Setup of a low intensity configuration for extracted beams at CNAO

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Motivations

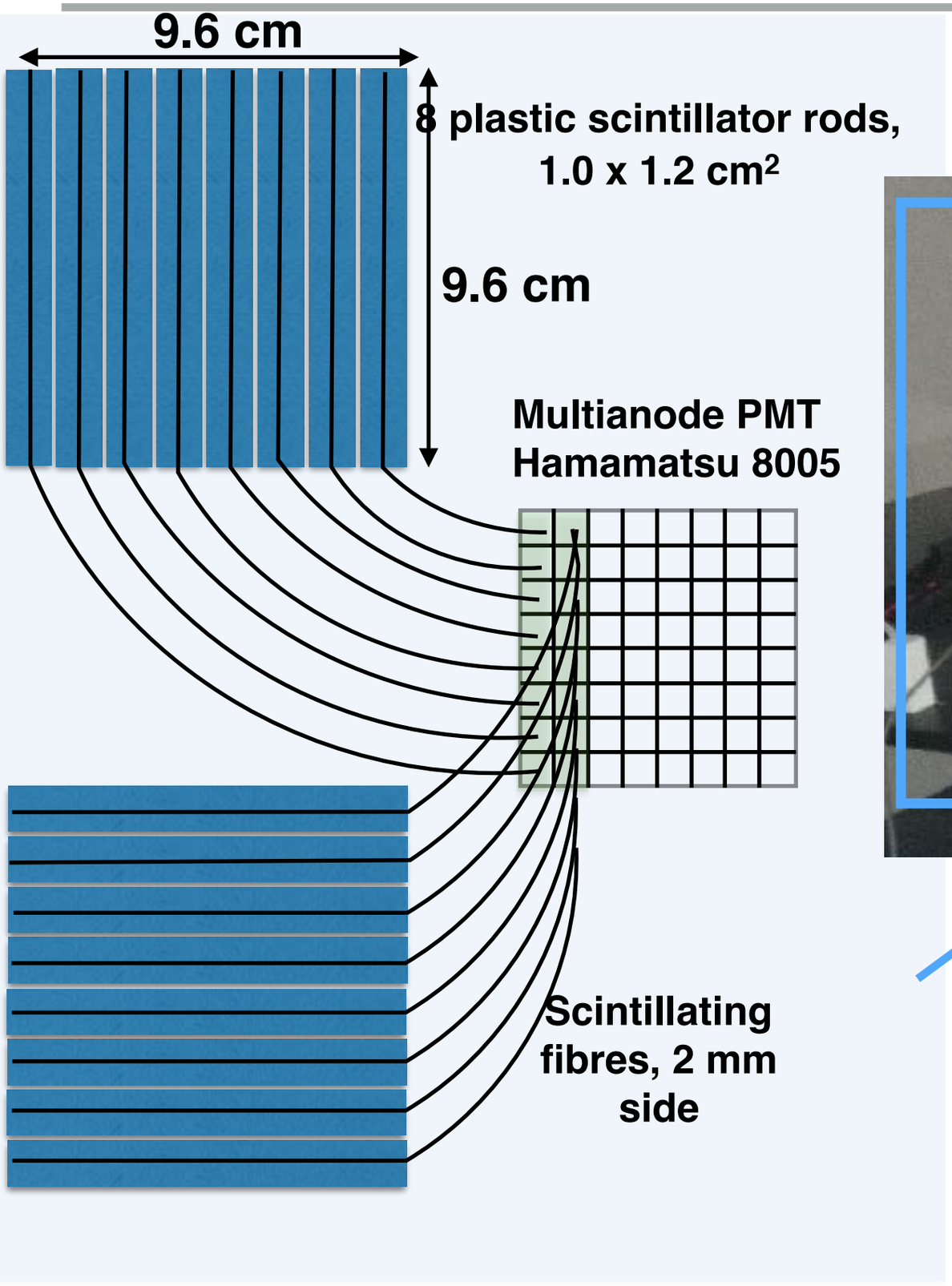
- **The present Dose Delivery System is able to steer the beam for intensities above ~10^6 particles/s**
- **For some applications like detector tests, some nuclear physics experiments (see FOOT exp.) a low intensity (10^3 - 10^4 particles/s) is required**

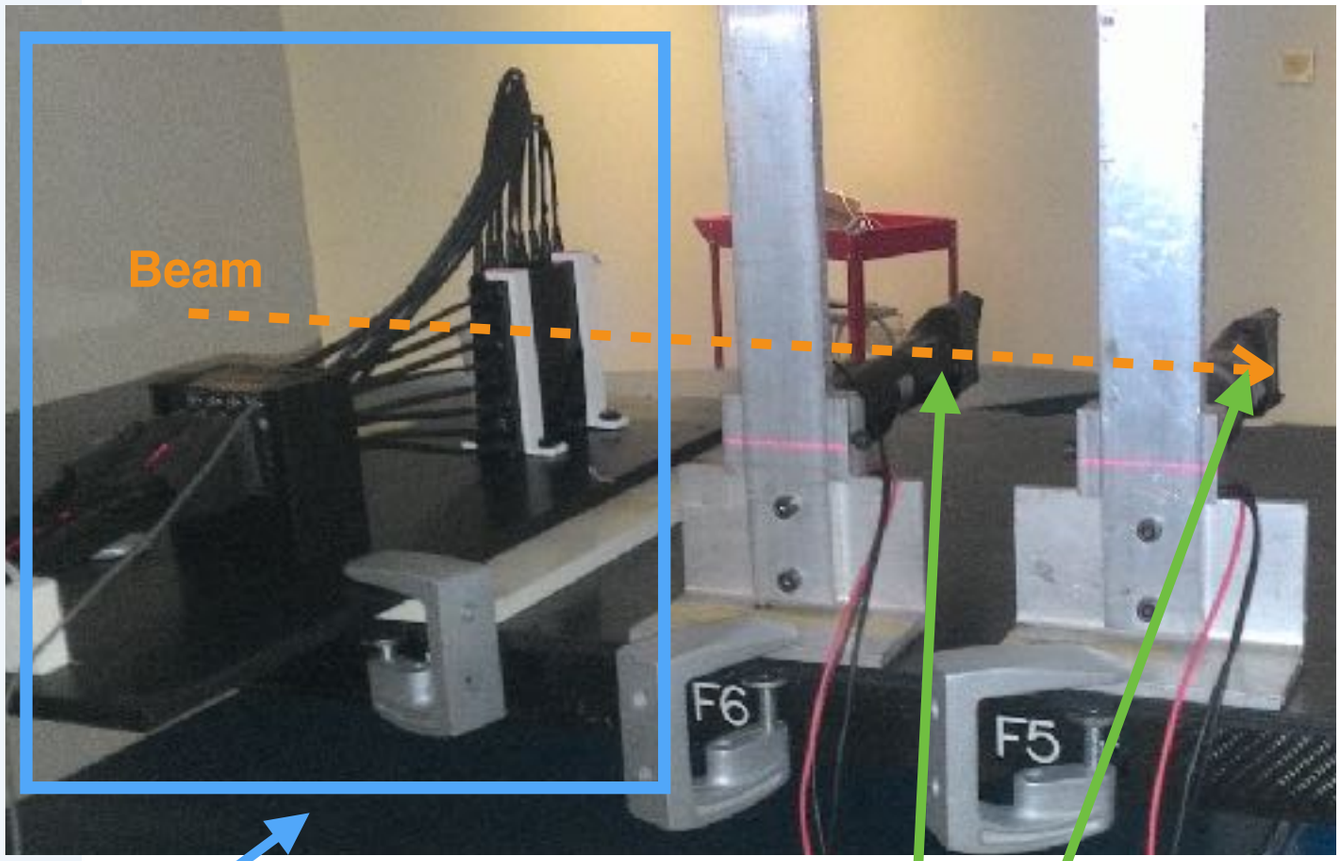
The idea…

- **how can we help the CNAO accelerator staff to find a setting in order to reach low beam intensities (~kHz)?**

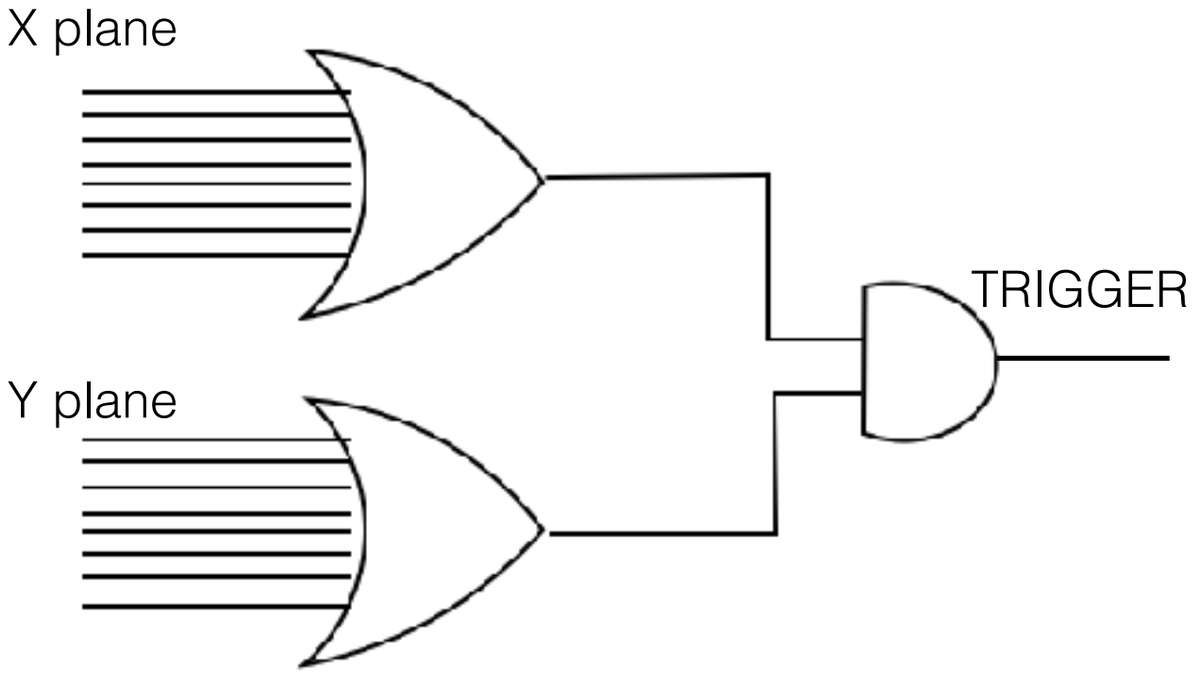
- **A dedicated detector, capable to count the incoming ions and to monitor the beam position in the x-y plane, has been developed (Roma - SBAI)**

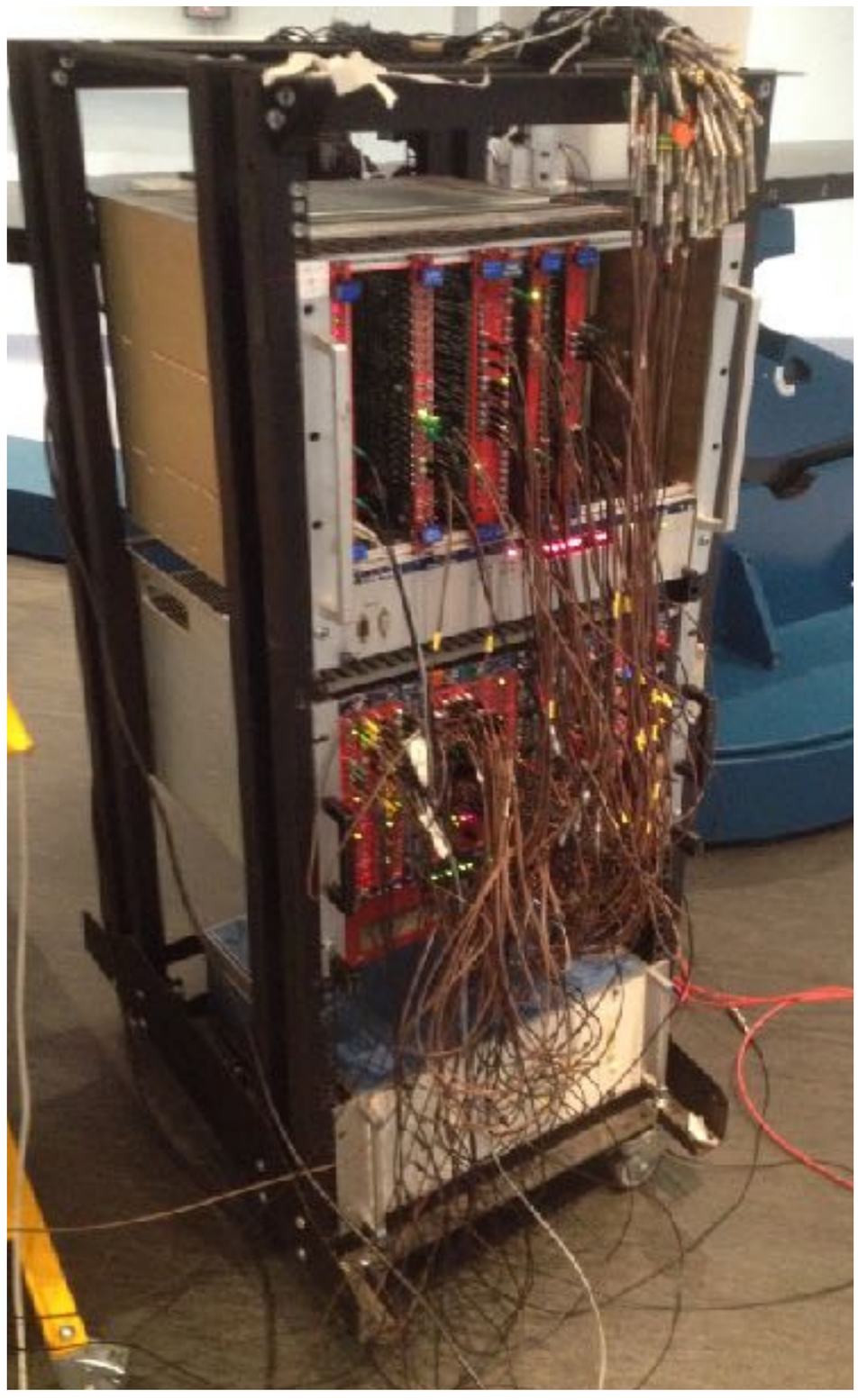
Experimental setup





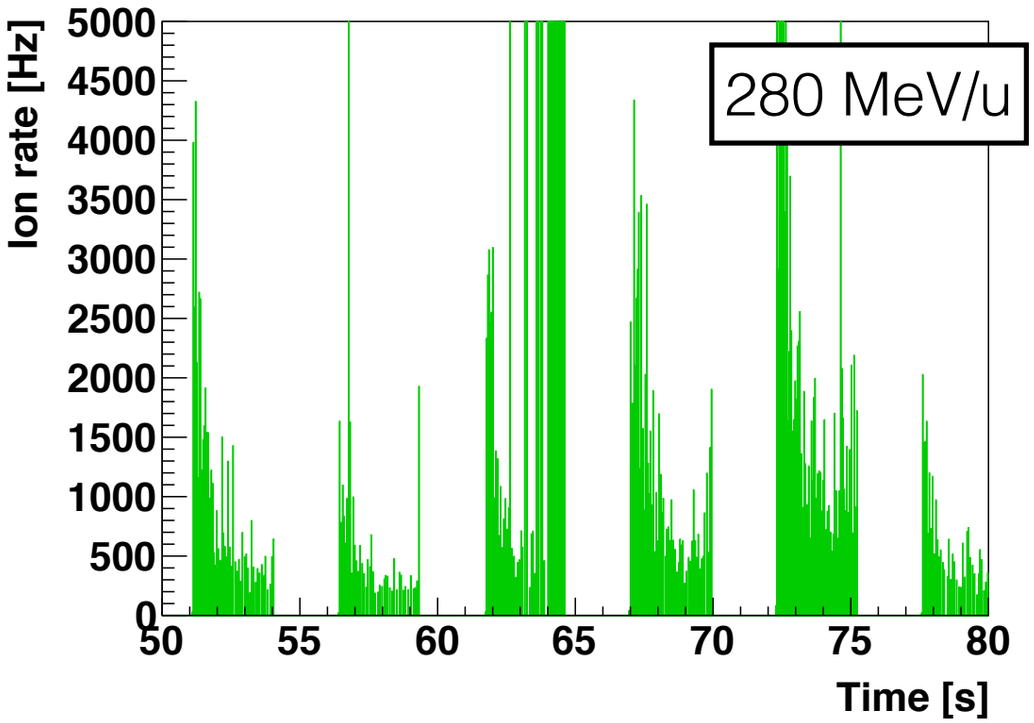
Trigger and DAQ

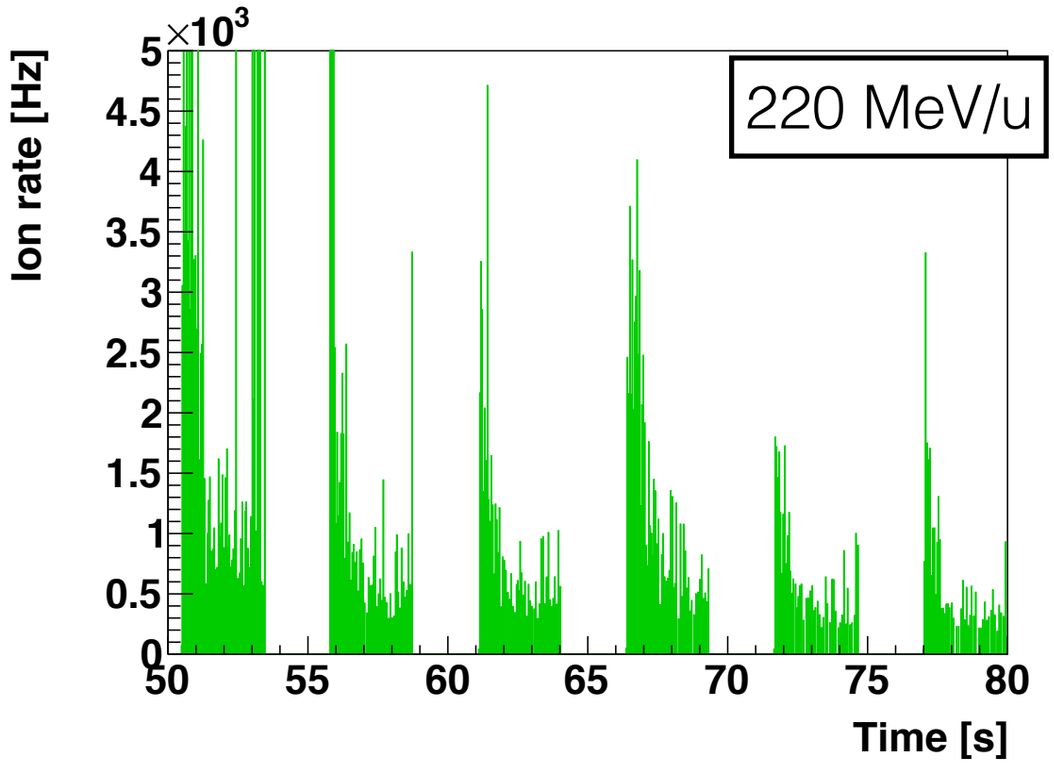


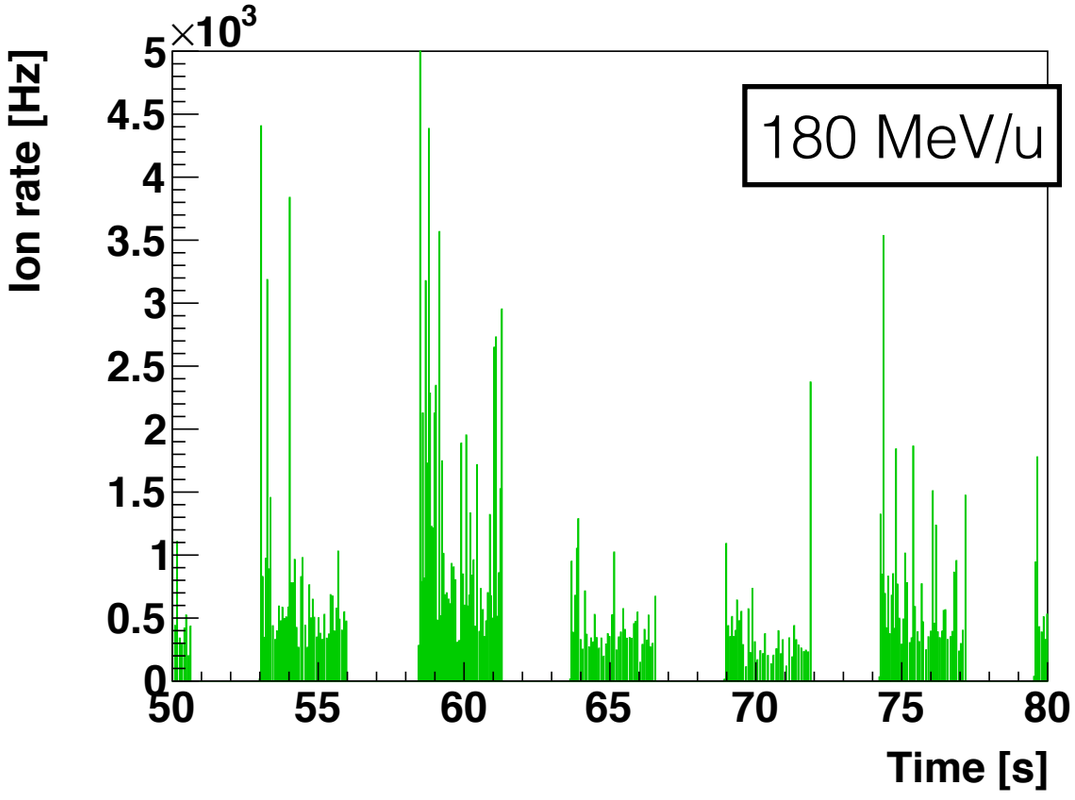


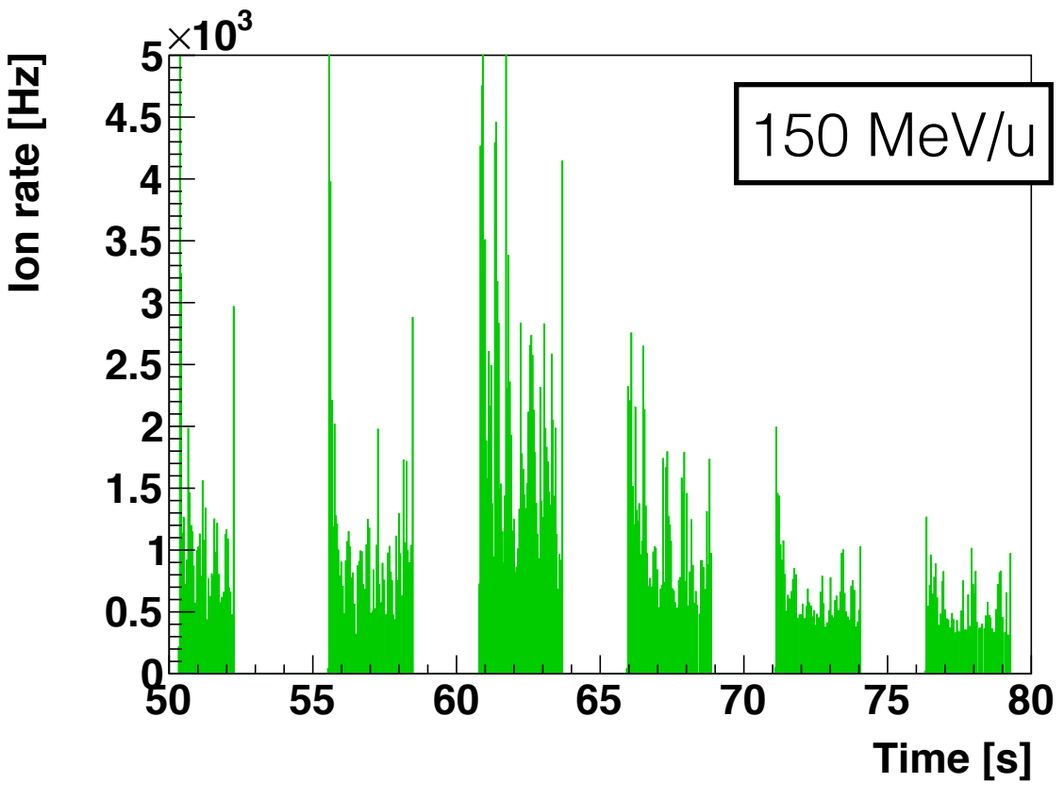
- **Trigger: coincidence between the X-Y planes. Fixed dead time of 30 ms**
- **VME-based data acquisition**
- **16 channels, multi-hit TDC V1290**
- **16 channels, QDC V792**
- **Scaler V560, V260**

Carbon ion beam - Intensities vs time



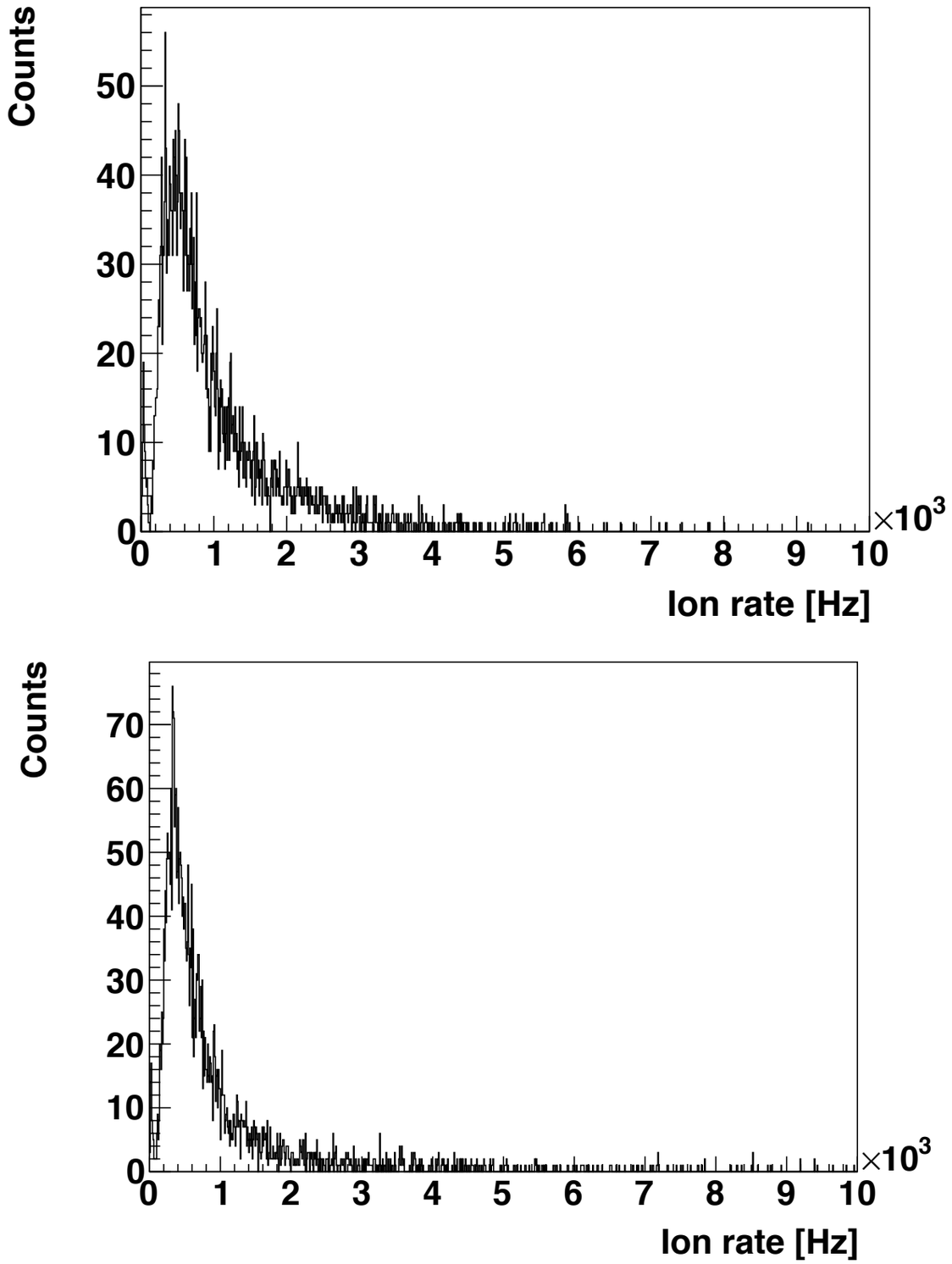


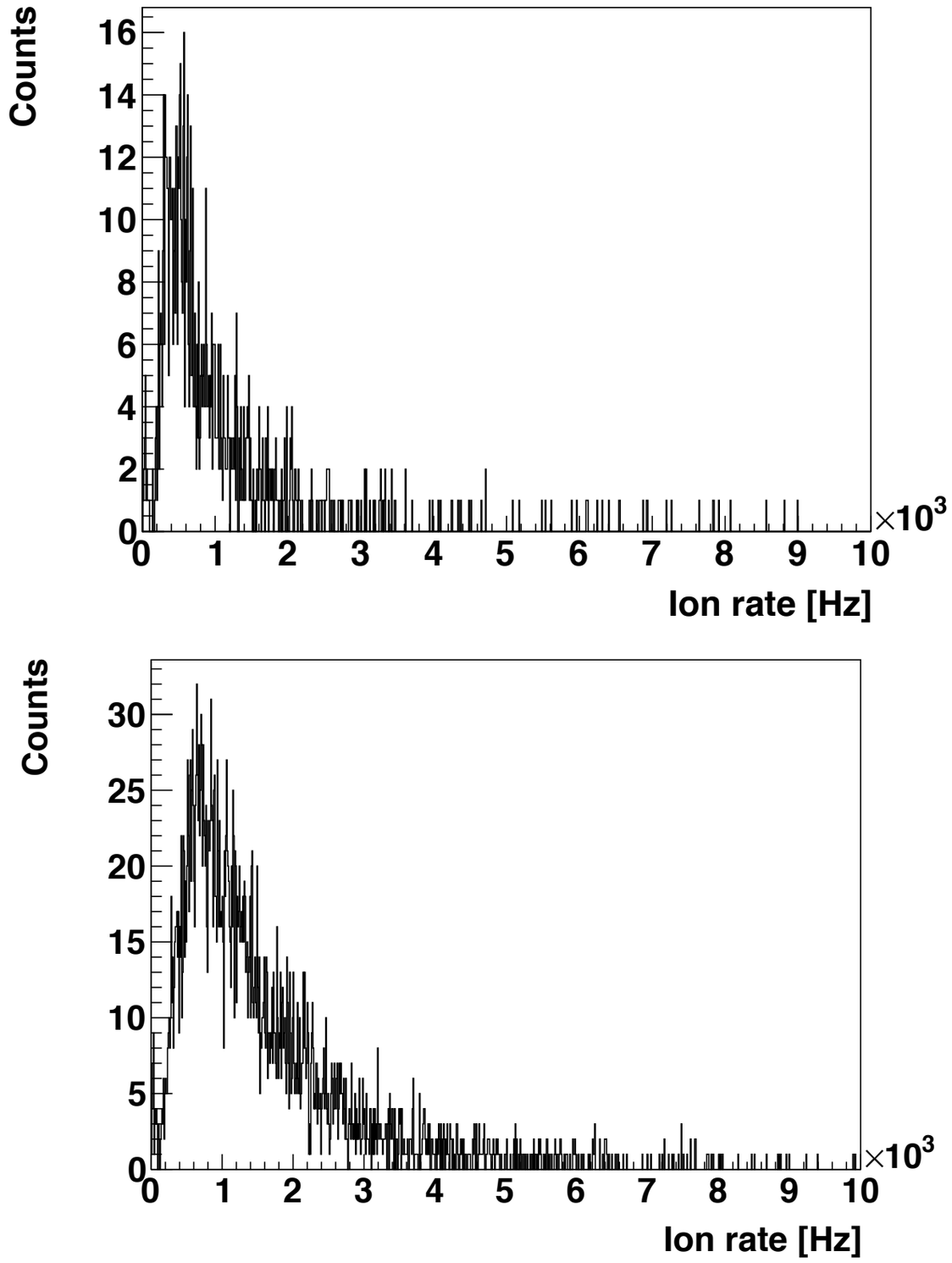




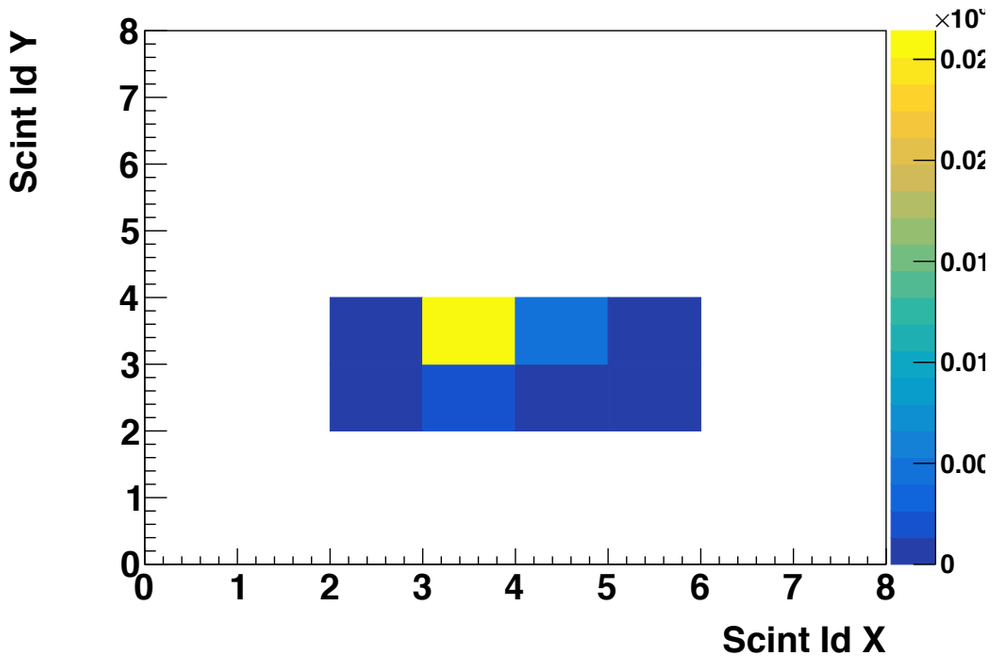
Carbon ion beam - Intensity distributions

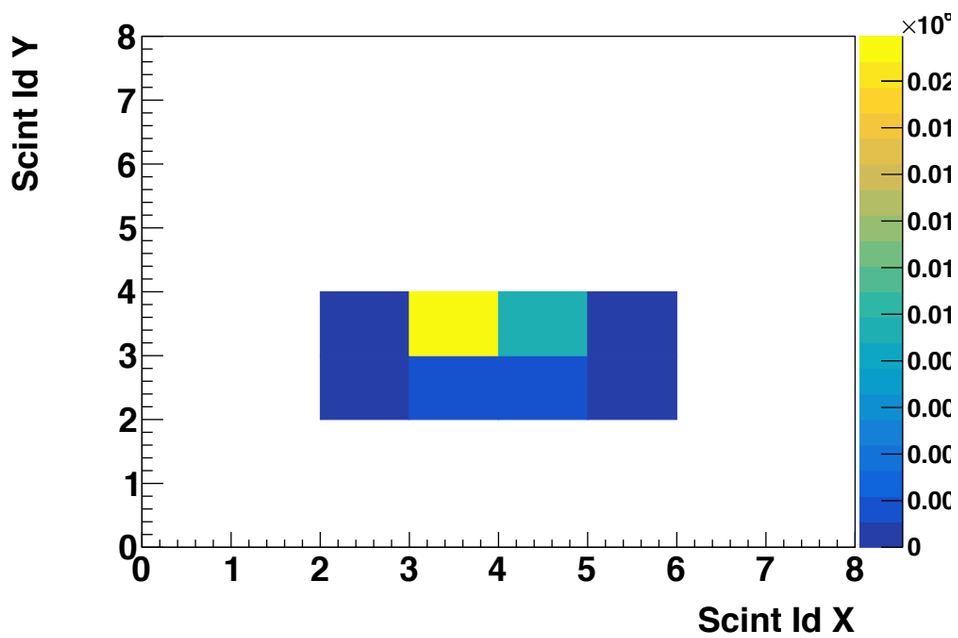
~90% efficiency has been measured, not applied in this analysis

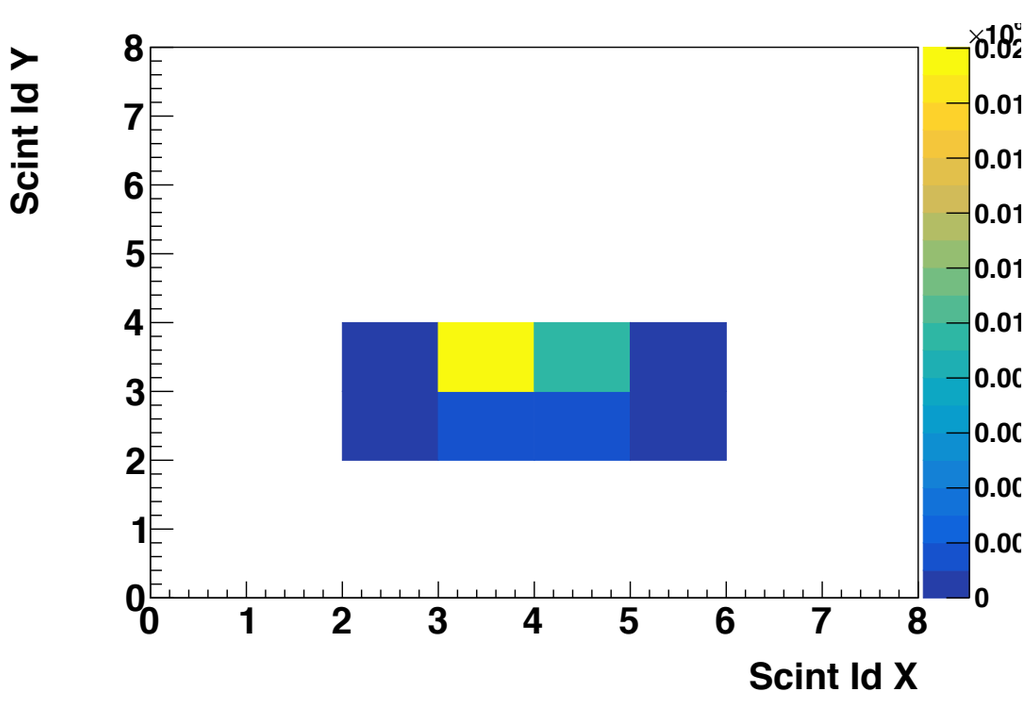


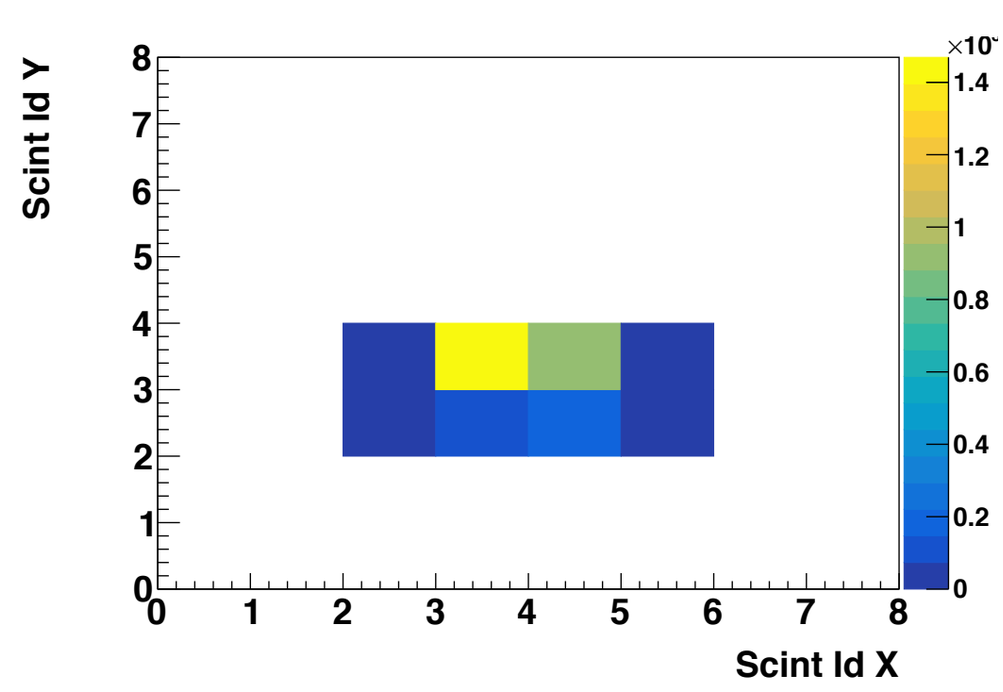


Carbon ion beam - Spatial distribution



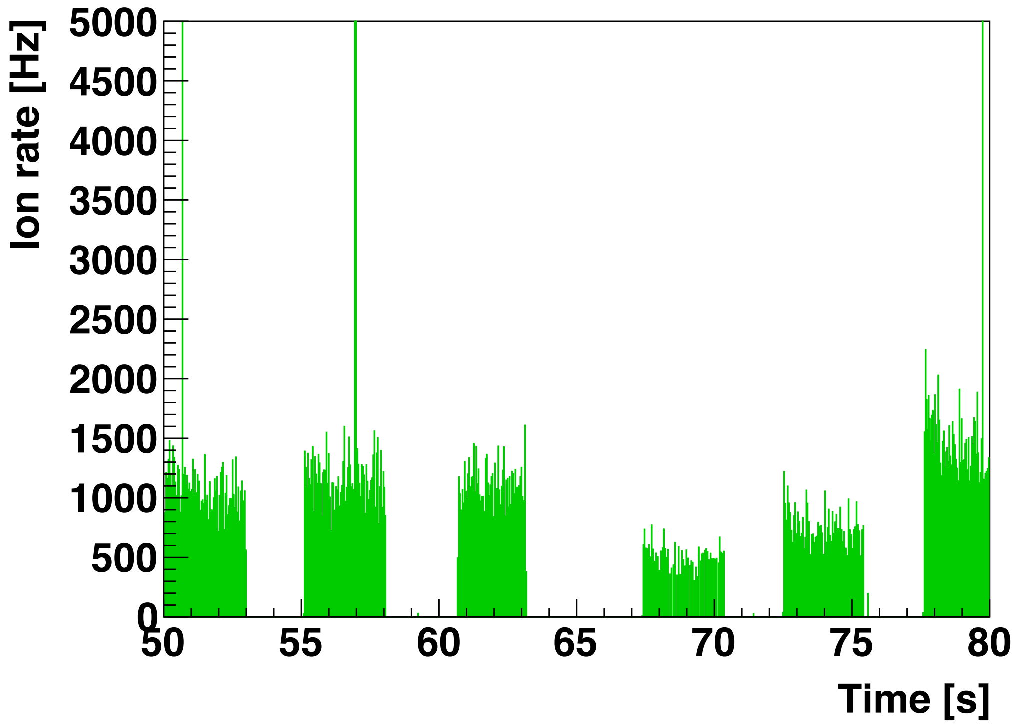


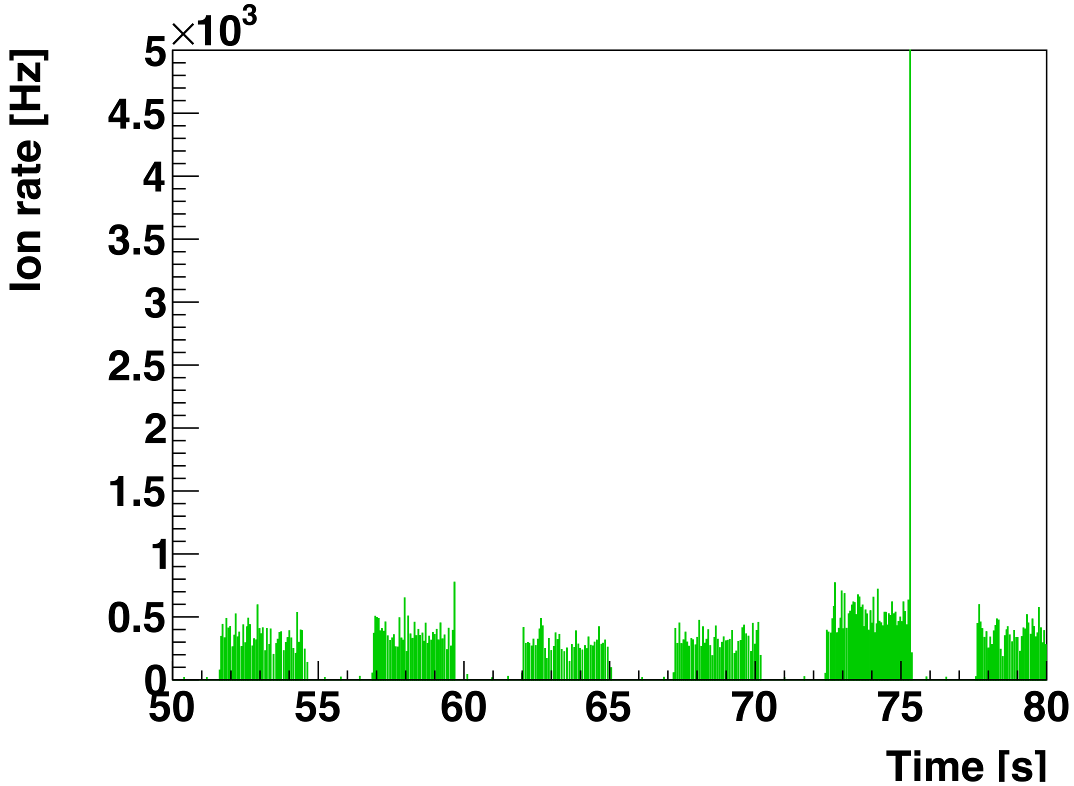


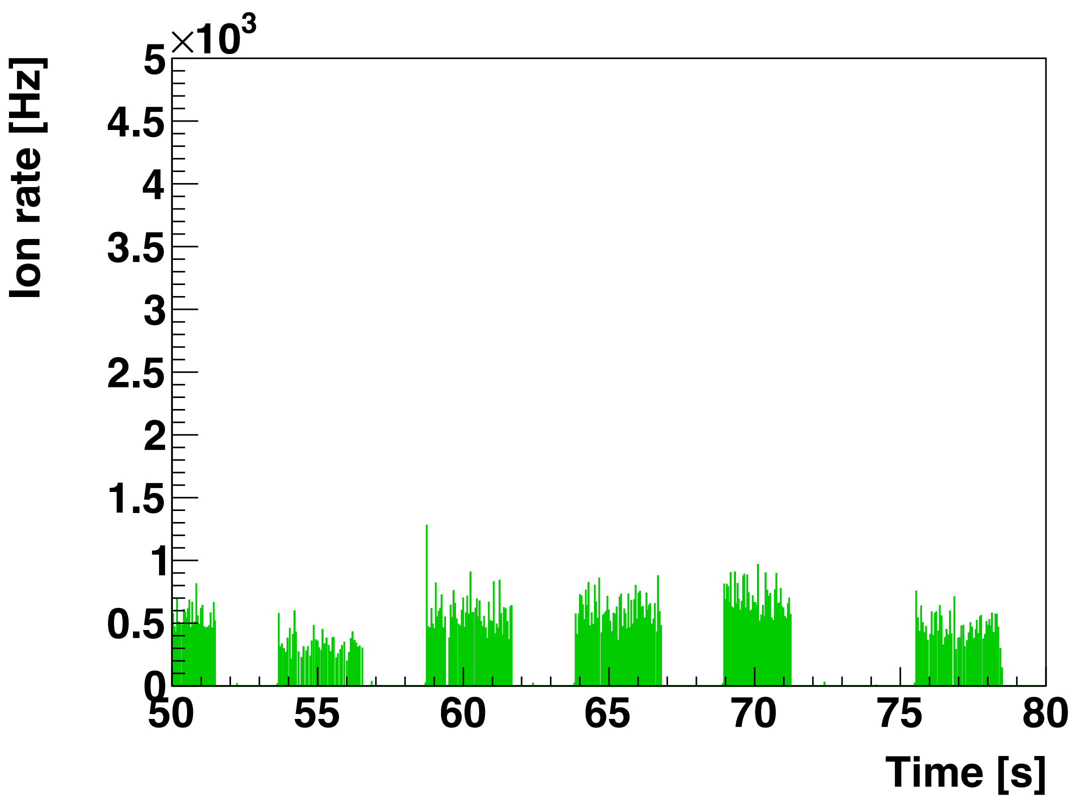


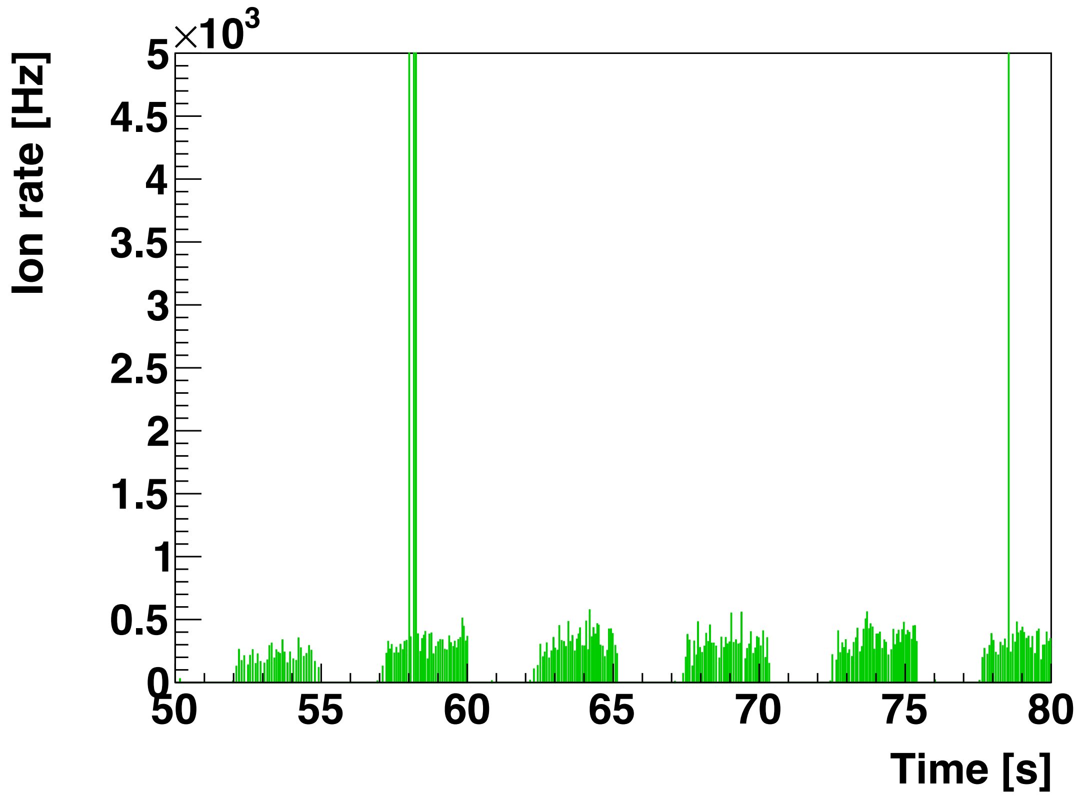
- **No significant beam spot movement!**

Proton beam - Intensities vs time

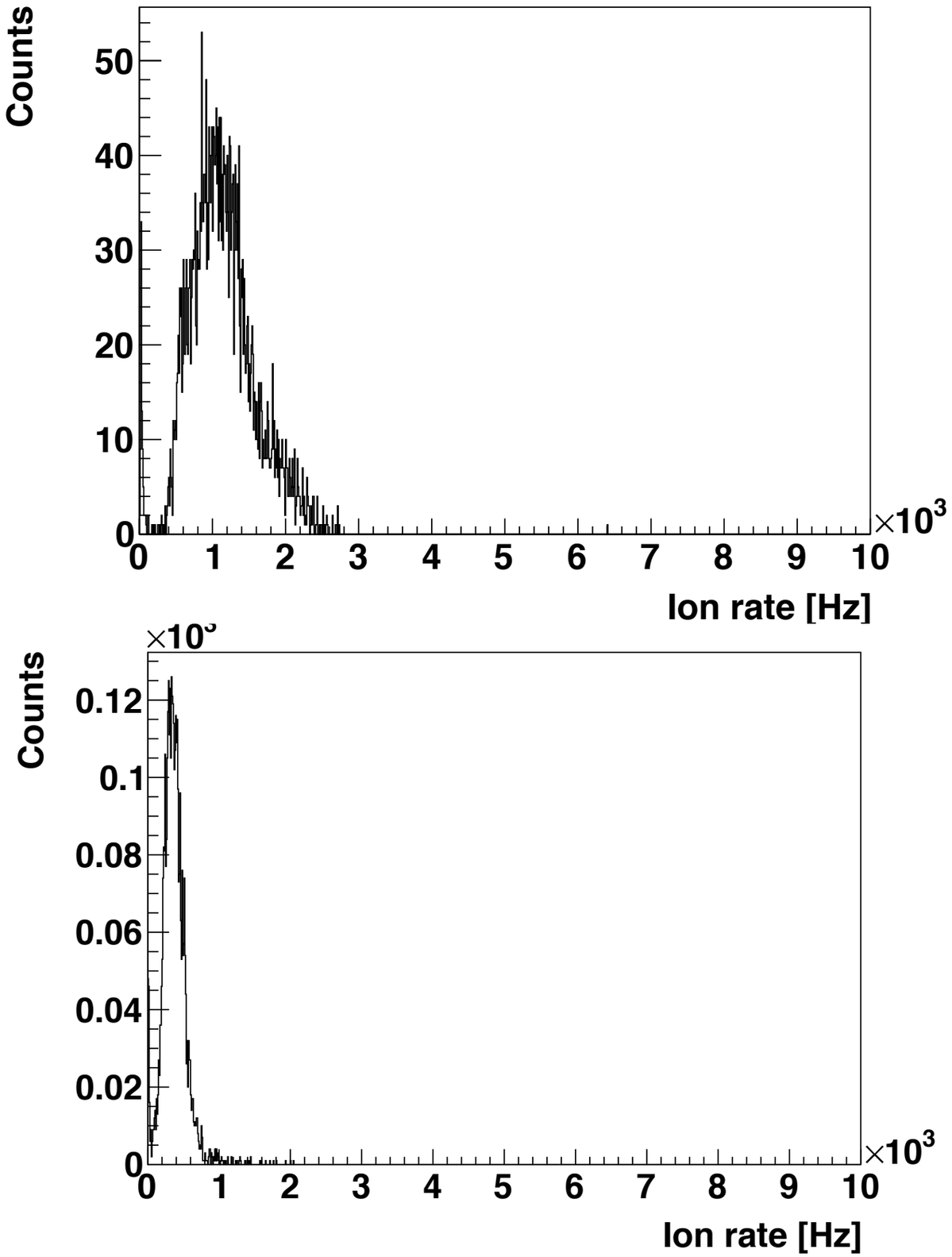


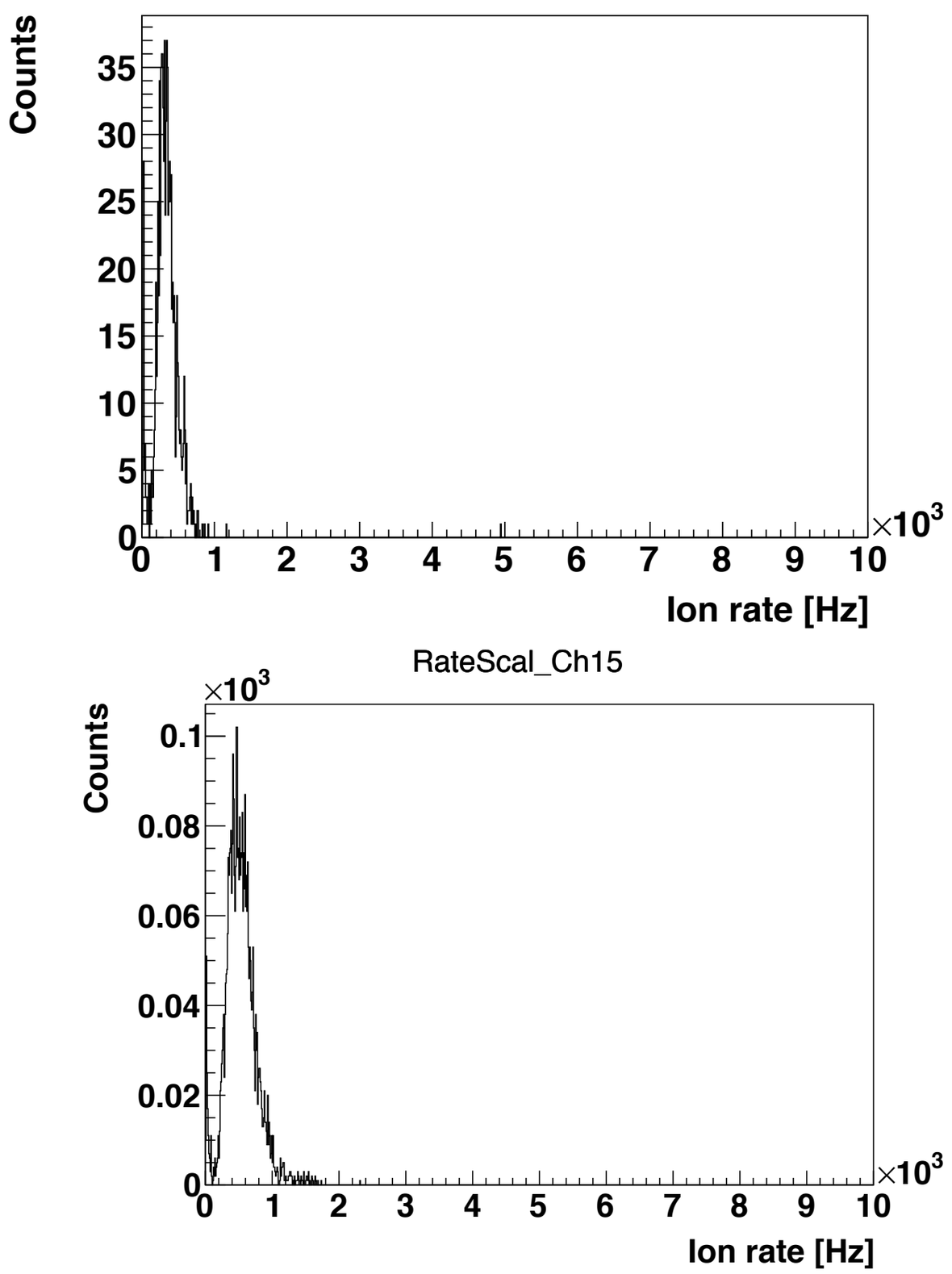






Proton beam - Intensity distribution





Conclusions

- **It was possible to reach beam intensities of the order of kHz at CNAO, both for Carbon ions and protons at different energies.**

- **The beam spot does not significantly change its position wrt the isocenter**

- **Such settings are reproducible. Tested for 2 different rooms (1 & 2)**

- **This configuration can be used also for the beam extracted in XPR**