



SAPIENZA
UNIVERSITÀ DI ROMA



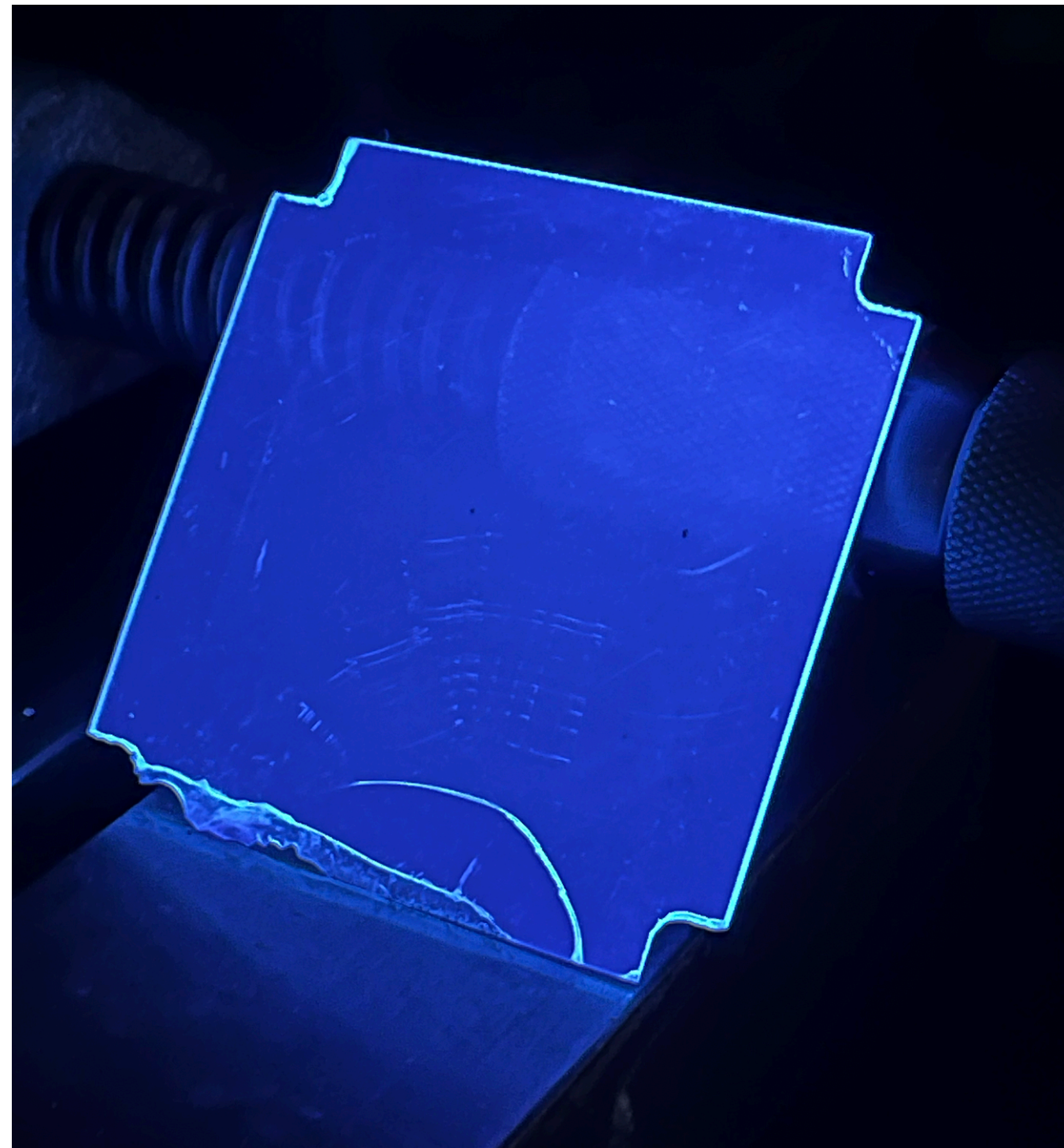
CENTRO RICERCHE
ENRICO FERMI

ST & Trigger update

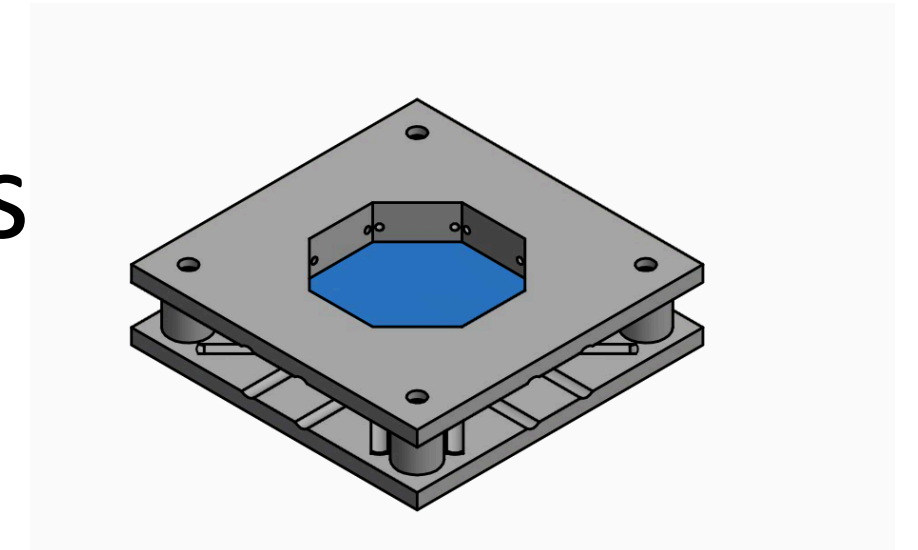
Giacomo Traini



ST Hardware



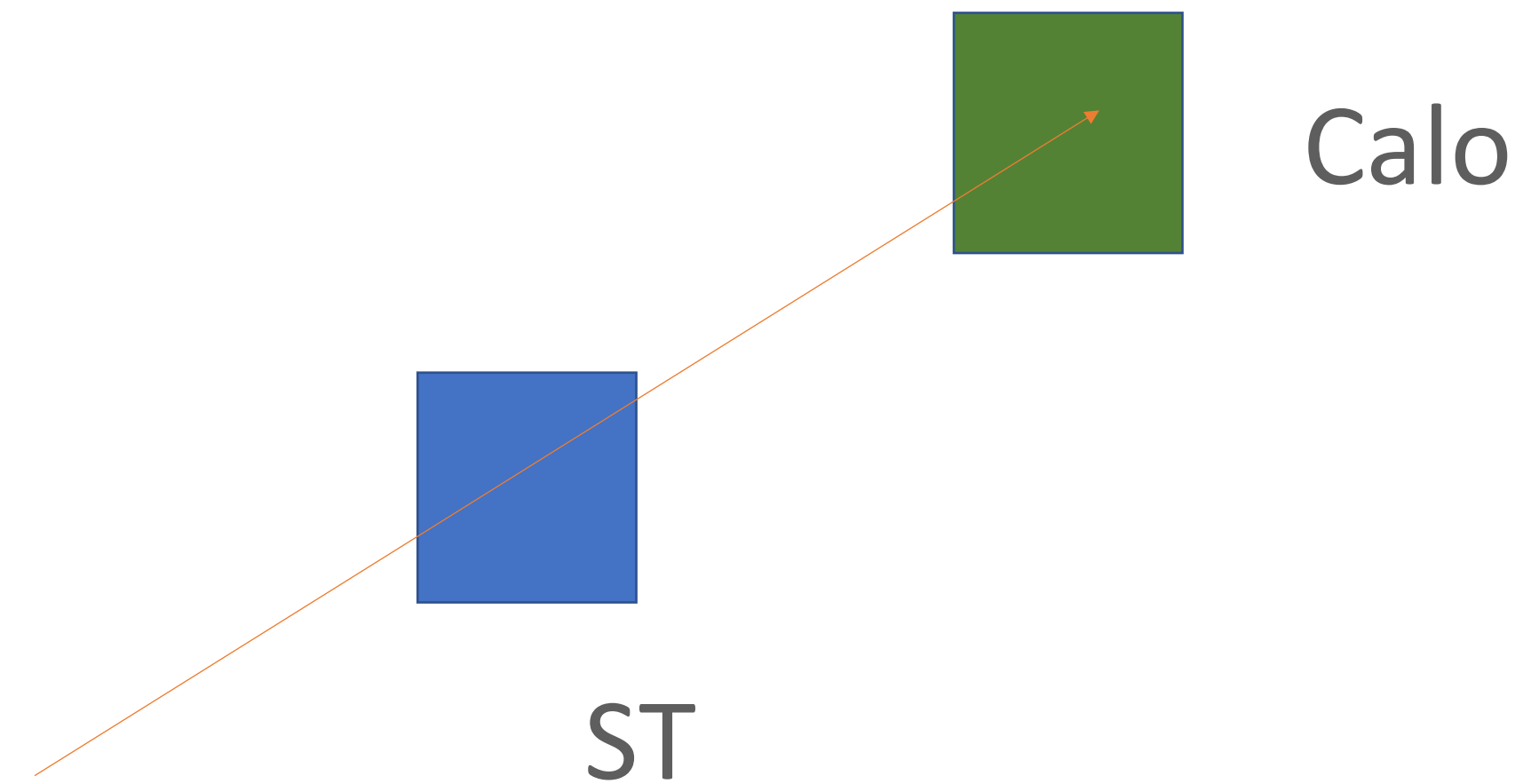
- "Battistero" is waiting for the new fast scintillators...



- We tested @ CNAO a prototype but simply ... it does not work! The concentration of the dopant is still too low (3%)

ST @ HIT

- The ST has been used to trigger the acquisition in the calorimeter calibration scan (excluding some runs with protons)
- O,C,He,p beams has been shot in wide energy range. We had the chance to review the ST performance with several particles/energies



ST review: time resolution

- We had not TW reference. The time resolution has been assessed with a self-consistent method

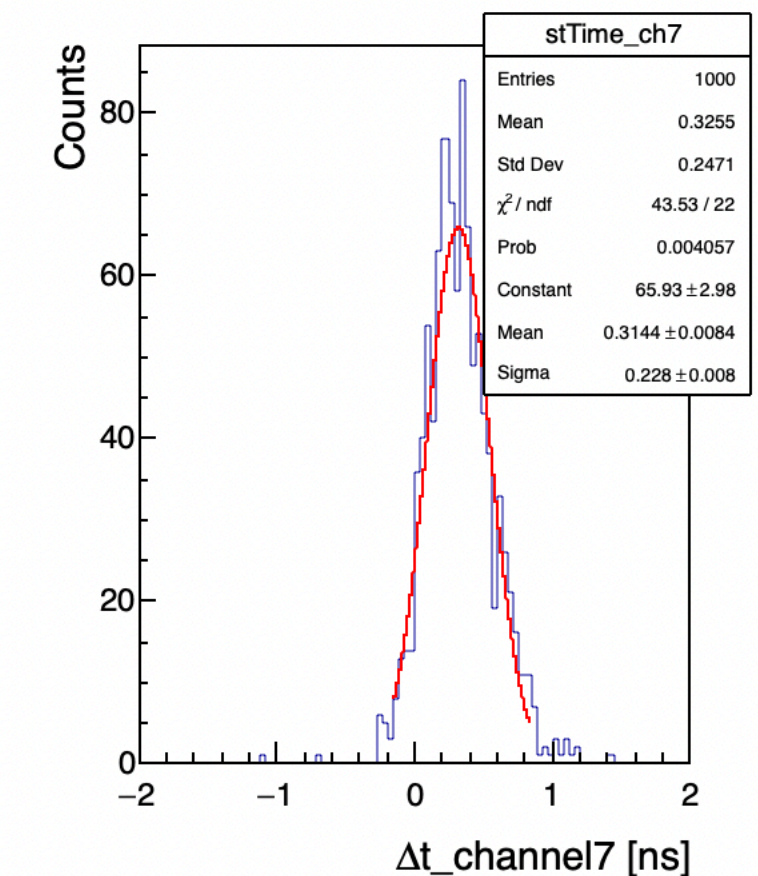
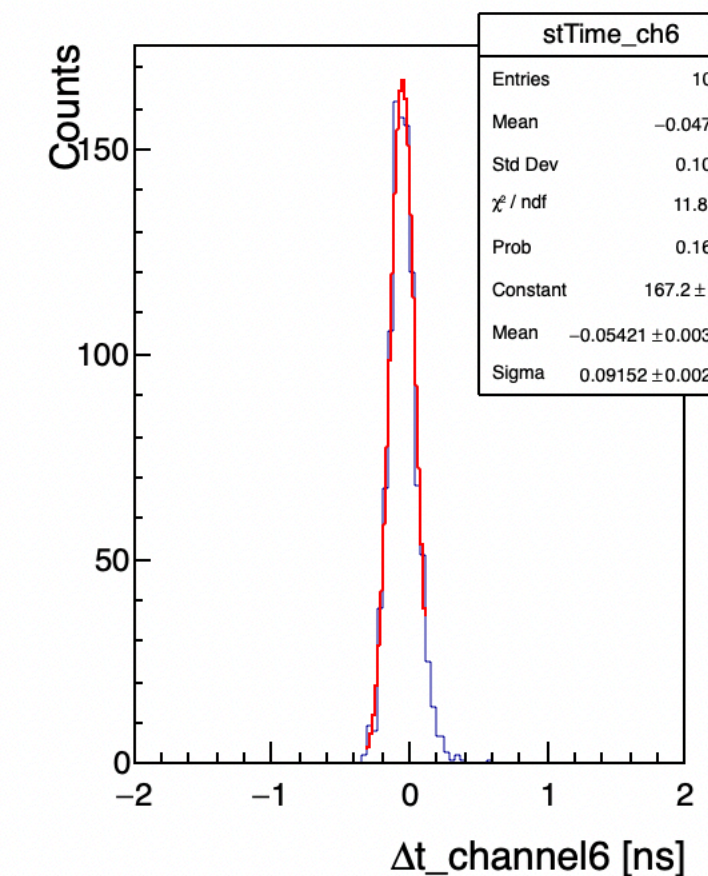
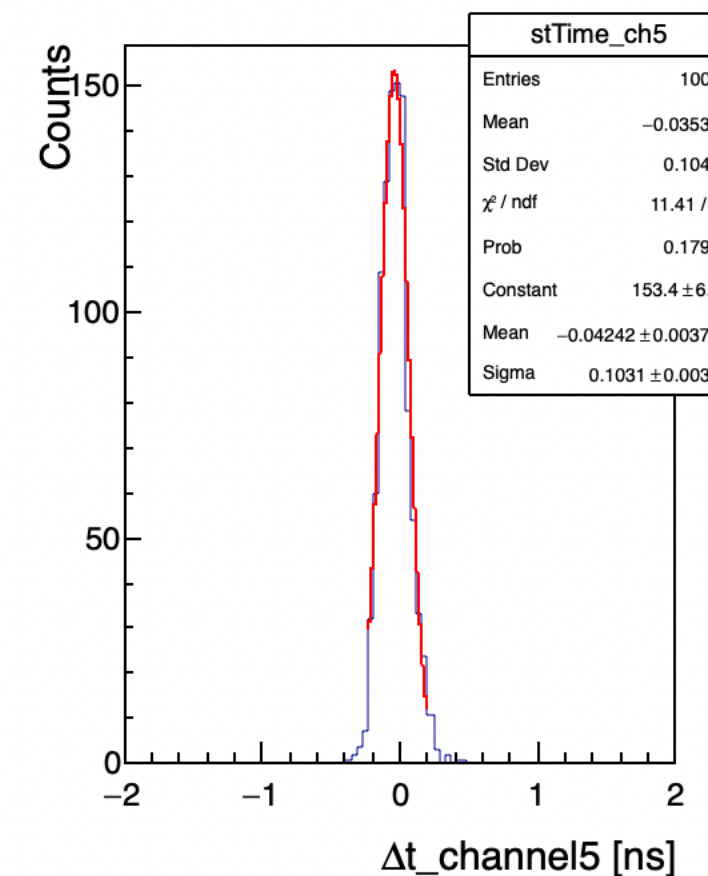
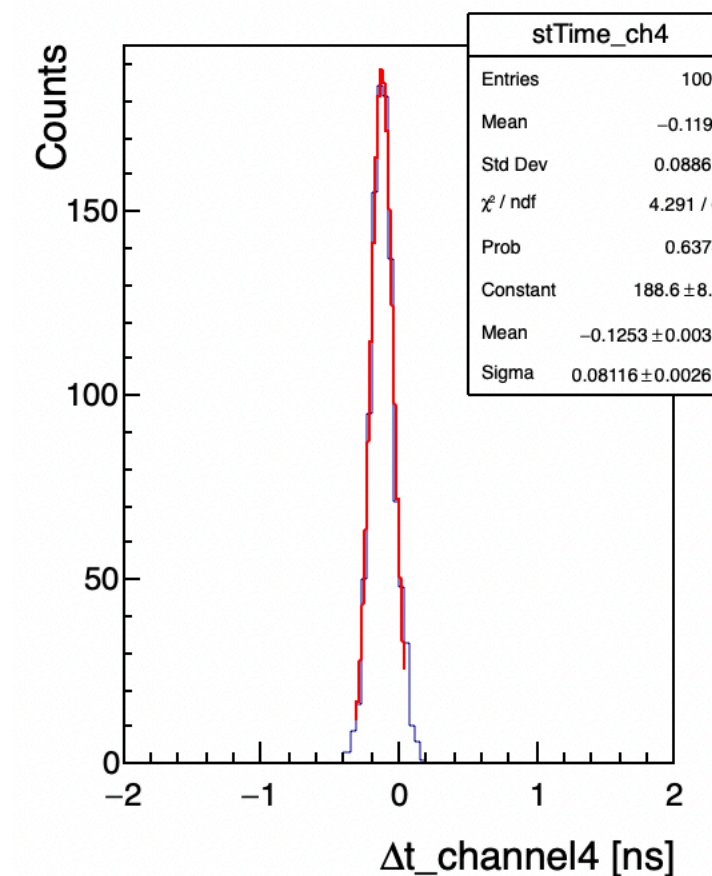
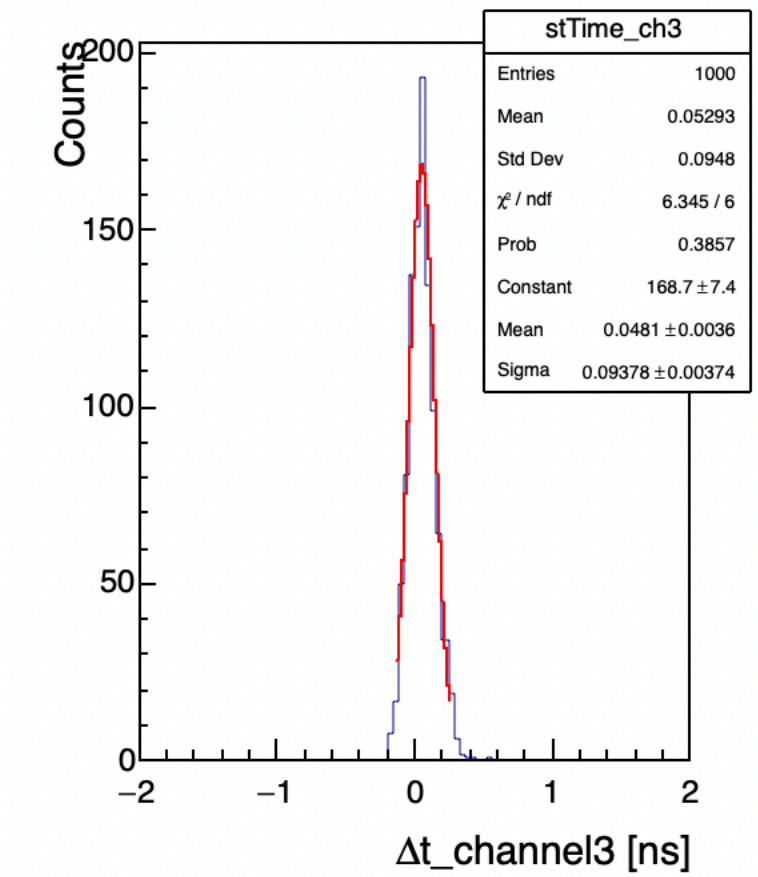
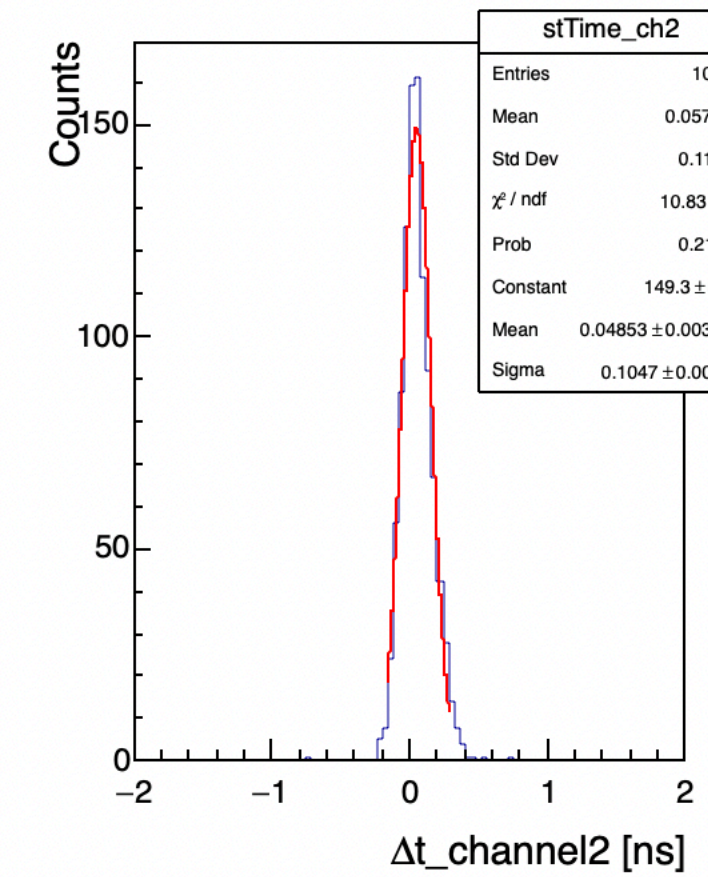
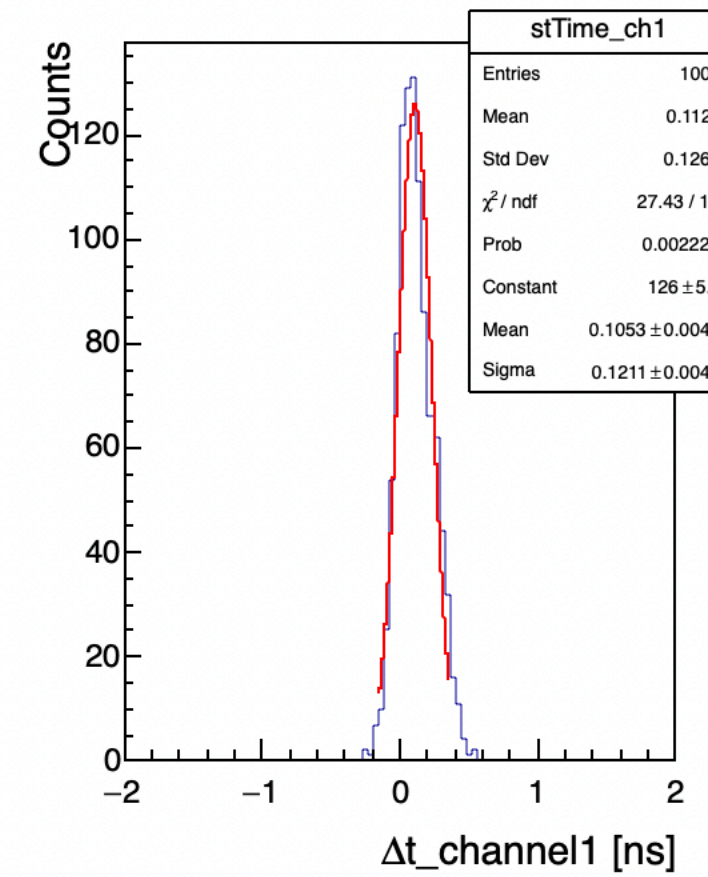
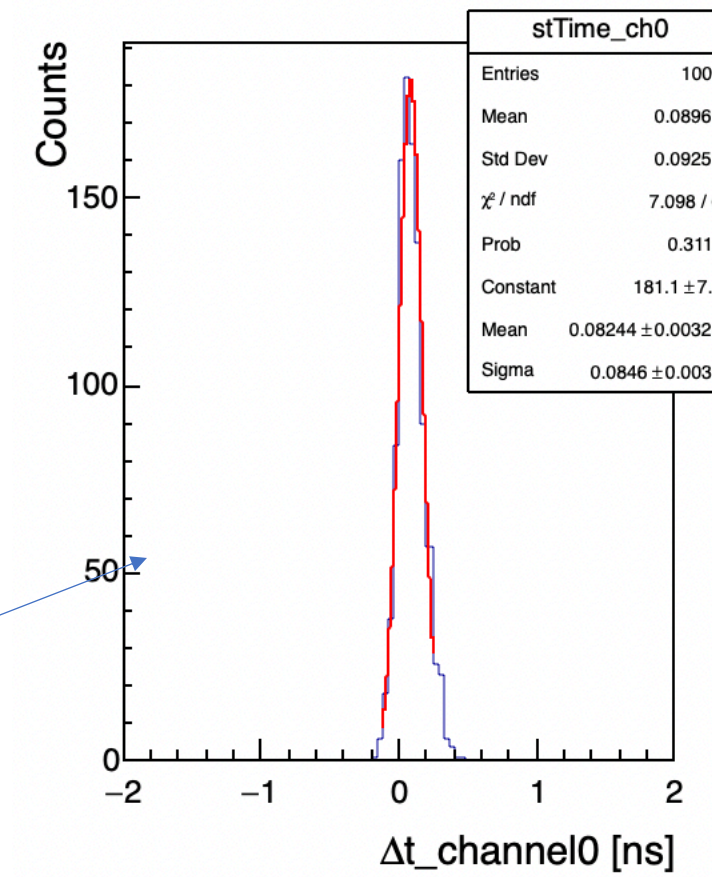
- The time resolution of the single channel σ_i has been evaluated as the standard deviation of

$$\Delta t_i = t_i - \frac{1}{7} \sum_{j \neq i} t_j$$

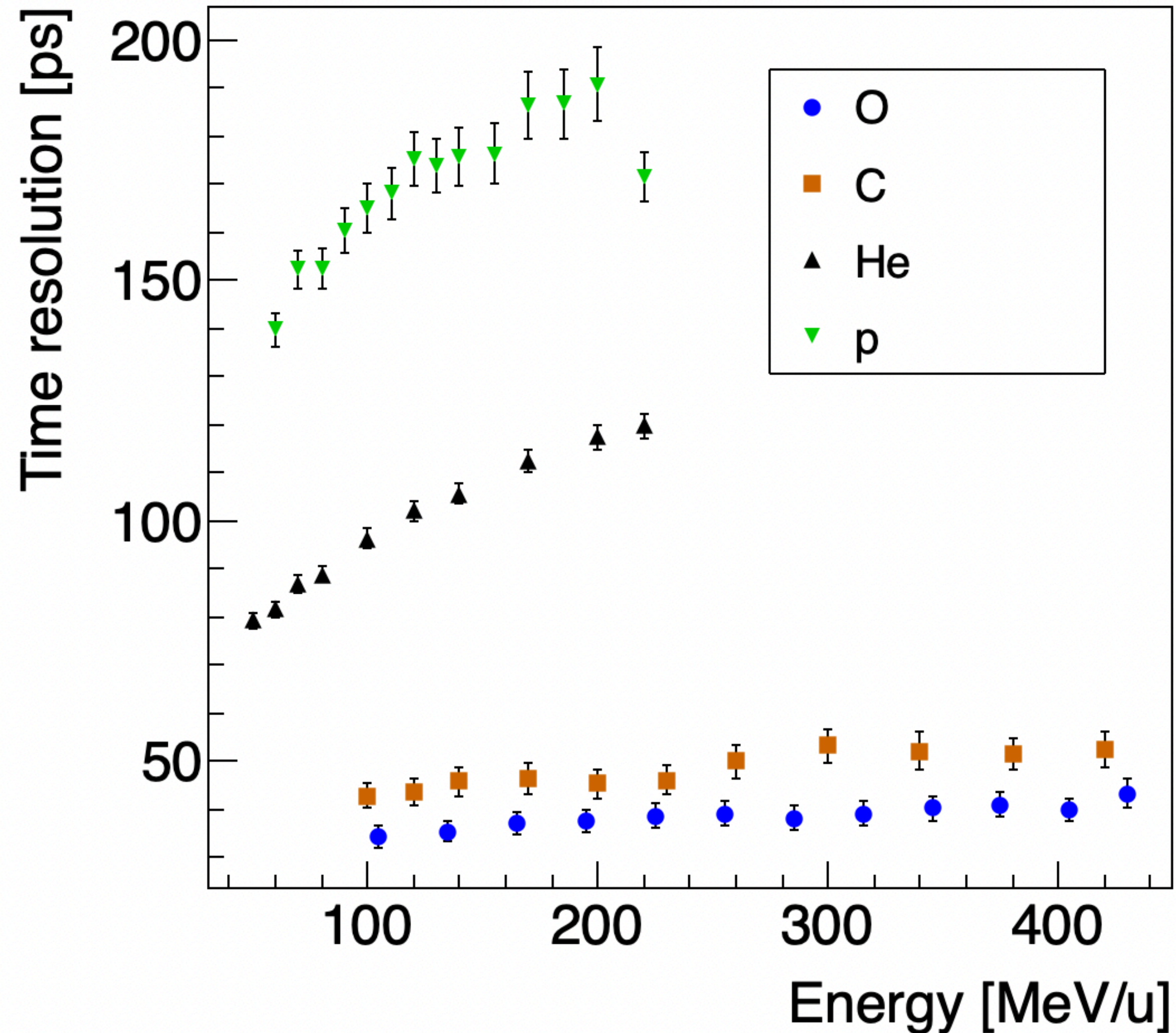
where t_i is the arrival time of the particle in the i -th channel

- Then, the ST time resolution has been taken as the the std deviation of the average

$$\sigma_{ST} = \frac{1}{8} \sqrt{\sum_i \sigma_i^2}$$



ST review: time resolution

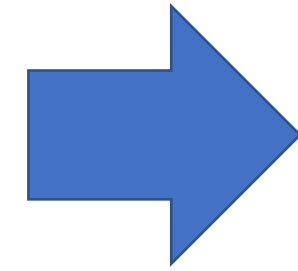


- Below 50 ps for C and O ions
- For He ions we are close to 100 ps. Question: do we need better?

ST review: time resolution

$$\sigma_t \propto \frac{1}{\sqrt{N_{\text{ph}}}}$$

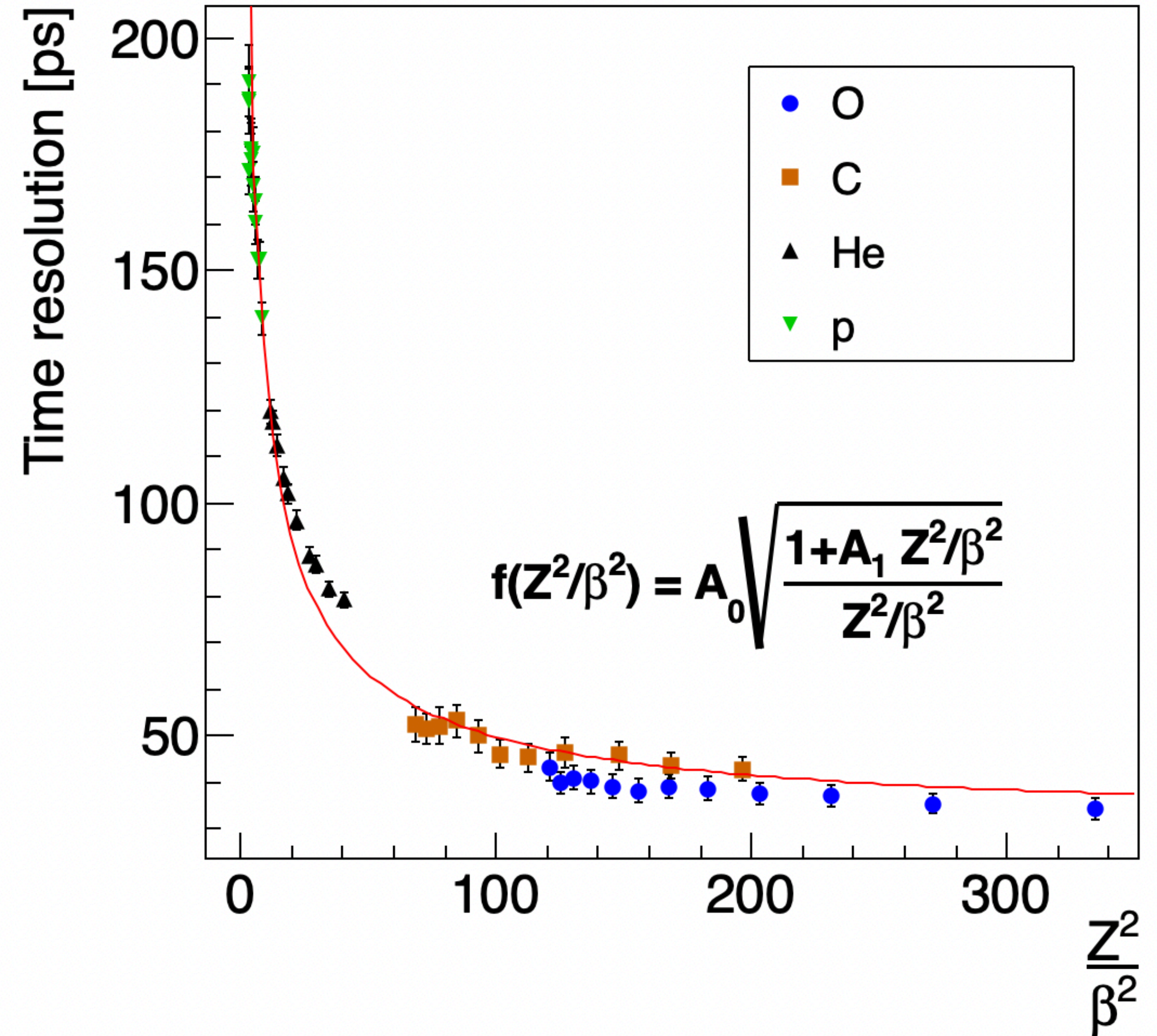
$$N_{\text{ph}} \propto \frac{\frac{dE}{dx}}{1 + kB \frac{dE}{dx}}$$



$$\sigma_t \propto \sqrt{\frac{1 + kB \frac{Z^2}{\beta^2}}{\frac{Z^2}{\beta^2}}}$$

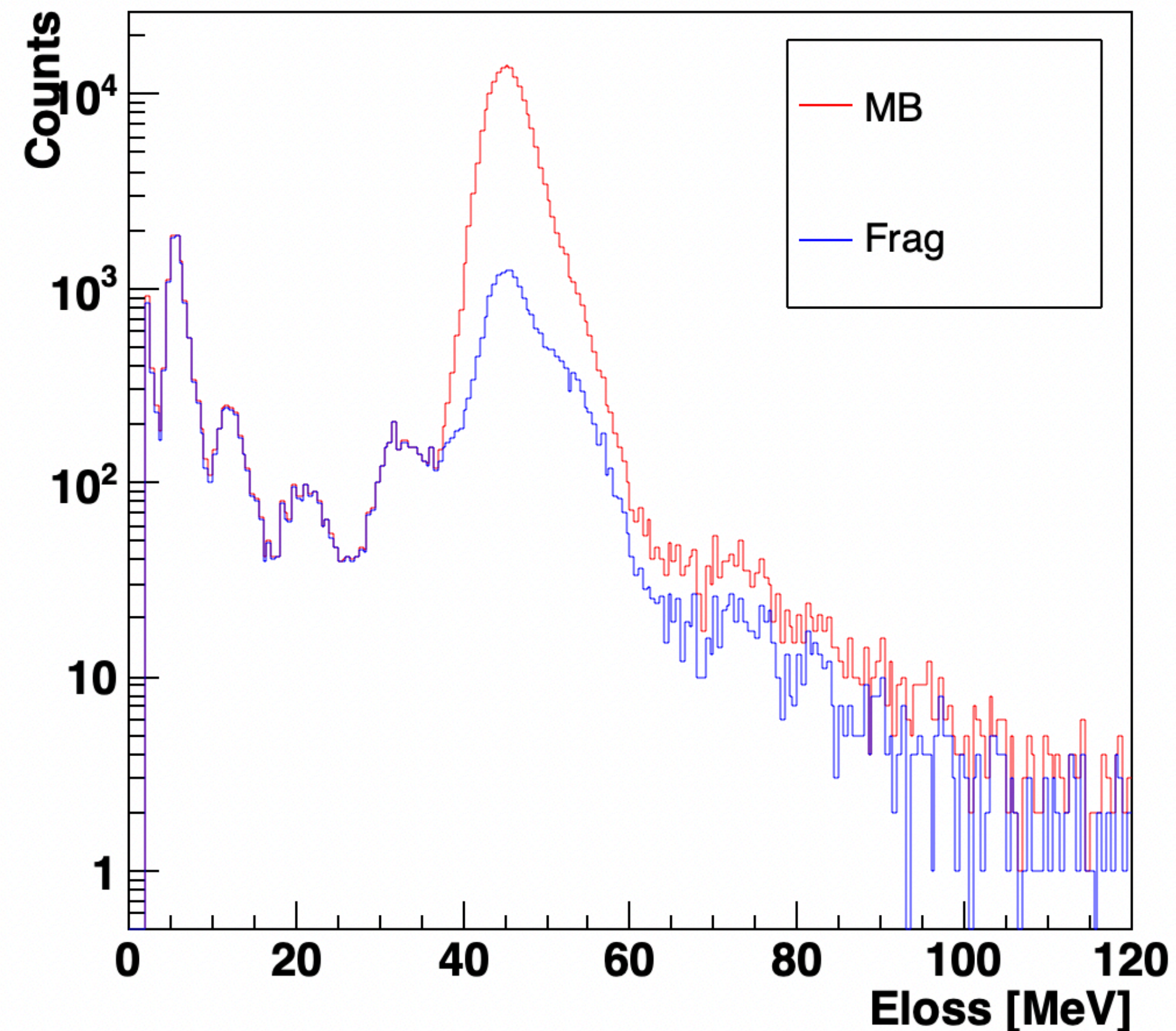
$$\frac{dE}{dx} \propto \frac{Z^2}{\beta^2}$$

- The trend is in agreement with expectations, suggesting that we have not reached the limit of electronics. This means that a more efficient light collection may be really effective in enhancing the resolution (battistero?)



Trigger

CNAO2022, C @ 220 MeV/u on C target



- Used both @HIT and @CNAO with different gains (~ 10 @ HIT, ~ 2 @CNAO)
- CAVEAT: we understood that we can not boost the beam rate so much, which translates in a lower gain
- Future developments: OR of full calo, backdate to old prescaling system