

# Beam Single-Spin Asymmetry Progress

---

Alicia Postuma (she/her)

PionLT/KaonLT Meeting Dec 7

University of Regina

KaonLT Experiment, Jefferson Lab Hall C



University  
of Regina



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



Run 4865 (LH<sub>2</sub>), positive vs negative helicity

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

## Efficiency Comparison (1.2)



Run 4870 (Dummy10cm), positive vs negative helicity

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

## Efficiency Comparison (2.1)



Runs 4865 (LH<sub>2</sub>) vs 4870 (Dummy10cm), SHMS left

	LH <sub>2</sub>	Dummy
KLT_Non_Scaler_EDTM_Live_Time	$0.9817 \pm 0.0079$	$0.9938 \pm 0.0141$
KLT_SHMS_Pion_ALL_TRACK_EFF	$0.9960 \pm 0.0017$	$0.9979 \pm 0.0084$
KLT_HMS_Elec_ALL_TRACK_EFF	$0.9932 \pm 0.0010$	$0.9969 \pm 0.0047$
KLT_SHMS_HGC_Pion_Eff	$0.3998 \pm 0.0025$	$0.3950 \pm 0.0130$
KLT_SHMS_Aero_ALL_Pion_Eff	$0.9895 \pm 0.0016$	$0.9920 \pm 0.0080$
<b>KLT_HMS_Cer_ALL_Elec_Eff</b>	<b><math>0.9516 \pm 0.0009</math></b>	<b><math>0.9655 \pm 0.0041</math></b>

## Efficiency Comparison (2.2)



Runs 4871 (LH<sub>2</sub>) vs 4880 (Dummy10cm), SHMS centre

	LH <sub>2</sub>	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
<b>KLT_SHMS_HGC_Pion_Eff</b>	<b>0.4023 ± 0.0041</b>	<b>0.4284 ± 0.0130</b>
KLT_SHMS_Aero_ALL_Pion_Eff	0.9915 ± 0.0026	0.9926 ± 0.0088
<b>KLT_HMS_Cer_ALL_Elec_Eff</b>	<b>0.9488 ± 0.0013</b>	<b>0.9663 ± 0.0041</b>

## Efficiency Comparison (2.3)



Runs 4882 (LH<sub>2</sub>) vs 4881 (Dummy10cm), SHMS right

	LH <sub>2</sub>	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
<b>KLT_SHMS_HGC_Pion_Eff</b>	<b>0.3925 ± 0.0066</b>	<b>0.4506 ± 0.0186</b>
KLT_SHMS_Aero_ALL_Pion_Eff	0.9932 ± 0.0040	0.9929 ± 0.0135
<b>KLT_HMS_Cer_ALL_Elec_Eff</b>	<b>0.9584 ± 0.0020</b>	<b>0.9688 ± 0.0048</b>



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

$$\bar{x} = \frac{\sum w_i x_i}{\sum w_i}$$

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

$$\sigma(\bar{x}) = \sqrt{\frac{1}{\sum w_i}}$$

One exception: if  $x_i = \sigma(x_i) = 0$ , I set  $w_i = 0$  to avoid dividing by zero.





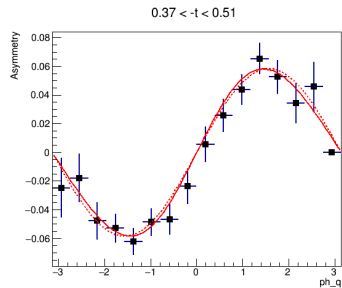
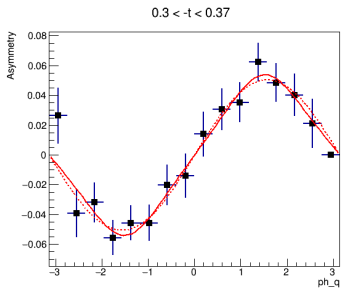
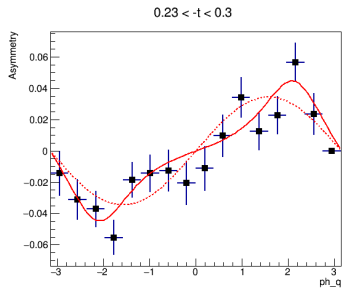
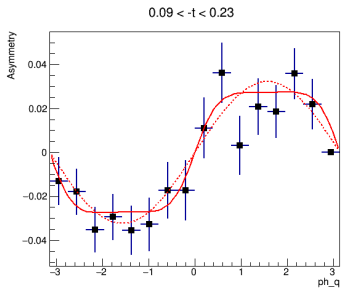
Complete fit:

$$BSA = \frac{A_{LU} \sin \phi}{1 + B \cos \phi + C \cos 2 \phi}$$

Approximated fit:

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

# Weighted Average and Fits





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

- Overlap within error
- Approximated fit shows monotonic increase (expected)
- Will need to constrain  $B$ ,  $C$  in total fit



- Dummy target subtraction — separate for each helicity, dividing total charge by two, then finding effective charge
- Determine reasonable constraints for  $B$  and  $C$  in the complete asymmetry fit
- Determine  $-t$  binning (with Ali)