Feasibility of proton radiography in high debris environments

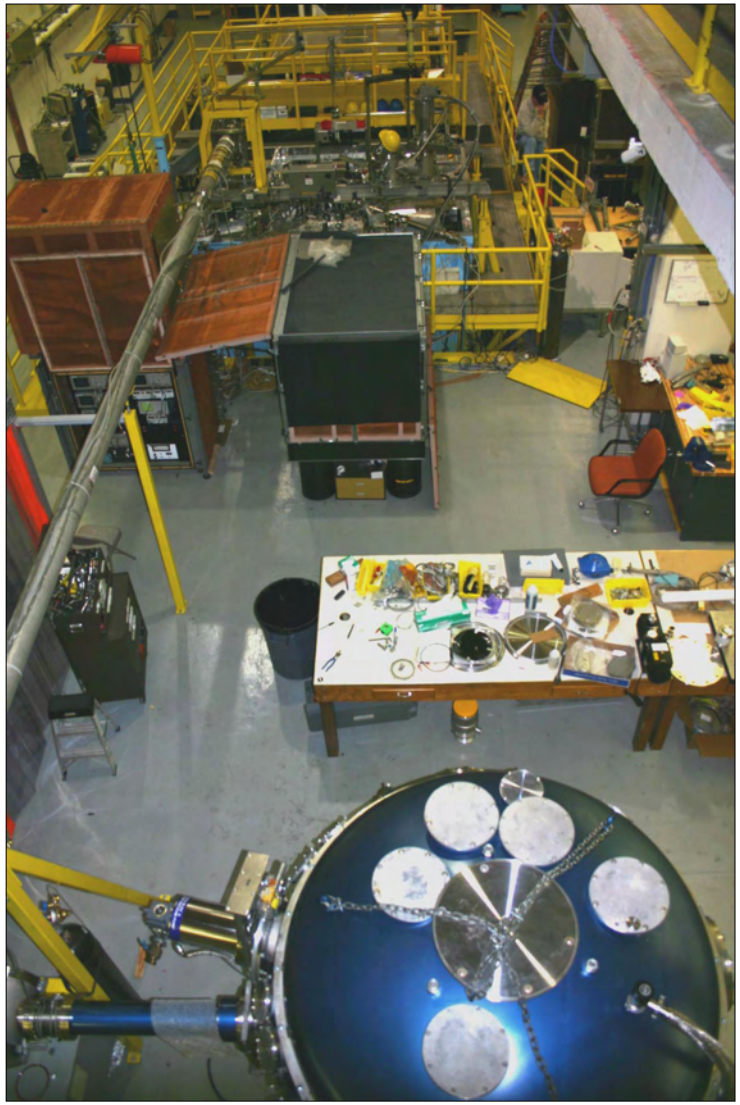
Nathalie Renard-Le Galloudec[1], J. Cobble[2], A. Merwin[1], Y. Paudel[1], I. Shrestha[3], G. C. Osborne[3], K. M. Williamson[3], V. L. Kantsyrev[3]

[1] *Nevada Terawatt Facility, Physics Department, University of Nevada, Reno, Nevada 89557, USA*

[2] *Los Alamos National Laboratory, Los Alamos, NM 87545*

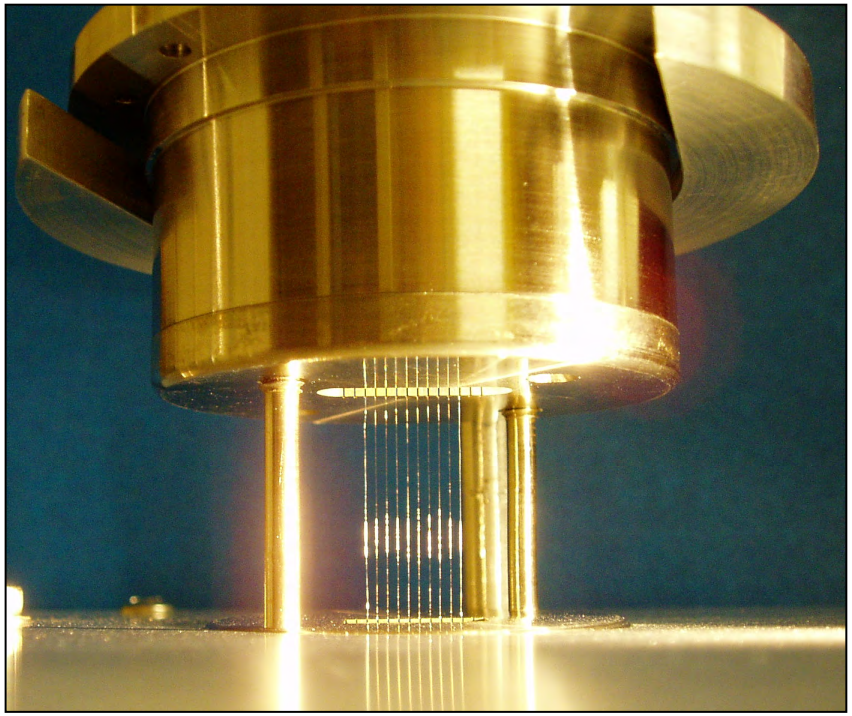
[3] *Physics Department, University of Nevada, Reno, Nevada 89557, USA*

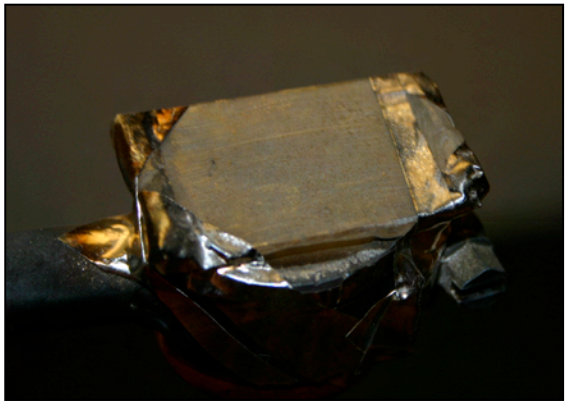
Our laser functions in a high EMP and a high debris environment

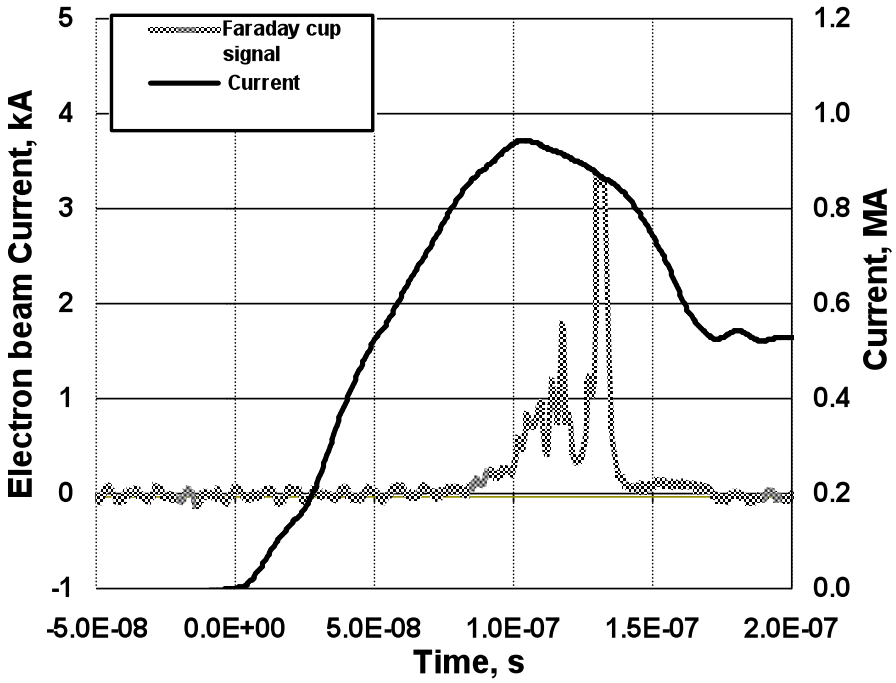


“The xray energy deposited in my samples is approximately the same as what NIF is emitting, since the z-pinch is more efficient at making xrays and our samples are so close!” S. Nelson , LLNL

Planar wires arrays were used to asses debris/noise

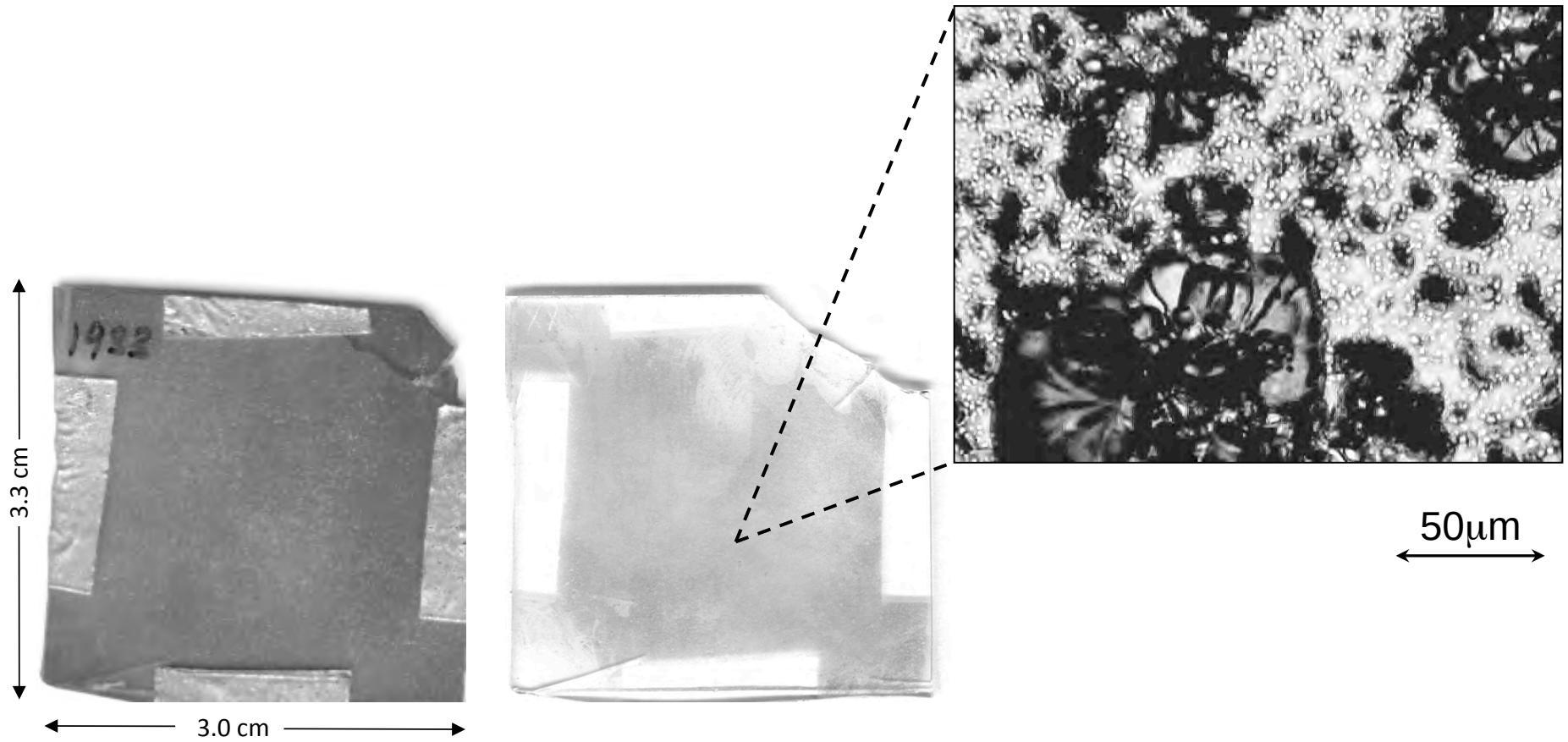






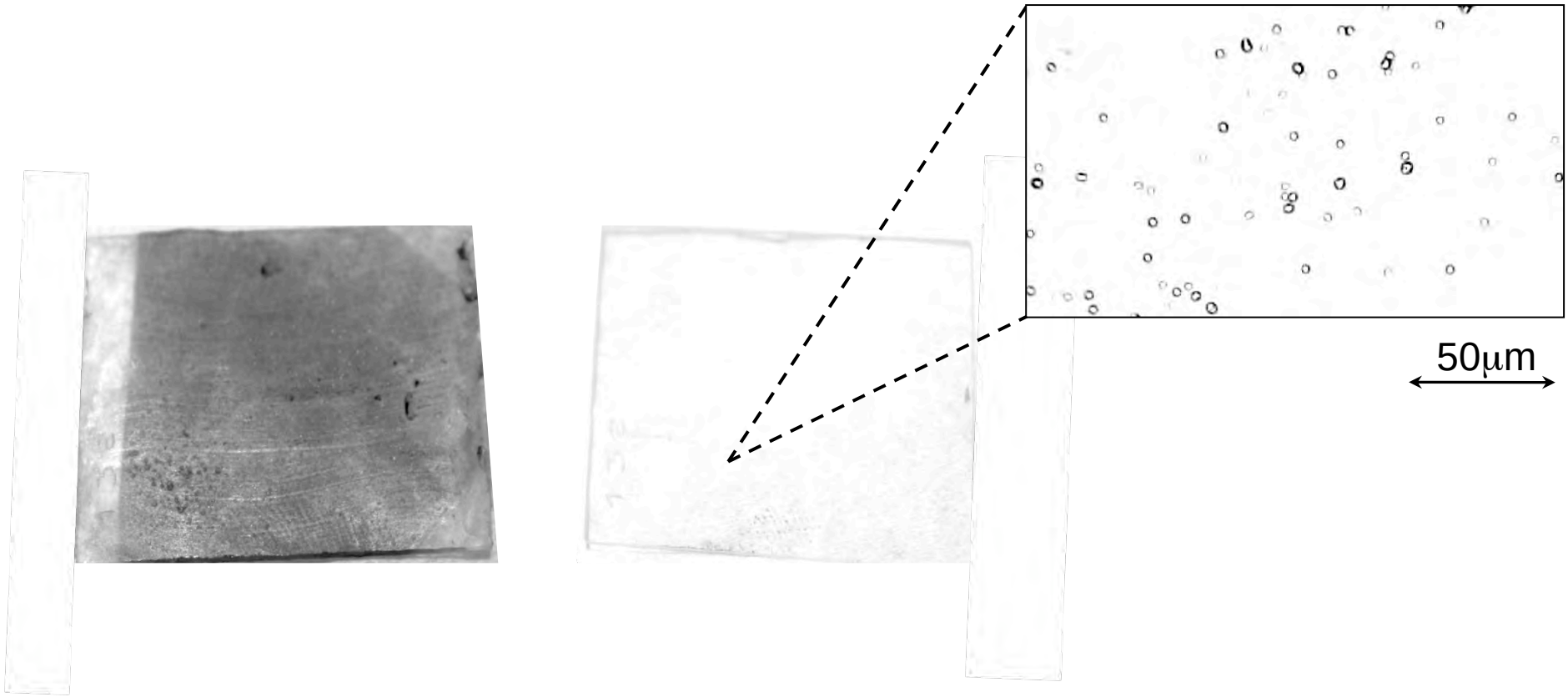
CR39 is not useable if unprotected

Debris residues
Broken CR 39
Proton tracks (that's the noise!)



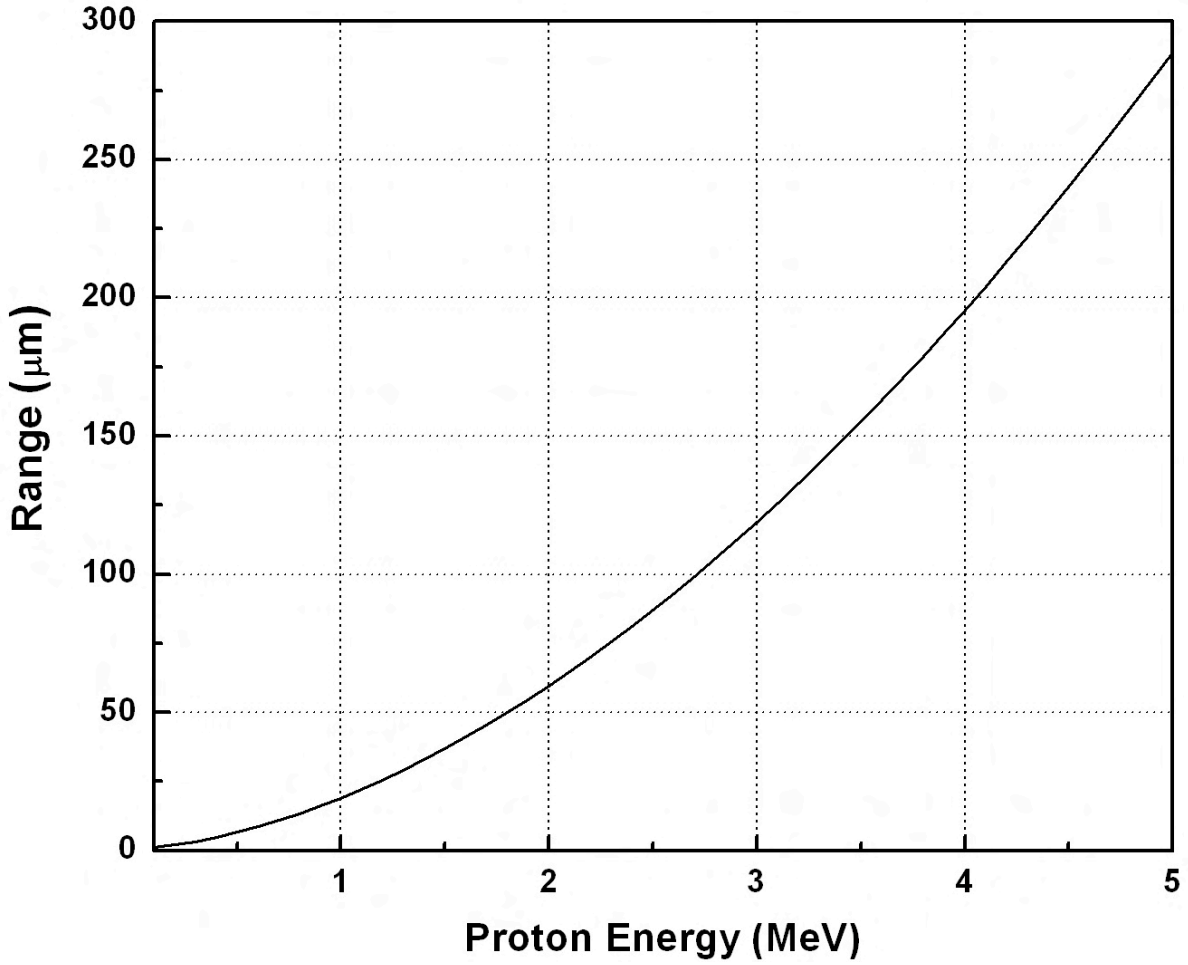
Soft protective layer prevents cracks, breakage and is washable

~~Debris residues~~
~~Broken CR-39~~
~~Proton tracks (that's the noise!)~~

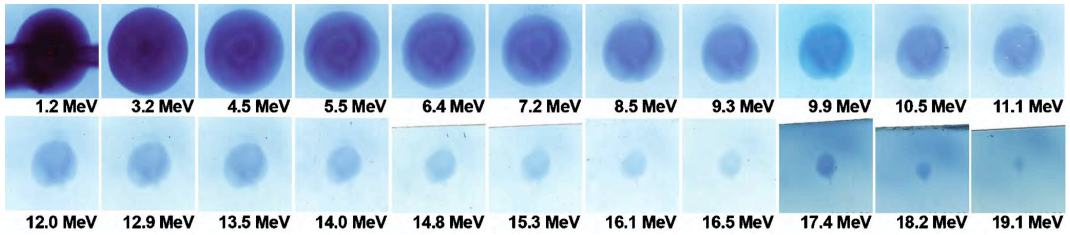


We demonstrated the feasibility of clean, very high signal to noise ratio proton radiography for these extremely hostile environments

Glycerol captures the bullets, the vaporized material and attenuates the low energy protons

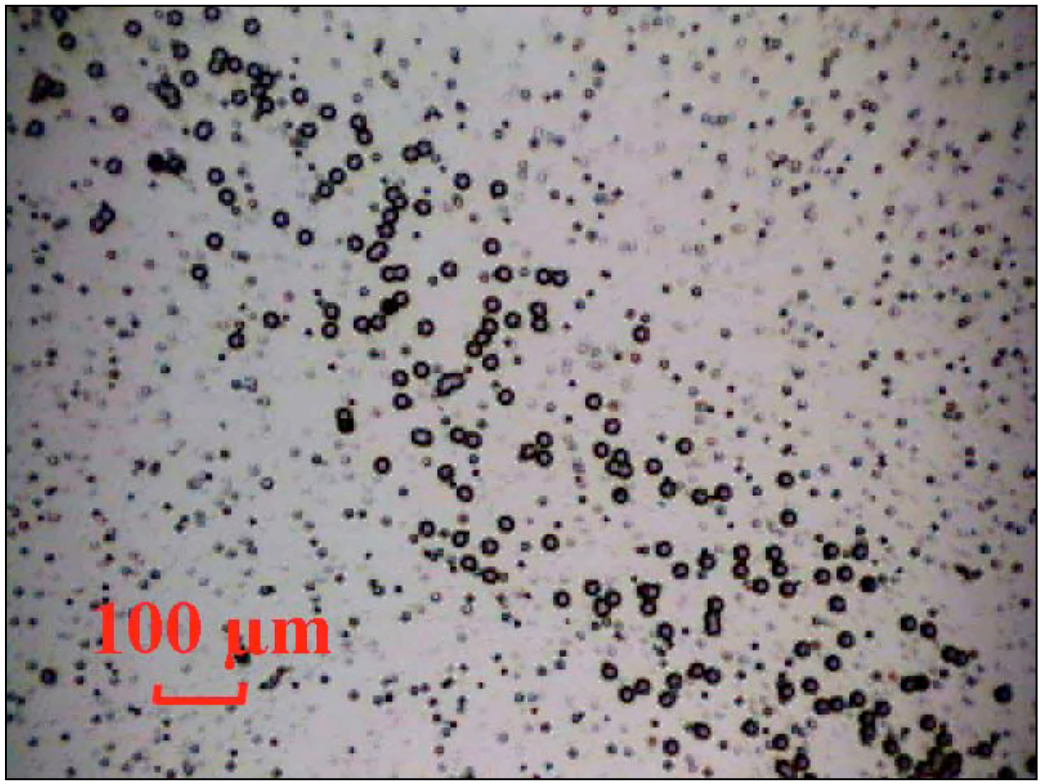


Typical laser-produced protons:



K. A. Flippo et al., PHYSICS OF PLASMAS 15, 056709 2008

Can a thin layer enhance signal to noise ratio?



C^{4+} ion track with energies approaching 15 MeV (TPIE) – LLE – courtesy of J. Cobble

It is believed that the uniform background comes from protons that do not go through the TPIE pinhole but scatter into the detector region through a bounce off of the top of the cart that holds the TPIE. The solid angle for this is a million times higher than the collection solid angle of the pinhole.