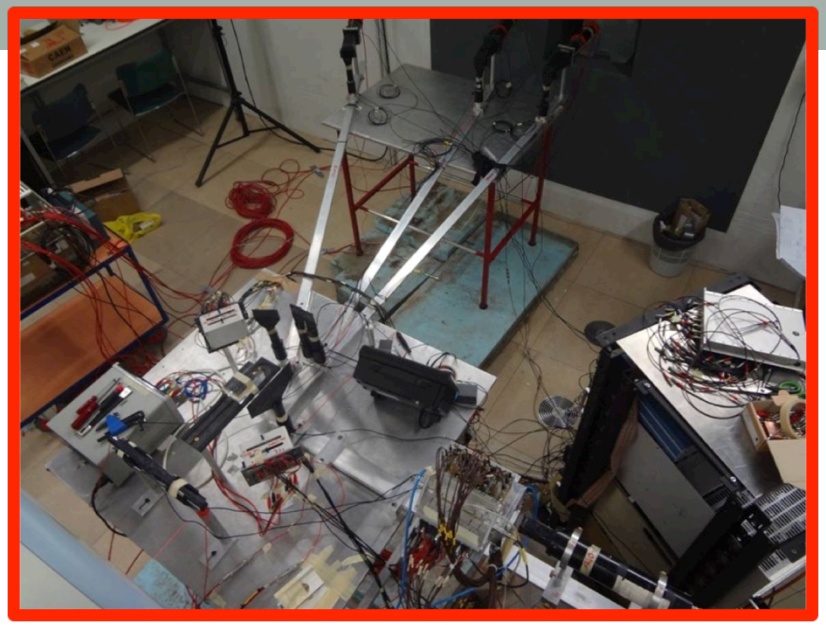

HIT DATA

Preliminary Analysis

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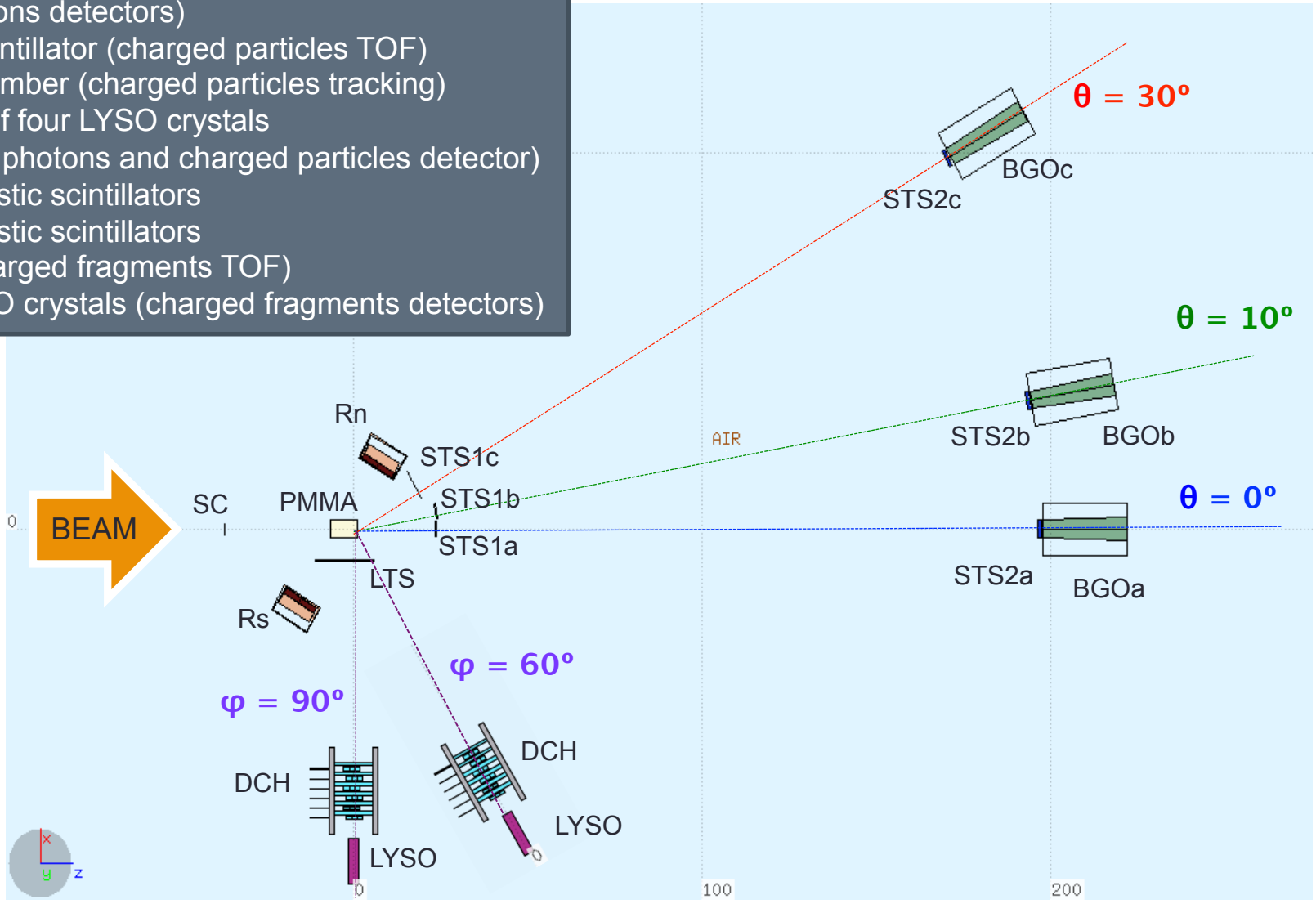
on behalf of
ARPG and RDH–WP5

RDH Meeting @ Roma

24 Aprile 2015

Experimental Setup

SC = plastic scintillator; trigger for the DAQ
PMMA = phantom
Rn = 2 pixelated LYSO,side by side,1.6x5x5 cm^3 each
Rs = 2 pixelated LYSO,side by side,1.6x5x5 cm^3 each
(PET photons detectors)
LTS = plastic scintillator (charged particles TOF)
DCH = Drift Chamber (charged particles tracking)
LYSO = matrix of four LYSO crystals
(prompt photons and charged particles detector)
STS1a,b,c = plastic scintillators
STS2a,b,c = plastic scintillators
(charged fragments TOF)
BGOa,b,c = BGO crystals (charged fragments detectors)



Collected Data

- HELIUM ion beam
  - 102 MeV/u (PMMA 7.65 cm long; 60º,90º)
  - 125 MeV/u (PMMA 10.0 cm long; 60º,90º)
  - 145 MeV/u (PMMA 12.65 cm long; 60º,90º)

- OXYGEN ion beam
  - 210 MeV/u (PMMA 7.65 cm long; 60º,90º)
  - 260 MeV/u (PMMA 10.0 cm long; 60º,90º)
  - 300 MeV/u (PMMA 12.65 cm long; 60º,90º)

- CARBON ion beam (PMMA 12.65 cm long; 90º)
  - 120 MeV/u
  - 160 MeV/u
  - 180 MeV/u
  - 220 MeV/u

Ongoing Analysis

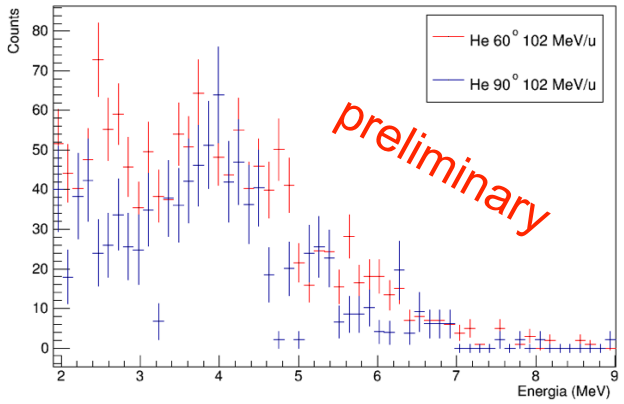
- Prompt Photons: SC, LYSO (90º, 60º)
  Purposes: energy spectra, yields
- PET Photons: PET heads (Rn, Rs: pixelated LYSO matrices)
  Purposes: spatial emission distribution to be related to the Bragg peak position, yields
- Charged Secondary Particles: SC, LYSO, LTS, DCH (90º, 60º)
  Purposes: spatial emission distribution to be related to the Bragg peak position, yields
- Charged Fragments: SC, BGO's, STS's (0º, 10º, 30º)
  Purposes: energy spectra, yields

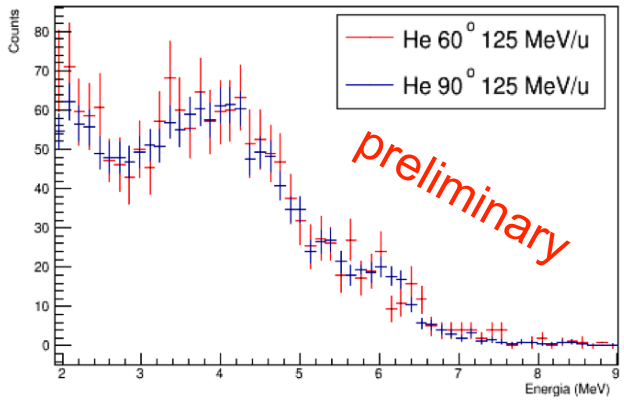
Prompt Photons

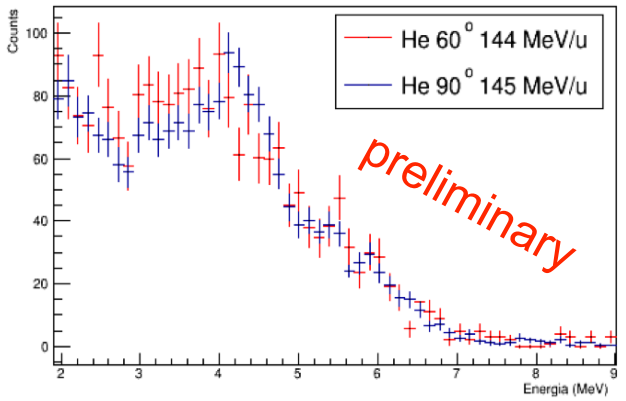
HELIUM beam

- The prompt photons have been selected from the Charge vs ToF distribution
- Using the RooFit tool, the number of prompt photons for each QDC bin has been extracted
- The LYSO energy calibration, obtained with the data collected at HIT with the ^{22}Na and ^{60}Co sources, has been applied to the raw spectra

The preliminary results show the agreement of the energy spectra shapes in the two different angular configurations (60º and 90º) for each beam energy (the spectra are normalized to the ~4 MeV peak)



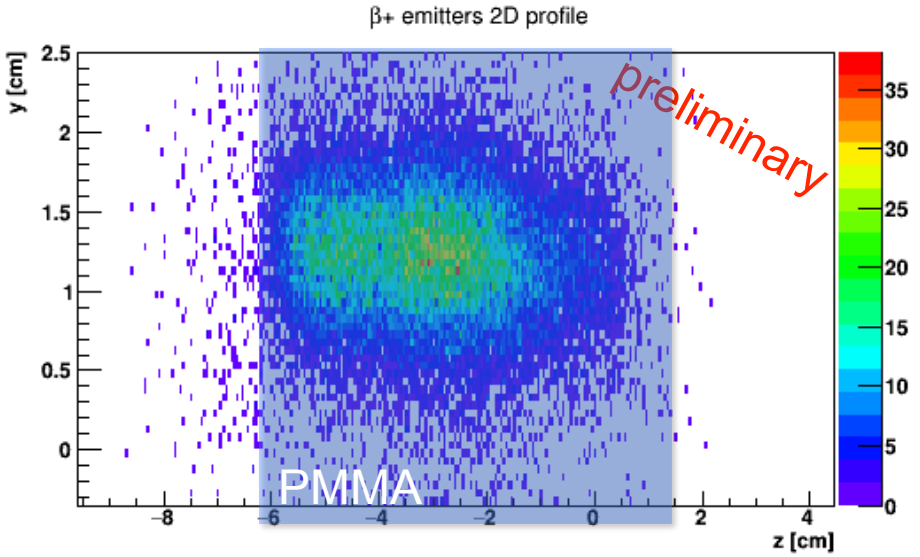


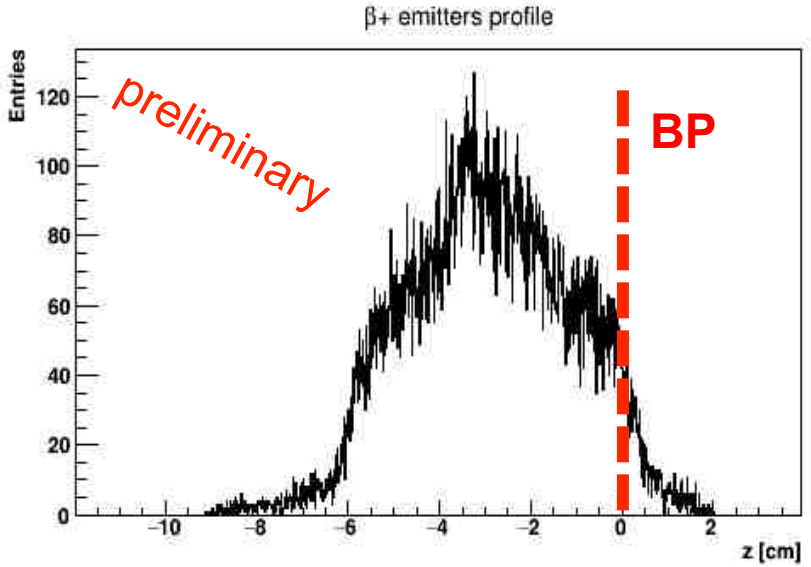


PET Photons

102 MeV/u HELIUM beam

The PET photons emission direction can be reconstructed using the pixelated LYSO crystals.
The emission profile (Z) of the PET photons can be related to the BP position.

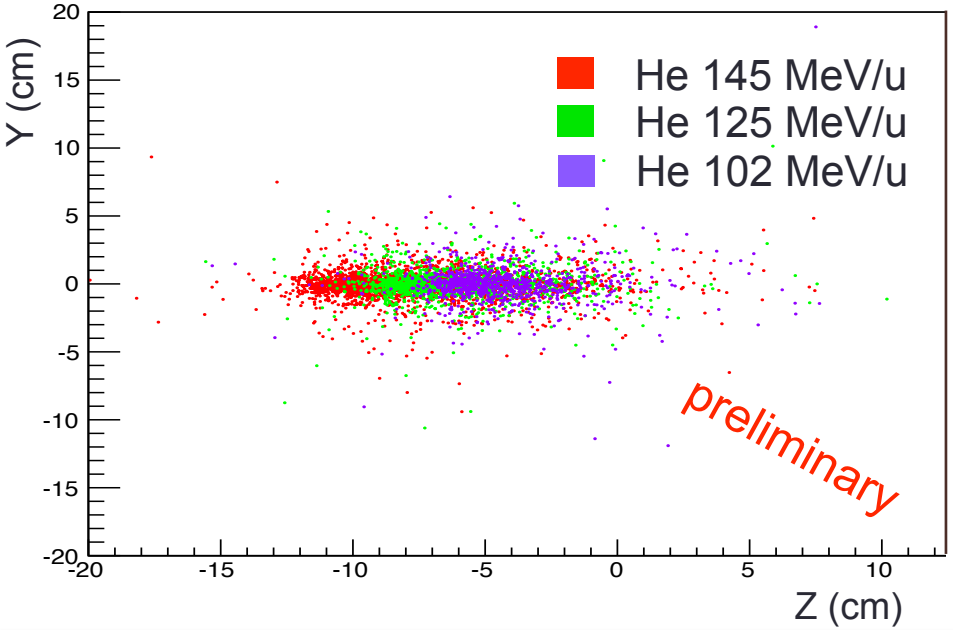


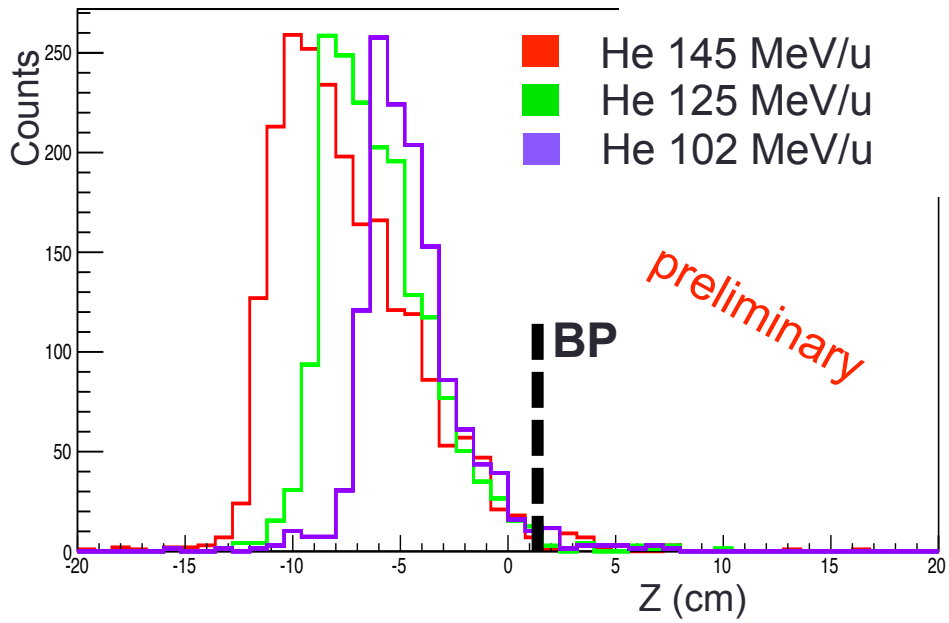


Charged Secondary Particles

HELIUM beam at different energies for the 90º configuration

The rise of the emission profiles (Z) of the secondary charged particles is related to the entrance of the beam in the PMMA target. The distributions have been fit in order to measure parameters that can be related to the BP position.
The Y-Z distributions show also the beam profile (Y).



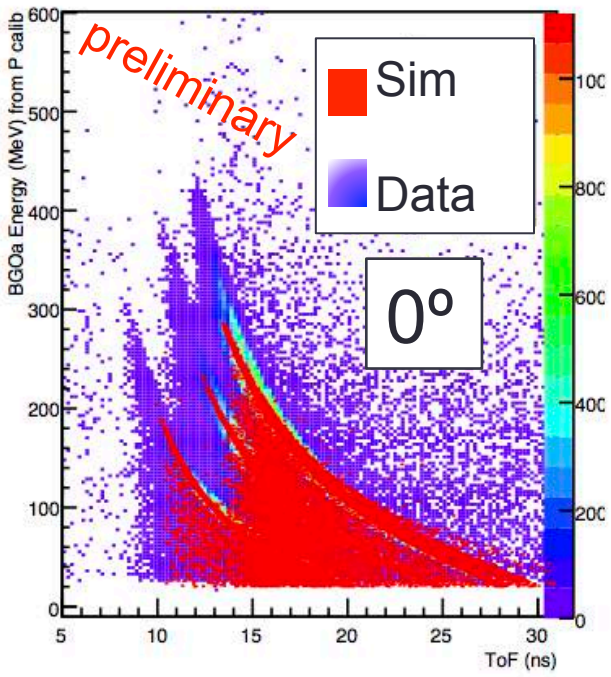


Charged Fragments

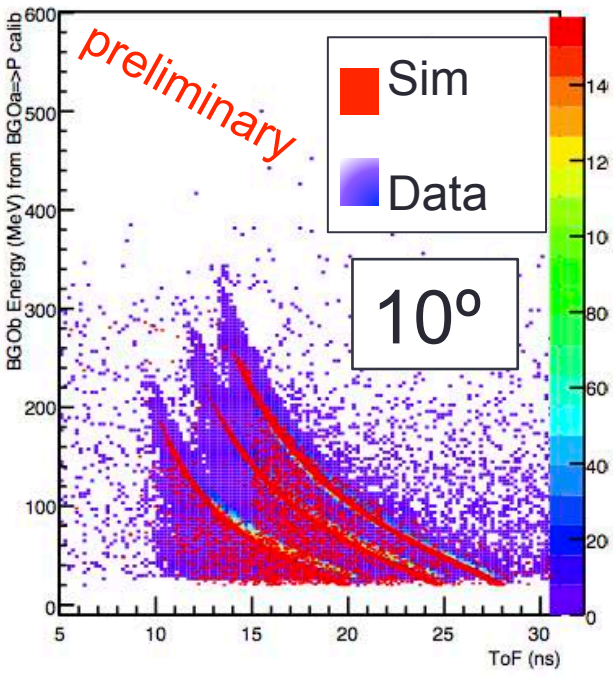
102 MeV/u HELIUM beam

The selection of the proton, deuteron and triton signals is guided by the FLUKA Monte Carlo simulation. After the particle identification, the energy spectra and yields can be extracted. The energy calibration has made with proton beams.

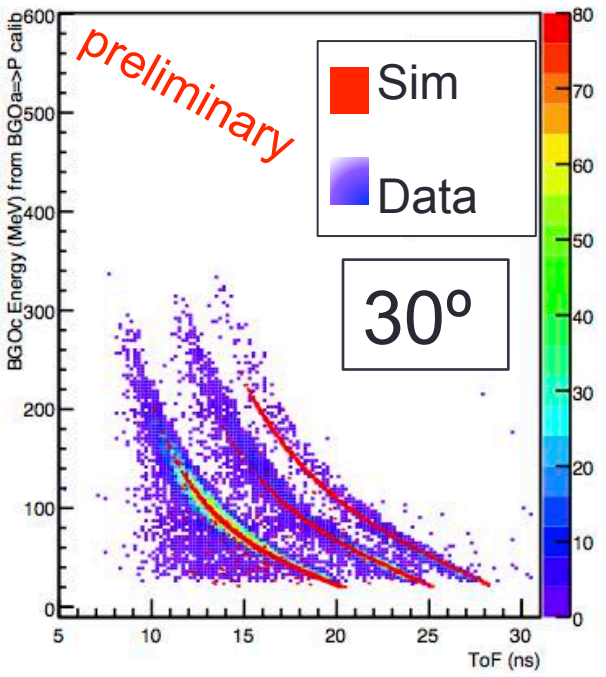
(Tsts2a - Tsts1a) vs ene (t0 corr)



(Tsts2b - Tsts1b) vs ene (t0 corr)



(Tsts2c - Tsts1c) vs ene (t0 corr)



Things to do and done:

- General: evaluation of the number of primaries impinging the target, DAQ dead time efficiency, detectors efficiency (we have almost everything…) in order to calculate the absolute yields; Oxygen and Carbon data analysis.
- Prompt Photons: yields; we have the energy spectra, showing the ^{12}C peak around 4 MeV.
- PET Photons: evaluation of the parameters to be related to the BP position, yields; from the temporal analysis off beam of the decays, the ^{11}C and ^{15}O isotopes are the most abundant β^+ emitters; we have the reconstructed profiles.
- Charged Secondary Particles: evaluation of the parameters to be related to the BP position, yields; we have the reconstructed profiles and the energy spectra.
- Charged Fragments: yields evaluation; we have the particle identification and the energy spectra.