Boiling Runs

Boiling runs: 1513-1530

HMS = 12.493 deg
SHMS = 36.88 deg
NPS = 20.58 deg

Calo HV Off, Sweep Magnet Off, EDTM = 100 Hz

RunNo	Target	ps-factor	Current	duration(s)
1513	LH2	ps3=1	5	868
1514	LH2	ps4=1	5	634
1515	LH2	ps4=3	10	735
1516	LH2	ps4=5	15	706
1517	LH2	ps4=9	25	962
1518	LD2	ps4=65	40	872
1519	LD2	ps4=33	25	659
1520	LD2	ps4=33	18	727
1521	LD2	ps4=17	10	599
1522	LD2	ps4=9	5	639
1523	0.5C	ps4=9	35	489
1524	0.5C	ps4=5	35	666
1525	0.5C	ps4=5	40	690
1526	0.5C	ps4=5	25	702
1528	0.5C	ps4=3	15	747
1530	0.5C	ps4=1	5	928

Boiling Runs

Target	RunNo	ps4	Pre-scale	Current (μA)	Duration (min)	Events	Events*ps (k)
LH2	1514	0	1	5	10	1023966	1024
	1515	2	3	10	10	912408	2736
	1516	3	5	15	10	751598	3758
	1517	4	9	25	15	811950	7308
LD2	1518	7	65	40	15	521346	33884
	1519	6	33	25	10	485796	16031
	1520	6	33	18	10	289841	9563
	1521	5	17	10	10	328346	5581
	1522	4	9	5	10	345025	3105
Carbon	1523	4	9	35	10	180135	1621
	1524	3	5	35	10	156607	783
	1525	3	5	40	10	187356	937
	1526	3	5	25	10	144809	724
	1528	2	3	15	10	153366	460
	1530	0	1	5	15	190627	190

KinC_x50_2

Boiling Yield Analysis

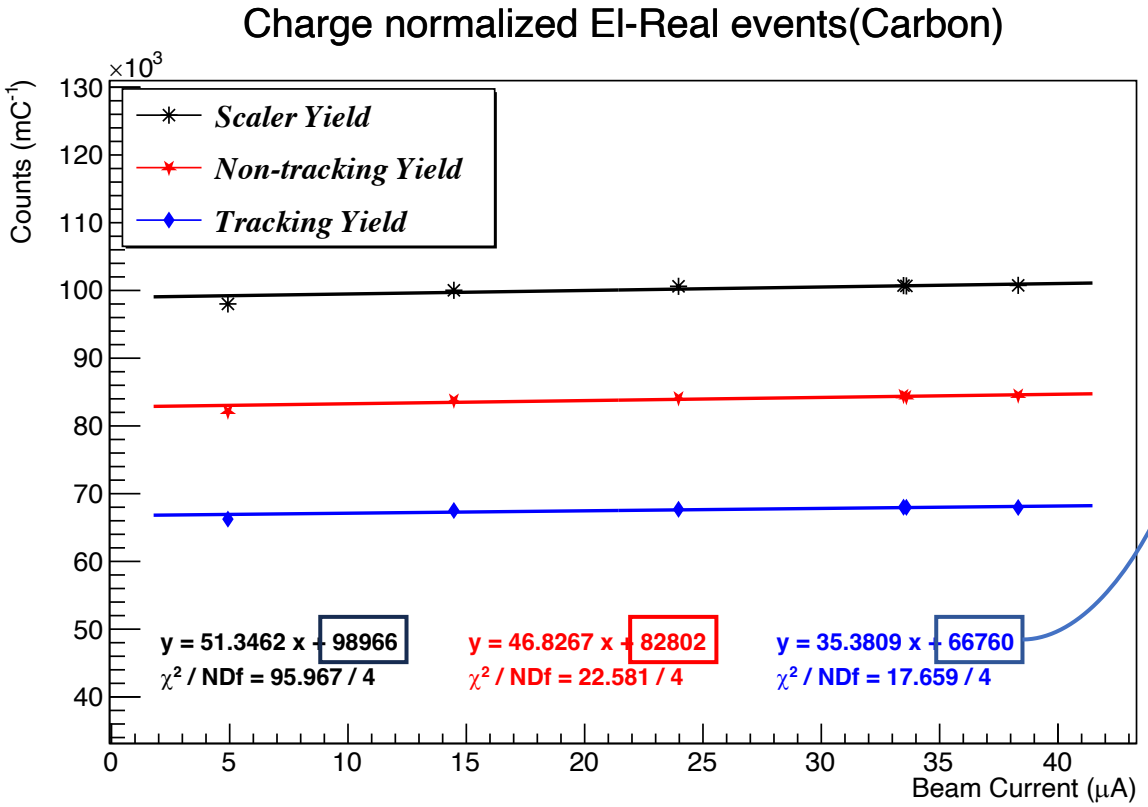
- Fill all the BCM4A scaler current readouts into a 1-D histogram → Gaussian Fitting → Get I and σ
- Use $I - 3\sigma$ μA cut to calculate the charge for each run
- Apply the same cut when selecting El-REAL events

Scaler Yield	Non-tracking Yield	Tracking Yield
$\frac{\text{scaler\_htrig4} - \text{scaler\_edtm}}{\text{charge}}$	$\frac{\#\text{ of events} \times \text{ps-factor}}{\text{charge} \times \text{LT}}$	$\frac{\#\text{ of events} \times \text{ps-factor}}{\text{charge} \times \text{LT} \times \text{track\_eff}}$
Cuts for scaler counting: ➢ Beam current cut	Cuts for event selection: ➢ Beam current cut ➢ Non-edtm ➢ npeSum>2 ➢ 0.6<etotnorm<1.5	Cuts for event selection: ➢ Beam current cut ➢ Non-edtm ➢ npeSum>2 ➢ 0.6<etotnorm<1.5 ➢ $\lvert\text{gtr\_dp}\rvert \leq 10$ ➢ $\lvert\text{vtx\_z}\rvert \leq 4$ ➢ vtx_ok and gtr_ok

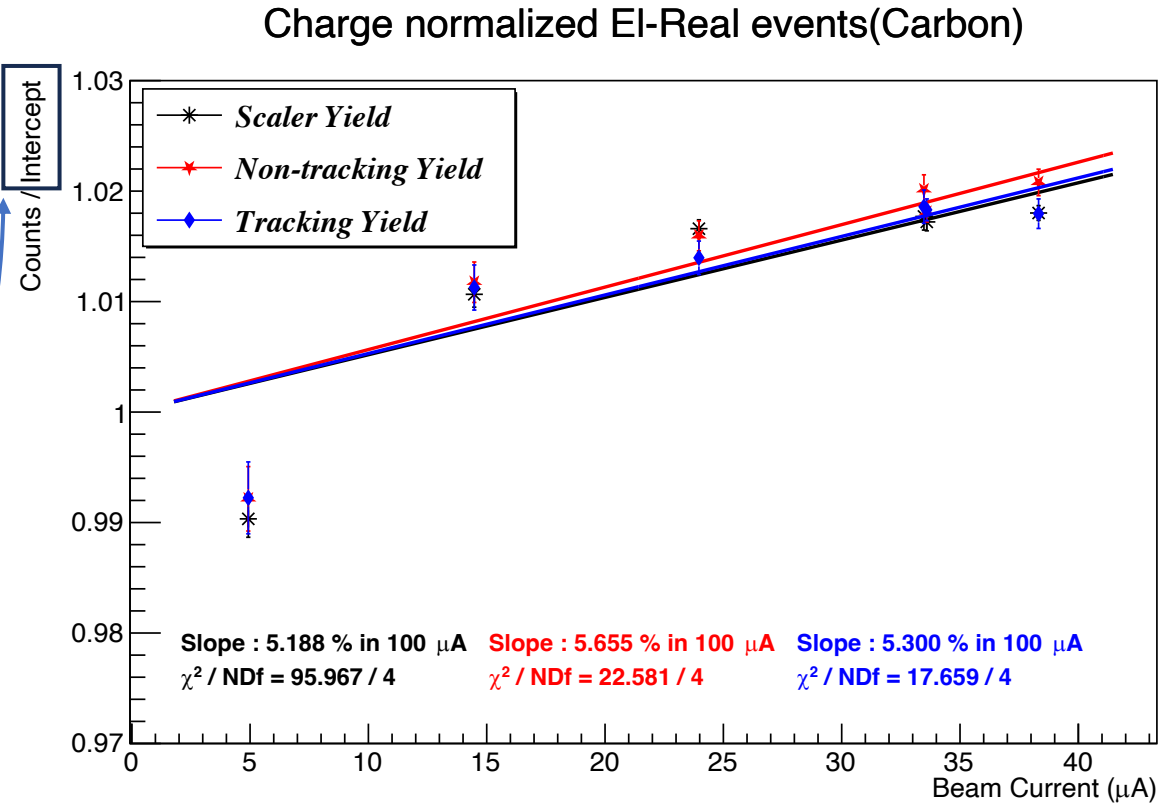
$$\text{LT} = \frac{\#\text{ of events}}{\text{scaler\_htrig4} - \text{scaler\_edtm}} \times \text{ps} - \text{factor}$$

Boiling Yield Analysis

Carbon



First Fitting

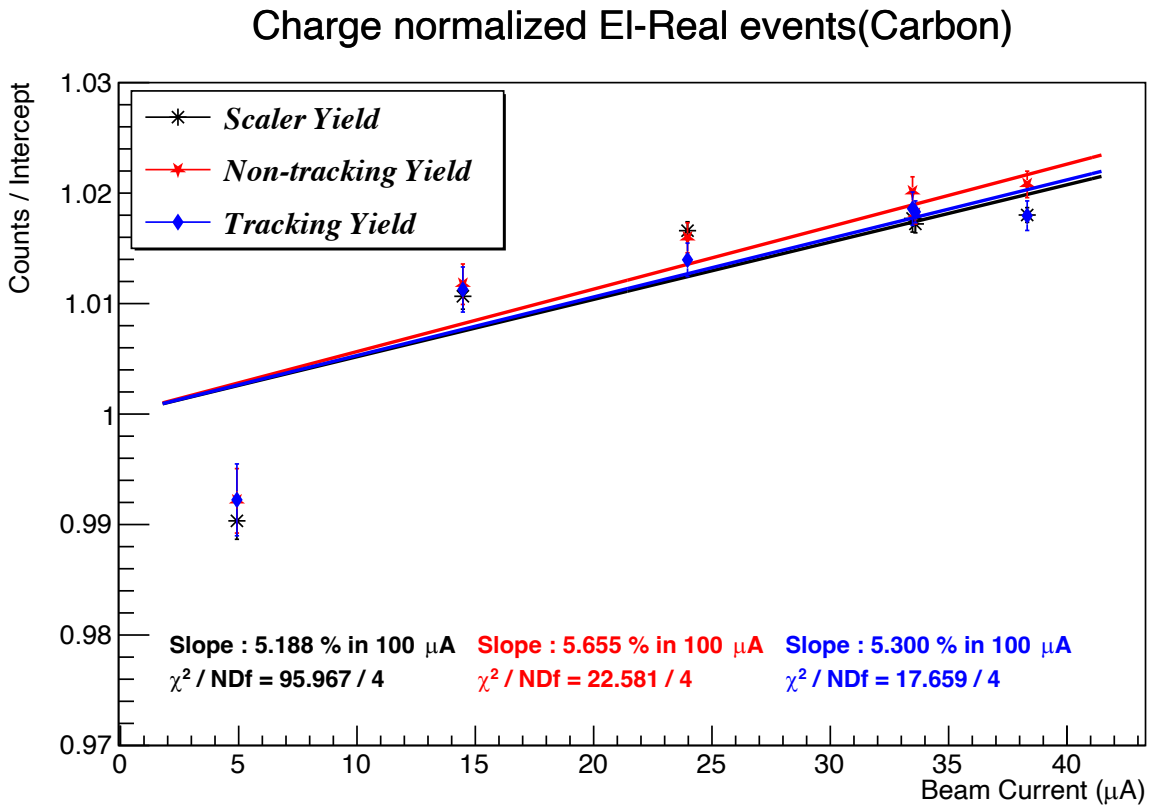


Second Fitting

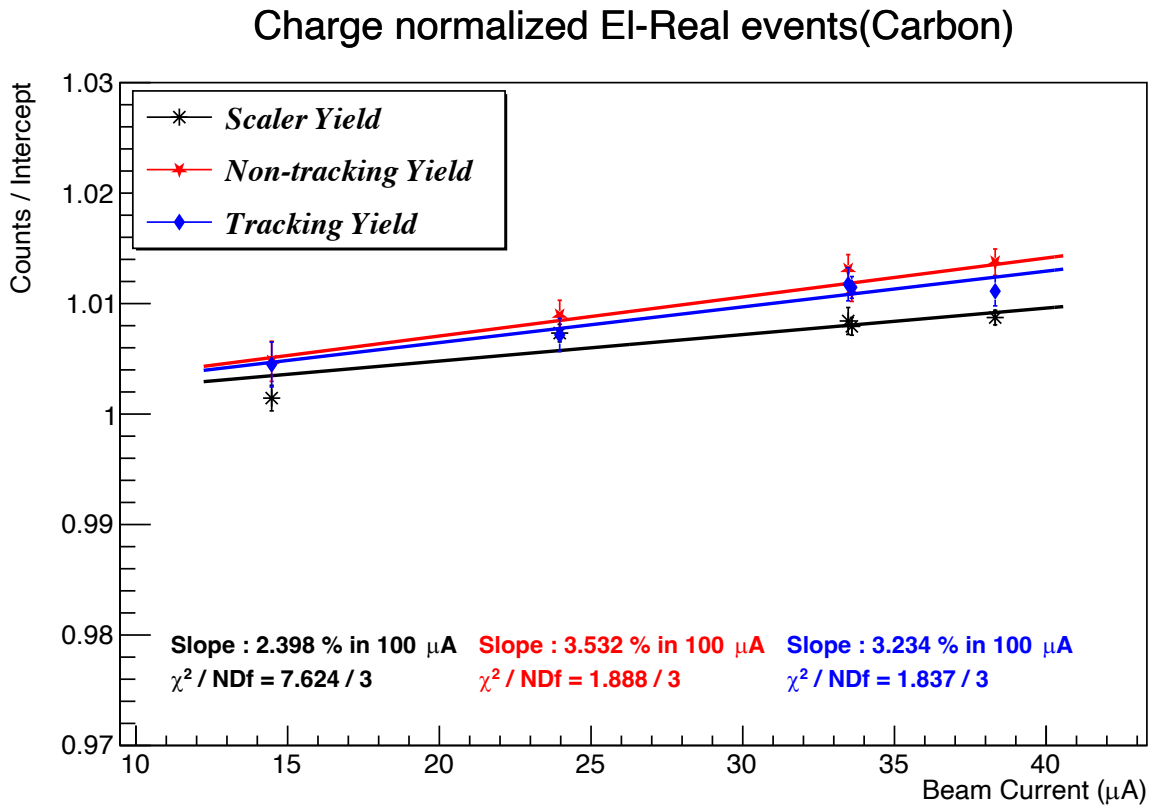
KinC_x50_2

Boiling Yield Analysis

Carbon



With 5 μA run

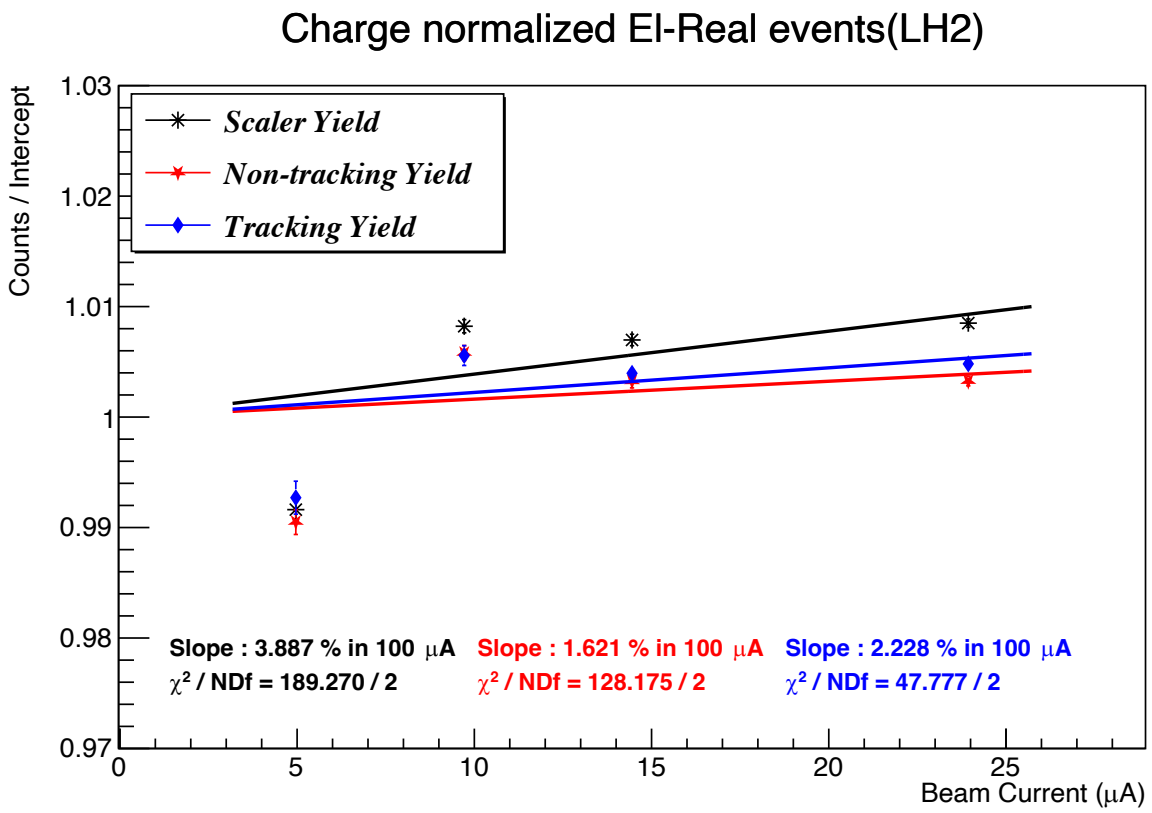


Without 5 μA run

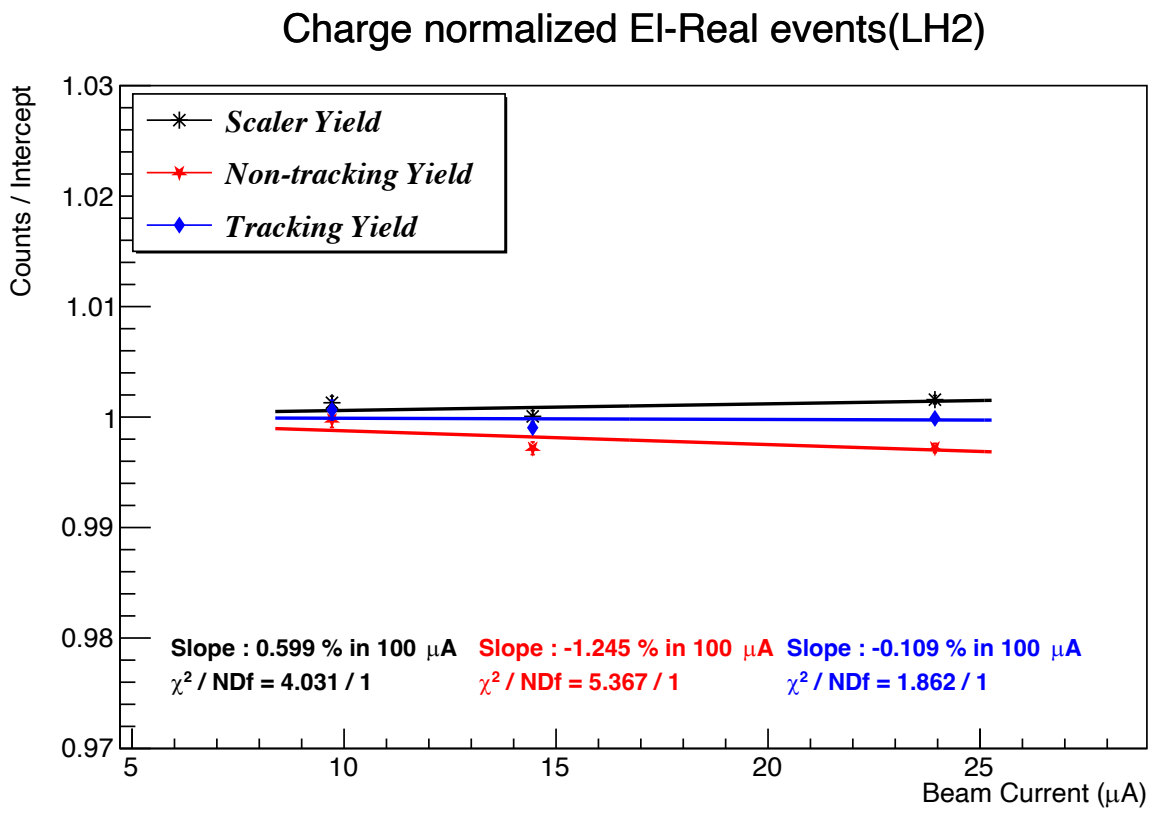
KinC_x50_2

Boiling Yield Analysis

LH2



With 5 μA run

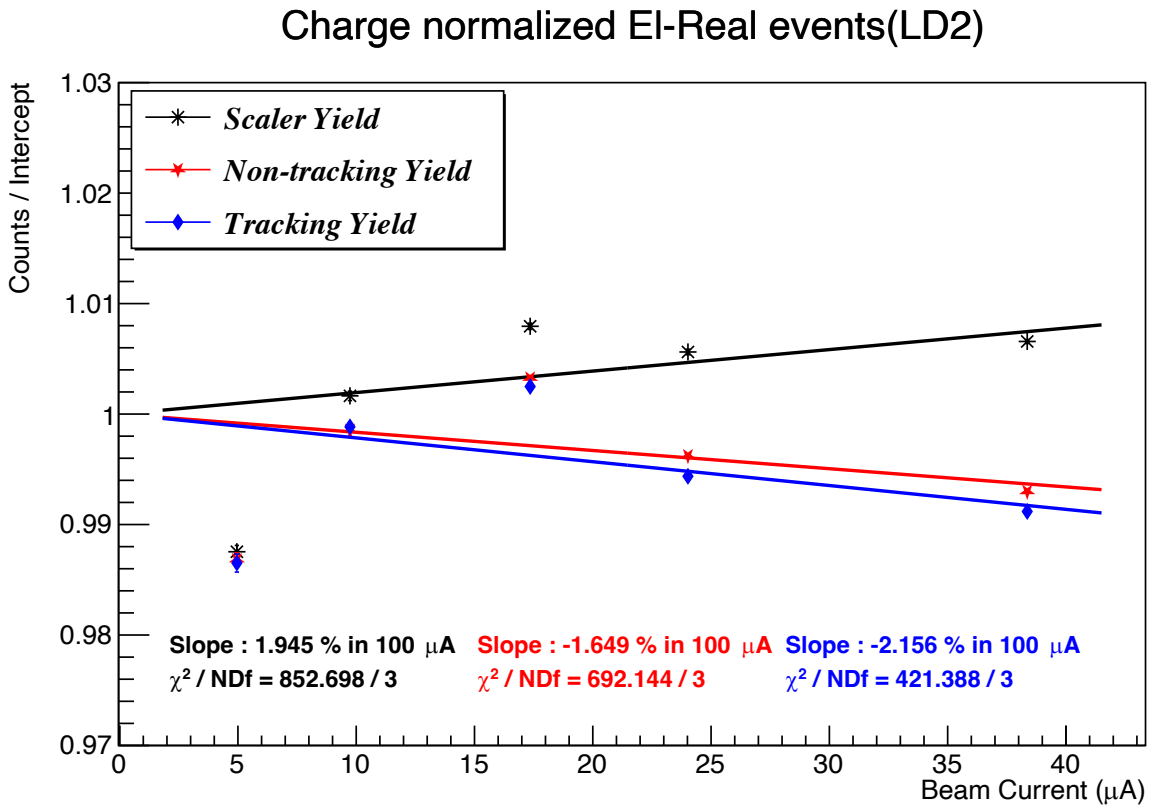


Without 5 μA run

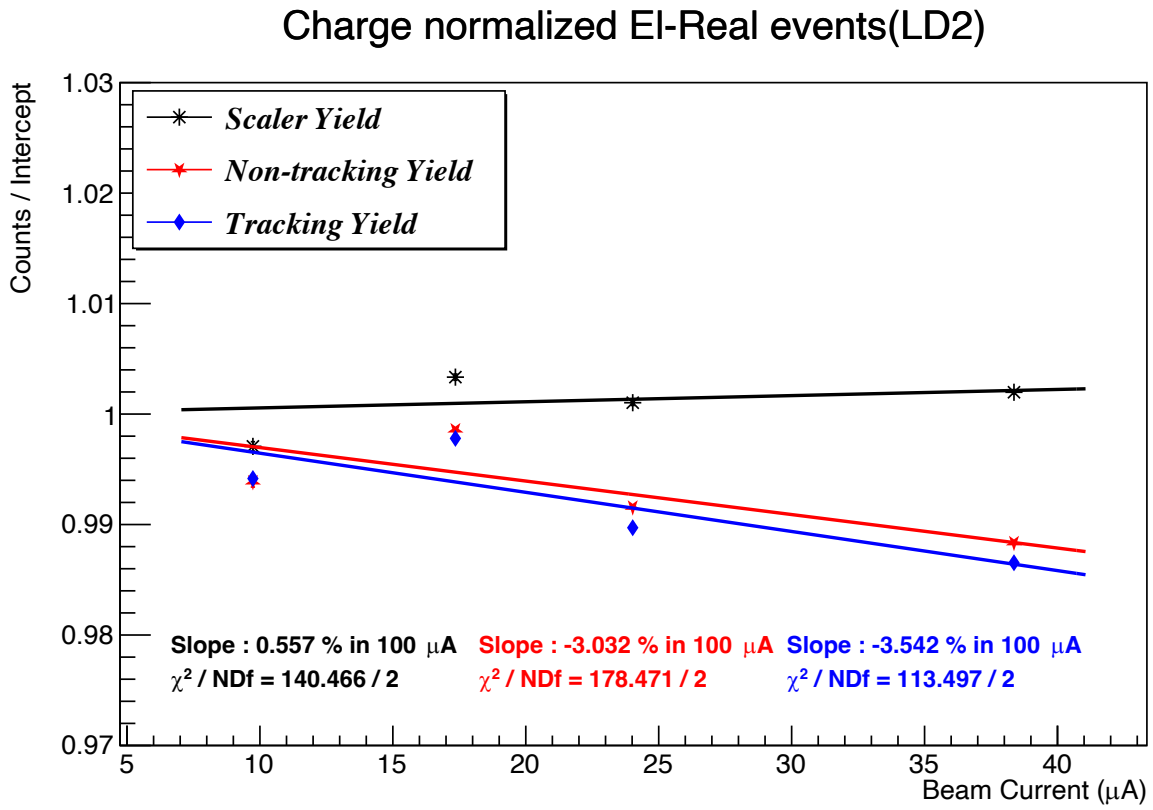
KinC_x50_2

Boiling Yield Analysis

LD2



With 5 μA run



Without 5 μA run

KinC_x50_2

Boiling Yield Analysis

	With 5 μA run			Without 5 μA run		
% in 100μA	Scaler	Non-Tracking	Tracking	Scaler	Non-Tracking	Tracking
Carbon	5.188	5.655	5.300	2.398	3.532	3.234
LH2	3.887	1.621	2.228	0.599	-1.245	-0.109
LD2	1.945	-1.649	-2.156	0.557	-3.032	-3.542

The Maximum current for LH2 is 25 μA ?

KinC_x50_2

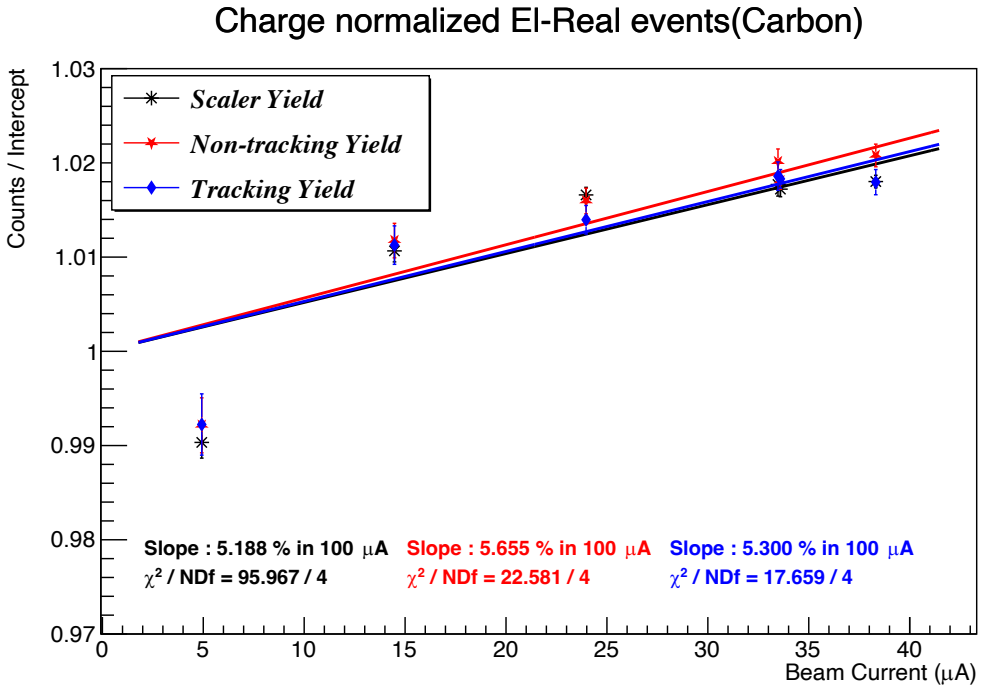
Low Current BCM4A Calibration

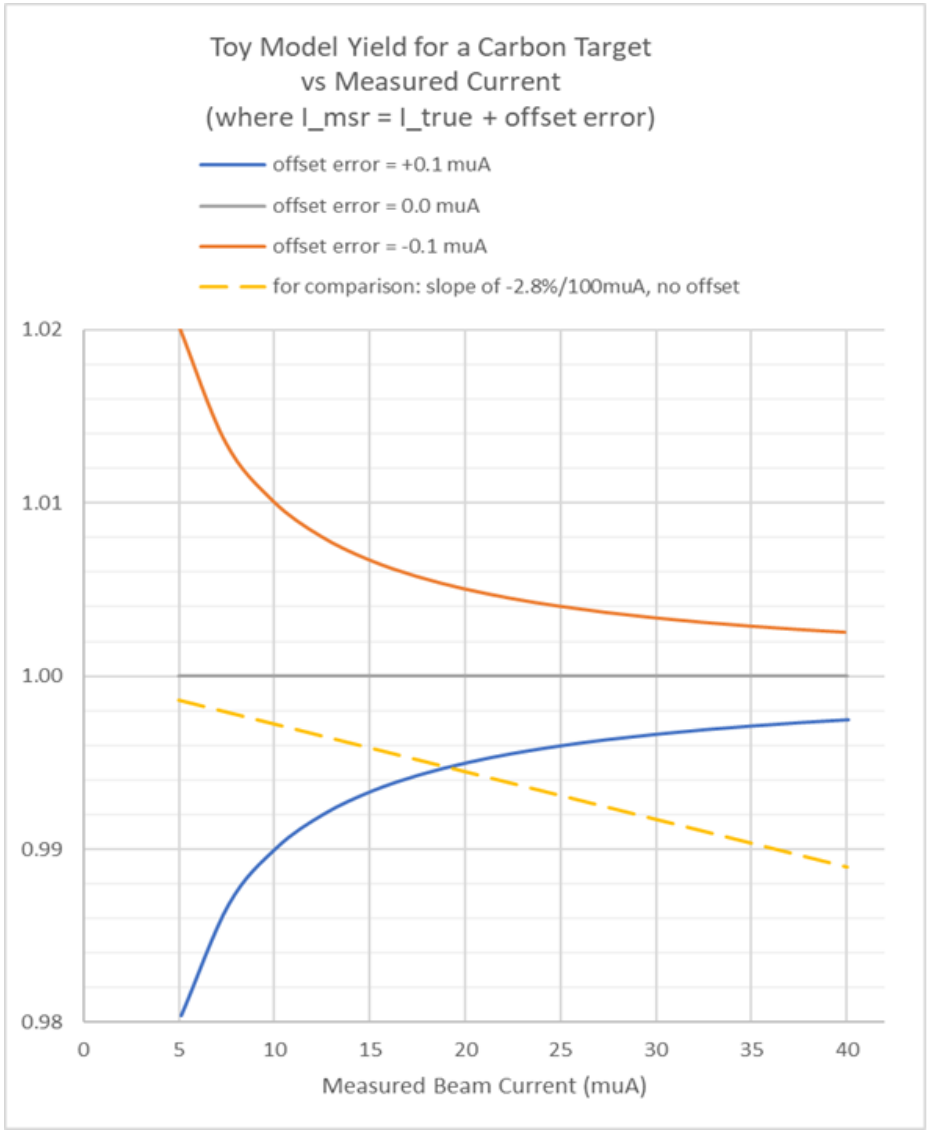
The formula to calculate the BCM4A current:

$$I_{BCM4A} = \frac{\left(scaler_{diff} \div Time_{diff}\right) - \boxed{(-1605)}}{\boxed{9570}}$$

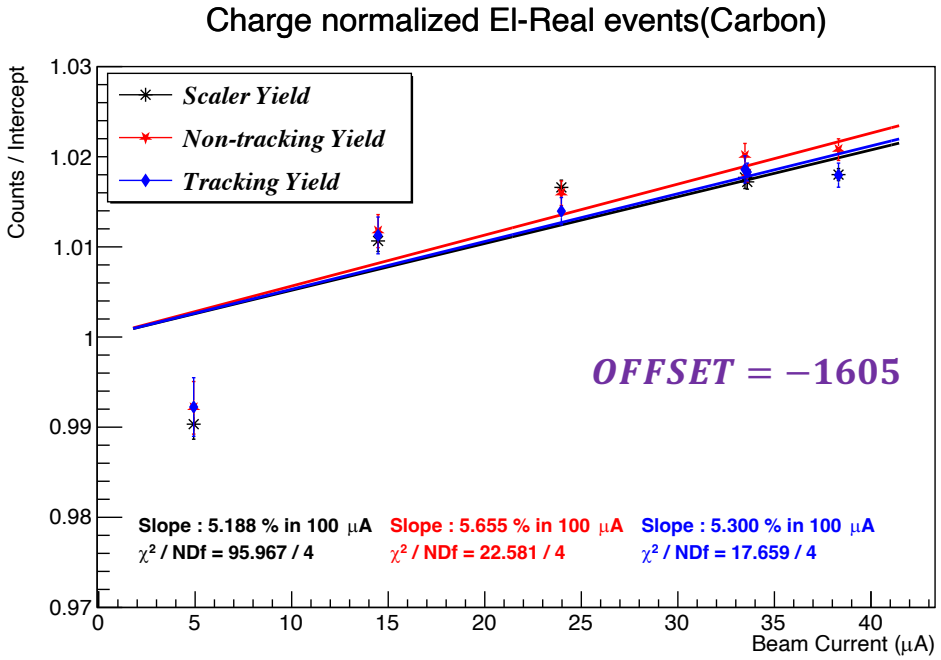
$OFFSET$ (−1605)

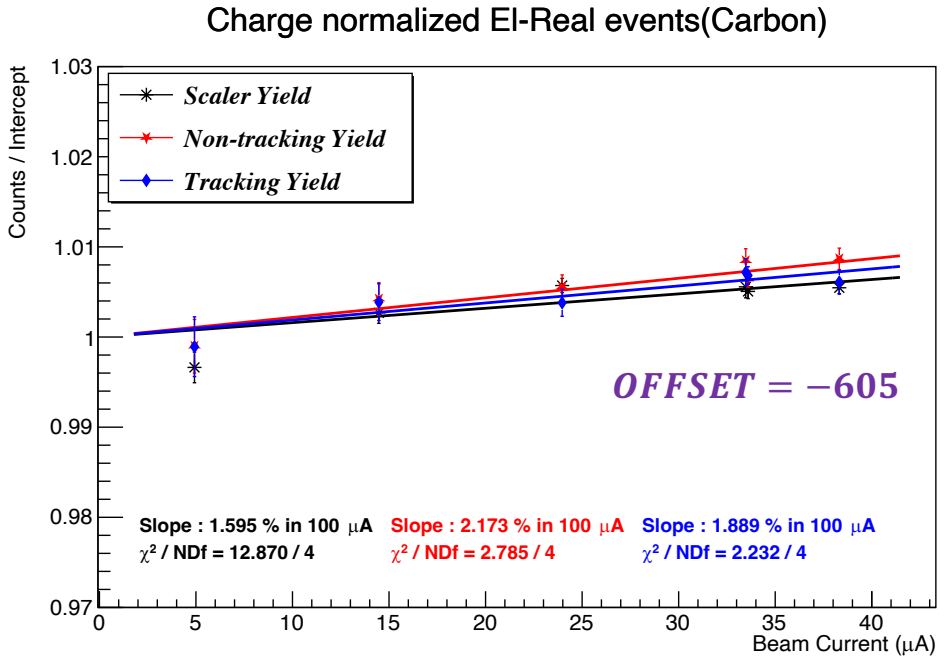
$GAIN$ 9570

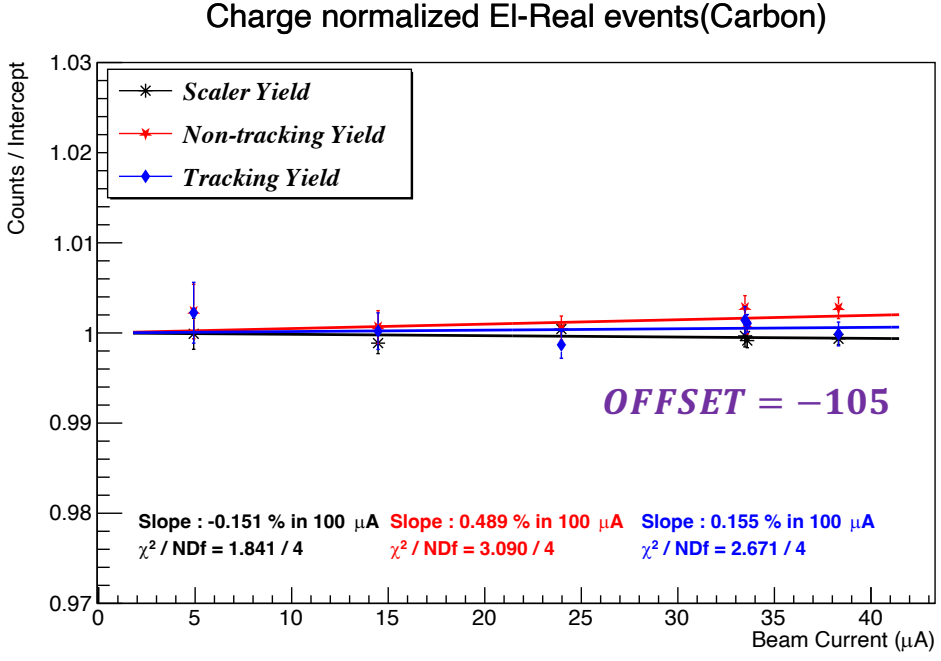


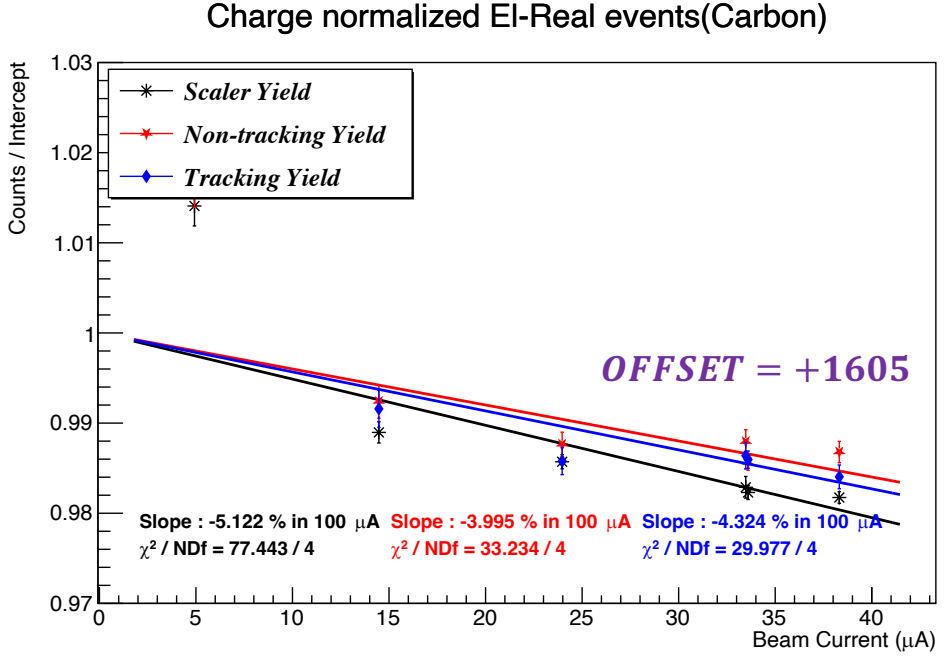


Low Current BCM4A Calibration









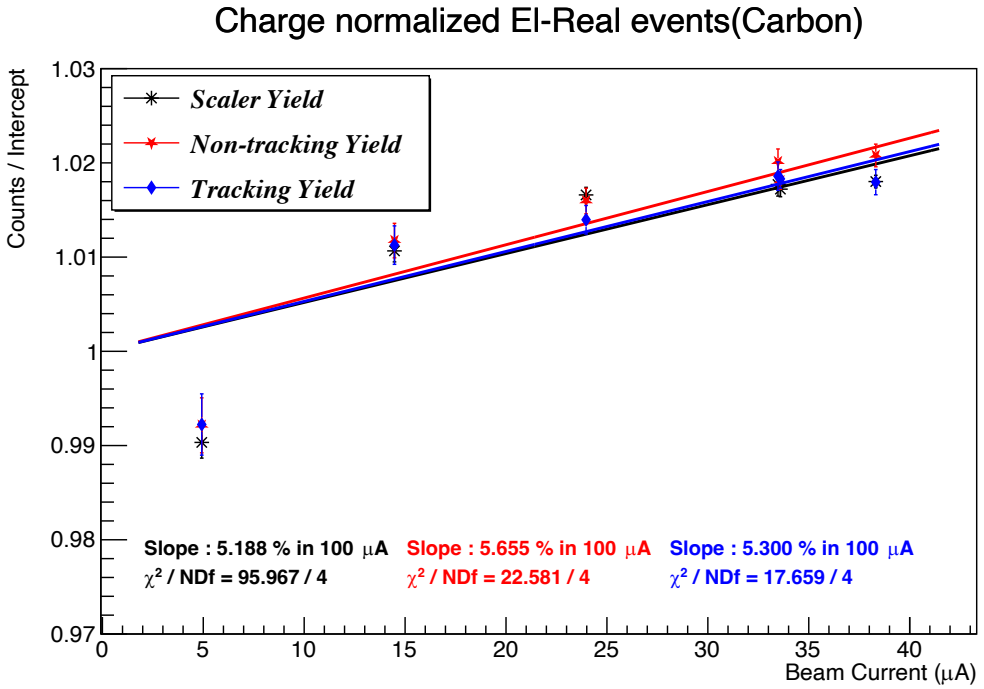
Low Current BCM4C Calibration

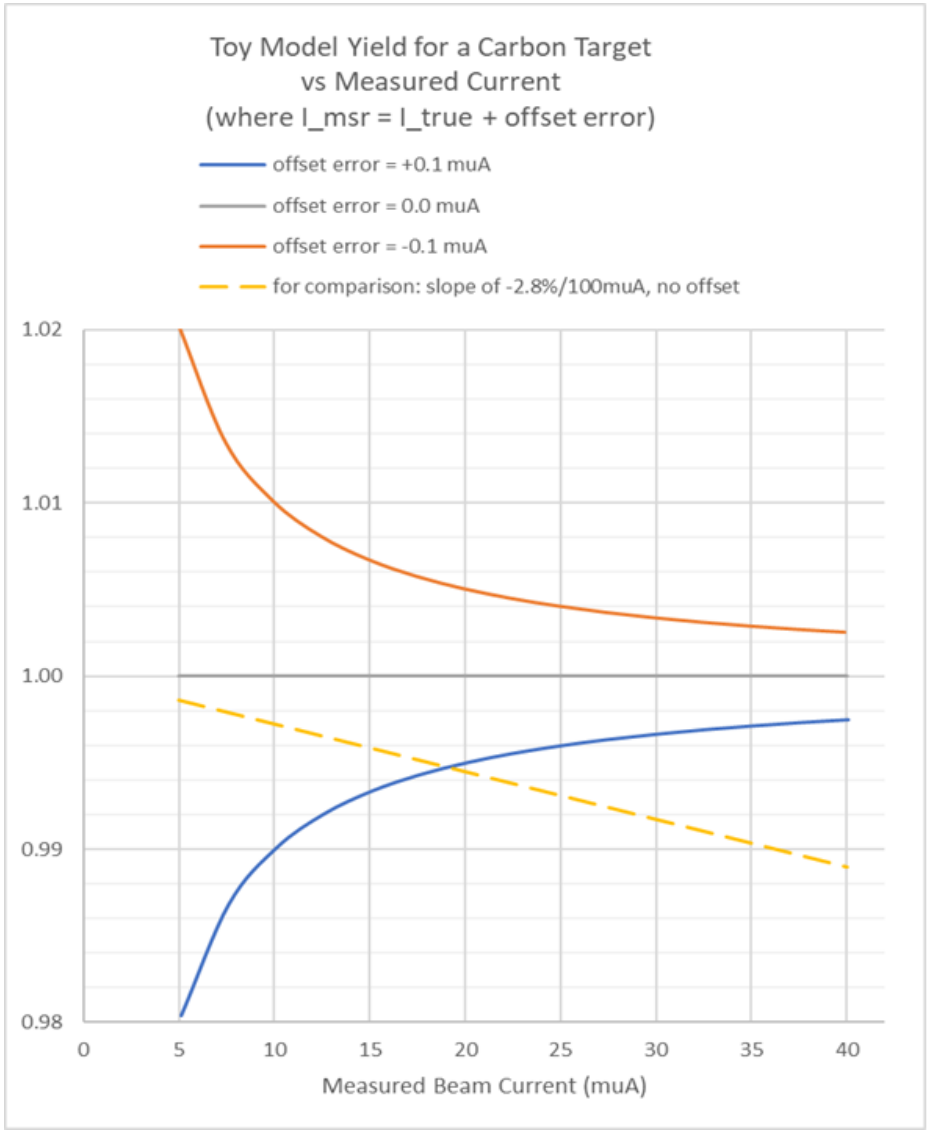
The formula to calculate the BCM4A current:

$$I_{BCM4C} = \frac{\left(scaler_{diff} \div Time_{diff}\right) - \boxed{250}}{\boxed{1332}}$$

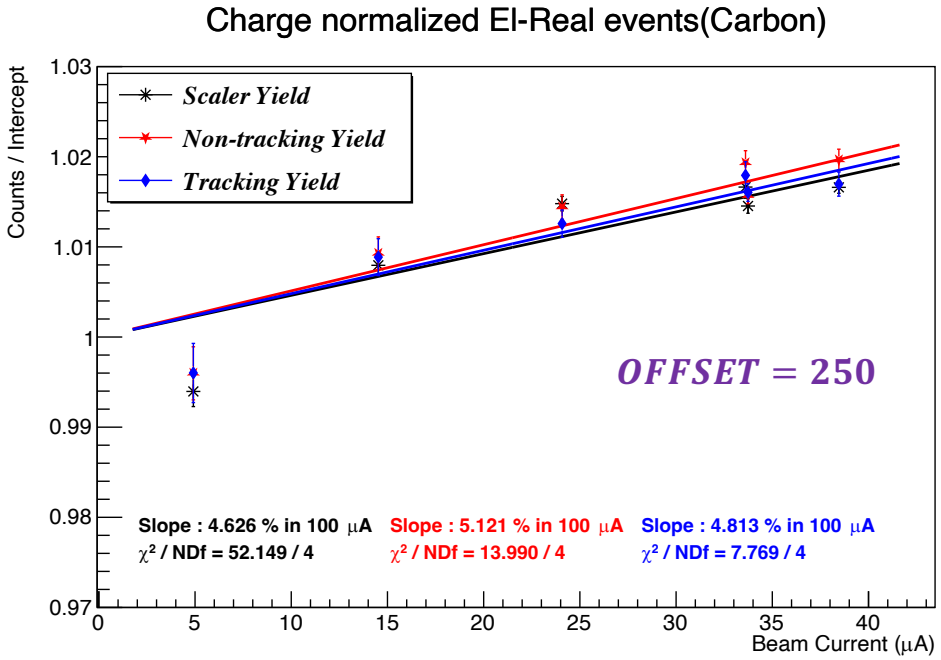
$\boxed{250}$: $OFFSET$

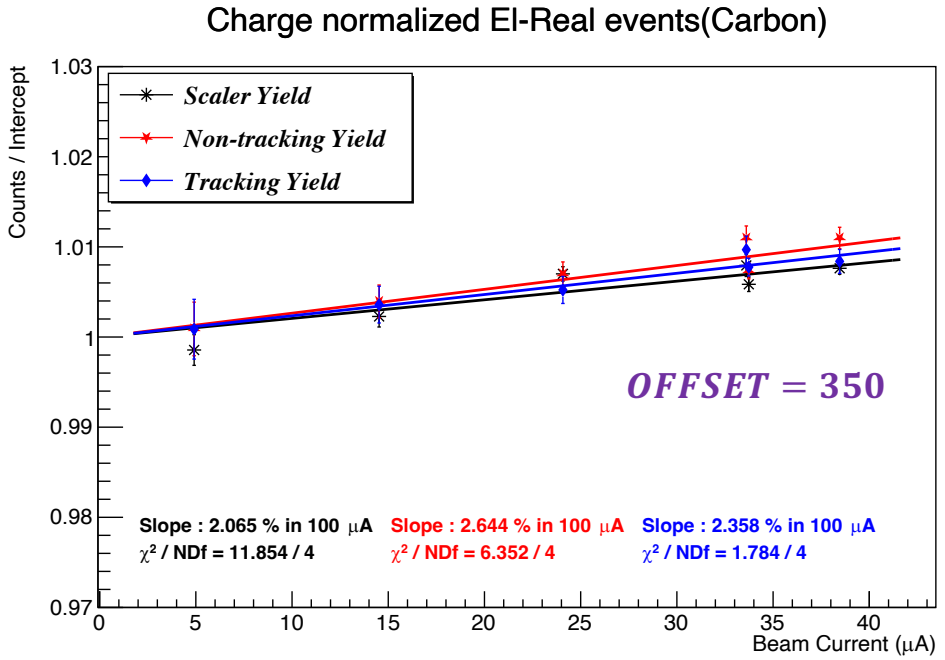
$\boxed{1332}$: $GAIN$

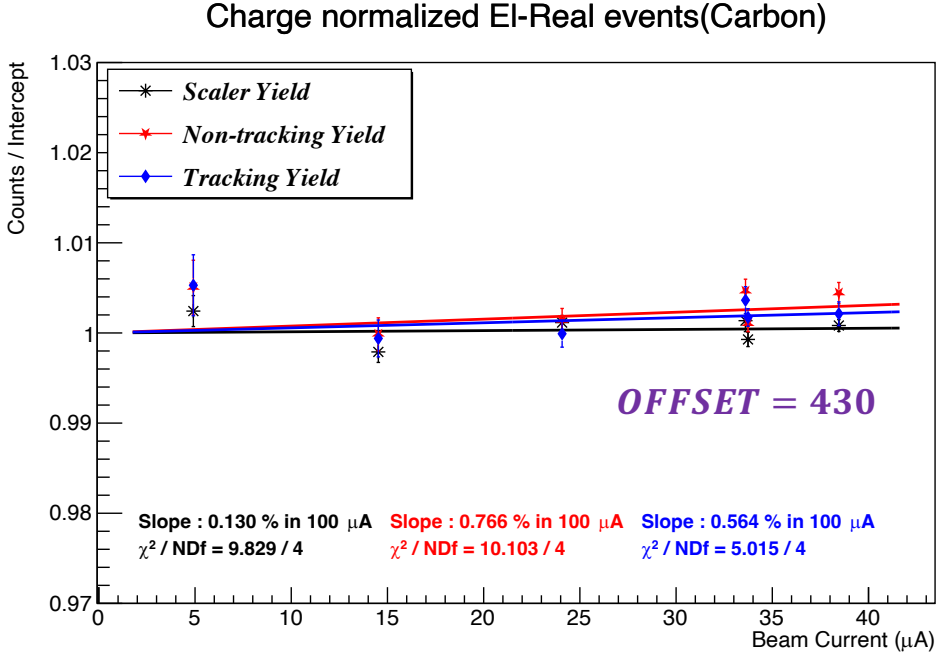


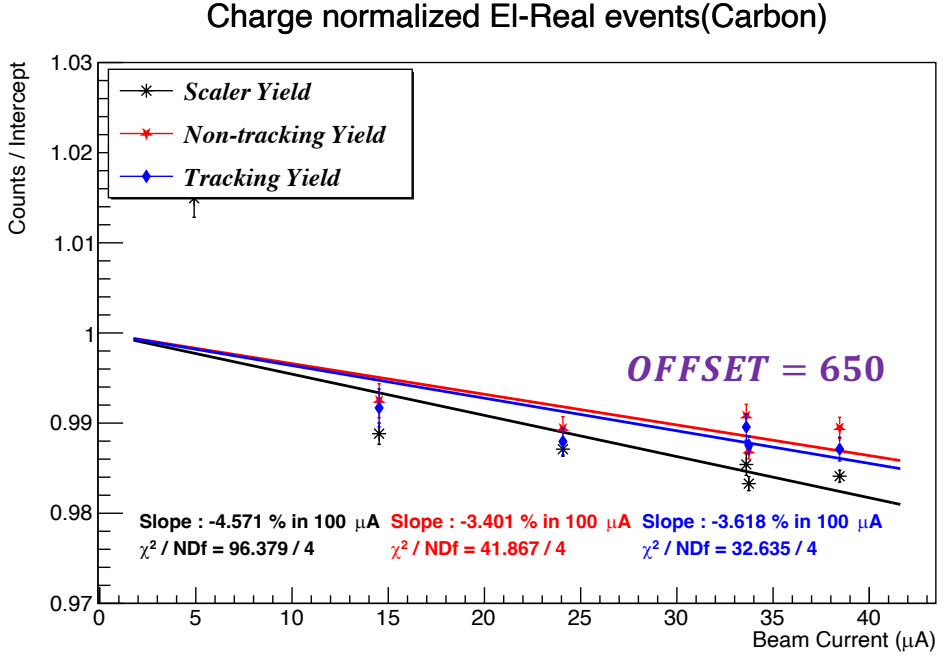


Low Current BCM4C Calibration

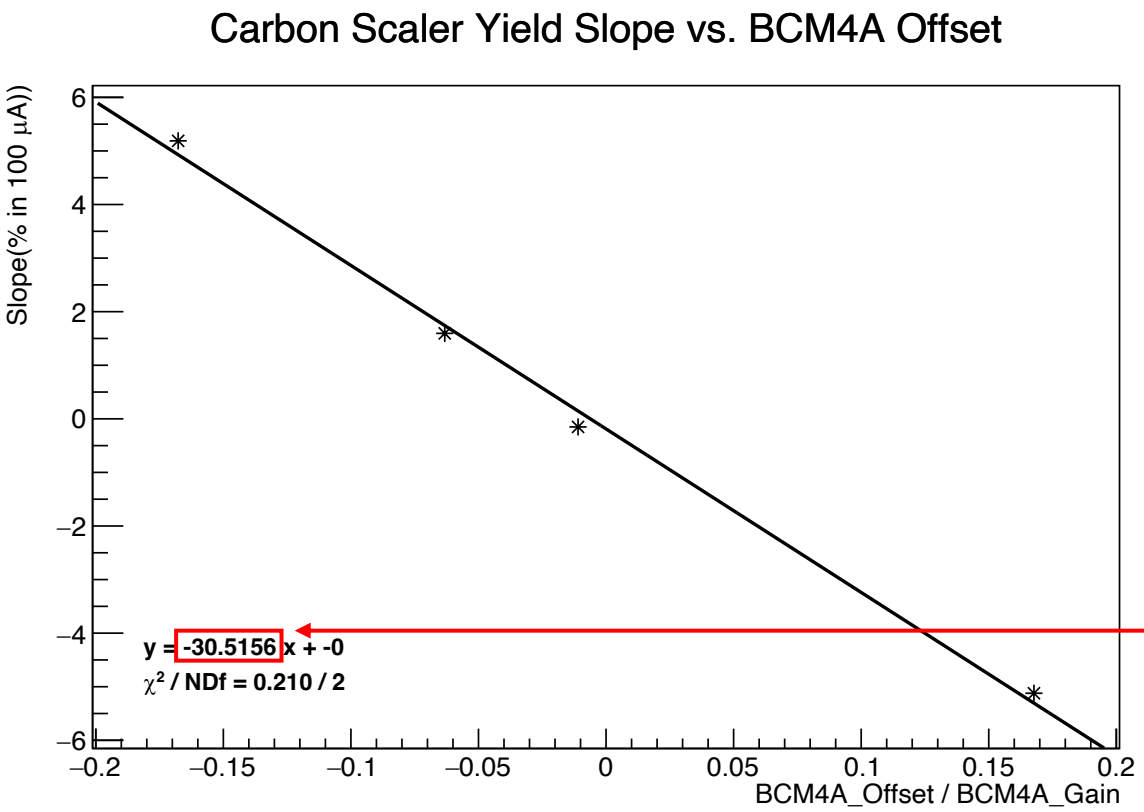


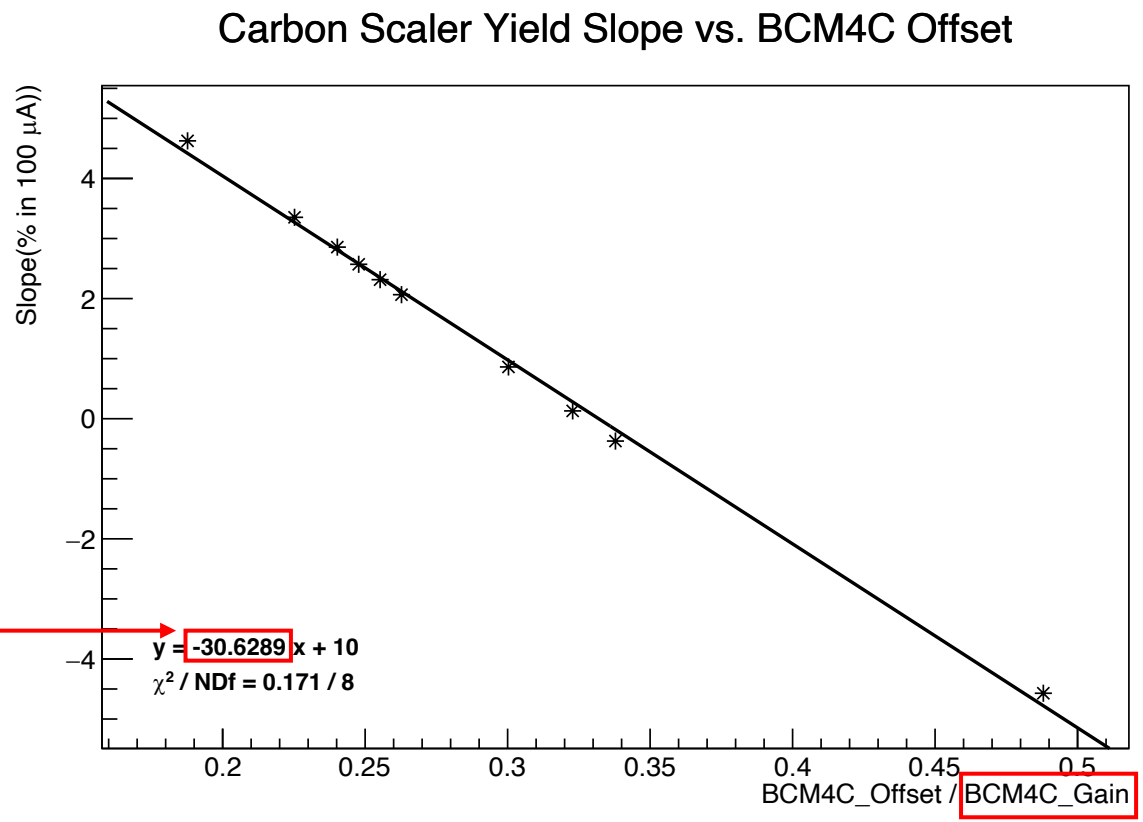






Low Current BCM Calibration



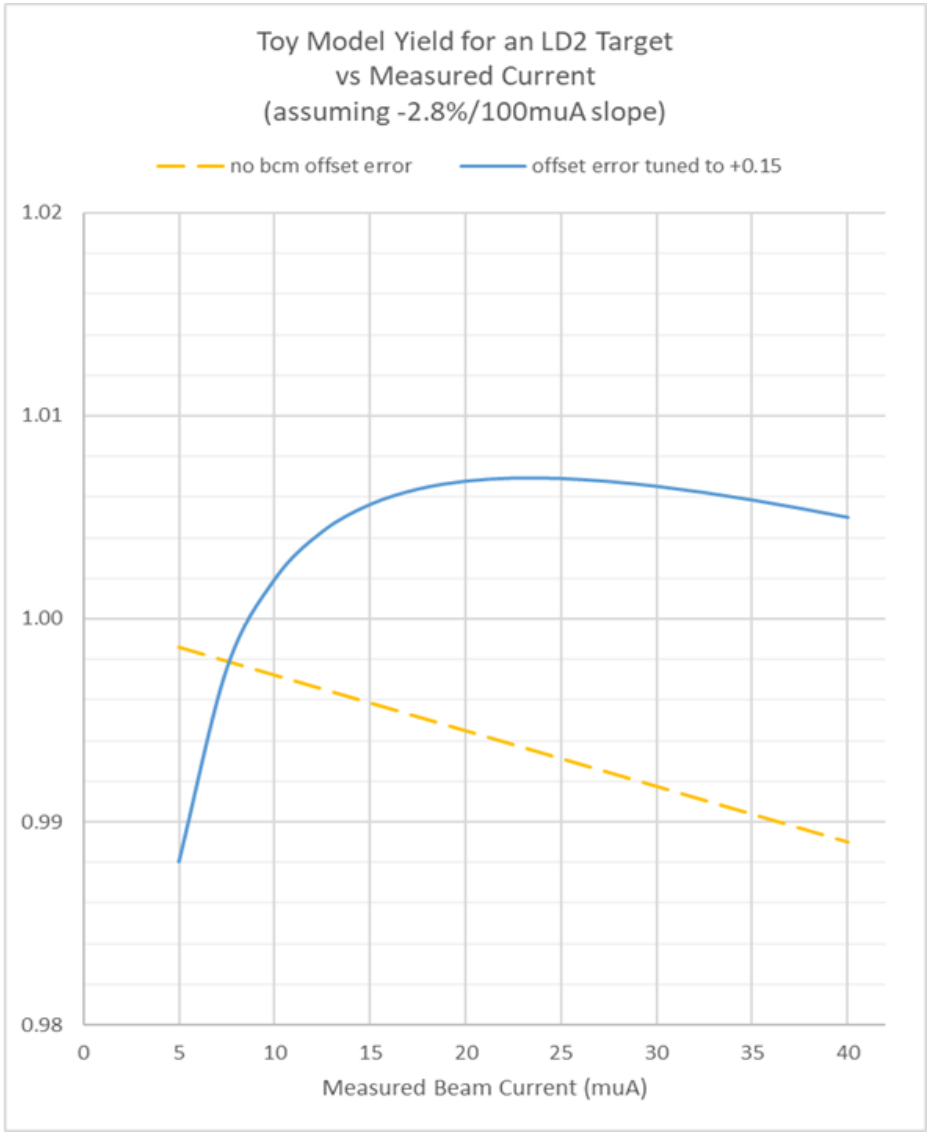


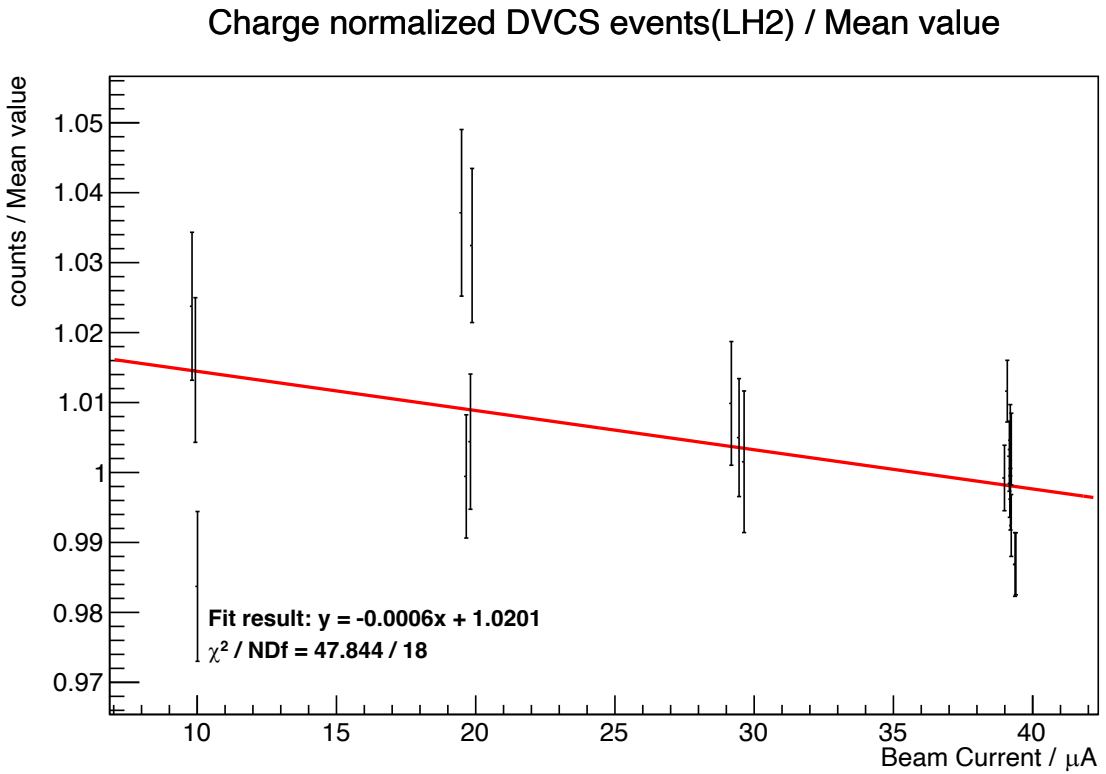
$BCM4A\_GAIN = 9570$

$BCM4C\_GAIN = 1332$

When changing the $\frac{OFFSET}{GAIN}$ value, different BCM has similar behavior.

Low Current BCM Calibration

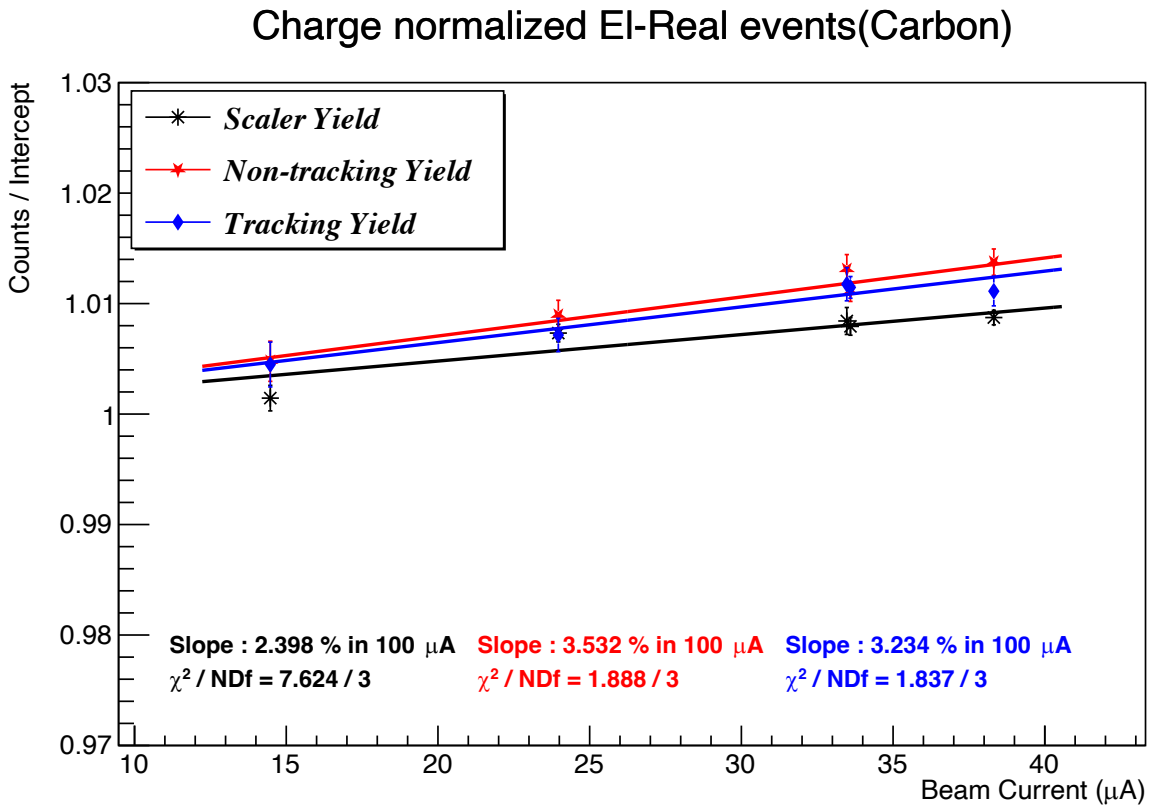




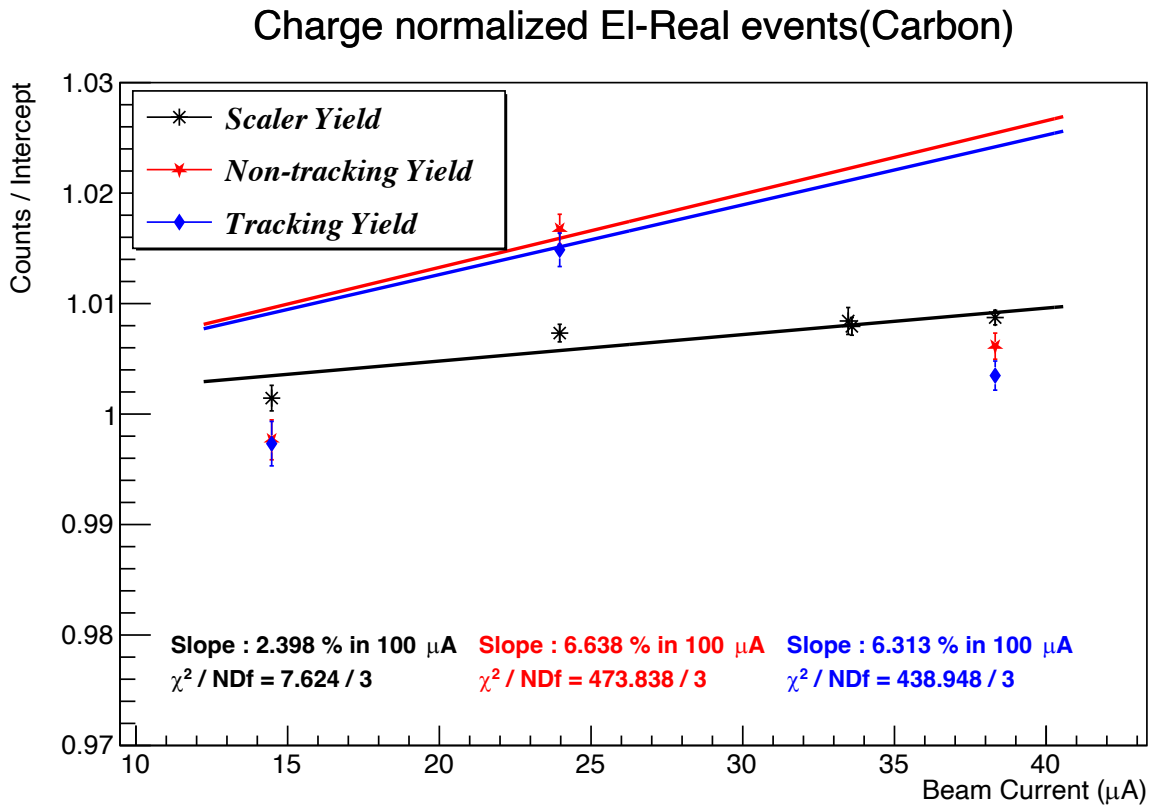
Possible Improvements

- Use correct BCM offset to calculate the charge
- Calculate LT in a more accurate way
- Apply new NPS CAL calibration coefficients

LT Calculation

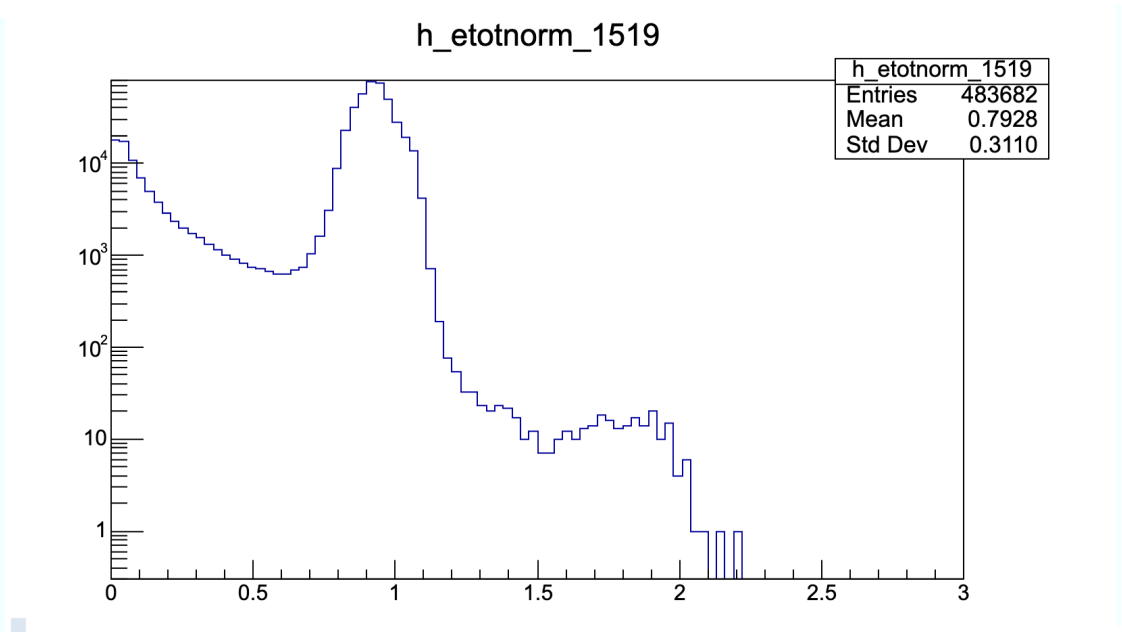


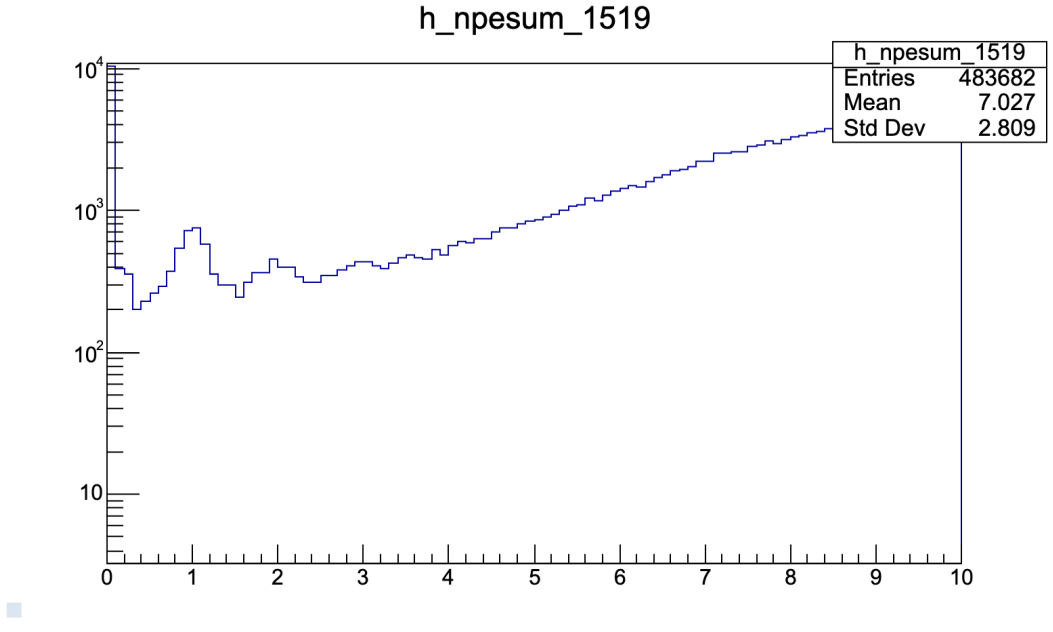
$$\mathrm{LT} = \frac{\#\ \text{of events}}{\text{scaler\_htrig4} - \text{scaler\_edtm}} \times \text{ps-factor}$$

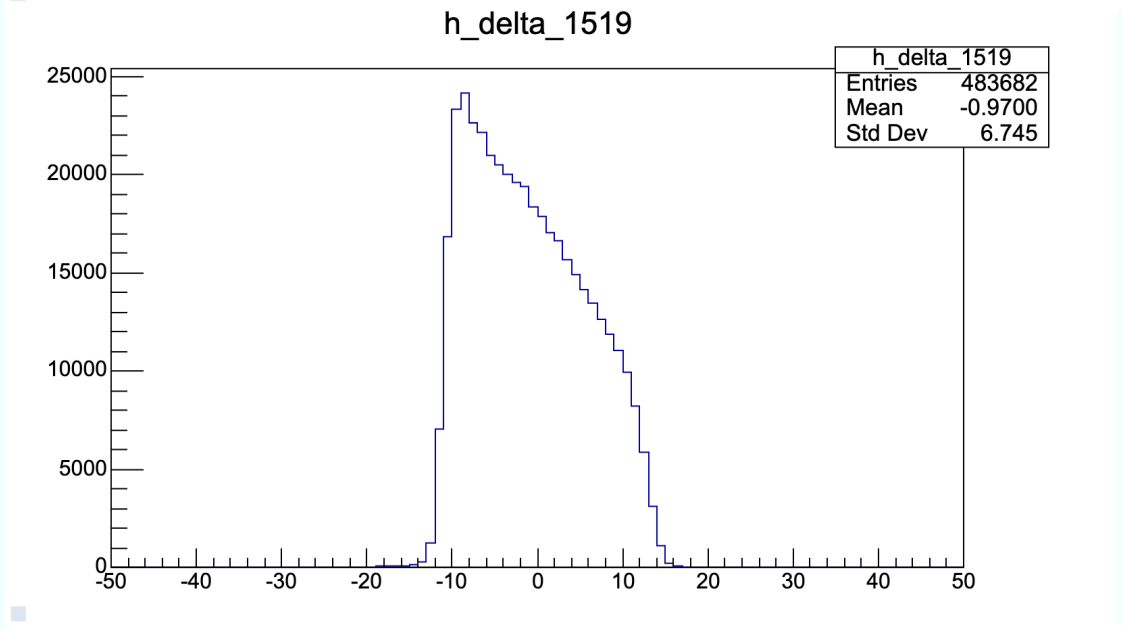


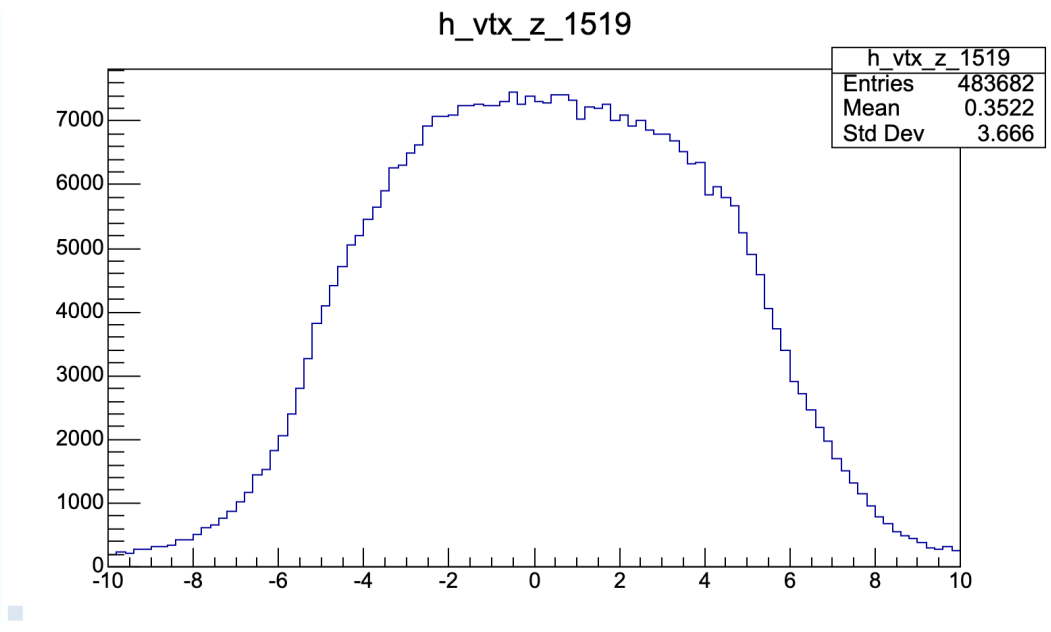
Directly from the report file
("HMS TRIG4 Computer Live Time")

Distributions









Distributions