



Measurements



Time window

- 4 * 6 hours shifts (there's a bonus hour in the first day: i believe that it counts as beam setup, I will Xchk.
 - Sat: 22 feb (2300 -> 600): (chance to have Oxy)
 - Sun: 23 feb (2300 -> 500): (chance to have Oxy)
 - Mon: 24 feb (2300 -> 500): Only He
 - Tue: 25 feb (2300 -> 500): Only He
- Available beams: He, O.
 - From Brons: A: Please note, that for switching the source from carbon to oxygen and vice versa we need something like 1 h , hence we **prefer** to have oxygen beam times only over the week end.
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Aim

→ Three different setups/measurements will be running in parallel

- Details on setup/geometry/electronics of single detectors and start counter discussed elsewhere: here general considerations about measurement goals/strategy

1) Charged/prompt gammas particles production at 90°

- Already done several times: 2 detectors (LYSO crystal + Drift Chamber) already used/known. 1 remaining new detector (Large Thin Scintillator) being built.

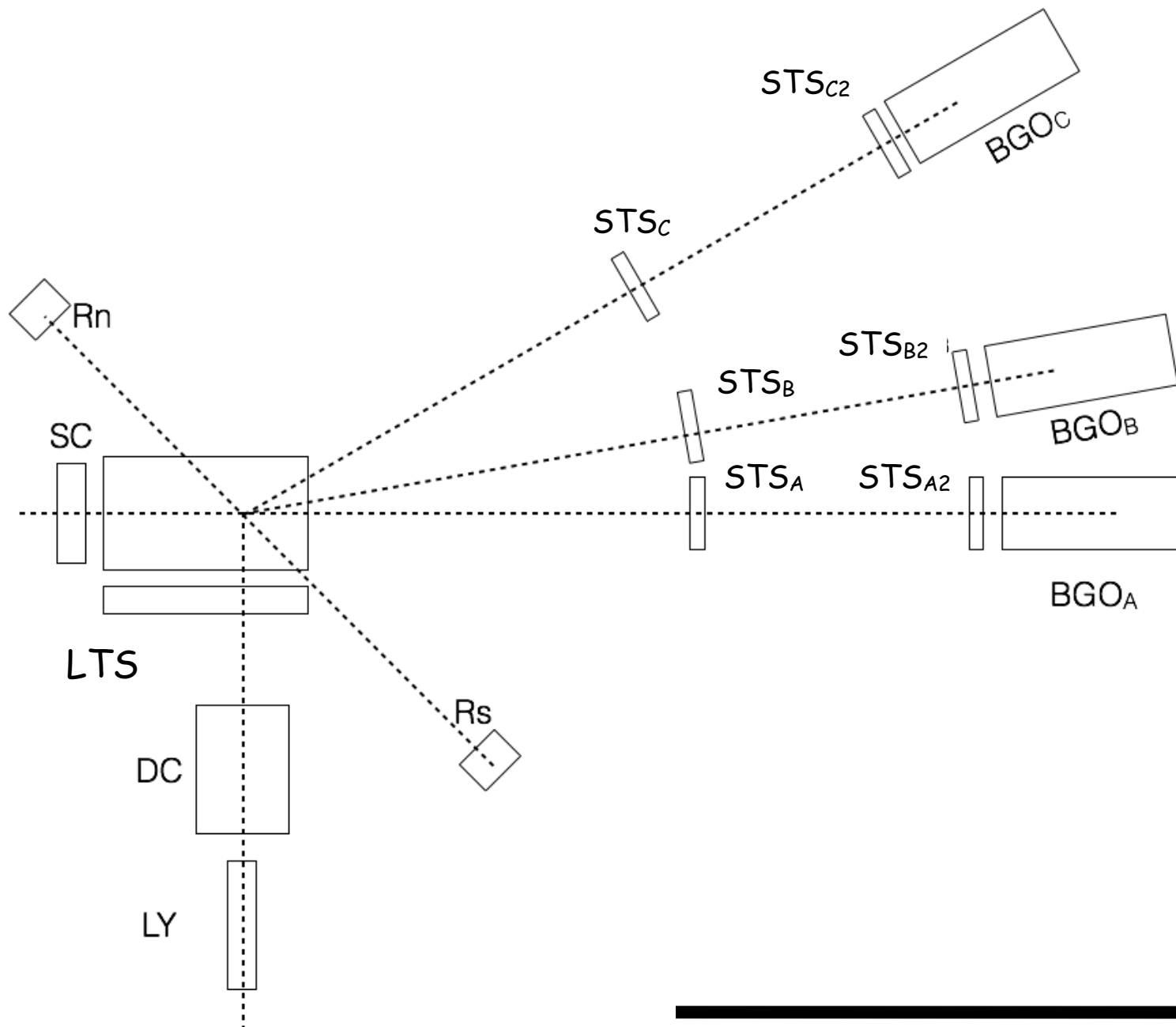
2) PET gammas at 45°

- Done only in Catania with different experimental conditions. 2 new detectors (never seen beam). Mechanics to be finished. Addition of 2 more detectors being considered (larger coverage along the PMMA/dose profile)

3) Fragmentation measurements btw 0° and 30°

- 9 New detectors. Never tried before. 3x(2 Small Thin Scintillators + 1 BGO crystal) parallel systems measuring ToF and dE/E to measure the fragmentation of He → (mainly He and p,d,t) and O → whatever in few forward angles btw 0° and 30°

General overview



Secondary @ 90° (I)

→ Charged particles:

- Measurement strategy: measure the production rates and spectra with a FIXED bragg peak position [driven by fragm. measurements need to have BP near the exit window from PMMA]
- Trigger given by either LTS&LYSO or by SC&LYSO (to be decided)
- Will detect p,d,t [identified by LYSO] and measure beta spectra [from ToF (LTS/LYSO)]; production position (Drift chamber back pointing); production rate (fluxes)
- Expected fluxes (@90°)
 - Measured at Catania and GSI:
 - Expected time needed to collect 1k tracks:
 - The BP monitoring will be done checking that we reconstruct each time the same position (since the BP position in space will be fixed)

Secondary @ 90° (II)

→ Prompt Gammas:

- Measurement strategy: measure the production rates and spectra with a FIXED bragg peak position [driven by fragm. measurements need to have BP near the exit window from PMMA]
- Trigger given by either LTS&LYSO or by SC&LYSO (to be decided)
- Will detect prompt gammas [identified by LYSO against large neutron bkg] and measure E spectra [from ToF pull fitting (LTS/LYSO)] and integrated production rate (fluxes)
- Expected fluxes (@90°)
 - Measured at Catania and GSI:
 - Expected time needed to collect 1 photons:

Secondary @ 90° (III)

→ Still to be optimized/fixed:

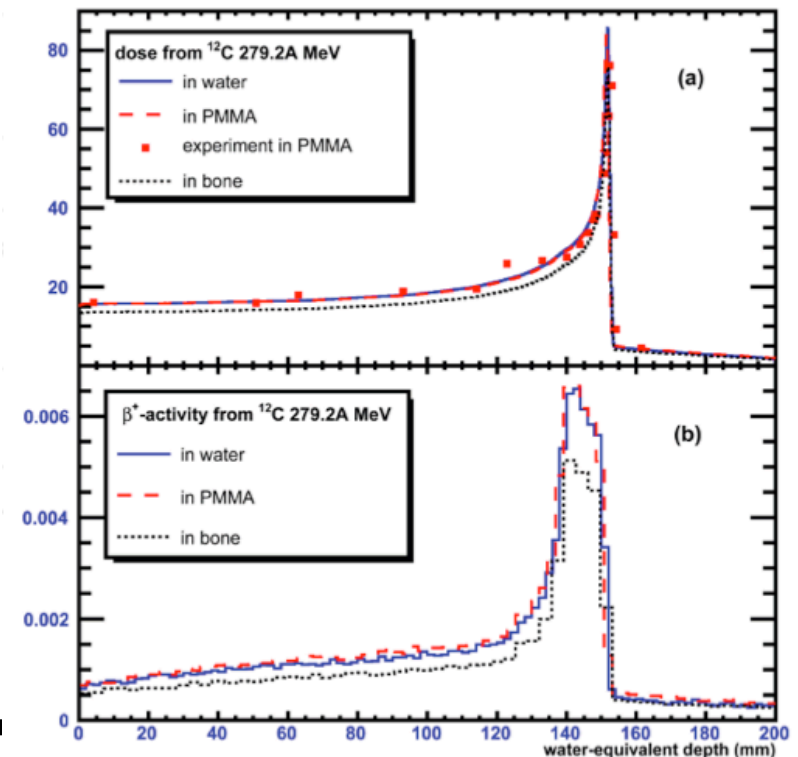
- Trigger strategy: LTS or SC?
- ToF measurements: characteristics of the LTS detector (width, length)
- Put some shielding BTW SC and LTS/CHMB/LYSO?

→ To be checked:

- how much time is needed for the measurements (charged particles)

PET emission

- Aim: study the emission of β^+ emitters along the beam interaction with PMMA phantom
 - Detectors placed at 45° : Catania like setup. This setup covers 7 cm along the beam path inside the PMMA. If larger path inside the PMMA is foreseen the full dose profile cannot be obtained.
 - Expected gamma rate: 8Hz (?) ~ independent of beam (He or O)
 - Energy (ToF) resolution?
- To be optimized:
 - Distance from beam axis.
 - Angle of operation (45° ?)
 - Which part of the profile we want to cover.



Fragm. @ FW small angles (I)

→ Aim:

- Measure the Energy spectra at different small forward angles
- Measure the production rates of different fragments

→ Key quantities

- Energy: measured by ToF (STS* and STS₂* detectors) and Xchk with BGO (suffering from no calib, + leak). **what is the expected E/ToF resolution?**
- PID: done using dE/E (BGO and STS₍₂₎* detectors)

→ Trigger strategy:

- either SC + BGOs or STS* and BGOs.
- Time to collect enough statistics @ 1 angle configuration?

Existing measurements

→ Gunzert marx:

- Measure the Energy spectra at different small forward angles
- Measure the production rates of different fragments
- Uses scinti + BaF2
- 0, 50, 10, 20, 30

→ Chiara (He)

- Setup: 1msr sol ang detector @ $6 \cdot 10^7$ incoming He, 160 MeV/u on 15 cm H₂O,
- p, He normalized fluxes at
 - 5°: $3 \cdot 10^{-4}$ p; 10^{-3} He
 - 15°: $7.2 \cdot 10^{-5}$ p; $4.3 \cdot 10^{-6}$ He
 - 30°: no He, $1.6 \cdot 10^{-5}$ p

Fragm. @ FW small angles (II)

→ To be optimized:

- Trigger strategy
- STS* dimensions: both at 0° and at $\neq 0^\circ$ (not only thickness but also width and height)
- Number of angles at which we want to perform the measurement
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