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O. Hammad Ali a,b, R. Sacchi a,b, Z. Ahmadi d, A. Attili b, N. Cartiglia b,
M. Donetti e, F. Fausti b,c, M. Ferrero b, S. Giordanengo b,
M. Mandurrino b, L. Manganaro a,b, G. Mazza b, V. Monaco a,b,
V. Sola b, A. Staiano b, A. Vignati b, R. Cirio a,b

a Dipartimento di Fisica, Università degli Studi di Torino, via P. Giuria 1,
10125 Torino, Italy
b Istituto Nazionale di Fisica Nucleare, sez. di Torino, via P. Giuria 1,
10125 Torino, Italy
c Dipartimento di Elettronica e Telecomunicazioni, Politecnico di Torino,
Corso Duca degli Abruzzi 24, 10129 Torino, Italy
d Faculty of Physics, Yazd University, Yazd, Iran
e Fondazione CNAO, Strada Campeggi 53, 27100 Pavia, Italy

Purpose. For beam monitoring in particle therapy, silicon detectors could overcome the limitations of ionization chambers. In particular, silicon sensors with internal gain (Ultra Fast Silicon Detectors, UFSDs) provide high signal-to-noise ratio and fast collection times (_1 ns in 50 lm thickness).
A segmented sensor could allow discriminating and counting single protons up to high fluxes of therapeutic beams. Moreover, the excellent time resolution suggests using time-of-flight techniques for measuring the proton beam energy.

Materials and Methods. Several 50 lm thick UFSD prototypes, both single pads or segmented in strips, doped with Boron or Gallium, and with different doping concentrations were fully characterized at the Turin university laboratory and tested on the clinical proton beam of the CNAO particle therapy facility, up to fluxes of 109 p/s.
Signal-to-noise ratio, pileup probability, internal gain and gain degradation with beam fluence were determined from the offline analysis of the collected waveforms and compared, whenever possible, to the laboratory measurements.

Conclusions. UFSDs are found to be a viable option for improving the qualification and the monitoring of a therapeutic proton beams. However, a careful design is necessary to avoid large pileup inefficiencies and early performance degradation