Beam Single-Spin Asymmetry Progress

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Group Meeting Dec 5

General Updates

- Edited report files
- Can not separate charge by helicity
- Replayed dummy runs
- Efficiencies very similar for positive vs negative helicity
- Experimented with weighted average of SHMS left, right, centre

Efficiency Comparison (1.1)

Run 4865 (LH_2), positive vs negative helicity

	HelPos	HelNeg
KLT_SHMS_Pion_ALL_TRACK_EFF	0.9959 ± 0.0025	0.9961 ± 0.0025
KLT_HMS_Elec_ALL_TRACK_EFF	0.9932 ± 0.0015	0.9932 ± 0.0015
KLT_SHMS_HGC_Pion_Eff	0.4001 ± 0.0035	0.3997 ± 0.0035
KLT_SHMS_Aero_ALL_Pion_Eff	0.9893 ± 0.0022	0.9897 ± 0.0022
KLT_HMS_Cer_ALL_Elec_Eff	0.9517 ± 0.0012	0.9516 ± 0.0012

Efficiency Comparison (1.2)

Run 4870 (Dummy10cm), positive vs negative helicity

	HelPos	HelNeg
KLT_SHMS_Pion_ALL_TRACK_EFF	0.9975 ± 0.0120	0.9982 ± 0.0120
KLT_HMS_Elec_ALL_TRACK_EFF	0.9968 ± 0.0067	0.9970 ± 0.0066
KLT_SHMS_HGC_Pion_Eff	0.3913 ± 0.0187	0.3980 ± 0.0183
KLT_SHMS_Aero_ALL_Pion_Eff	0.9926 ± 0.0115	0.9912 ± 0.0114
KLT_HMS_Cer_ALL_Elec_Eff	0.9652 ± 0.0059	0.9658 ± 0.0059

Efficiency Comparison (2.1)

Runs 4865 (LH_2) vs 4870 (Dummy10cm), SHMS left

	LH_2	Dummy
KLT_Non_Scaler_EDTM_Live_Time	0.9817 ± 0.0079	0.9938 ± 0.0141
KLT_SHMS_Pion_ALL_TRACK_EFF	0.9960 ± 0.0017	0.9979 ± 0.0084
KLT_HMS_Elec_ALL_TRACK_EFF	0.9932 ± 0.0010	0.9969 ± 0.0047
KLT_SHMS_HGC_Pion_Eff	0.3998 ± 0.0025	0.3950 ± 0.0130
KLT_SHMS_Aero_ALL_Pion_Eff	0.9895 ± 0.0016	0.9920 ± 0.0080
KLT_HMS_Cer_ALL_Elec_Eff	$\mathbf{0.9516 \pm 0.0009}$	$\mathbf{0.9655 \pm 0.0041}$

Efficiency Comparison (2.2)

Runs 4871 (LH_2) vs 4880 (Dummy10cm), SHMS centre

	LH_2	Dummy
KLT_Non_Scaler_EDTM_Live_Time	0.9899 ± 0.0086	0.9981 ± 0.0133
KLT_SHMS_Pion_ALL_TRACK_EFF	0.9964 ± 0.0028	0.9976 ± 0.0091
KLT_HMS_Elec_ALL_TRACK_EFF	0.9933 ± 0.0015	0.9966 ± 0.0046
KLT_SHMS_HGC_Pion_Eff	$\mathbf{0.4023 \pm 0.0041}$	$\mathbf{0.4284 \pm 0.0130}$
KLT_SHMS_Aero_ALL_Pion_Eff	0.9915 ± 0.0026	0.9926 ± 0.0088
KLT_HMS_Cer_ALL_Elec_Eff	$\mathbf{0.9488 \pm 0.0013}$	$\mathbf{0.9663 \pm 0.0041}$

Efficiency Comparison (2.3)

Runs 4882 (LH_2) vs 4881 (Dummy10cm), SHMS right

	LH_2	Dummy
KLT_Non_Scaler_EDTM_Live_Time	0.9966 ± 0.0087	0.9992 ± 0.0139
KLT_SHMS_Pion_ALL_TRACK_EFF	0.9972 ± 0.0042	0.9956 ± 0.0137
KLT_HMS_Elec_ALL_TRACK_EFF	0.9945 ± 0.0023	0.9963 ± 0.0054
KLT_SHMS_HGC_Pion_Eff	**0.3925 ± 0.0066**	**0.4506 ± 0.0186**
KLT_SHMS_Aero_ALL_Pion_Eff	0.9932 ± 0.0040	0.9929 ± 0.0135
KLT_HMS_Cer_ALL_Elec_Eff	**0.9584 ± 0.0020**	**0.9688 ± 0.0048**

Weighted Average

Tried combining SHMS Left, Right, Centre with a weighted average at each data point:

$$\overline{x} = \frac{\Sigma w_i x_i}{\Sigma w_i}$$

$$w_i = \frac{1}{\sigma(x_i)^2}$$

$$\sigma(\overline{x}) = \sqrt{\frac{1}{\Sigma w_i}}$$

One exception: if $x_i = \sigma(x_i) = 0$, I set $w_i = 0$ to not break math.

Fitting

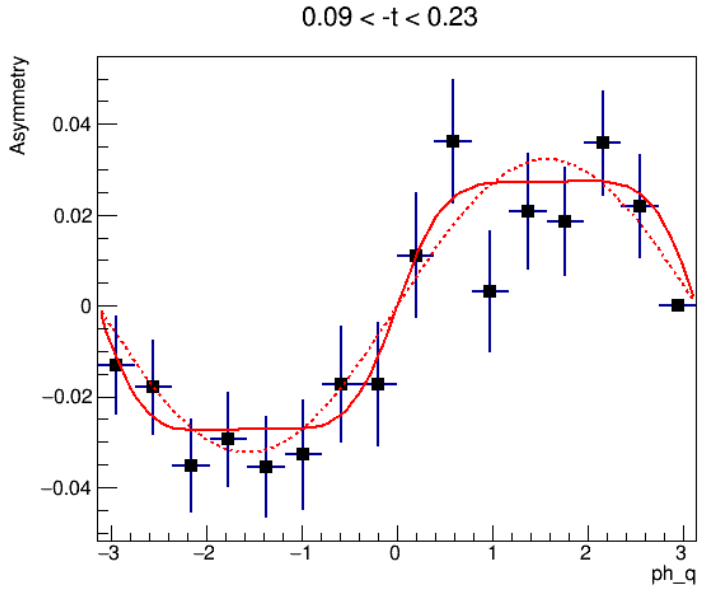
Complete fit:

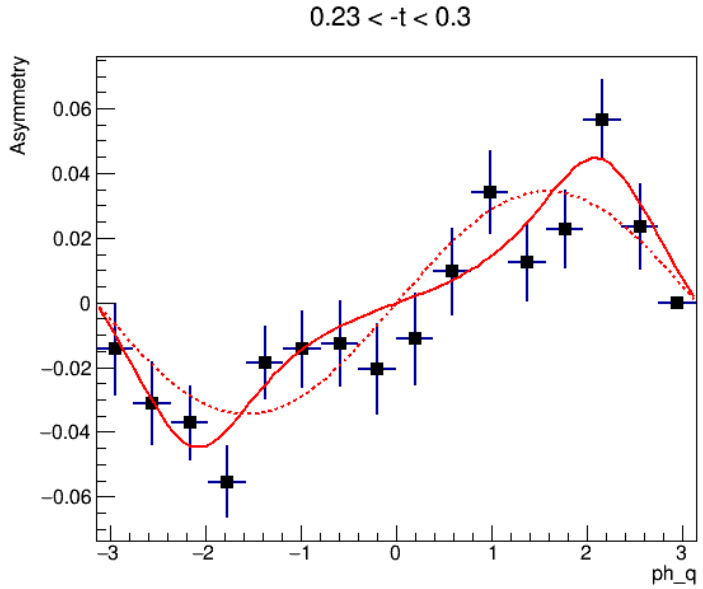
$$BSA = \frac{\boldsymbol{A_{LU}} sin\phi}{1 + Bcos\phi + Ccos2\phi}$$

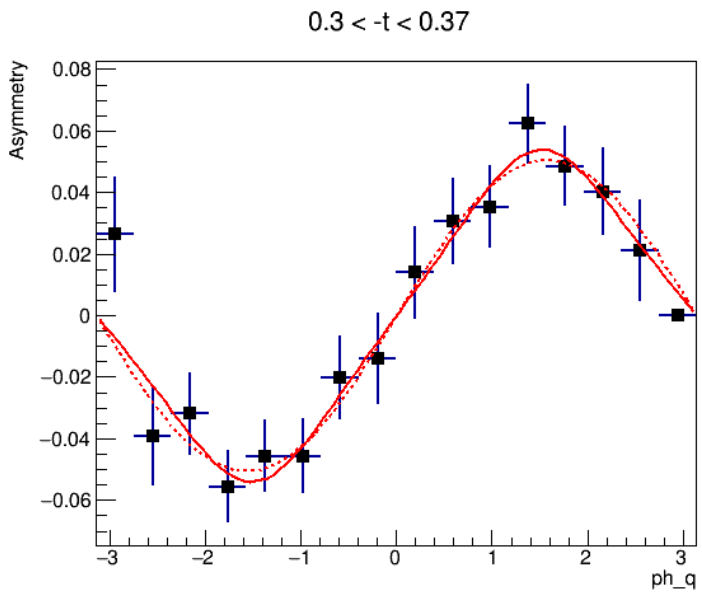
Approximated fit:

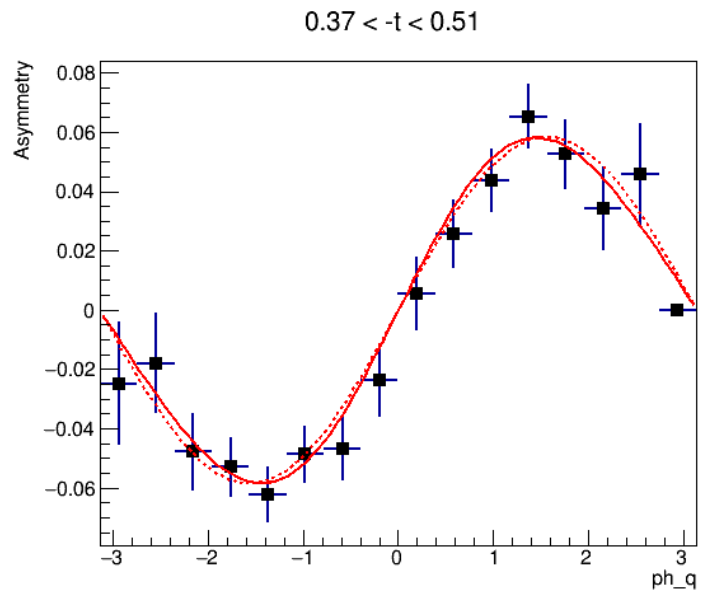
$$BSA = \boldsymbol{A_{LU}} sin\phi$$

Weighted Average and Fits









Comparison

A_{LU} ($\times 10^{-2}$)		
-t	Complete fit	Approximated fit
0.09 – 0.23	3.7 ± 0.5	3.2 ± 0.4
0.23 – 0.30	2.3 ± 0.9	3.4 ± 0.4
0.3 – 0.37	4.6 ± 0.8	5.0 ± 0.5
0.37 – 0.51	5.7 ± 0.7	5.8 ± 0.4
0.51 – 1	6.1 ± 0.9	5.9 ± 0.5

Questions

- Dummy subtraction - thoughts on how to normalize?
- Cut charge in half, or multiply by fraction of events with each helicity? (If the latter, then at which step?)
- Thoughts on extracting A_{LU}?