CR-39 detectors

Aim: measurements in the Bragg peak region of the hadron beam in order to assess:

- **Beam dimension (longitudinal and transversal straggling)**
- **LET distribution on each track detector**
- **Fragmentation**
- **Mapping of the neutron filed around the target**

Experiment 1:

Irradiation with a Proton beam, with a fluence of $6.84*10^6$ particles of a stack of 10 CR-39 detectors, with dimension 30 mm x 40 mm x 1.5 mm each. Energy of protons = 117.5 MeV. (101 mm H2O)

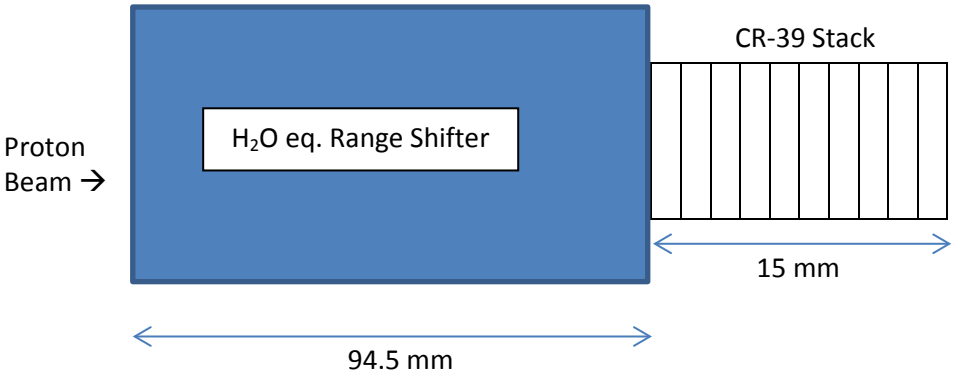

Figure 2. Experimental setup with Proton beam

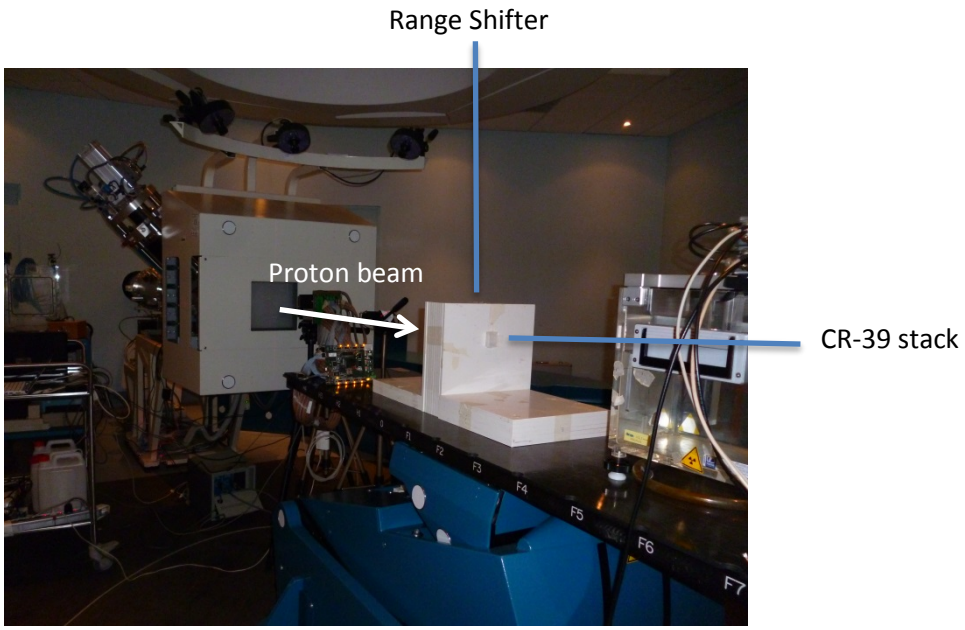

Figure 1. This picture shows the experimental setup with the beam direction represented by the white arrow incident on the range shifter acting as a water equivalent phantom and the CR-39 stack placed behind the range shifter.

Experiment 2 and 3:

Irradiation with Carbon ions with a fluence about $7*10^4$ (very low fluence not measurable with the beam delivery system) particles of a stack of 10 CR-39 detectors as in experiment 1.

Energy = 217.5 MeV/nucleon 101 mm H2O;

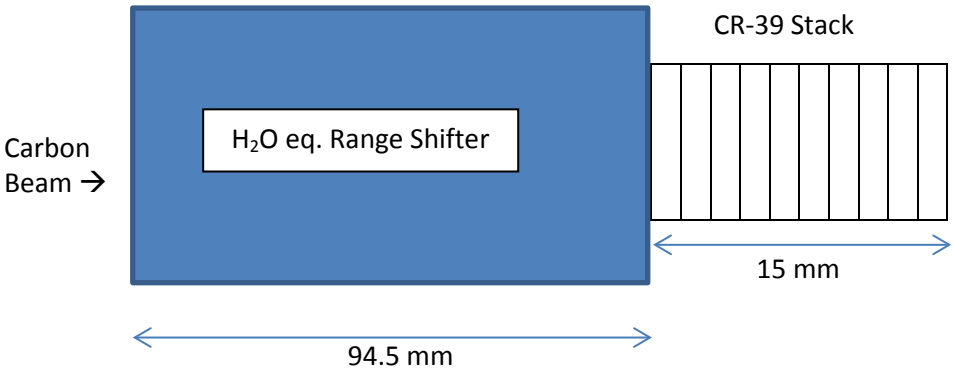

Figure 3. Experimental setup with Carbon ions beam

Experiment 2 and 3 were done using the same conditions listed above in order to check the reproducibility of the measurement of the beam straggling using CR-39.

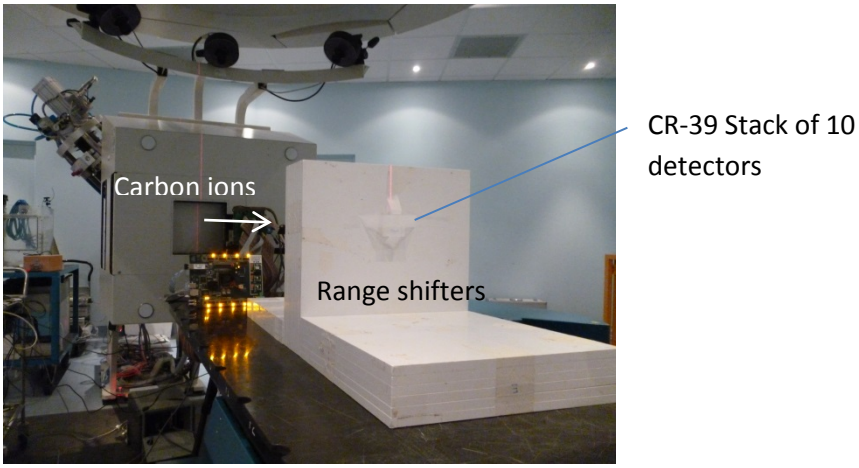

Figure 4. Experiment 2 and 3 have the same configuration as in Experiment 1 but the beam is changed to the Carbon ions.

Experiment 4:

In experiment 4, a stack of 26 CR-39 detectors (1.5 mm each) were used and irradiated without using any phantom. The stack was placed directly in the Carbon beam. E = 108.4 MeV/nucleon (30mm H2O

A fluence of $7*10^4$ particles was calculated for this experiment.

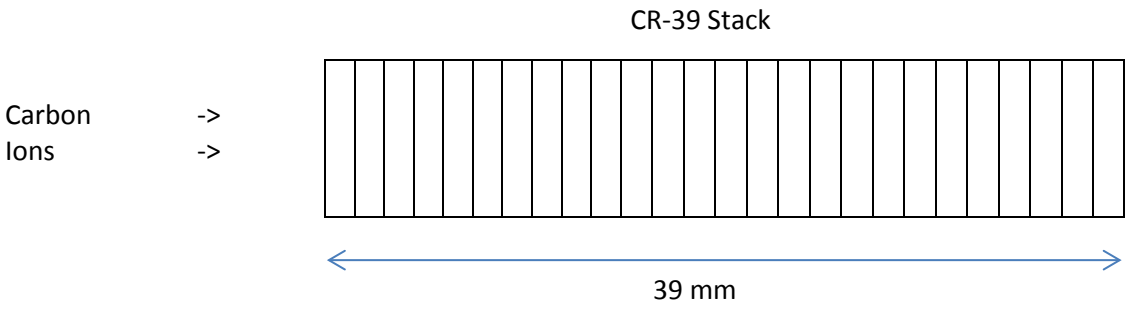

Figure 5. Experimental setup

Experiment 5:

A neutron dosimeter based on CR-39 coupled to PMMA was irradiated in experiment 5 and the dose measured will be compared to the LUPIN detector. The passive dosimeter is shown in figure 6. The dosimeters were placed at different positions behind the water equivalent phantom. These positions were calculated so that the secondaries produced from the phantom by the Carbon beam could be measured at different angles.

The fluence of particles was calculated to be of $7.25*10^8$ particles for the entire irradiation.

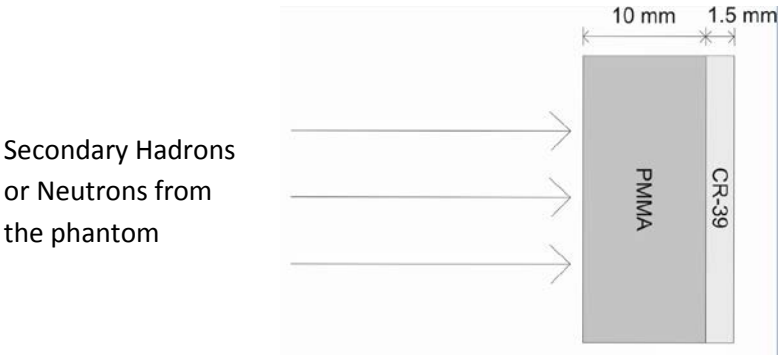

Figure 6. Illustration of the CR-39 based dosimeter

The dosimeters were thus placed at the following angles from the axis of the beam: 0°, 5°, 15°, 25°, 35° and 45° as illustrated in figure 7. The LUPIN was placed at 45° on the other side of the beam axis from the CR-39 detectors as shown in figure 8.

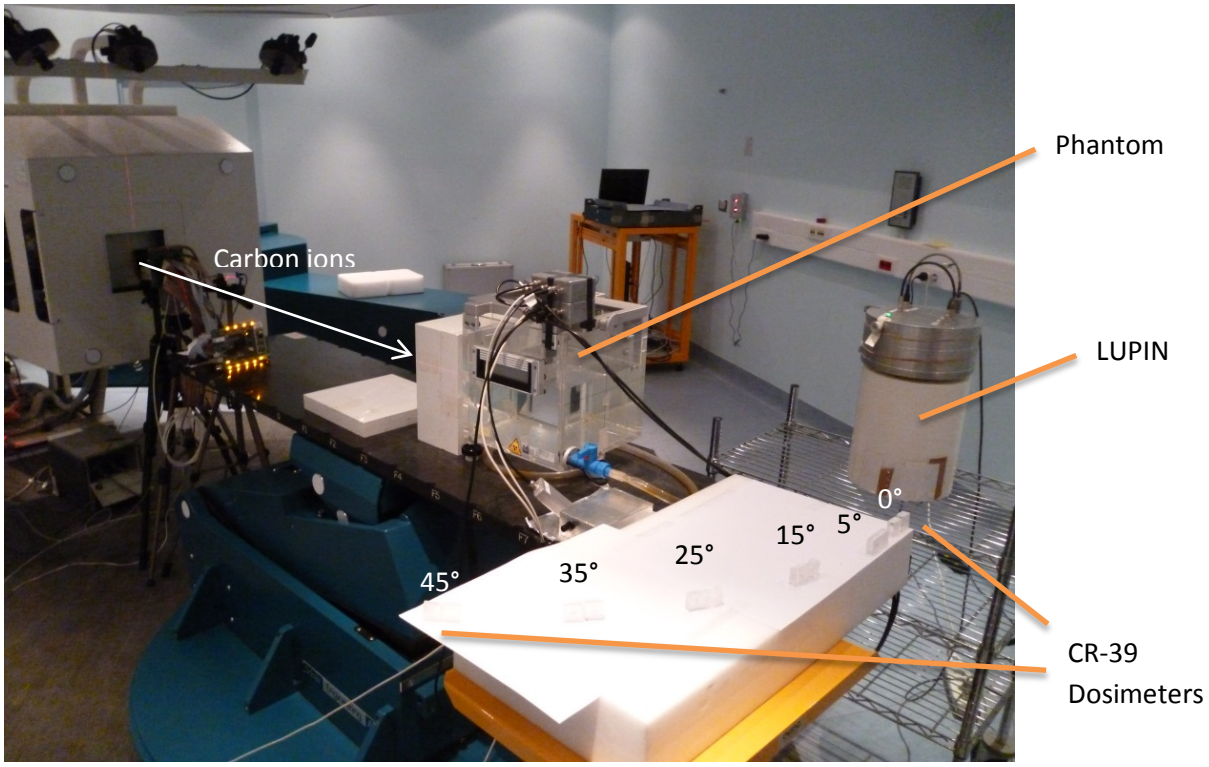

Figure 7. Illustration of the detectors' dispositions around the phantom

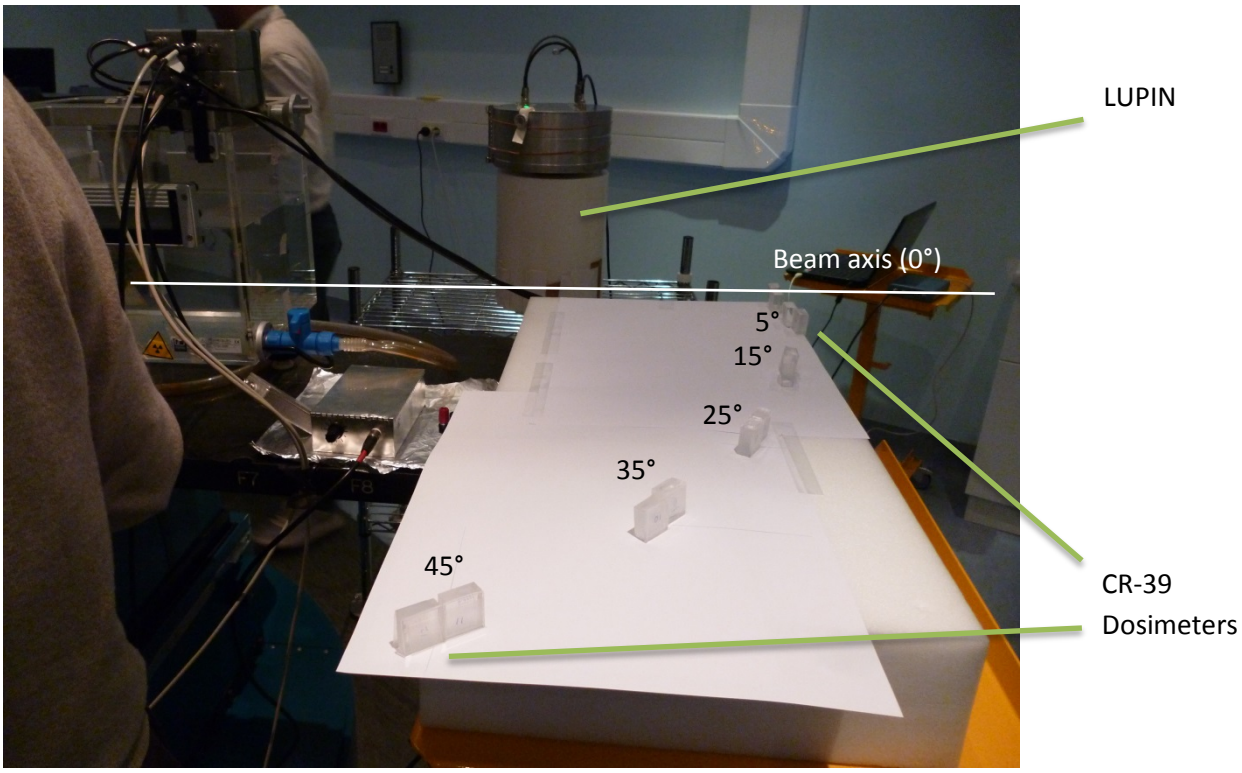

Figure 8. Positioning of the LUPIN and the CR-39 based dosimeters around the beam axis.