Pion-LT Meeting

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LTSep Analysis

- Working on physics setting: **Q2 = 3.85, W = 2.62, t = 0.21 (2 epsilons)**
- The following studies need to be finalized before the LTSep analysis:
  - **Missing mass offset and cut determination**
  - **Diamond cut determination**
  - **t-resolution check**
  - **t and phi-binning**
  - **Data and SIMC yields**

LTSep Analysis

- **Cuts for pion physics data**

HMS Cuts (Electrons)
-8 < H_gtr_dp < 8
-0.08 < H_gtr_th < 0.08
-0.045 < H_gtr_ph < 0.045
H_hod_goodstarttime == 1.0
HMS_Cal_etottracknorm > 0.7
H_Cer_npeSum > 1.5

SHMS Cuts (Pions)
-10 < P_gtr_dp < 20
-0.06 < P_gtr_th < 0.06
-0.04 < P_gtr_ph < 0.04
Ctime_epCoinTime_ROC1 – Prompt Peak
P_hod_goodstarttime == 1.0
P_aero_npeSum > 1.5
1.2 < P_RF_DIST < 3.4

Analysis Cuts (Pions)
0.90 < MMpi < 1.06
Diamond Cut Applied

LTSep Analysis

- **Global Offsets:**

Global In-Plane Offsets – Momentum and Energy offsets in 0.1% unit, Angle offset in mrad unit			
BE	dBE	Global Offsets for 5.9 GeV to 9.9 GeV	
5984.8	-0.0500	HMS_dtheta	1.5000
6394.7	-0.1500	HMS_dp	0.0000
7937.6	-0.2222	SHMS_dtheta	1.4000
8478.6	-0.1333	SHMS_dp	4.5000
9171.3	-0.0444	Offsets for 10.5 GeV	
9876.9	-0.2222	HMS_dtheta	1.5000
		HMS_dp	-3.2000
10546.8	-1.0000	SHMS_dtheta	1.4000
		SHMS_dp	4.5000

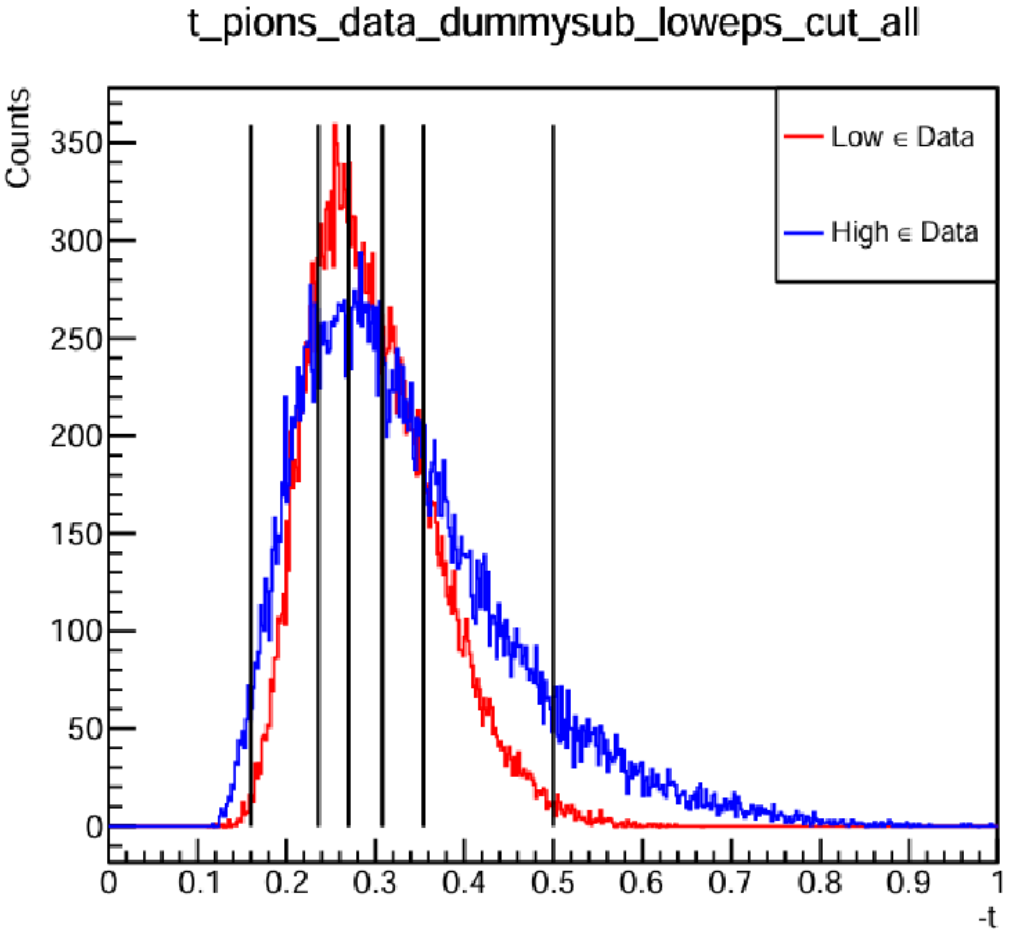
- Implemented Out-of-plane offsets (**HMS = +0.001875rad and SHMS = -0.000155rad**)

t-binning

- t-binning for “Q2 = 3.85, W = 2.62, t = 0.21 (2-epsilons)”

- Divided “t” into 5-bins

t_min	t_max	Yield (loweps)	Error (loweps)	Yield (higheps)	Error (higheps)
0.160	0.236	5170.833	73.447	6505.667	81.246
0.236	0.270	5371.667	74.758	4316.333	66.242
0.270	0.308	5350.833	74.933	4937.667	70.942
0.308	0.354	5104.167	73.460	4955.167	71.335
0.354	0.332	5224.833	75.651	8588.167	94.167



t-binning range 0.16 – 0.50

- Divided “phi” into 15-bins

LTSep Analysis

- Data is normalized.

$$Effective\ charge = Charge \times Tracking\ Eff \times Detector\ Eff \times Hodo\frac{3}{4}Eff \times EDTM\ Live\ Time \times Boiling\ Corr$$

- In data normalization, Following quantities are included:
  - **Charge (run-by-run)**
  - **Tracking Efficiencies (HMS and SHMS run-by-run)**
  - **Detector Efficiencies (HMS Cer and HMS Cal run-by-run)**
  - **Hodo ¾ Efficiencies (HMS and SHMS run-by-run)**
  - **EDTM Live Time (run-by-run)**
  - **Dummy Target Thickness Correction Applied – (3.527 +/- 0.227 - PionLT)**
  - **Nathan's Boiling Correction Applied (-0.00028)**

LTSep Analysis

- Uncertainties Calculations (Absolute):
- Used raw histograms (after cuts) for error calculation.
- Took integral and error using ROOT (IntegralAndError())

- Effective charge is calculated as (calculated run-by-run);

$$Effective\_charge\_run\_i = Charge \times Tracking\ Eff \times Detector\ Eff \times Hodo\frac{3}{4}Eff \times EDTM\ Live\ Time \times Boiling\ Corr$$

$$Effective\_charge\_run\_i\_err = Effective\_charge\_run\_i \times \sqrt{\left(\frac{charge\_error}{charge}\right)^2 + \left(\frac{Tracking\_Eff\_error}{Tracking\_Eff}\right)^2 + \left(\frac{Detector\_Eff\_error}{Detector\ Eff}\right)^2 + \dots\dots}$$

- Total effective charge is calculated as;

$$Total\_effective\_charge = Effective\_charge\_run1 + Effective\_charge\_run2 + Effective\_charge\_run3 + \dots\dots\dots\dots..$$

$$Total\_effective\_charge\_err = \sqrt{(Effective\_charge\_run1\_err)^2 + (Effective\_charge\_run2\_err)^2 + \cdots\dots..}$$

- For dummy, also included thickness correction factor.

LTSep Analysis

- Physics yield error is calculated as (calculated run-by-run);

$$Normalized\_data = Data\_counts/Total\_data\_effective\_charge$$

$$Normalized\_data\_err = Normalized\_data \times \sqrt{\left(\frac{Data\_count\_error}{Data\_counts}\right)^2 + \left(\frac{Total\_data\_effective\_charge\_error}{Total\_data\_effective\_charge}\right)^2}$$

$$Normalized\_dummy = Dummy\_counts/Total\_dummy\_effective\_charge$$

$$Normalized\_dummy\_err = Normalized\_dummy \times \sqrt{\left(\frac{Dummy\_count\_error}{Dummy\_counts}\right)^2 + \left(\frac{Total\_dummy\_effective\_charge\_error}{Total\_dummy\_effective\_charge}\right)^2}$$

$$Normalized\_data\_dummy\_sub = Normalized\_data - Normalized\_dummy$$

$$Normalized\_data\_dummy\_sub\_err = \sqrt{(Normalized\_data\_err)^2 + (Normalized\_dummy\_err)^2}$$