E458

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:

Multiple scattering of protons and detector development

SPOKESPERSON:

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RUNNING TIME: 24 hours

BEAM LINE: N0 area

BEAM REQUIREMENTS:

Type of particle	proton
Beam energy	80 MeV
Energy resolution	< 0.5 MeV
Beam intensity	< 10^{-5} nA for small scattering angle / ~ 1 nA for large scattering angle
Beam dimension	FWHM ~ 2 mm in diameter

BUDGET: 100,000 yen (Ar-CO_2 gas)

SAFETY CONTROLLED ITEMS:

None (non-flammable gas in use is Ar-CO_2)

TITLE:

Multiple scattering of proton and carbon ion and detector development

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SUMMARY OF THE PROPOSAL

For better patient treatment, beam delivery technology in particle therapy has advanced from broad field to pencil beam scan and is aiming for radiosurgery with narrow beam. Following the development precision in dose estimation should be emphasized and accuracy of simulation requires reliable data base. Purpose of this proposal is verification of multiple scattering angle distribution and energy transferred in water, aluminum and PMMA targets with 80 MeV protons. Simulation at 80 MeV will be presented at the B-PAC meeting.

A novel experimental setup is proposed to fulfill the above purposes simultaneously. Scattering angle is measured by single proton passage. Low intensity (10^4 - 10^5 protons/second or ~10^{-5} nA) proton beam in request guarantees that only one proton passes detector at any instant. Two sets of MWC's locate in front and behind target reconstruct trajectory of individual proton. With 150 μm resolution from single wire measurement and 4 X- and 4 Y-direction measurements in each PWC, better than 0.1 degree angular resolution is expected. With such resolution, this experiment should settle small scattering angle issue in simulations. Simultaneously types of interactions (EM or nuclear one) with targets may be separated by measuring remained kinetic energy after proton transverses target. Such separation is made possible by "Range finder", which is a collection of scintillation slabs where proton stops. By reading out information from each slab remain kinetic energy of proton can be determined at 5 MeV resolution or better. We expect better software should improve its ability in discriminating EM interaction from nuclear one. Since information collected is based on individual proton, relation between its scattering angle and energy loss in target can provide further investigation on models adopted by different simulations. Data of carbon ion experiment should improve data base related to carbon ion therapy and it is expected to be carried out in next fiscal year.