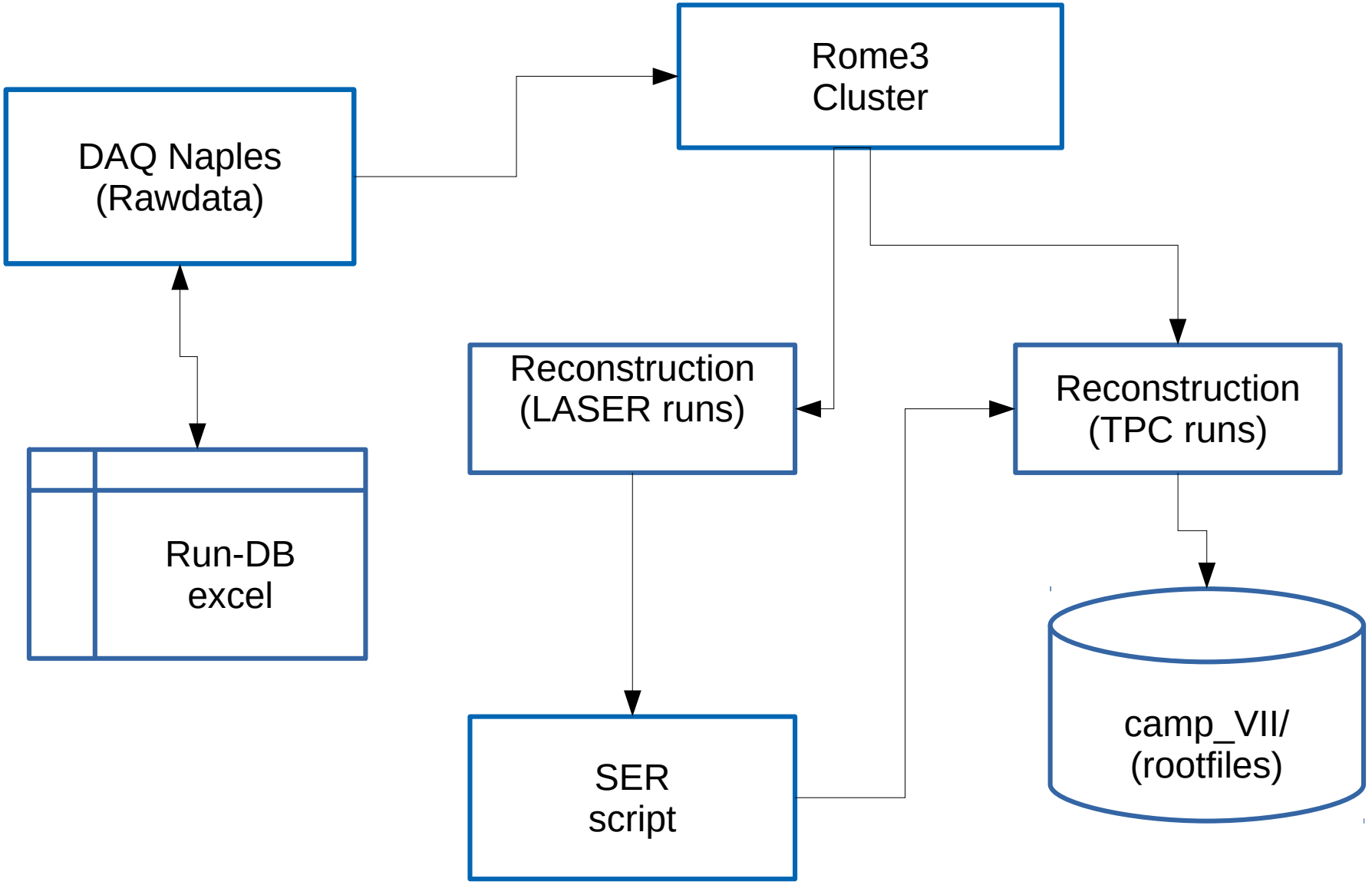
TPC performance I: SER, S1, LY (Facts and Opinions)

Nicola Rossi

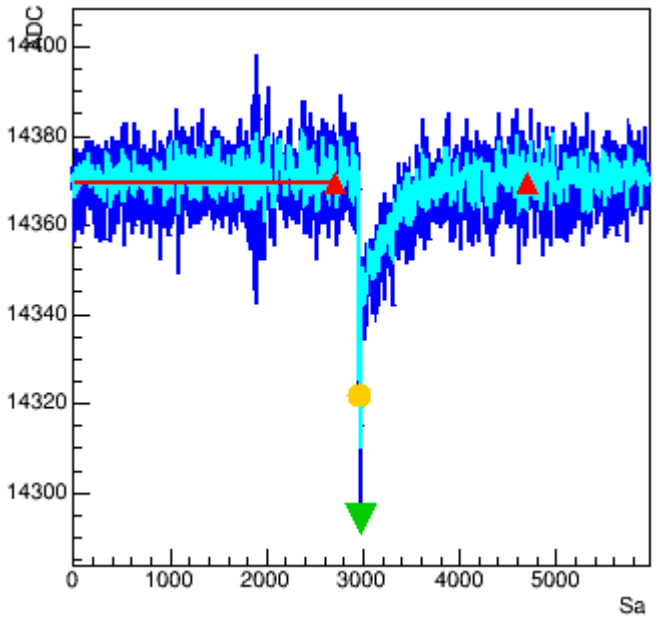
ReD – Face to face meeting

19-29 Dec 2018

Reconstruction Chain



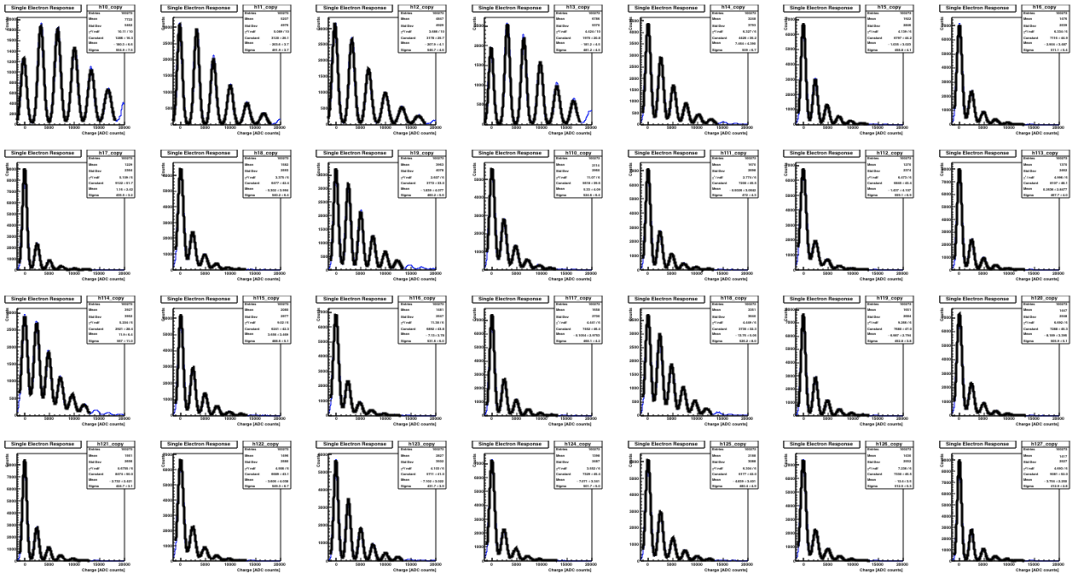
SER Charge and aplitude

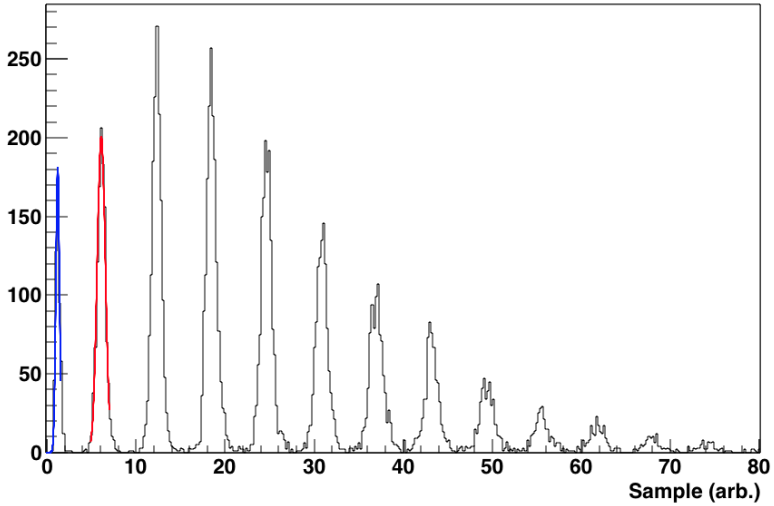


- DAQ window (20 us)
- pretrigger ~4us
- integration ~
- comb of independent Gaussian fit

S/N >~ 5
Mu/Sigma >~ 1/6

Charge spectrum





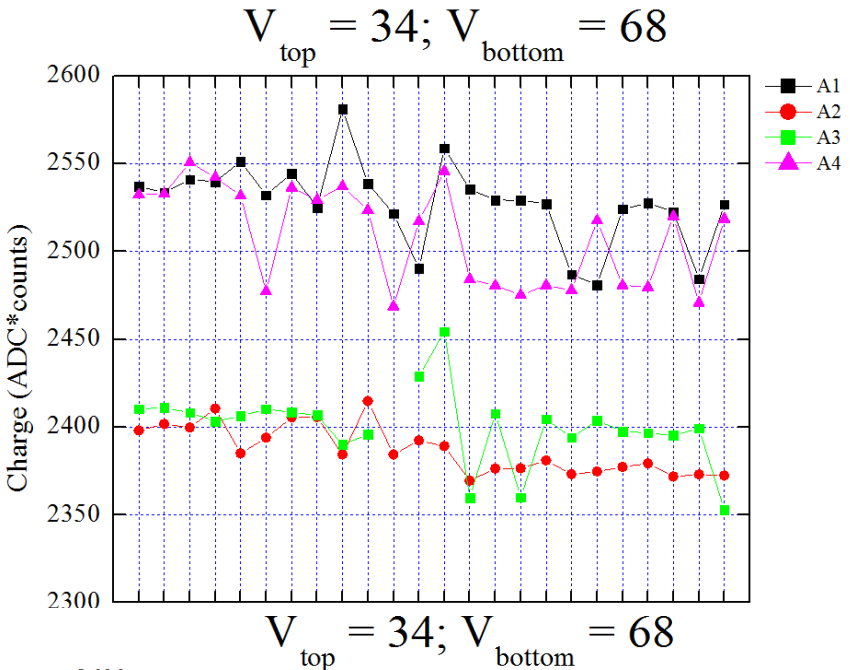
Amplitude Spectrum

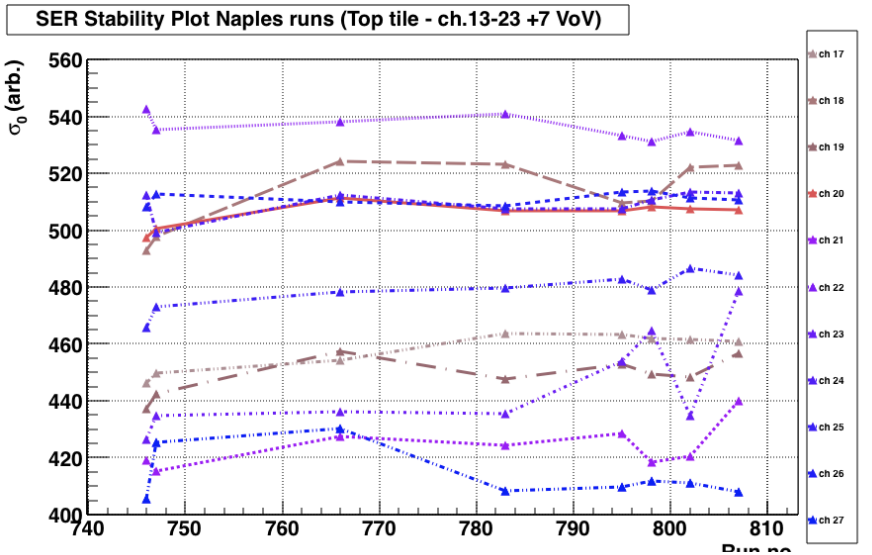
→Matched filter

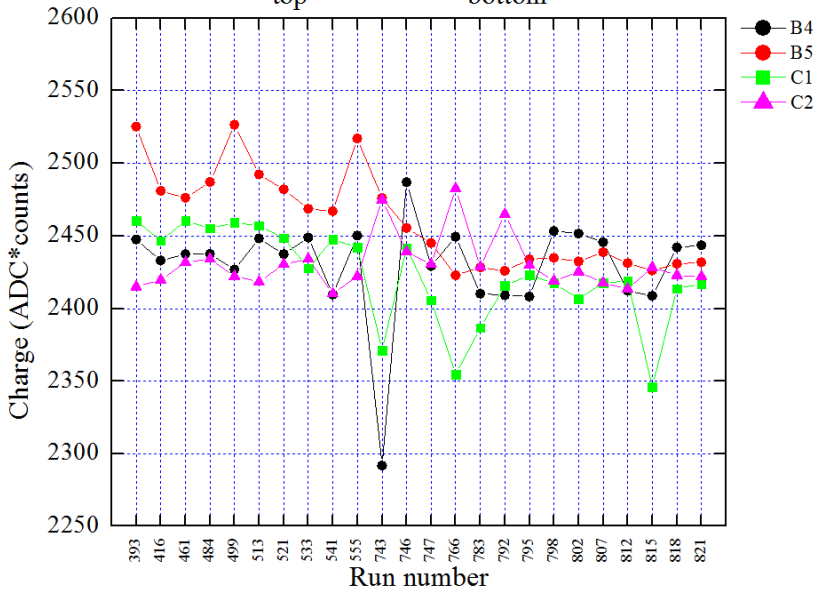
SER Stability

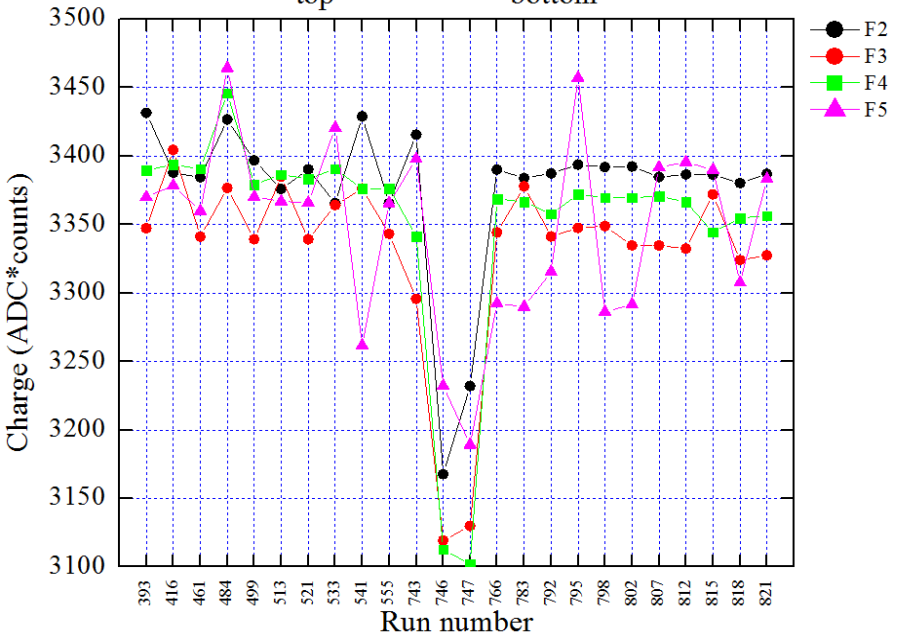
→ Vlad

→ Simone

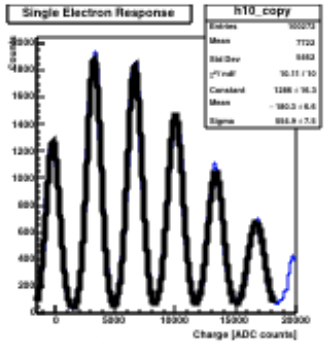








Vinogrado's Anlysis



$$K_{dup} = \frac{p}{1-p}$$

$$E[X] = L(1 + K_{dup})$$

$$Var[X] = L(1 + K_{dup})(1 + 2K_{dup}) = FE[x]$$

$$f_k = \frac{\int G(k)}{\text{Total}}$$

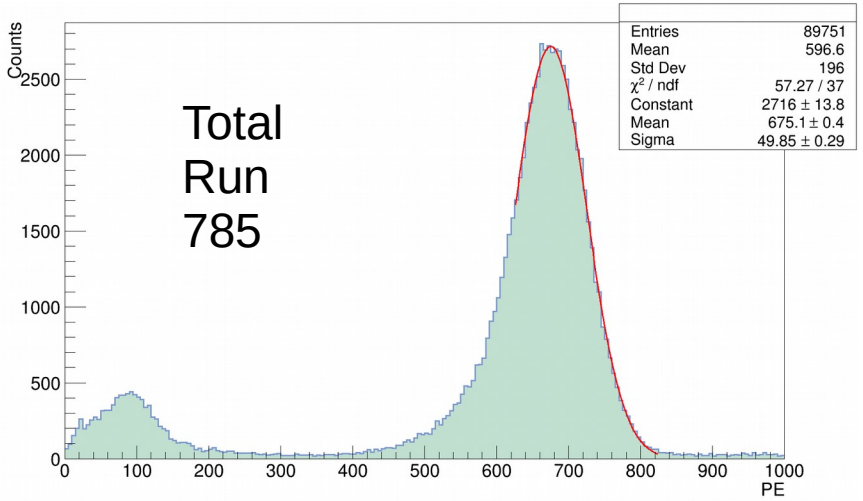
Likelihood fit to the Vinogradov's Model
→ L, p

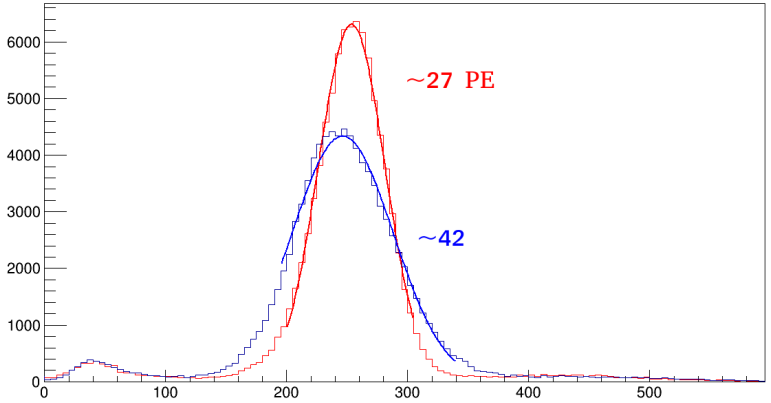
K_{dup} = average PE per real PE

Here K_{dup} is an effective parameters that accounts for:
- cross-talks
- delayed cross talk
- after-pulses

… in the 4 us integration window because we are doing a "charge" analysis

LY and top/bottom asymmetry (^{241}Am)





DEFINITIONS

Gross LY = Mu/E_{am}

Net LT = $Mu/(E_{am}(1+K_{dup}))$

Simple resolution Model

$$\sigma(PE)^2 = PE \times LY (1 + K_{dup}) (1 + 2K_{dup}) \times (1 + r_{SPE}^2) + \sigma_{baseline}^2$$

Top/Bottom Analysis vs OV

Am 241 source runs with different OV

Likelihood

TOTAL	VOV (+)	mu	sigma	Kdup (SER)	LY gross	LY net	Resolution	Fano	Expected Fano	Fano Ratio	p Vinog.
779	5,00	505,75	37,93	0,19	8,50	7,14	7,50	2,90	1,38	2,10	**0,16**
782	6,00	559,30	40,83	0,27	9,40	7,40	7,30	3,10	1,54	2,01	**0,21**
785	7,00	672,35	49,75	0,40	11,30	8,07	7,40	3,70	1,80	2,06	**0,29**
789	8,00	773,50	56,47	0,55	13,00	8,39	7,30	4,20	2,10	2,00	**0,35**

	VOV (+)	mu	sigma	Kdup (SER)	LY gross	LY net	Resolution	Fano	Expected Fano	Fano Ratio	p Vinog.
TOP	5,00	254,10	26,90	**0,19**	4,27	3,59	0,11	**2,85**	1,38	2,06	**0,16**
	6,00	292,7	30,30	**0,26**	4,92	3,90	0,10	**3,14**	1,52	2,06	**0,21**
	7,00	337,80	34,20	**0,43**	5,68	3,97	0,10	**3,46**	1,86	1,86	**0,30**
	8,00	390,9	39,50	**0,48**	6,57	4,44	0,10	**3,99**	1,96	2,04	**0,32**
BOTTOM	5,00	244,20	43,10	**0,19**	4,10	3,45	0,18	**7,61**	1,38	5,51	**0,16**
	6,00	280,40	51,20	**0,27**	4,71	3,71	0,18	**9,35**	1,54	6,07	**0,21**
	7,00	322,40	59,00	**0,36**	5,42	3,98	0,18	**10,80**	1,72	6,28	**0,26**
	8,00	369,80	68,70	**0,58**	6,22	3,93	0,19	**12,76**	2,16	5,91	**0,37**

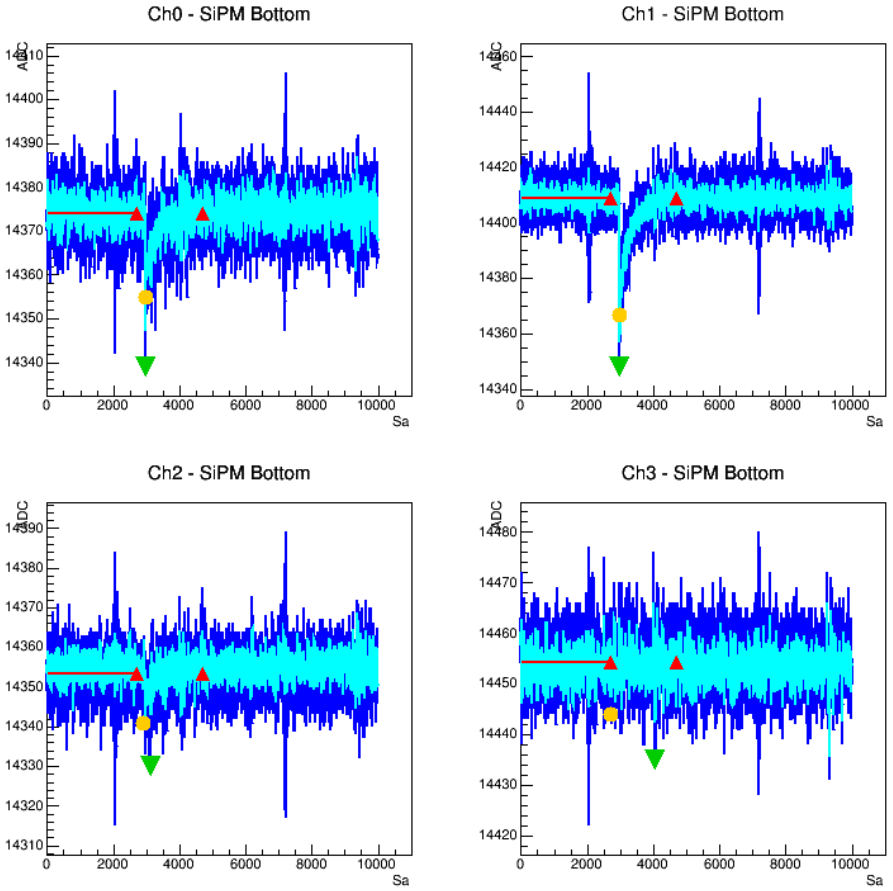
K_{dup} is the average of bot and top channels

Discrepancy between Fano Expected and Deduced by Laser runs:

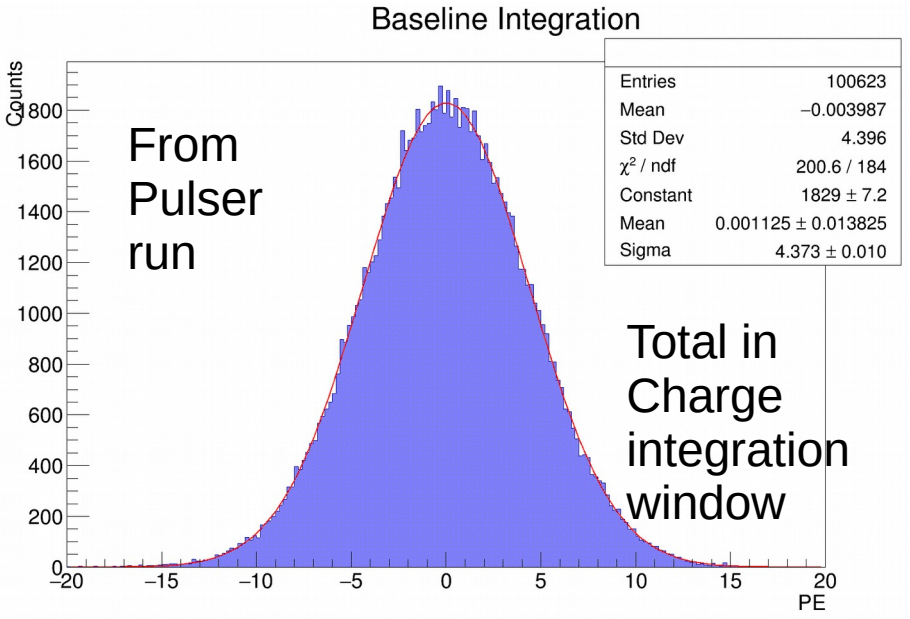
- TOP: factor x2
- BOTTOM: factor x6

Resolution changed
From 11% (Catania) to 7.5% (Naples)

About the baseline noise

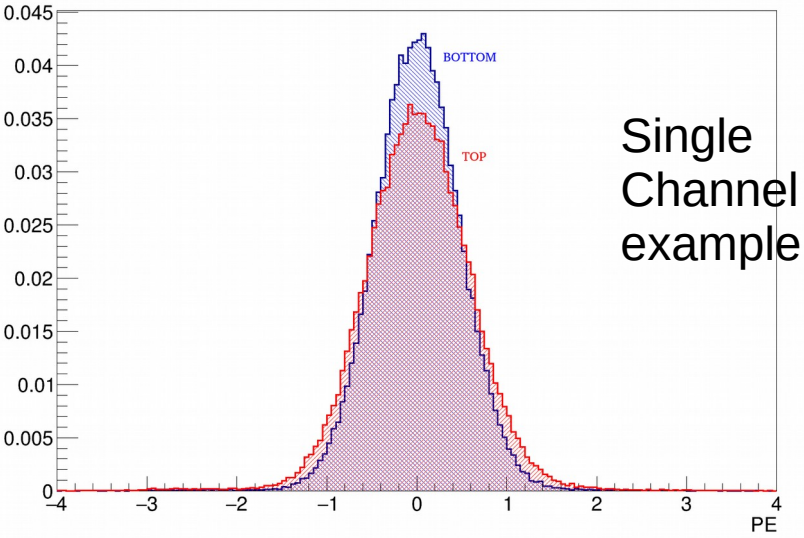


BOTTOM
Persistent baseline noise



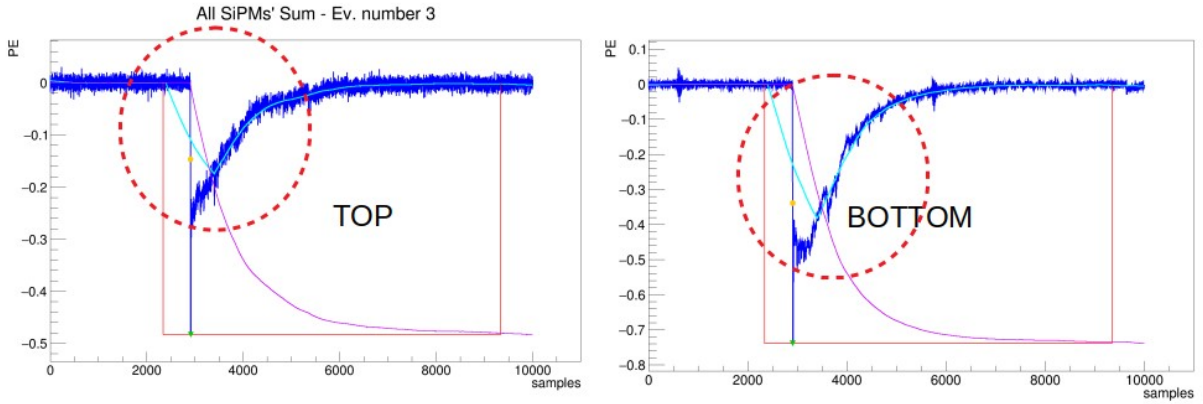
From Pulser run

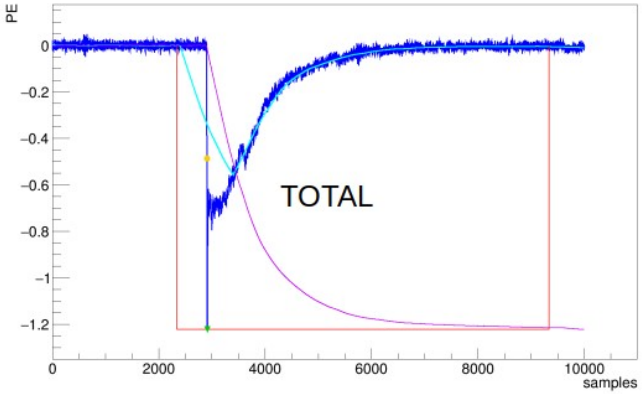
Total in Charge integration window



Single Channel example

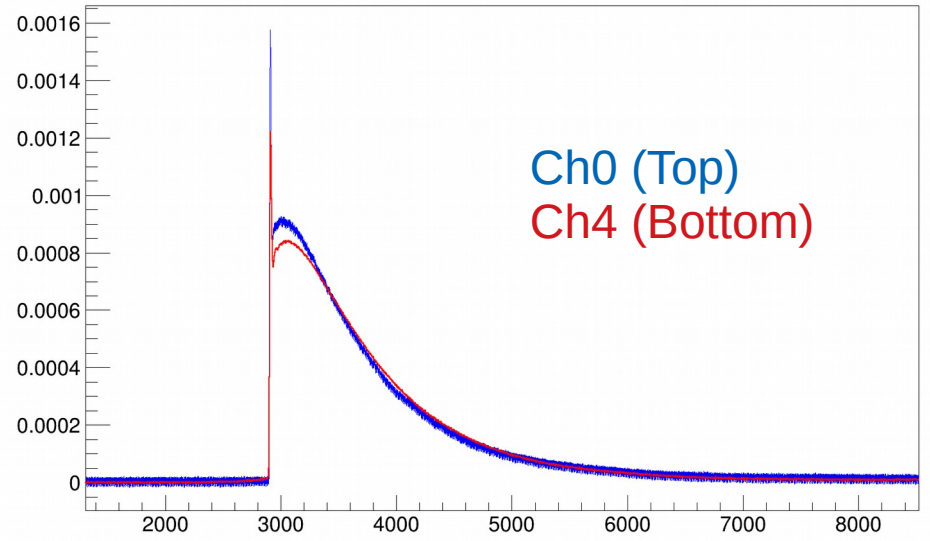
Average WF top/bottom



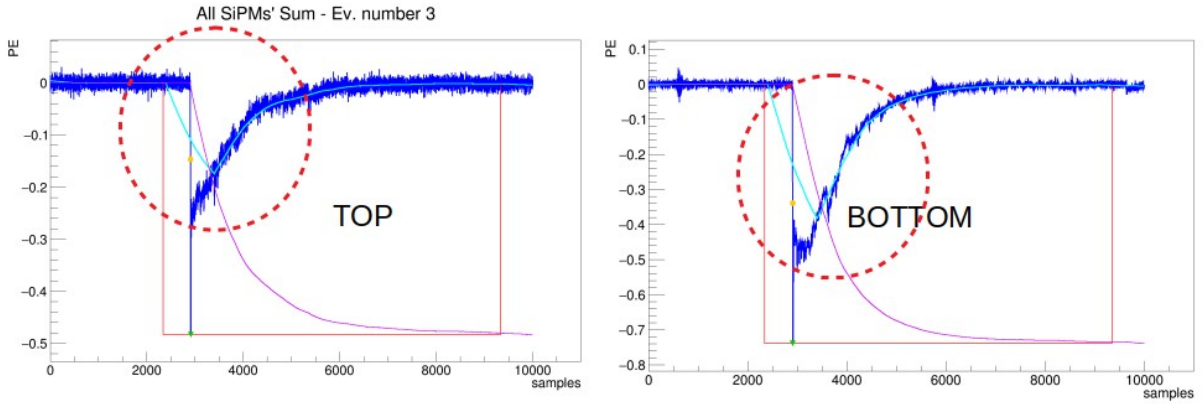


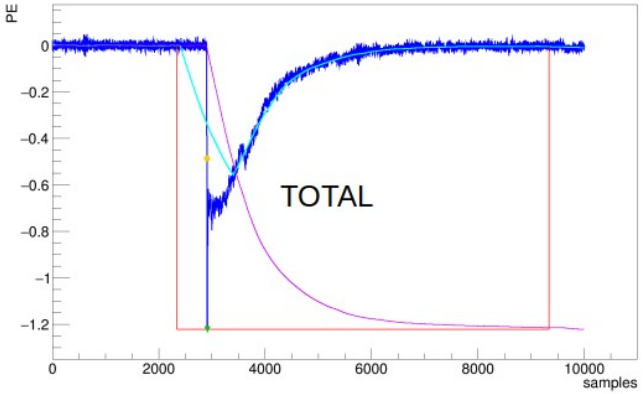
An example: wf from run 785 (^{241}Am)

Average of 10.000 Wfs
Around the Am241 peak
from run 785



Average WF top/bottom





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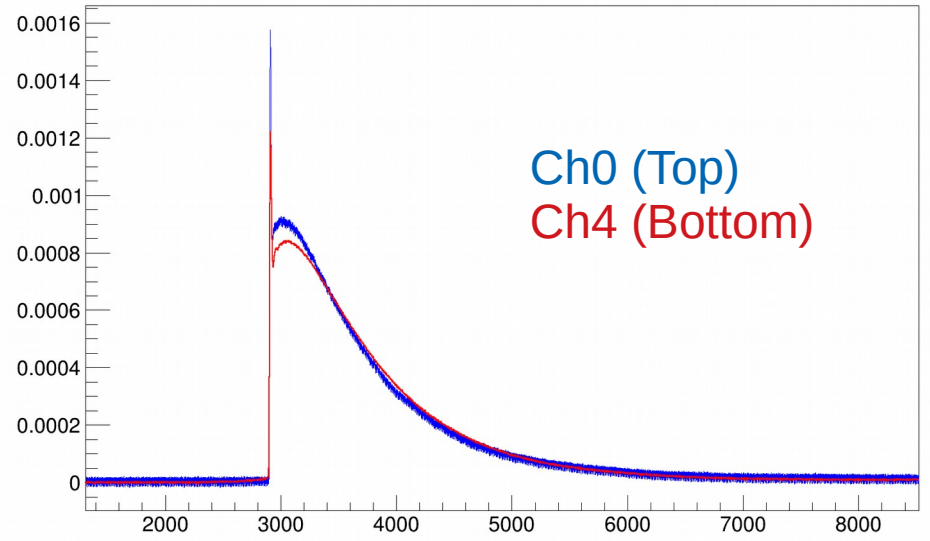
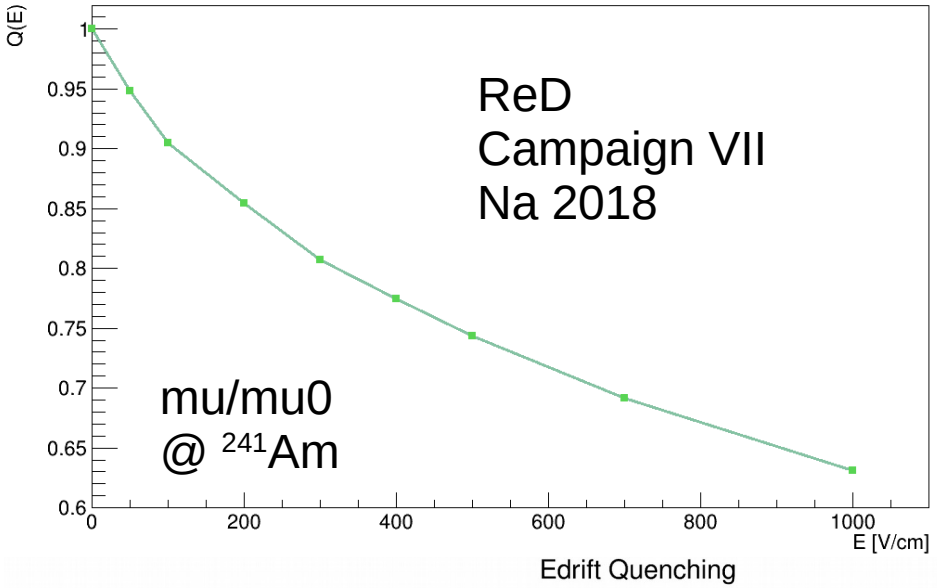


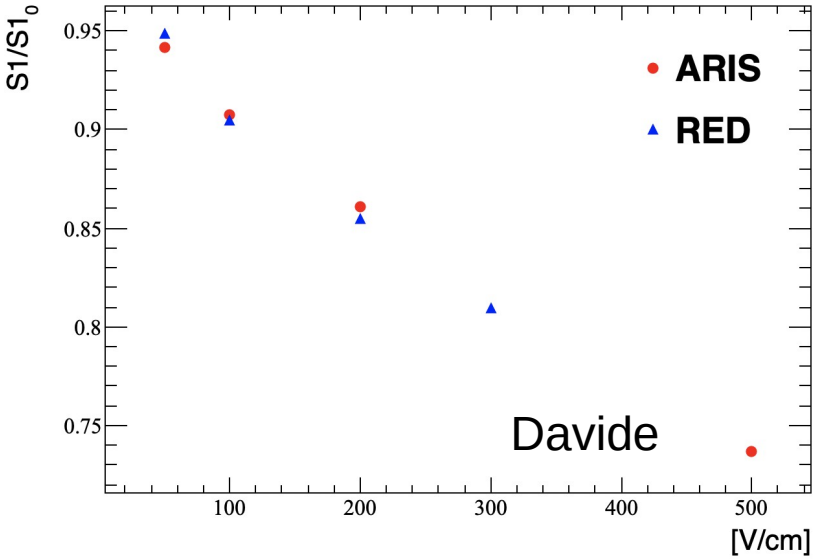
Possible issue

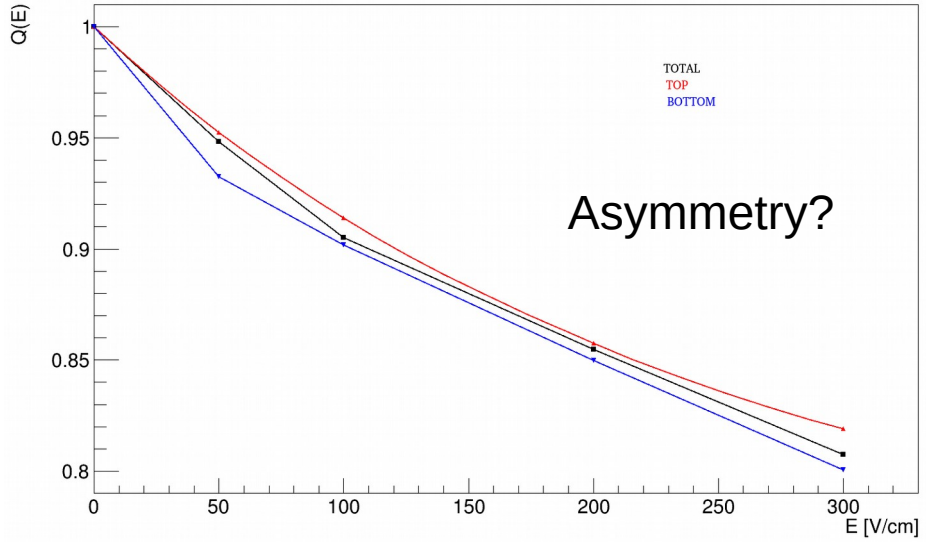
- Noise?
- SPE resolution?
- Optical cross talk
- Positive correlations among channels?
- TPB and Geometry? (→ Maximo) (source position, I_bias)
- Non linear dependency of K_{dup} upon the total light

- **!!! BUG IN THE RECONSTRUCTION CODE !!!**

Quenching VS E_{drift}







fdoke_vs_field