Comparison of GeV proton scattering simulations by PHTIS and Cherenkov light measurements by RMS-p

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Tests for the energy calibration of RMS-p (Radiation Monitor for Space weather measuring Protons), an energetic proton monitor to be installed on the next geostationary meteorological satellite Himawari-10, were conducted using proton beams produced by the accelerator at the J-PARC Center of the Japan Atomic Energy Agency (JAEA). RMS-p measures the energy of incident protons by the intensity of Cherenkov radiation in a synthetic quartz glass. In the test, 400 MeV to 3 GeV monoenergetic protons produced by the accelerator at J-PARC were scattered by an aluminum shutter, and the component emitted from the beamline into the air was measured by RMS-p. The protons from the Al(p, xp) reaction of aluminum have a mixture of elastic and quasi-elastic scattering components, and the cross sections of each depend on the energy and scattering angle. To calibrate the RMS-p energy, it is necessary to know the energy spectrum of the scattered protons as they reach the glass. Between the aluminum shutter and the Cherenkov glass, there is a SS duct of the beamline, a Ta shield to prevent contamination of low-energy particles, and silicon semiconductors to identify the viewing direction, so that the proton energy loss due to these components must also be estimated. In this presentation, we report the results of the PHITS simulations of the protons produced in the Al(p, xp) reaction and their spectra as they arrive at the glass, and a comparison analysis of these spectra with measured Cherenkov light data by RMS-p.

Keywords: Cherenkov detector for spacecraft, PHITS simulation, GeV-energy proton, Al(p, px) reaction

