Data Analysis of End to End Runs for Cosmic Rays for Tower A

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Instrument Analysis Workshop 3

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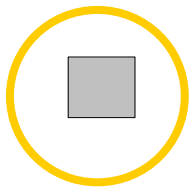
Overview of Data Taking Configurations

- **It is changing as fast as the software**
  - **used to be 8 and 9 the first two towers…**



1 Tower
(Single bay, special grid)

12	13	14	15
8	9	10	11
4	5	6	7
0	1	2	3

2 Towers

12	13	14	15
8	9	10	11
4	5	6	7
0	1	2	3

4 Towers

12	13	14	15
8	9	10	11
4	5	6	7
0	1	2	3

6 Towers

12	13	14	15
8	9	10	11
4	5	6	7
0	1	2	3

8 Towers

12	13	14	15
8	9	10	11
4	5	6	7
0	1	2	3

10 Towers

12	13	14	15
8	9	10	11
4	5	6	7
0	1	2	3

12 Towers

12	13	14	15
8	9	10	11
4	5	6	7
0	1	2	3

14 Towers

12	13	14	15
8	9	10	11
4	5	6	7
0	1	2	3

16 Towers

12	13	14	15
8	9	10	11
4	5	6	7
0	1	2	3

LAT

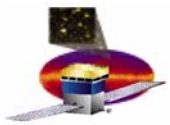
Tower A – Week of March 14

Time (h)			Test Name	Description	
22					
2	1	1	Baseline Cosmic Rays (CR)	all settings nominal	TEM Diag OFF
1	2	3	Condition Scan CR	Change only TKR DAC to 22	
1		6	Condition Scan CR	Read TKR from Right RC	
1		7	Condition Scan CR	Read TKR from Left RC	
1	3	1	Baseline CR Trigger	Only TKR is allowed to open trigger window	
1		2	Baseline CR Trigger	Only CAL_LO set to 20 MeV is allowed to open window	
1	4	1	Nominal CR Rate	Overlay rate of 1 kHz	
1		2	Nominal CR Rate	Overlay rate of 5 kHz	
1		3	Nominal CR Rate	Overlay rate of 10 kHz	TEM Diag ON
1		4	Nominal CR Rate	Overlay rate of 20 kHz	
1	5	3	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and change only TKR DAC to 22	
1		6	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and and read TKR from Right RC	
1		7	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and read TKR from Left RC	
1	7	1	Baseline CR Data Volume	Zero suppression OFF	
1	8	6	Nominal CR Data Volume	Overlay rate of 1kHz, CAL 4 range, Zero Suppression OFF	
1		9	Nominal CR Data Volume	Overlay rate of 10kHz, CAL 4 range, Zero Suppression OFF	
2	B	1	SVAC (Calibration,Performance,MC)	all settings nominal	
2		9	SVAC (Calibration,Performance,MC)	CAL High Energy muon gain, four range readout	
1		12	SVAC (Calibration,Performance,MC)	Zero suppression OFF, four range readout	

Tower AB – Week of March 28

Time (h)			Test Name	Description
37				
2	1	1	Baseline Cosmic Rays (CR)	all settings nominal
1	2	1	Condition Scan CR	Set unregulated power supply to 29V - need PDU
		2	Condition Scan CR	Set unregulated power supply to 27V - need PDU
		3	Condition Scan CR	Change only TKR DAC to 22
1		6	Condition Scan CR	Read TKR from Right RC
1		7	Condition Scan CR	Read TKR from Left RC
1	3	1	Baseline CR Trigger	Only TKR is allowed to open trigger window
1		2	Baseline CR Trigger	Only CAL_LO set to 20 MeV is allowed to open window
1	4	1	Nominal CR Rate	Overlay rate of 1 kHz
1		2	Nominal CR Rate	Overlay rate of 5 kHz
1		3	Nominal CR Rate	Overlay rate of 10 kHz
1		4	Nominal CR Rate	Overlay rate of 20 kHz
1	5	3	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and change only TKR DAC to 22
1		6	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and and read TKR from Right RC
1		7	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and read TKR from Left RC
1	7	1	Baseline CR Data Volume	Zero suppression OFF
1	8	6	Nominal CR Data Volume	Overlay rate of 1kHz, CAL 4 range, Zero Suppression OFF
1		9	Nominal CR Data Volume	Overlay rate of 10kHz, CAL 4 range, Zero Suppression OFF
4	B	2	SVAC (Calibration,Performance,MC)	all settings nominal
15		10	SVAC (Calibration,Performance,MC)	CAL High Energy muon gain, four range readout
1		13	SVAC (Calibration,Performance,MC)	Zero suppression OFF, four range readout

More statistics to study CAL edges



Data Analysis Working Groups for Tower A : cosmic rays

Time (h)			Test Name	Description	
22					
2	1	1	Baseline Cosmic Rays (CR)	all settings nominal	
1	2	3	Condition Scan CR	Change only TKR DAC to 22	TKR Group
1		6	Condition Scan CR	Read TKR from Right RC	
1		7	Condition Scan CR	Read TKR from Left RC	
1	3	1	Baseline CR Trigger	Only TKR is allowed to open trigger window	
1		2	Baseline CR Trigger	Only CAL_LO set to 20 MeV is allowed to open window	
1	4	1	Nominal CR Rate	Overlay rate of 1 kHz	Trigger Group
1		2	Nominal CR Rate	Overlay rate of 5 kHz	
1		3	Nominal CR Rate	Overlay rate of 10 kHz	
1		4	Nominal CR Rate	Overlay rate of 20 kHz	
1	5	3	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and change only TKR DAC to 22	
1		6	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and and read TKR from Right RC	
1		7	Nominal Rate Condition Scan CR	Overlay rate of 10 kHz and read TKR from Left RC	
1	7	1	Baseline CR Data Volume	Zero suppression OFF	CAL Group
1	8	6	Nominal CR Data Volume	Overlay rate of 1kHz, CAL 4 range, Zero Suppression OFF	
1		9	Nominal CR Data Volume	Overlay rate of 10kHz, CAL 4 range, Zero Suppression OFF	
2	B	1	SVAC (Calibration,Performance,MC)	all settings nominal	
2		9	SVAC (Calibration,Performance,MC)	CAL High Energy muon gain, four range readout	
1		12	SVAC (Calibration,Performance,MC)	Zero suppression OFF, four range readout	

Charge to Working Groups

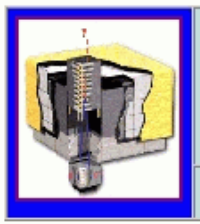
- Identify distributions that can be used to compare with the baseline run
- Develop muon selection cuts using CAL and TKR
  - Cut on CAL variables and analyze TKR variables
  - Cut on TKR variables and analyze CAL variables
  - Cut on both loosely
  - Cut on both with tight cuts
- Apply cuts and compare distributions with those from baseline runs
  - Shape should not change if we selected muons !
- We have 10 high-priority E2E runs to analyze in two weeks before the two towers are tested in a grid
  - Can we try it?

Let's try an example…

- **For the moment, the integrated tower runs have all the same setting so**
  - **Use runs with TKR A only as an example**

- **TKR A Runs**
  - 398000801 – DAC = 22 (here noise creeps in!)
    - Thanks Hiro for getting us a run to use an example
  - 398000307 – DAC = 26 (trigger rate supposed to be flat)
  - 398000310 – DAC = 30 (let's call this the baseline run)

Select the Runs by E2E ID



GLAST Shift Logbook
Shift Run Info

GLAST Home | Help | Shift Index | List Runs

Run Range: 0-1000000000 (e.g. 2500-2550 2567)

Run Date Range: taken from _____ to _____ (use format YYYY-MM-DD)'

Duration (s): _____ (e.g. > 1000) **No. of events:** _____ (e.g. > 1000)

Completion status: Any **Particle Type:** Any

Instrument Type: Any **Orientation:** Any

I&T Test ID/Config ID: _____ (e.g. 0/1) **No. of towers:** _____ (e.g. 1)

TKR Serial No.: _____ example **CAL Serial No.:** _____ example

Script Name: _____ (e.g. calf_mu*) **Schema file:** _____ (e.g. em2cal*)

Suite Name: _____ (e.g. LPT)

Suite Date Range: taken from _____ to _____ (use format YYYY-MM-DD)'

FITS file: _____ (e.g. *2805*)

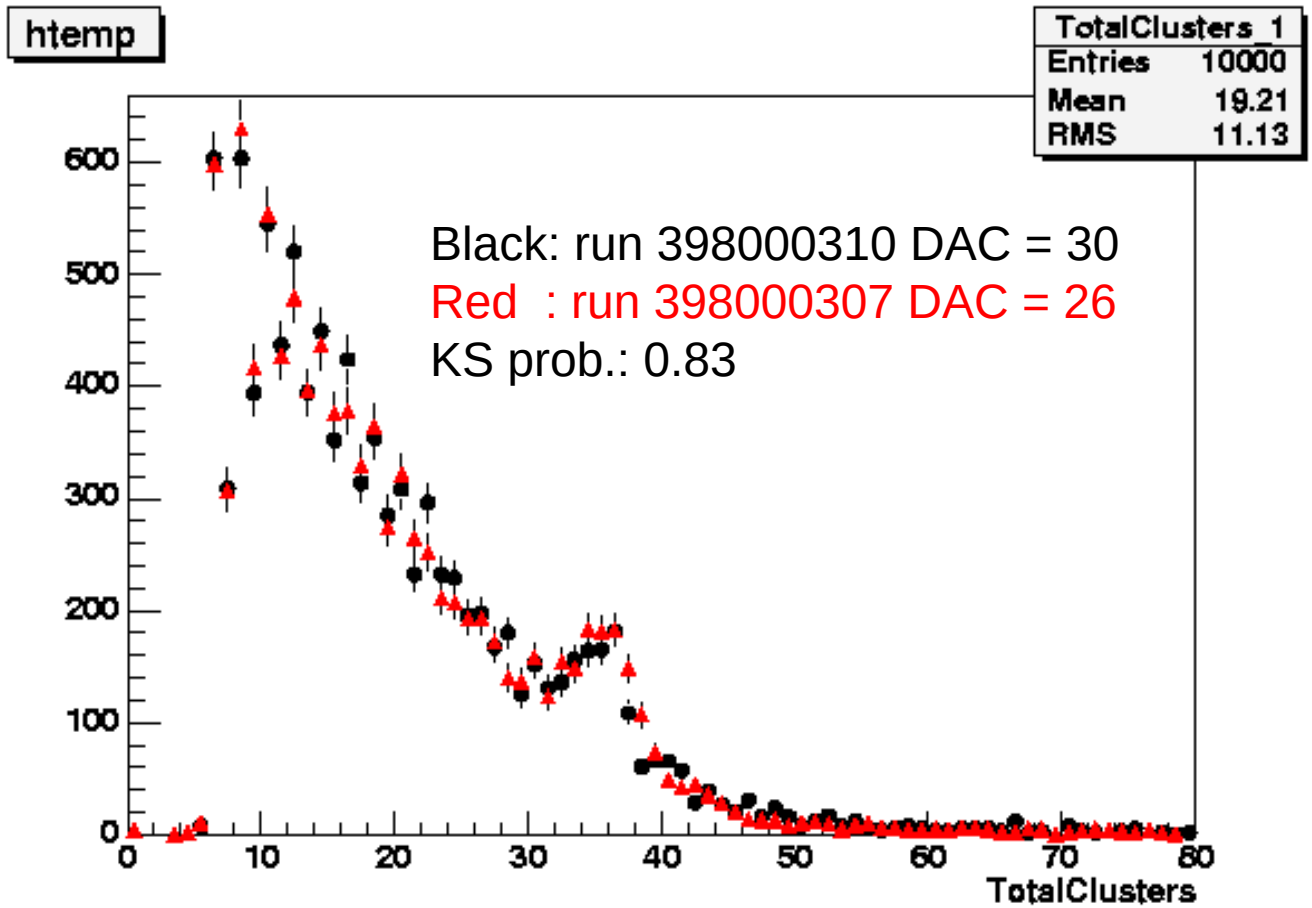
Site: Any **Phase:** Any

list runs | list root files

Table from previous slide will be available on the web

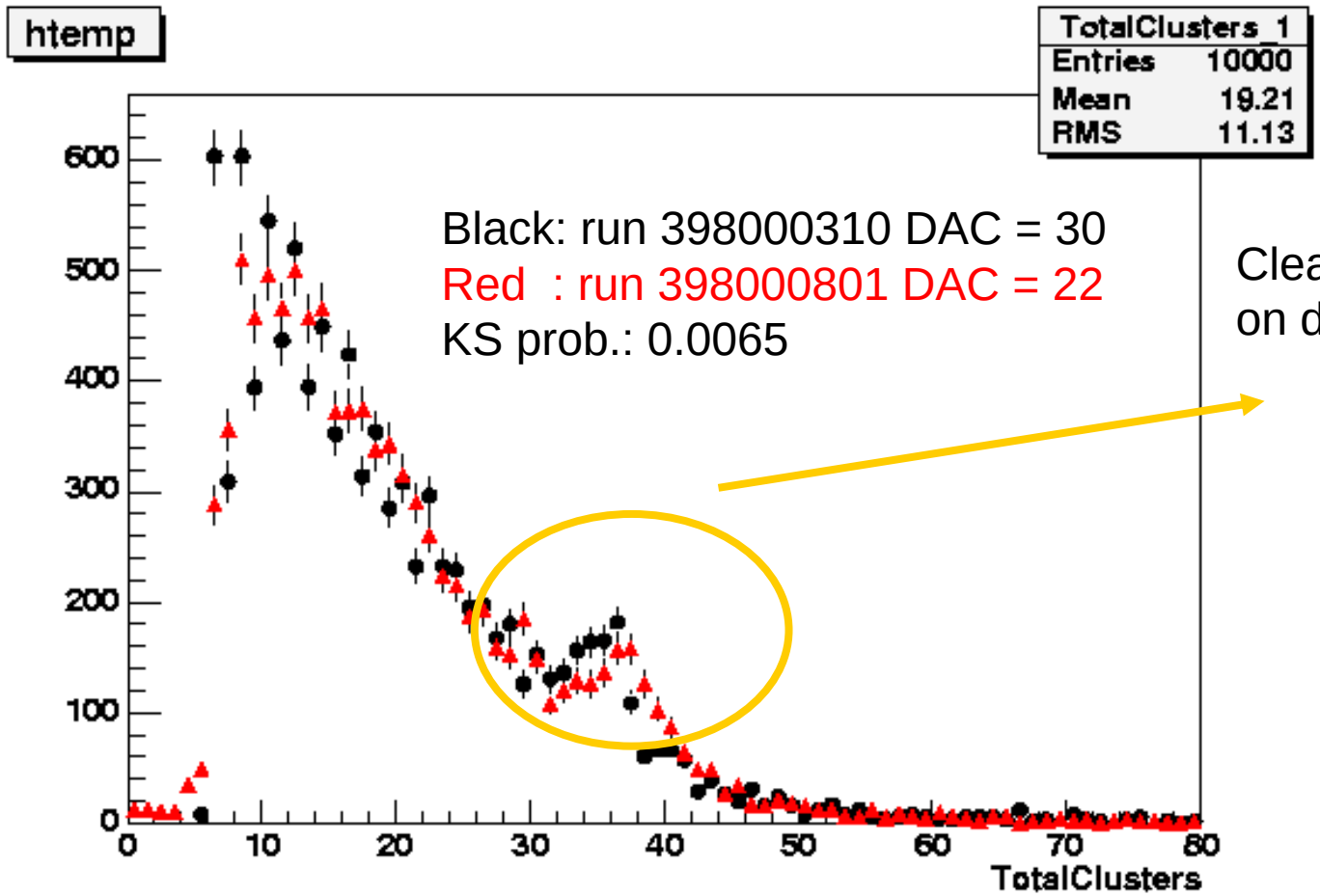
Check the Method

- **Apply a KS test to compare shapes of distributions for runs you expect to see no changes…**
  - **KS = 1 means shapes are identical**



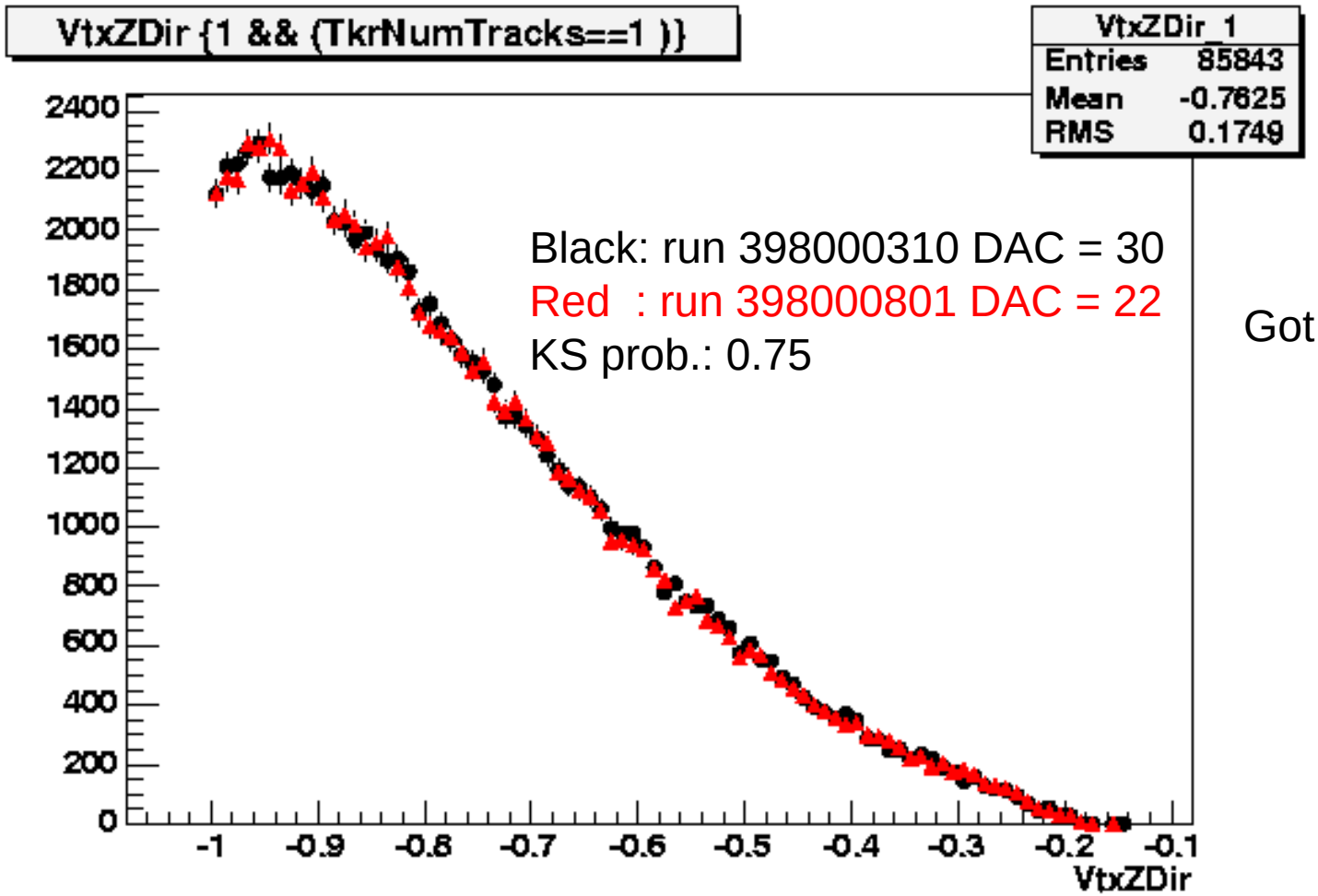
Compare a run with low thresholds with the baseline run

- **Apply a KS test to compare shapes of distributions for runs you expect to see changes…**
  - **KS = 1 means shapes are identical**



Compare a run with low thresholds with the baseline run

- **Apply a muon selection cut and you expect to see no changes…**
  - **KS = 1 means shapes are identical**



Black: run 398000310 DAC = 30
Red : run 398000801 DAC = 22
KS prob.: 0.75

Got better !

Summary

- Conceptually the problem is very easy
  - However when we think about the details one realizes more work is involved
  - It is not obvious which distributions to choose
- Ideally we would like to have people working in a group
  - Get there faster because it foster discussions
- In the afternoon we will organize working groups to start thinking about the data analysis
  - It is just a brainstorm session do not be shy…
    - Need volunteers to coordinate the three groups
  - A good starting point is to look at variables in the merit and svac nutples

Back up slides

Electronic Calibrations and Threshold Determination

- Purpose
  - Determine operational thresholds
  - Charge injections to support the SVAC offline calibrations with muons
    - We are doing these tests inside and outside the grid for Tower A
    - Baseline is to do these tests once per tower inside the grid
- Duration
  - Approximately 1 day (TBR)
- Tests
  - TKR tests
    - TE604 – Threshold Dispersion
    - TE601 – Threshold Calibrations
    - TE602 – TOT conversion parameter calibrations
  - CAL test suites
    - calibDAC – FLE/FHE characterization charge injection
    - calibGen – calibrations with charge injection
    - muTrig – FLE/FHE characterization with muons
      - » Done also by I&T tests C1 and C4 for Tower A
      - » Procedures will merge for 2 towers

Multiple Towers – SVAC Tests - muons

Time (h)			Test Name	Description
20				
4	B	2	SVAC (Calibration,Performance,MC)	all settings nominal
15		10	SVAC (Calibration,Performance,MC)	CAL High Energy muon gain, four range readout
1		13	SVAC (Calibration,Performance,MC)	Zero suppression OFF, four range readout

There is no requirement for E2E runs for multiple towers

VDG Runs

- **Current Data Taking configurations (13h)**
  - **9/1 : VDG, Nominal settings (1h)**
    - **No zero suppression**
  - **9/2, 9/3, 9/4: VDG, Nominal settings, vary rates (3 x 1h =3h)**
    - **Place target at 3 different positions (1", 2'', 4" from topmost Si tray) use Zero suppression On**
  - **9/5, 9/6: VDG, Nominal settings but add pulse generator(2x 1h = 2h)**
    - **Overlay Pulse generator at 1 and 10 kHz on VDG triggers**
  - **9/7: Flight configuration, horiz orientation and TEM diagnostics is ON (1h)**
    - » **Only occurs for tower A when tested with VDG photons – shoot from angle below top layer of CAL**
  - **9/8: Flight configuration, horiz orientation and TEM diagnostics is ON (1h)**
    - » **Only occurs for tower A when tested with VDG photons – shoot from angle 10 cm above bottom of TKR**
  - **B16: Flight configuration, horiz orientation and TEM diagnostics is ON (4h)**
    - » **Only occurs for 2 towers when tested with VDG photons**
  - **B11: same as B16 but with VDG OFF (1h)**
    - » **Background estimation before tests with VDG photons**

Overview of Trigger Tests

Time (h)			Test Name	Description
26				
1	T	1	TREQ Alignment - TKR	Only TKR and EXT_MU can open window
1			TREQ Alignment - CAL	Only CAL and EXT_MU can open window
8	T	2	TACK Delay - TKR	Only TKR and EXT_MU can open window
8			TACK Delay - CAL	Only CAL and EXT_MU can open window
4	T	4	Trigger Efficiency	Enable TKR nominal OR CAL_LO near noise floor
4	T	5	Trigger Window Width	

- TREQ Alignment (GEM)
  - To verify the timing alignment and jitter for each GEM trigger input
- TACK Delay Scan
  - To determine the optimal trigger output (TACK) delay for each subsystem simultaneously
- FLE muon Scan (done by I&T tests C1 to C4)
  - To find operational thresholds for CAL_LO to trigger on muons
- Trigger Efficiency
  - To measure trigger efficiencies
- Trigger Window Tests
  - For a sample of good muon events what fraction of each trigger type is latched within the window for different window widths