Another update on the calibration strategy

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April conclusion

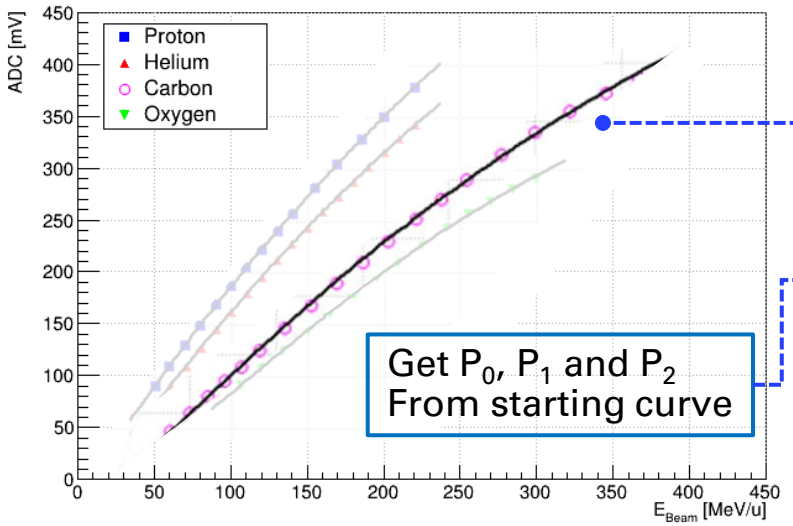
Do we REALLY need a third ion to do a good calibration (He? O? Both?)?

What if we can find a two parameter function to transform the Modified Birks Px?

HIT2022: a brief recap

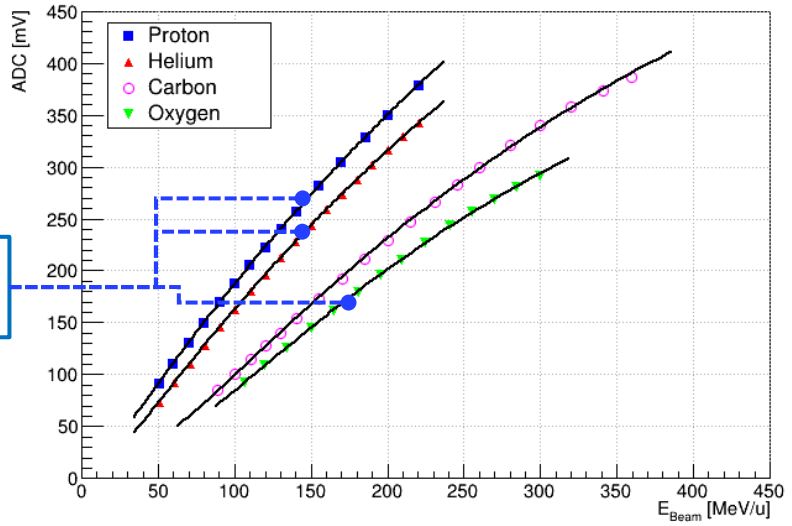
HOW?

$$ADC(E) = \frac{p_0 x^2}{1 + p_1 x + p_2 x^2}$$

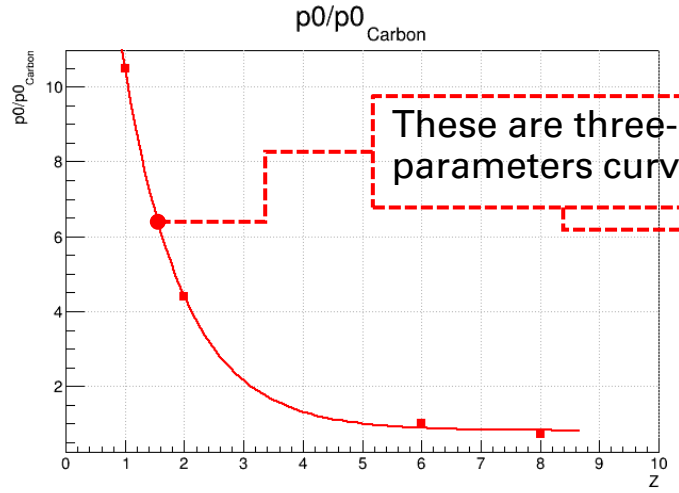


Get P_0, P_1 and P_2 From starting curve

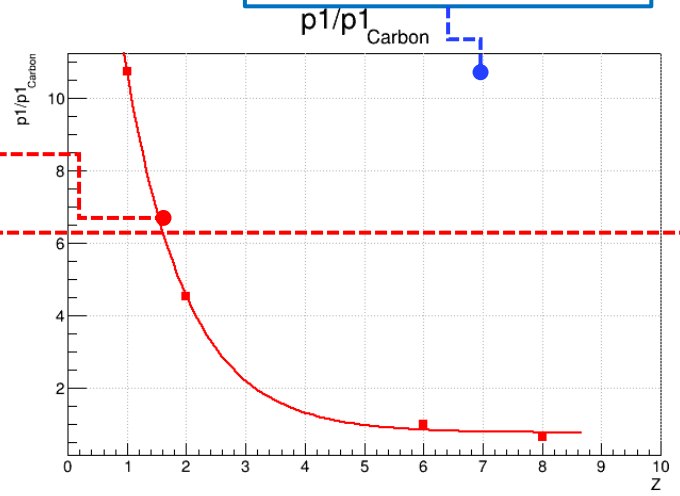
Combine these information and obtain new P_0, P_1 and P_2

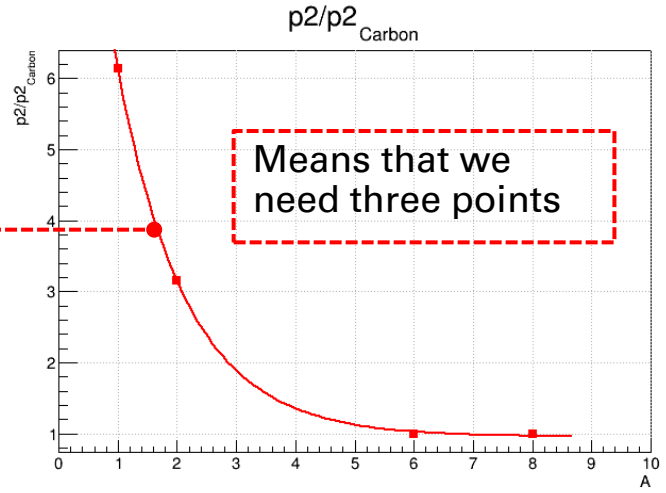


Choose Z of the new curve and retrieve $P_{new}/P_{starting}$



These are three-parameters curves

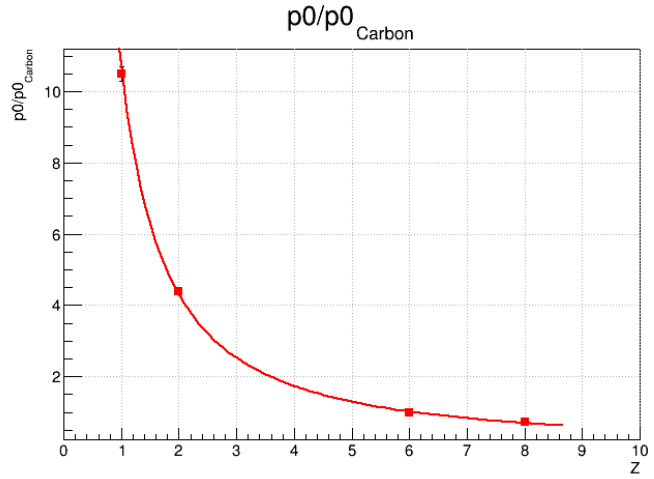




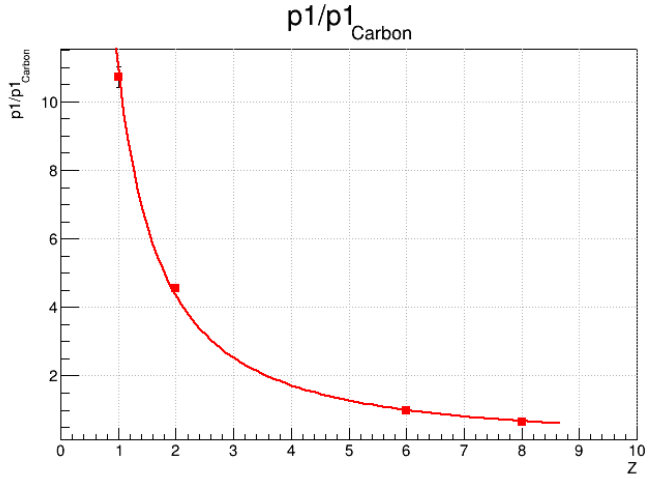
Means that we need three points

HIT2022: a new function

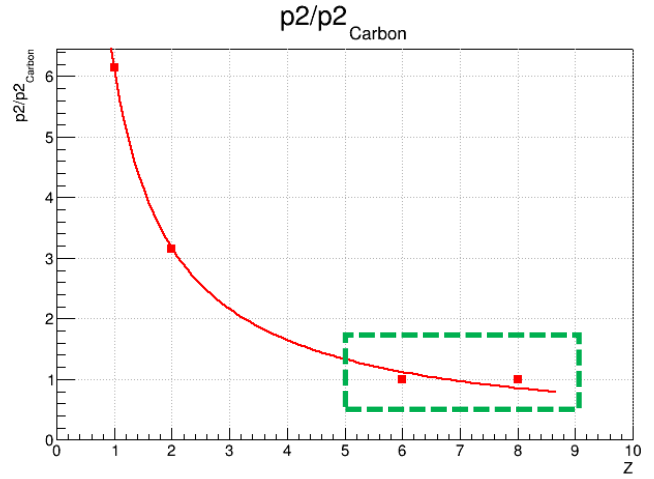
$$\frac{P_x}{P_{x_{carbon}}} = a_0 Z^{a_1}$$



Residual Z = 1 -2.3637 %
Residual Z = 2 2.1337 %
Residual Z = 6 1.3135 %
Residual Z = 8 4.2848 %

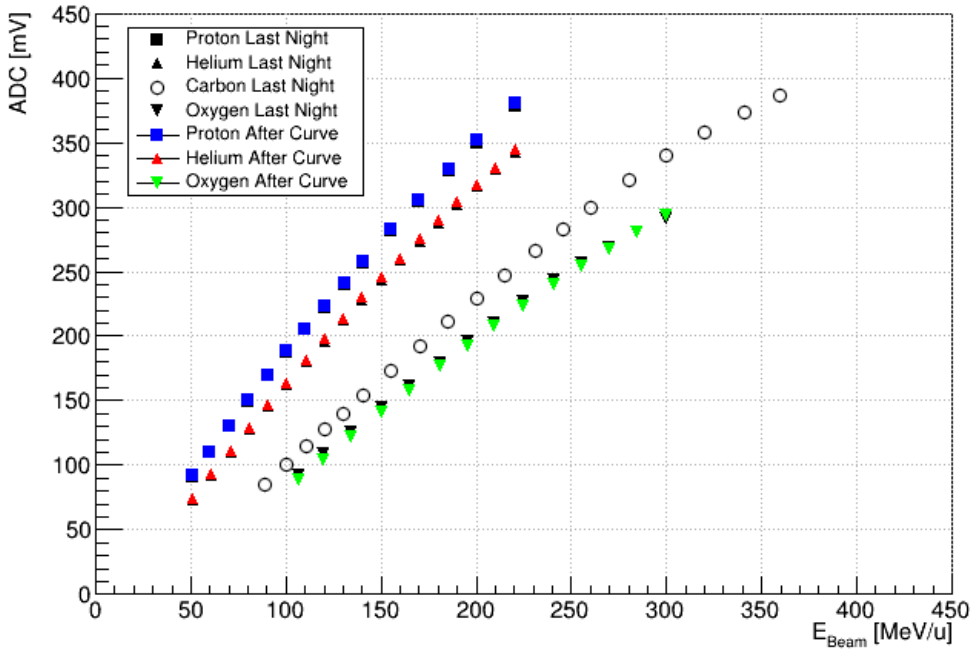


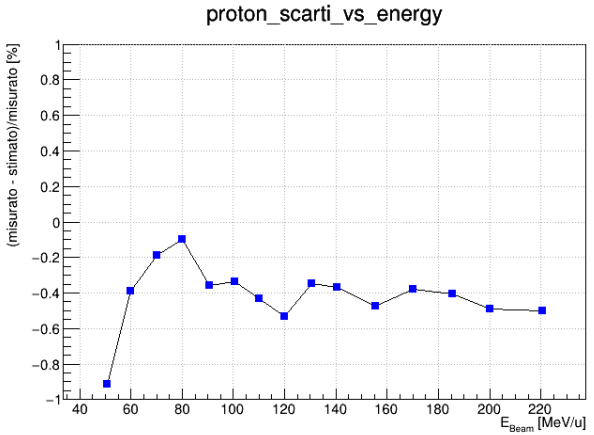
Residual Z = 1 -2.5802 %
Residual Z = 2 4.2543 %
Residual Z = 6 0.2778 %
Residual Z = 8 -3.4482 %

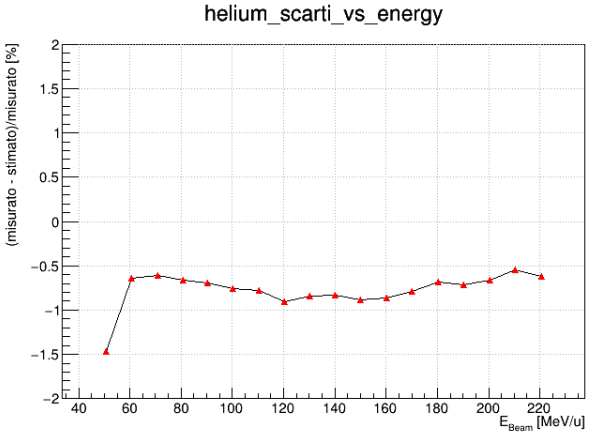


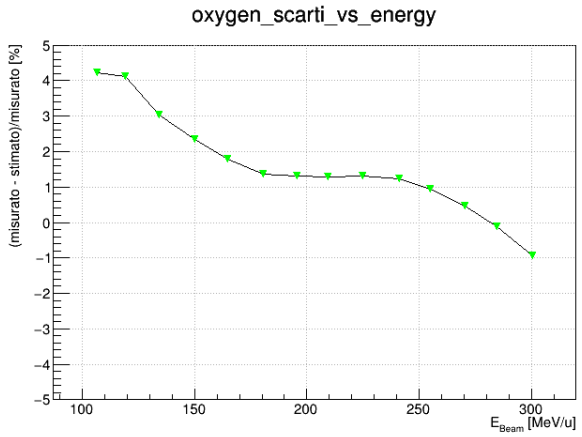
Residual Z = 1 0.2157 %
Residual Z = 2 -0.4776 %
Residual Z = 6 -11.7764 %
Residual Z = 8 14.2848 %

HIT2022: a new function



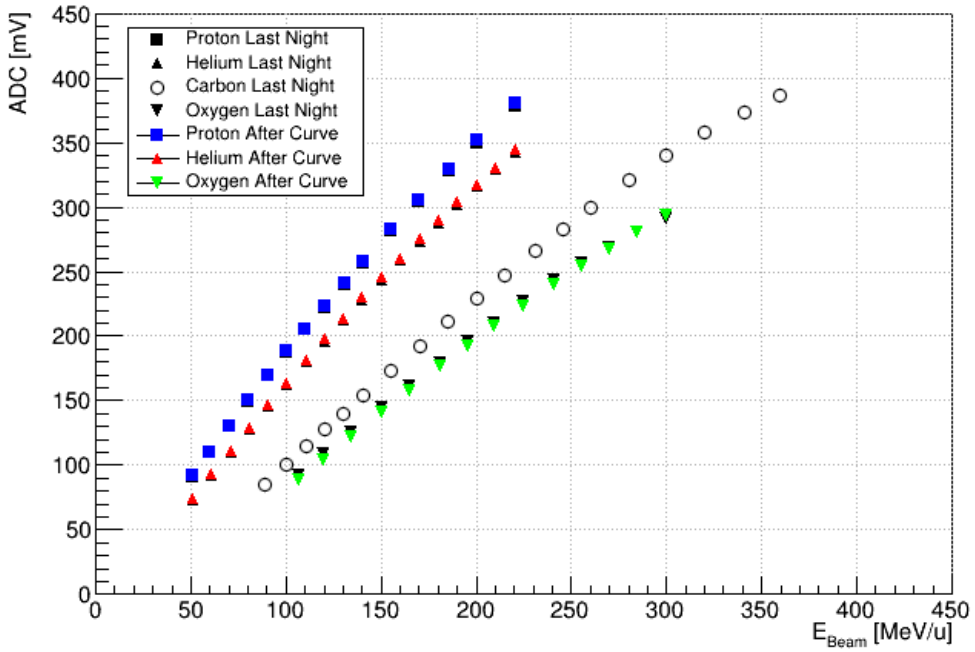






We can use a two parameters function to charge equalize Birks function

CNAO2024: check feasibility

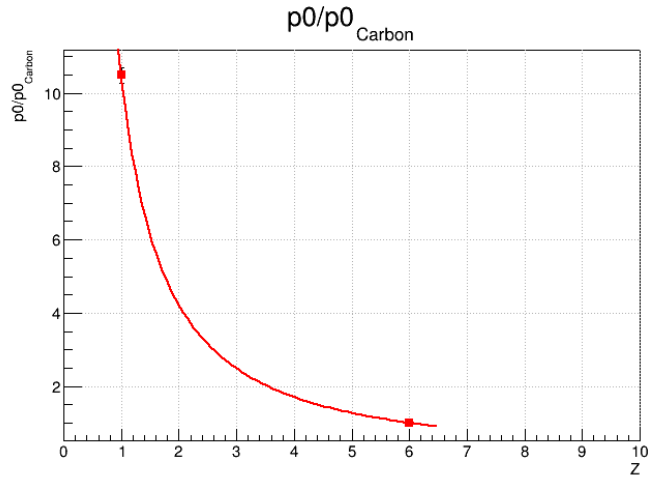


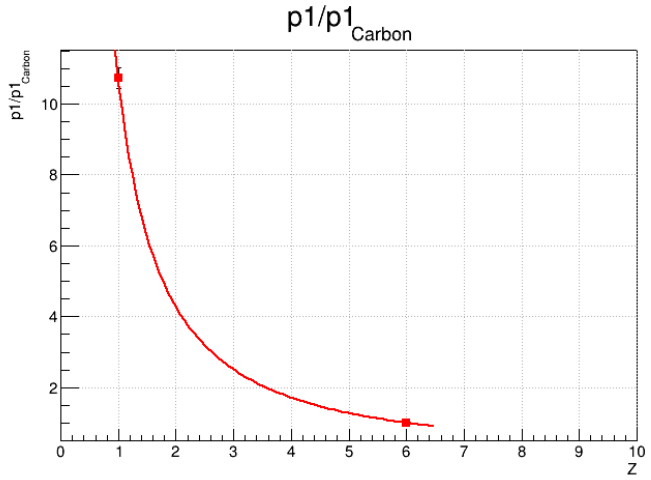
In future test beam at CNAO only proton and carbon beams will be available, are they enough?

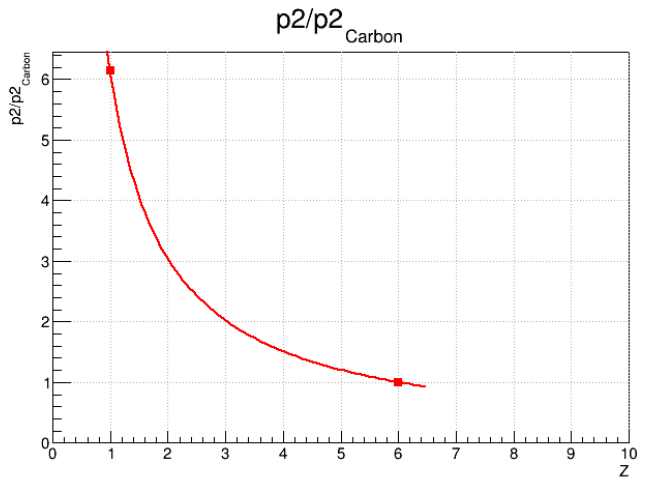
Let's repeat the same exercise with just the proton and carbon points

CNAO2024: check feasibility

$$\frac{P_x}{P_{x_{carbon}}} = a_0 Z^{a_1}$$







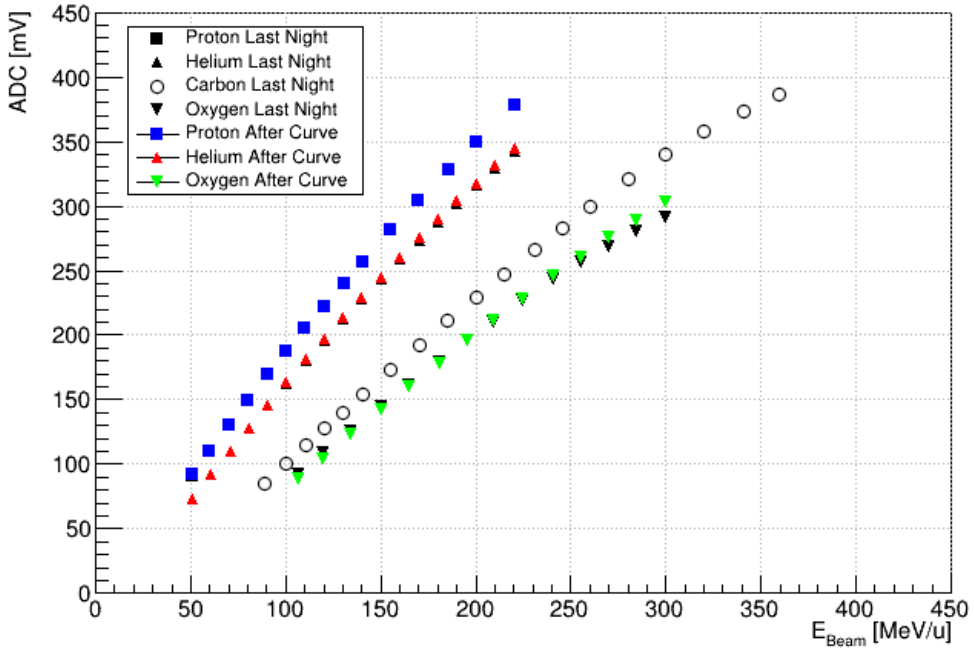
Residual Z = 1	0.0001	%
Residual Z = 2	4.0107	%
Residual Z = 6	1.17e-5	%
Residual Z = 8	5.3698	%

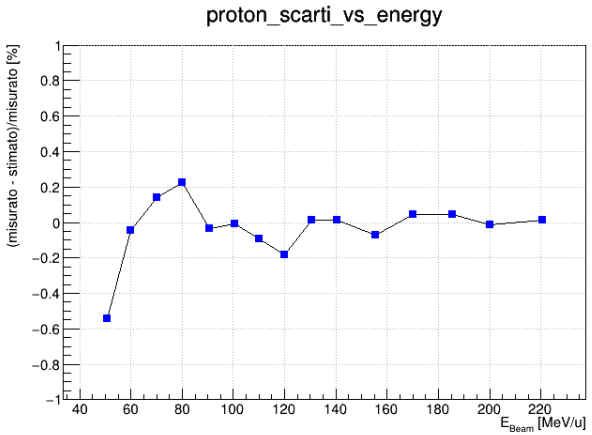
Residual Z = 1	0.0122	%
Residual Z = 2	5.6253	%
Residual Z = 6	-5.78e-5	%
Residual Z = 8	-4.2022	%

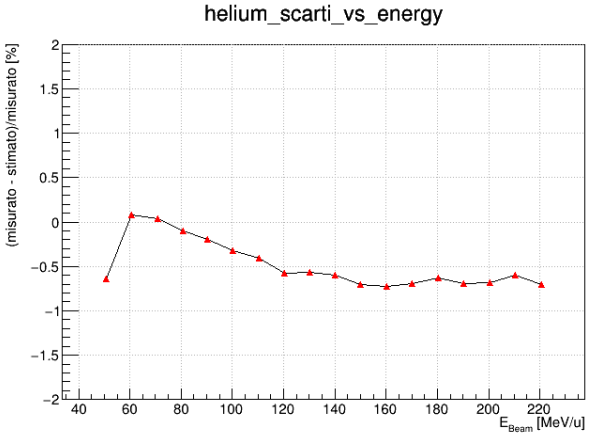
Residual Z = 1	-4.21e-5	%
Residual Z = 2	3.6188	%
Residual Z = 6	1.01e-5	%
Residual Z = 8	24.578	%

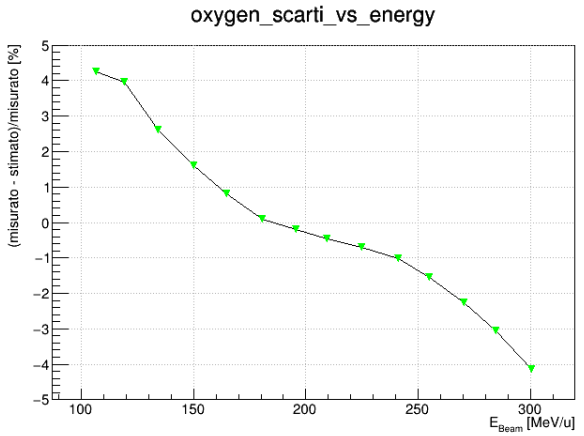
Residual calculated by extrapolating Px/Px at Z = 2 and 8

CNAO2024: check feasibility









In conclusion we can use a two parameters function to charge equalize Birks function*

* Higher residuals in Oxygen are weird, probably something happen back at HIT. Look at P2/P2carbon distribution

Extras: comparison between methods