Test of lead glass blocks to use as a trigger for the maPMT test in beam

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Purpose

Test old lead glass blocks (courtesy from Brad Sawastky) and calibrate them with cosmics. We may want to use these blocks as trigger for the maPMT test in beam.
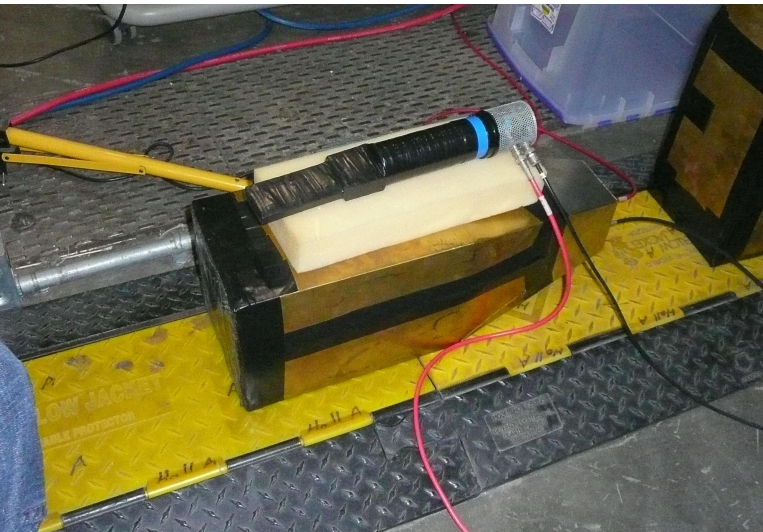
These blocks were sitting in Hall A, underneath the beam line, at the moller polarimeter level => presumably not so good, mainly because of the presence of helium;
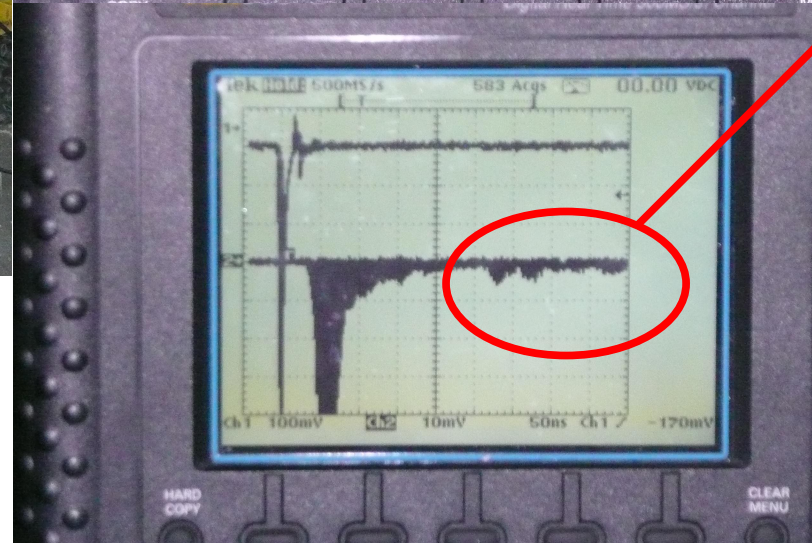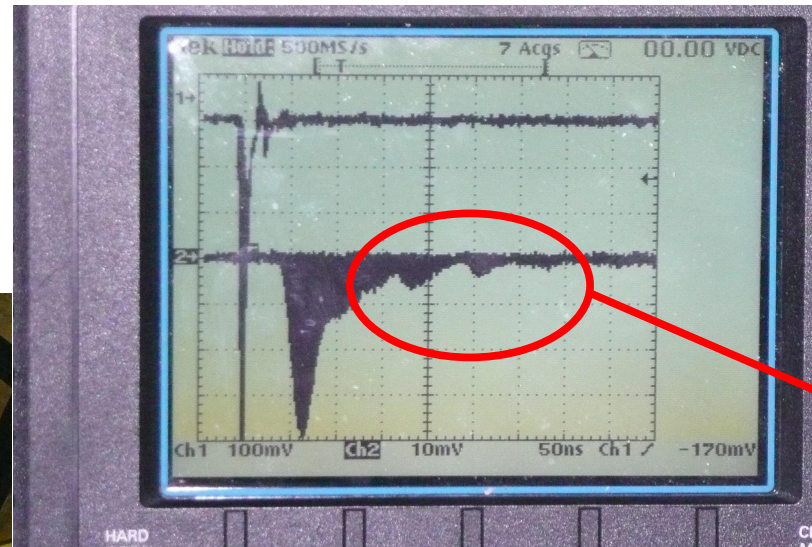
Got two blocks, numbered 18 and 20

Block response test at the scope

Blocks in coincidence with a small scintillator paddle => response observed at the scope.

Block 20 response

Afterpulsing
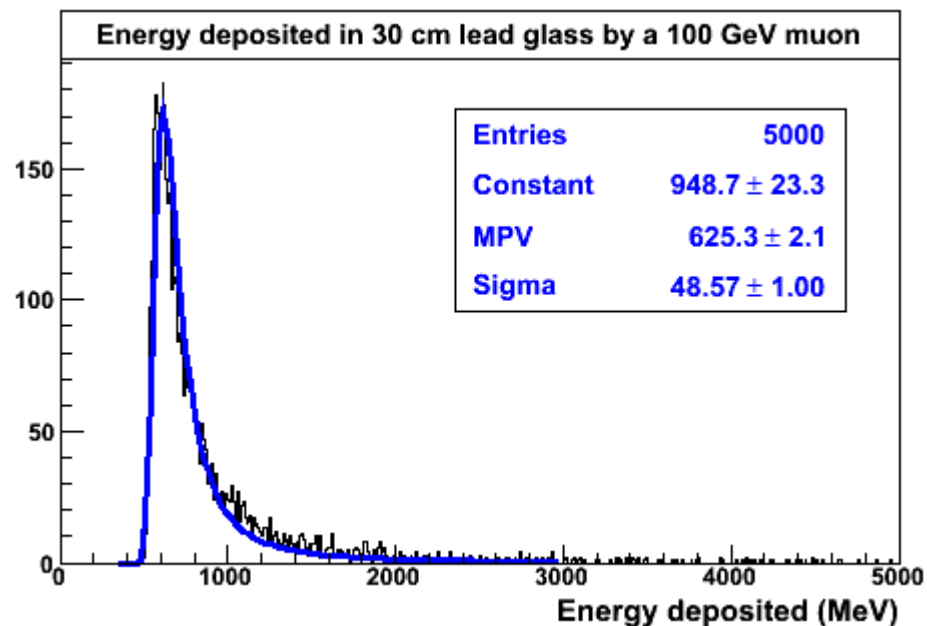=> typical of He contamination

Not too important in regard to the signal => Blocks can still be used.

Block 18 response

Calibration with cosmics

Measure the response of both blocks to minimum ionizing particles going through the longitudinal section of the blocks.

This energy has been evaluated to ~ 600 MeV (Simulation G4), for a 100 GeV muon.
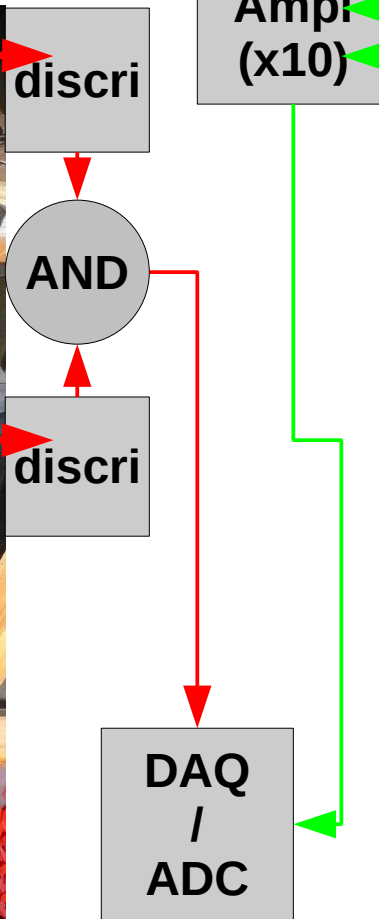(Calculation with Bethe Block formula: ~ 500 MeV => 20 % agreement)

Energy deposited in 30 cm lead glass by a 100 GeV muon

Entries	5000
Constant	948.7 ± 23.3
MPV	625.3 ± 2.1
Sigma	48.57 ± 1.00

Energy deposited (MeV)

Calibration with cosmics: Setup

Scintillator paddles: gives the trigger

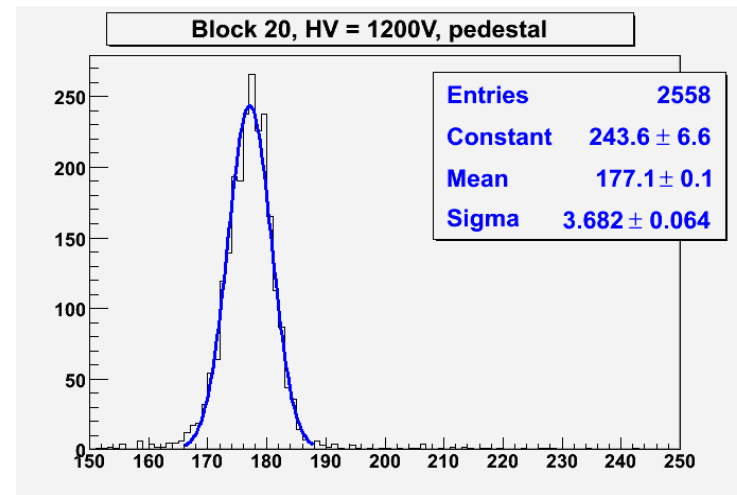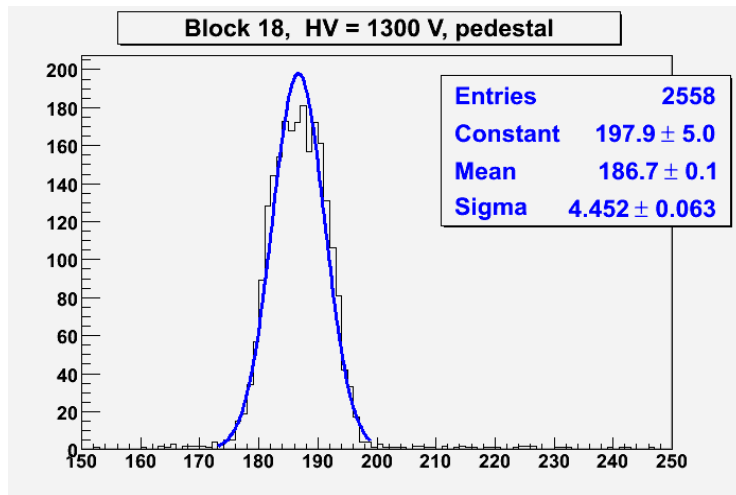Blocks installed between the paddles: read if trigger is given

DAQ shared with Simona (couldn't run at the same time)
=> two "periods" of run: 10/28 -> 10/31; 11/9-10.

Calibration with cosmics: results on 1st period

Pedestals

Recorded for each HV. their positions are stable with the value
of the HV for the first period.

Block 18 (ADC channels)			
Date	HV (V)	peak	σ
10/28	1300	187	5
10/29	1200	187	5
10/30	1150	191	4

Block 20 (ADC channels)			
Date	HV (V)	peak	σ
10/28	1200	177	4
10/29	1100	177	4
10/30	1150	182	3

11/16/2011

Calibration with cosmics: results on 1st period

Block responses

ADC spectra obtained with different voltages. MIP peaks fitted with gaussian

Other block cut at pedestal+5 sigma
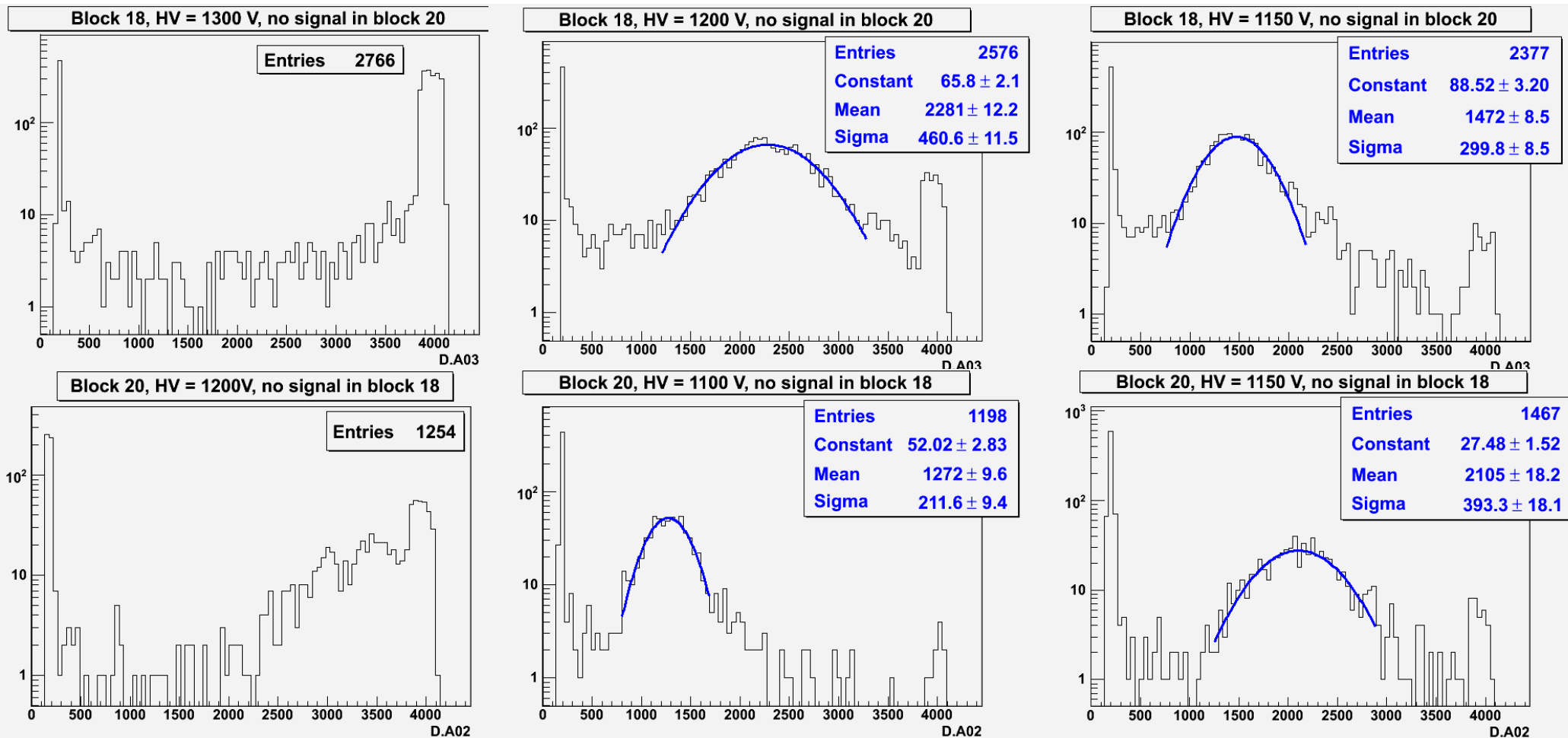
Calibration with cosmics: results on 1st period

Block response

Signal, pedestal subtracted:

Block 18 (ADC channels)			
Date	HV (V)	Pedestal	Signal
10/28	1300	187	-
10/29	1200	187	2094
10/30	1150	191	1281

Block 20 (ADC channels)			
Date	HV (V)	Pedestal	Signal
10/28	1200	177	-
10/29	1100	177	1095
10/30	1150	182	1923

/!\ assuming response *linear* with HV /!\

Block	$\Delta G/\Delta V$ (V^{-1})	HV for ~1600 ADC signal	Expected signal (ADC)
18	16.26	1170	1606
20	16.56	1130	1591

=> around 1600 ADC channels response and gain match expected at 1% level.

Calibration with cosmics: results on 2nd period
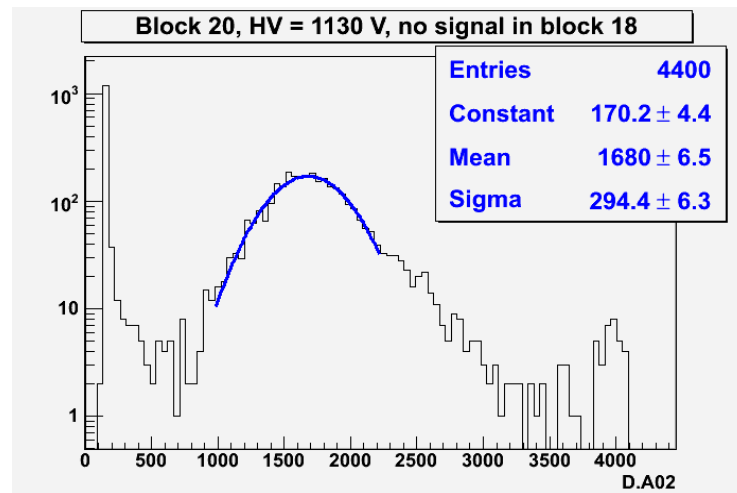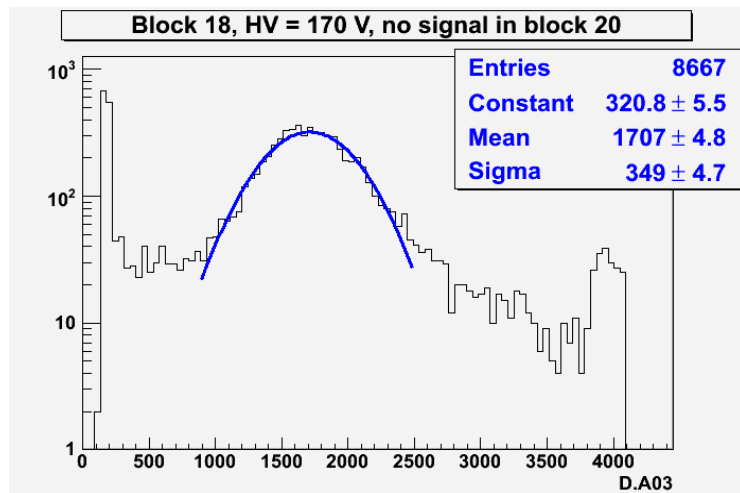
Pedestals

Small pedestal shift from 1st to 2nd run period.
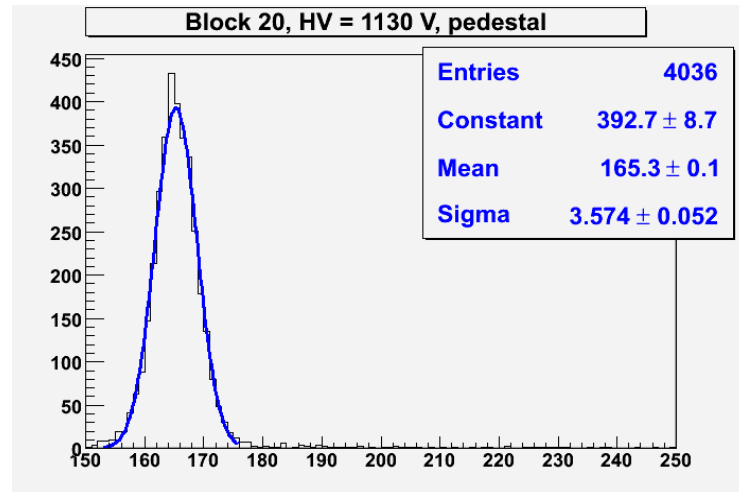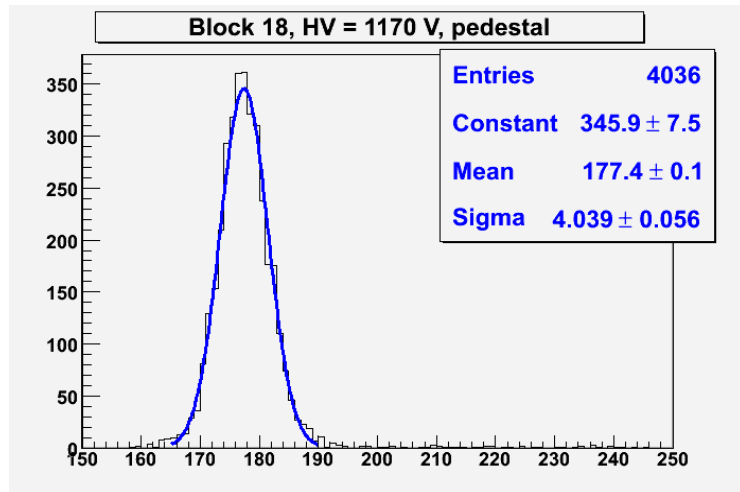
Block 18 (ADC channels)			
Date	HV (V)	peak	σ
10/28	1300	187	5
10/29	1200	187	5
10/30	1150	191	4
11/10	1170	177	4

Block 20 (ADC channels)			
Date	HV (V)	peak	σ
10/28	1200	177	4
10/29	1100	177	4
10/30	1150	182	3
11/10	1130	165	4

Calibration with cosmics: results on 2nd period

Block response

Block	HV (V)	Expected signal (ADC)	Pedestal (ADC)	Obtained signal (ADC)
18	1170	1606	177	1530
20	1130	1591	165	1515

=> Blocks gain matched within 1% accuracy

=> Obtained response has 5% agreement with expected
   (assuming gain linear with HV)

Test summary

- Blocks are working about fine... PMTs are helium contamined, but
  they are still functional;

- Cosmics calibration is done:
  => Blocks have been gain matched with 1% accuracy;
  => Responses are predictible w.r.t the HV applied to the 5% level;