

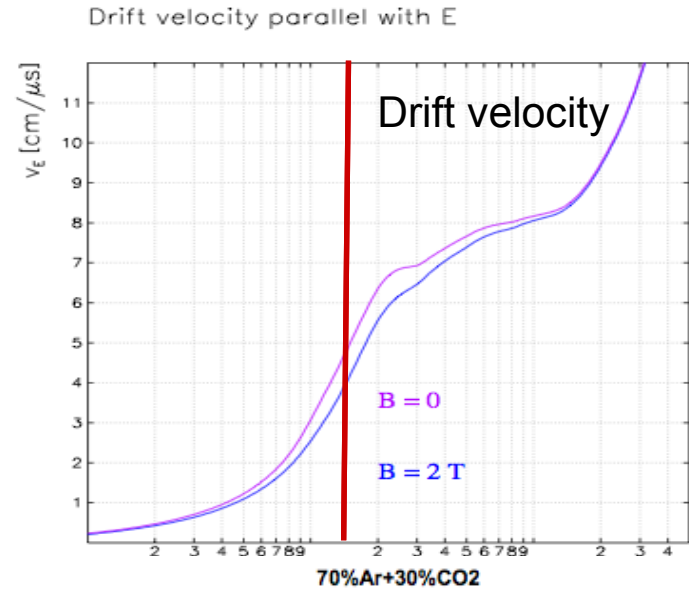
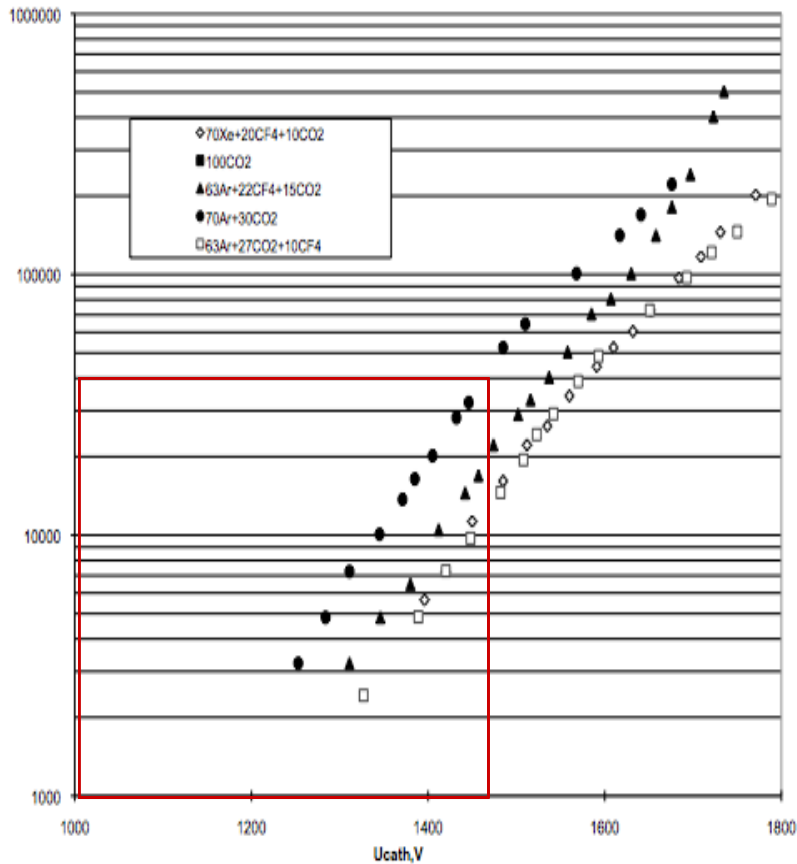
TRT Test manual

- Some important information p. 2-3
- Noise studies p.4-7
- Operation with particles p. 8-14

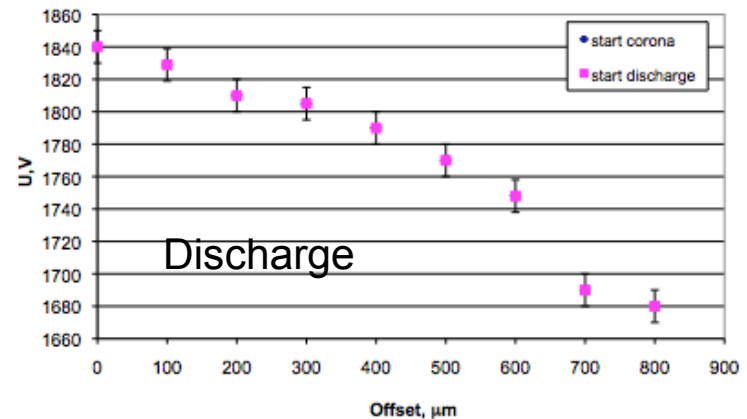
Some important information

- Mixture 70%Ar+30%CO₂
- Nominal voltage is 1480 V (gas gain $\sim 4 \cdot 10^4$)
- E-field near the cathode = $V/r \cdot \ln(R/r) = 1480/0.2 \cdot \ln(2000/15) = 1512$ V/cm

Gas gain



Plot of 191932 on 17/12/10 after Gerdien - version 7.30



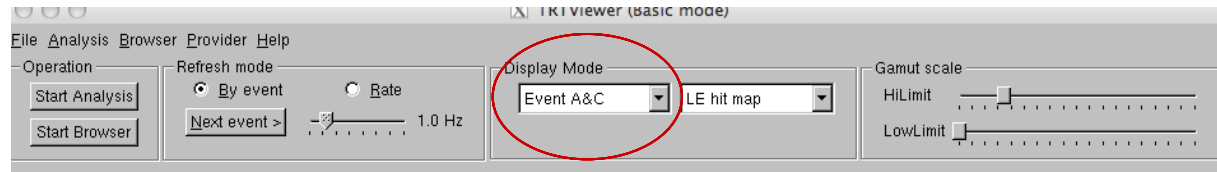
Some important information

- Particle loses ~ 1 keV in Ar-mixture
- One primary ionization cluster ~ 80 - 100 eV (3-4 el)
- Electronics noise with the detector ~ 3000 el
- Nominal threshold should be >4 sigma above the noise (now ~ 14000 el)
- Phys. Threshold = $EI.Thr * W / (Gas\ gain * Signal\ fraction)$
- In our case $\sim 14000\text{ el} * 27/4 * 10^4 * 0.12 = 79\text{ eV}$
- 10 DAC counts $= \sim 1400\text{el}$ or 8 eV

Tasks1: Noise characterization

Start DAQ

1. Set random trigger
2. Set a LL threshold to 86
3. Start DAQ
4. Start Online mode of the TRTViewer (command trtviewer DAQ)

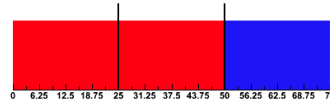
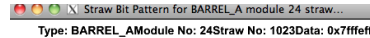
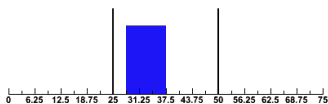
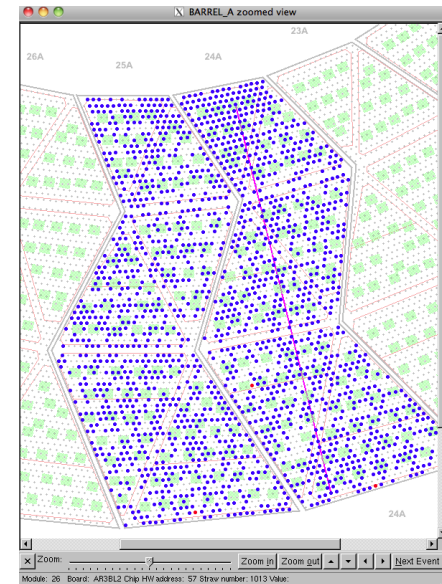


Work with the event display

Double click on general picture gives a zoomed view.

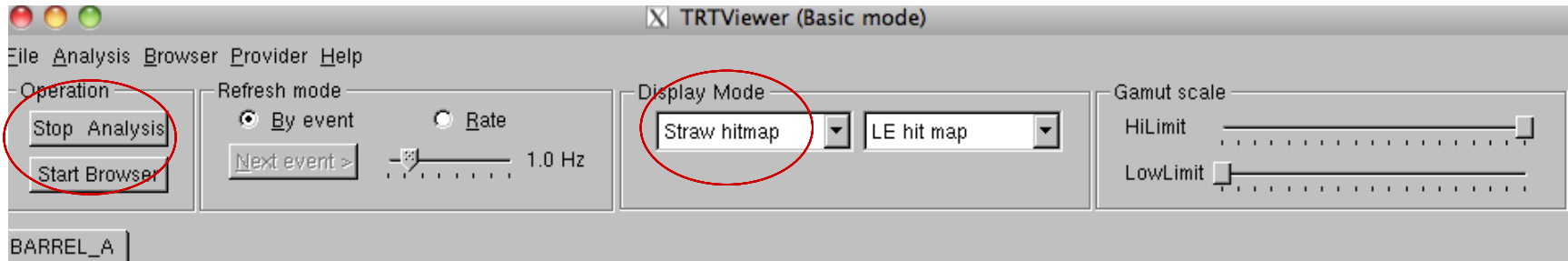
On ZOOM window a double click on each straws gives a bit pattern information

1. What means color coding?
2. What is the main characteristic of the noise signal?
3. Noise uniformity around the detector?



Tasks1: Noise characterization

Start Analysis mode of the TRTViewer



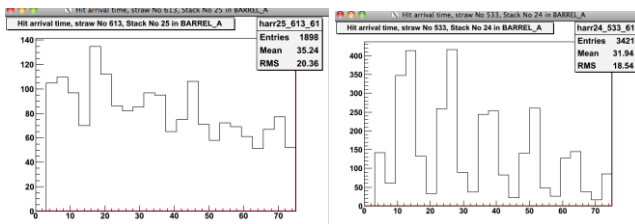
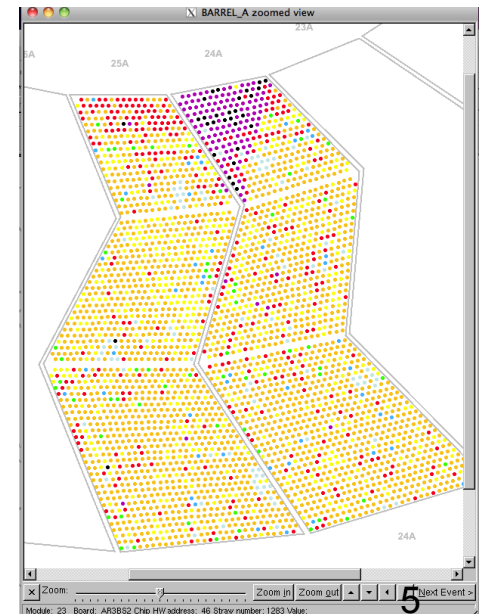
Set a display mode to “Straw map)

1. Use a different contrast of the noise representation.
2. What noise map tells you?

Work with the hit maps

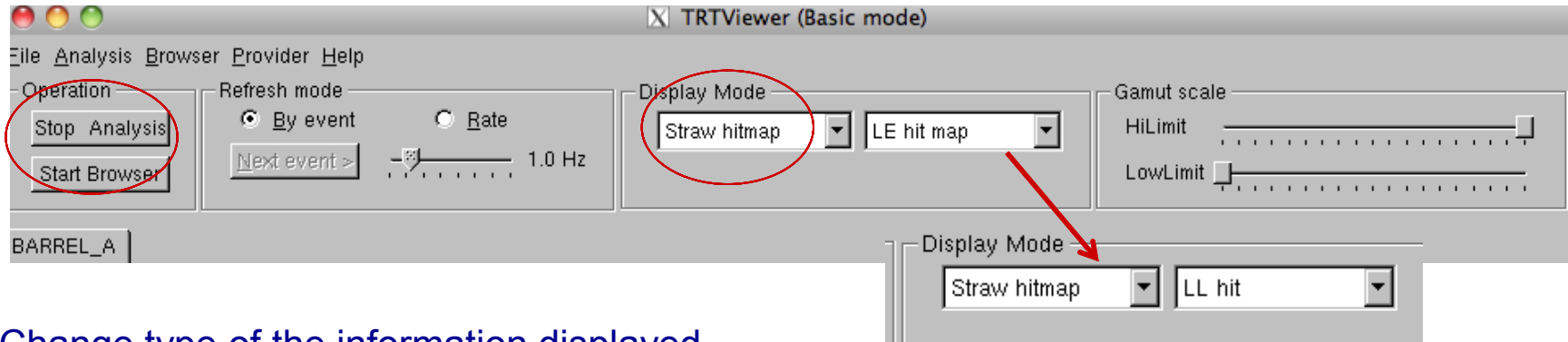
Double click on general picture gives a zoomed view.
On ZOOM window a double click on each straws gives
time distribution of the arriving signals

1. How to estimate noise rate?
2. How to distinguish a random noise and a clock noise?
3. Is the noisy area related to the clock activity.



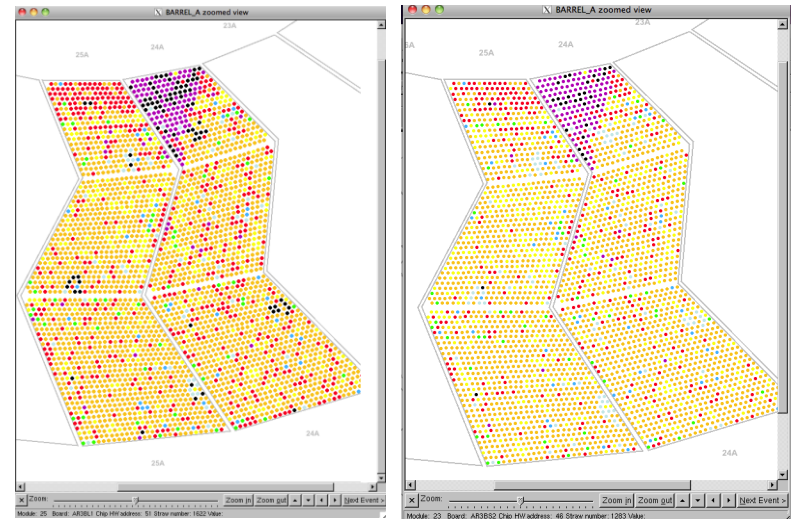
Tasks1: Noise characterization

Start Analysis mode of the TRTViewer



Change type of the information displayed

1. What is the difference between two representation?
2. What is the characteristics of the straws which have 100% occupancy?
3. Dead channel definition using the noise map
 - A)
 - B)



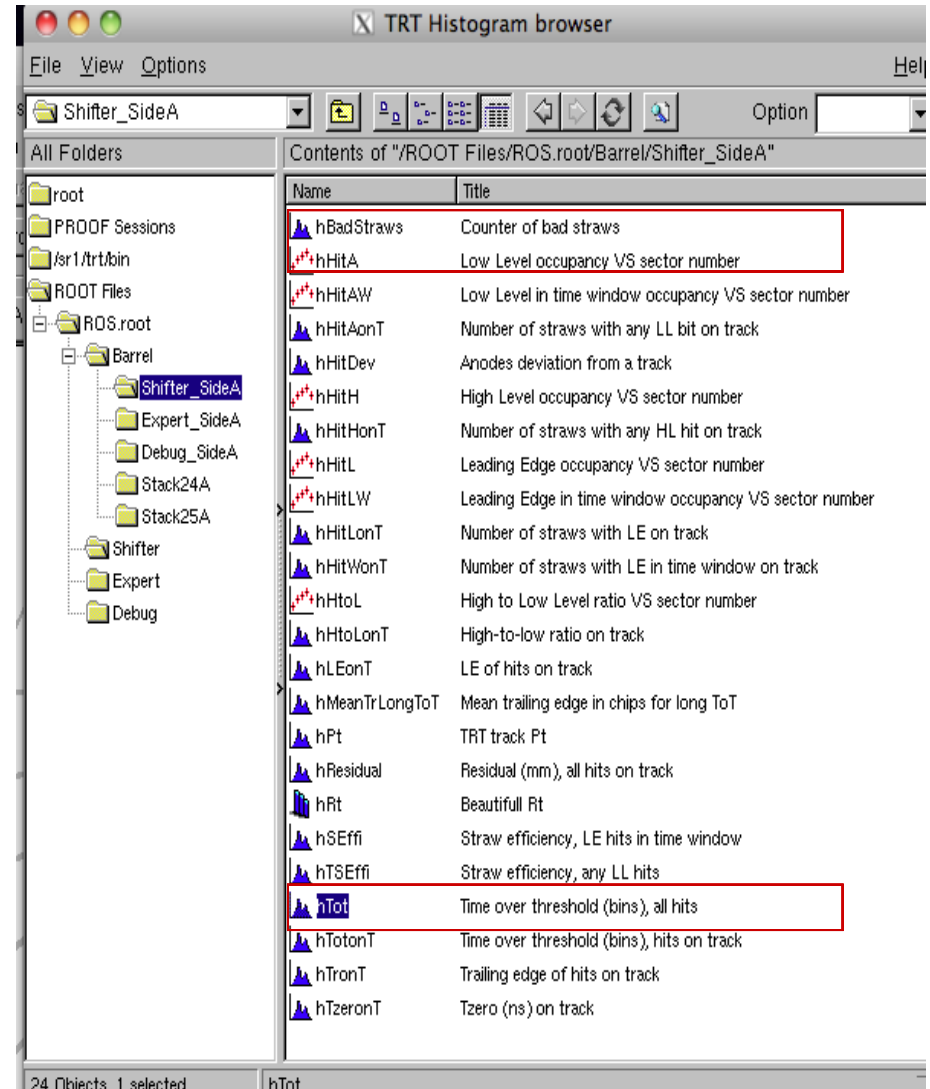
Tasks1: Noise characterization

Start Browser

1. Check selected histograms.
2. What is most probable ToT for the noise signals?
3. What is the average straw occupancy (write number to the table)?
4. Dead straw number?

Repeat the same observations for nominal threshold 116

1. List the observed difference and find explanation if possible.
2. Take noise occupancy scan at 86,96,106, 116 and 126 and make a plot of occupancy and average ToT.
3. Preliminary choice of the operation threshold.



Task 2. Operation with Particles

Start DAQ for particles

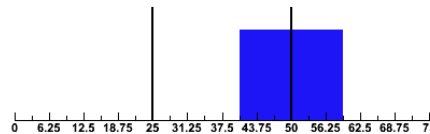
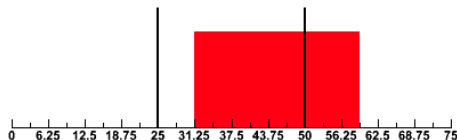
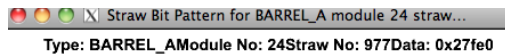
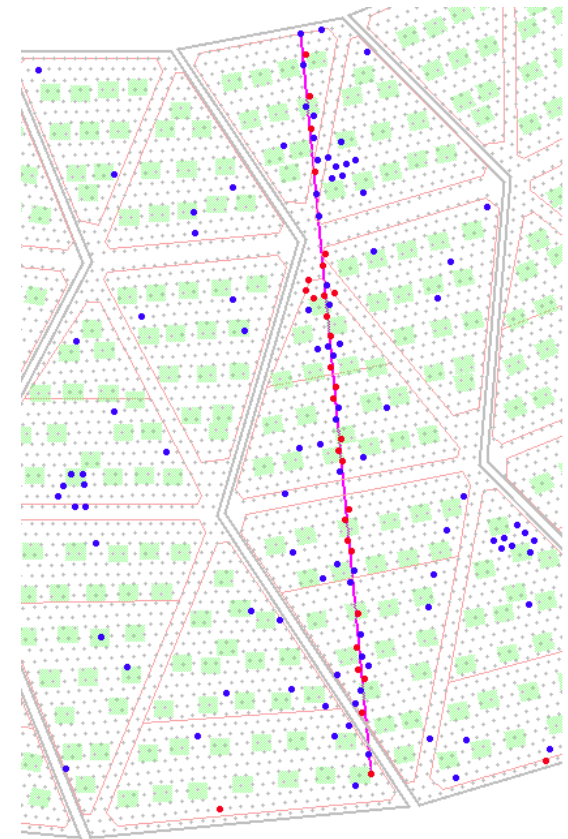
1. Set Fast OR trigger
2. Set a LL threshold to 116
3. Check HV 1480 V
4. Start DAQ
5. Start Online mode of the TRTViewer (command: trtviewer DAQ)

Work with the event display

Double click on general picture gives a zoomed view.

On ZOOM window a double click on each straws gives a bit pattern information

1. What means color coding?
2. What is the signal difference between hits from particles and noise?
3. Noise suppression possibility?

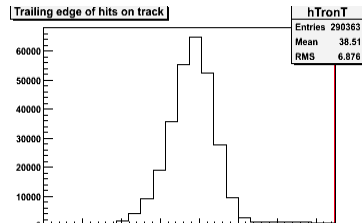
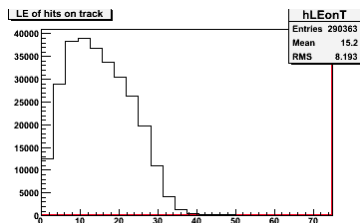


Task 2. Operation with Particles

Start Browser and check selected histograms

1. Number on straws crossed by particle.
2. Straw profile.
3. Leading edge distribution on track.
4. Trailing edge distribution on track.
 - Discuss the physics reason why they look as on the pictures.
5. Hit residual distribution.
6. R-T distribution.
7. Straw efficiency.
8. Time Over Threshold distribution
 - Discuss the shape and conclusion how to minimize the noise effect

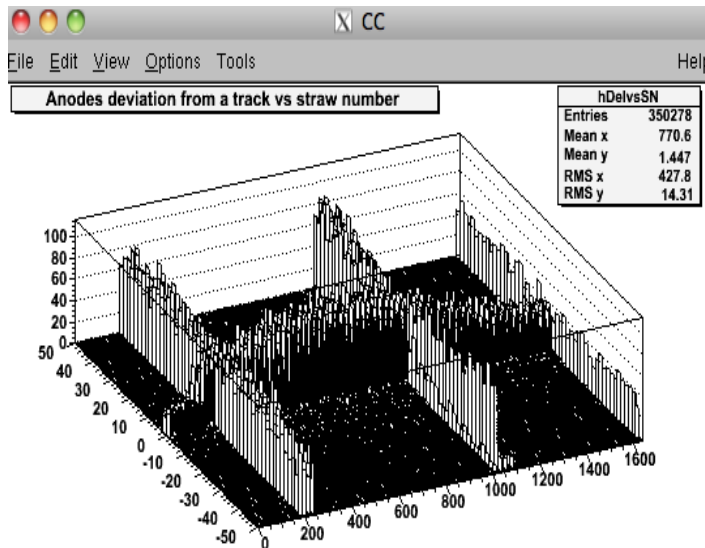
Name	Title	Number
hBadStraws	Counter of bad straws	
hHitA	Low Level occupancy VS sector number	
hHitAW	Low Level in time window occupancy VS sector number	
hHitAonT	Number of straws with any LL bit on track	1
hHitDev	Anodes deviation from a track	2
hHitH	High Level occupancy VS sector number	
hHitHonT	Number of straws with any HL hit on track	
hHitL	Leading Edge occupancy VS sector number	
hHitLW	Leading Edge in time window occupancy VS sector number	
hHitLonT	Number of straws with LE on track	
hHitWonT	Number of straws with LE in time window on track	
hHtoL	High to Low Level ratio VS sector number	
hHtoLonT	High-to-low ratio on track	
hLEonT	LE of hits on track	3
hMeanTrLongToT	Mean trailing edge in chips for long ToT	
hPt	TRT track Pt	
hResidual	Residual (mm), all hits on track	5
hRt	Beautiful Rt	6
hSEffi	Straw efficiency, LE hits in time window	
hTSEffi	Straw efficiency, any LL hits	7
hTot	Time over threshold (bins), all hits	
hTotonT	Time over threshold (bins), hits on track	8
hTronT	Trailing edge of hits on track	4
hTzeronT	Tzero (ns) on track	



Task 2. Operation with Particles

Check selected 2D histograms and discuss the results

1. Anode deviation from a track.
2. Hit arrival time.
3. Trailing edge distribution.
4. Recommendations for the detector tuning.
5. R-T dependence.



TRT Histogram browser

File View Options Help

2- and 3-dim

All Folders

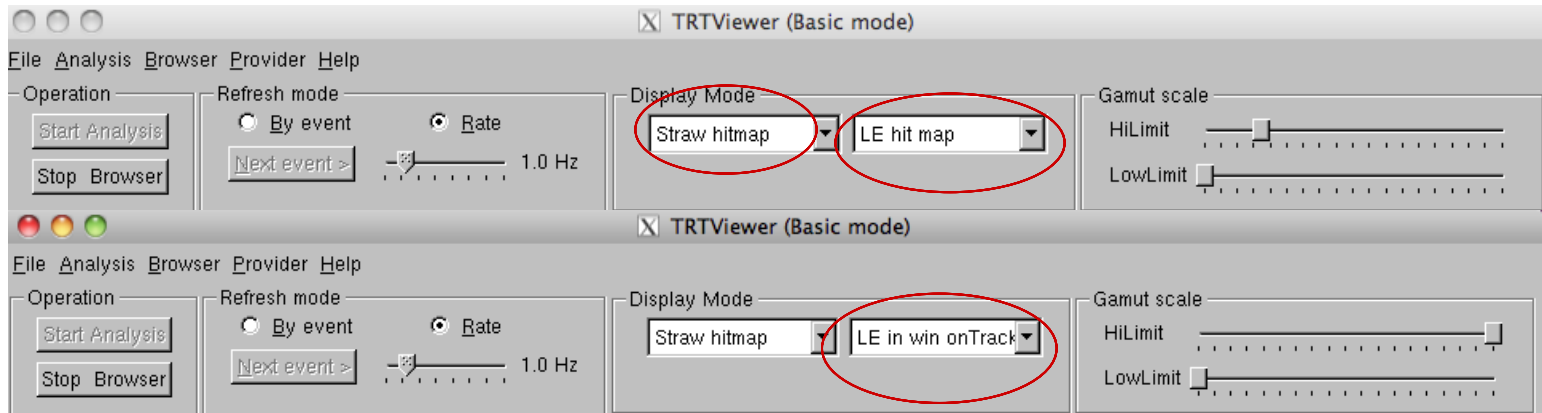
Contents of "/ROOT Files/ROS.root/Barrel/Stack24A/2- and 3-dim"

Name	Title
hDeivsSN	Anodes deviation from a track vs straw number 1
hHitArr	Hit arrival time
hHitArronT	Hit arrival time on track 2
hHitArronTBoard	Hit arrival time on track for boards
hHitArronTChip	Hit arrival time on track, chips
hHitTr	Hit trailing time
hHitTrLong	Hit trailing time, ToT>ToTmin
hHitTrLongBoard	Hit trailing time for boards, ToT>ToTmin
hHitTronT	Hit trailing time on track 3
hHitTronTBoard	Hit trailing time on track for boards 3
hRtChip	Beautiful Rt 4

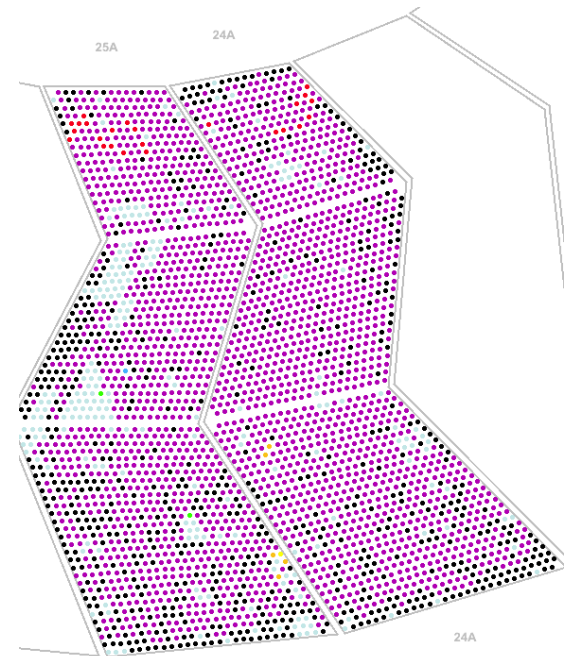
11 Objects. hRtChip

Task 2. Operation with Particles

Work with the straw maps



1. Compare LE hit map and LE on track
2. Straw efficiency level and uniformity
3. Possible reasons for dead areas:
 - Dead chips?
 - Too high threshold?
 - HV problems?
4. Leading edge distribution for individual straws.



Task 2. Operation with Particles

Define dependence straw efficiency and drift-time accuracy on threshold and HV

Start DAQ

1. Set Fast OR trigger
2. Take runs at different LL thresholds settings with a step of 15 DAC counts form 108 to 140 at 1480V
3. Take also runs with HV settings 1430 at the same LL thresholds.

Analysis

1. Start Online mode of the TRTViewer (command trtviewer DAQ)
2. Start browser and check corresponding histograms
3. Present the results as a plot
4. Try to explain observed behavior.

The screenshot shows the ROOT browser interface with the following table of contents for the 'Shifter_SideA' folder:

Name	Title
hBadStraws	Counter of bad straws
hHitA	Low Level occupancy VS sector number
hHitAW	Low Level in time window occupancy VS sector number
hHitAonT	Number of straws with any LL bit on track
hHitDev	Anodes deviation from a track
hHitH	High Level occupancy VS sector number
hHitHonT	Number of straws with any HL hit on track
hHitL	Leading Edge occupancy VS sector number
hHitLW	Leading Edge in time window occupancy VS sector number
hHitLonT	Number of straws with LE on track
hHitWonT	Number of straws with LE in time window on track
hHtoL	High to Low Level ratio VS sector number
hHtoLonT	High-to-low ratio on track
hLEonT	LE of hits on track
hMeanTrLongToT	Mean trailing edge in chips for long ToT
hPt	TRT track Pt
hResidual	Residual (mm), all hits on track 1
hRt	Beautiful Rt
hSEff	Straw efficiency, LE hits in time window
hTSEff	Straw efficiency, any LL hits 2
hTot	Time over threshold (bins), all hits
hTotonT	Time over threshold (bins), hits on track
hTronT	Trailing edge of hits on track
hTzeronT	Tzero (ns) on track

24 Objects, 1 selected. hTronT

Task 3: Conclusions about the problems found and make recommendations what should be fixed.

1. Noise issues
2. Dead straws
 - Electronics
 - HV
3. Misbehaving channels
4. Threshold and HV to be used

Your comments/questions.

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