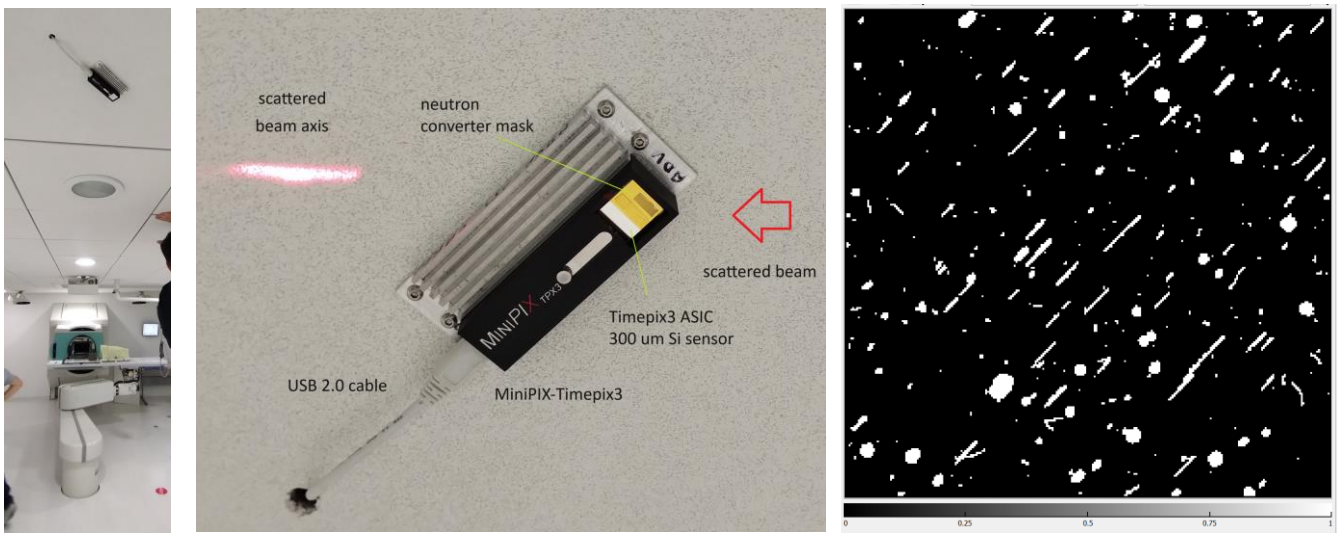

Figure. 1. (a) The treatment room at PTC showing the accelerator beam nozzle and patient table in the back and the detector fixed on the room ceiling. (b) The miniaturized radiation camera MiniPIX-Timepix3 with a 300 μm Si sensor and neutron (thermal, fast) converter mask. (c) Detection of the secondary radiation field (1 s time interval) produced at the detector position by a 226 MeV proton beam without phantom. The full 256 × 256 pixel matrix = 14.1 mm × 14.1 mm is shown. Particle-type groups analyzed include scattered protons of low energy (large rounded tracks) and of high energy (straight long tracks).

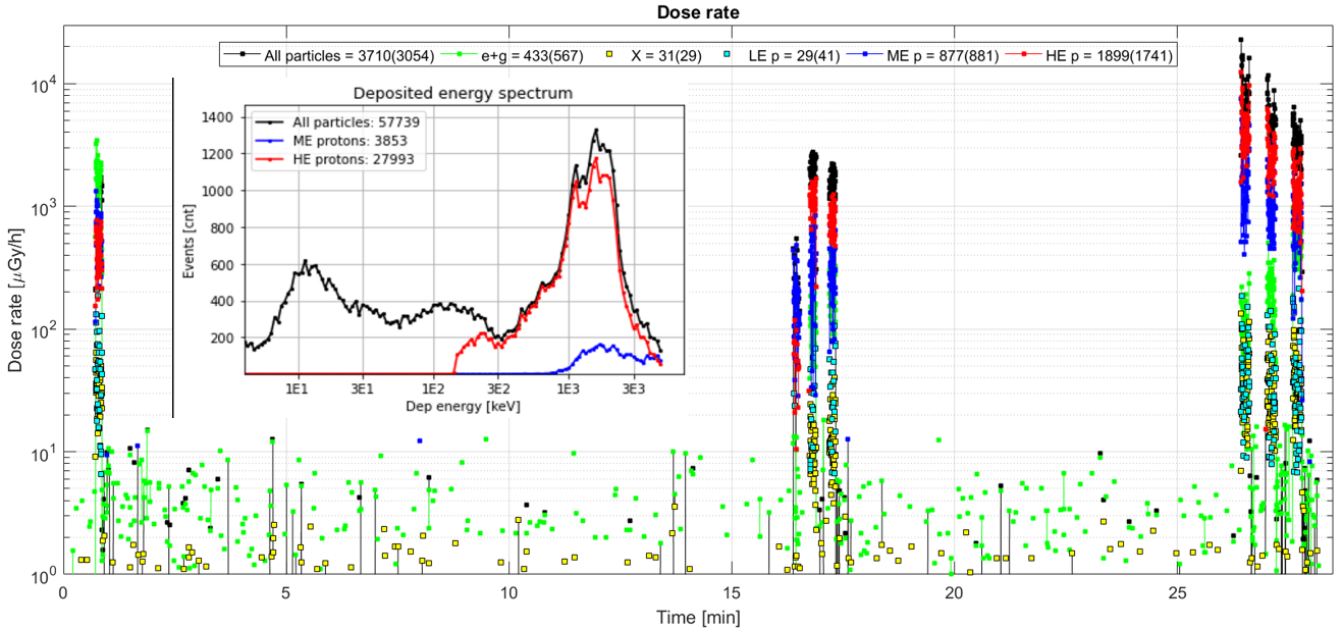

Figure. 2. Dose rate of the secondary radiation field at the detector position measured by MiniPIX-Timepix3 produced by a radiotherapy clinical proton beam of energy 100, 170 and 226 MeV at the PTC. Results are shown for a 30 min time interval containing three periods of quality assurance procedure. Results are given for all particles (black) and for resolved particle-type events: high-energy scattered protons (red), medium-energy scattered protons (blue), electrons and low-energy gamma rays (green) and X rays (yellow). For selected particle-type classes are included the corresponding deposited energy spectra (see inset).