BCM1F:Thresholds and other stuff

Elena Castro

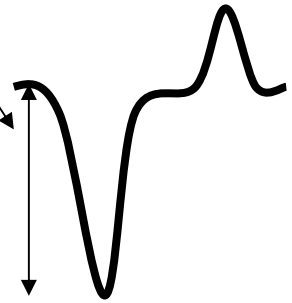
BRM weekly meeting

25/10/2010

Gain of the modules

CH	V_{negmax} (mV)
1/1 (0)	156
1/2 (1)	79 Low gain
1/3 (2)	159
1/4 (3)	130
2/1 (4)	101
2/2 (5)	98
2/3 (6)	134
2/4 (7)	134

- We apply a test pulse of: Vin=-1V
- We measure amplitude of negative peak of signal in the input to discriminator v258B (after Fan-in/Fan-out AC coupled outputs)



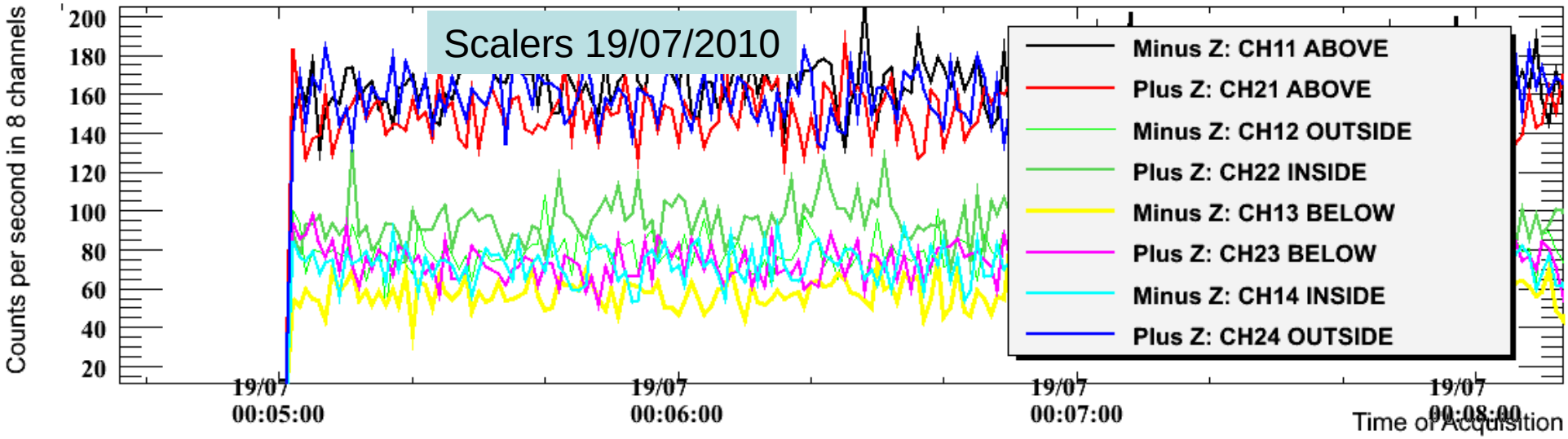
- Scope scale 50mV±10mV

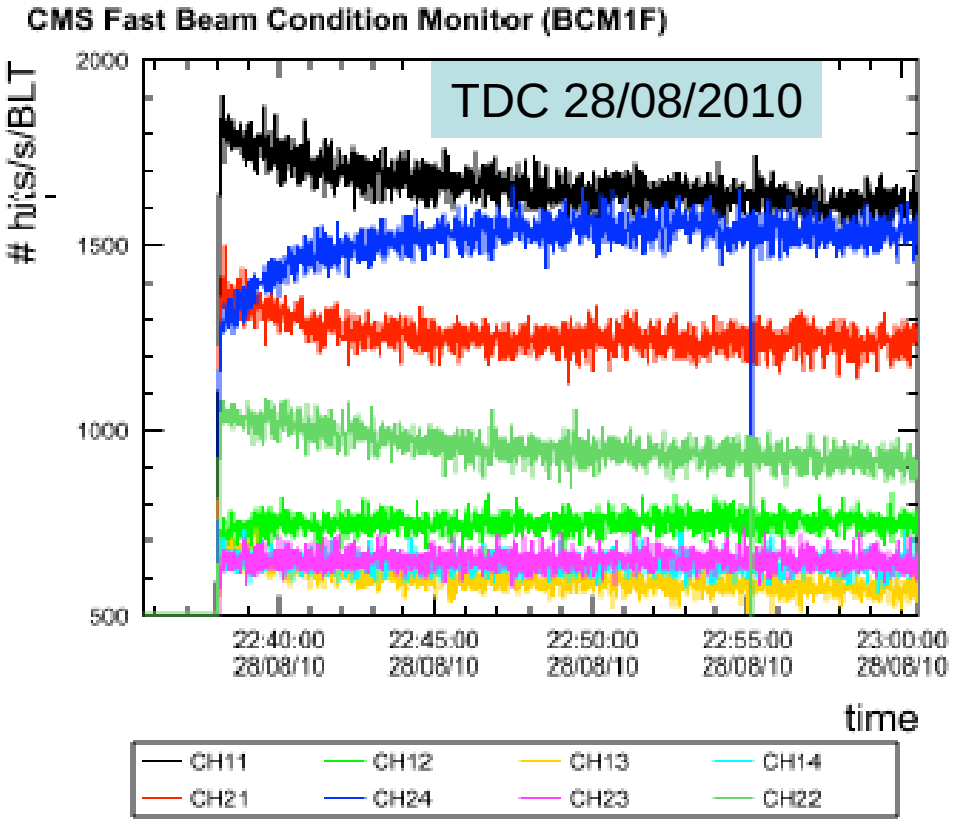
Vthr offset in discriminator

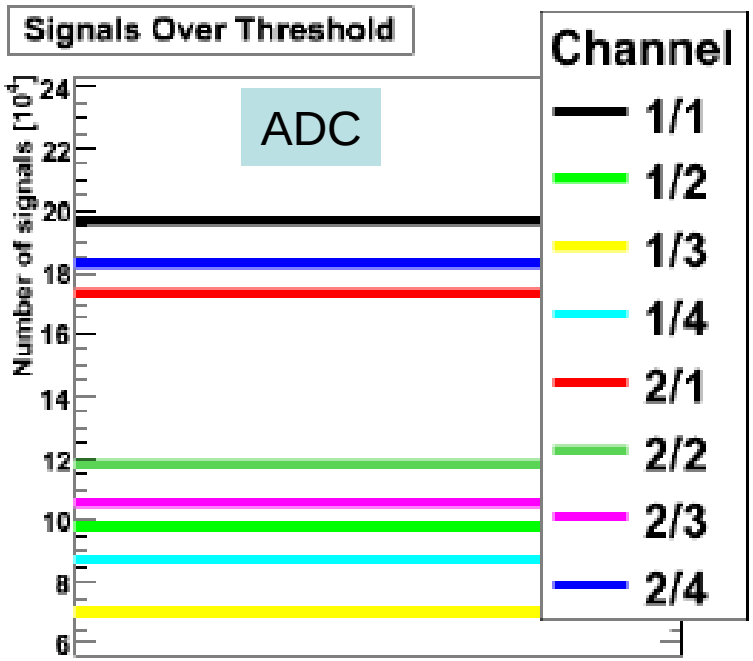
Vthr (mV)	Vin in pulse generator that gives output (mV)								**Scope scale**
	ch11	ch12	ch13	ch14	ch21	ch22	ch23	ch24	
-16	-23	-23	-23	-23	-22	-22	-23	-22	**5mV/div±1mV**
ΔVthr	7	7	7	7	6	6	7	6	
-24	-31	-31	-31	-31	-30	-31	-32	-30	**5mV/div±1mV**
ΔVthr	7	7	7	7	6	7	8	6	
-50	-60	-58	-60	-58	-50	-62	-58	-58	**10mV/div±2mV**
ΔVthr	10	8	10	8	10	12	8	8	

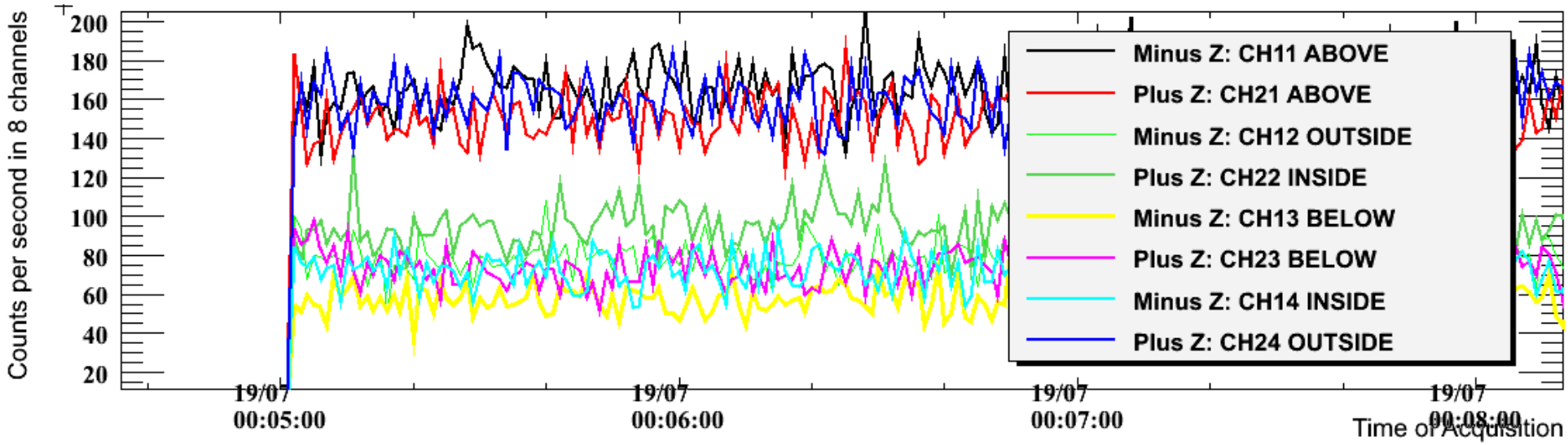
1-Set Thr in code
2-Start increasing negative amplitude of pulse until we see hits in the scaler
3-The amplitude of negative pulse is the real Thr

Average of 7mV of offset in the Vthr of all channels


Scalers 19/07/2010
Counts per second in 8 channels
200
180
160
140
120
100
80
60
40
20
19/07
00:05:00
19/07
00:06:00
19/07
00:07:00
19/07
00:08:00
Time of Acquisition
Minus Z: CH11 ABOVE
Plus Z: CH21 ABOVE
Minus Z: CH12 OUTSIDE
Plus Z: CH22 INSIDE
Minus Z: CH13 BELOW
Plus Z: CH23 BELOW
Minus Z: CH14 INSIDE
Plus Z: CH24 OUTSIDE


CMS Fast Beam Condition Monitor (BCM1F)
TDC 28/08/2010
hits/s/BLT
2000
1500
1000
500
22:40:00
28/08/10
22:45:00
28/08/10
22:50:00
28/08/10
22:55:00
28/08/10
23:00:00
28/08/10
time
CH11
CH12
CH13
CH14
CH21
CH24
CH23
CH22

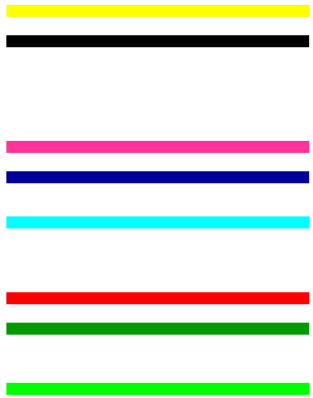

Signals Over Threshold
ADC
Number of signals [10^4]
24
22
20
18
16
14
12
10
8
6
Channel
1/1
1/2
1/3
1/4
2/1
2/2
2/3
2/4



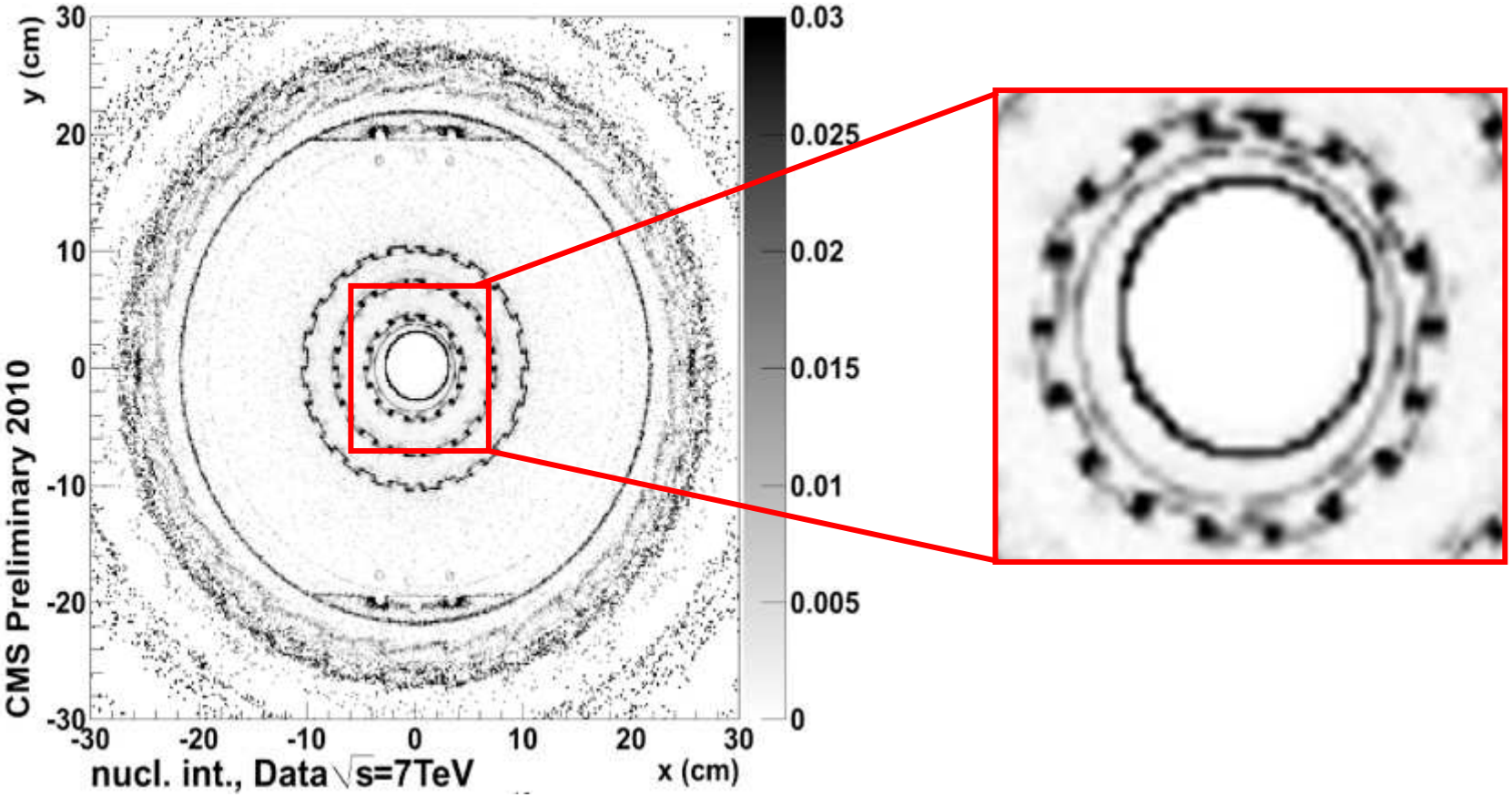
All Thr voltages, expecting the one for ch2/3, where the same
Then, the count rates are not correlated with the gain in the modules

CH	V_{negmax} (mV)
1/1 (0)	156
1/2 (1)	79 Low gain
1/3 (2)	159
1/4 (3)	130
2/1 (4)	101
2/2 (5)	98
2/3 (6)	134
2/4 (7)	134

Expected order in scalers



Pixel barrel geometry: BP displacement



Does this displacement affect BCM1F?

Calculations of Thresholds using amplitude spectra of ADC for each channel

Influences on Thresholds

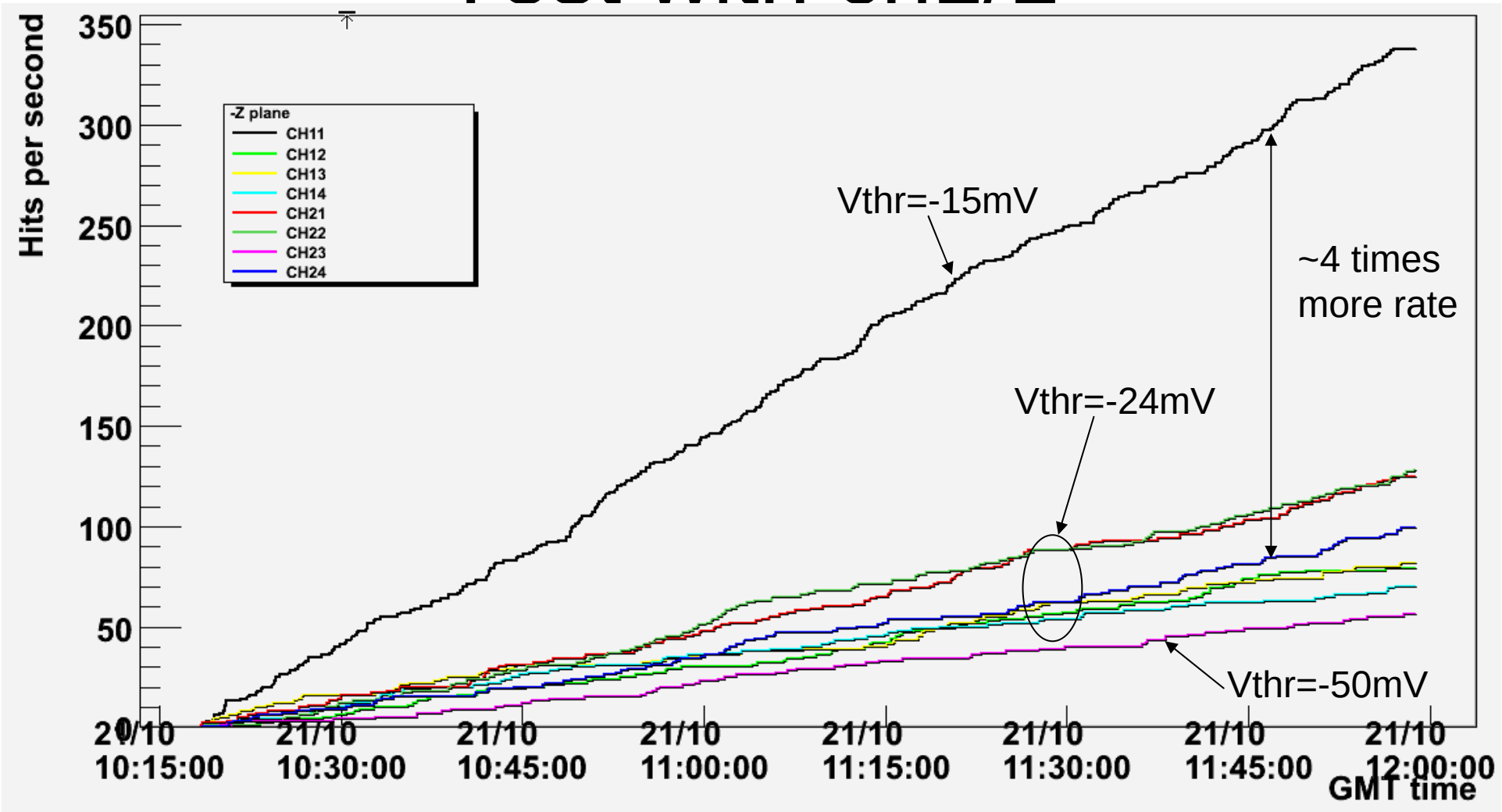
- ADC trigger signal (BCM1F OR)
- ADC calibration (1 ADC count = 4.6 mV)
- Discriminator offset (12 mV in Zeuthen)

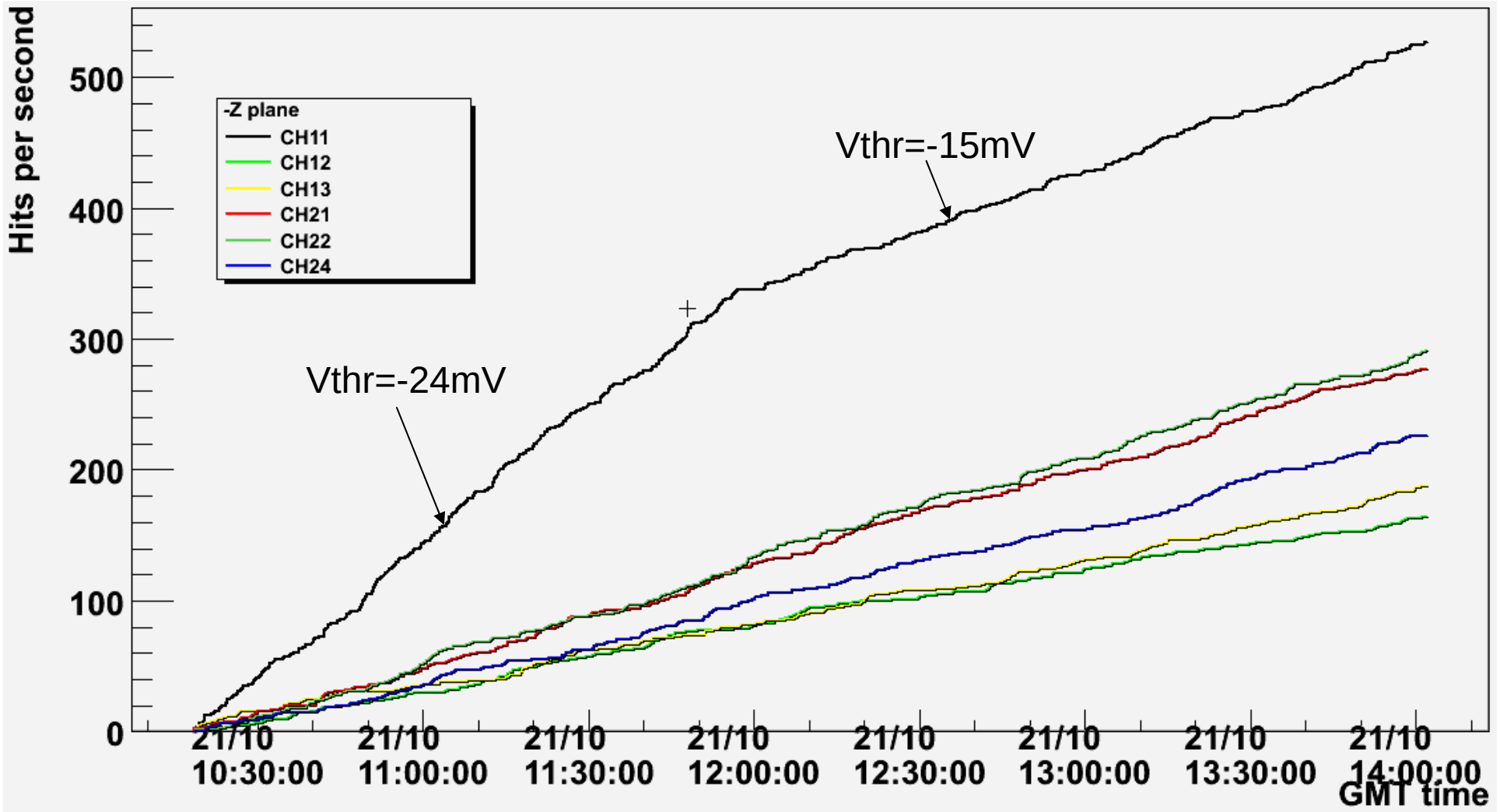
	Thresholds for no beam		Thresholds for non-collliding		Thresholds for colliding		Average	
Channel	-24 mV	-16 mV	-24 mV	-16 mV	-24 mV	-16 mV		
0 = 1/1	3	3	3	3	2	2	2,67	0,56
1 = 1/2	3	2			3	2	2,5	0,52
2 = 1/3		4,5			3	3	3,5	0,73
3 = 1/4		4			3,5	3	3,5	0,73
4 = 2/1	3	3	3		2	2	2,6	0,54
5 = 2/2	4	2,5	3		2,5	2	2,8	0,58
6 = 2/3	5	6	5		4	4	4,8	1
7 = 2/4	4	3			2	2	2,75	0,57

Calculated Thresholds

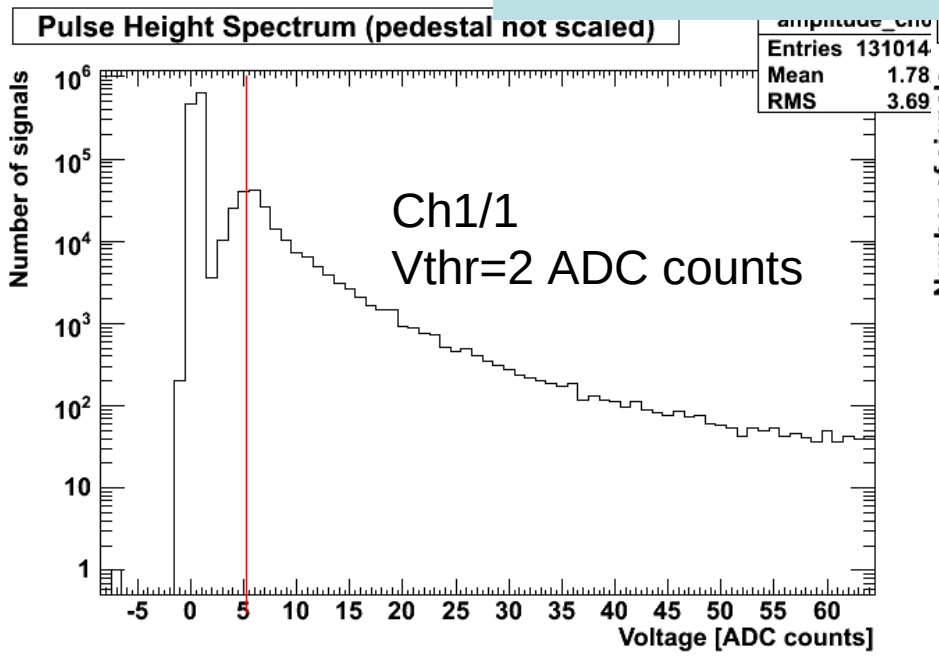
ch	ADC bins	ADC thr(mV)	Discr. offset	Real Vthr(mV)	round	Vthr (mult. 2)	Vthr/2	Vthr hex
11	2,67	12,282	7	5,282	6	6	3	0x3
12	2,5	11,5	7	4,5	5	6	3	0x3
13	3,5	16,1	7	9,1	10	10	5	0x5
14	3,5	16,1	7	9,1	10	10	5	0x5
21	2,6	11,96	6	5,96	6	6	3	0x3
22	2,8	12,88	6	6,88	7	8	4	0x4
23	4,8	22,08	7	15,08	16	16	8	0x8
24	2,75	12,65	6	6,65	7	8	4	0x4

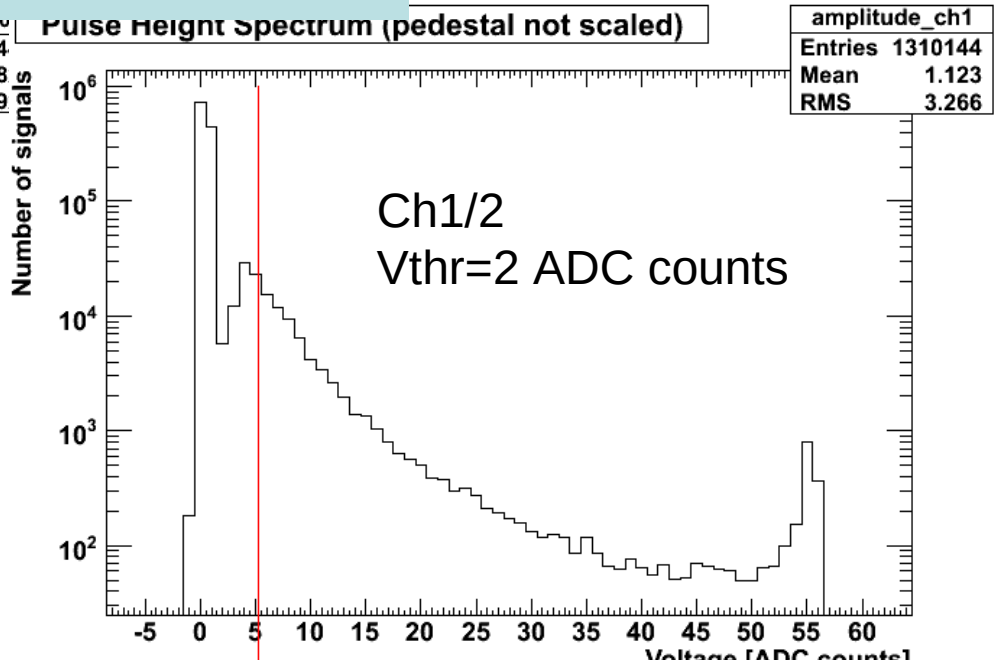
Test with ch1/1

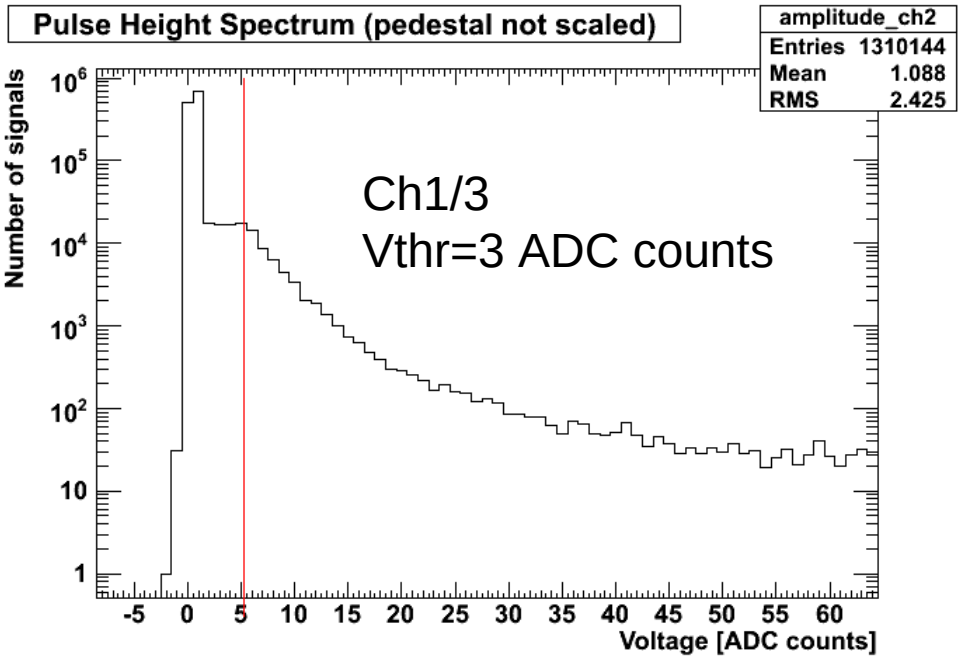


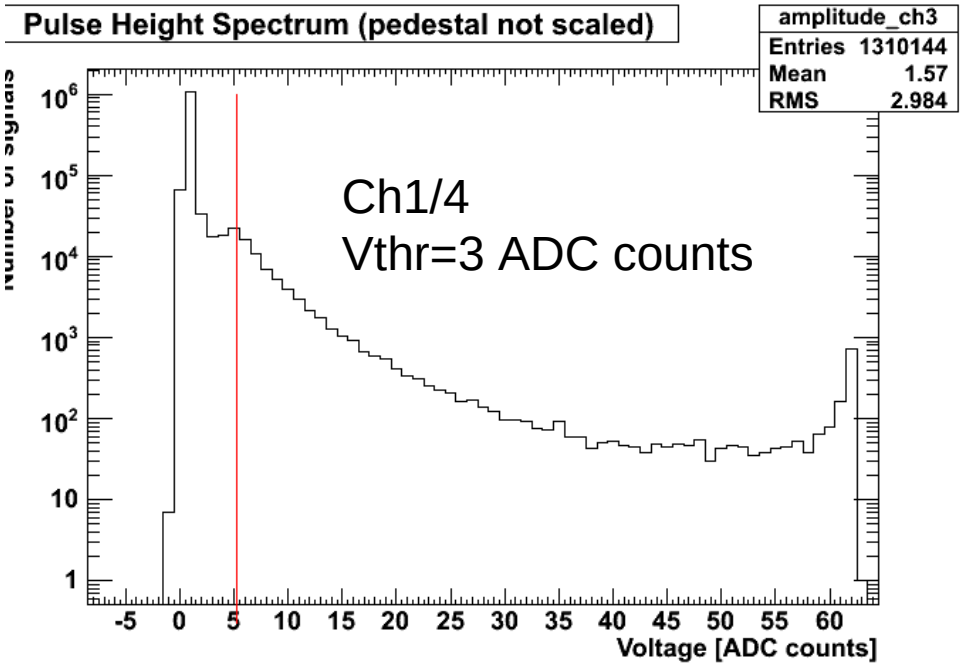

Hits per second
500
400
300
200
100
0
-Z plane
CH11
CH12
CH13
CH21
CH22
CH24
Vthr=-15mV
Vthr=-24mV
21/10 10:30:00
21/10 11:00:00
21/10 11:30:00
21/10 12:00:00
21/10 12:30:00
21/10 13:00:00
21/10 13:30:00
21/10 14:00:00
GMT time

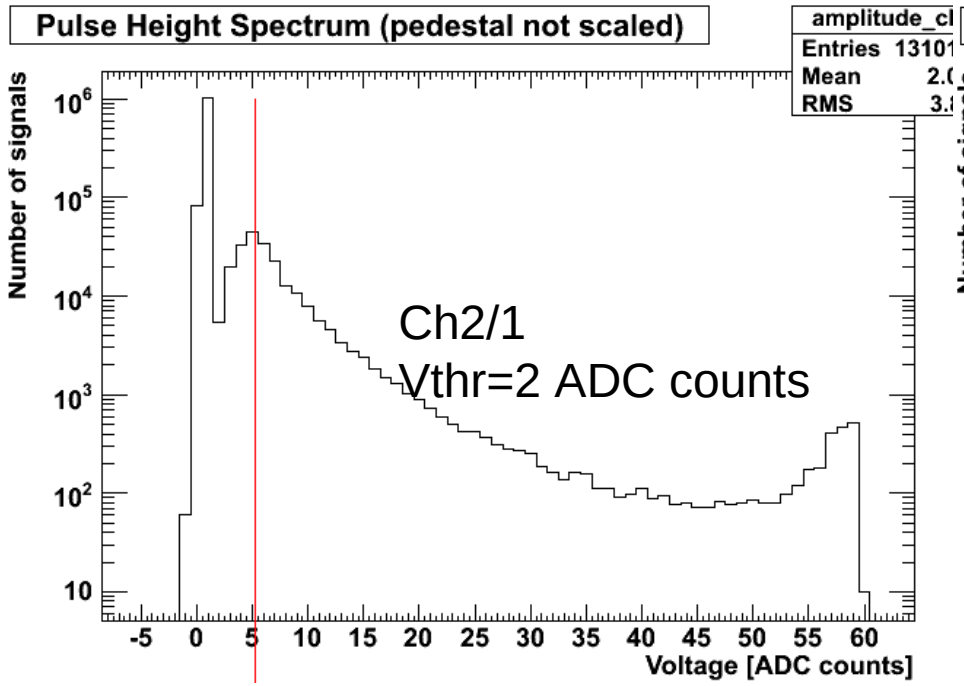
20/08/2010 Vthr BCM1F OR =-16mV

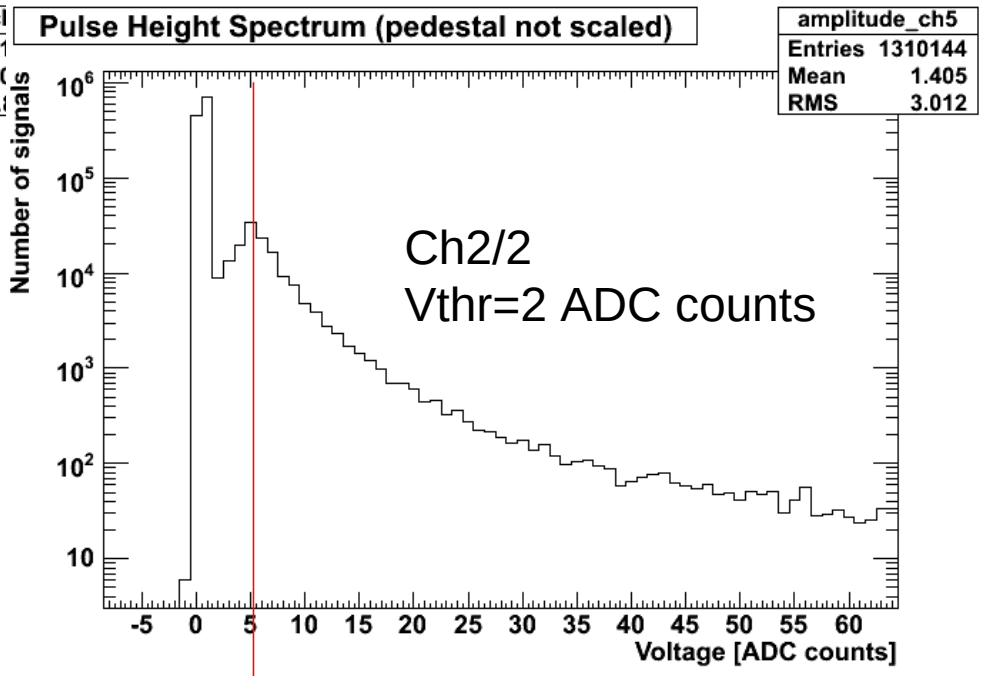


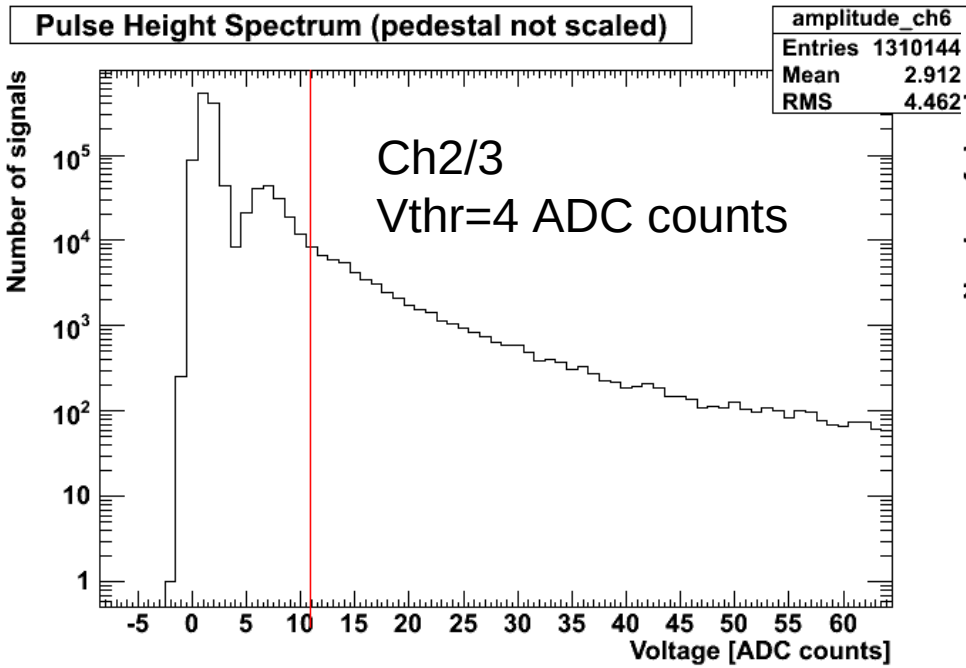


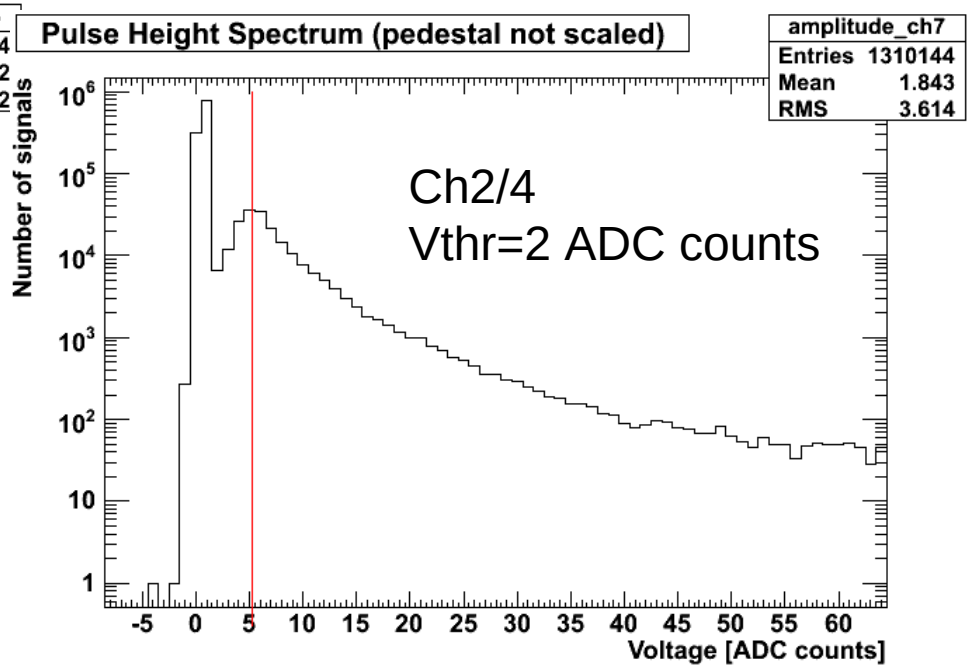




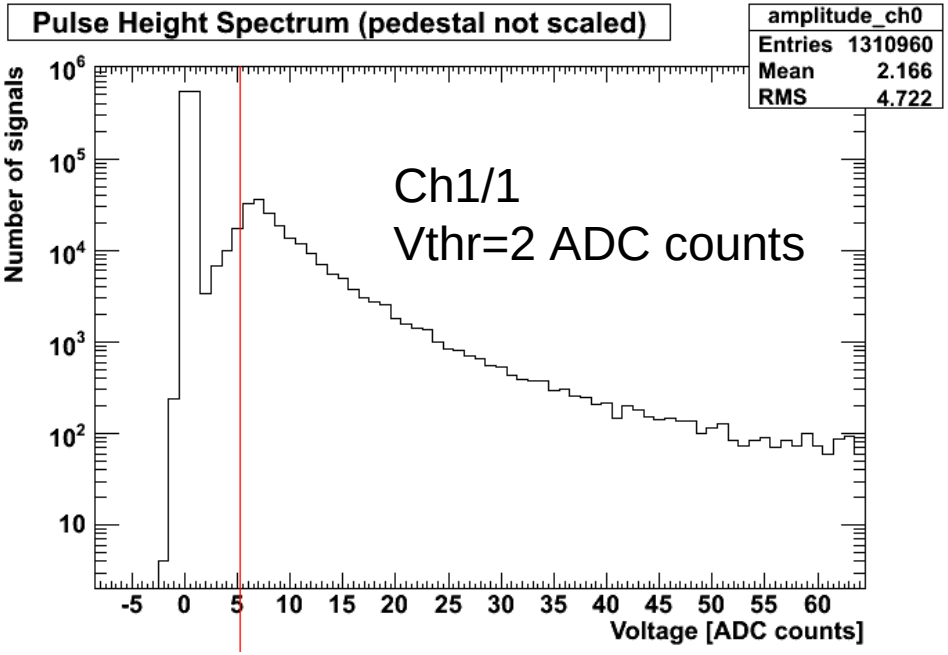

Pulse Height Spectrum (pedestal not scaled)
amplitude_ch1
Entries 1310144
Mean 2.0
RMS 3.1
Number of signals
Voltage [ADC counts]
Ch2/1
Vthr=2 ADC counts

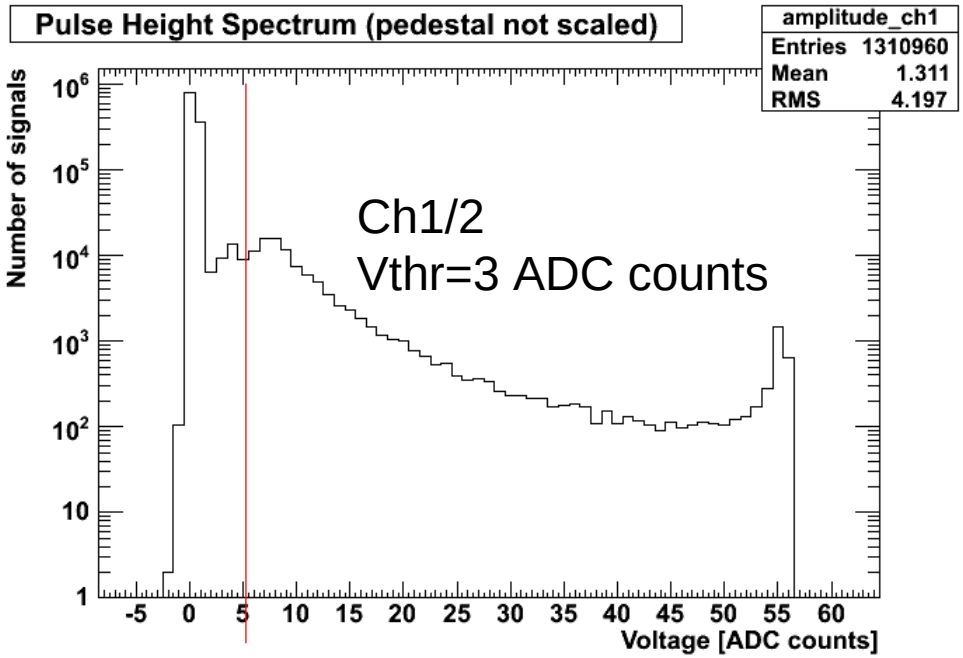

Pulse Height Spectrum (pedestal not scaled)
amplitude_ch5
Entries 1310144
Mean 1.405
RMS 3.012
Number of signals
Voltage [ADC counts]
Ch2/2
Vthr=2 ADC counts

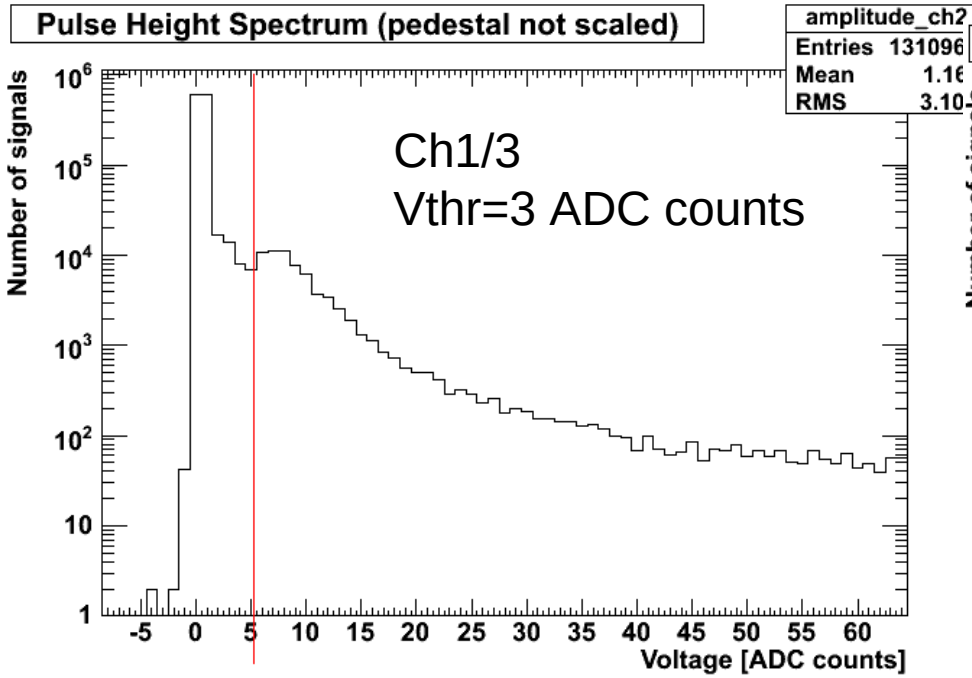

Pulse Height Spectrum (pedestal not scaled)
amplitude_ch6
Entries 1310144
Mean 2.912
RMS 4.462
Number of signals
Voltage [ADC counts]
Ch2/3
Vthr=4 ADC counts

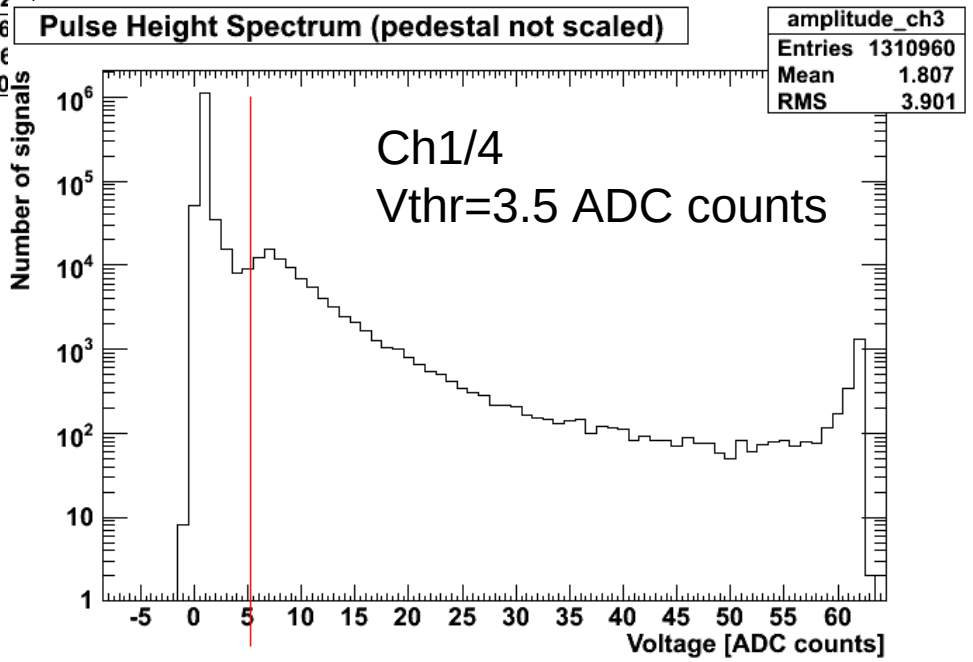

Pulse Height Spectrum (pedestal not scaled)
amplitude_ch7
Entries 1310144
Mean 1.843
RMS 3.614
Number of signals
Voltage [ADC counts]
Ch2/4
Vthr=2 ADC counts

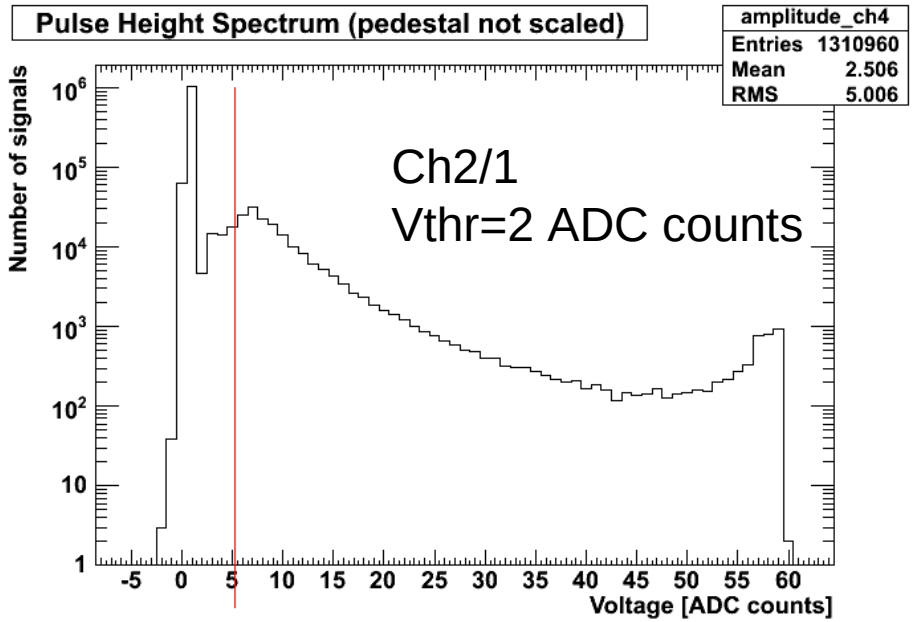
20/08/2010 Vthr BCM1F OR =24mV

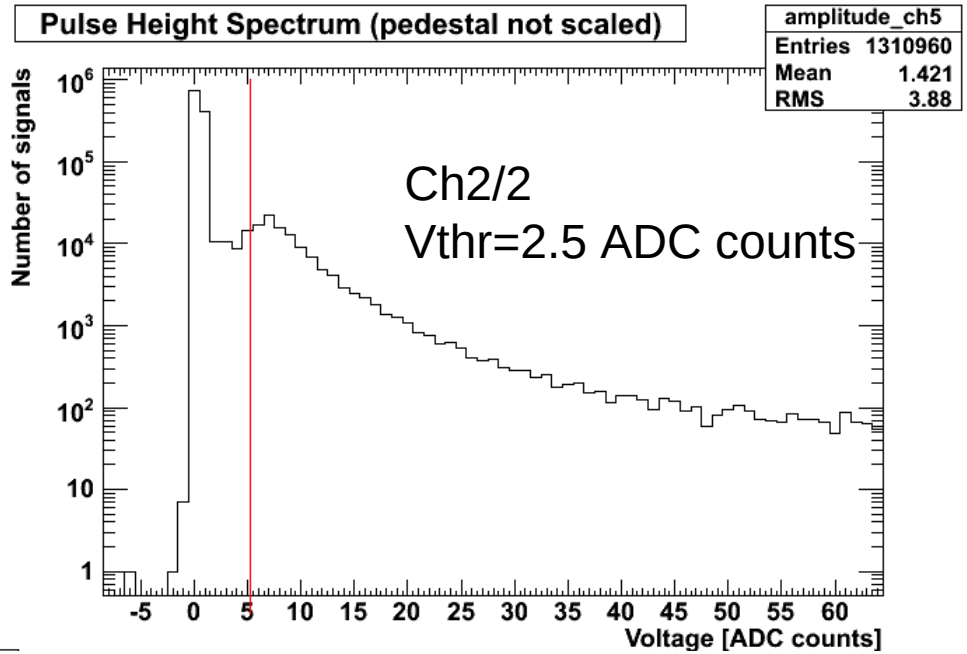


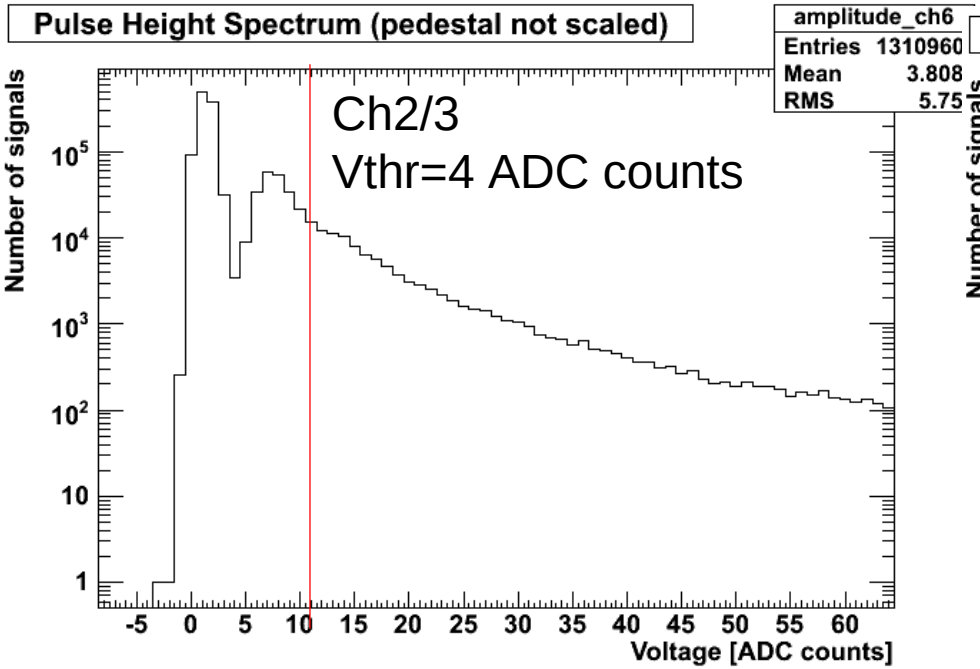


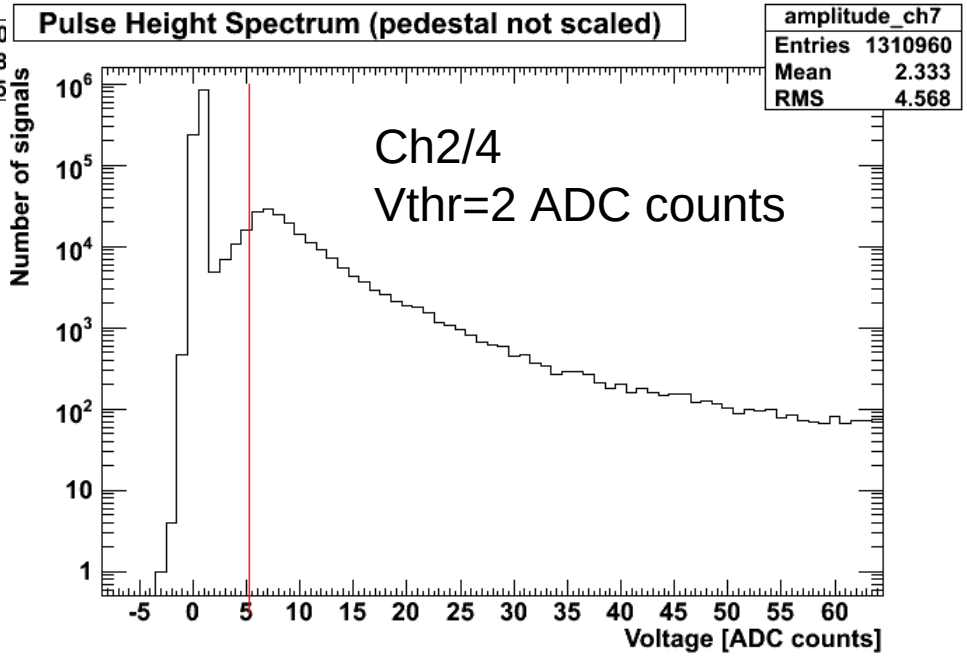


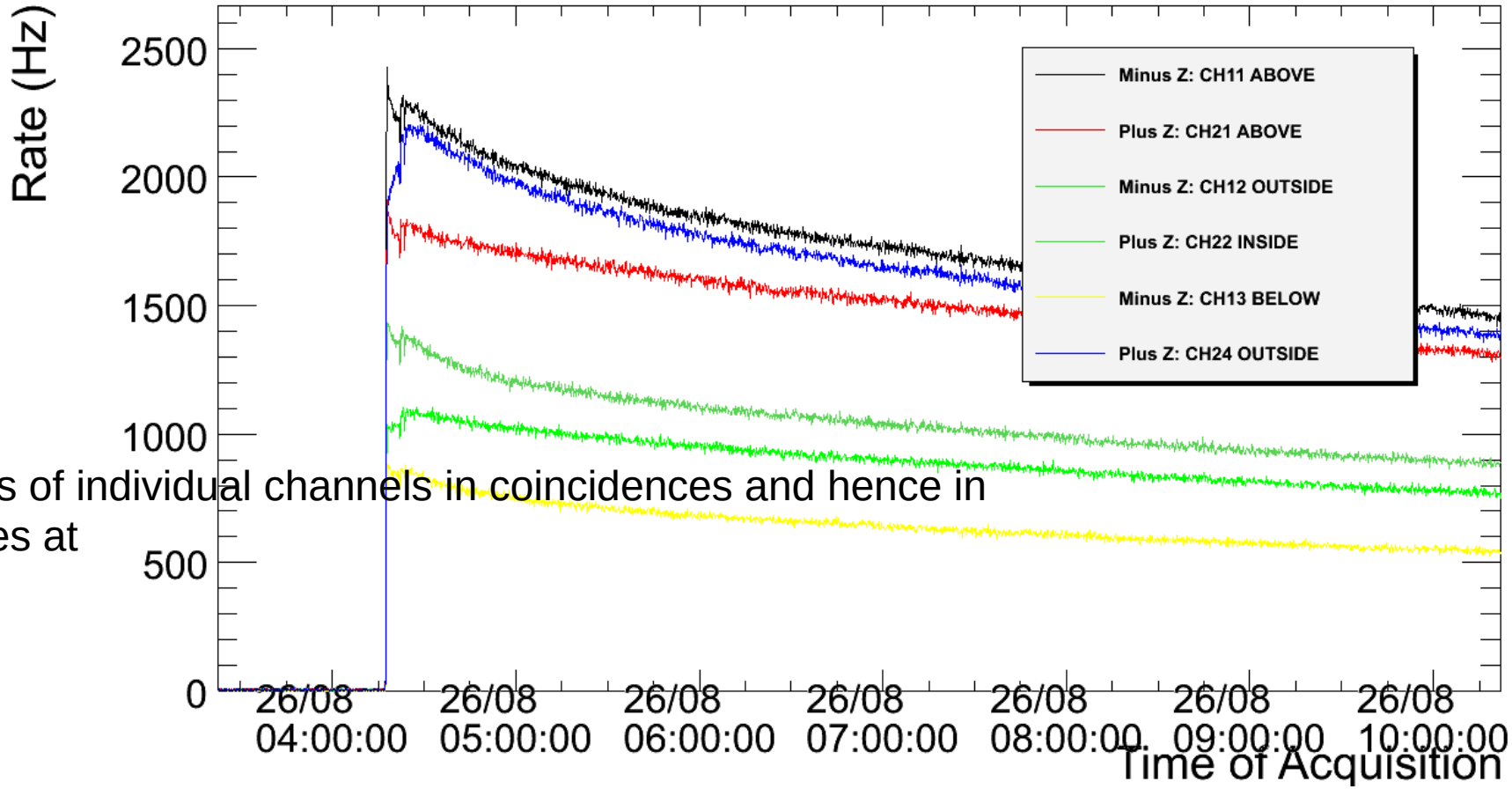



Pulse Height Spectrum (pedestal not scaled)
amplitude_ch4
Entries 1310960
Mean 2.506
RMS 5.006
Ch2/1
Vthr=2 ADC counts
Number of signals
Voltage [ADC counts]


Pulse Height Spectrum (pedestal not scaled)
amplitude_ch5
Entries 1310960
Mean 1.421
RMS 3.88
Ch2/2
Vthr=2.5 ADC counts
Number of signals
Voltage [ADC counts]


Pulse Height Spectrum (pedestal not scaled)
amplitude_ch6
Entries 1310960
Mean 3.808
RMS 5.75
Ch2/3
Vthr=4 ADC counts
Number of signals
Voltage [ADC counts]


Pulse Height Spectrum (pedestal not scaled)
amplitude_ch7
Entries 1310960
Mean 2.333
RMS 4.568
Ch2/4
Vthr=2 ADC counts
Number of signals
Voltage [ADC counts]



tes of individual channels in coincidences and hence in
ates at

New Thresholds

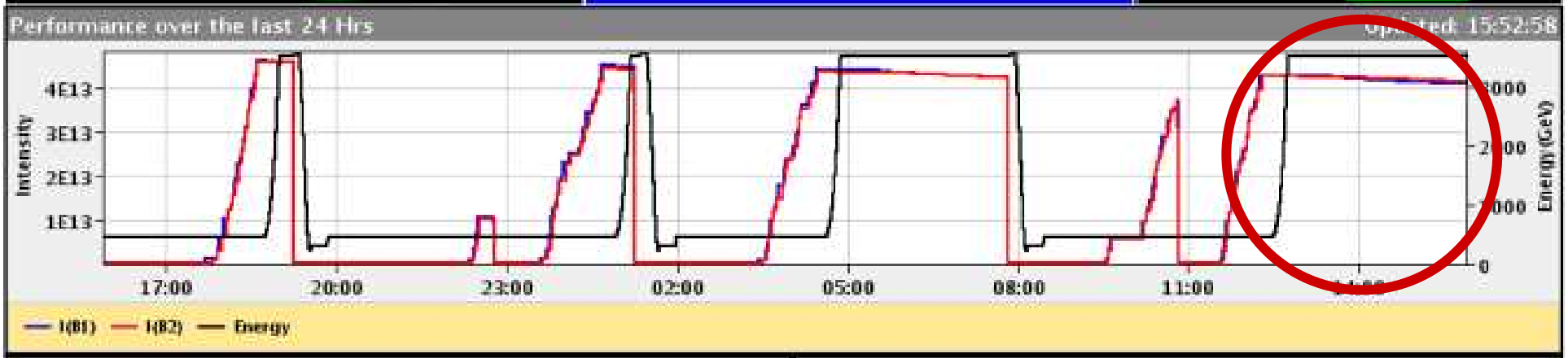
- On 26th October a threshold scan was done in presence of beam with channels ¼ and 2/3, those disabled from background 1
- On 27th October we made the same but without beam for rest of channels
- We played with thresholds around the calculated value until the rate of accepted noise was reasonable.

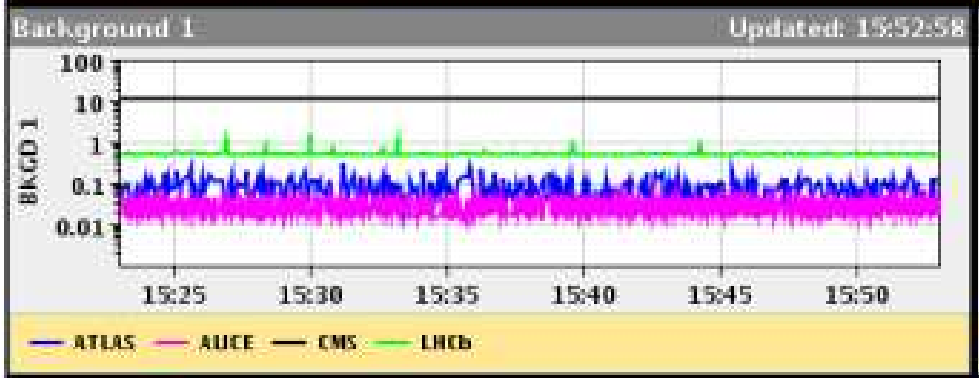
ch	old Vthr	new Vthr	mV
1/1	0xC	0x8	-23mV
1/2	0xC	0x5	-17mV
1/3	0xC	0x8	-23mV
1/4	0xC	0x5	-17mV
2/1	0xC	0x5	-16mV
2/2	0xC	0x6	-18mV
2/3	0x19	0x8	-23mV
2/4	0xC	0x5	-16mV

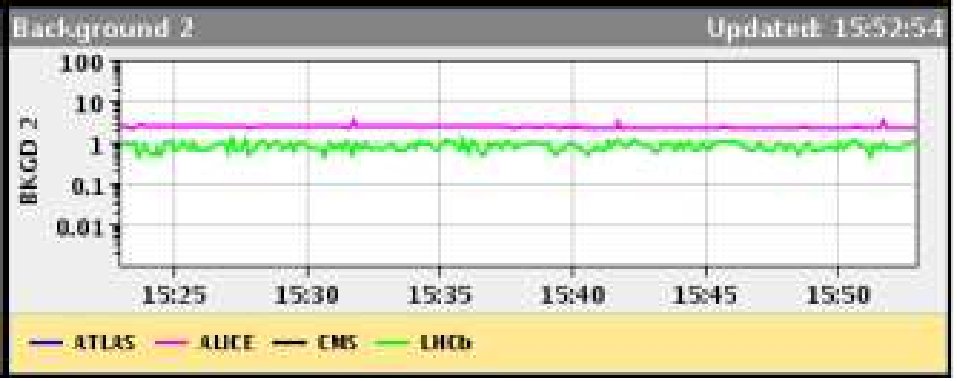
26-Oct-2010 15:52:58 Fill #: 1444 Energy: 3500 GeV I(B1): 4.07e+13 I(B2): 4.12e+13

	ATLAS	ALICE	CMS	LHCb
Experiment Status	PHYSICS	PHYSICS	PHYSICS	PHYSICS
Instantaneous Lumi (ub.s)^-1	165.031	1.155	161.943	132.811
BRAN Luminosity (ub.s)^-1	158.523	1.174	150.547	123.240
Fill Luminosity (nb)^-1	1479.2	--	1444.6	1165.5
BKGD 1	0.131	0.021	12.664	0.535
BKGD 2	679.000	2.390	0.000	1.105
BKGD 3	2.000	0.006	2.393	0.522

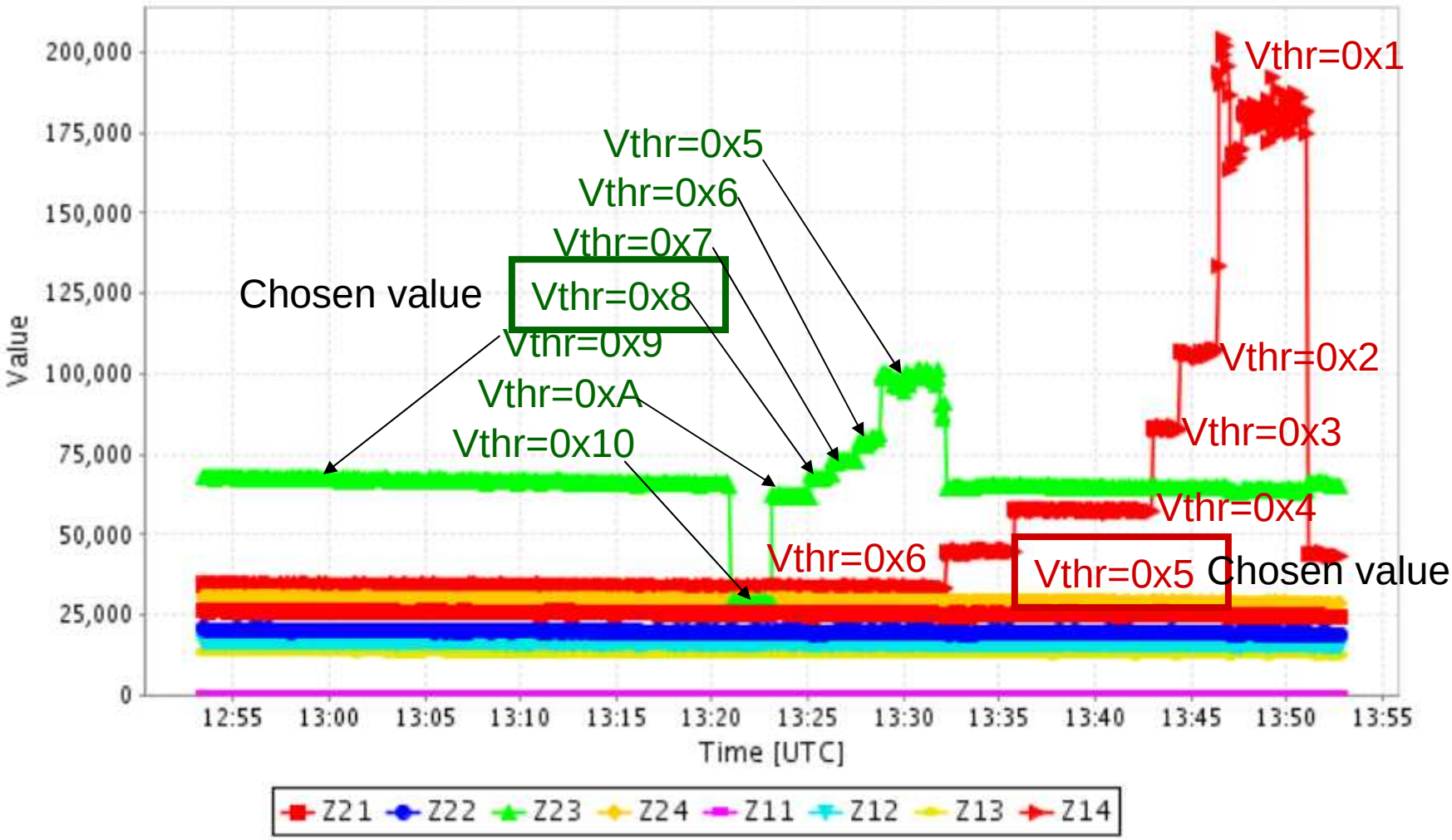
LHCb VELO Position IN Gap: 0.0 mm STABLE BEAMS TOTEM: STANDBY



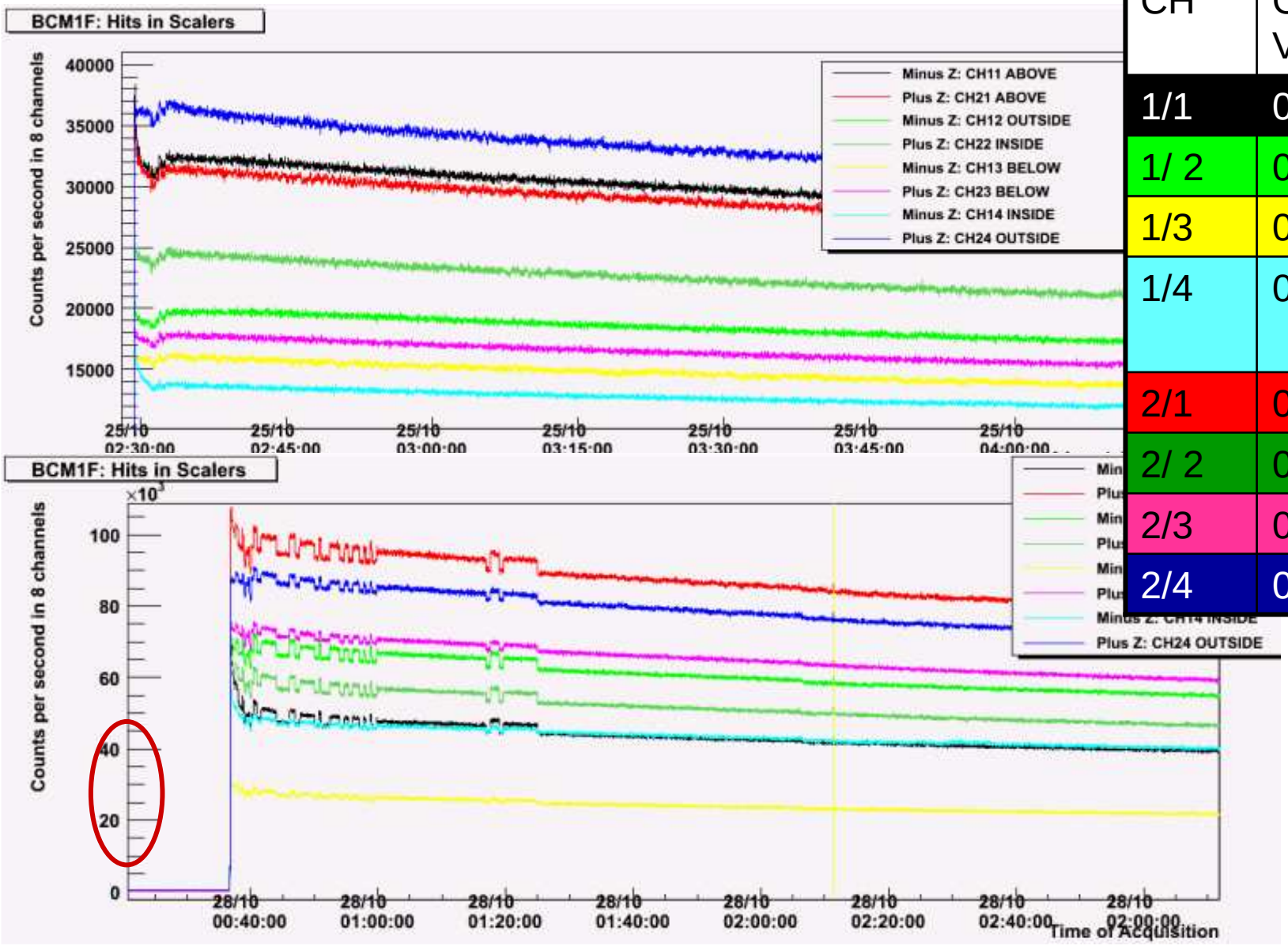




Vthr scan


Vthr=0x1
Vthr=0x5
Vthr=0x6
Vthr=0x7
Chosen value
Vthr=0x8
Vthr=0x9
Vthr=0xA
Vthr=0x10
Vthr=0x2
Vthr=0x3
Vthr=0x4
Vthr=0x6
Vthr=0x5
Chosen value
Value
200,000
175,000
150,000
125,000
100,000
75,000
50,000
25,000
0
12:55
13:00
13:05
13:10
13:15
13:20
13:25
13:30
13:35
13:40
13:45
13:50
13:55
Time [UTC]
Z21
Z22
Z23
Z24
Z11
Z12
Z13
Z14

Effect of new thresholds



CH	Old Vthr	New Vthr
1/1	0xC	0x8
1/ 2	0xC	0x5
1/3	0xC	0x8
1/4	0xC	0x5
2/1	0xC	0x5
2/ 2	0xC	0x6
2/3	0x19	0x8
2/4	0xC	0x5

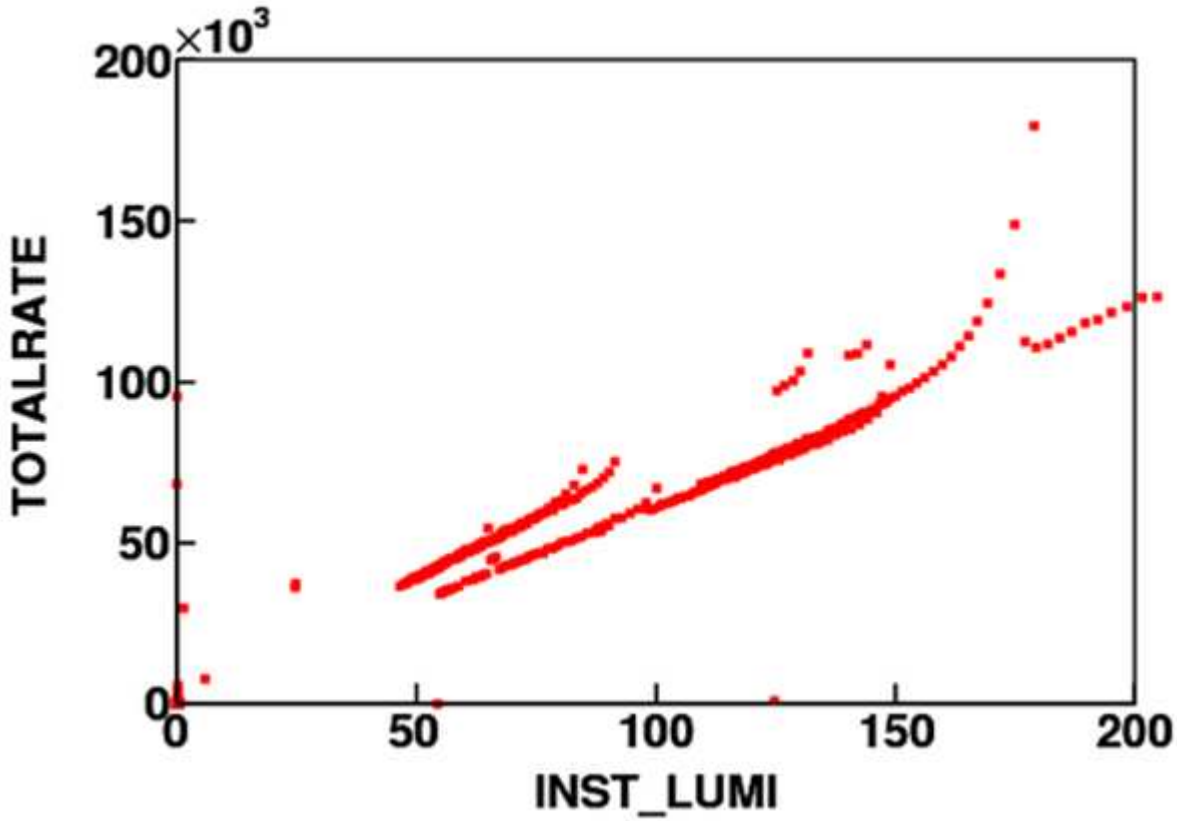
BRM Elog entry (by Gino Bolla):
http://cmsonline.cern.ch/portal/page/portal/CMS%20online%20system/Elog?_piref815_429145_815_429142_429142.strutsAction=%2FviewMessageDetails.do%3FcatId%3D493%26subId%3D30%26msgId%3D456894

BSC is proven to be unreliable (this was likely expected at the inst-lumi we have now). I am considering putting some cuts on BCM1f rates instead of BSC for the pixel instructions.
I need to correlate it with the instantaneous lumi. In the attached plot there are two slopes. Please explain the plot and the origin of the two slopes. If you can please point to a slope (either in the plot or out of your knowledge) to be trusted as what to expect.

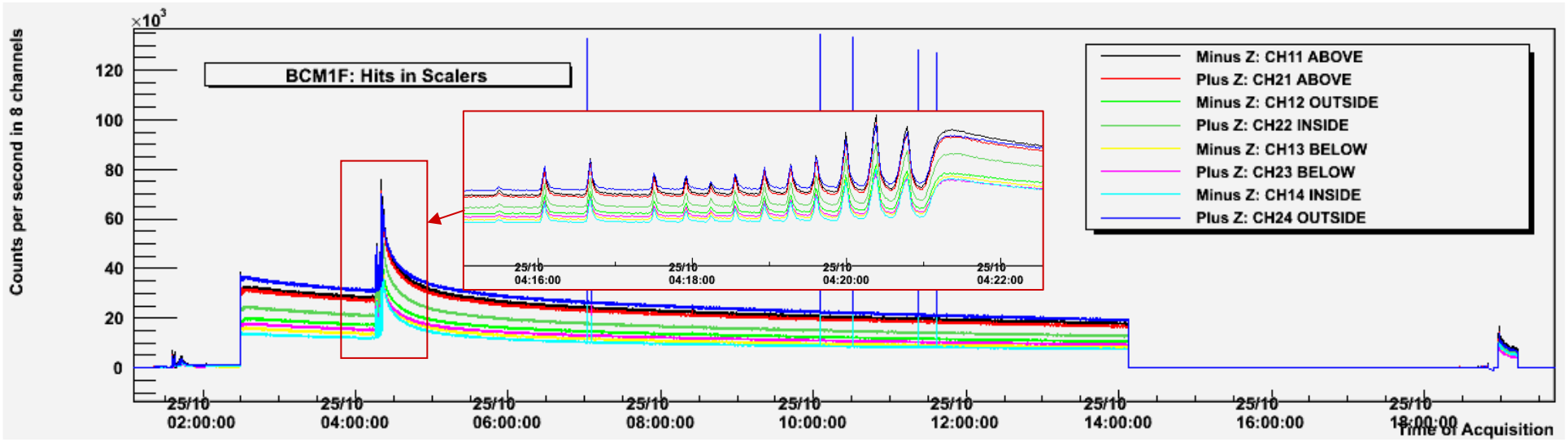
Gino Bolla

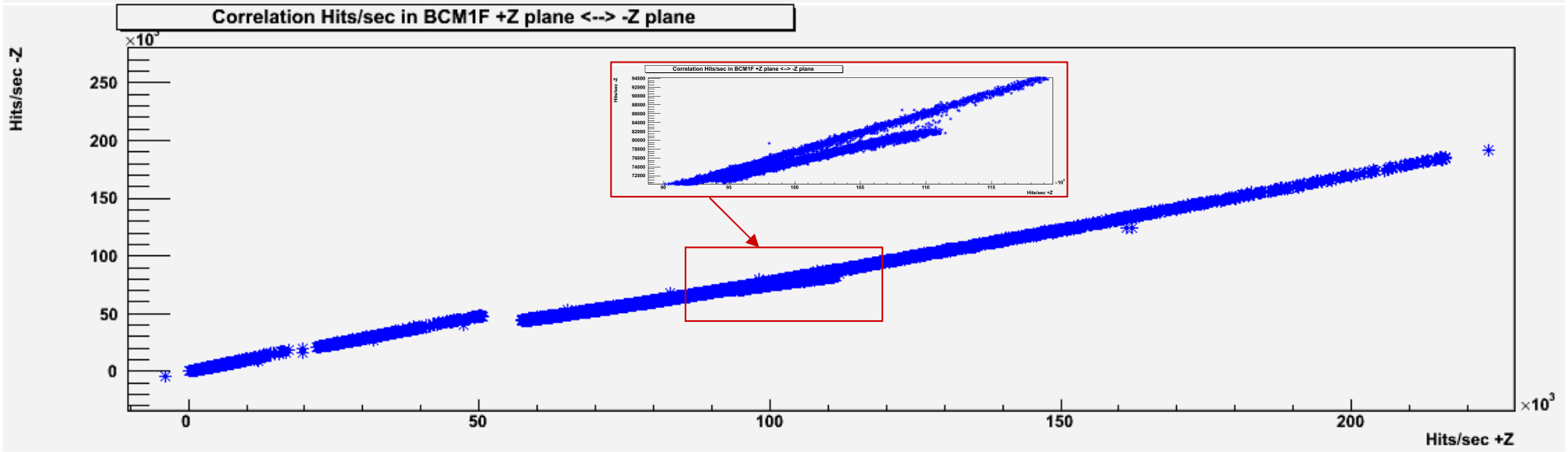
Fills 148862+148864

Old thresholds

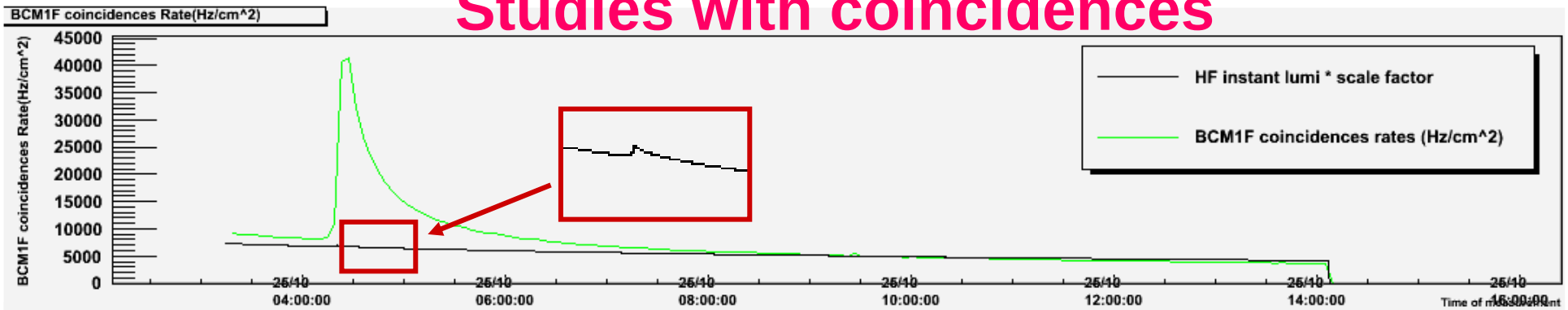


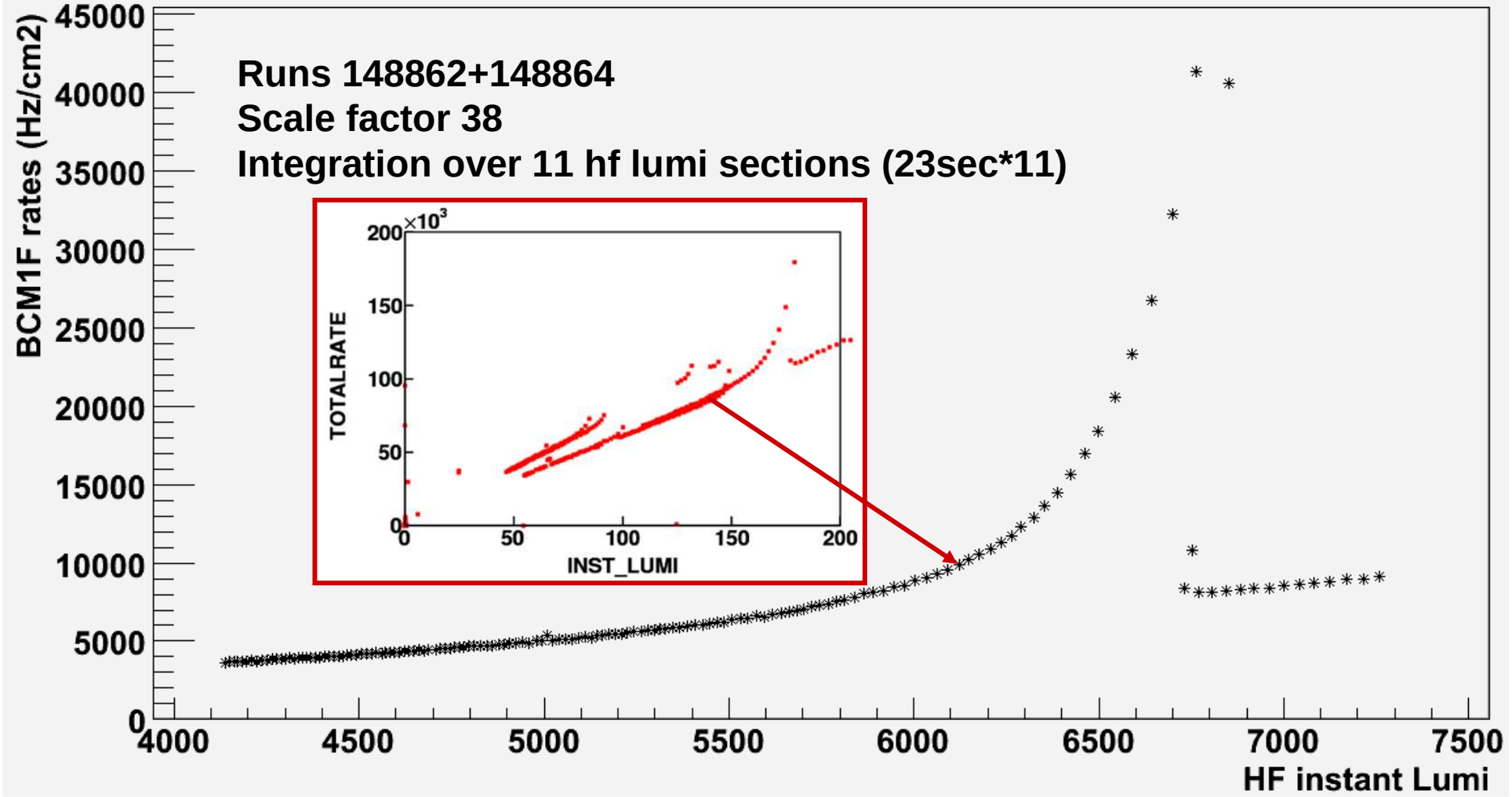
Scalers counts in 8 channels



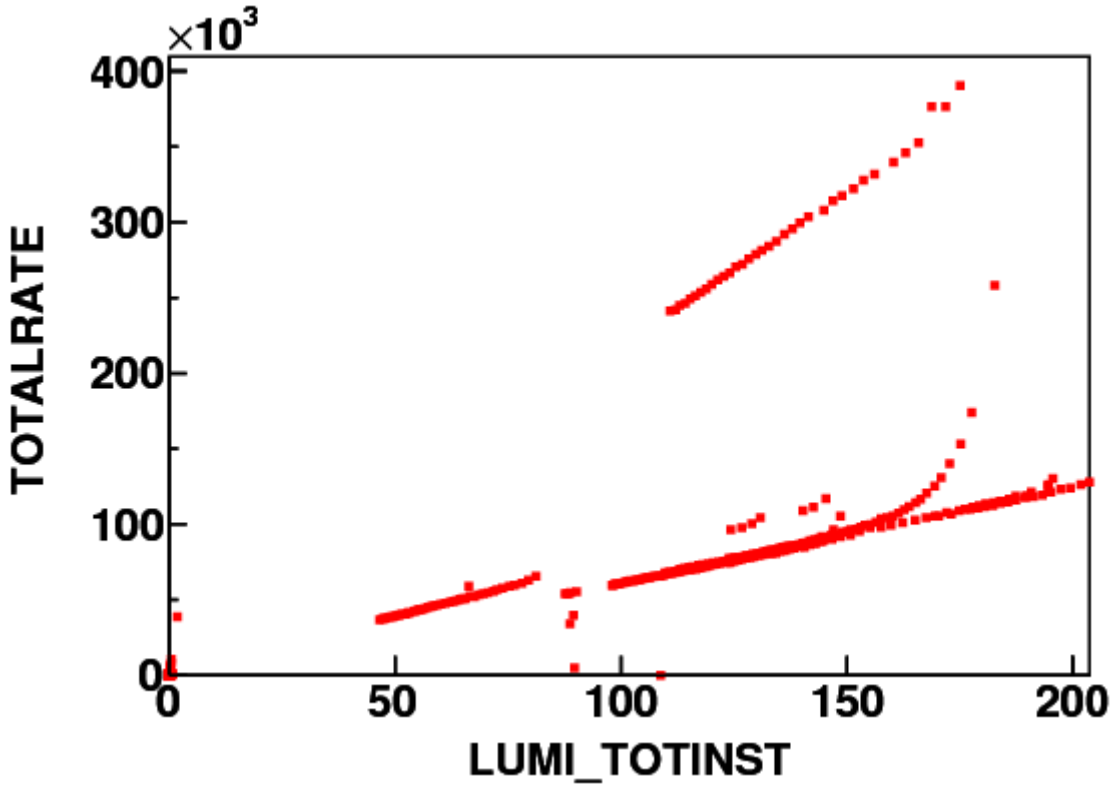


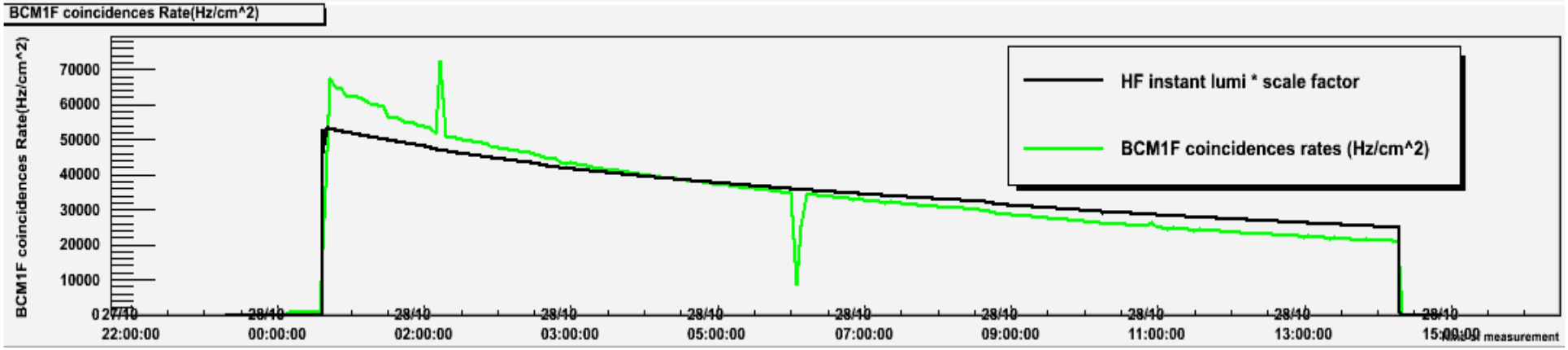
Studies with coincidences

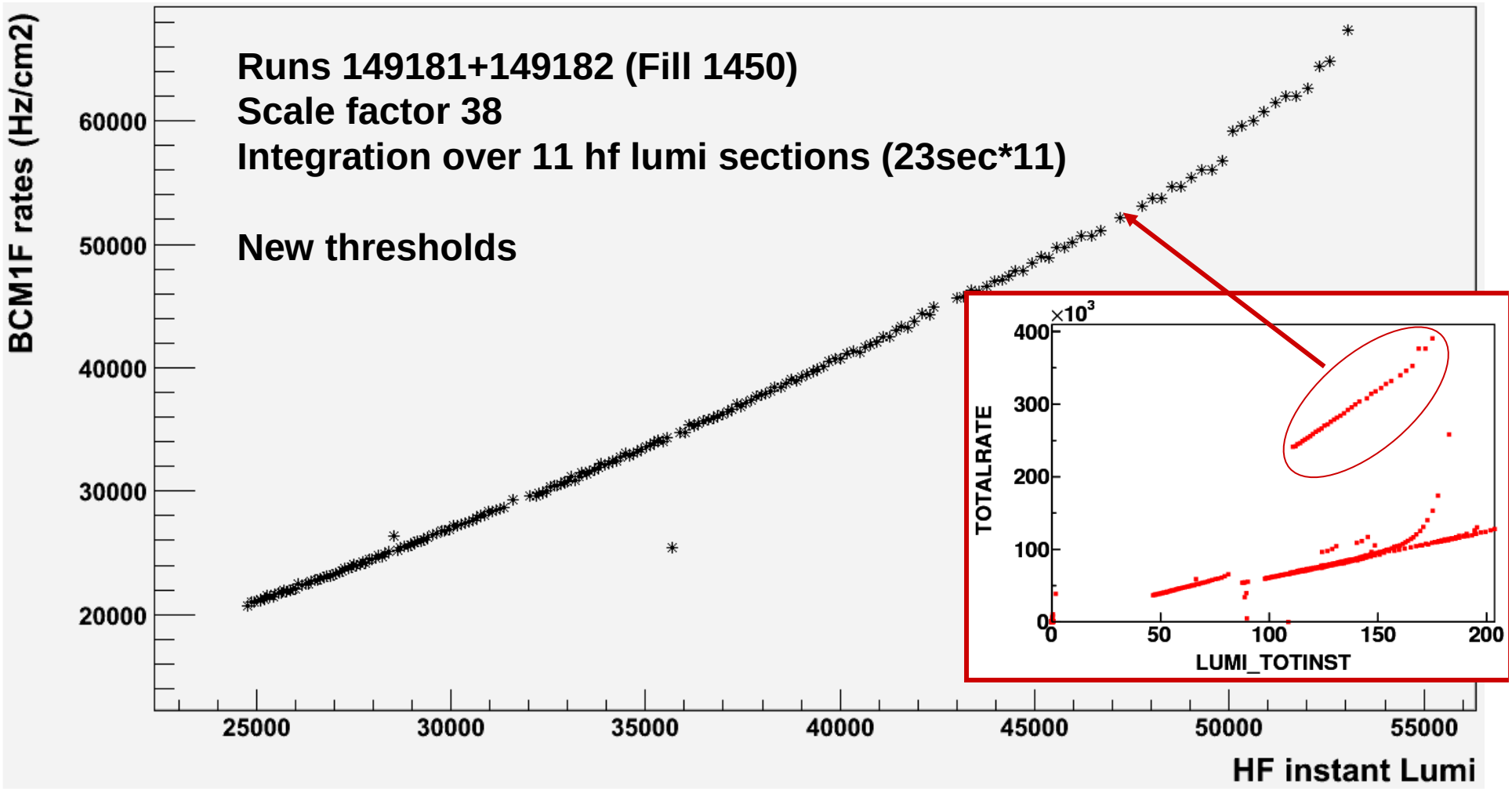




An update.
With the last fill (1450) there is a third slope.
This is likely due to the change of thresholds that was applied yesterday.




BCM1F coincidences Rate(Hz/cm^2)
BCM1F coincidences Rate(Hz/cm^2)
70000
60000
50000
40000
30000
20000
10000
0
HF instant lumi * scale factor
BCM1F coincidences rates (Hz/cm^2)
27/10 22:00:00
28/10 00:00:00
28/10 02:00:00
28/10 03:00:00
28/10 05:00:00
28/10 07:00:00
28/10 09:00:00
28/10 11:00:00
28/10 13:00:00
28/10 15:00:00
Atlas measurement


Runs 149181+149182 (Fill 1450)
Scale factor 38
Integration over 11 hf lumi sections (23sec*11)
New thresholds
BCM1F rates (Hz/cm2)
60000
50000
40000
30000
20000
25000
30000
35000
40000
45000
50000
55000
HF instant Lumi
×10^3
400
300
200
100
0
TOTALRATE
0
50
100
150
200
LUMI_TOTINST