Cross Section Measurements Relevant for Radiotherapy and for the Evaluation of the Health Risk for Astronauts

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I. INTRODUCTION

The use of carbon beams in radiotherapy is nowadays considered very important for the high ionization density induced by these ions at the end of the range and to their high biological effectiveness [1]. This permits to use much focalised doses on the tumour mass. Nevertheless, more information is needed on nuclear cross sections of carbon on tissue components and tissue - equivalent materials.

The optimization of the treatment to maximize the Tumor Control Probability can be improved in order to control the Risk of Complications in Normal Tissues, which could be caused essentially by lighter particles with different range and stopping power, produced for example from the break up of the primary beam.

Cross section data are therefore required to implement codes, which should predict the biological effects of carbon beams and of their secondary products in a broad energetic range [2].

Measurements have been performed in Legnaro studying the reactions ^{12}C on ^{12}C, ^{40}Ca, Mylar, ^{181}Ta from 6 to 20 MeV/n and ^{16}O on ^{12}C, from 6 to 18.5 MeV/n.

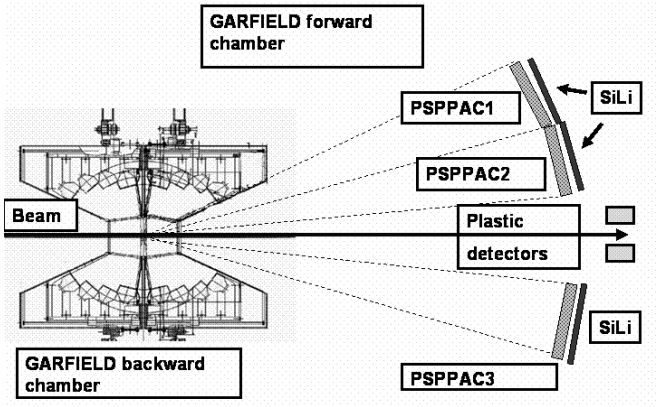

***Fig. 1** – Experimental set-up*

II. EXPERIMENTAL SET-UP

A schematic view of the experimental set-up is shown in Fig. 1. One of the two GARFIELD drift chambers [3], with gaseous micro-strip detectors in the amplification region, covers the region between s=30° and 150°: the ΔE signals are provided by the micro-strip gas detectors, which collect and pre-amplify the electrons produced in the gas along the track of the reaction products, while the residual energy signal is given by CsI(Tl) crystals, which are located in the same gas volume.

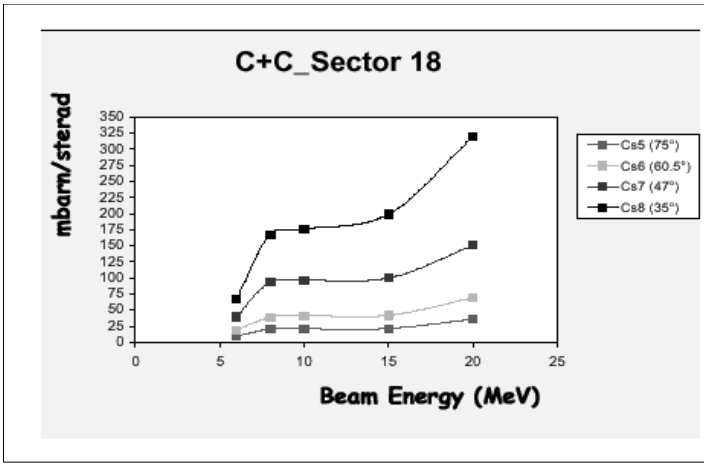

***Fig 2** - Cross section for α-particles emitted in the C + C reaction, for different detection angles, as a function of the incident energy.*

The forward angles have been covered by three position sensitive parallel plate avalanche counters (PSPPACs - 20x20 cm^2), followed by some Si(Li) detectors, in order to measure energy and mass of the forward products using the Time Of Flight- Residual Energy method.

III.PRELIMINARY RESULTS

Some preliminary results obtained for α-particles emitted in the reactions ^{12}C + ^{12}C and ^{16}O+ ^{12}C for 4 different angles are shown in Fig.2 and Fig.3 as a function of the incident energy. Double differential cross section spectra $\delta^2\sigma/\delta\Omega\delta E$ for the two reactions and as a function of the different incident energies have also been obtained.

The analysis is still in progress: much work has to be

performed extracting cross section information for α-particles for all the other targets, but also for different reaction products which have to be studied in order to give information on the total reaction cross section.

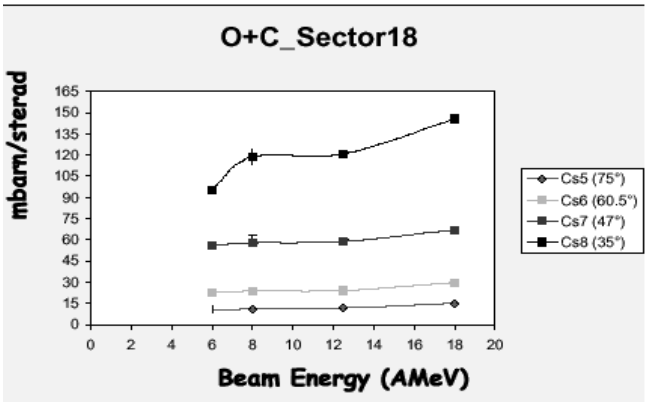

Fig 3 *- Cross section for α-particles emitted in the O + C reaction, for different detection angles, as a function of the incident energy.*

IV.ACKNOWLEDGMENTS

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