

sPHENIX Commissioning Workfest

TPC Dead Channel Map

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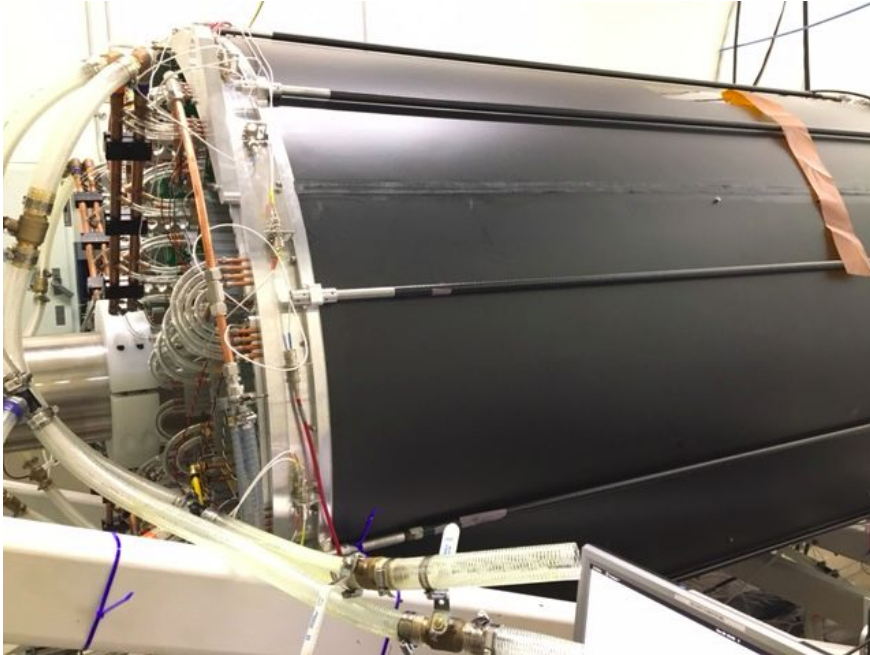
3) Methods

Introduction

sPHENIX TPC (Time Projection Chamber)



sPHENIX TPC (Time Projection Chamber)



sPHENIX TPC Stats:

Length - $\sim 2 \times 1.05 \text{ m} = 6.9 \text{ ft}$

Diameter - $\sim 2 \times 78 \text{ cm} = 5.1 \text{ ft}$

Sectors/Regions = 12 sectors/side \times 3 regions/sector

Electronic Readout Cards = 26 / sector

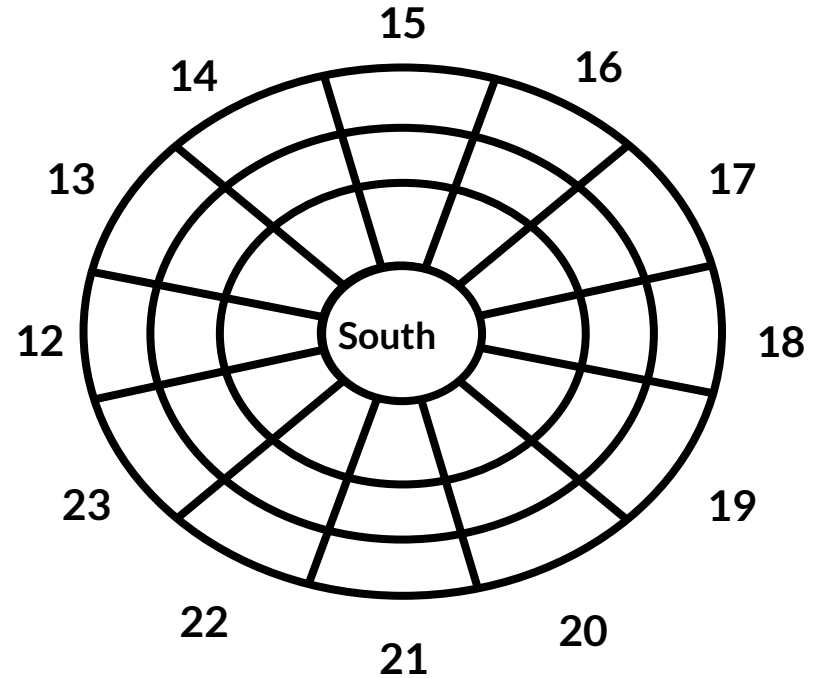
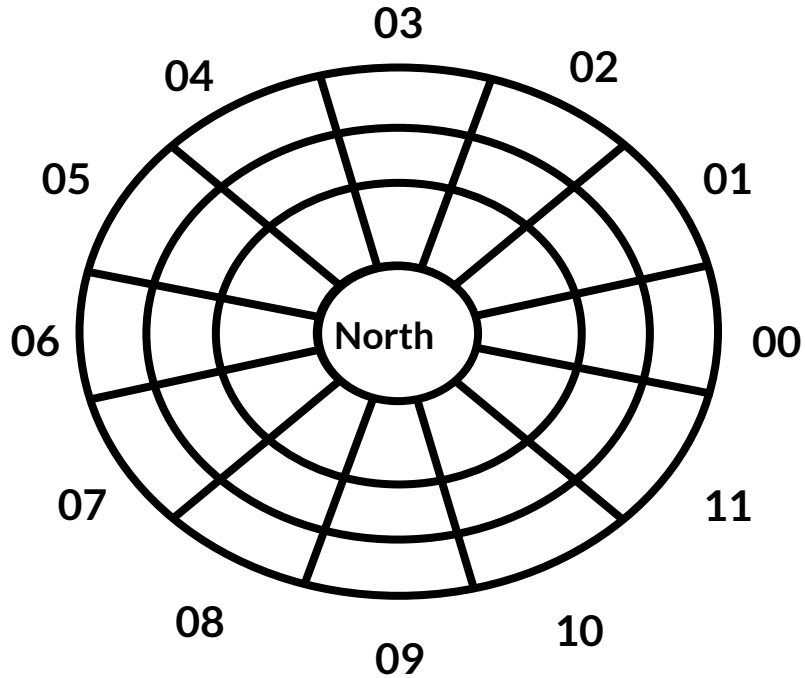
Channels = 256 / Readout Card

Gas: Argon/CF₄ (60:40)

Introduction

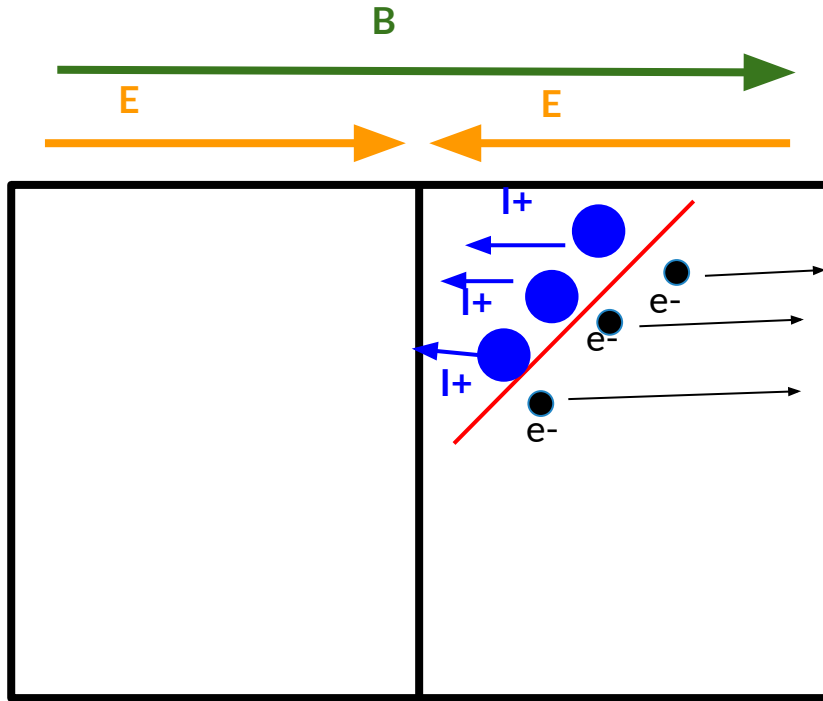


sPHENIX TPC (Time Projection Chamber)

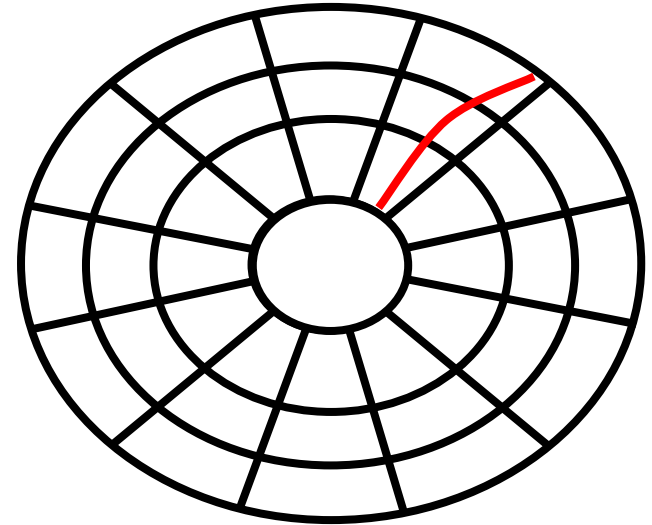


Introduction

sPHENIX TPC (Time Projection Chamber)



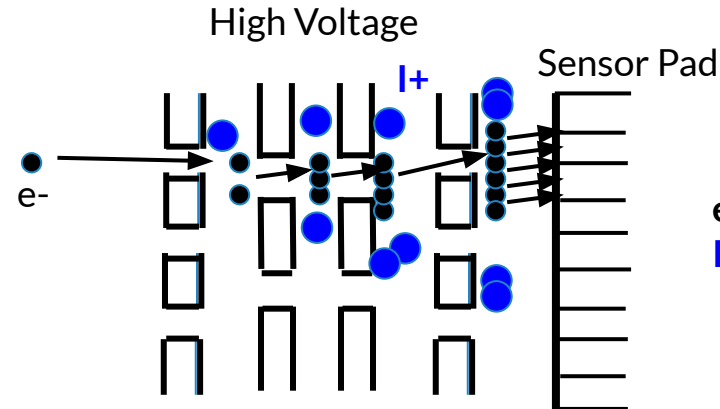
R
E
A
D
O
U
T



sPHENIX TPC (Time Projection Chamber)

Readout

- GEM (Gaseous Electron Multiplier) Chamber (Multiplication, IBF suppression)
- Segmented Copper Pads



e^- multiplied, pass through
 I^+ sticks to foil (suppressed)

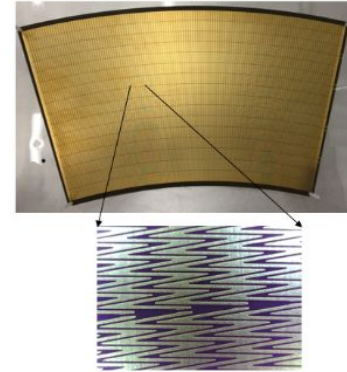


Figure 4. sPHENIX readout plane with closeup of zig-zag pads.

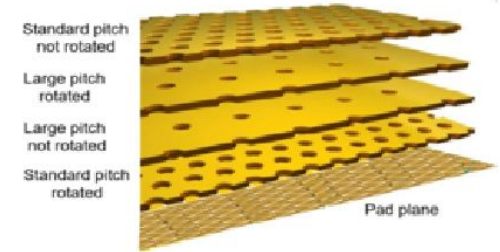
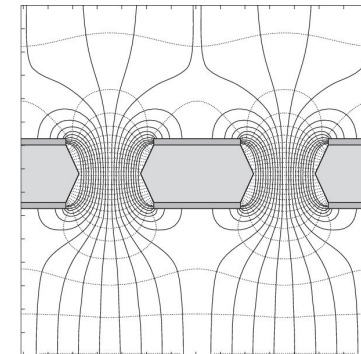


Figure 5. sPHENIX Quadruple GEM layout.



GEM Hole
 E-Field

sPHENIX TPC (Time Projection Chamber)

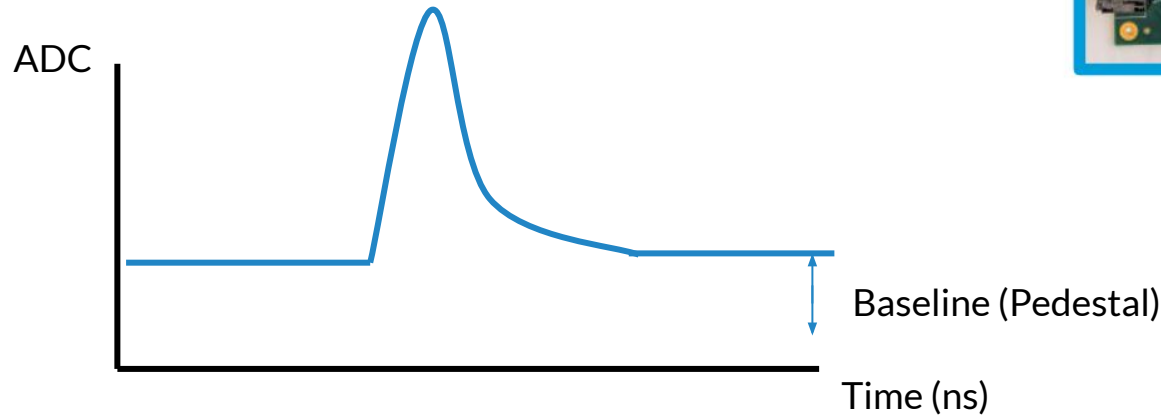
Readout Electronics

- Front End Electronics (FEE) card
 - Analogue/Digital Conversion
 - Shaping
 - Multiplexing

From readout pads

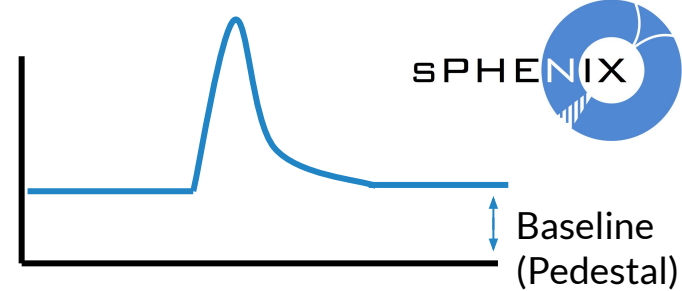


To DAM/DAQ



Introduction

sPHENIX TPC (Time Projection Chamber)



- Pedestal Test

Past 2-3 weeks

No Gas, No B/E Field

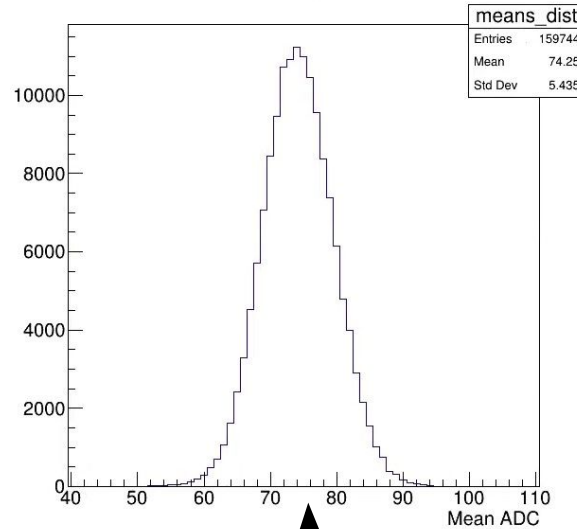
Just noise

- Answers the following questions:

- 1) What is the ADC value of pedestal ?
(mean over time)
- 2) How stable is it it ?
(std. dev. over time)

1) What is ADC value of pedestal ?

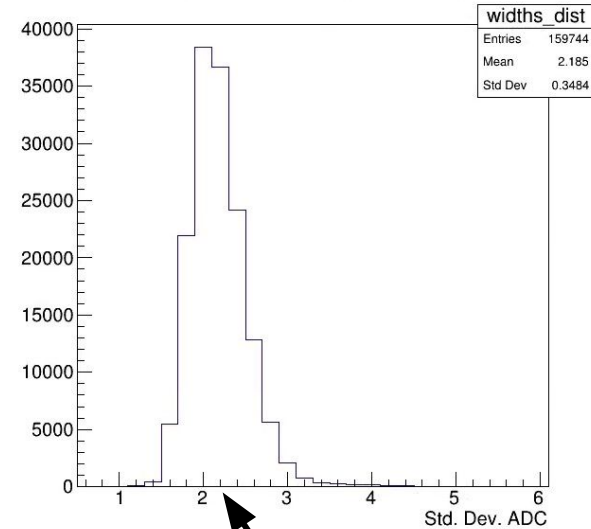
Pedestal Runs, Distribution of mean ADC for each channel in TPC



Mean (~74 ADCs/channel)

2) How Stable is it?

Pedestal Runs, Distribution of std. dev. ADC for each channel in TPC



Std. Dev. (~2 ADCs/channel)

sPHENIX TPC (Time Projection Chamber)

- Pedestal Test

Past 2-3 weeks

- From this test we can also answer:

Can we read out all channels?

NO

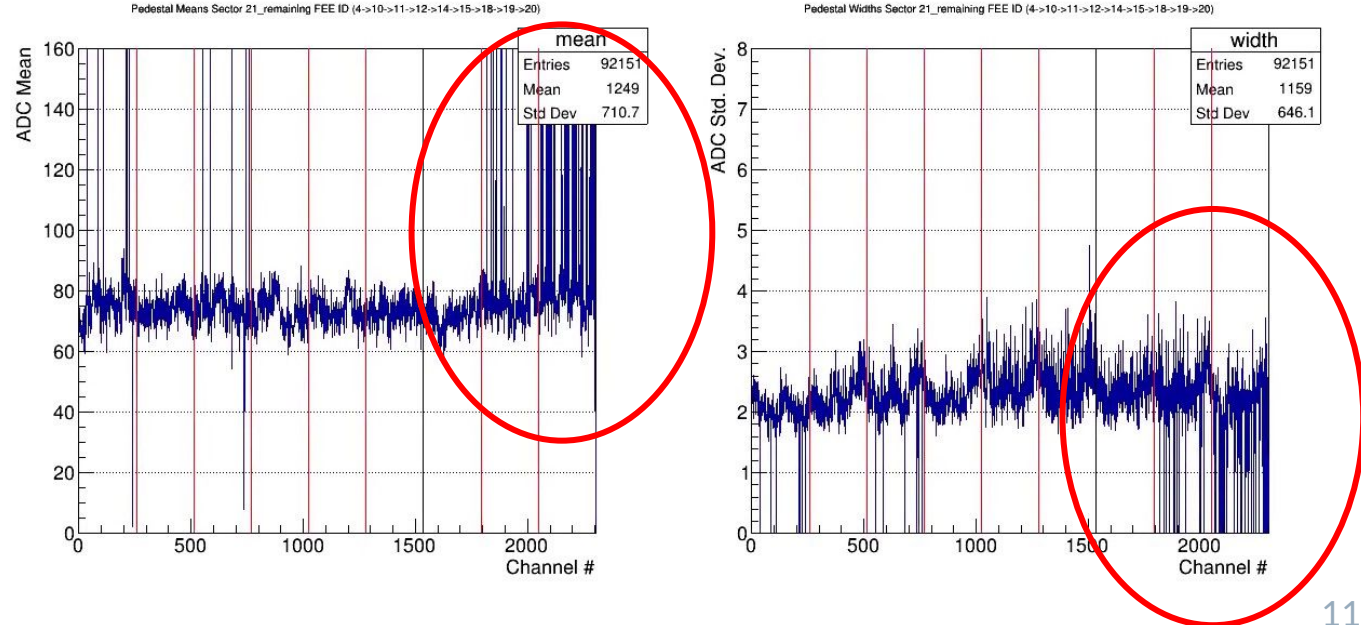
Where are the channels we can not read out?

This Workfest !

sPHENIX TPC (Time Projection Chamber)

- Can not read all channels

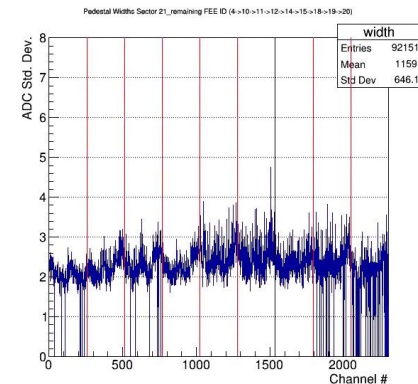
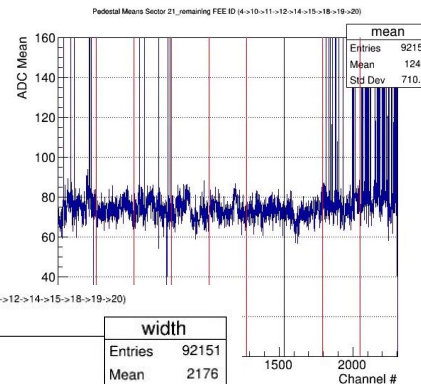
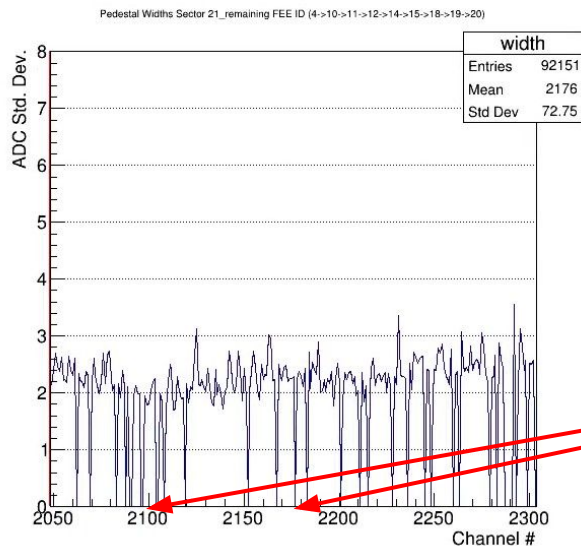
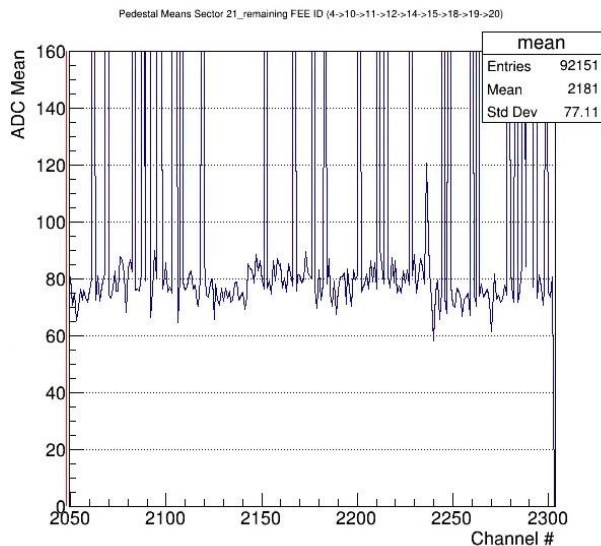
Main challenge, Stuck ADCs



sPHENIX TPC (Time Projection Chamber)

- Can not read all channels

Main challenge, Stuck ADCs



1 FEE - zoomed in

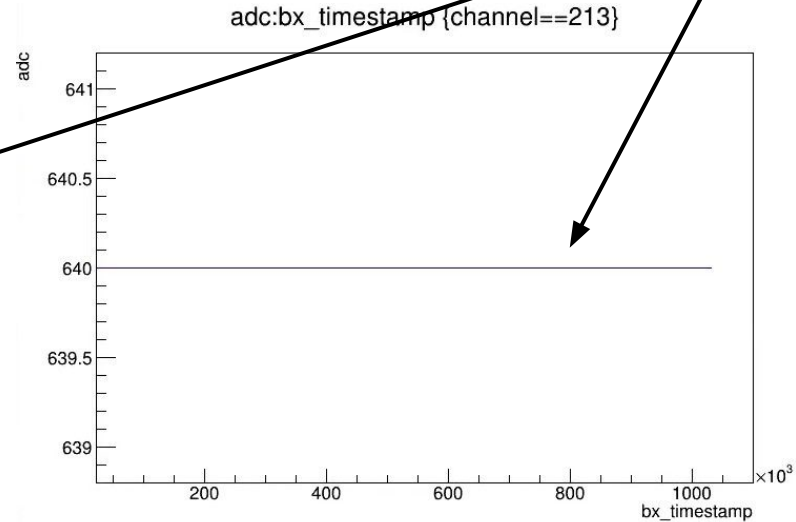
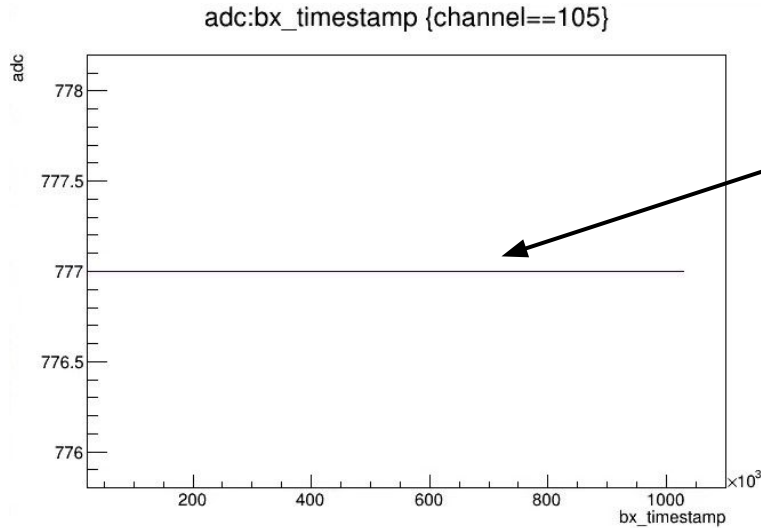
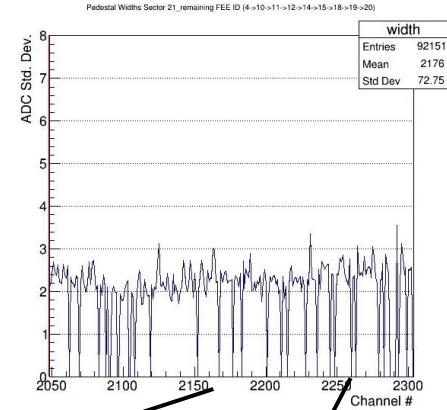
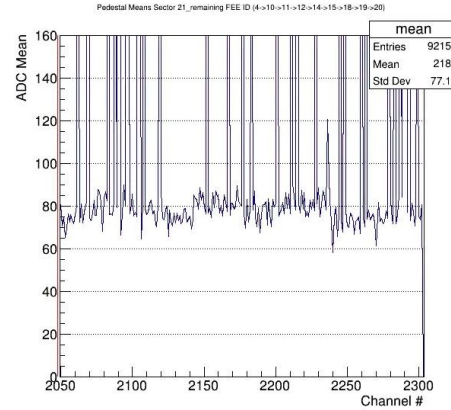
Stuck ADCs - Std. Dev. = 0

Introduction

sPHENIX TPC (Time Projection Chamber)

- Can not read all channels

Main challenge, Stuck ADCs



sPHENIX TPC (Time Projection Chamber)

- TPC Dead Channel Map (WHERE ARE STUCK ADCs?)

(from Jin Huang)

- **1 ROOT file with**
 - [TNtuple](#) of TPC Sector ID (00 - 23) / FEE ID (0 - 25) / Channel ID (0-255)
- **1 ROOT file with**
 - TNtuple of TPC Sector ID (00-23) / FEE ID (0-25) / Channel ID (0-255) / Pedestal Value / Noise Value
- **To continue: need further input from tracking crew**

sPHENIX TPC (Time Projection Chamber)

- TPC Dead Channel Map (WHERE ARE STUCK ADCs?)
- Where to get this information (SDCC/RCF):

/sphenix/data/data02/sphnxpro/tpc/chughes/workfest

```
-bash-4.2$ pwd
/sphenix/data/data02/sphnxpro/tpc/chughes/workfest
-bash-4.2$
-bash-4.2$
-bash-4.2$
-bash-4.2$
-bash-4.2$ ls
combined  NS  SS
-bash-4.2$
```


sPHENIX TPC (Time Projection Chamber)

- TPC Dead Channel Map (WHERE ARE STUCK ADCs?)

- Where to get this information (SDCC/RCF):

/sphenix/data/data02/sphnxpro/tpc/chughes/workfest

- 3 sub-directories

Combined, NS, SS

Combined = ALL DATA FILES IN ONE PLACE

NS = DATA FILES FROM NORTH SIDE SECTORS (00-11) ONLY

SS = DATA FILES FROM SOUTH SIDE SECTORS (12-23) ONLY

```
-bash-4.2$ pwd
/sphenix/data/data02/sphnxpro/tpc/chughes/workfest
-bash-4.2$
-bash-4.2$
-bash-4.2$
-bash-4.2$
-bash-4.2$ ls
combined  NS  SS
-bash-4.2$
```

sPHENIX TPC (Time Projection Chamber)

- TPC Dead Channel Map (WHERE ARE STUCK ADCs?)
- /sphenix/data/data02/sphnxpro/tpc/chughes/workfest/NS

```
-bash-4.2$ pwd
/sphenix/data/data02/sphnxpro/tpc/chughes/workfest/NS
-bash-4.2$
-bash-4.2$
-bash-4.2$
-bash-4.2$
-bash-4.2$
-bash-4.2$ ls
R1_R2  R3  remaining
-bash-4.2$ █
```

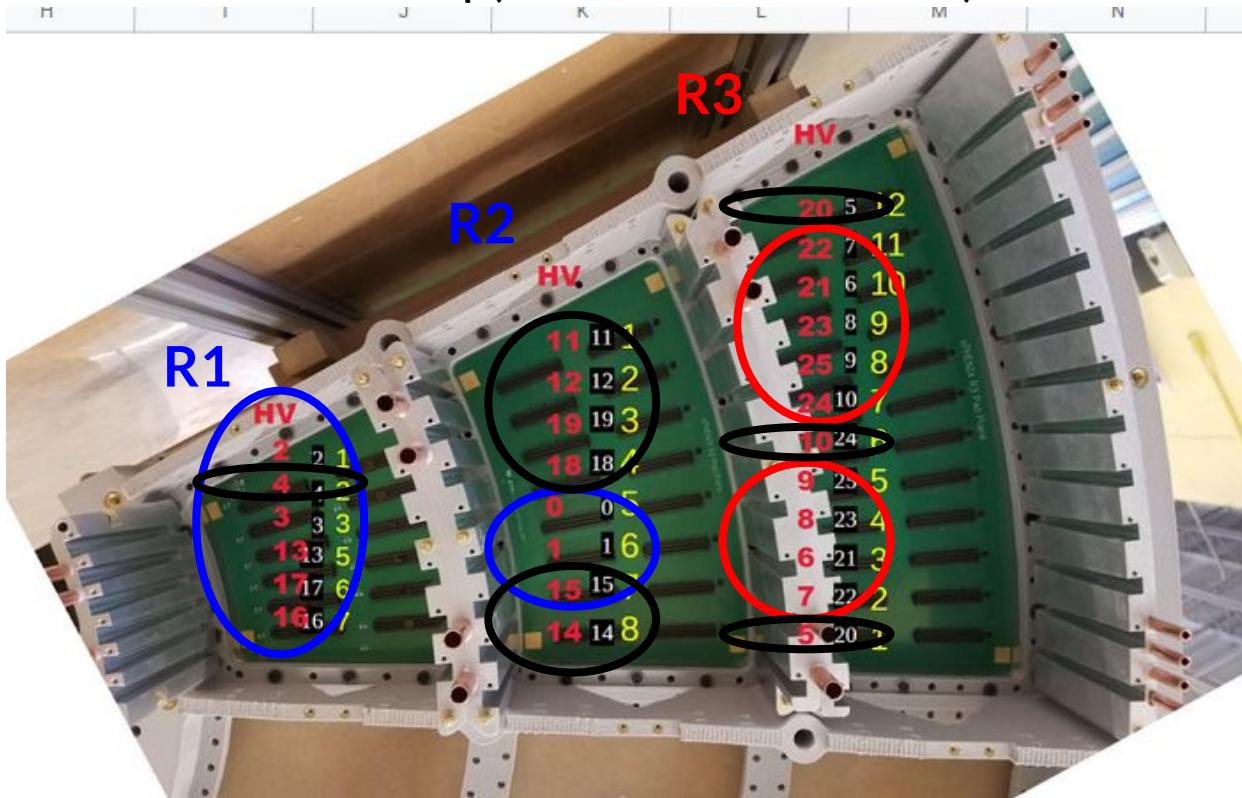
R1_R2 - Subset of FEEs in R1_R2 only (all sectors)

R3 - Subset of FEEs in R3 only (all sectors)

Remaining - All FEEs left (all sectors - could be in R1, R2, or R3)

sPHENIX TPC (Time Projection Chamber)

- TPC Dead Channel Map (WHERE ARE STUCK ADCs?)



R1_R2 - Subset of FEEs in R1_R2 only (all sectors)

R3 - Subset of FEEs in R3 only (all sectors)

Remaining - All FEEs left (all sectors - could be in R1, R2, or R3)

*Note repeat of FEE 4 & 15

*FEE ID 5 is left out (no data)

sPHENIX TPC (Time Projection Chamber)

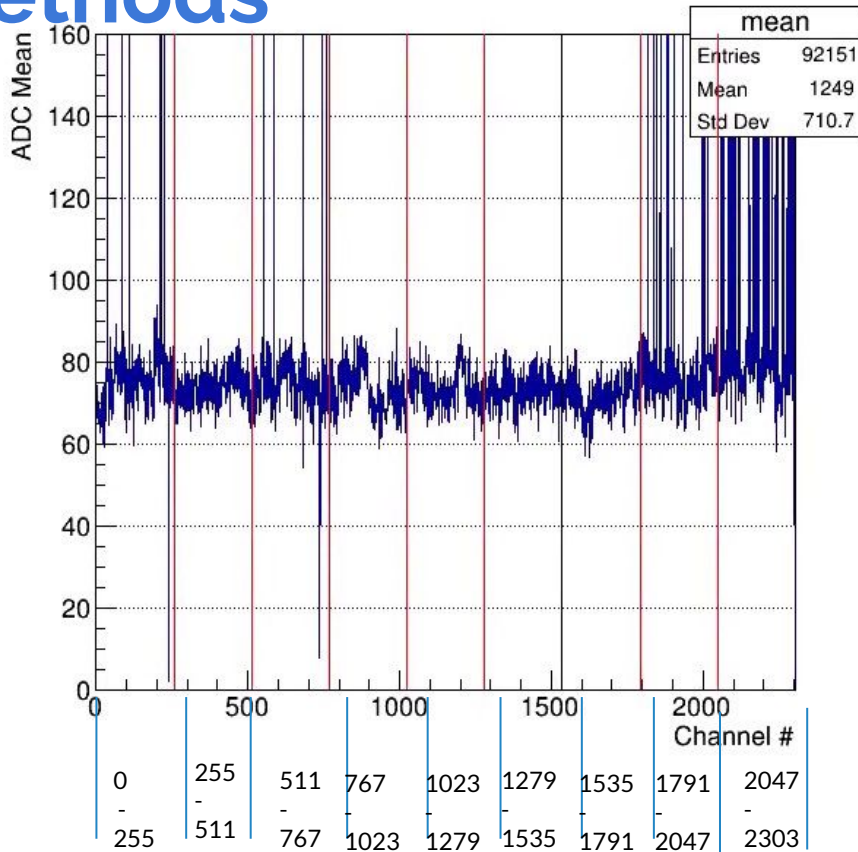
- TPC Dead Channel Map (WHERE ARE STUCK ADCs?)

```
-bash-4.2$ pwd
/sphenix/data/data02/sphnxpro/tpc/chughes/workfest/NS
-bash-4.2$
-bash-4.2$
-bash-4.2$
-bash-4.2$
-bash-4.2$
-bash-4.2$ ls
R1_R2  R3    remaining
-bash-4.2$ cd R1_R2/
-bash-4.2$ ls
Sec_00  Sec_01  Sec_02  Sec_03  Sec_04  Sec_05  Sec_06  Sec_07  Sec_08  Sec_09  Sec_10  Sec_11
-bash-4.2$ cd Sec_00
-bash-4.2$ ls
allsampatree2_test_183111.root  sampatree2_test_183111.1.root  sampatree2_test_183111.4.root  sampatree2_test_183111.7.root
mean_width_183111_rootfile.root  sampatree2_test_183111.2.root  sampatree2_test_183111.5.root  sampatree2_test_183111.8.root
sampatree2_test_183111.0.root  sampatree2_test_183111.3.root  sampatree2_test_183111.6.root  sampatree2_test_183111.9.root
-bash-4.2$ pwd
/sphenix/data/data02/sphnxpro/tpc/chughes/workfest/NS/R1_R2/Sec_00
-bash-4.2$ █
```

We want the data in this
mean_width_183111_rootfile.root

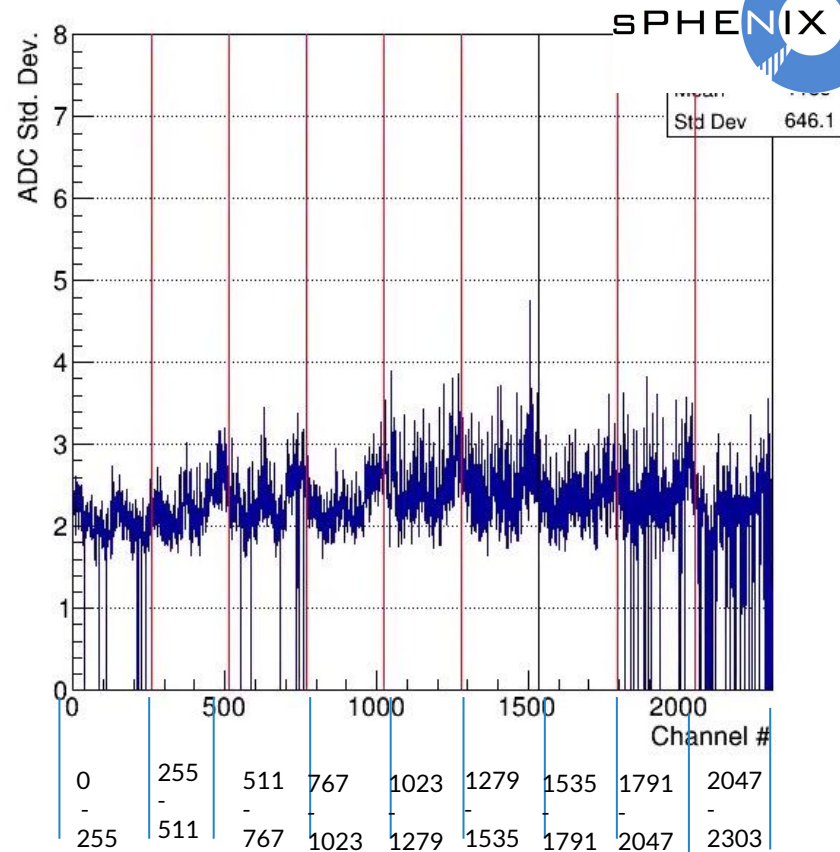
Methods

Pedestal Means Sector 21_remaining FEE ID (4->10->11->12->14->15->18->19->20)



R1_R2 2 4 3 13 17 16 0 1 15
R3 6 7 8 9 21 22 23 24 25
Remaining 4 10 11 12 14 15 18 19 20

Pedestal Widths Sector 21_remaining FEE ID (4->10->11->12->14->15->18->19->20)



Same as Mean plot

Problems

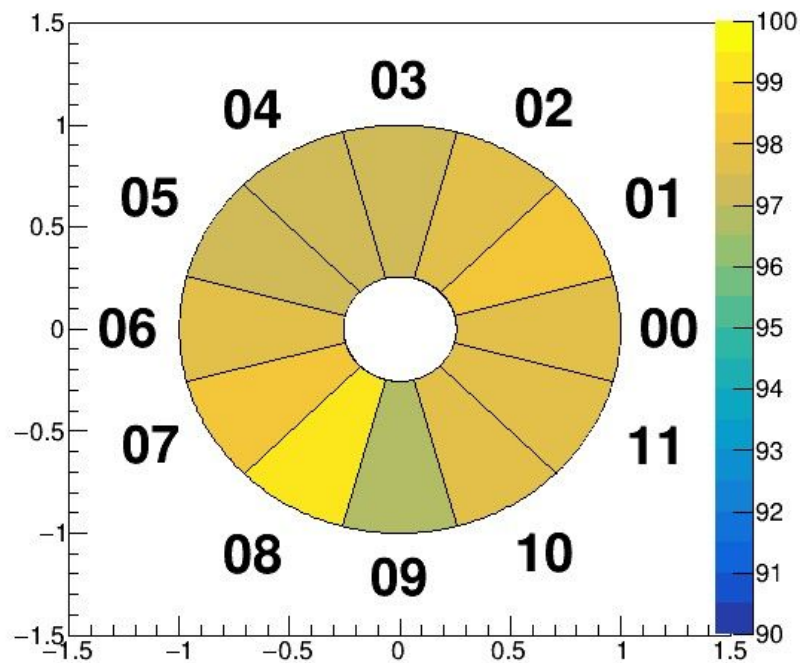
- FEE ID 14 is dropped out on MOST runs (firmware issues)
- FEE ID 5 is dropped out on ALL runs (firmware issues)
- FEE ID 4 and 15 repeated in firmware

Example Code to get started (bad channel criteria $\text{MEAN} > 110$ AND/OR $\text{STD. DEV} < 0.5$)

```
/sphenix/data/data02/sphnxpro/tpc/chughes/Analyze.C  
/sphenix/data/data02/sphnxpro/tpc/chughes/Analyze2.C
```

(NEEDS A LOT OF WORK !!!!!!!)

Alive Channel Fraction North Side (%)



Alive Channel Fraction South Side (%)

