Beam Single-Spin Asymmetry Progress

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Group meeting

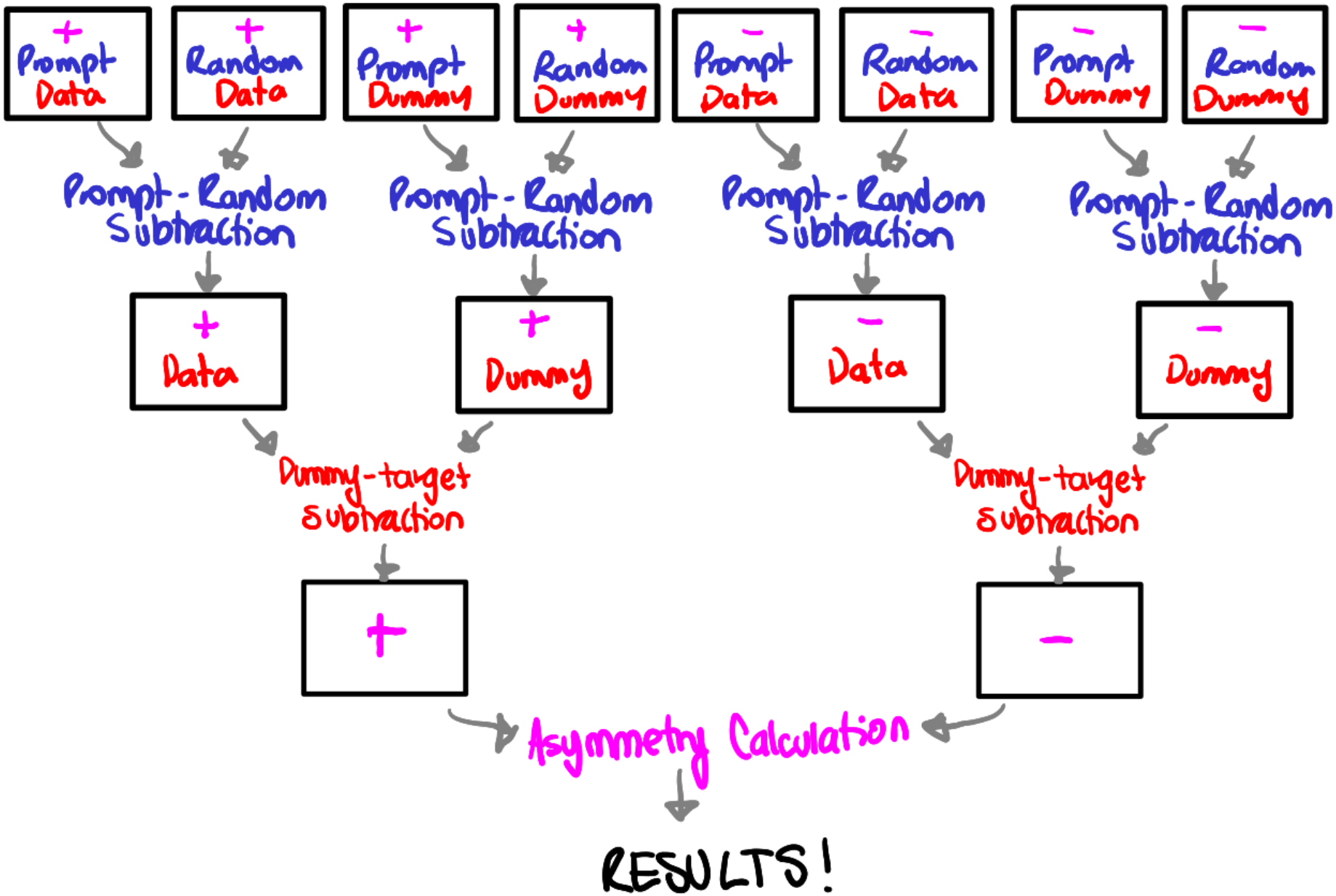
General Updates

- Replayed 10.6 GeV production (both LH2 and Dummy) with updated error calculations

→ Peter Bosted's analysis suggests only 10.6 has enough statistics and polarization for a good asymmetry calculation

- Explored error calculations in analysis
- Dummy target subtraction
- Polar plots
- Explored fitting
- Isolated cross-section ratio

Analysis Flowchart



Error Propagation

Assumes independent errors and follows general rules for error propagation:

Initial bin error: $\sigma = \sqrt{N}$

Prompt-random subtraction: $\sqrt{\sigma^2_{PROMPT} + (\sigma_{RANDOM}/6)^2}$

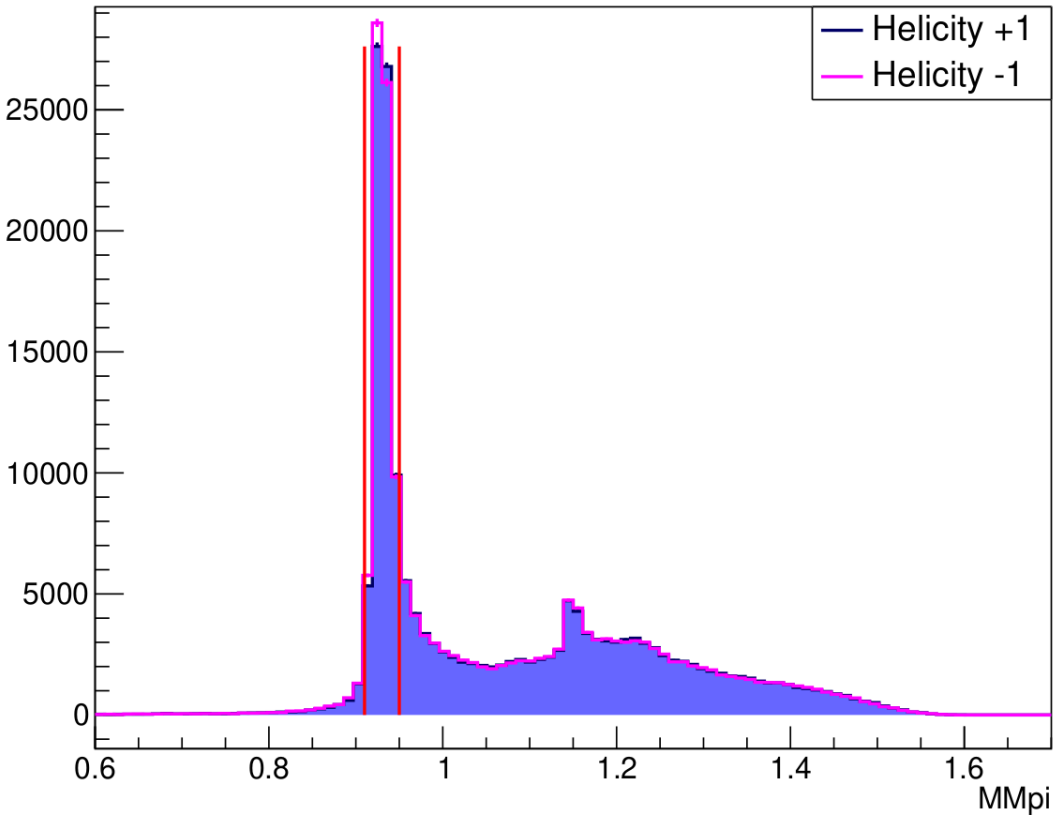
Dummy target subtraction: $\sigma\sqrt{(\sigma_{LH2}/Q_{LH2})^2 + (\sigma_{DUMMY}/Q_{DUMMY})^2}$

Asymmetry calculation:

$$\sqrt{\left(\frac{\sqrt{\sigma_+^2 + \sigma_-^2}}{N_+ + N_-}\right)^2 + \left(\frac{\sqrt{\sigma_+^2 + \sigma_-^2}(N_+ - N_-)}{(N_+ + N_-)^2}\right)}$$

Not considering: error on effective charge or polarization

MM spectrum - LH2



CUTS:

H_cal_etottracknorm>0.8

P_cal_etottracknowm>0.05

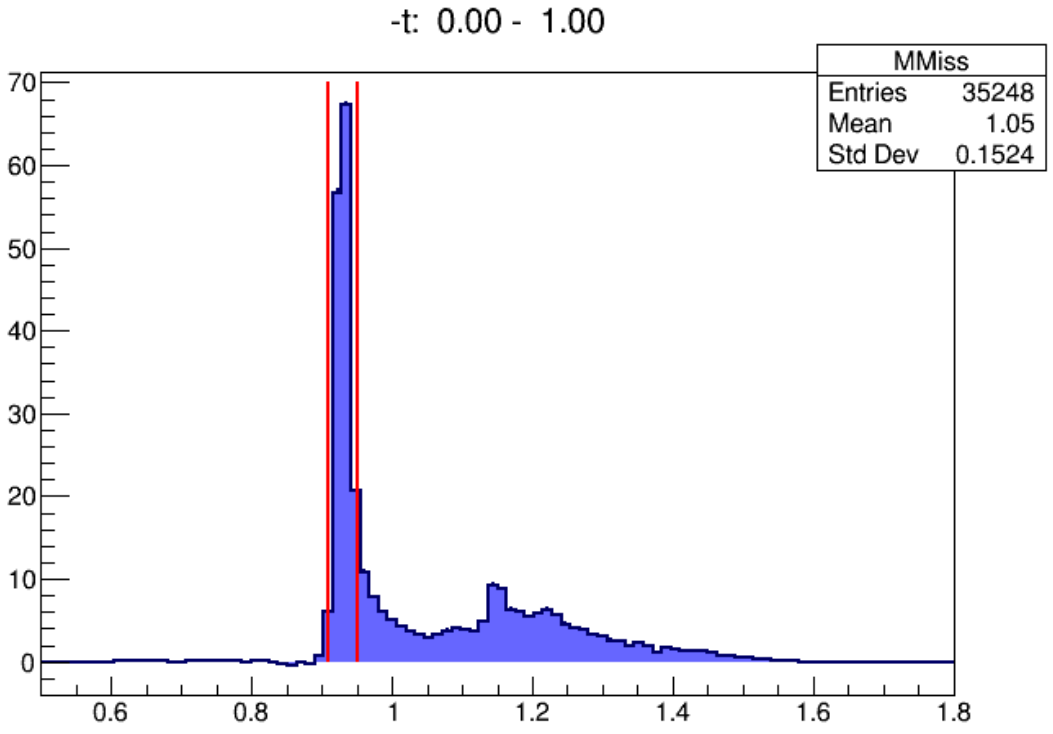
H_cer_npeSum>1.5

P_aero_npeSum>1.5

abs(H_gtr_beta-1)<0.2

abs(P_gtr_beta-1)<0.5

MM spectrum - With Dummy Target Subtraction



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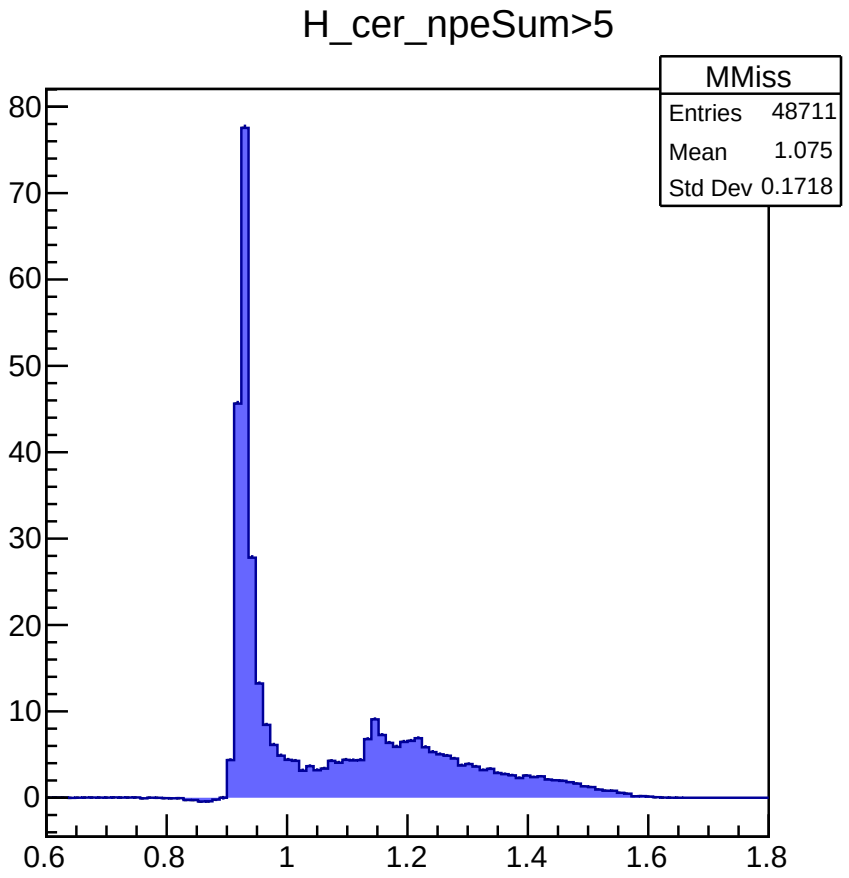
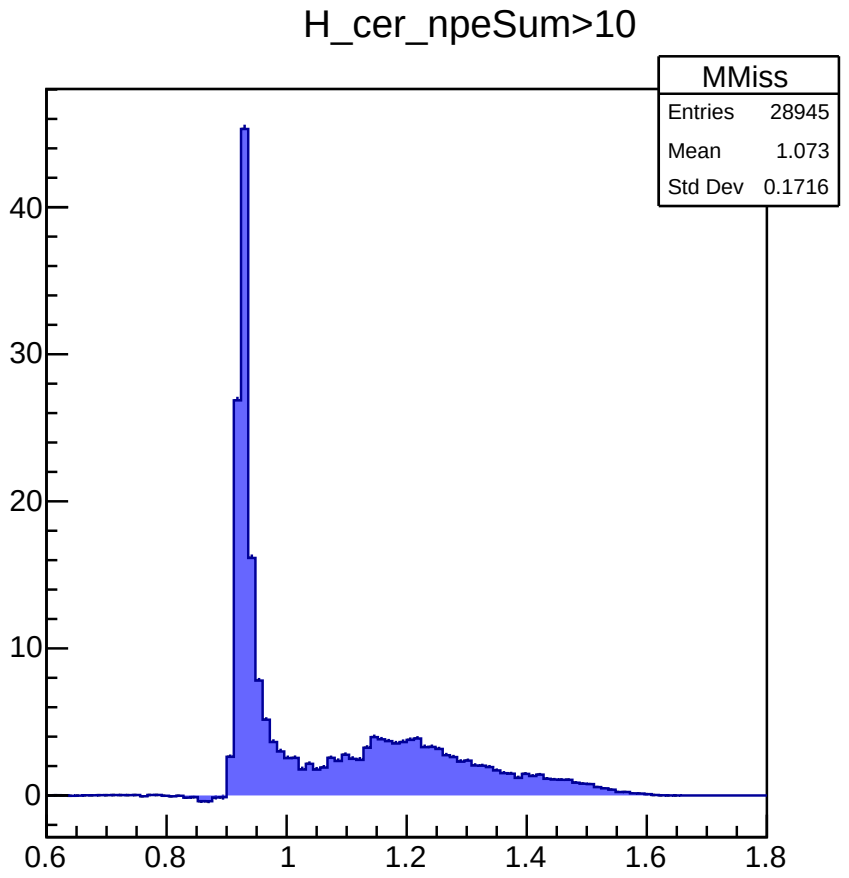
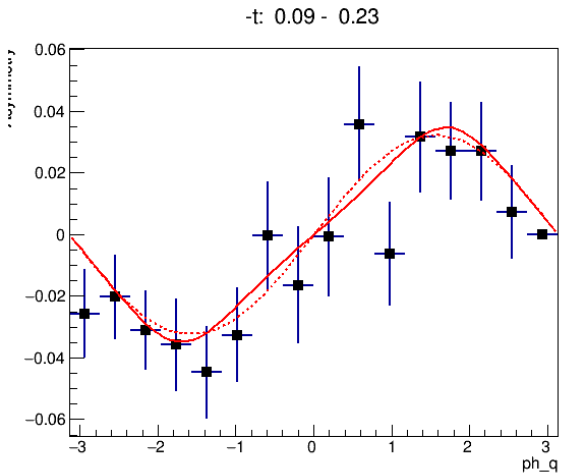
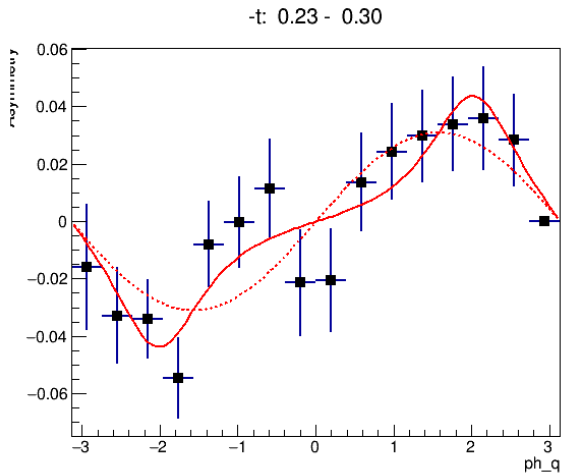
Kaon Leakthrough

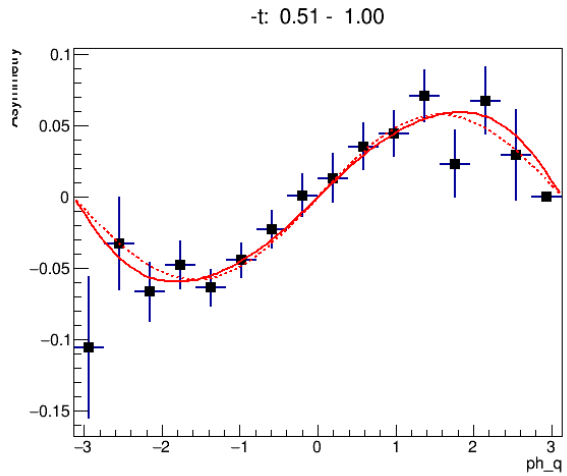


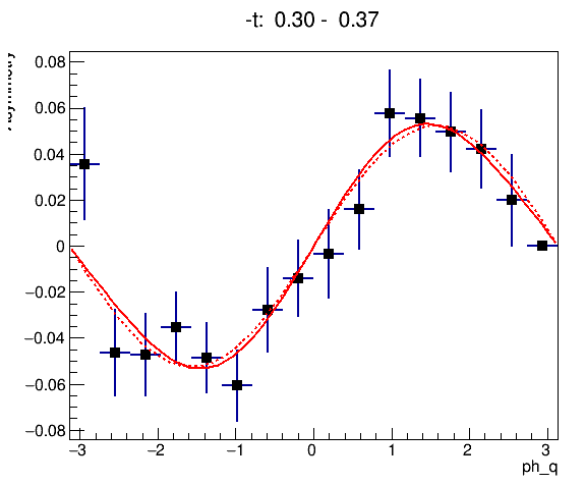


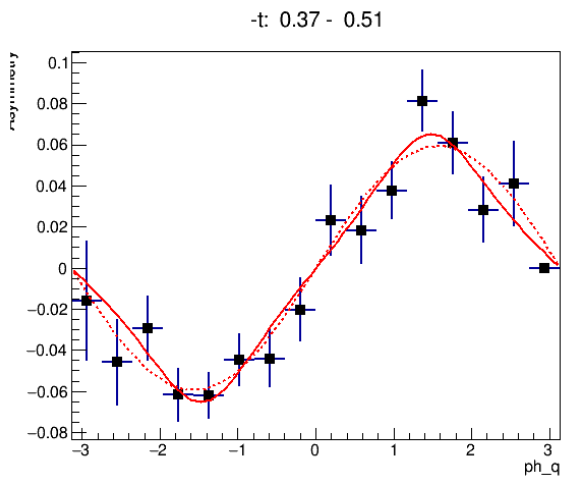
Updated Asymmetry Plots











Overfitting

Some graphs were fitting oddly when using three parameter fit:

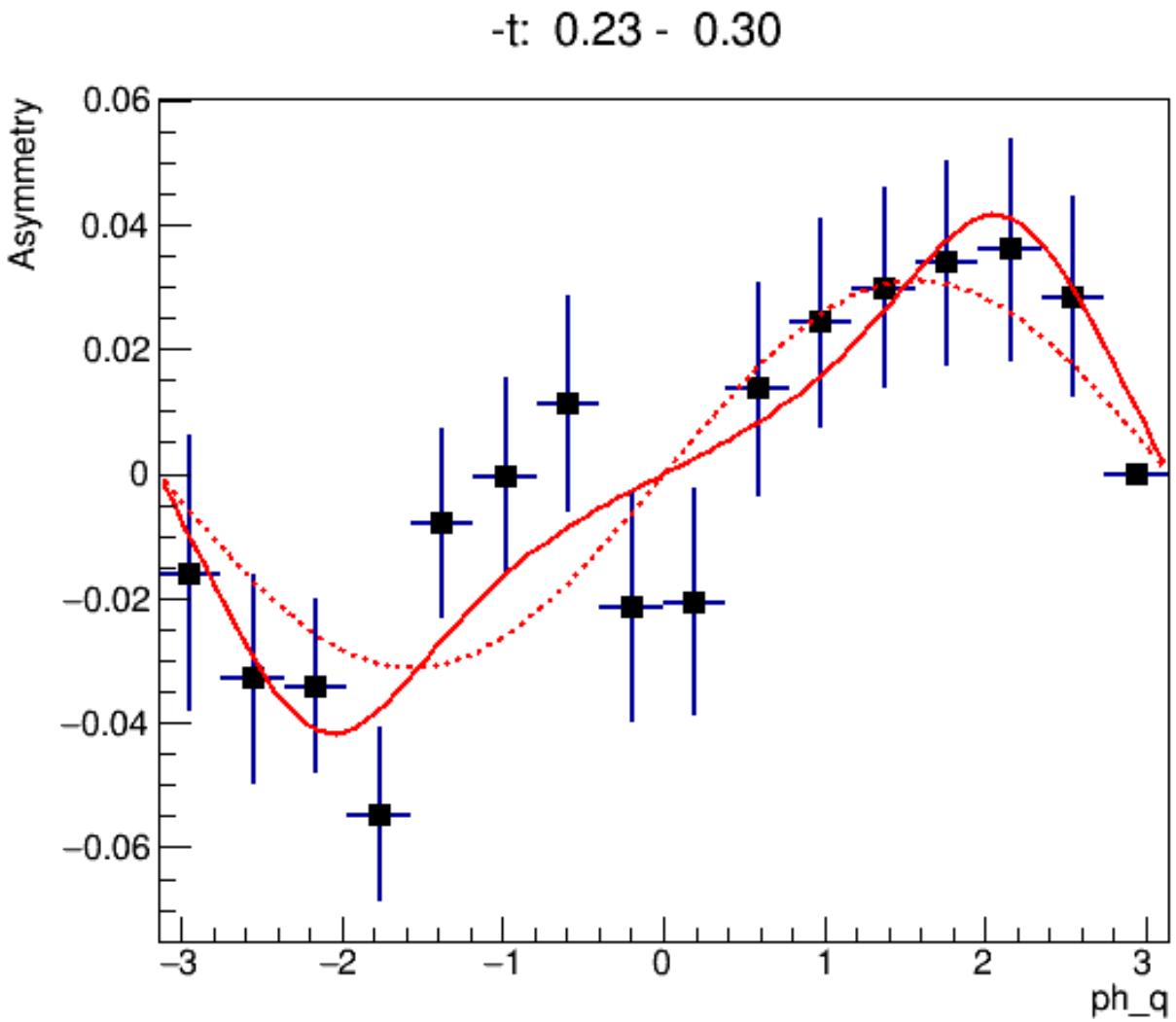
$$BSA = \frac{A sin\phi}{1 + B cos\phi + C cos2\phi}$$

I attempted two different things based on our discussion in December:

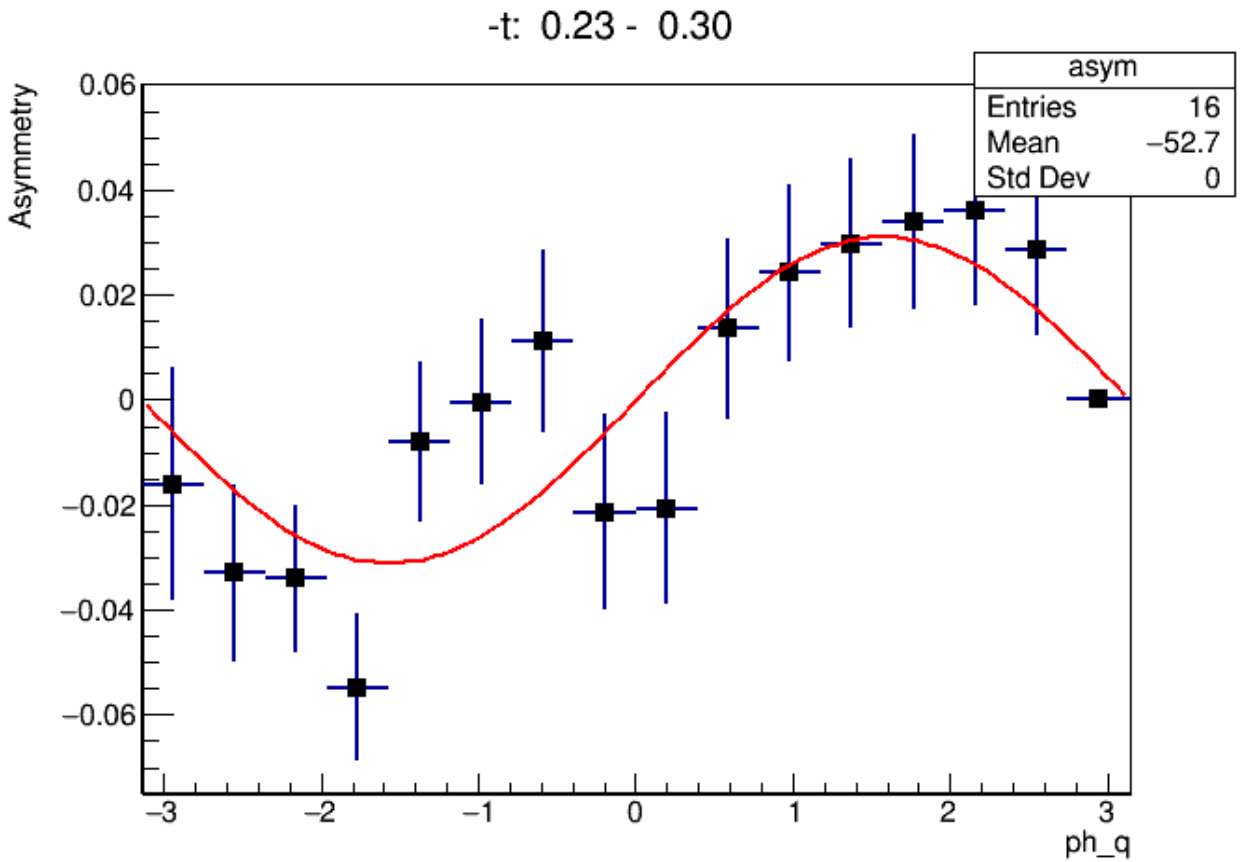
Strategy 1: first, fit $BSA = A_0 sin\phi$, then do the full fit with the restriction $A_0 - \sigma(A_0) < A < A_0 + \sigma(A_0)$

Strategy 2: do full fit with the restriction that $0 < B < A$ and $0 < C < A$

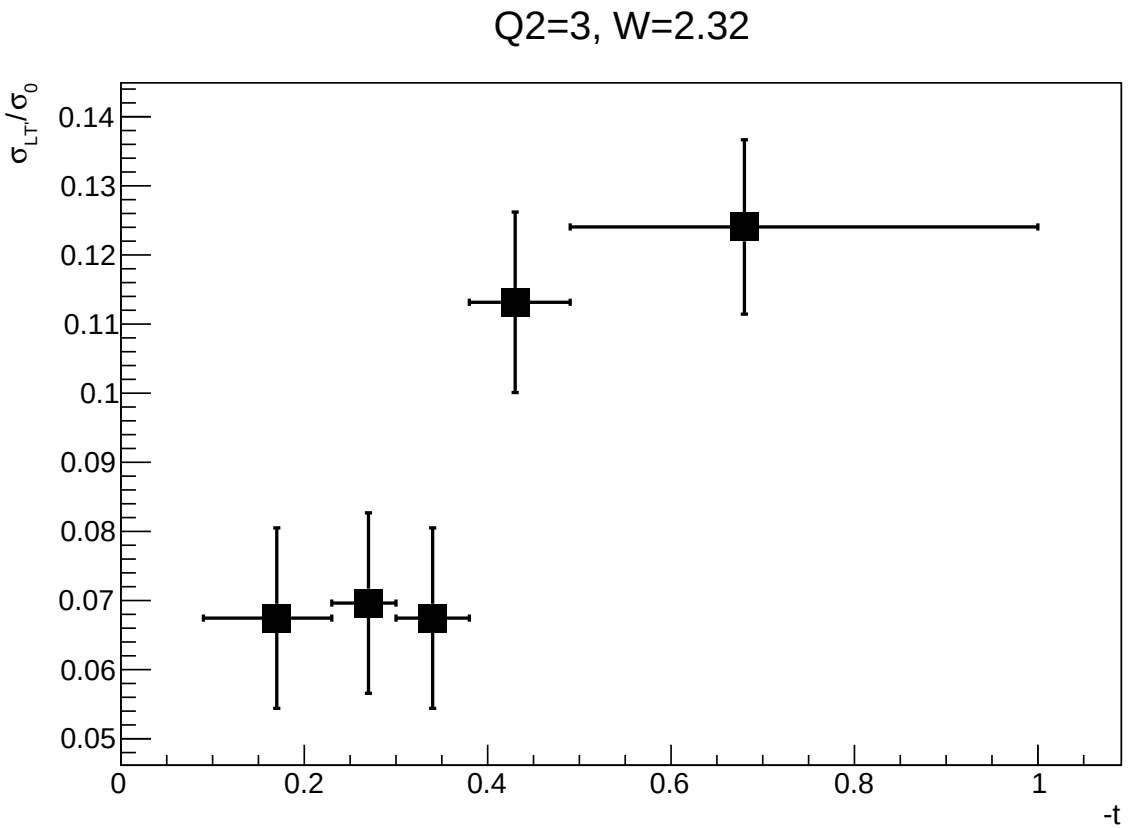
Strategy 1



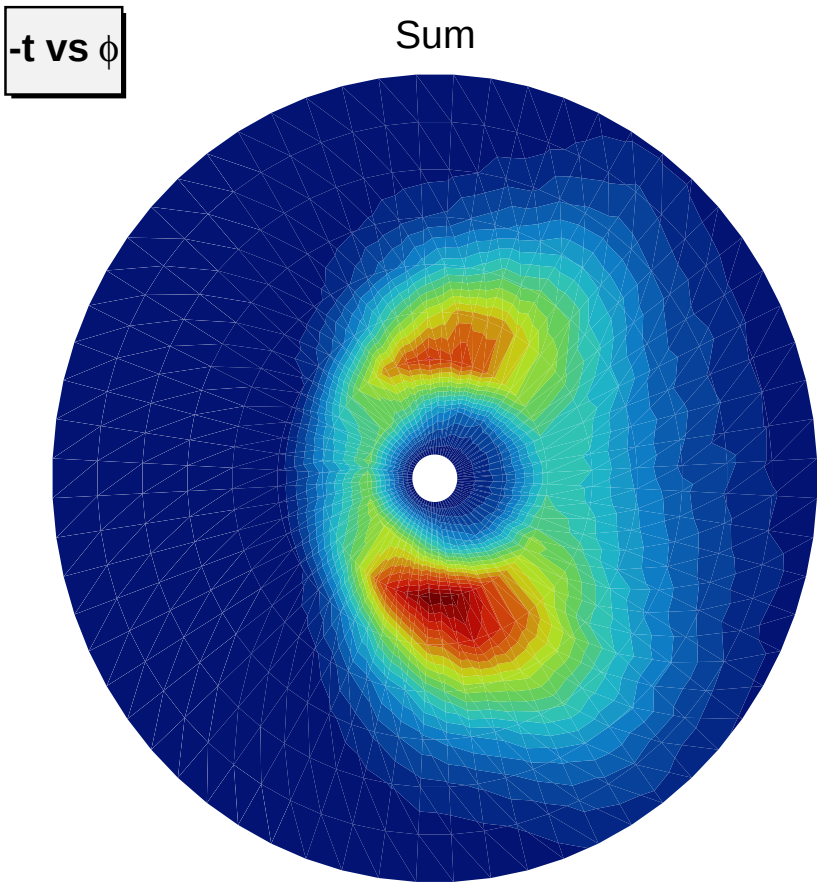
Strategy 2

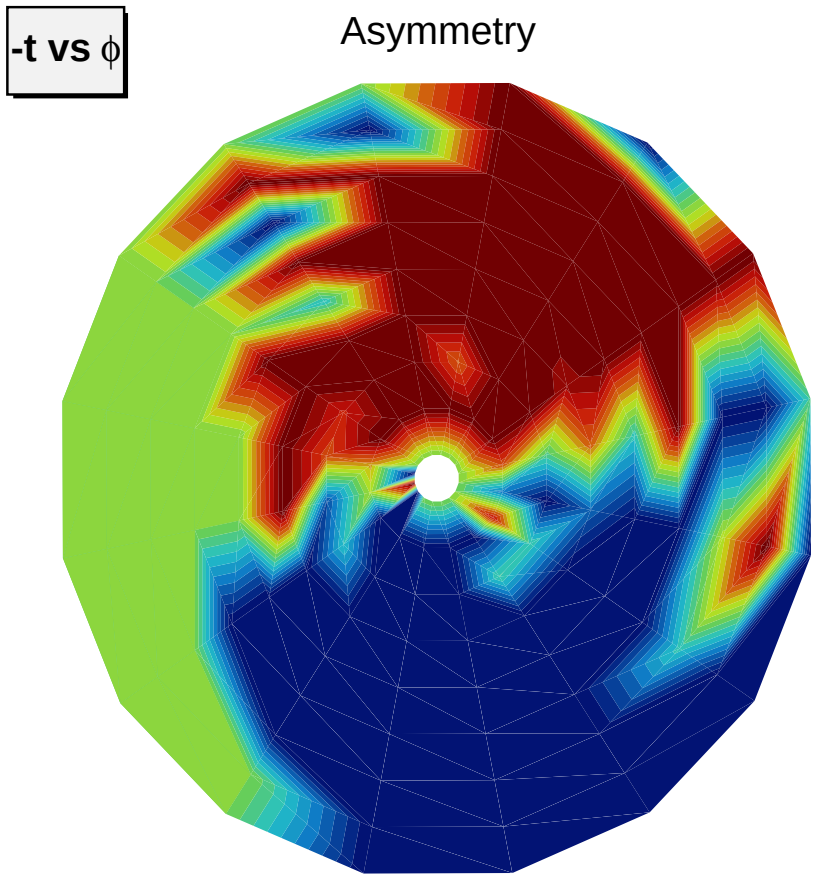

-t: 0.23 - 0.30
asym
Entries 16
Mean −52.7
Std Dev 0
Asymmetry
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
−3
−2
−1
0
1
2
3
ph_q

Cross-Section Ratio

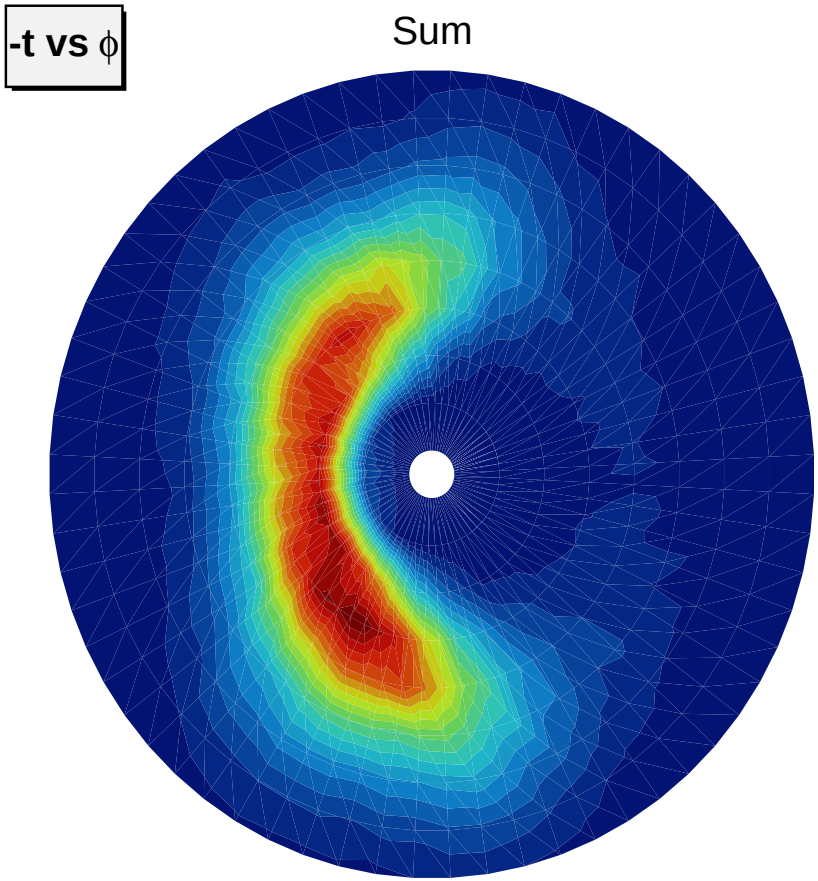


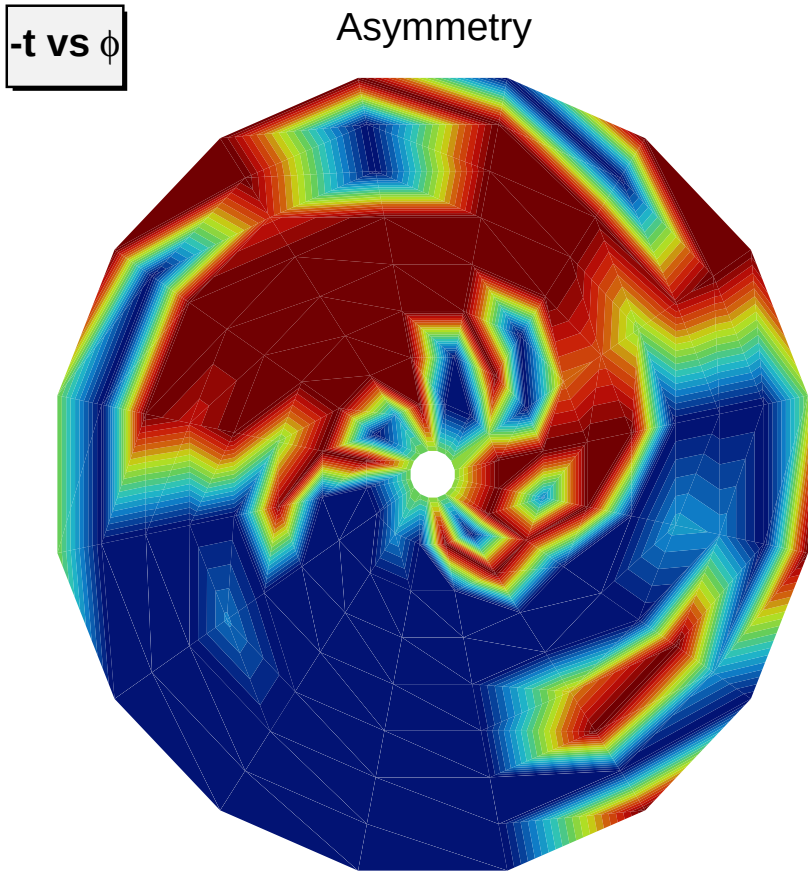
Polar Plot - Center



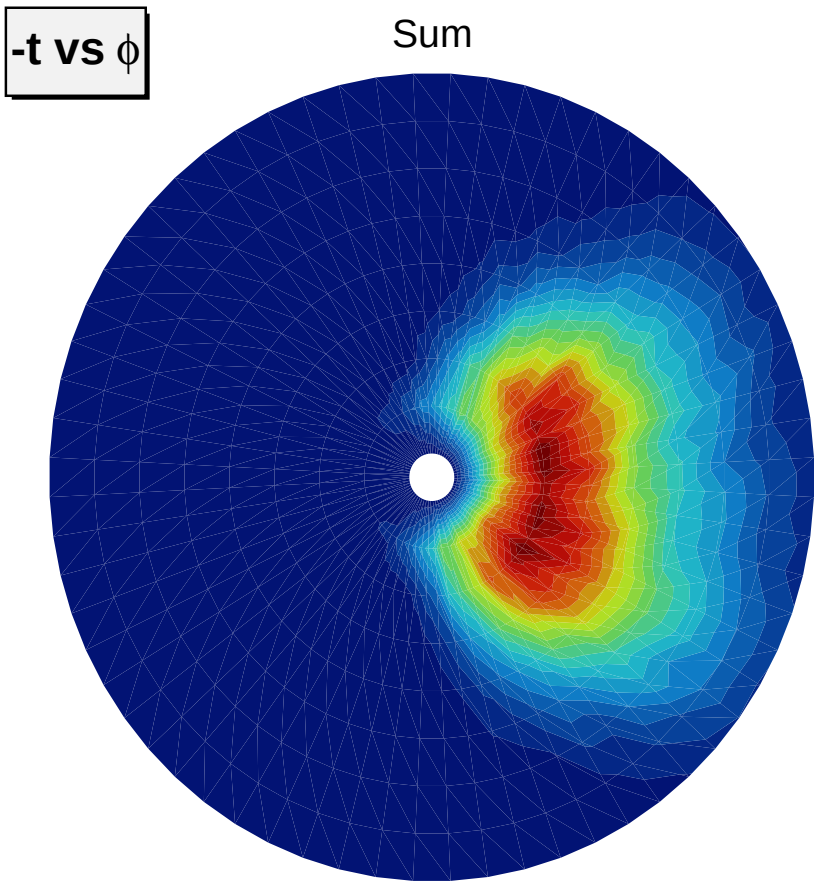


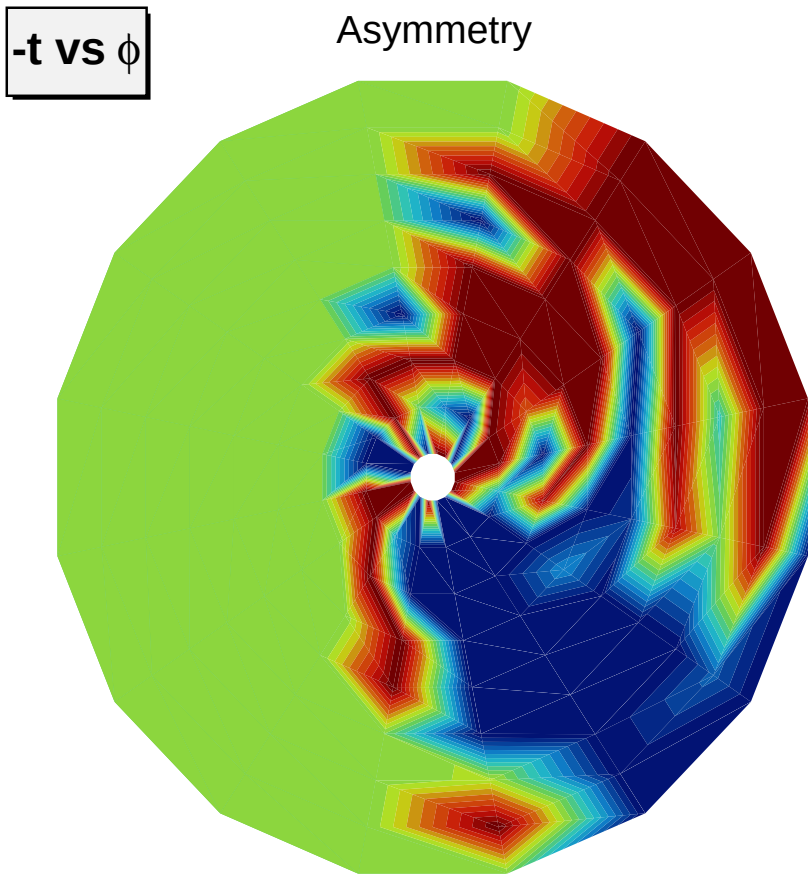
Polar Plot - Left



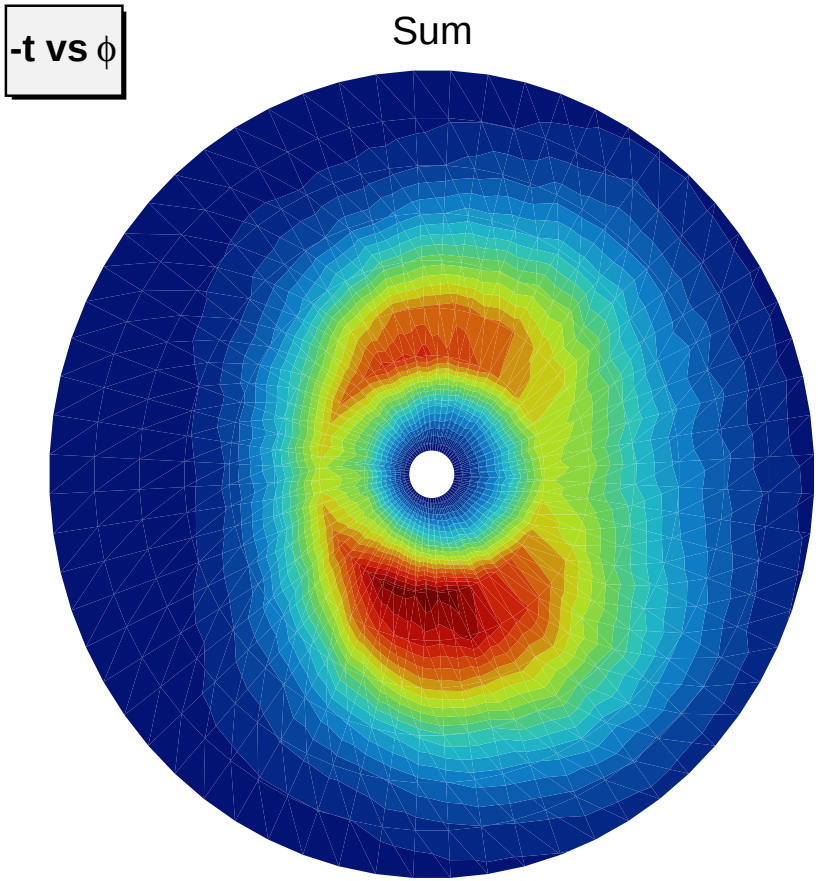


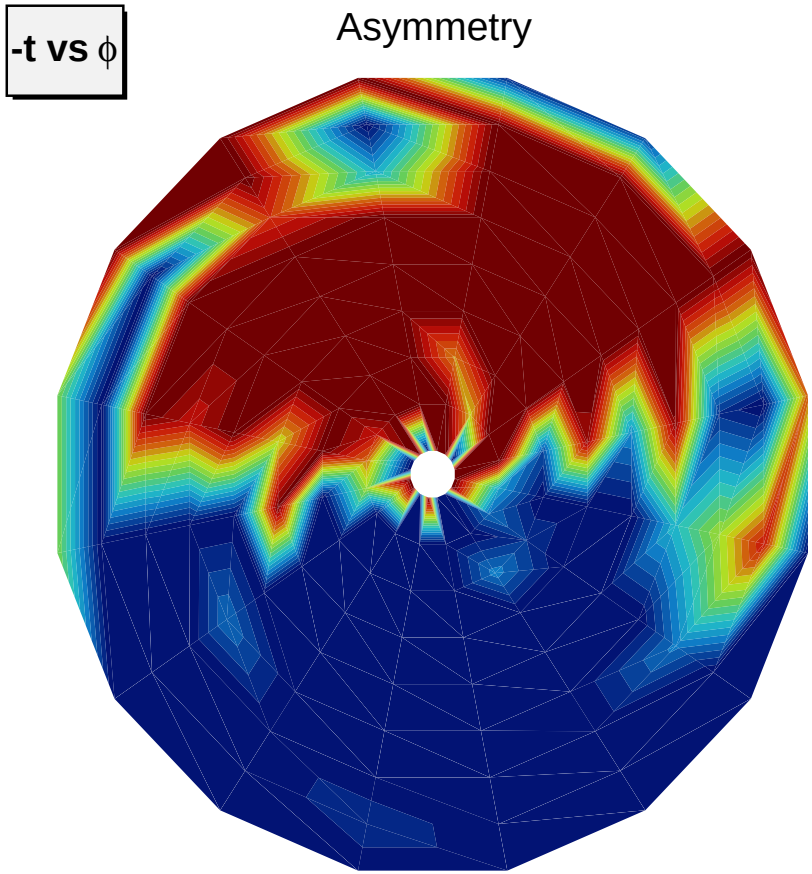
Polar Plot - Right





Polar Plot - All





Next Steps

- Make things less preliminary

→ Dummy target thickness in subtraction

→ PID cuts and subtractions on mean -t, ϵ calculations

- Repeat for more settings
- Run models for comparison