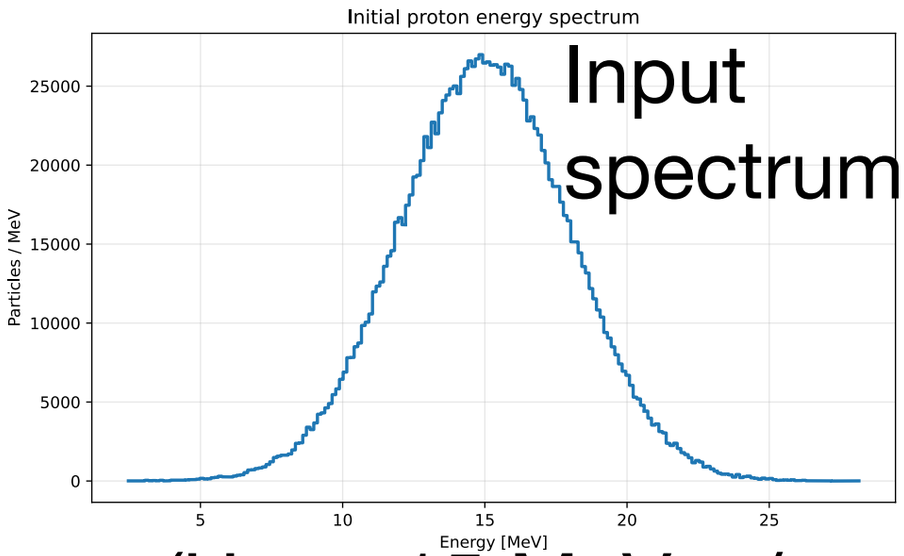
IMPERIAL

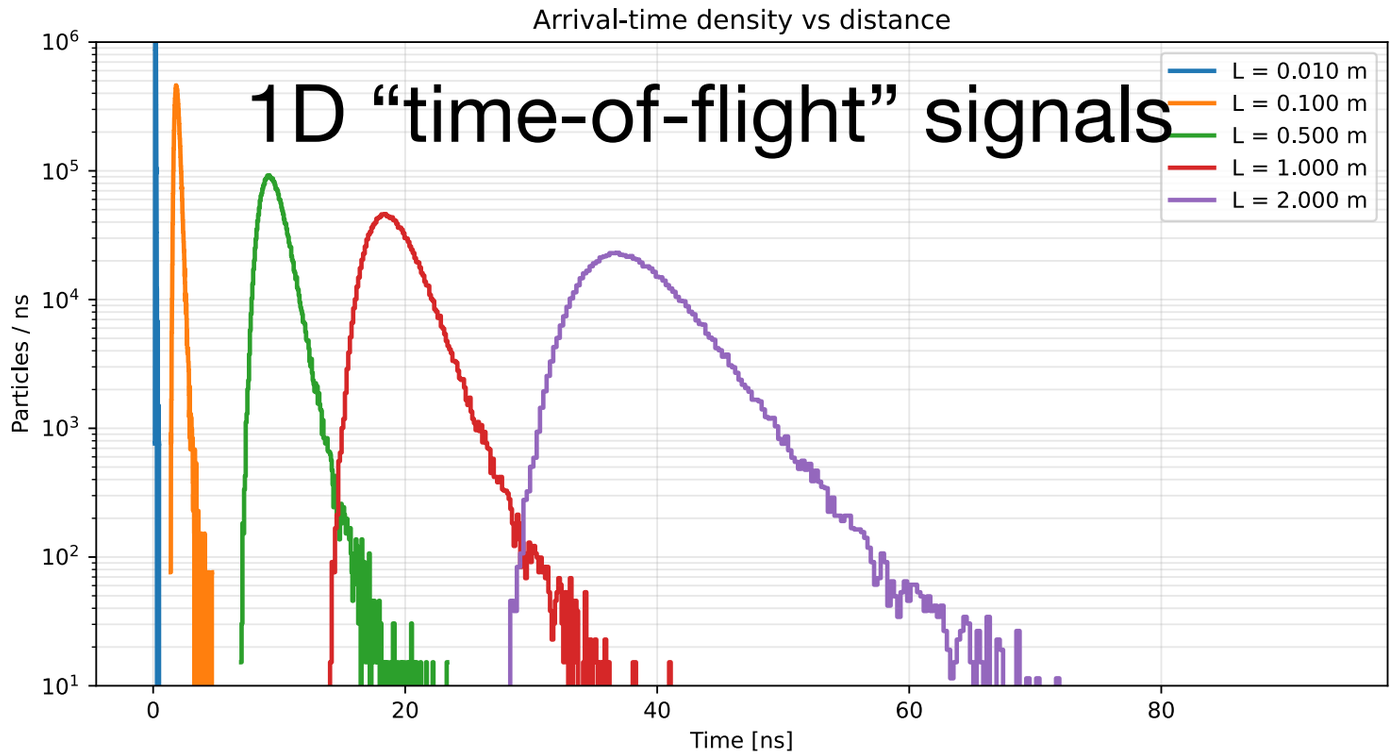
Time-of-flight diagnostics for ion spectroscopy

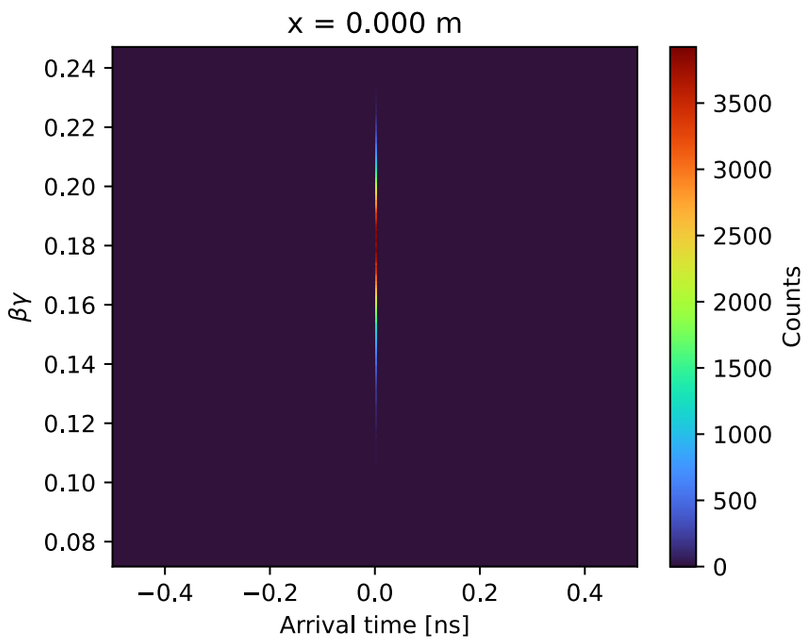
LhARA CM #9
29/04/2026

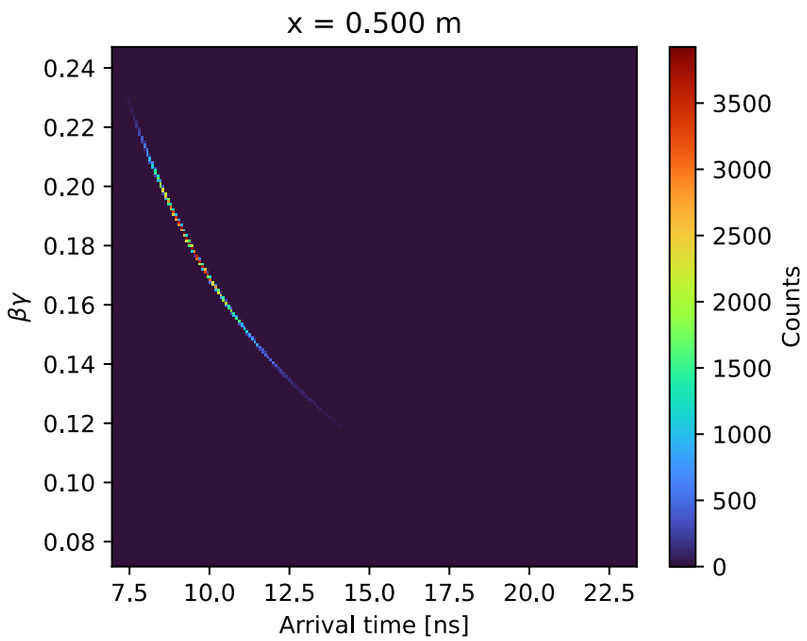
Basic idea

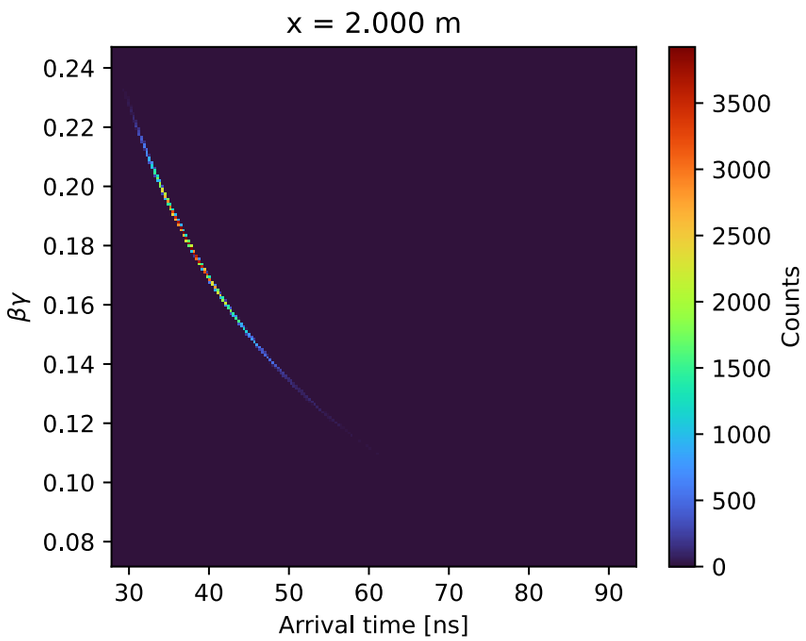


(Here, 15 MeV w/ 3 MeV spread)





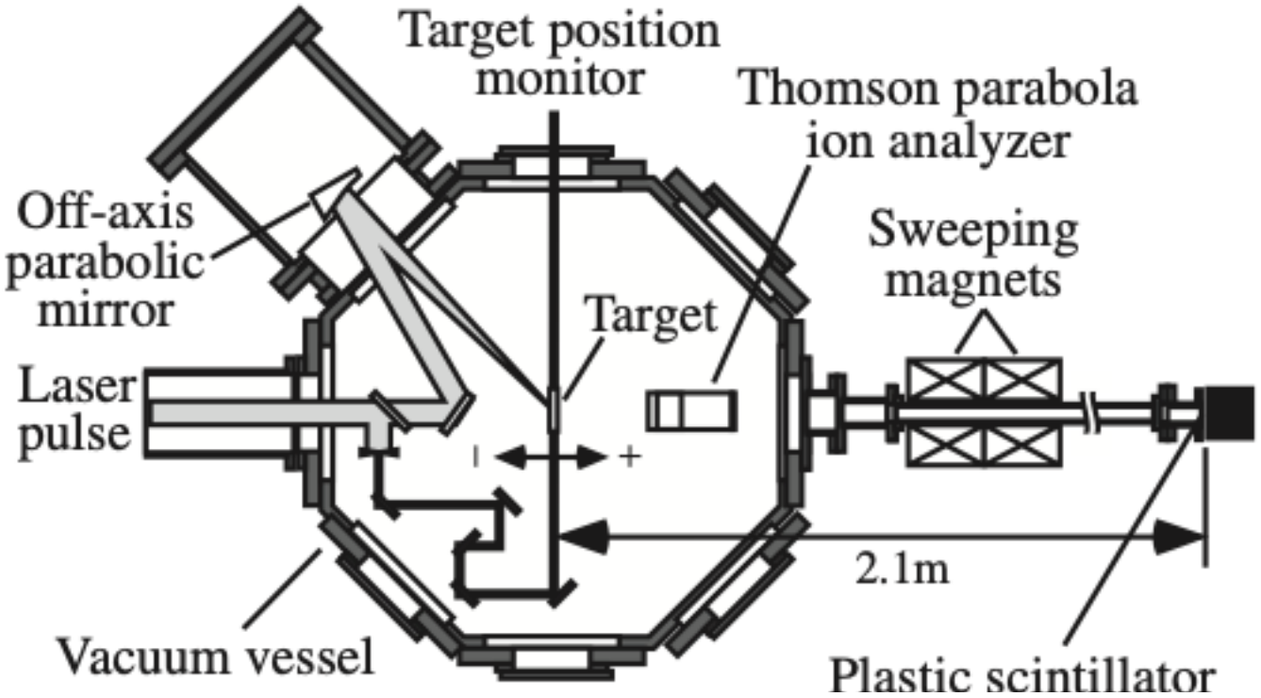


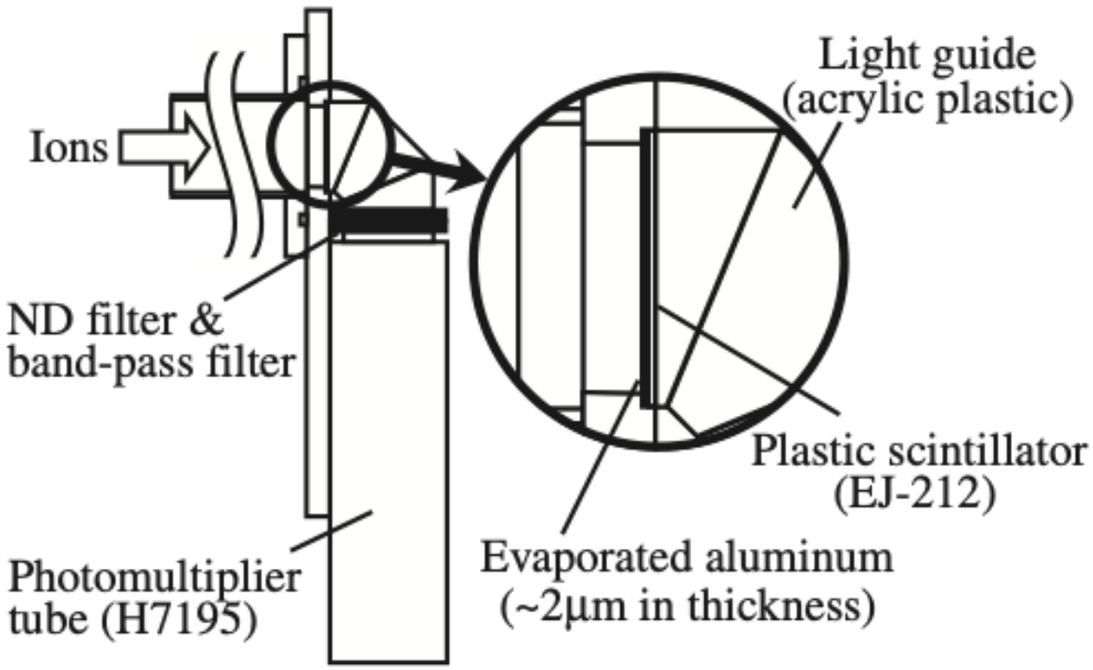


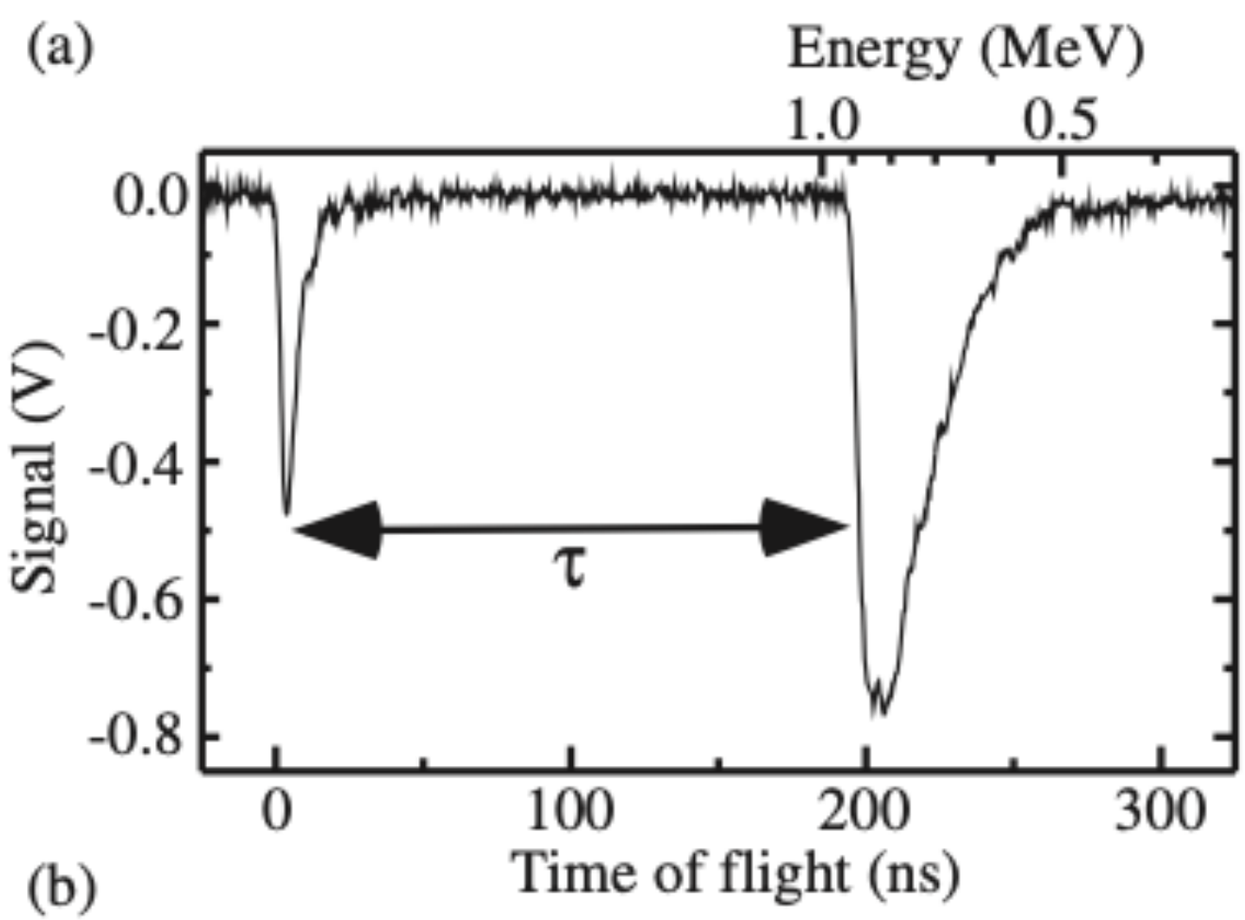
p_x-t phase space at fixed distance

Some examples in the literature

Nakamura+, Jpn. J. Appl. Phys. 45, L913 (2006)





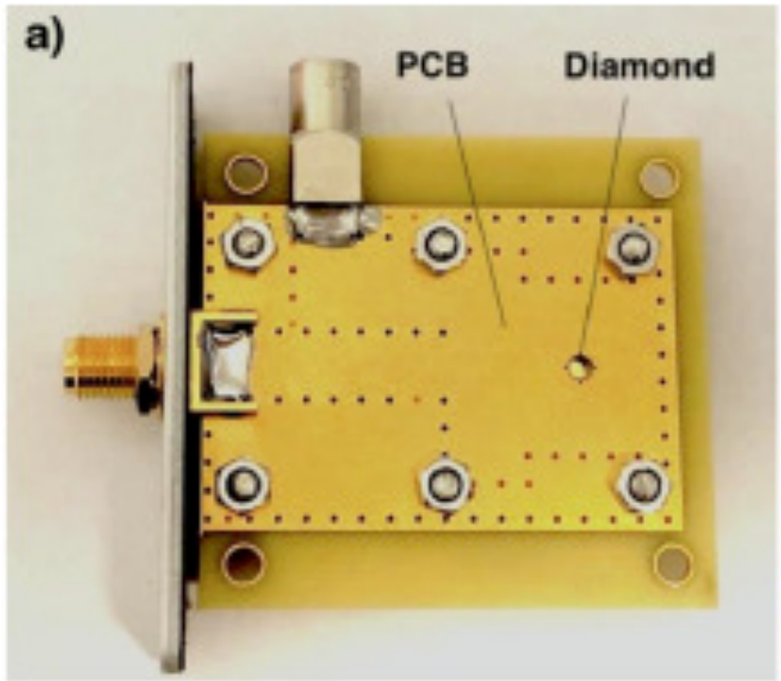


Uses a *fast plastic scintillator* coupled to a PMT

Low energy in this paper, but has been used up to 40 MeV

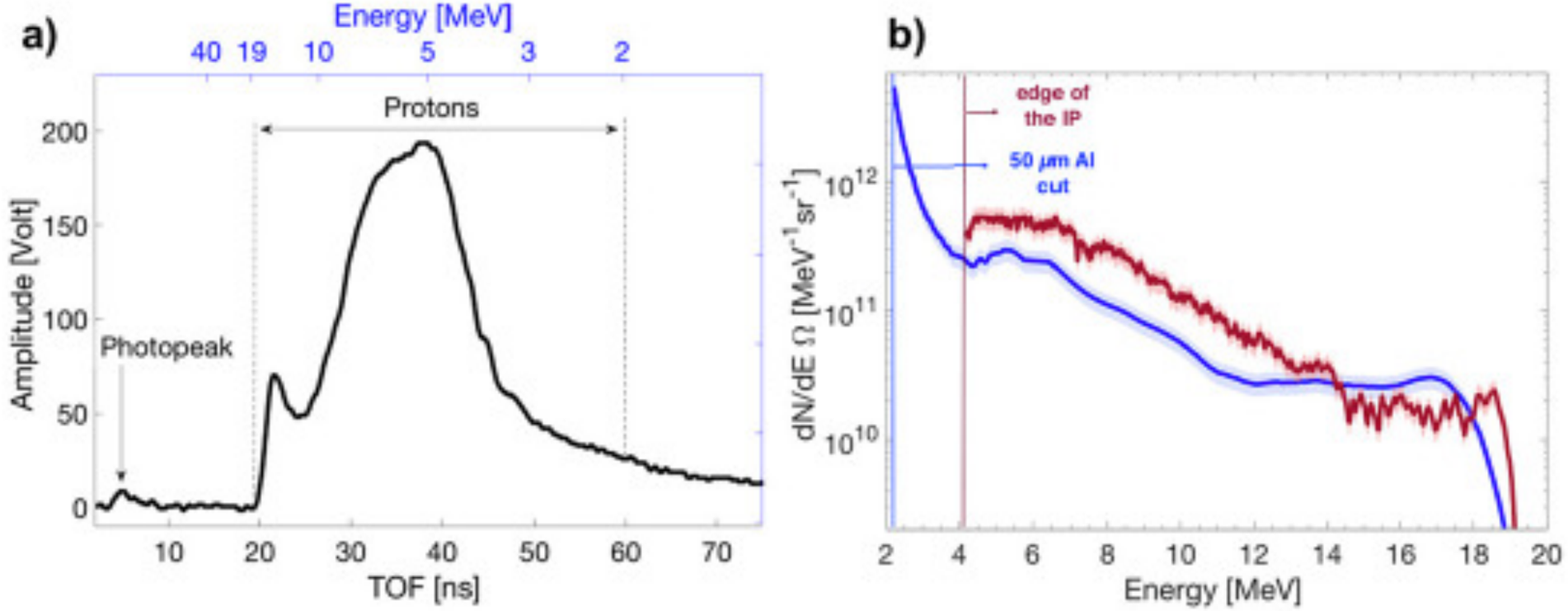
Some examples in the literature

Scuderi+, NIM A 978, 164364 (2020)



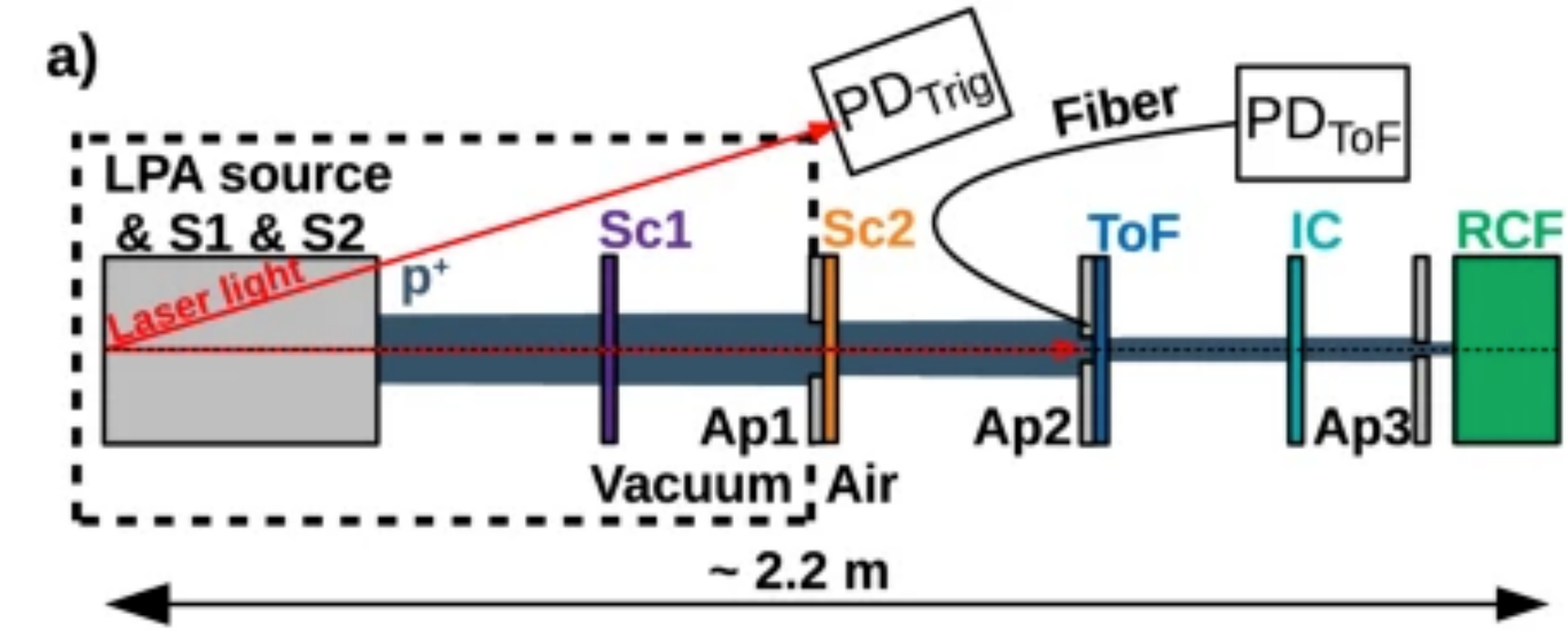
Uses a biased *diamond detector* with integrated PCB

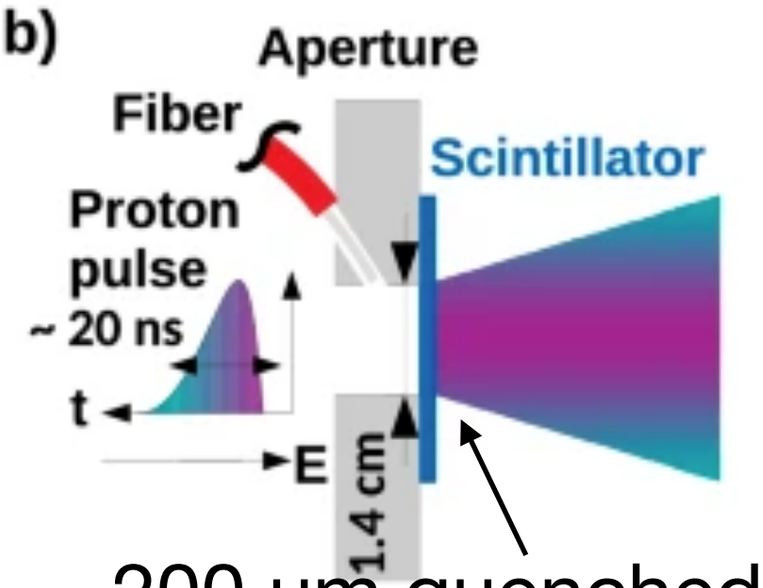
Good time resolution & compact - but EMP mitigation is hard



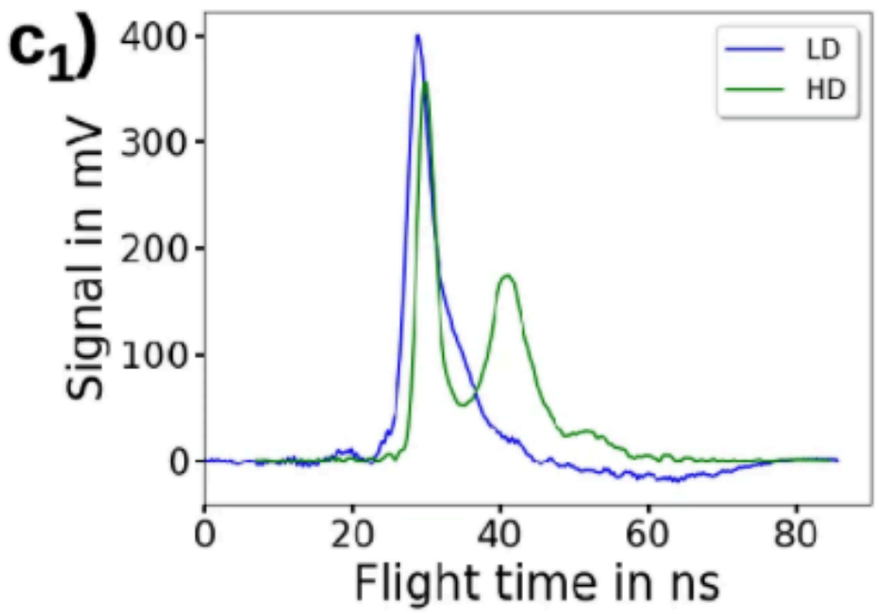
Some examples in the literature

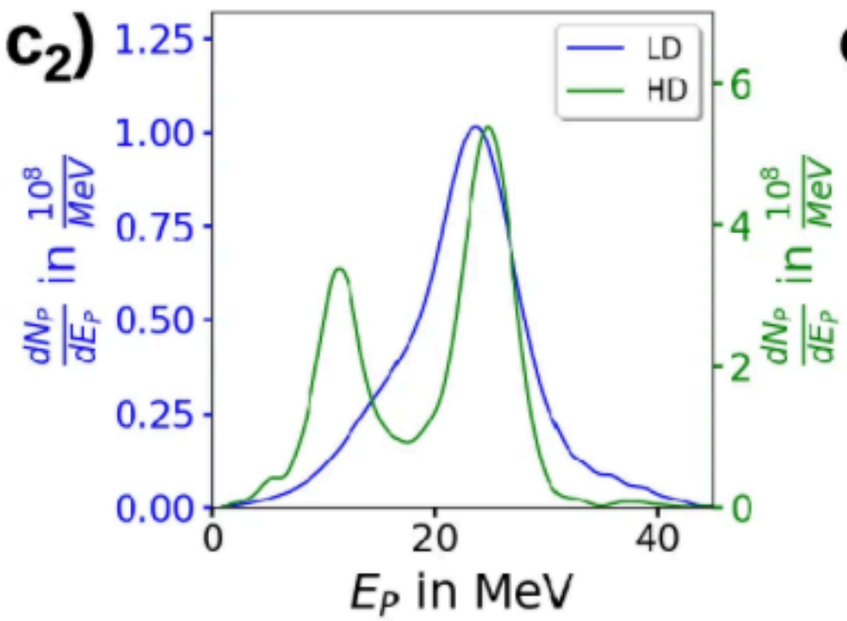
Reimold+, Sci. Rep. 12:21488 (2022)

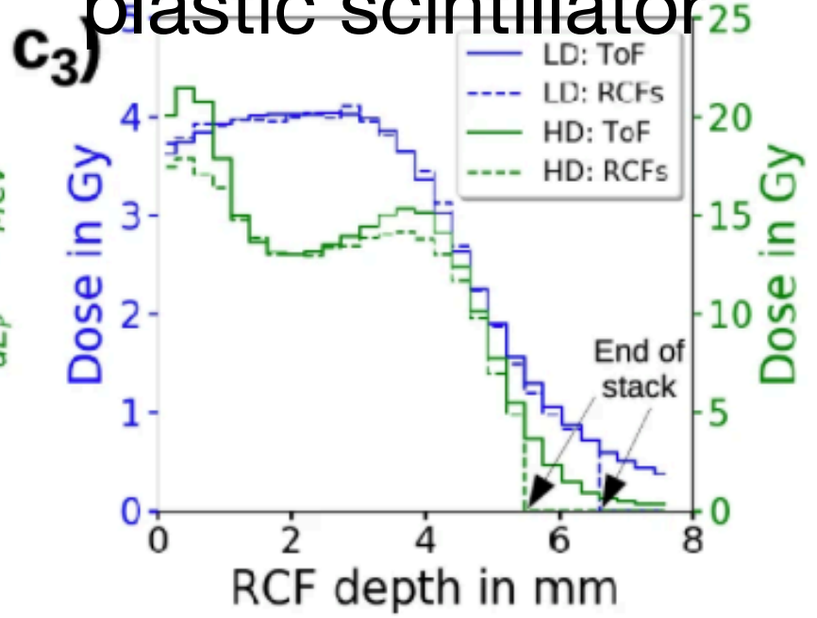




200 um quenched plastic scintillator



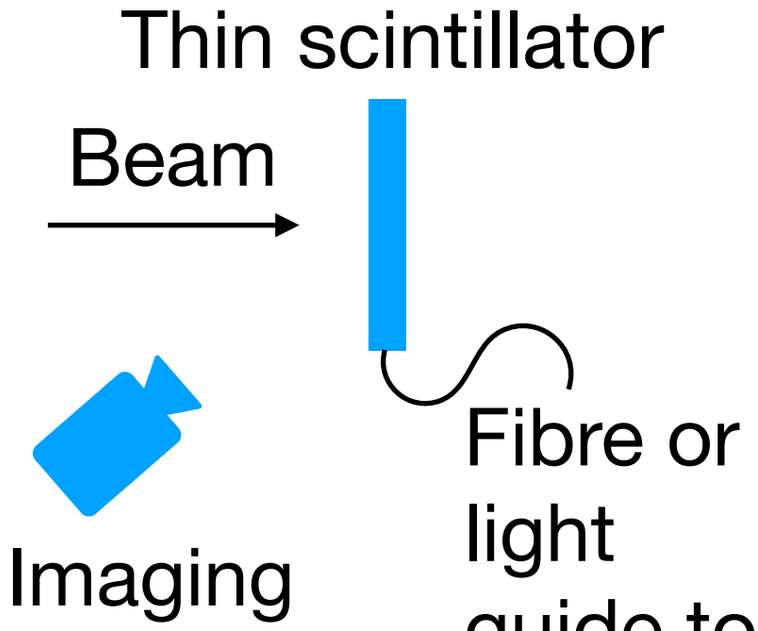




Using a thin filter which is transmissive - *on shot energy spectrum* which can be cross calibrated to give proton number

Ideas for adapting it to PoPLaR/LhARA-like beamlines

Combined transmission TOF & imaging



Sparse TOF using scintillating fibres

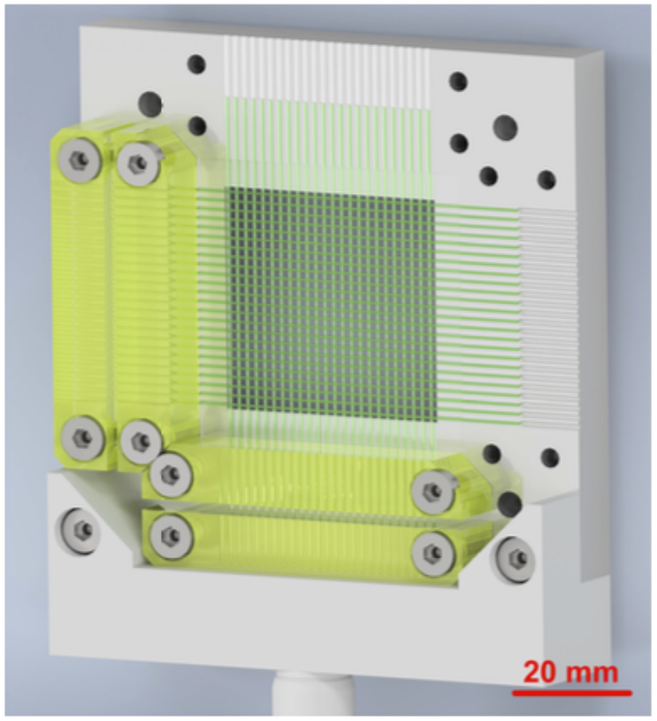


Image from Patel+ HPLSE 12 e70 (2024)

Use fewer fibres & send each to PMT

1D or 2D TOF arrays