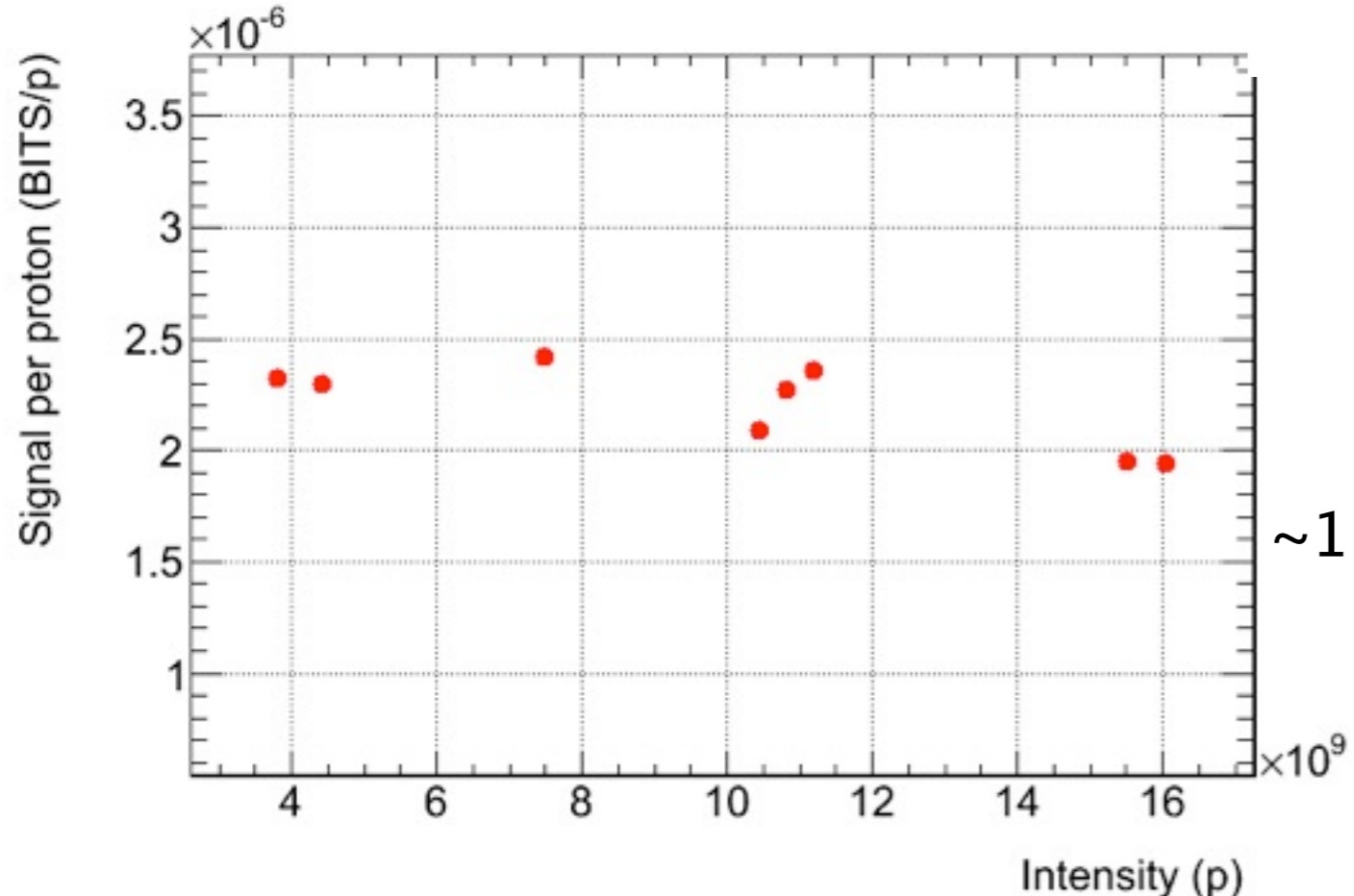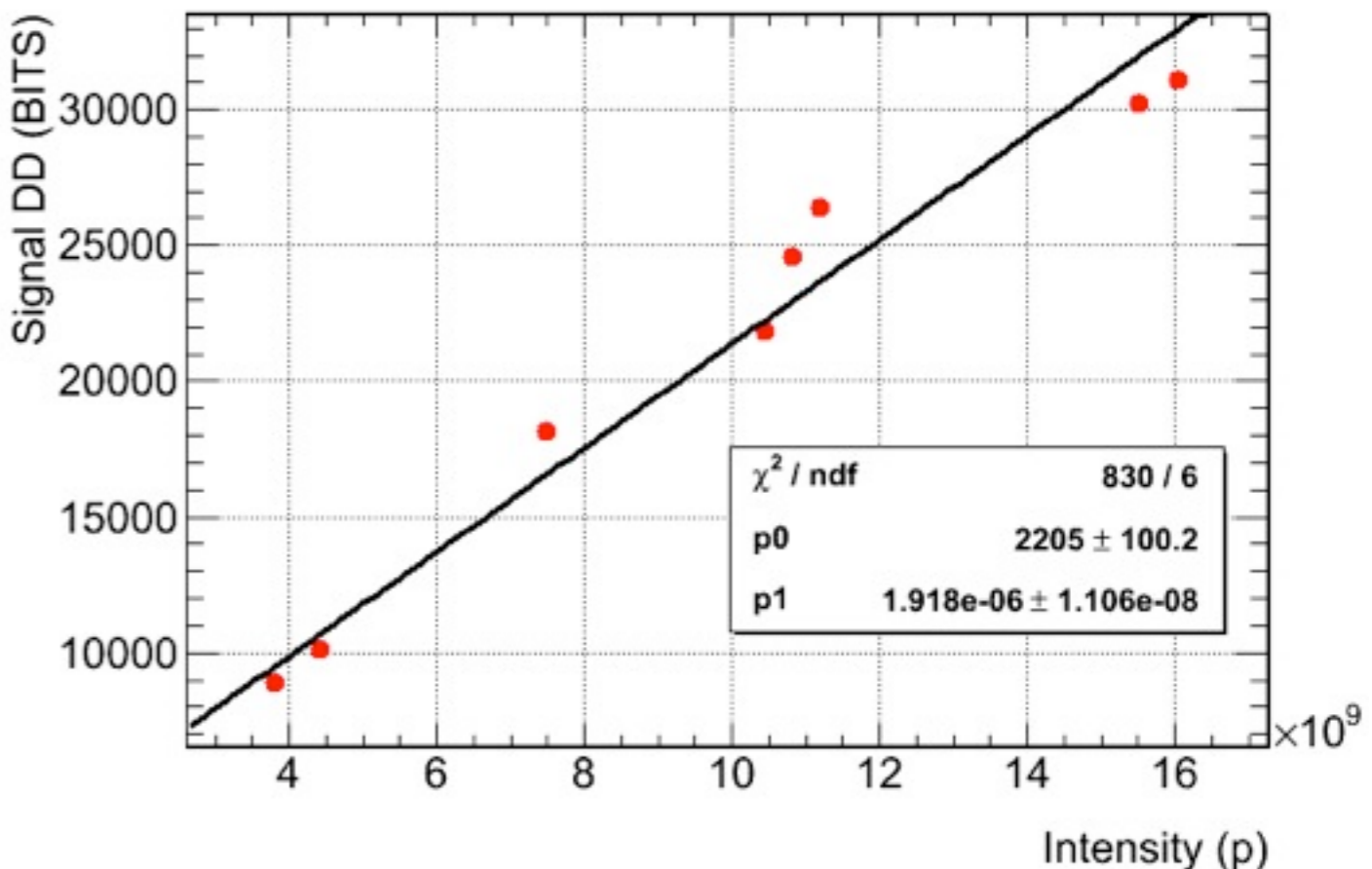# Direct Dump calibration factors: BITS -> lost protons

MD

8 shots of probe intensity bunches onto a close TCSG.4L6.B2 were used to calibrate the Direct Dump BLMs.

Approximately linear behaviour On the same support here is one IC and one SEM.

Signal normalized to intensity in order to get a calibration factor.

2.22E−6 BITS/p

~15% decrease due to space charge effects?

Direct Dump calibration factors: BITS -> Gy

Hi Jan:

Let me explain how I computed the conversion factor for the Direct Dump BLM. From the Dynamic range (50mA/65536 ADC counts) we have that each bit corresponds to 0.763E-6 A.

As mentioned in our discussion the Ionization Chambers have a low pass filter with time constant 138us. Since from the read out we get the peak signal I assume that the signals smoothes out in this 138us so one ADC count corresponds to a charge collection of 0.763E-6 A x 138us = 1.05E-11 C.

Now assuming an average energy of 34.8 MeV to produce an electron-ion pair in N2 we have that 1Gy(N2) = 5.26 E-5 C. Combining the results above we have a conversion factors between adc counts and Gy (collected in 138us) of
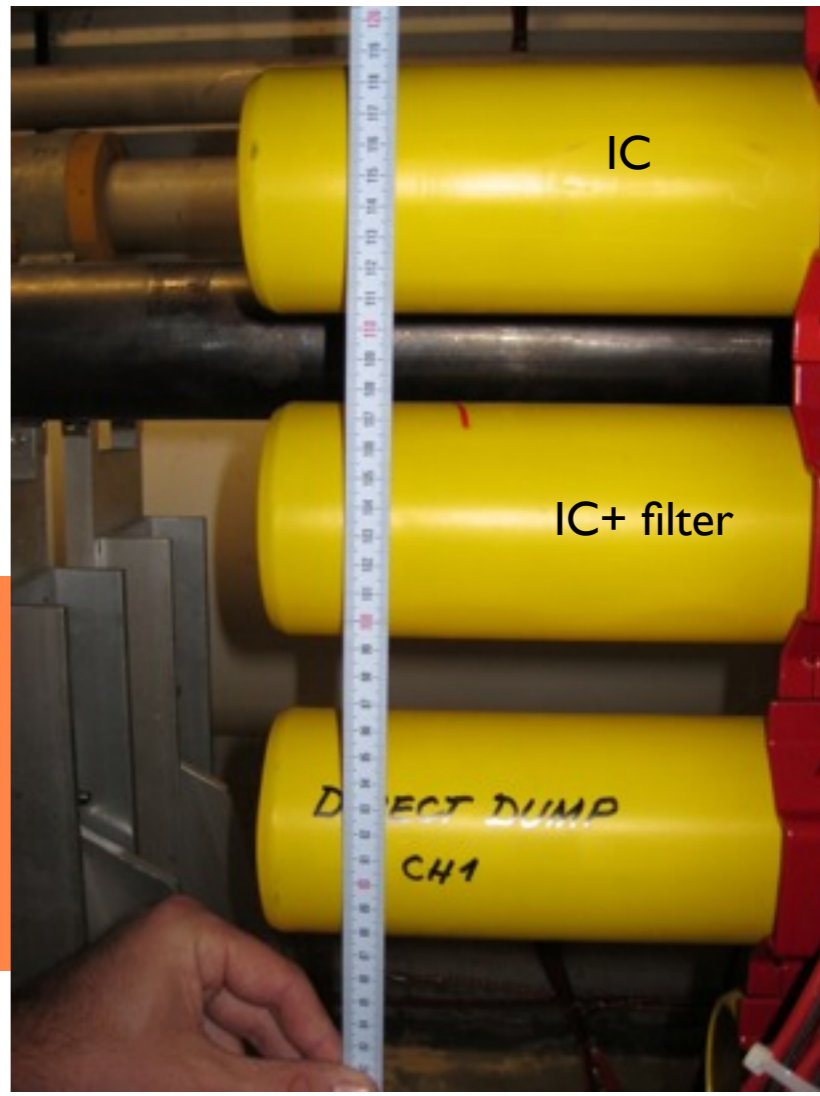
2.0E-6 Gy/adc count.

I apply this factor to the Direct dump for the signals collected during the MD and compare them with the IC with filter located at the same location and I get that the signals in the DD monitor are roughly 1/2 the signals in the IC with filter. See plot below.
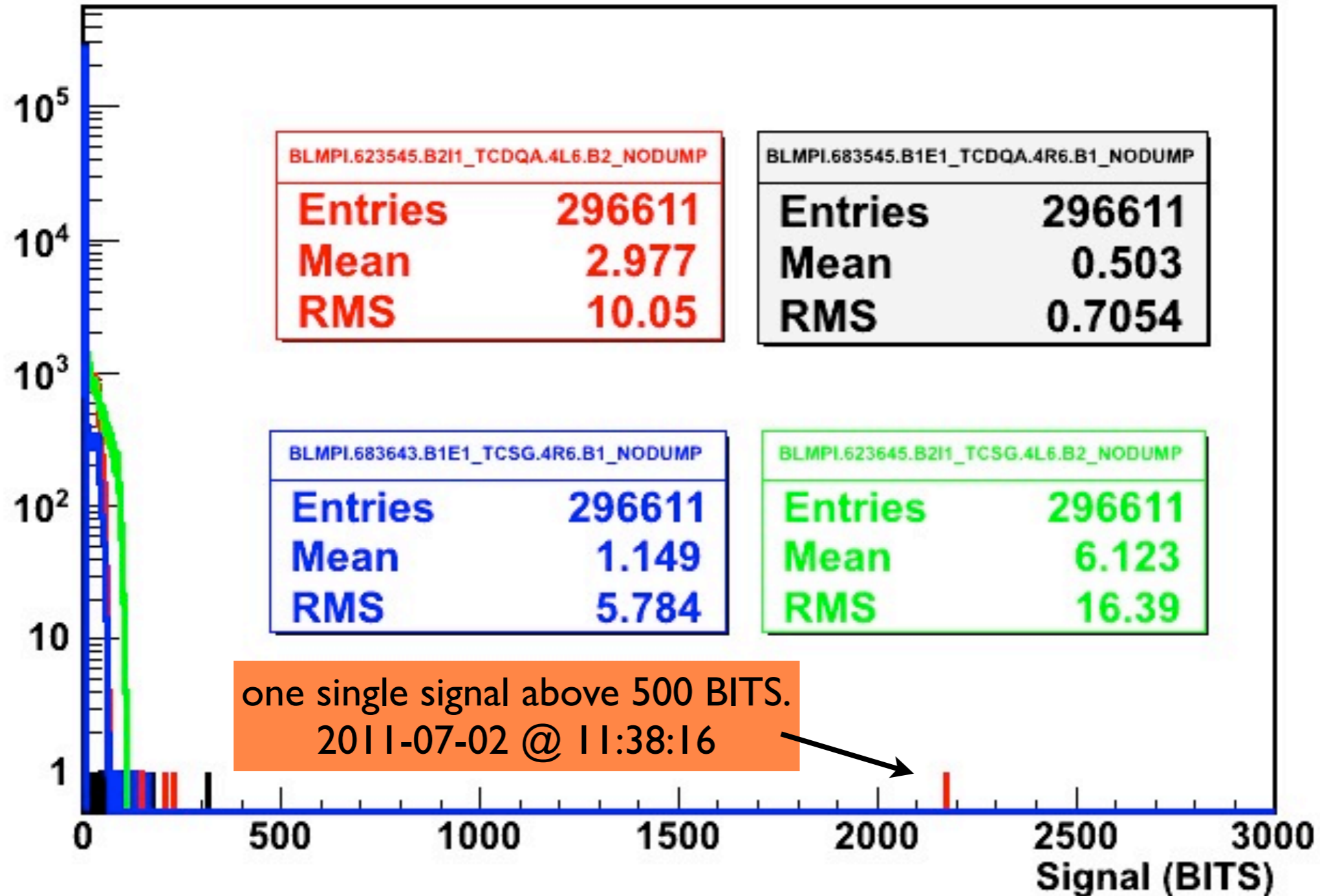
Cheers

Eduardo
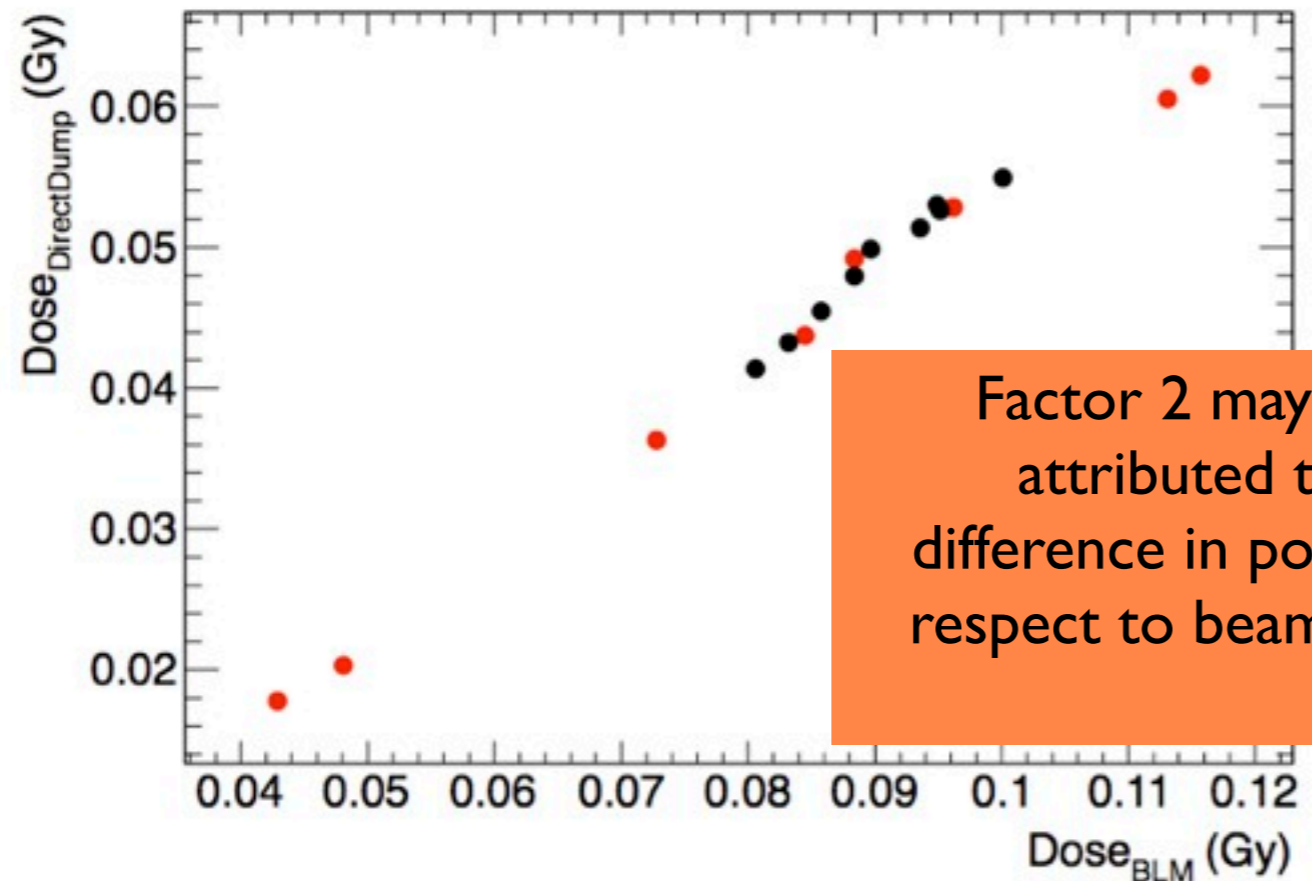
Factor 2 may be attributed to difference in position respect to beam pipe
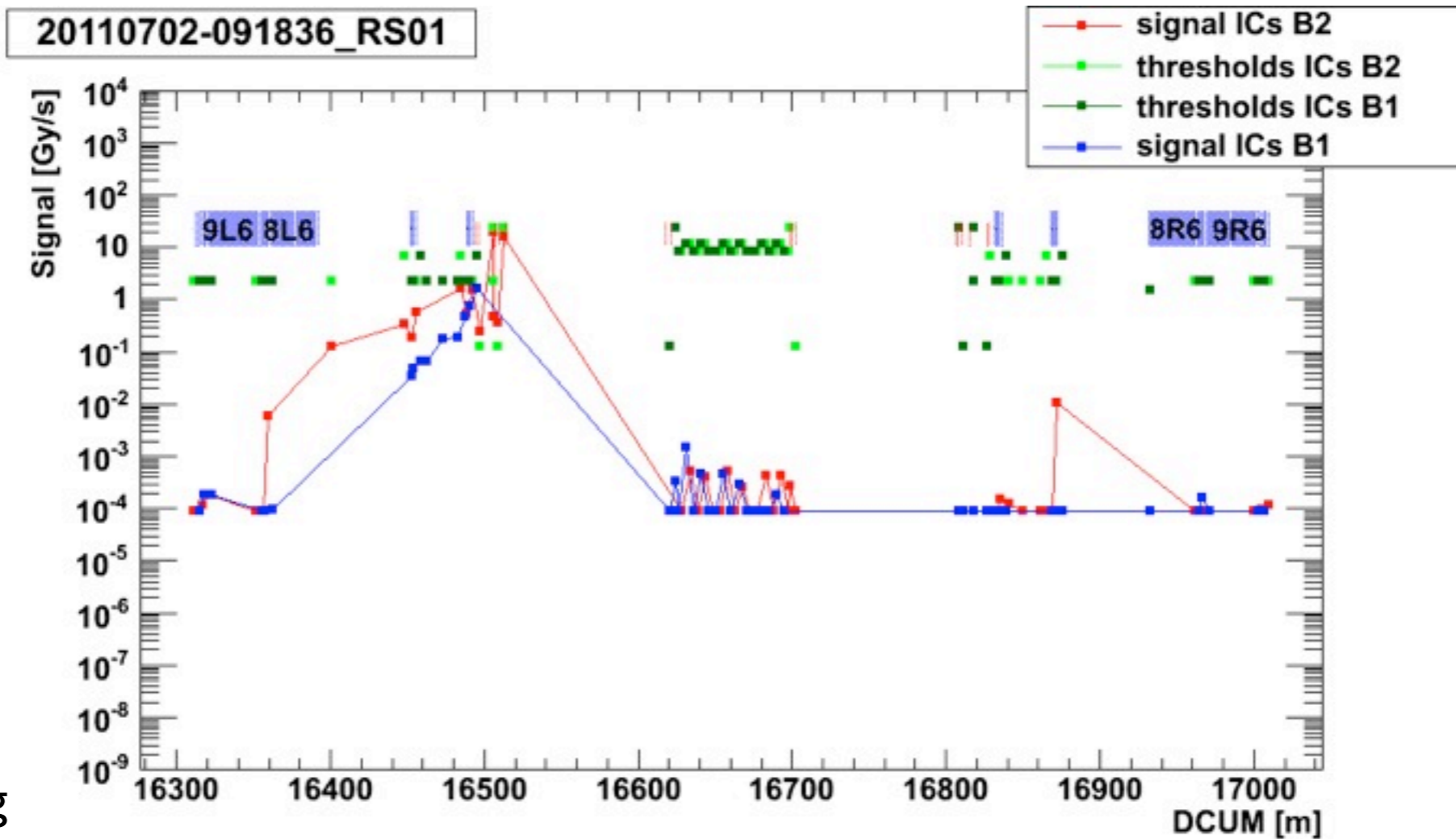
Direct Dump Signal Distribution

Signal distribution excluding dumps
and periods with no beam

Details of Event: 02/07/2011 @ 11:38:16 (local time)

monitors with big filter installed

Most critical signals. Monitors over threshold are maskable

Expert name	dcum (m)	S_RS01 (Gy/s)	T_RS01 (Gy/s)	S/T
BLMEI.04L6.B2I10_TCDQA.B4L6.B2	16508.9	0.362	0.127	2.84
BLMEI.04L6.B2I10_TCDQM.4L6.B2	16497.0	0.241	0.127	1.89
BLMEI.04L6.B2I10_TCSG.4L6.B2	16505.5	19.1	23.17	0.83
BLMEI.04L6.B2I10_TCDQA.A4L6.B2	16512.5	14.8	23.17	0.683

same dcum as direct dump BLMs (No filter installed)

Details of Event: 02/07/2011 @ 11:38: (local time)
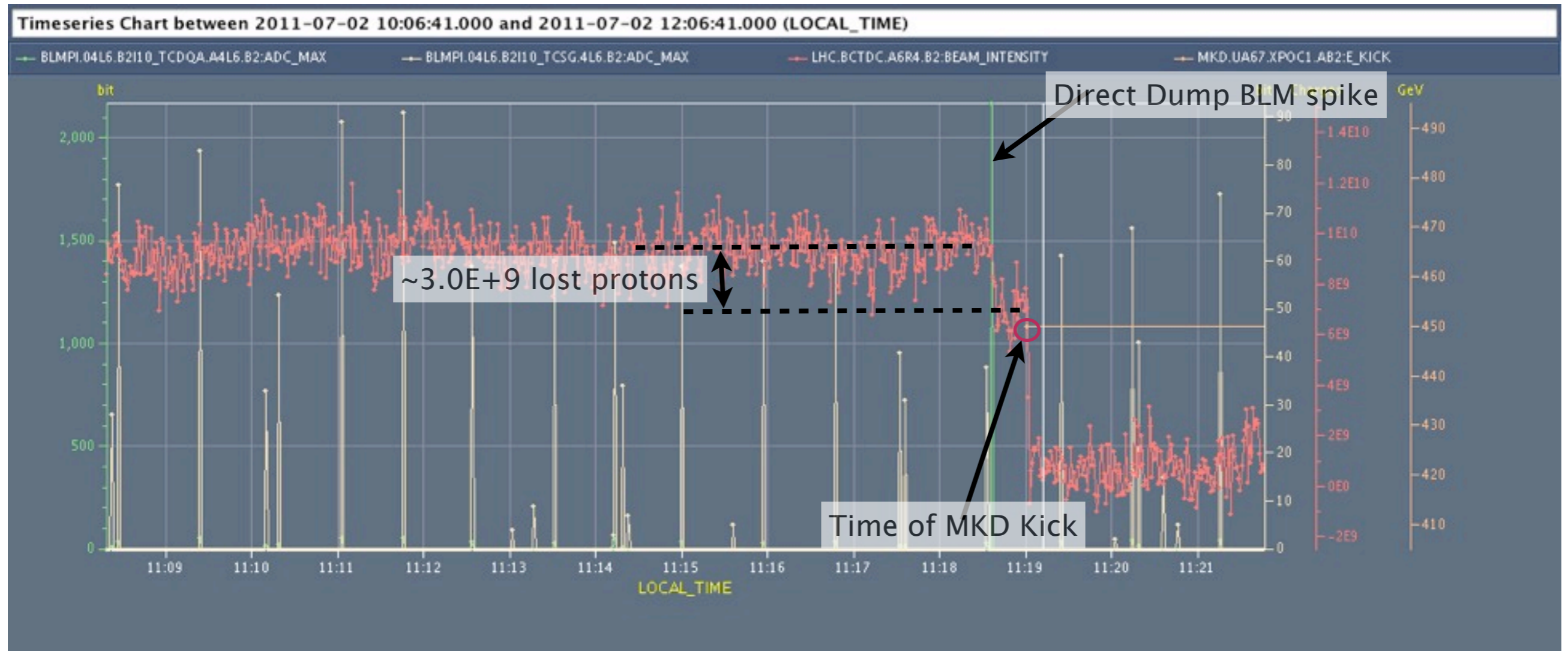
Use conversion factor to extract # of lost protons

Signal DD = 2172 BITS (Sdd/2.22E–6 ~ 1E+9 p)

Consistent with drop in intensity

Threshold estimation

– The standard neighbouring monitors did not reach the dump threshold during the event of 2nd of July. Therefore not safe to take the direct dump signal in this case as a reference

– The threshold estimation below is based on the 23.17Gy/s threshold on RS01 of the standard monitors located at the same dcum as the DD monitors (BLMEI.04L6.B2I10_TCSG.4L6.B2 and BLMEI.04L6.B2I10_TCDQA.A4L6.B2).

– Assumptions :

1) Lets consider an instantaneous loss. Due to the effect of the analog cable length, the charge collected by a BLM in the 40us integration window is about 40% of the total (modeled with a 120us RC filter).

2) The signal recorded in the DD BLM is a factor 2 lower than the one in the standard IC due to different position respect to the beam.

$$Tdd = (\ 2 \times (23.17\ Gy/s \times 40\ us)\ /\ 0.40\ )\ /\ 2.0\ uGy/BIT = 2317\ BITS$$

Thr in Gy in RS01

Assumption 1   Assumption 2

Suggestion. Factor 3 safety =>   DUMP THRESHOLD ~ 3 x Tdd ~ 7500 BITS = 0.015 Gy