Pulse shape and PMT stabilization period from spontaneous signal from a ultra dense hydrogen source

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Ultra dense hydrogen has been reported to emit spontaneous high-energy particles, Kaons, Pions and Muons [1][2][3]. Kaon decays to Pions with a lifetime of $(1.2380\pm0.0021)\times10^{-8}$ s and Pions decay to Muons with a lifetime of 2.6033×10^{-8} seconds. Some of Leif Holmlids work has been replicated now in Oslo using his help and advice for building similar setup.

In this work we present study of the pulse behavior of the spontaneous signal as detected by assembly of Photomultiplier tube PMT and muon converter [2], similar to Leif Holmlid design. We have detected distribution of multiple peaks very close in time in the raw signal. The multiple peaks appear always very close in time, the shaping amplifier integrates them often together in one larger peak that affects the interpretation of resulting spectrum greatly. This has not been discussed by Leif in his published papers and first attempt of comparison with his spectra and new will be performed and how it affects the high energy particle conclusion.

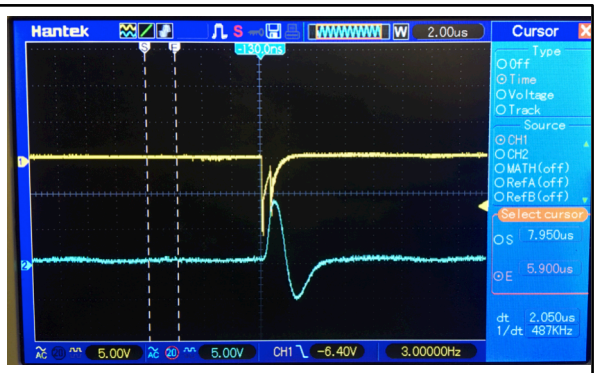

Figure 2: PMT + fast preamplifier raw signal (yellow) showing double pulse possibly from one or two particles interacting with the muon converter and the PMT, the shaping amplifier (blue) integrates these two events to a single event.

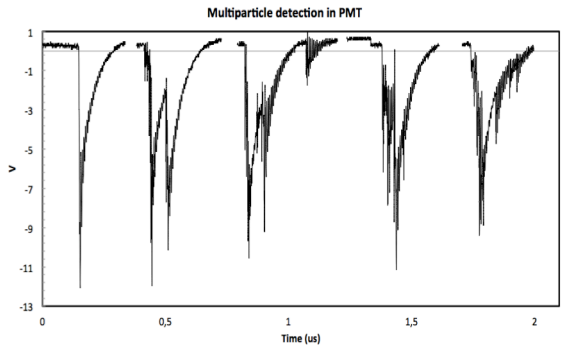

Figure 1: A collection of different PMT + fast preamplifier raw signal events showing varying number of close evennts in time. multiple peaks when PMT is close to Ultra Dense Hydrogen Source.

[1] Holmlid, L. (2013). Laser-mass spectrometry study of ultra-dense protium p(−1) with variable time-of-flight energy and flight length. *International Journal of Mass Spectrometry*, *351*, 61–68. https://doi.org/10.1016/j.ijms.2013.04.006

[2] Holmlid, L., & Olafsson, S. (2015). Muon detection studied by pulse-height energy analysis: Novel converter arrangements. *Review of Scientific Instruments*, *86*(8). https://doi.org/10.1063/1.4928109

[3] Holmlid, L., & Olafsson, S. (2016). Charged particle energy spectra from laser-induced processes: Nuclear fusion in ultra-dense deuterium D(0). *International Journal of Hydrogen Energy*, *41*(2), 1080–1088. https://doi.org/10.1016/j.ijhydene.2015.10.072