Pion-LT/Kaon-LT Collaboration Meeting

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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) SHMS Right #2

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

Take 45k EVTS

Mode -10   2 min

Dummy.   10 min @ 40 µA

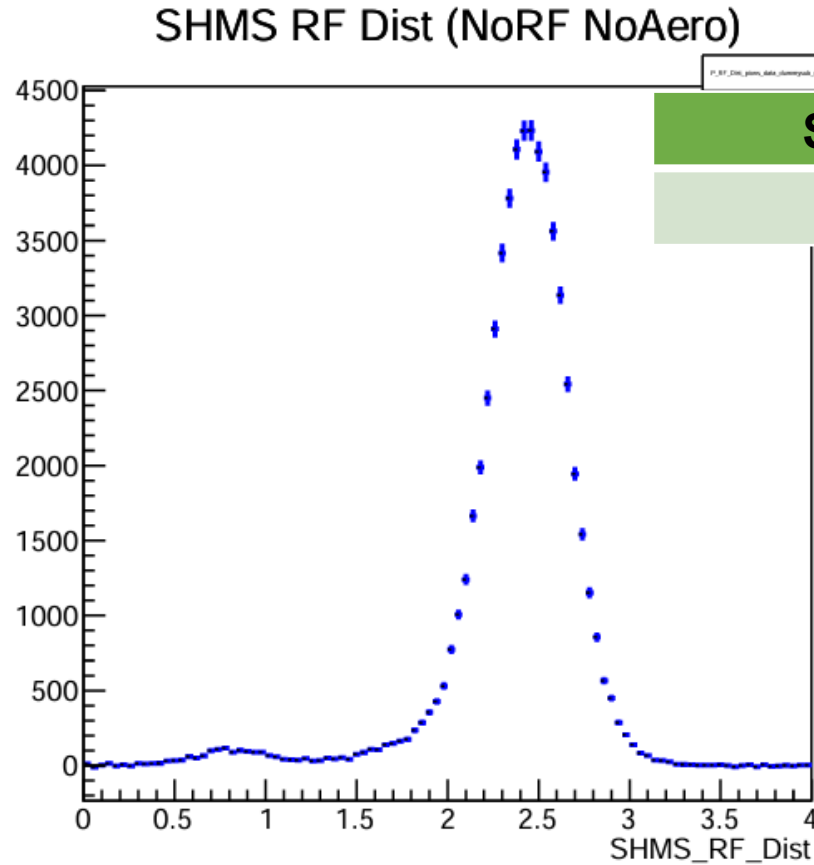2) HMS Elastic Singles $\theta = 18.048°$

→ Set PS1 = -1

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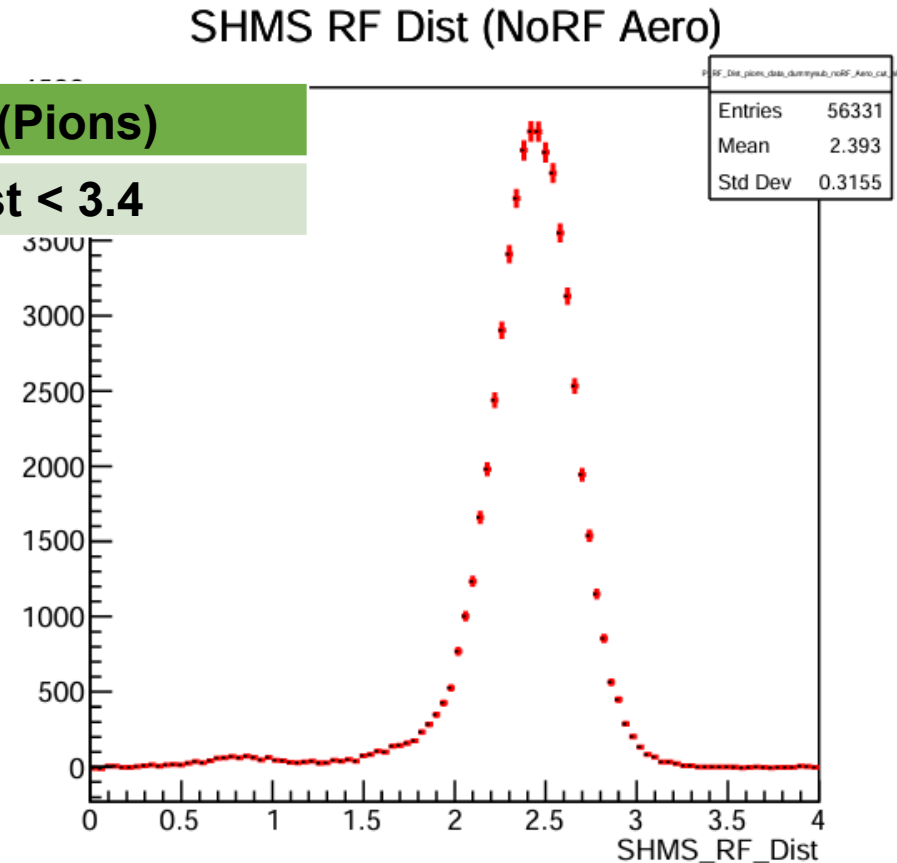with PS4 = 0

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

→ Do Dummy

RF Cut Study

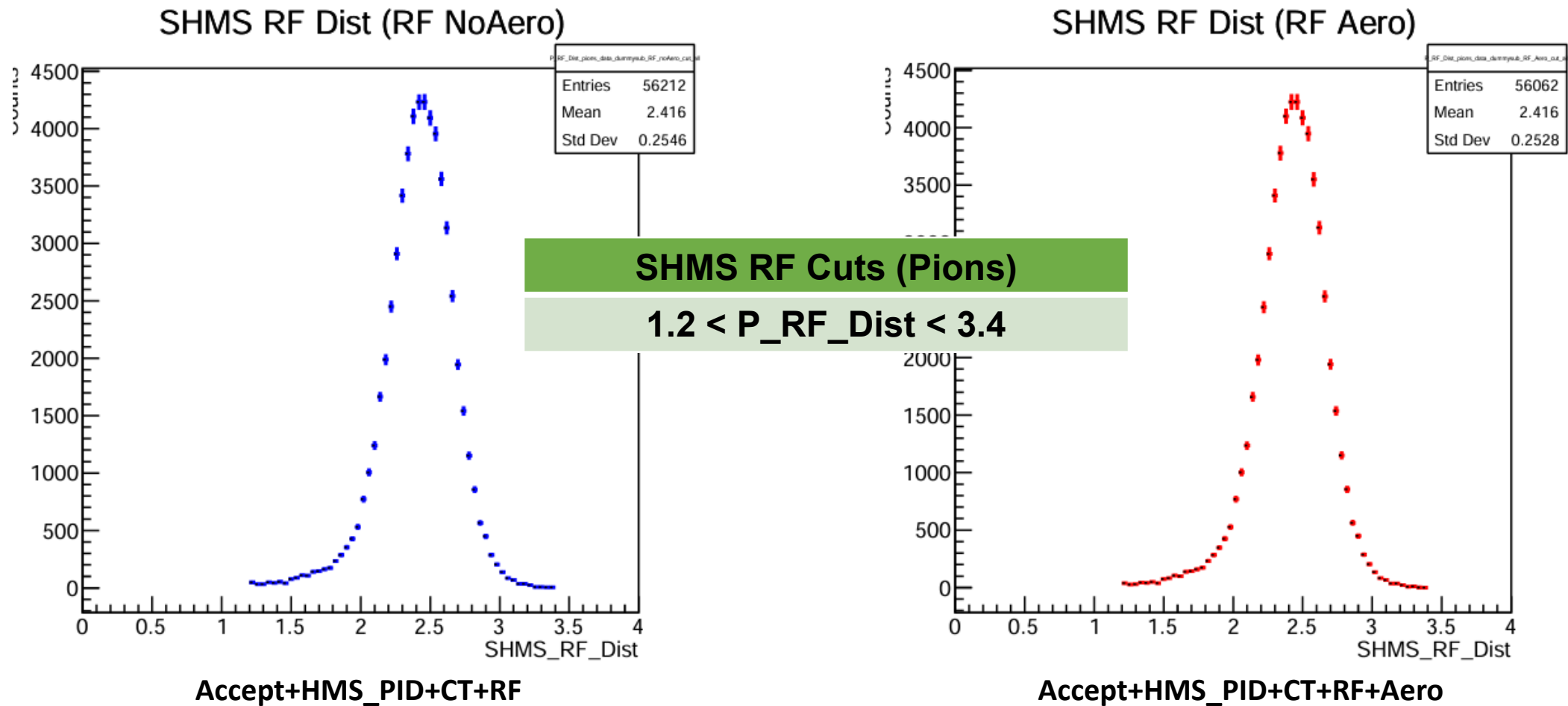- **Finalized RF cut for physics setting** "Q2 = 3.85, W = 2.02, t = 0.49 (2 epsilons)"

| SHMS RF Cuts (Pions) |
| 1.2 < P_RF_Dist < 3.4 |

Accept+HMS_PID+CT+RF

Accept+HMS_PID+CT+RF+Aero

RF Cut Study

- **Finalized RF cut for physics setting** "Q2 = 3.85, W = 2.02, t = 0.49 (2 epsilons)"

Accept+HMS_PID+CT+RF

SHMS RF Cuts (Pions)

1.2 < P_RF_Dist < 3.4
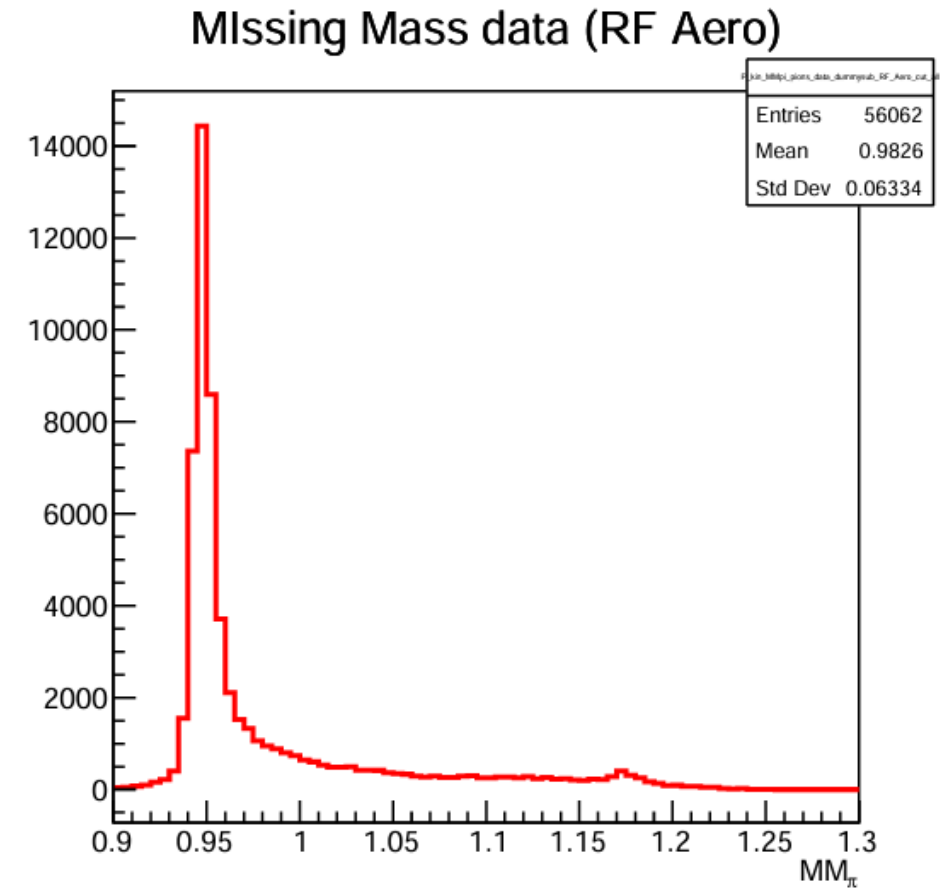
Accept+HMS_PID+CT+RF+Aero

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 > 0.5

MIssing Mass data (RF NoAero)

Entries	56212
Mean	0.9826
Std Dev	0.06337

Accept+HMS_PID+CT+RF

MIssing Mass data (RF Aero)

Entries	56062
Mean	0.9826
Std Dev	0.06334

Accept+HMS_PID+CT+RF+Aero

SHMS PID Cut Study

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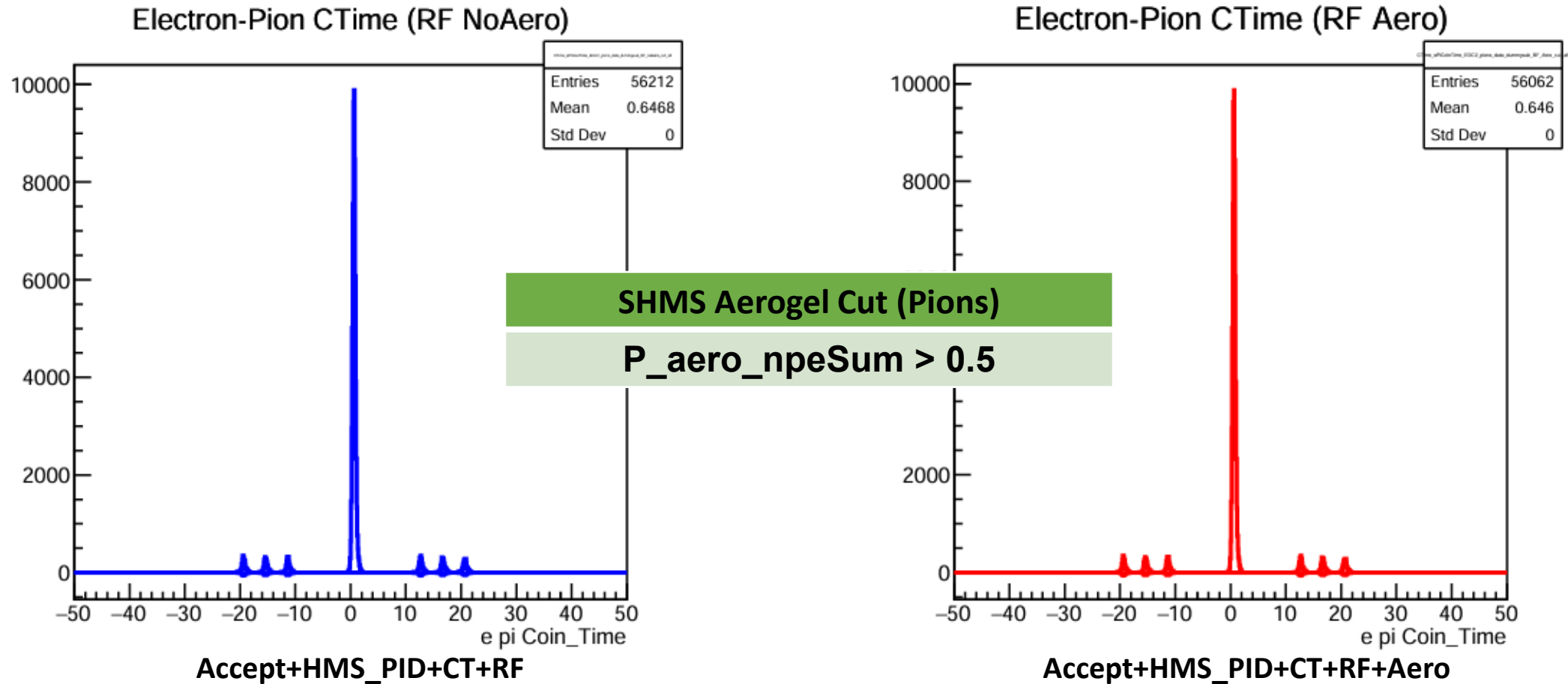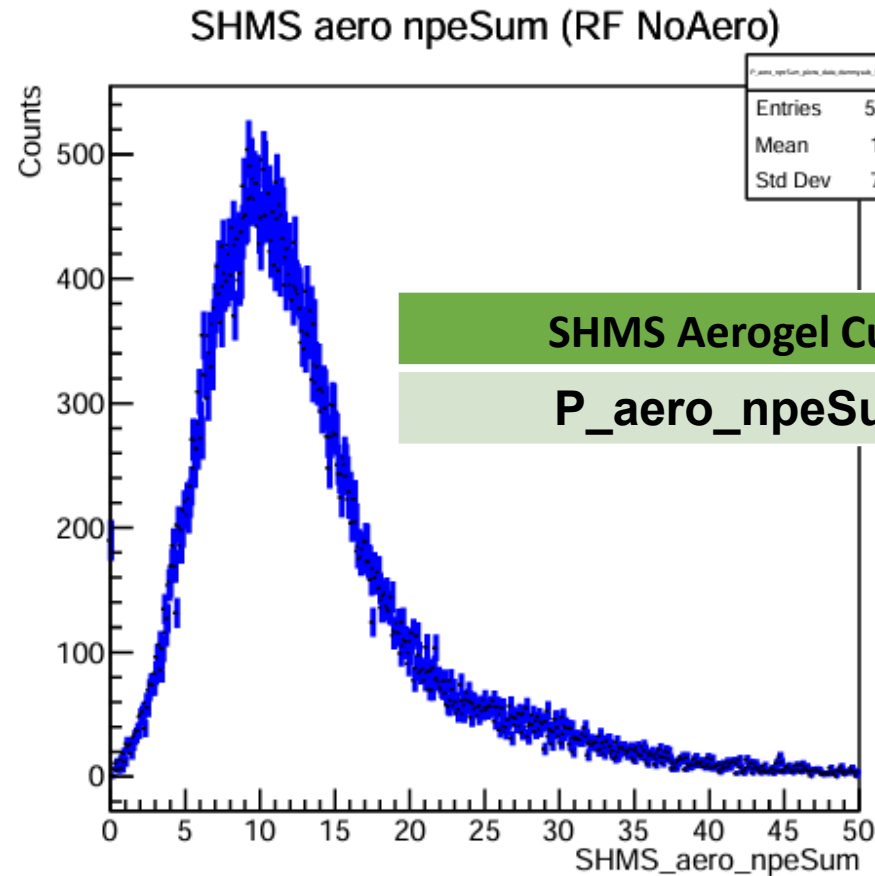

SHMS Aerogel Cut (Pions)

P_aero_npeSum > 0.5

Electron-Pion CTime (RF NoAero)

Entries	56212
Mean	0.6468
Std Dev	0

Accept+HMS_PID+CT+RF

Electron-Pion CTime (RF Aero)

Entries	56062
Mean	0.646
Std Dev	0

Accept+HMS_PID+CT+RF+Aero

SHMS PID Cut Study

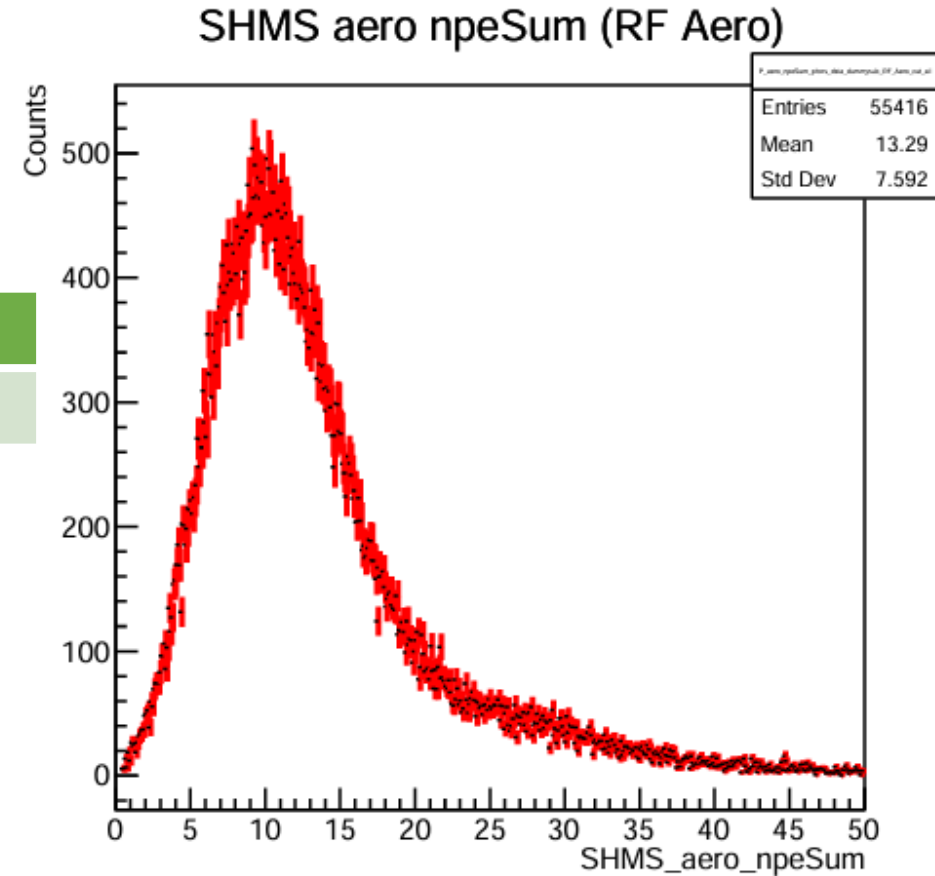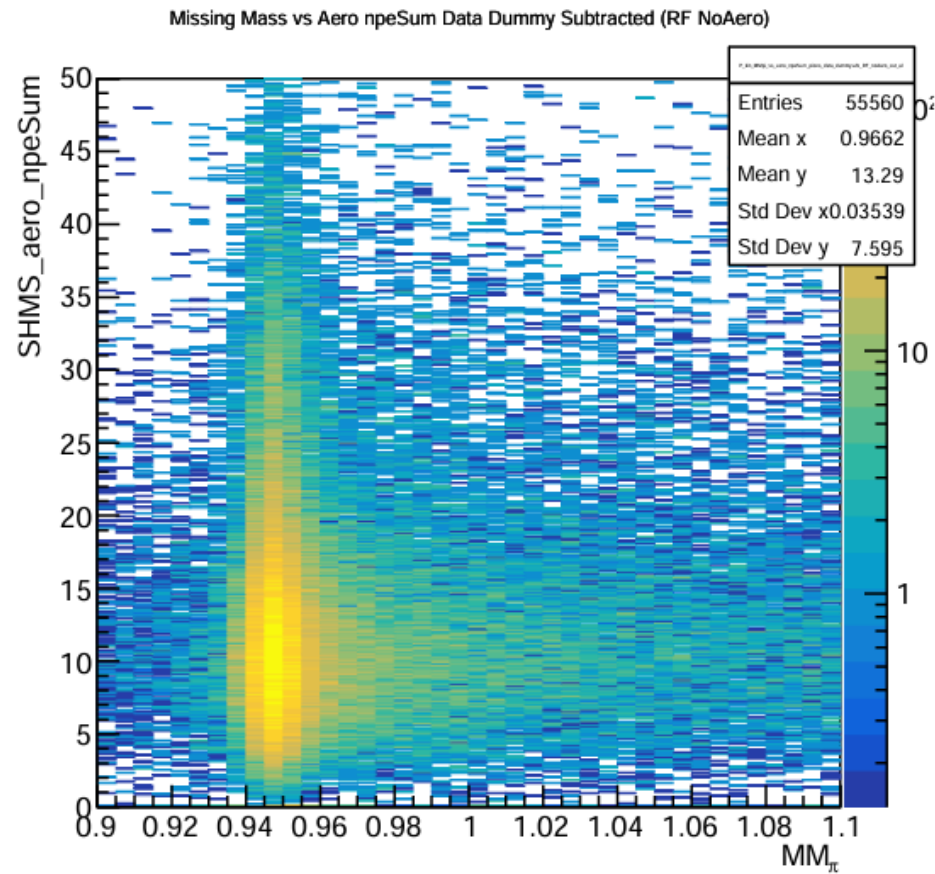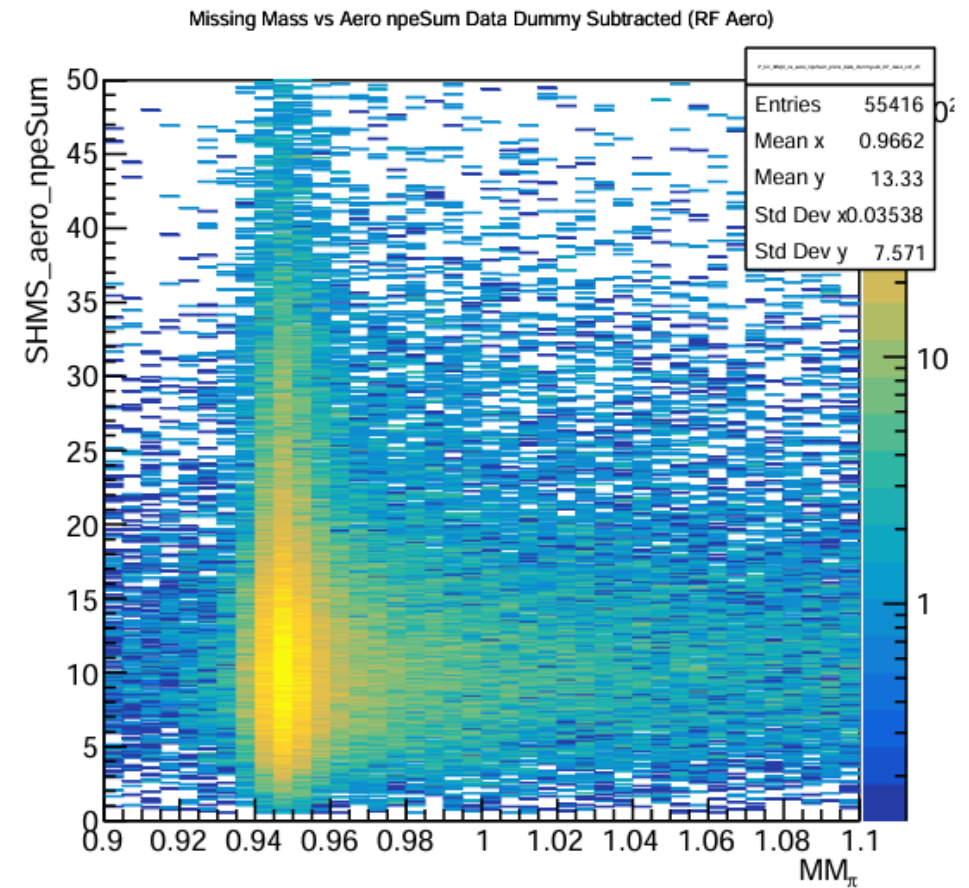- **Finalized Aerogel cut for physics setting** "Q2 = 3.85, W = 2.02, t = 0.49 (loweps – n = 1.030)"

SHMS aero npeSum (RF NoAero)

Entries	55560
Mean	13.25
Std Dev	7.619

SHMS Aerogel Cut (Pions)

P_aero_npeSum > 0.5

Accept+HMS_PID+CT+RF

SHMS aero npeSum (RF Aero)

Entries	55416
Mean	13.29
Std Dev	7.592

Accept+HMS_PID+CT+RF+Aero

SHMS PID Cut Study

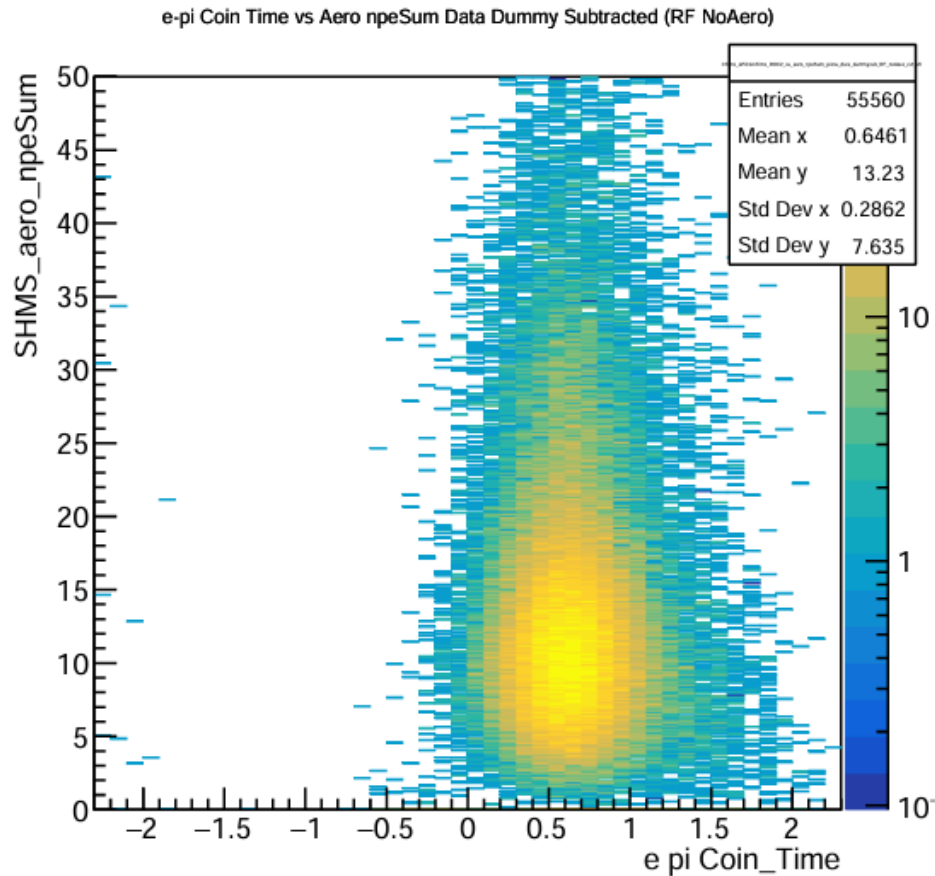- **Finalized Aerogel cut for physics setting** "Q2 = 3.85, W = 2.02, t = 0.49 (loweps – n = 1.030)"

Missing Mass vs Aero npeSum Data Dummy Subtracted (RF NoAero)

Accept+HMS_PID+CT+RF

Missing Mass vs Aero npeSum Data Dummy Subtracted (RF Aero)

Accept+HMS_PID+CT+RF+Aero

SHMS PID Cut Study

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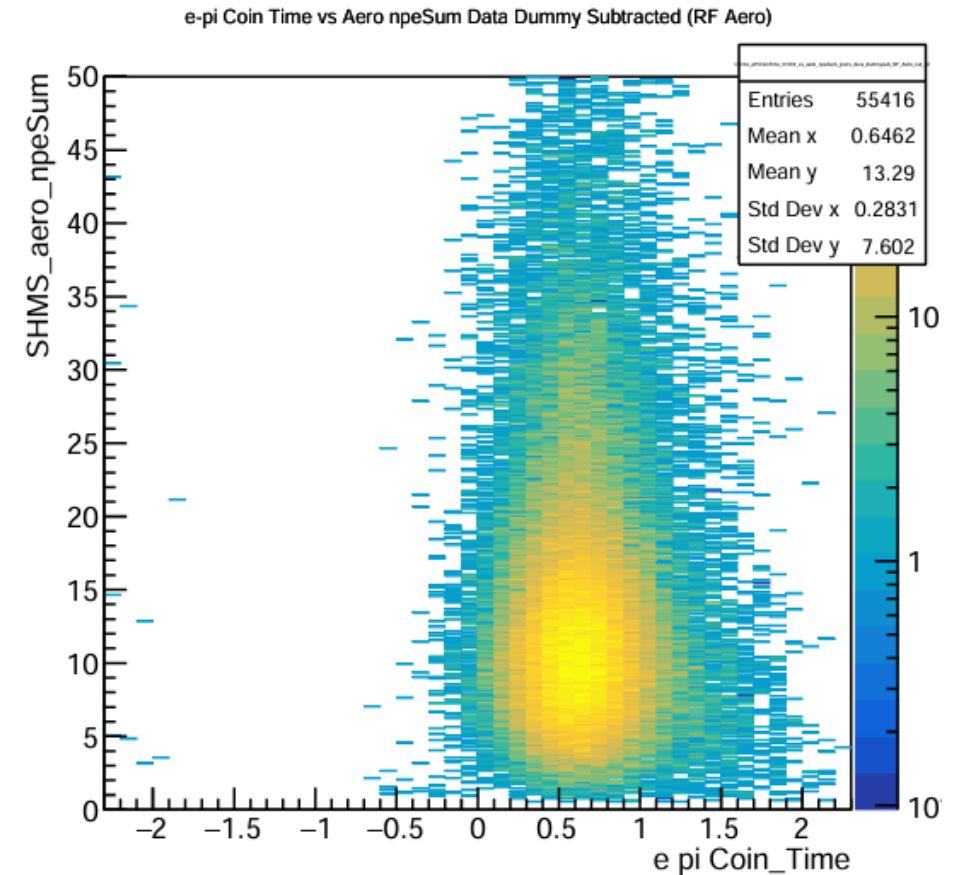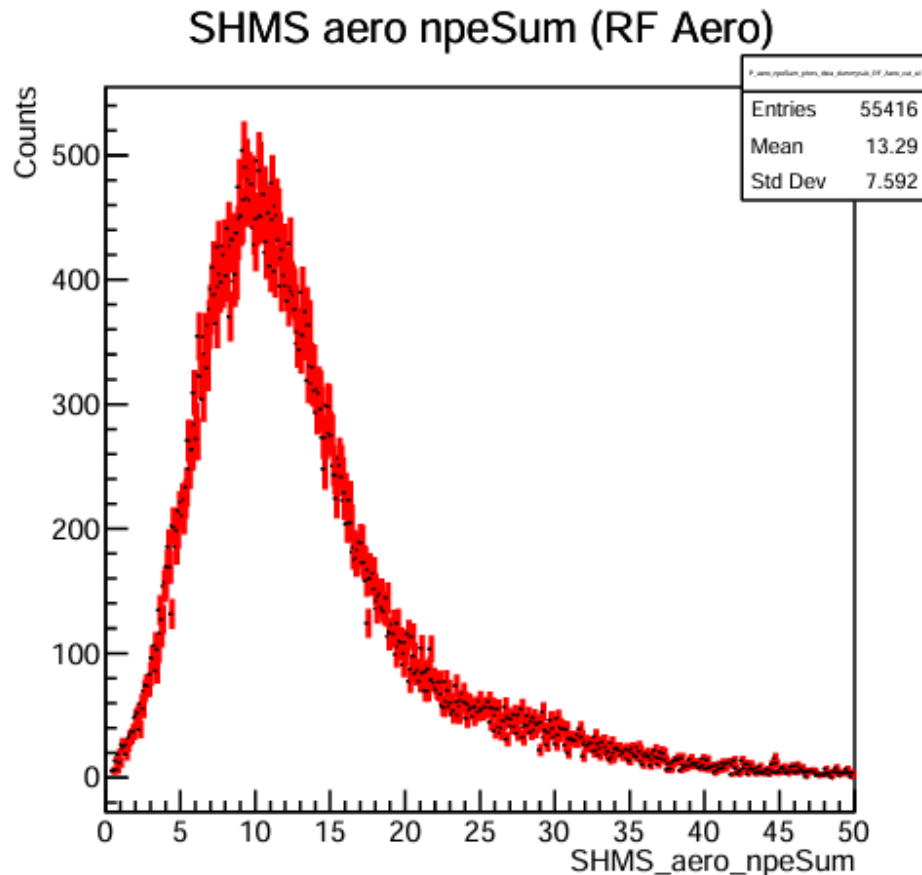

Accept+HMS_PID+CT+RF

Accept+HMS_PID+CT+RF+Aero

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 > 0.5

SHMS PID Cut Study

- **Finalized Aerogel cut for physics setting** "Q2 = 3.85, W = 2.02, t = 0.49 (higheps – n = 1.011)"

MIssing Mass data (RF NoAero)

Entries	640365
Mean	1.016
Std Dev	0.105

Accept+HMS_PID+CT+RF

SHMS Aerogel Cut (Pions)

P_aero_npeSum > 0.5

MIssing Mass data (RF Aero)

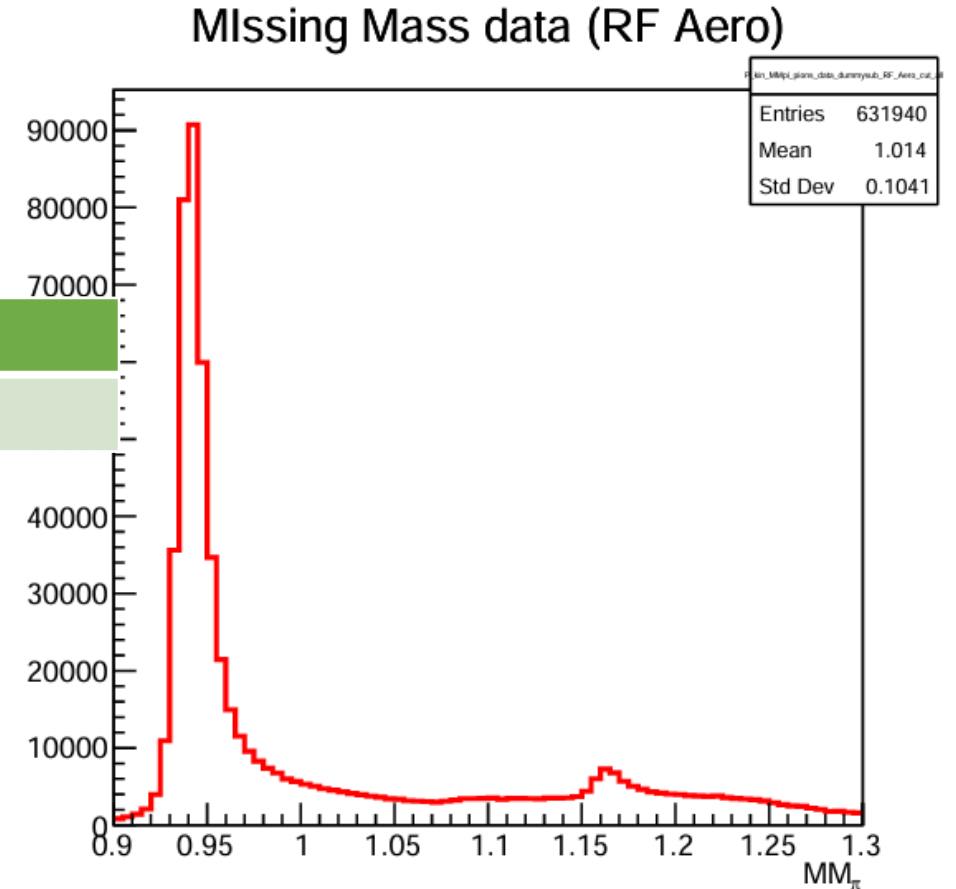| Entries | 631940 |
| Mean | 1.014 |
| Std Dev | 0.1041 |

Accept+HMS_PID+CT+RF+Aero

SHMS PID Cut Study

- **Finalized Aerogel cut for physics setting** "Q2 = 3.85, W = 2.02, t = 0.49 (higheps – n = 1.011)"

SHMS Aerogel Cut (Pions)

P_aero_npeSum > 0.5

Accept+HMS_PID+CT+RF

Accept+HMS_PID+CT+RF+Aero

SHMS PID Cut Study

- **Finalized Aerogel cut for physics setting** "Q2 = 3.85, W = 2.02, t = 0.49 (higheps – n = 1.011)"
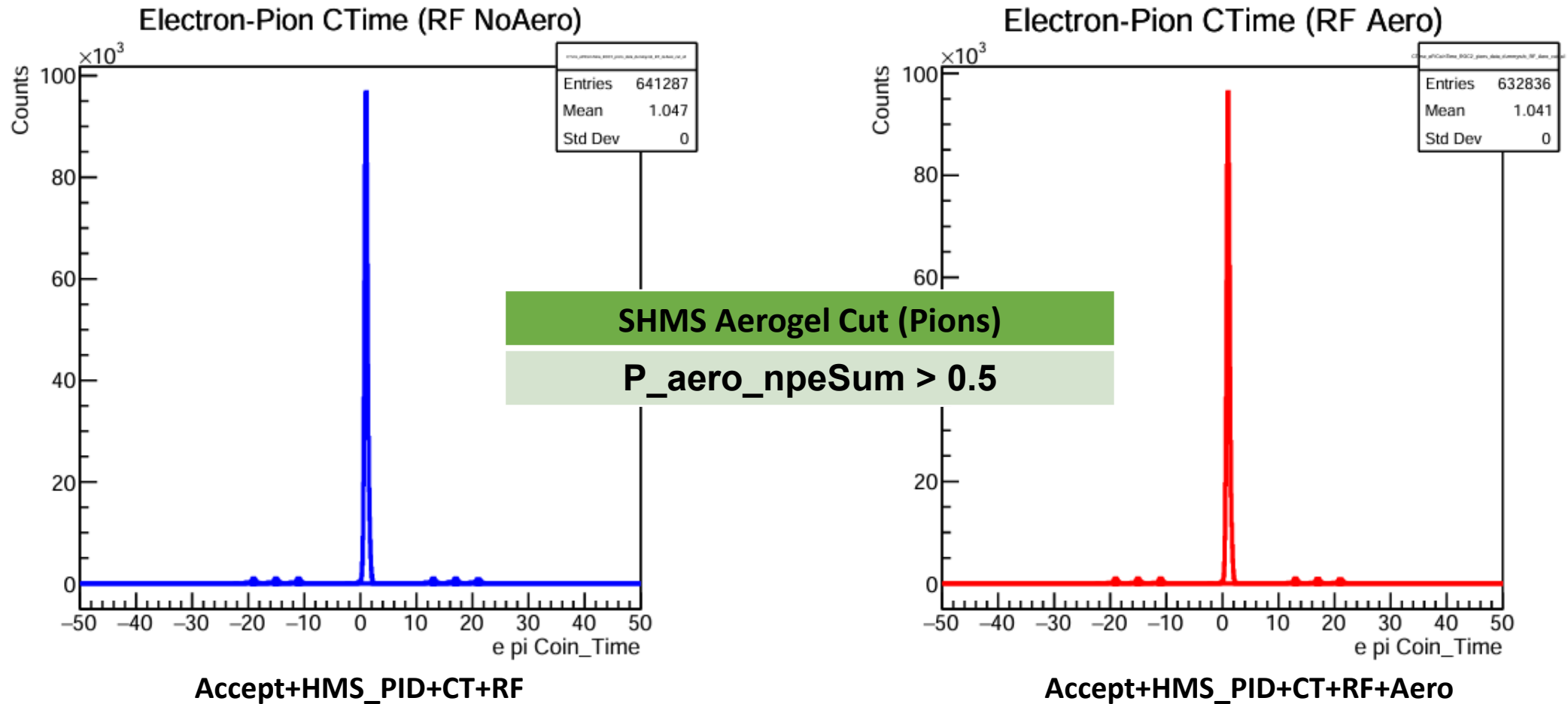

SHMS Aerogel Cut (Pions)

P_aero_npeSum > 0.5
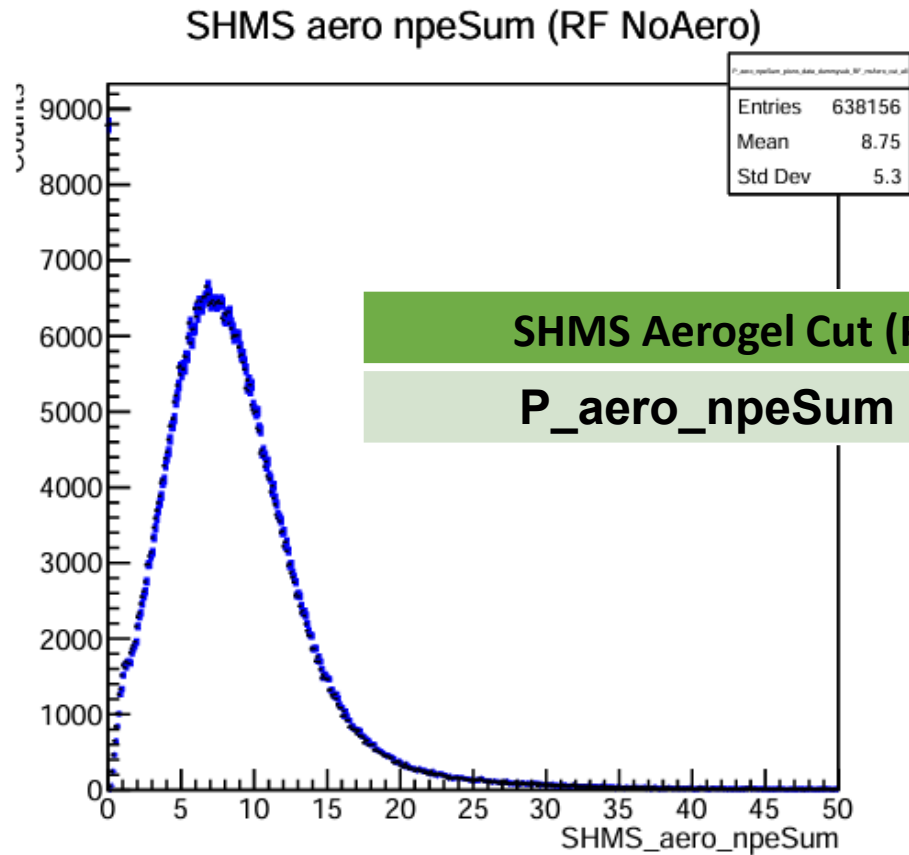
Accept+HMS_PID+CT+RF

Accept+HMS_PID+CT+RF+Aero

SHMS PID Cut Study

- **Finalized Aerogel cut for physics setting** "Q2 = 3.85, W = 2.02, t = 0.49 (higheps – n = 1.011)"

Missing Mass vs Aero npeSum Data Dummy Subtracted (RF NoAero)

Entries	637237
Mean x	0.9628
Mean y	9.021
Std Dev x	0.0399
Std Dev y	5.201

Accept+HMS_PID+CT+RF

Missing Mass vs Aero npeSum Data Dummy Subtracted (RF Aero)

Entries	628817
Mean x	0.9628
Mean y	9.065
Std Dev x	0.03989
Std Dev y	5.175

Accept+HMS_PID+CT+RF+Aero

SHMS PID Cut Study

- **Finalized Aerogel cut for physics setting** "Q2 = 3.85, W = 2.02, t = 0.49 (higheps – n = 1.011)"

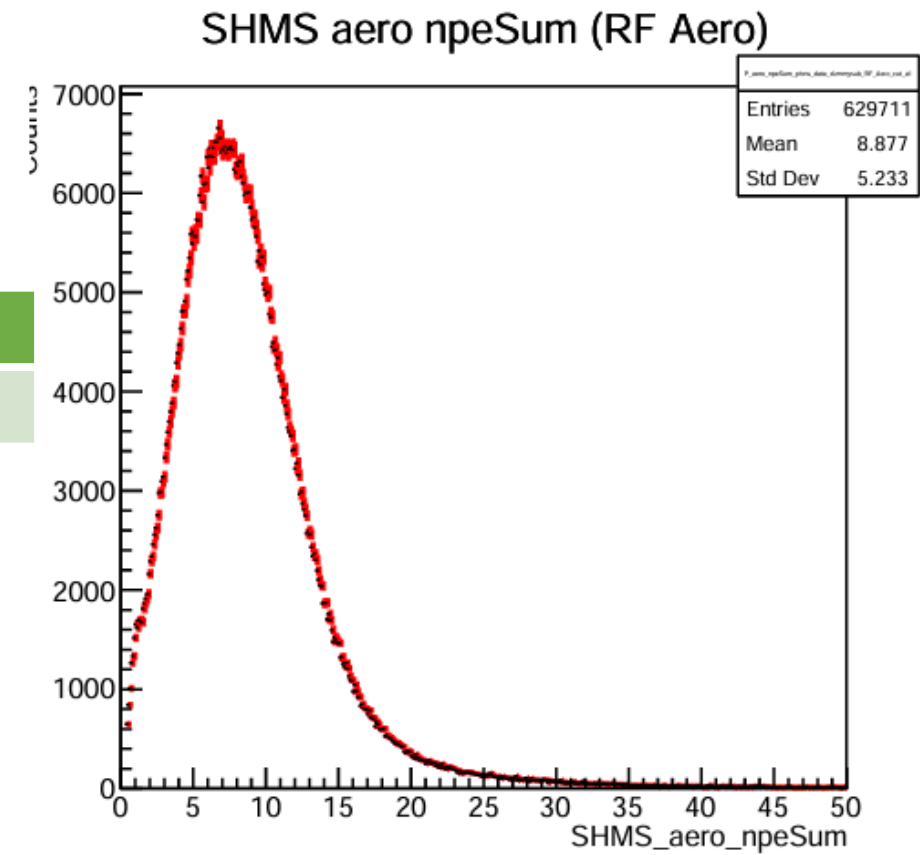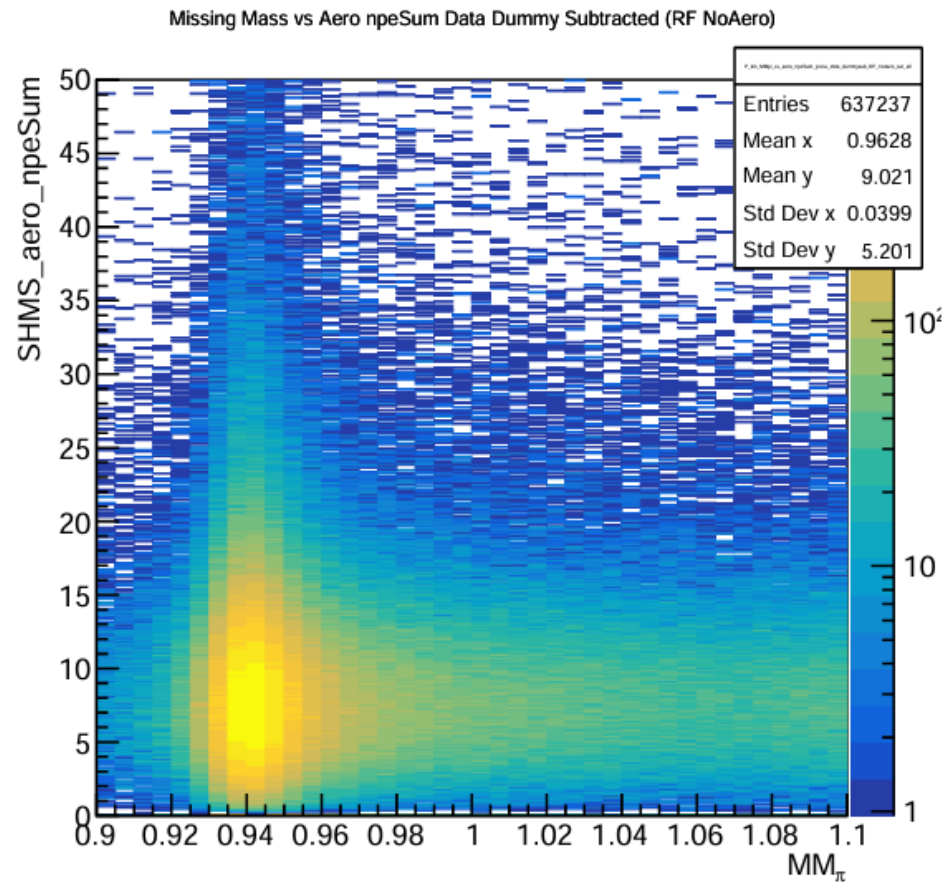**Accept+HMS_PID+CT+RF**

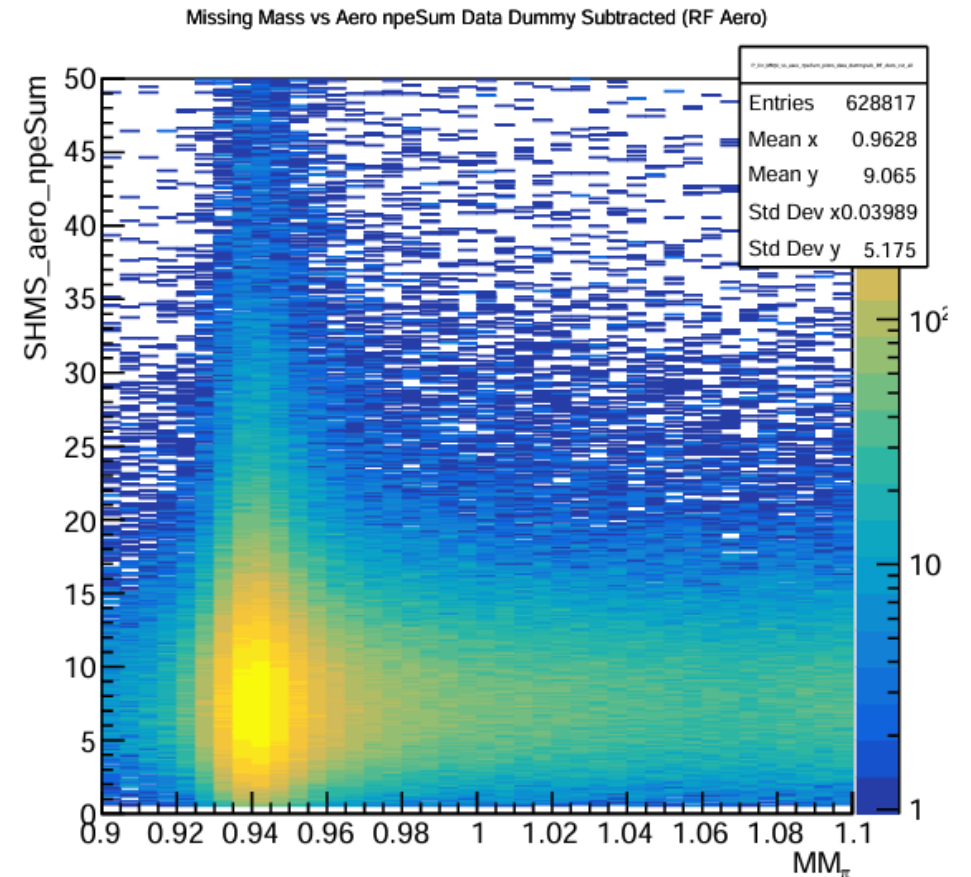**Accept+HMS_PID+CT+RF+Aero**

SHMS PID Cut Study

- **Finalized Aerogel cut for physics setting** "Q2 = 3.85, W = 2.02, t = 0.49 (higheps – n = 1.011)"
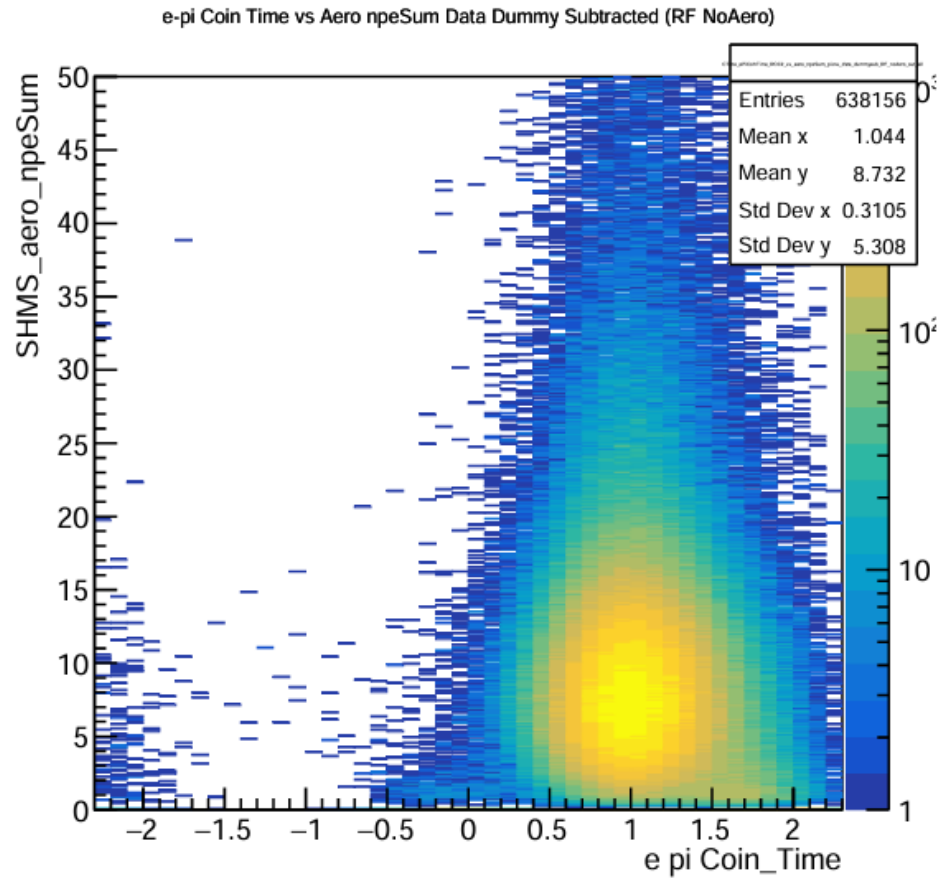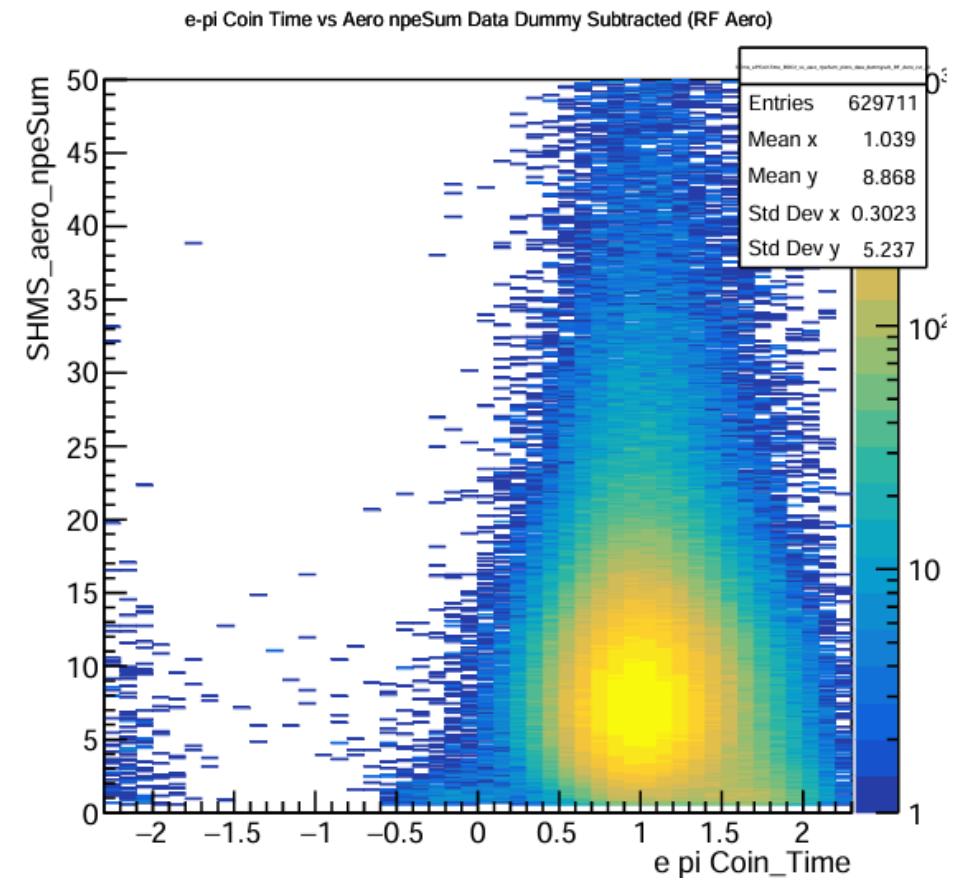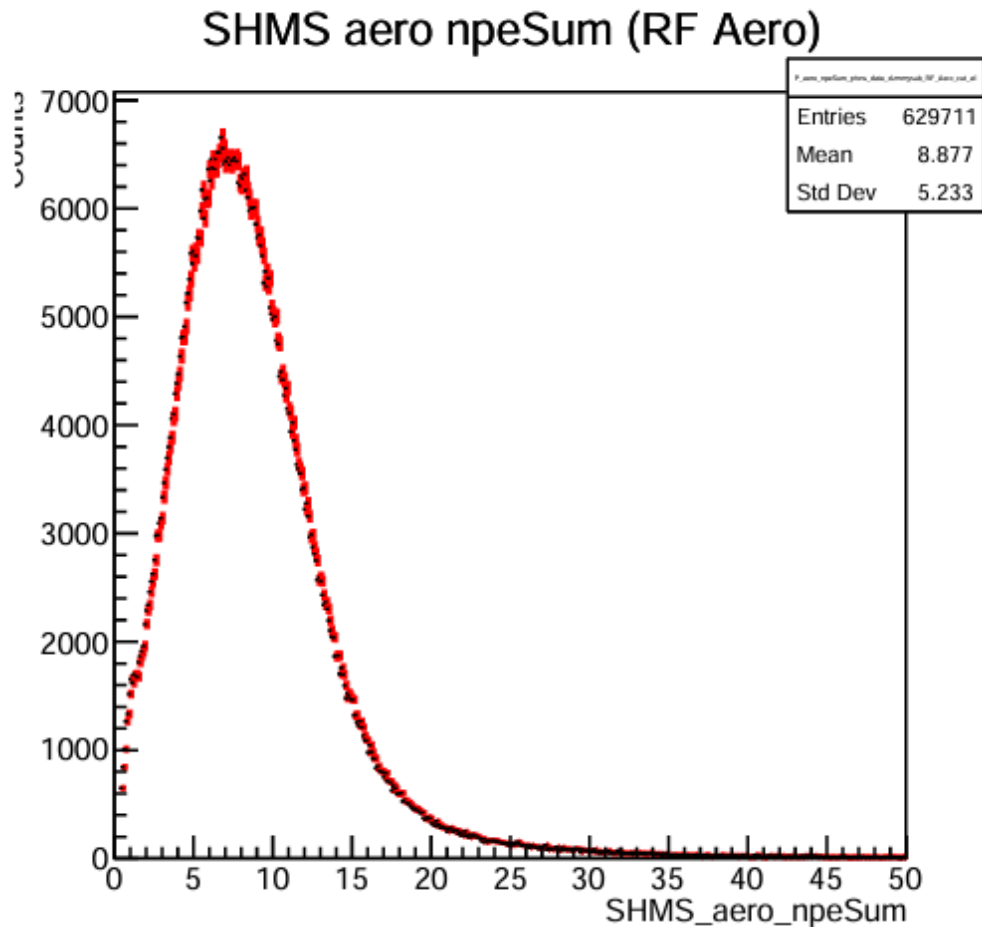

SHMS Aerogel Cut (Pions)
P_aero_npeSum > 0.5

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===============================================
###### RF Efficiency Calculation #########
Cut applied on Aerogel detector: P_aero_npeSum > 0.50
===============================================
RF Ndid: 653132.67
RF Nshould: 662692.33
RF Efficiency: 0.98557 +/- 0.00015
===============================================
Wrote RF efficiency to /group/c-pionlt/USERS/junaid/hall
ta.csv
Info in <TCanvas::Print>: pdf file /group/c-pionlt/USERS
nLT_coin_prod_SHMS_PID.pdf has been created using the cu
Info in <TCanvas::Print>: Current canvas added to pdf fi
_W2p02_t0p49_higheps_PionLT_coin_prod_SHMS_PID.pdf and f
Processing Complete
```

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**
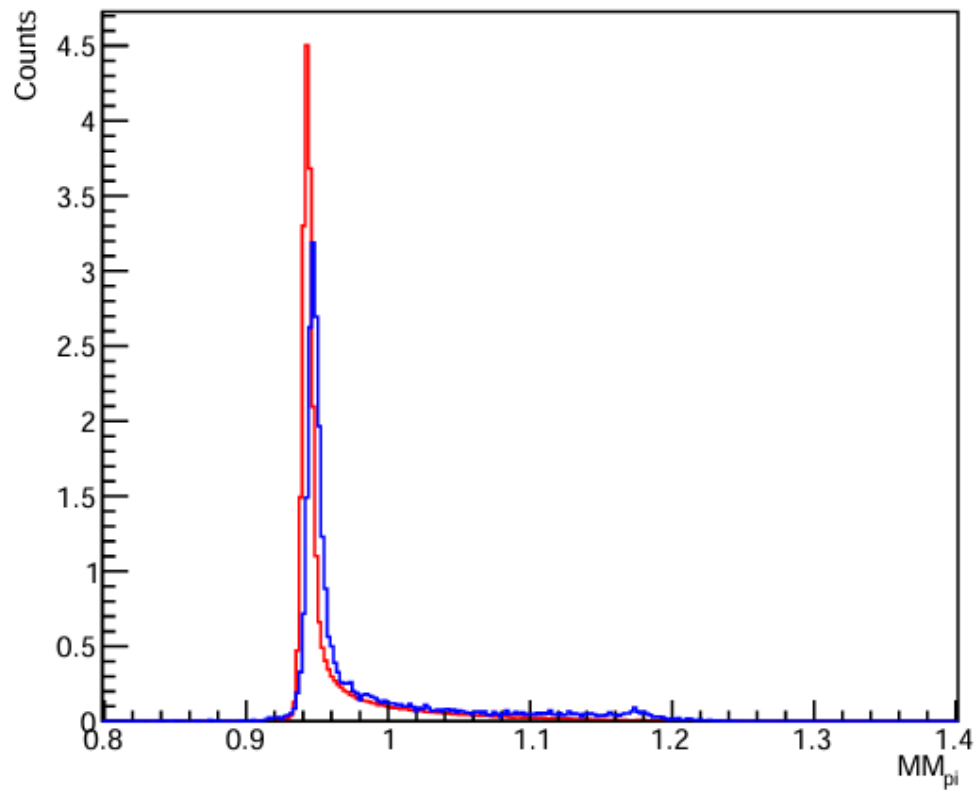- **Found the following offsets:**

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

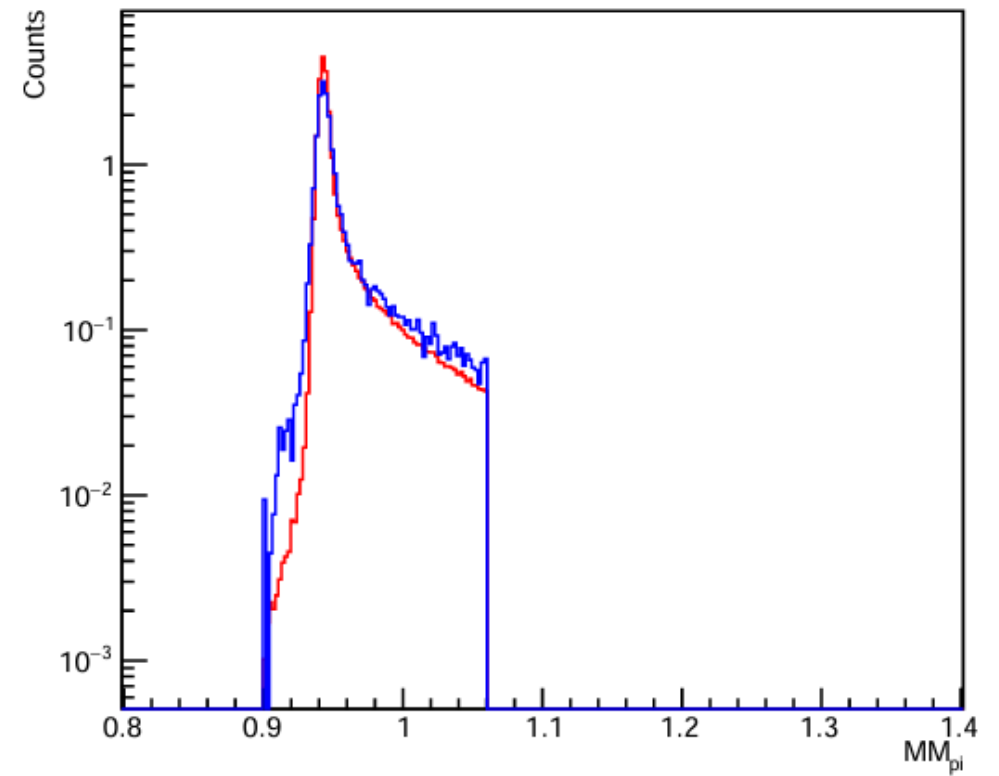- **Applied missing mass cut on both data and SIMC:**

$$0.90 < MMpi < 1.06$$

Missing Mass Offsets and Cut Study

MIssing Mass SIMC (cut_all)

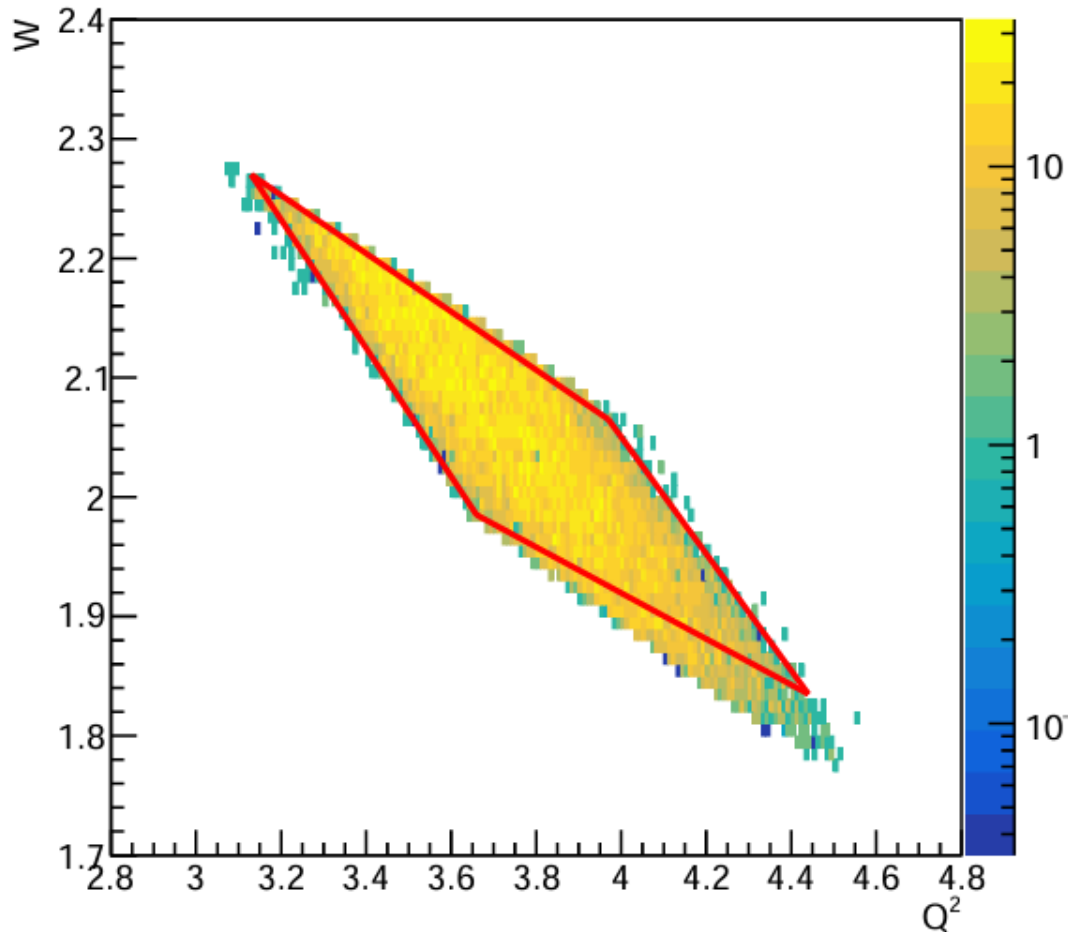MIssing Mass SIMC (cut_all)

Diamond Cut Study

- **Determined diamond cut from "Q3p85_W2p02_t0p49_lowepsilon_center" setting by looking at Q2vsW plot.**

- **Found the following offsets:**

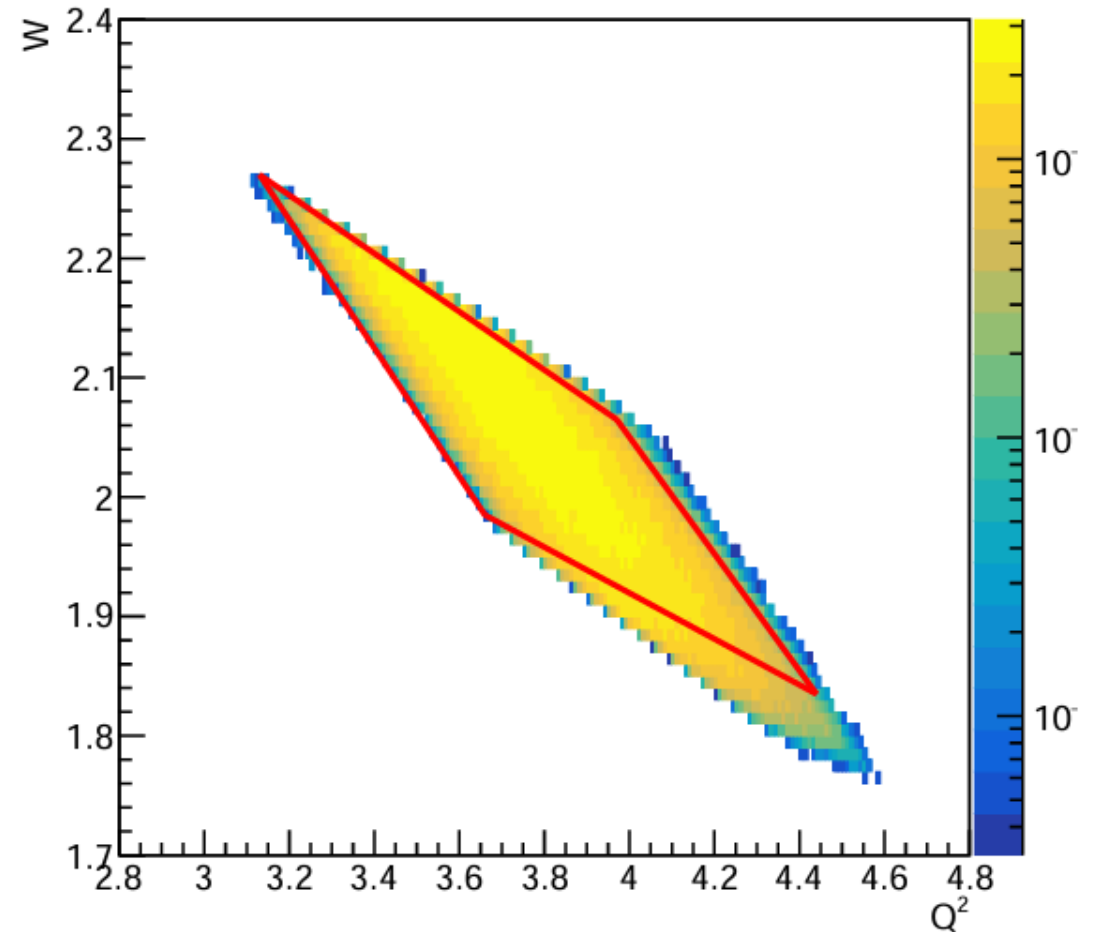| Vertex Points	Vertex Values (x, y)
Q3p85_W2p02_t0p49_top_left	(3.130, 2.270)
Q3p85_W2p02_t0p49_top_right	(4.000, 2.065)
Q3p85_W2p02_t0p49_bottom_left	(3.645, 1.985)
Q3p85_W2p02_t0p49_bottom right	(4.450, 1.825)

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

Diamond Cut Study

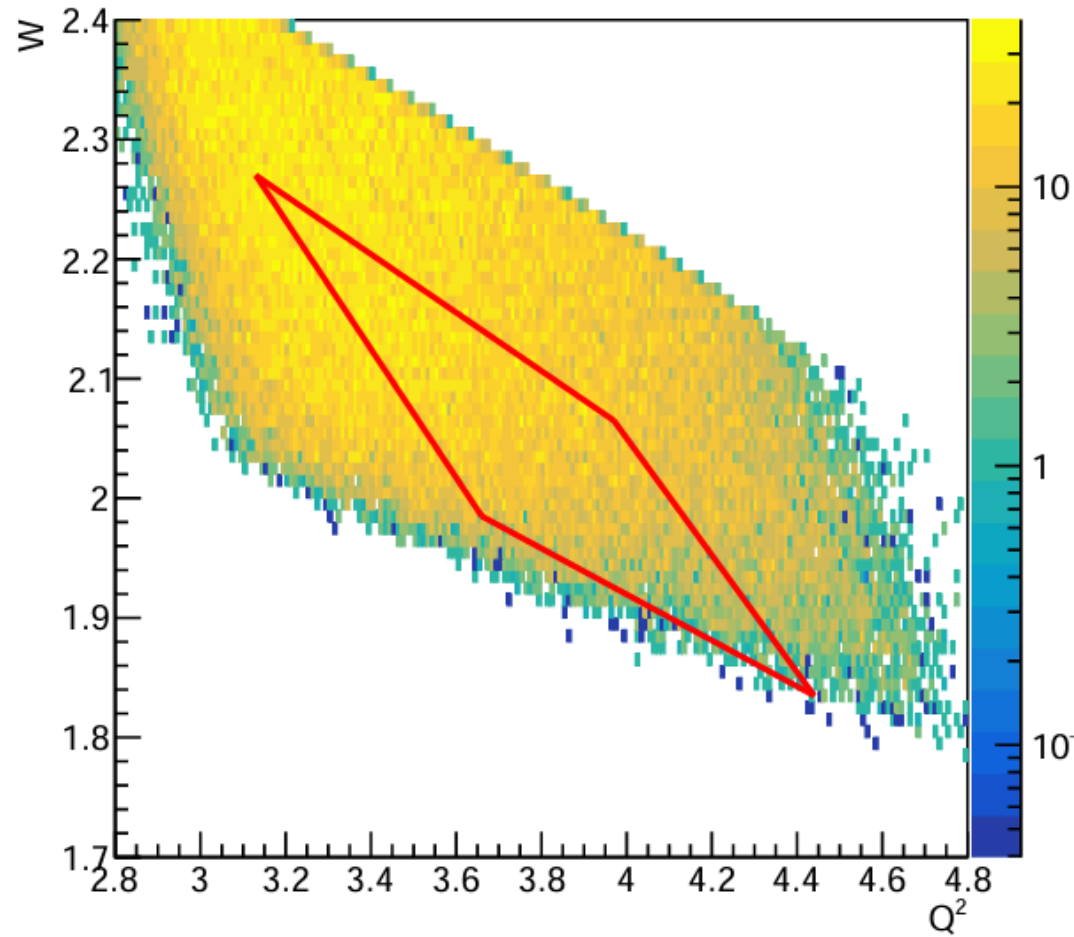Q² vs W (Accpt+PID+RF+RandDummySub) Distribution
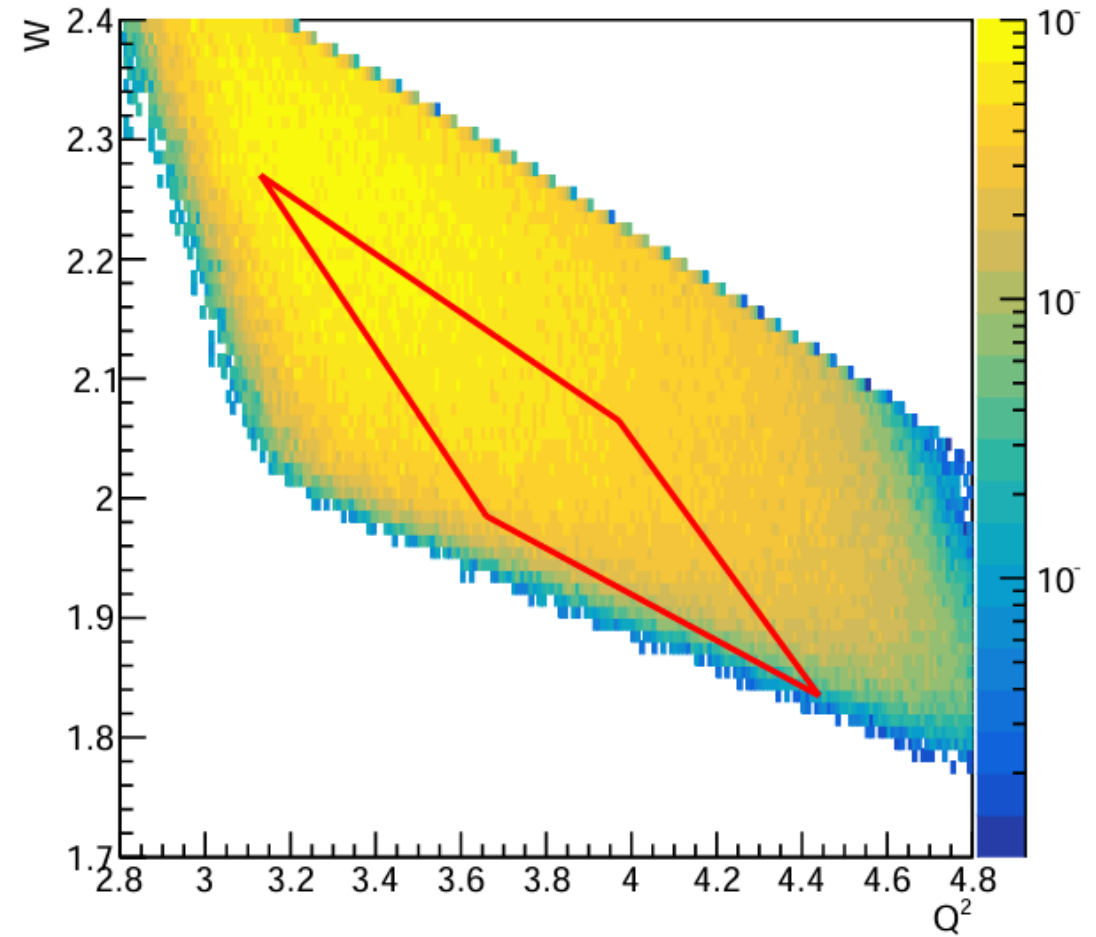
Q² vs W SIMC Distribution

Q² vs W (Accpt+PID+RF+RandDummySub) Distribution

Q² vs W SIMC Distribution

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 **"Q2 = 3.85, W = 2.02, t = 0.49 (2 epsilons)"**