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LOW THRESHOLD-ENERGY ION-CHAMBER SYSTEM FOR PROTON THERAPY MONITORING

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A system of three low threshold-energy ion-chambers, giving new possibilities
in proton beam monitoring and analyzing, is considered. The system includes a new double-gap chamber with the total gap of 1mm, with polyimid films of 3\,μm thickness and with the sensitive area 113-\,cm^2 and two double-gap ion-chambers, each with the total gap of 2 mm. Ionization losses in each of six sensitive air gaps, as well as the total loss, are measured in coincidence for every accelerator spill. Total amount of material crossed by the beam is only 1.7 g/cm^2. Being almost transparent for protons at Bragg-peak energy and below, the anode separates two neighbour gaps and peculiar behavior of loss correlations can be observed. This behavior can be explained by alternative trend of energy-loss dependence below and above Bragg peak. Recombination contribution is estimated as only few percents at 1 nA/cm^2. An essential contribution to the dose from protons at about 1 MeV and below was demonstrated both by calculations and experimental data. Selected contributions of fast and slow protons and δ electrons to the energy loss can be extracted from data. The system demonstrated a stable operation after a proton irradiation of 5 Mrad.

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