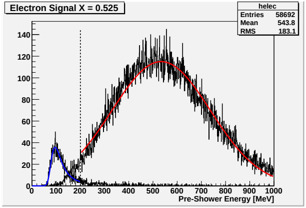

Figure: Pion (blue) and electron (red) fits to pre-shower energy for runs 1580-1647 and x = 0.525.

- Runs 1580-1650, x = 0.525
- $\frac{\pi}{e}(0->1000MeV) \sim 4.6\%$
- $\frac{\pi}{e}(200->1000MeV) \sim 0.6\%$

Helicity-Dependent Live Time

- To Compute helicity dependent live time we need to select helicity dependent T2 triggered and scalar events
  1. Cut on helicity ADC (this is trigger event based) and count scalar and triggered events
  2. Cut on helicity ADC for triggered events and use helicity-gated scalar counts for scalar events
- Scalar counts are not refreshed at same rate as triggered events
- Results in multiple helicity states having same scalar count

Table: Example of scalar and triggered event read out

Event	Scalar clock	helicity (triggered event based)
1	1	1
2	1	1
3	1	0
4	1	-1
5	2	-1

Scalar Read Out Frequency

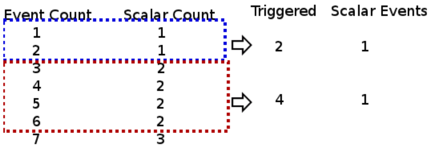

Figure: Cartoon defining a scalar and trigger events.

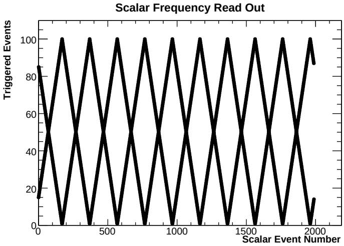

Figure: Scalar frequency read out.

Summary

- Cutting on helicity from triggered based events not trivial
- Will look into using helicity-gated scalars (don't see why we can't)