Run 15 TSSA of Open Heavy Flavor Electrons at Midrapidity (6)

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Reminder

Last update -- 07/01/2020

- Background fraction calculation procedure and results shown

For This Talk:

- Bunch shuffling cross check results
- $A_N \sin\varphi_s$ cross check results
- Charge separated asymmetries
- New pre-background corrected asymmetries
  - Changed asymmetry library to reflect proper arm mapping (east=0, west=1 for dc analyses, opposite for EMCal analyses)
  - Using bin averages instead of bin centers

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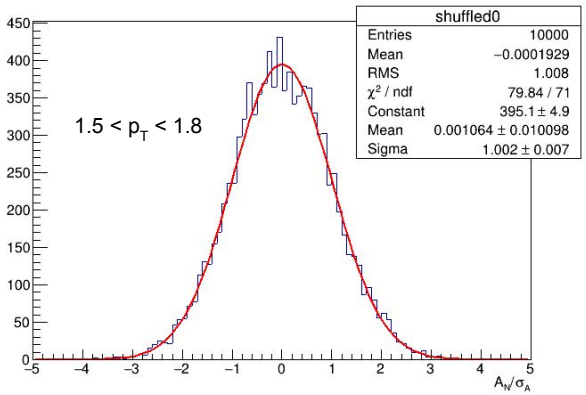
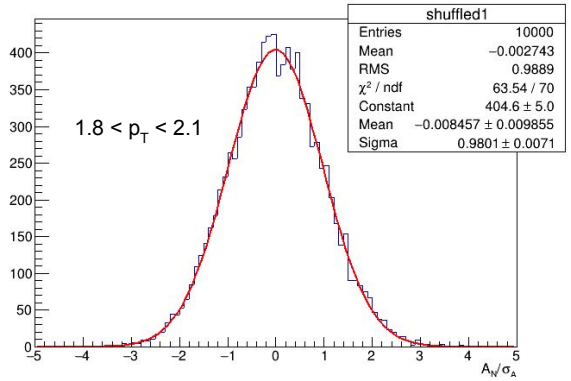
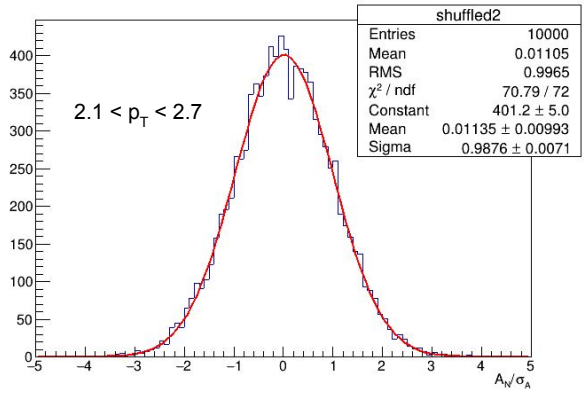
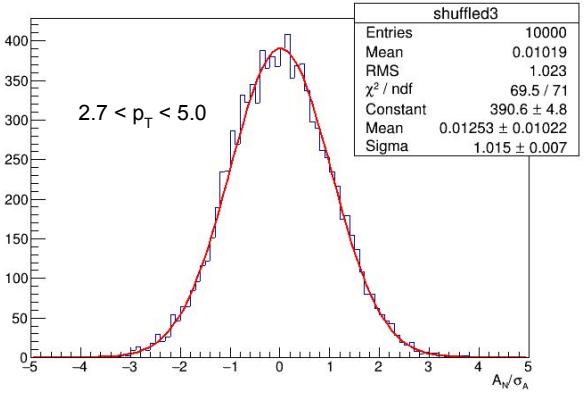
Bunch Shuffling

- 10,000 shuffles
- Mean consistent with 0 for each p_T bin
- Sigma consistent with 1 for each p_T bin
- **Conclusion:** No need to assign additional systematics from bunch shuffling



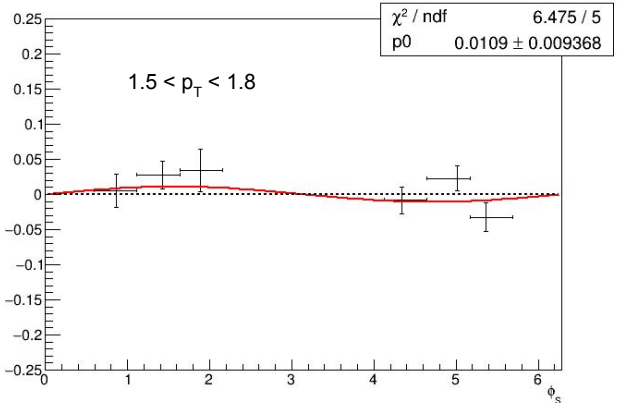


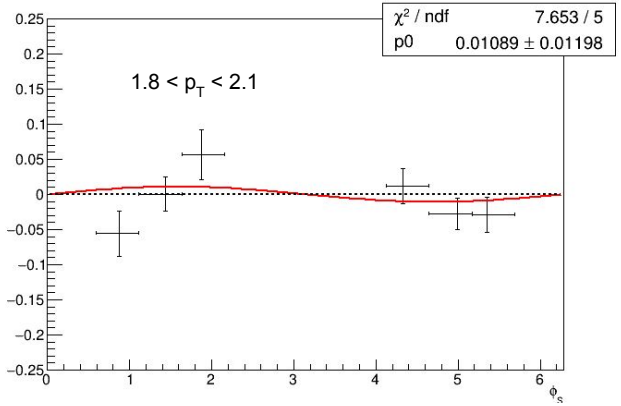


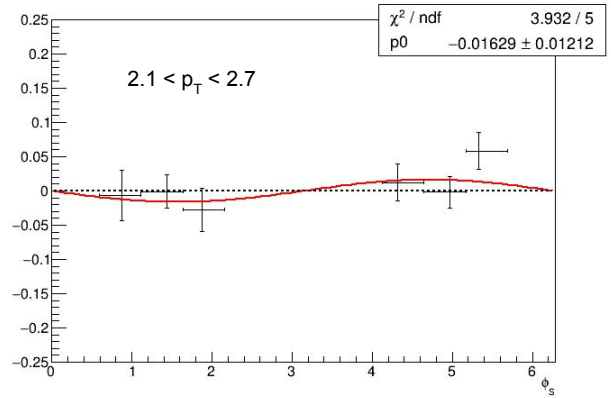


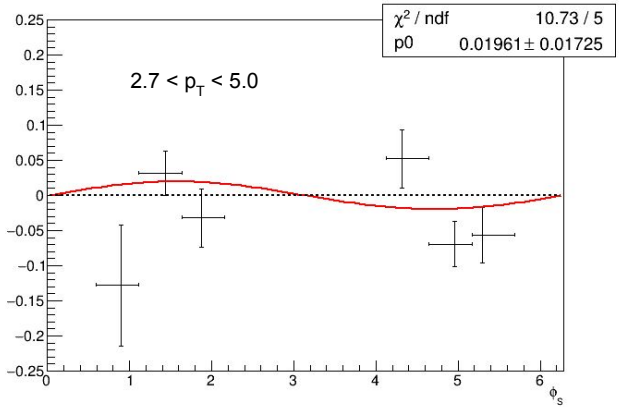
$A_N \sin\varphi_s$ Modulation - Yellow Beam Fits

- Asymmetry values for yellow beam in each p_T bin are extracted from amplitudes of sinusoidal fits in φ_s
  - $p0 = A_N(p_T^i) +/- \sigma(p_T^i)$



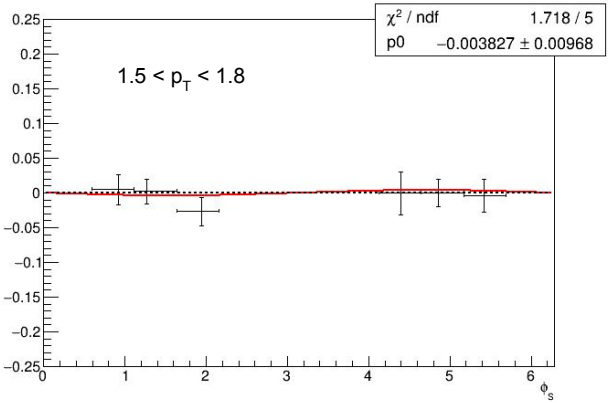


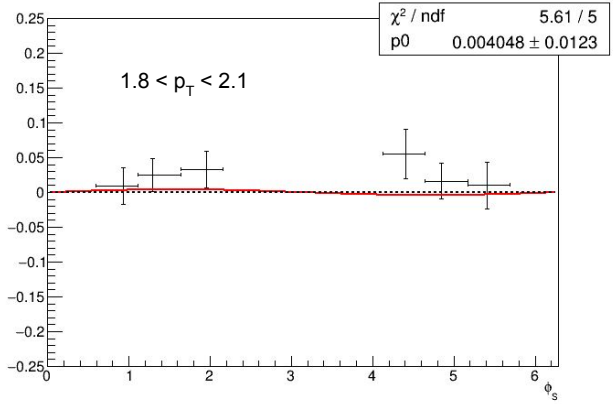


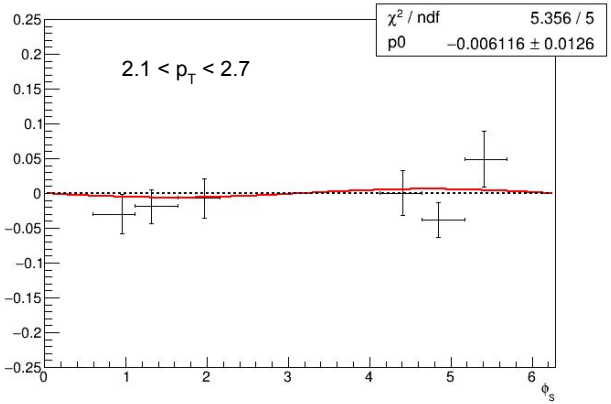


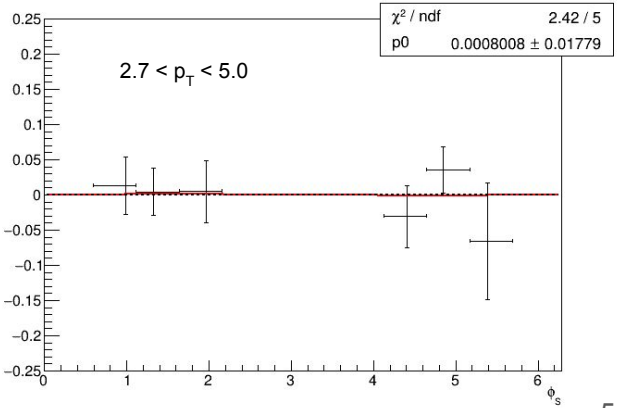
$A_N \sin\varphi_s$ Modulation - Blue Beam Fits

- Asymmetry values for blue beam in each p_T bin are extracted from amplitudes of sinusoidal fits in φ_s
  - $p0 = A_N(p_T^i) +/- \sigma(p_T^i)$



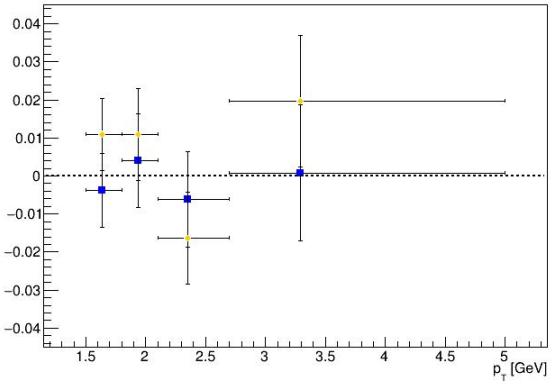


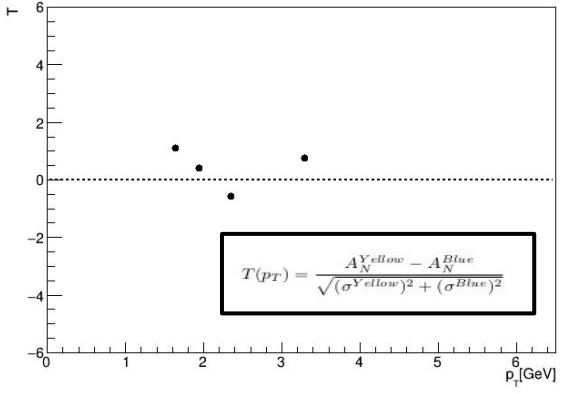




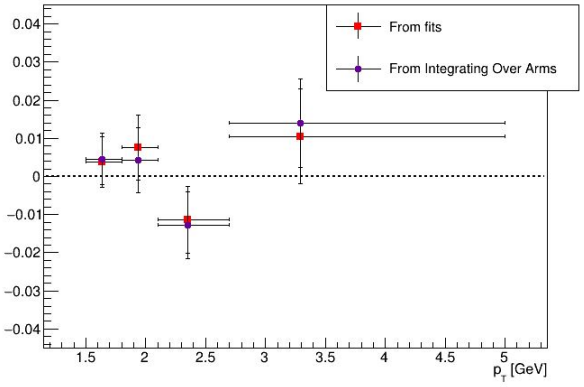
$A_N \sin\varphi_s$ Modulation - Comparison Plots

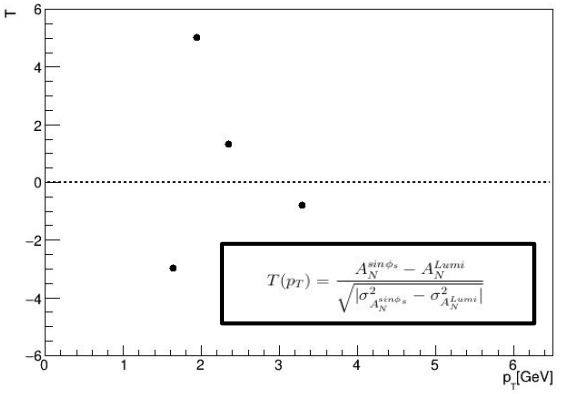
- Top plot shows yellow and blue beam fit parameters extracted as asymmetries



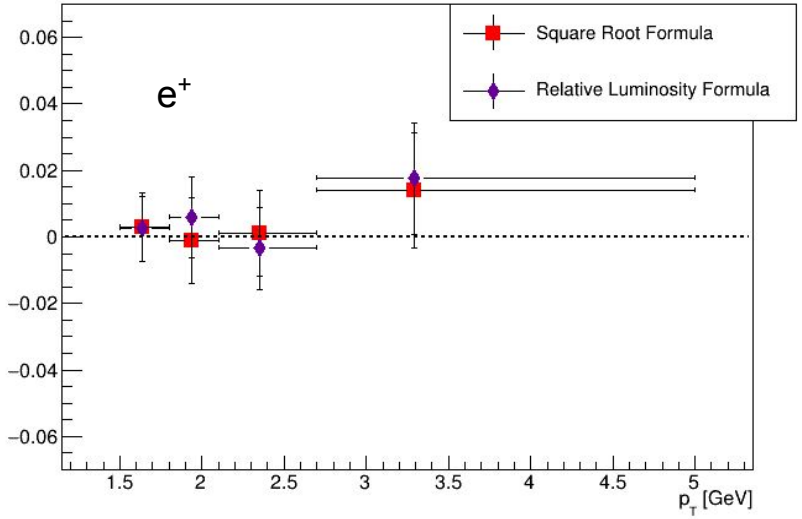


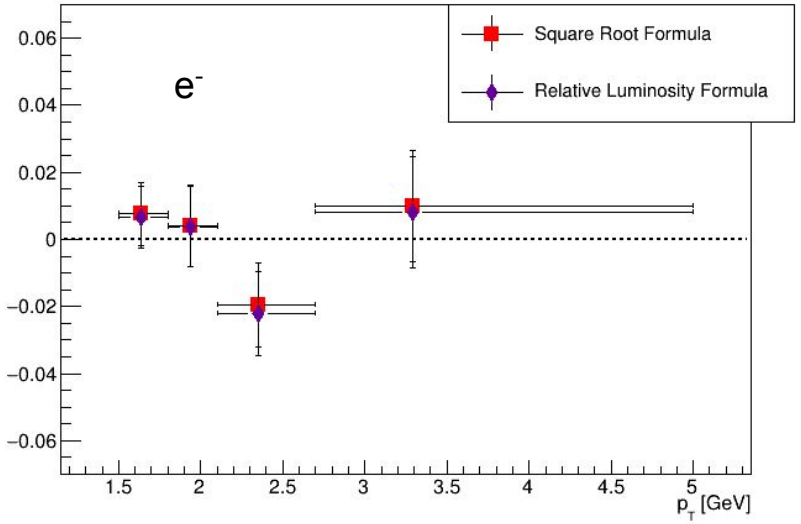
- Bottom plot shows weighted average from fits (red) compared to relative luminosity result (purple)





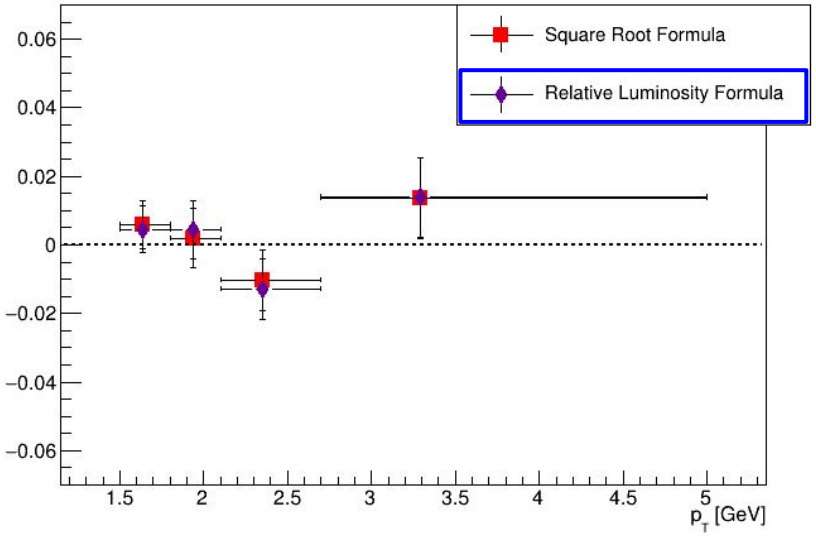
Charge Separated A_N (Before Background Correction)

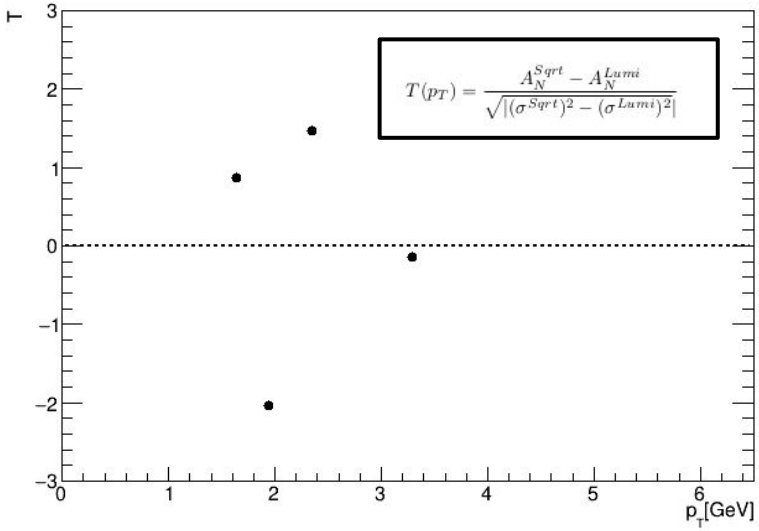




- Charge separated asymmetries shown here, they seem to be consistent with one another
- Are charge separated asymmetries worth including in a publication?
  - **Motivation:** theory predicts A_N^{D0} and A_N^{D0bar} are different

Charge Combined A_N (Before Background Correction)





- Updated results, different than what was presented on 04/29/2020 - **new results differ only by sign!**
  - Fixed asymmetry library to reflect that for drift chamber analyses, east arm corresponds to 0 and west arm corresponds to 1 (this is opposite for EMCAL analyses)
- These measurements are used to calculate the lumi-sqrt systematic uncertainty, and are the inputs to the background corrected asymmetries

A_N Summary Table

- Relative luminosity formula used for A_N and statistical uncertainty
  - Results before background correction are shown

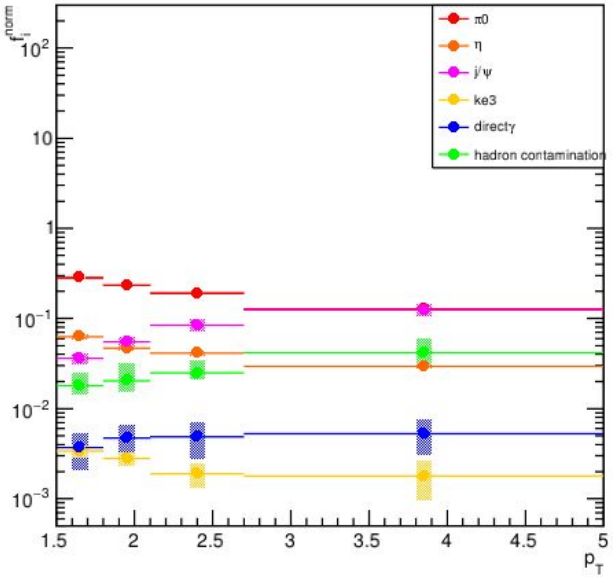
p_T [GeV]	$\langle p_T \rangle$ [GeV]	$N_{e^\pm}$	A_N^{S+B} (lumi)	$\sigma_{A_N^{S+B}}$ (stat)	$\sigma_{A_N^{S+B}}$ (sys: lumi-sqrt)
1.5 - 1.8	1.639	37655	0.00460	0.00674	0.00134
1.8 - 2.1	1.936	23404	0.00432	0.00856	0.00235
2.1 - 2.7	2.349	22202	-0.0128	0.00879	0.00242
2.7 - 5.0	3.290	12771	0.0139	0.0116	0.000301

Background Correction

$$A_N^{OHF\to e} = \frac{A_N^e - f_{h^\pm} A_N^{h^\pm} - f_{J/\Psi\to e} A_N^{J/\Psi\to e}}{1 - f_{h^\pm} - f_{J/\Psi\to e} - f_{\pi^0\to e} - f_{\eta\to e} - f_{\gamma\to e}}$$

$$\sigma_{A_N^{OHF\to e}} = \frac{\sqrt{(\sigma_{A_N^e})^2 + (f_{h^\pm}\sigma_{A_N^{h^\pm}})^2 + (f_{J/\Psi\to e}\sigma_{A_N^{J/\Psi\to e}})^2}}{1 - f_{h^\pm} - f_{J/\Psi\to e} - f_{\pi^0\to e} - f_{\eta\to e} - f_{\gamma\to e}}$$

- Macro in place to calculate background corrected asymmetries
  - Photonic background pi0, eta, and gamma are consistent with 0, treated as a dilution only
  - Formulas shown here will be applied for the background corrected asymmetries
- Working on dealing with J/ψ asymmetry
  - Early checks of calculating background asymmetry from Run15 data do not look promising
  - Midrapidity measurement from 2006 has very large statistical error bars
  - **Current Goal:** Toy MC study to analyze how dielectron decay kinematics dilute J/ψ asymmetry in hopes that the background correction of J/ψ→e can also be treated as a dilution factor only
  - Will update on this and background corrected asymmetries in the next few weeks



Next Steps

- Finish up analysis note -- goal to finish first draft by next week
- Present final (background corrected) asymmetries
- Present systematic uncertainties
  - lumi-sqrt
  - recalculate asymmetries with limits of systematic uncertainty on background fractions
- Decide what plots to include in manuscript, preliminary request
- PPG formation (members identified and contacted)

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For Your Information

I have been tracking my analysis progress on the web:
http://www-personal.umich.edu/~dillfitz/PHENIX_Analysis/index.html

For bunch shuffling results, see:
http://www-personal.umich.edu/~dillfitz/PHENIX_Analysis/Asymmetry_Ana/bunchShuffling/

For $A_N \sin\varphi_s$ results, see:
http://www-personal.umich.edu/~dillfitz/PHNIX_EAnalysis/Asymmetry_Ana/sinPhi/

For charge separated results, see:
http://www-personal.umich.edu/~dillfitz/PHENIX_Analysis/Asymmetry_Ana/chargeSep/pTBins/

For charge combined results, see:
http://www-personal.umich.edu/~dillfitz/PHENIX_Analysis/Asymmetry_Ana/pTBins/

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Backup

Charge Separated A_N (Before Background Correction)

- Charge separated asymmetries shown here, they seem to be consistent with one another
- Are charge separated asymmetries worth including in a publication?
  - Motivation: theory predicts A_N^{D0} and A_N^{D0bar} are different
- Results for e^- t-test seem strange by eye (i.e. large t values in last 2 bins), but it is calculated in the same manner as the e^+ results