

17.05.2019



BGO Test @GSI 04-09/04

FOOT Meeting

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Setup @GSI



	Setup
Tile	15 μm
Wrapping	Reflective Paint
Board	V1
Digitizer	62.5 MHz $V_{pp} = 10 \text{ V}$ 12 bits
Trigger	Self-Trigger/External
Beam Energy	400 MeV/u

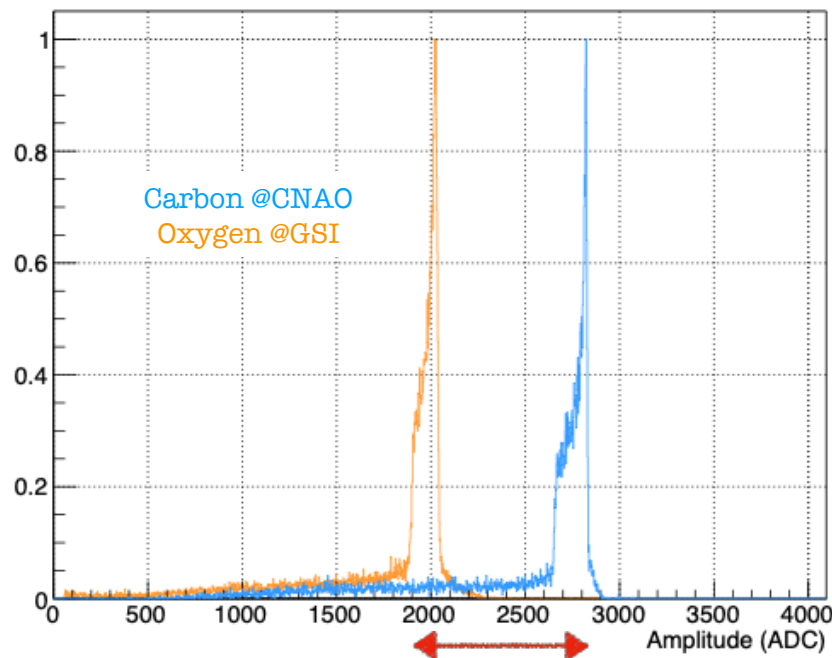


Amp & Charge Distribution

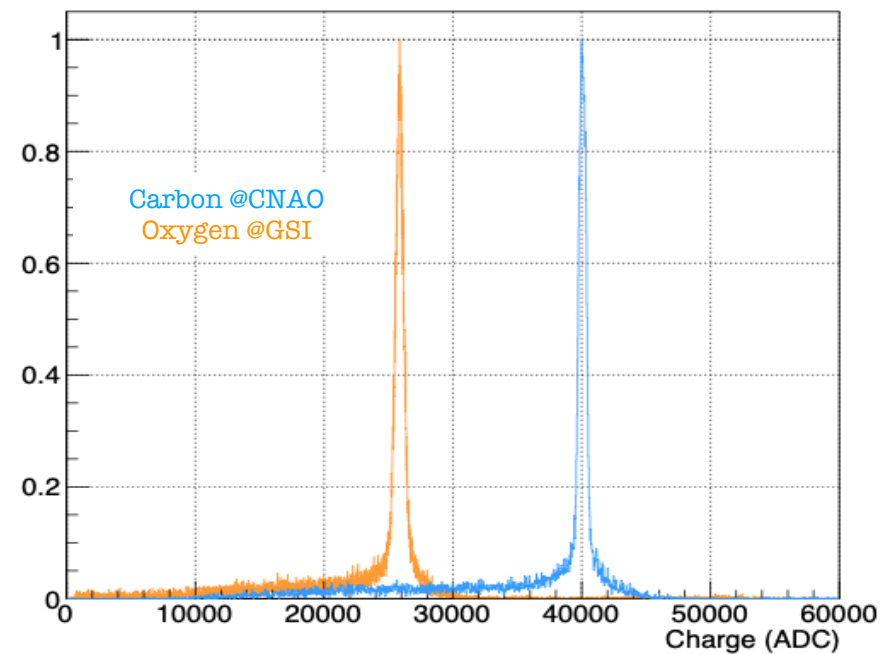


400 MeV/u

Amplitude Distribution



Charge Distribution



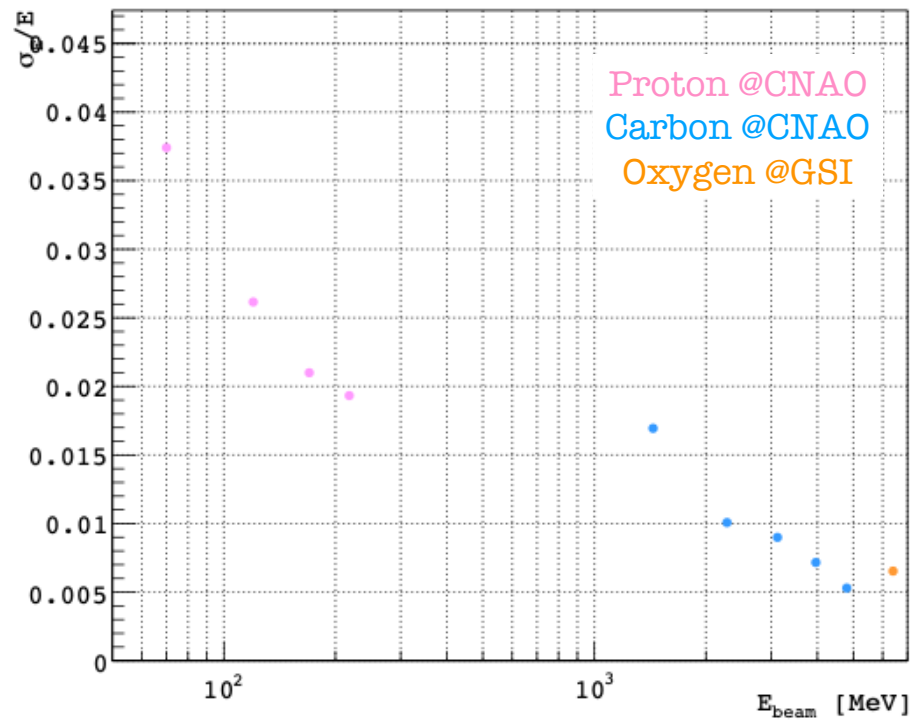
- Different HV
- Detectors in front of BGO

HV @CNAO = 34 V
HV @GSI = 33 V

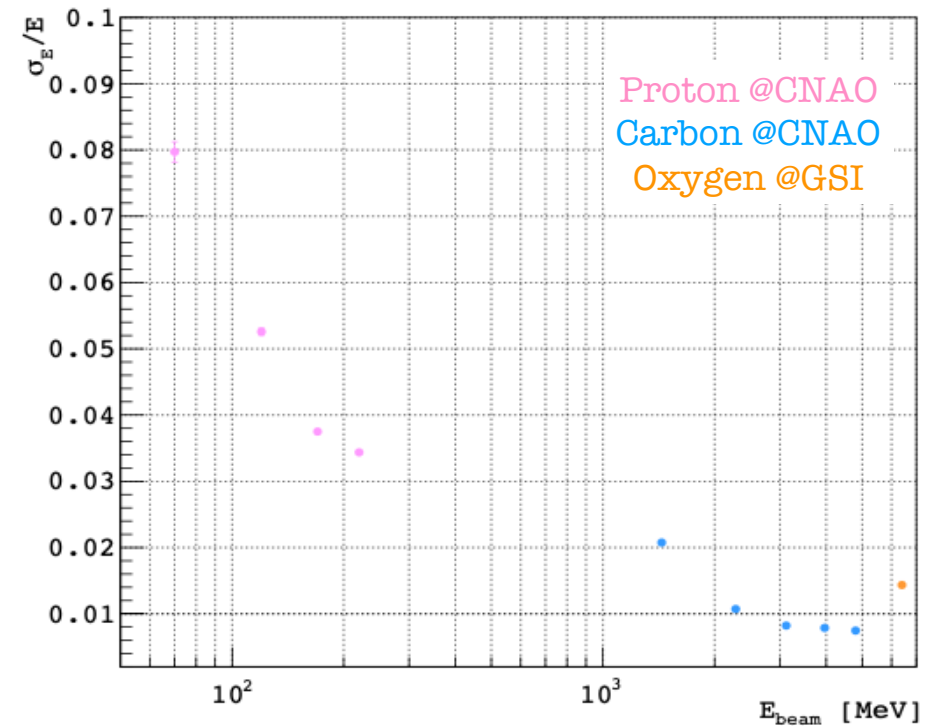
Energy Resolution



Amplitude Analysis



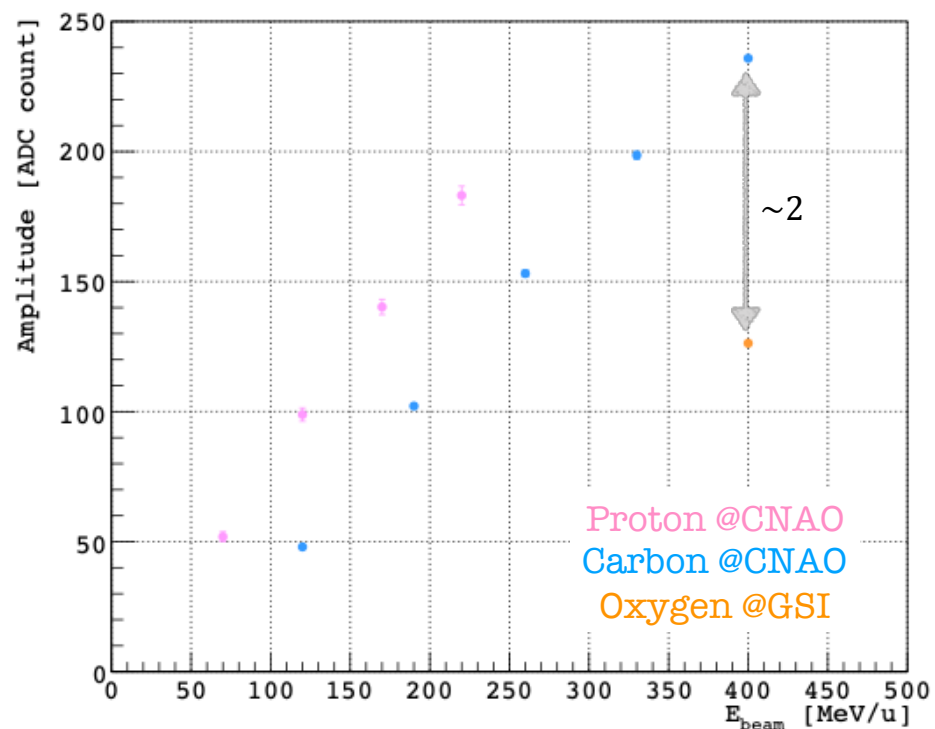
Charge Analysis



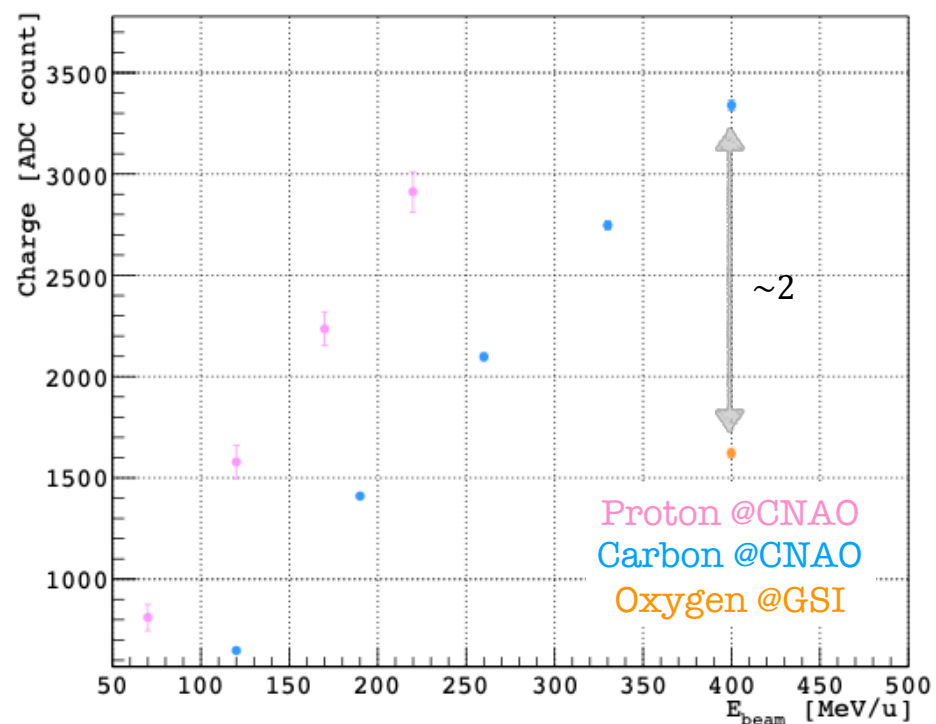
Linearity



Amplitude Analysis



Charge Analysis



Digitizer Test



Digitizer **V1742** CAEN

12 bits

1 Ghz

1024 samplings

$V_{pp} = 1\text{ V}$

Digitizer **V1740** CAEN

12 bits

62.5 Mhz

1024 samplings

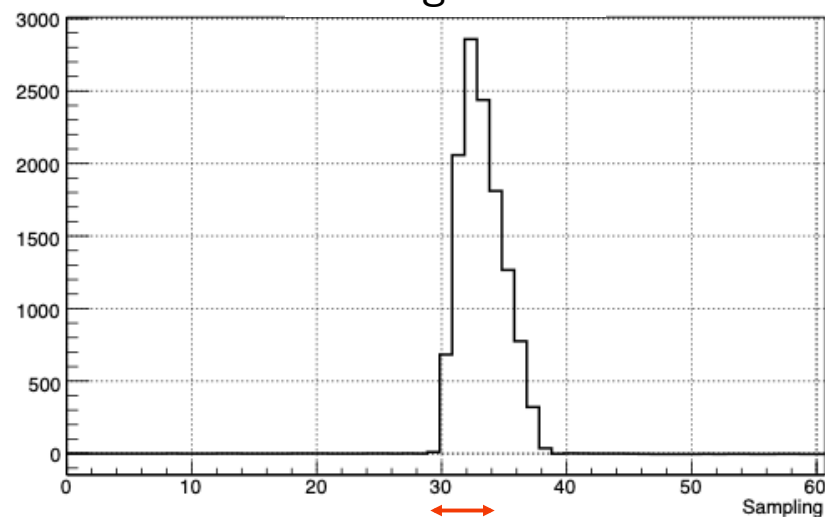
$V_{pp} = 10\text{ V}$



Test on V1740

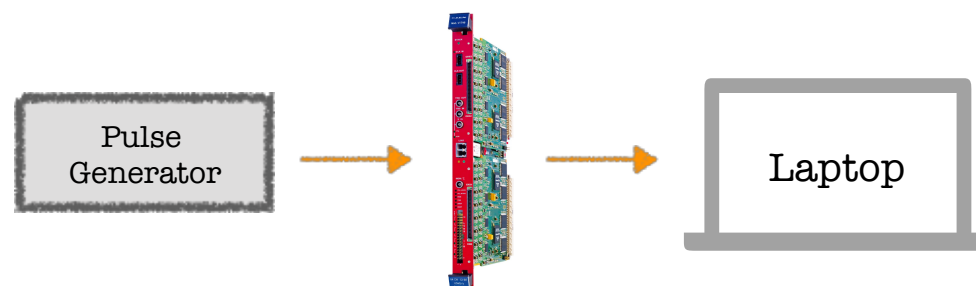


Signal

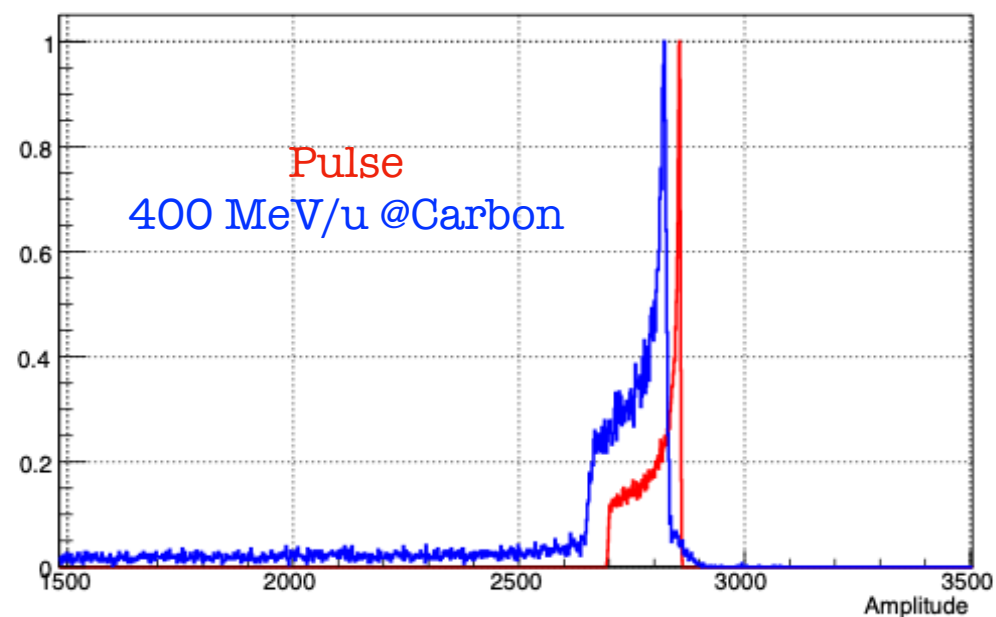


Rising time: 40 - 50 ns

Pulse sent from pulse generator to the Digitizer



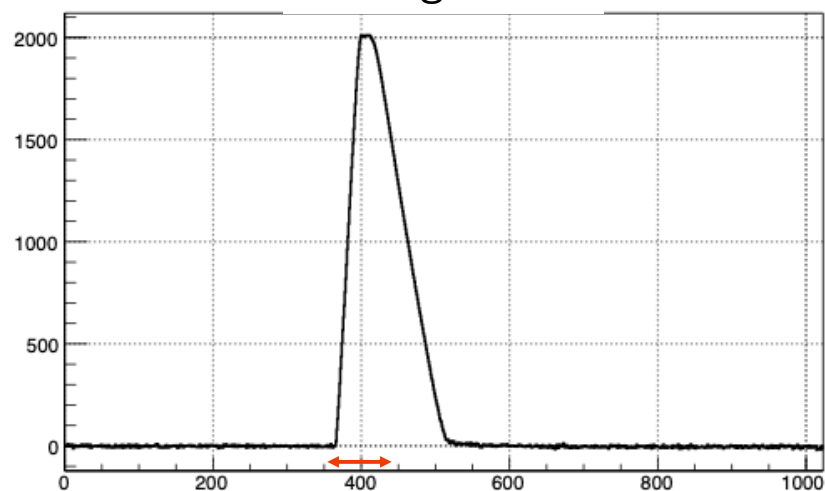
Amplitude Distribution



Test on V1742

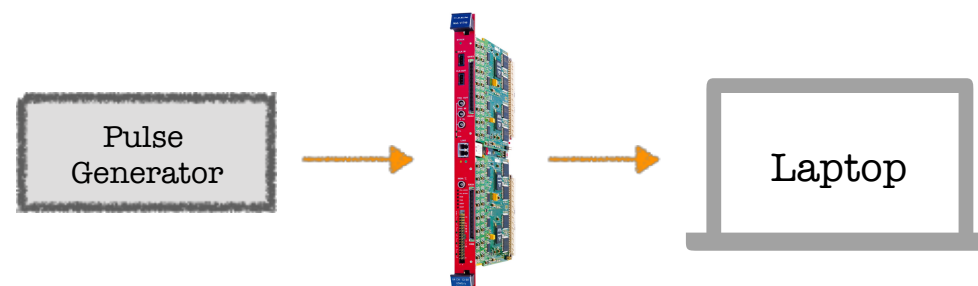


Signal

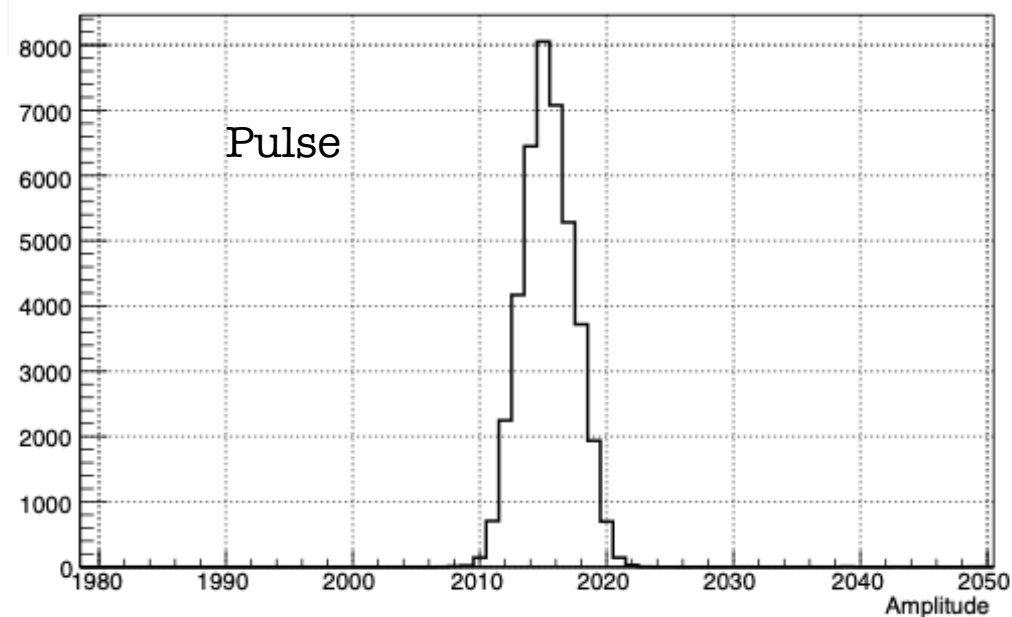


Rising time: 40 - 50 ns

Pulse sent from pulse generator to the Digitizer



Amplitude Distribution





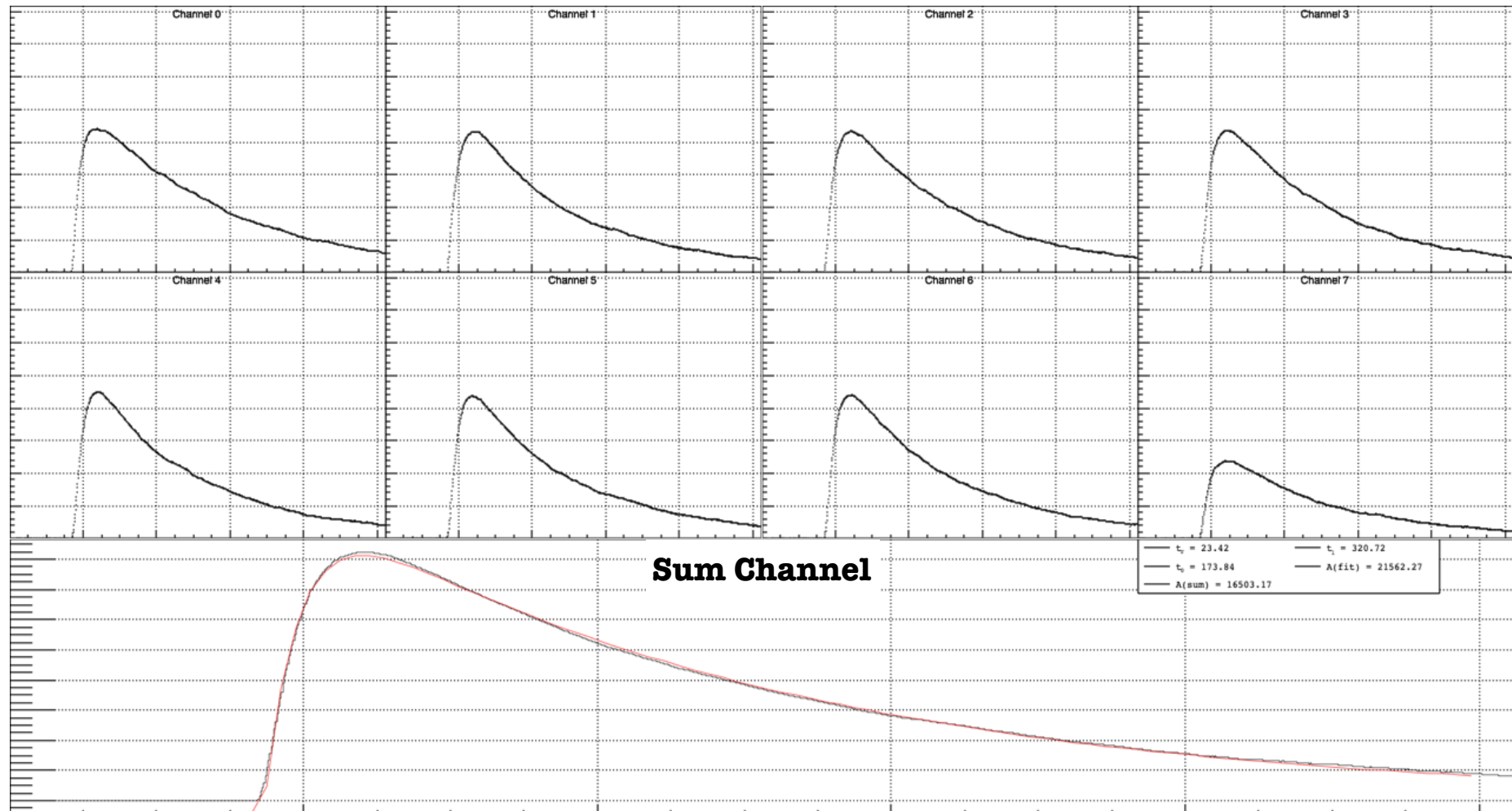
BackUp Slides

Signal with board_v0

Carbon 400 MeV/u

October

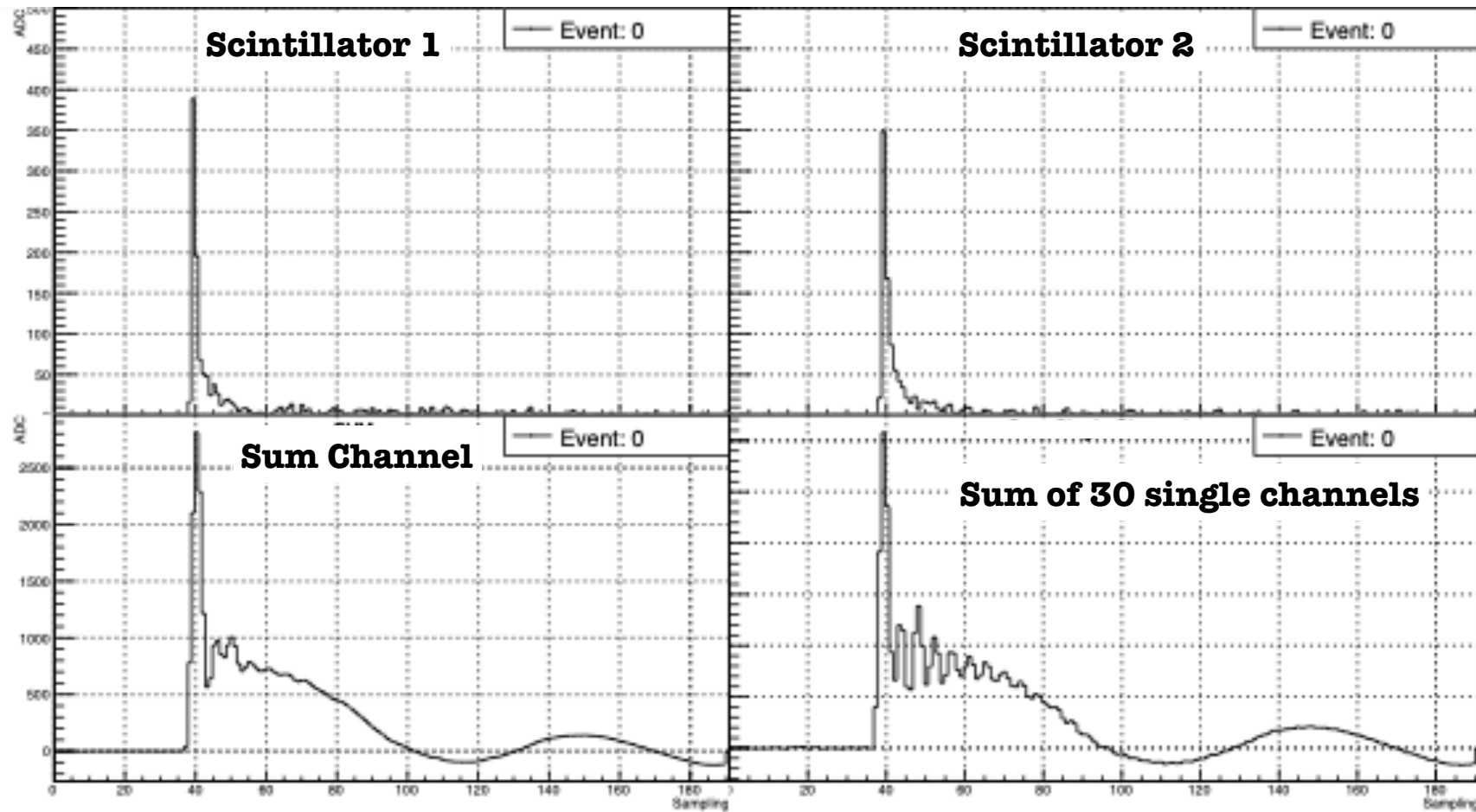
Signals from FAN OUT



Signal with board_V1

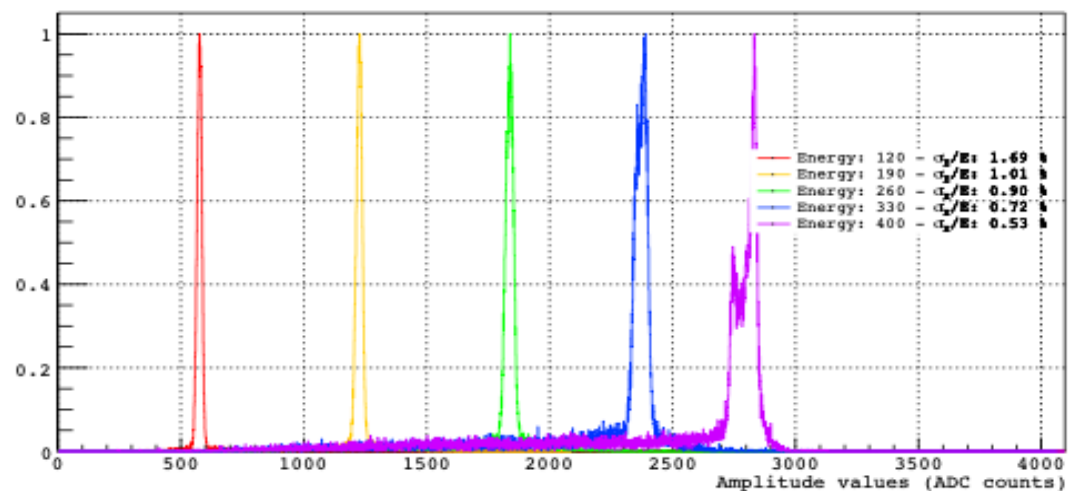
Carbon 400 MeV/u

March



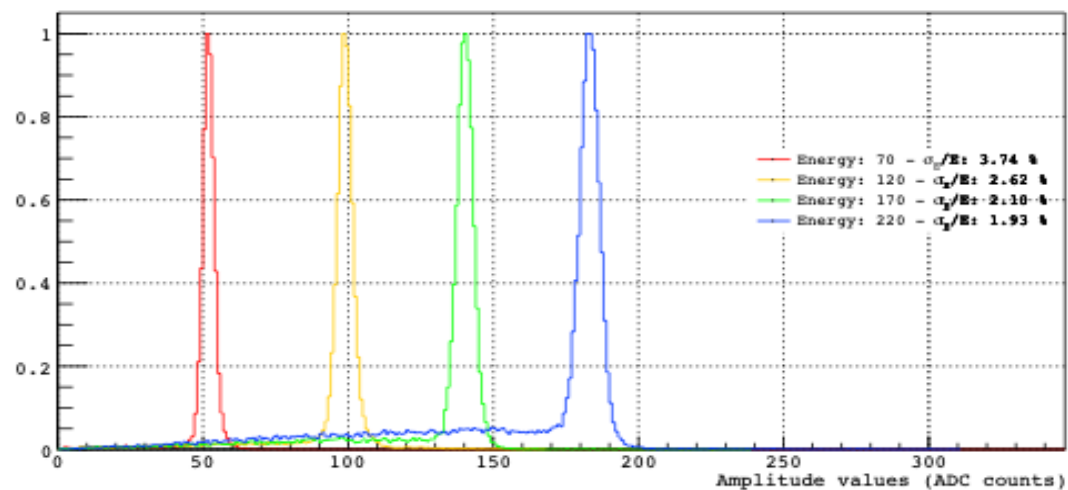
Amplitude Analysis

Amplitude Analysis - Carbon



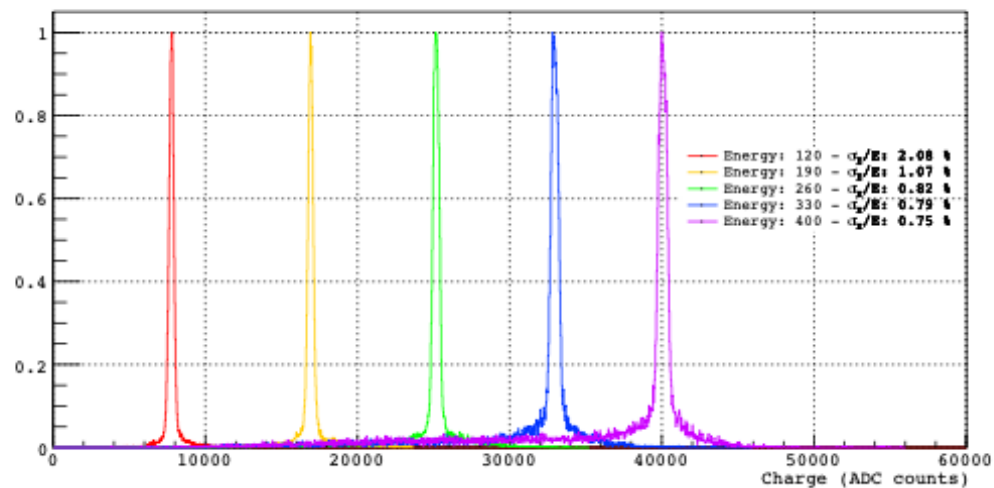
March

Amplitude Analysis - Proton



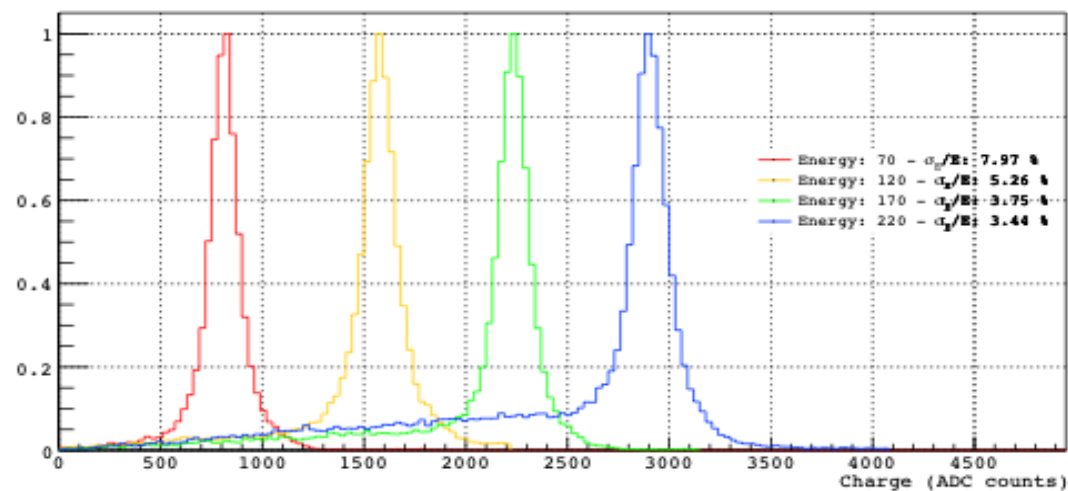
Charge Analysis

Charge Analysis - Carbon



March

Charge Analysis - Proton



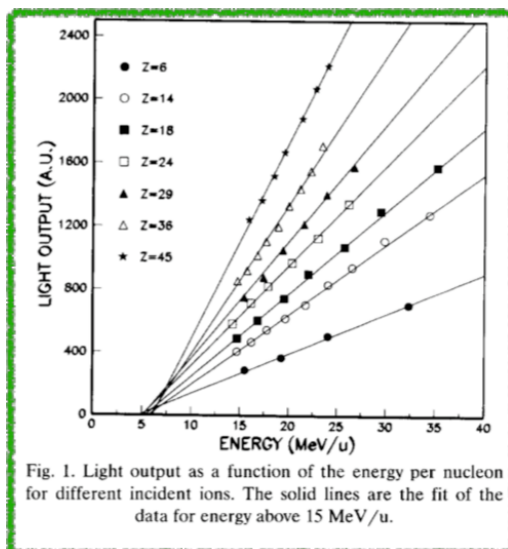
Linearity



15 μm

March

“Calibration of CsI(Tl) scintillators for heavy ions ($3 \leq Z \leq 54$) in a wide energy range ($E/u \leq 60 \text{ MeV/u}$)”,
P. Mastinu, P. Milazzo, M. Bruno, M. D’Agostino, L. Manduci



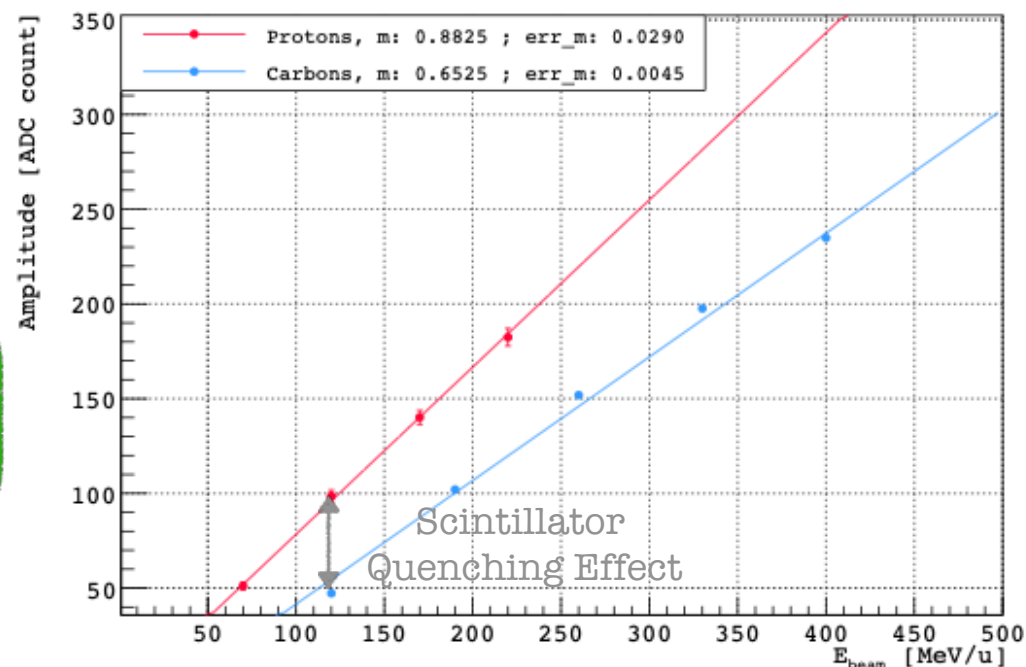
Birks Formula

$$dL/dx = \text{const} \cdot dE/dx / (1 + k_B \cdot dE/dx)$$

where:

- **k** is the Quenching Parameter
- **BdE/dx** is the density of quenching centres per unit distance

Linearity - Amplitude Analysis - 15 μm SiPM array



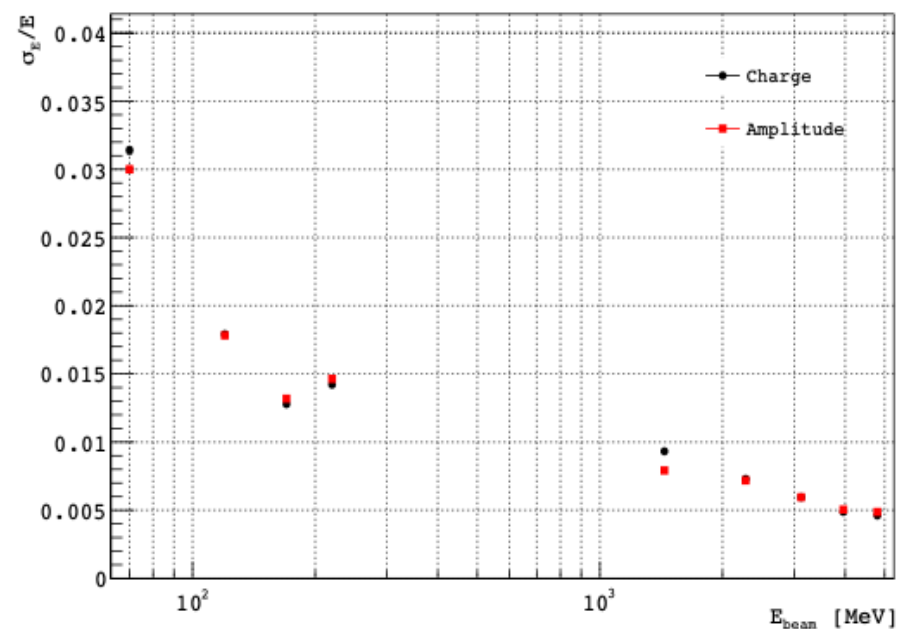
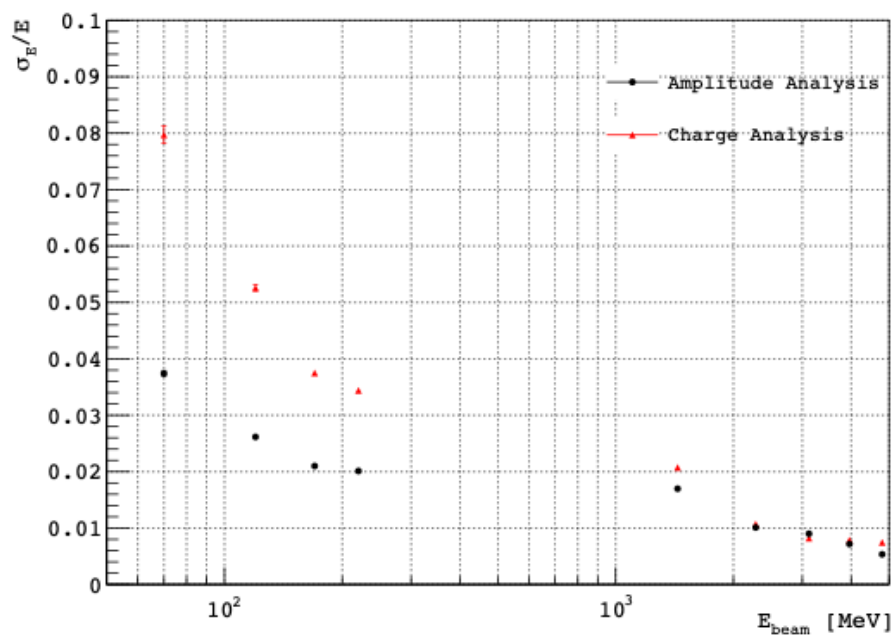
Energy Resolution



March

Comparison between Amplitude & Charge Analysis:

October



SiPMs parameters



SiPM Type			# SPADs		Fill Factor (%)		Capacitance (≈)	
Technology	Cell size (μm)	SiPM size (mm ²)	1 mm ²	SiPM	Single SPAD	SiPM	pF/mm ²	SiPM (pF)
RGB-HD	15	16	3832	61314	54	52	40	620
RGB-HD	20	16	2158	34532	65	60	40	620
NUV-HD	30	36	1122	40410	77	71	35	1260

