

Pion-LT/Kaon-LT Collaboration Meeting

Muhammad Junaid
Ph.D. Student
Department of Physics
University of Regina, Canada

Pre-LTSep Analysis

- Working on physics setting: $Q2 = 3.85$, $W = 2.02$, $t = 0.49$ (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-binning
 - phi-binning
 - Data yields
 - SIMC yields
 - Data/SIMC comparison and ratios
 - Average kinematics and ratios calculation

Took Extra Right Setting at Higheps

Extra Settings due to HMS saturation

1) 5HMS Right #2

$\theta = 18.0^\circ$ (otherwise as on p 9-10)

Take 45k EVTS

Mode -10 2min

Dummy 10min @ 40nA

2) HMS Elastic Singles $\theta = 18.048^\circ$

→ Set PS1 = -1

→ Adjust beam current so we can run
with PS4 = 0

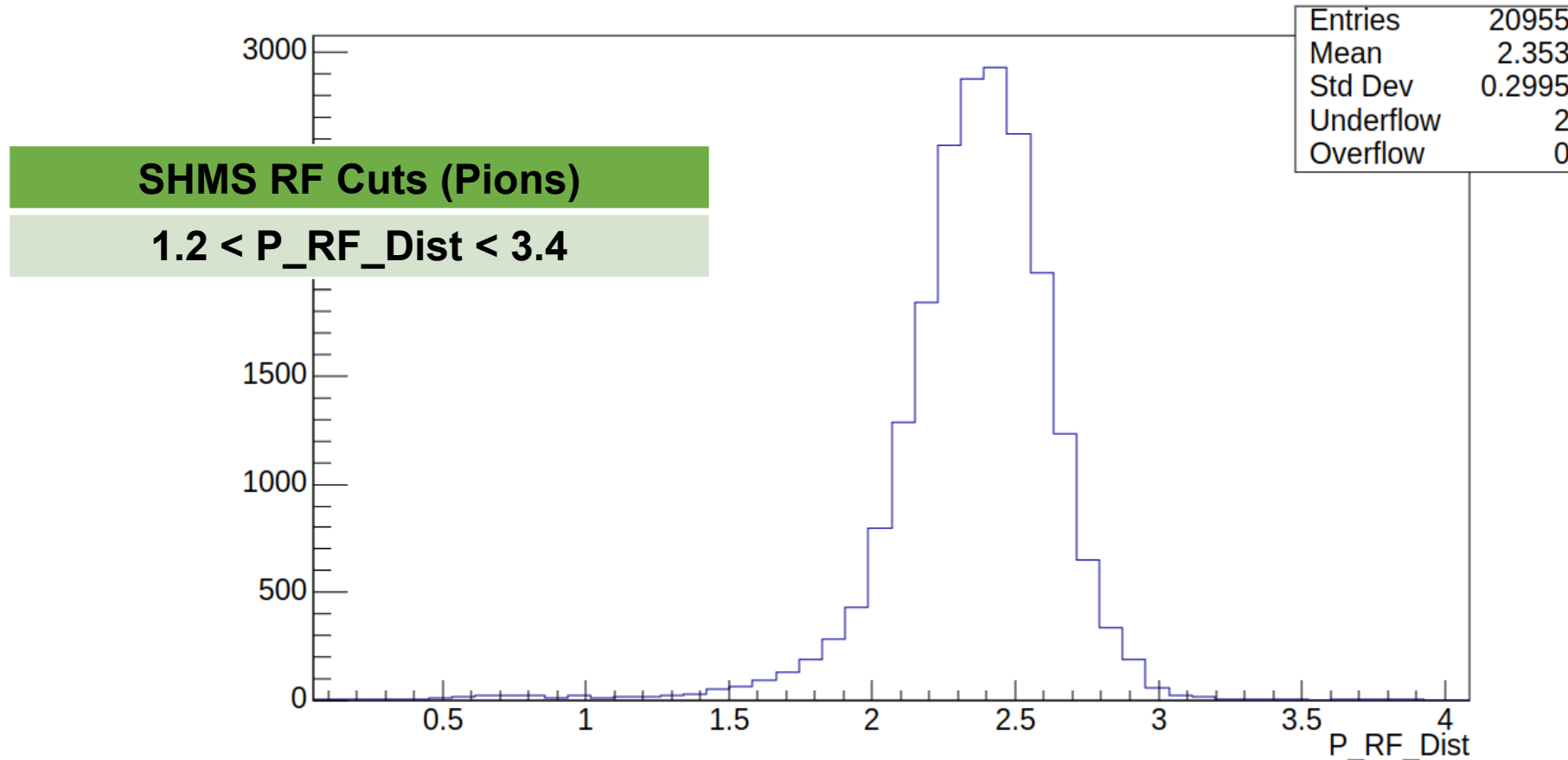
→ Take data ~ 30 min. (10Hz elastics)

→ Do Dummy

RF Cut Study

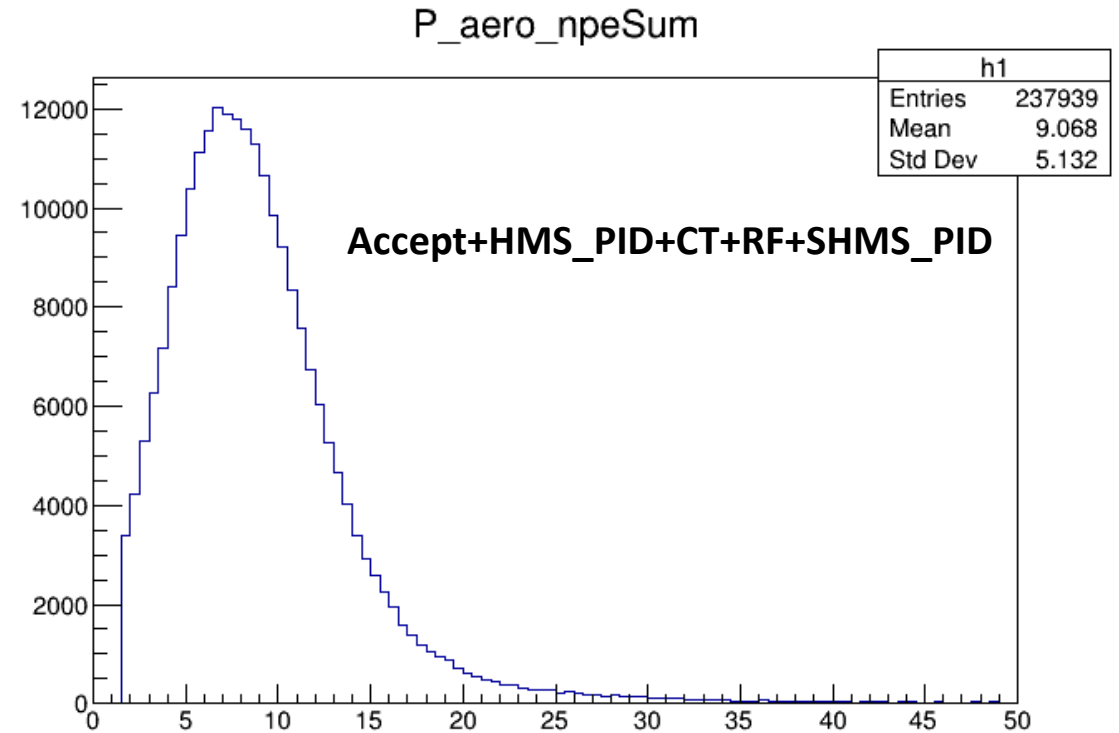
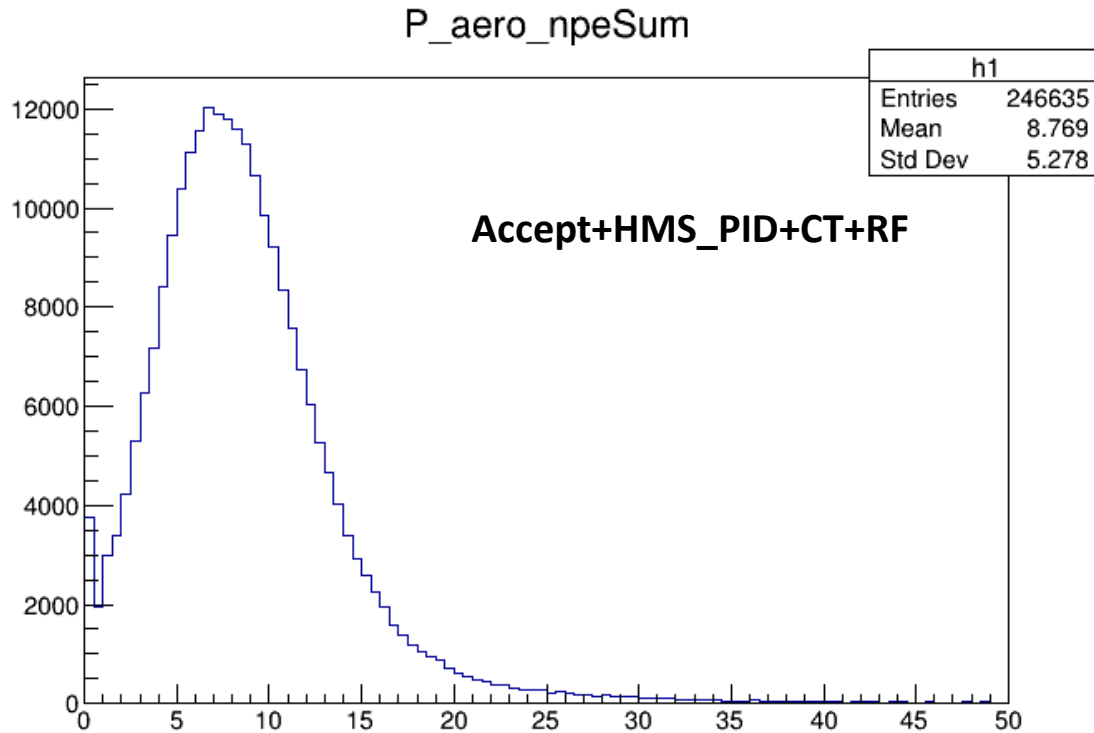
- Finalized RF cut for physics setting “ $Q2 = 3.85$, $W = 2.02$, $t = 0.49$ (2 epsilons)”

drawing branch P_RF_Dist from Cut_Pion_Events_Prompt



SHMS PID Cut Study

- Finalized Aerogel cut for physics setting “ $Q2 = 3.85$, $W = 2.02$, $t = 0.49$ (loweps – $n = 1.030$)”

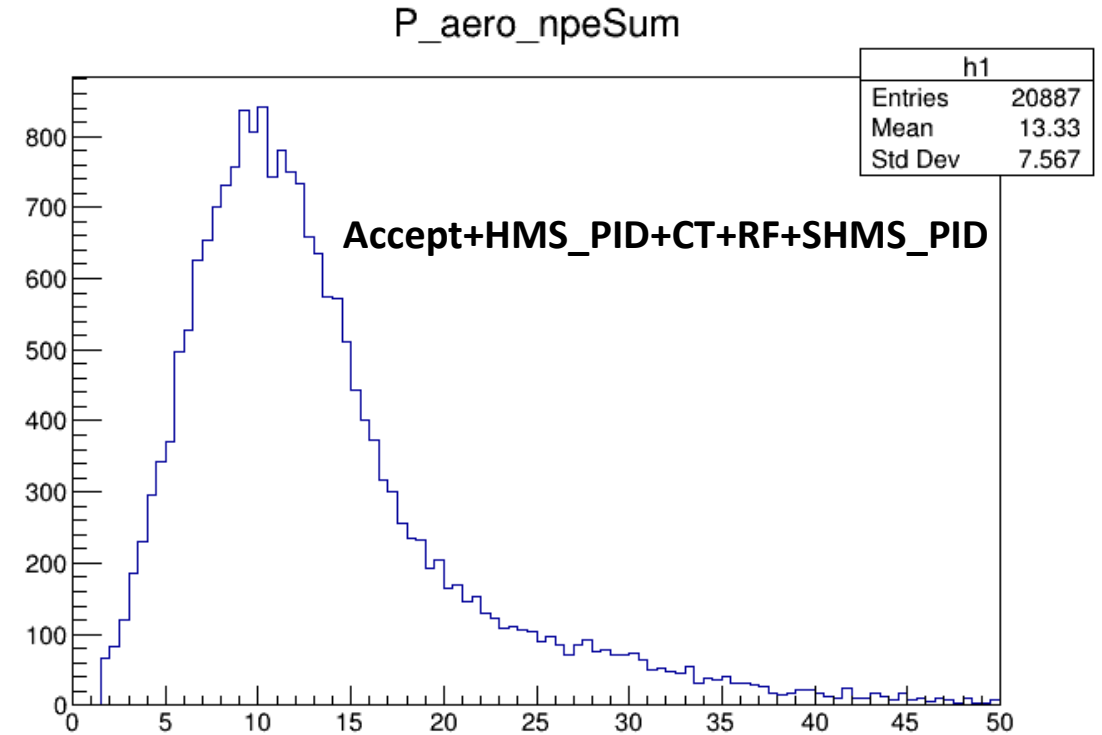
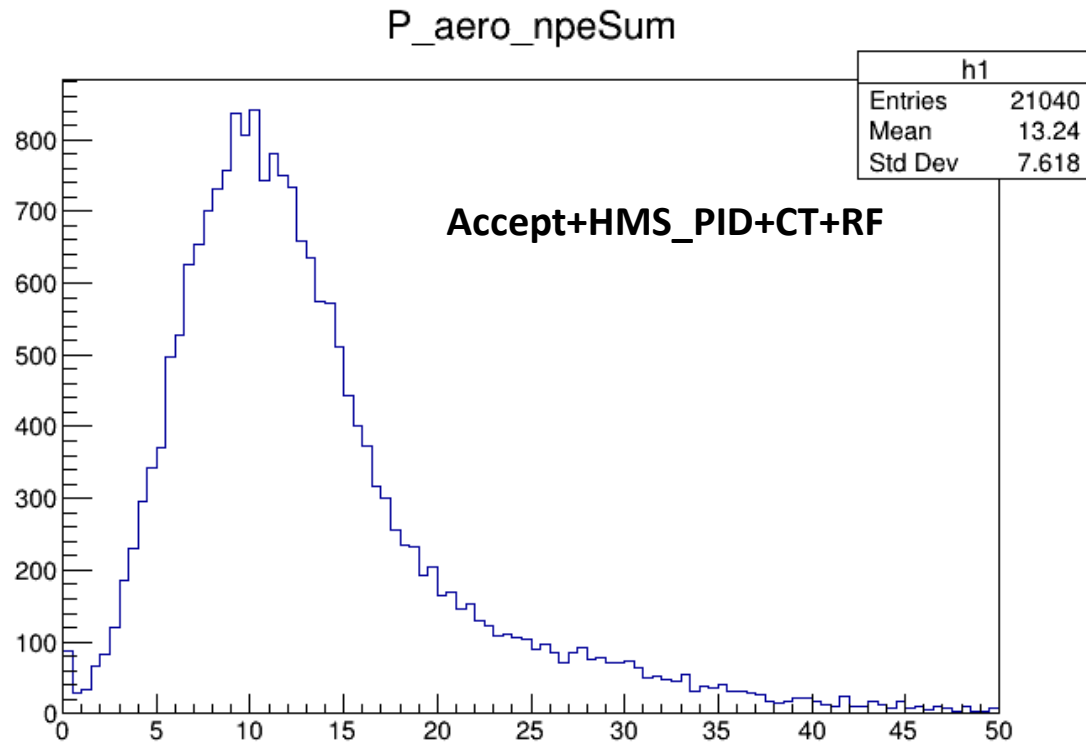


SHMS Aerogel Cut (Pions)

$P_{aero_npeSum} > 1.5$

SHMS PID Cut Study

- Finalized Aerogel cut for physics setting “ $Q_2 = 3.85$, $W = 2.02$, $t = 0.49$ (highpys – $n = 1.011$)”



SHMS Aerogel Cut (Pions)

$P_{\text{aero_npeSum}} > 1.5$

Global Offsets

- 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**)

Event Selection Cuts

■ 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)
$-10 < P_gtr_dp < 20$
$-0.06 < P_gtr_th < 0.06$
$-0.04 < P_gtr_ph < 0.04$
$P_hod_goodstarttime == 1.0$
$P_aero_npeSum > 1.5$
$1.2 < P_RF_DIST < 3.4$

Analysis Cuts (Pions)
Ctime_epCoinTime_ROC1 Prompt Peak + Random Sub
$0.90 < MMpi < 1.06$
Diamond Cut Applied

■ Cuts for SIMC

HMS Cuts (Electrons)
$-8 < hsdelta < 8$
$-0.08 < hsxpfp < 0.08$
$-0.045 < hsypfp < 0.045$

SHMS Cuts (Pions)
$-10 < ssdelta < 20$
$-0.06 < ssxpfp < 0.06$
$-0.04 < ssypfp < 0.04$

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

Missing Mass Offsets and Cut Study

- Compared missing mass plots between data and SIMC for each setting
- Did peak fitting to calculate the difference between the data and the SIMC missing mass peaks
- Found the following offsets:

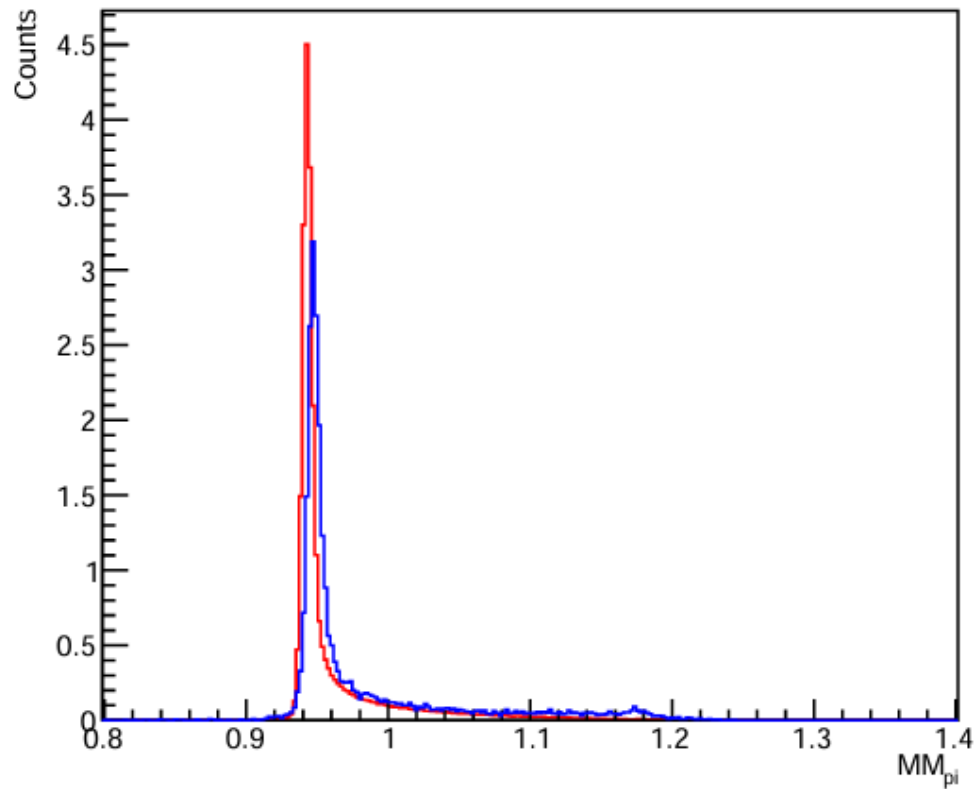
Settings	Offset Value
Q3p85_W2p02_t0p49_lowepsilon_right	-0.005375
Q3p85_W2p02_t0p49_lowepsilon_center	-0.004475
Q3p85_W2p02_t0p49_lowepsilon_left	-0.003993
Q3p85_W2p02_t0p49_highepsilon_right2	0.002912
Q3p85_W2p02_t0p49_highepsilon_right1	0.001117
Q3p85_W2p02_t0p49_highepsilon_center	0.002464
Q3p85_W2p02_t0p49_highepsilon_left	0.001551

- Applied missing mass cut on both data and SIMC:

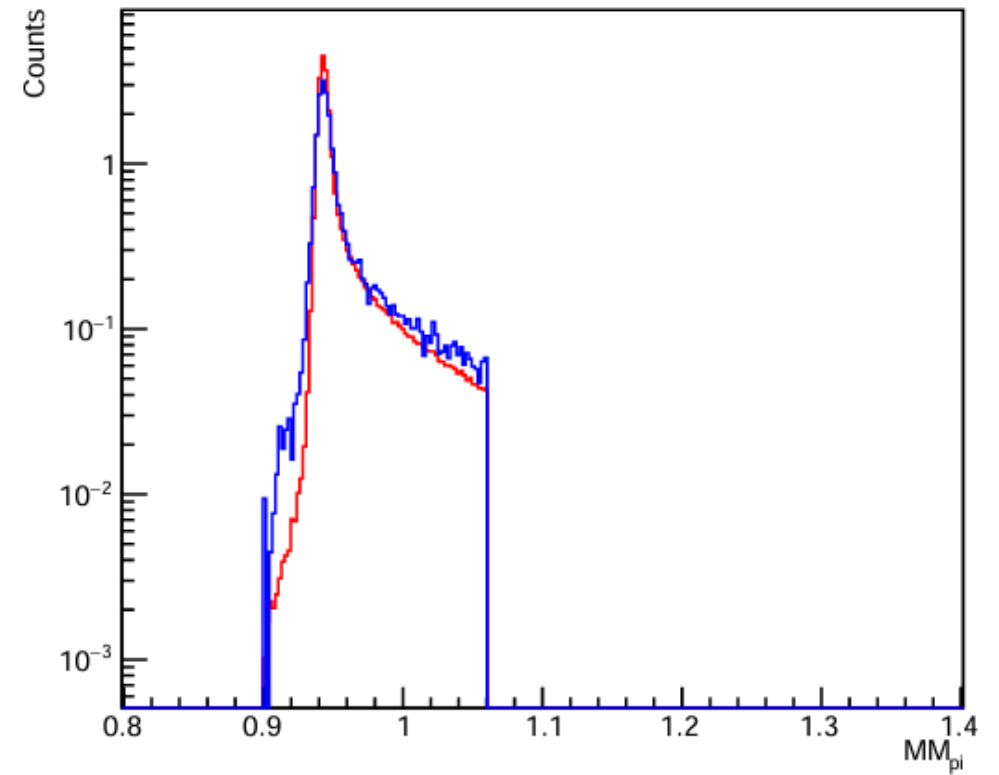
$$0.90 < MM_{pi} < 1.06$$

Missing Mass Offsets and Cut Study

Missing Mass SIMC (cut_all)



Missing Mass SIMC (cut_all)



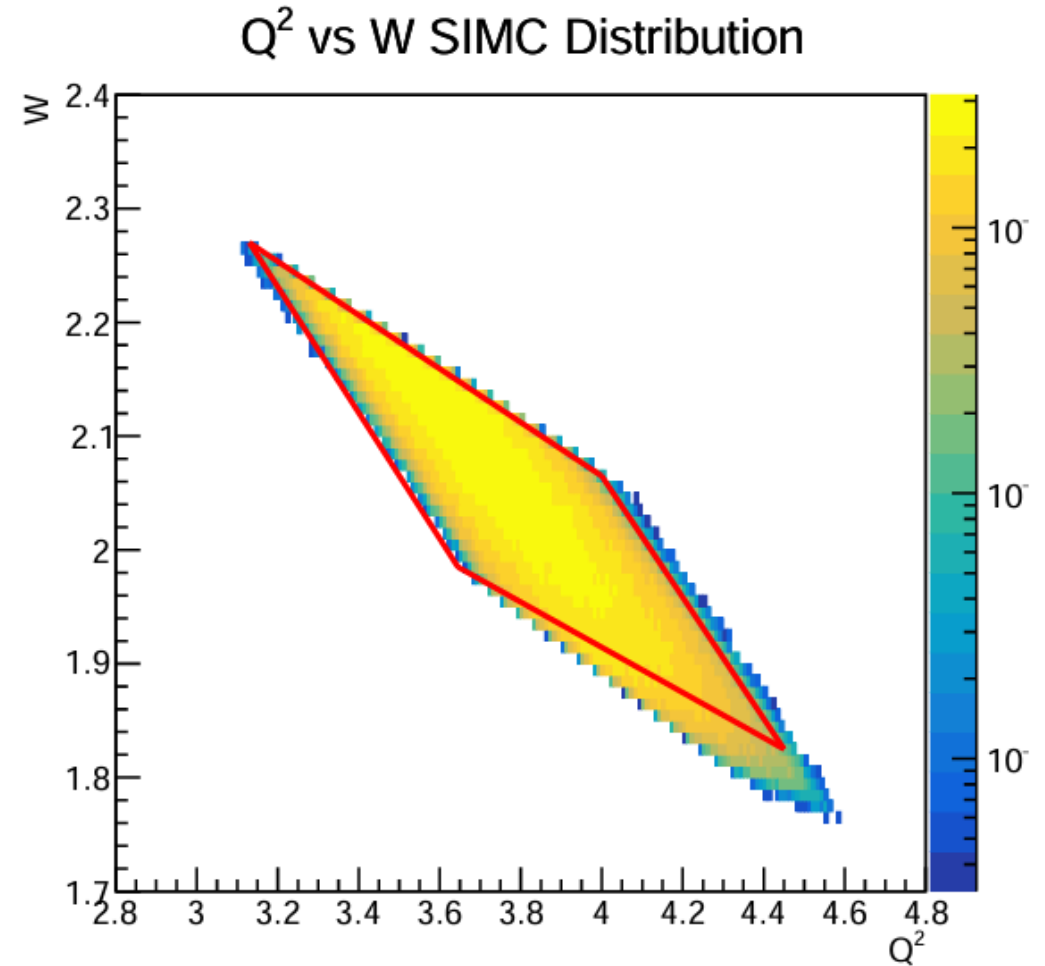
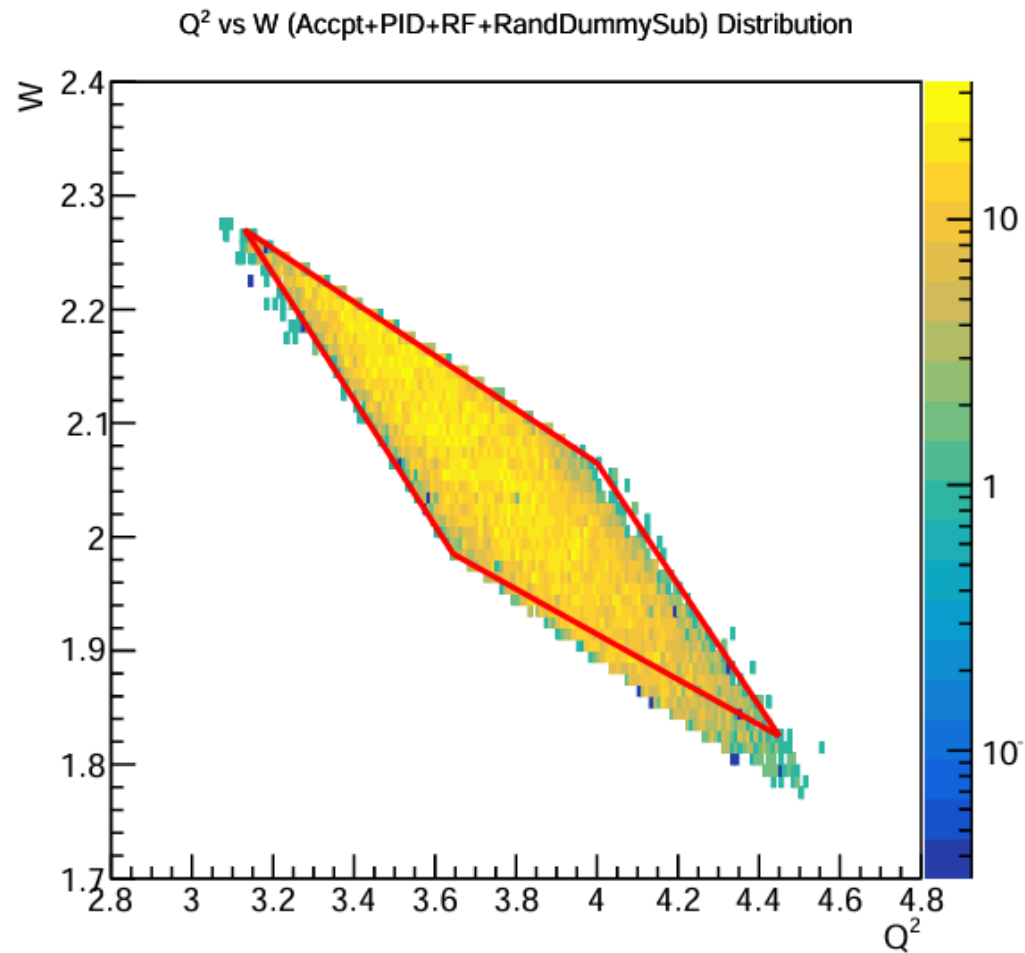
Diamond Cut Study

- Determined diamond cut from “**Q3p85_W2p02_t0p49_lowepsilon_center**” setting by looking at Q2vsW plot.
- **Found the following offsets:**

Vertex Points	Vertex Values (x, y)
Q3p85_W2p02_t0p49_top_left	(3.130, 2.270)
Q3p85_W2p02_t0p49_top_right	(4.000, 2.065)
Q3p85_W2p02_t0p49_bottom_left	(3.645, 1.985)
Q3p85_W2p02_t0p49_bottom right	(4.450, 1.825)

- Tested diamond cut on all physics and SIMC settings.
- **Diamond Cut looks good.**

Diamond Cut Study



Pre-LTSep Analysis

- ❑ Determined RF cut and efficiency for physics setting.
- ❑ Calculated pion absorption correction for physics setting.
- ❑ Finalized missing mass offsets and cuts.
- ❑ Finalized diamond cut.
- ❑ In progress:
 - Working on t-resolution check and t-binning for physics setting “ $Q^2 = 3.85$, $W = 2.02$, $t = 0.49$ (2 epsilons)”