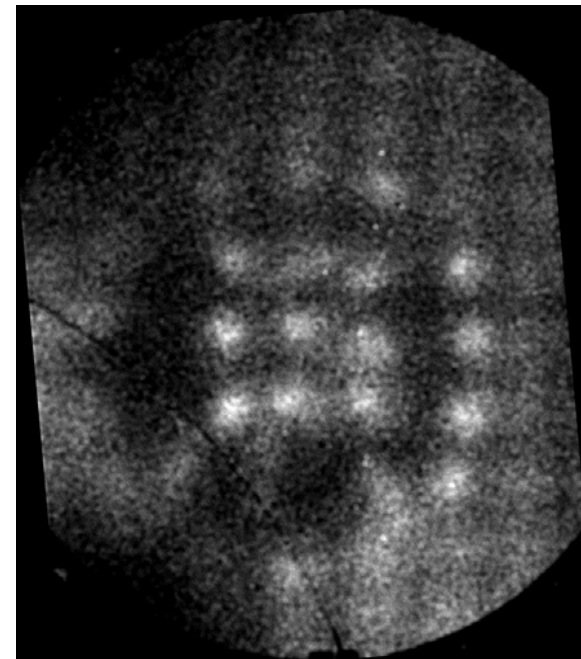
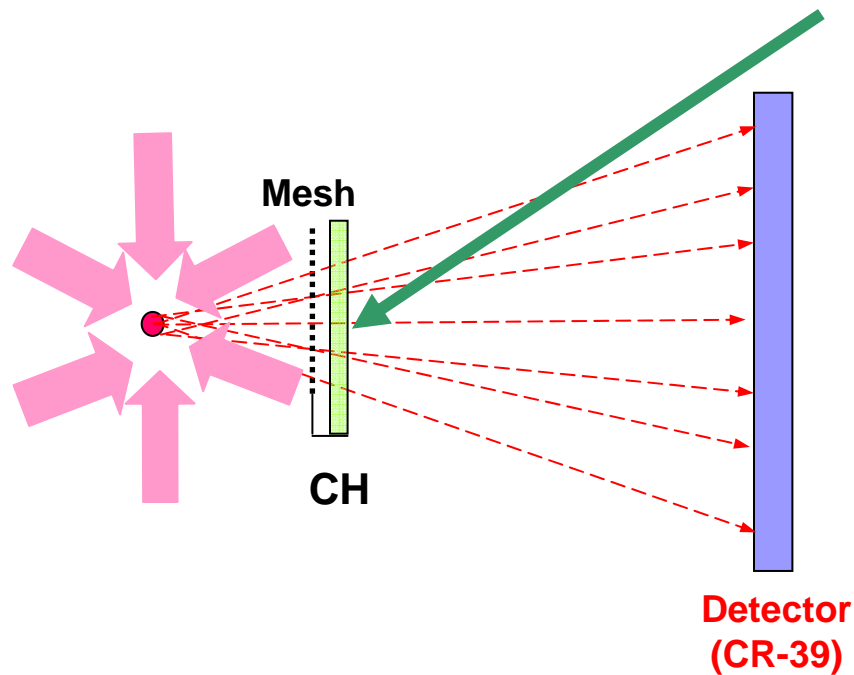


Proton radiography of electromagnetic fields generated by laser driven plastic foils



Collaborators

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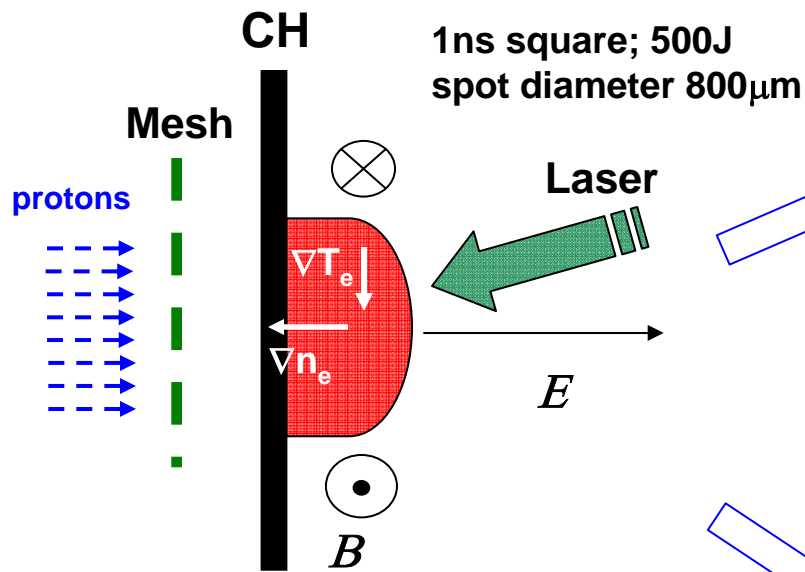
LLNL

Summary

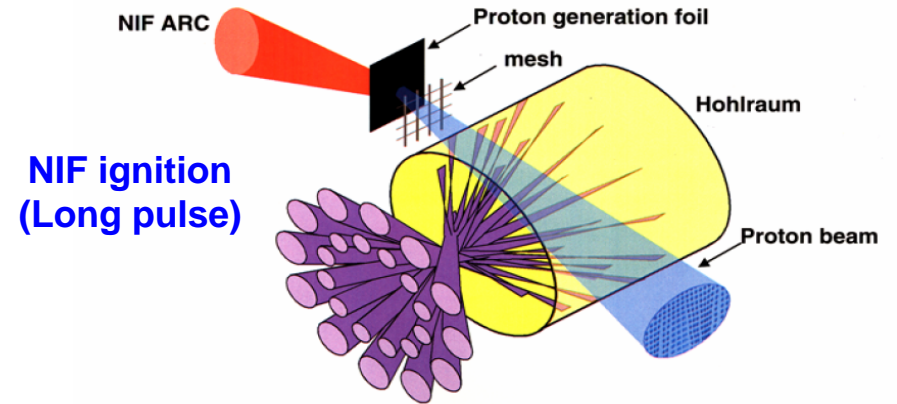
NLUF sponsored experiments at OMEGA have shown that proton radiography can be used to infer E and B field strengths in laser induced plasmas

- **DD and $D^3\text{He}$ backlighter protons are generated from spherical implosions**
- **$E+B$ fields are generated by one OMEGA laser beam driving a CH foil**
- **Transient B fields ~ 0.5 MG have been probed**
- **Transient E fields $\sim 10^9$ V/m have been probed**

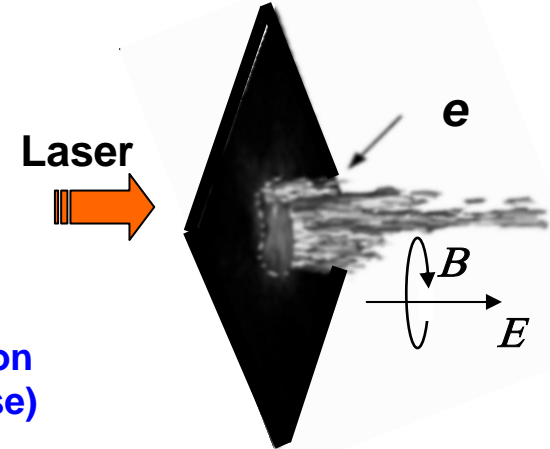
Schematic and principal of the proton radiograph experiment.



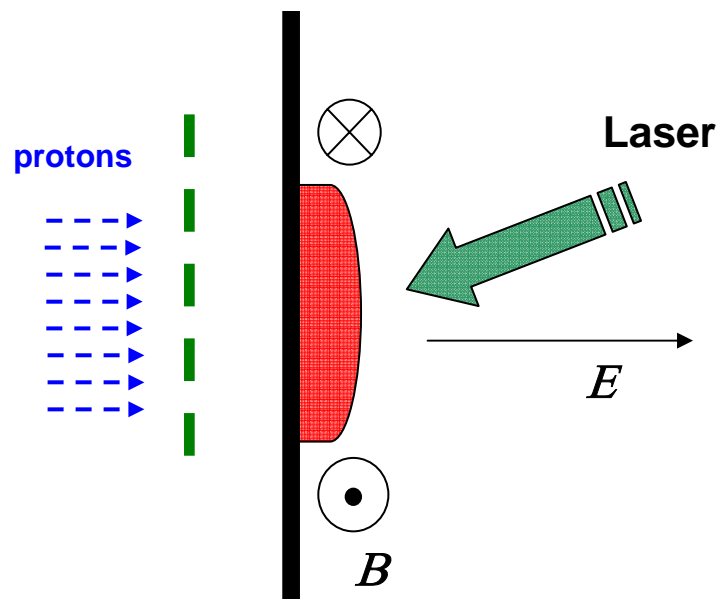
This experiment



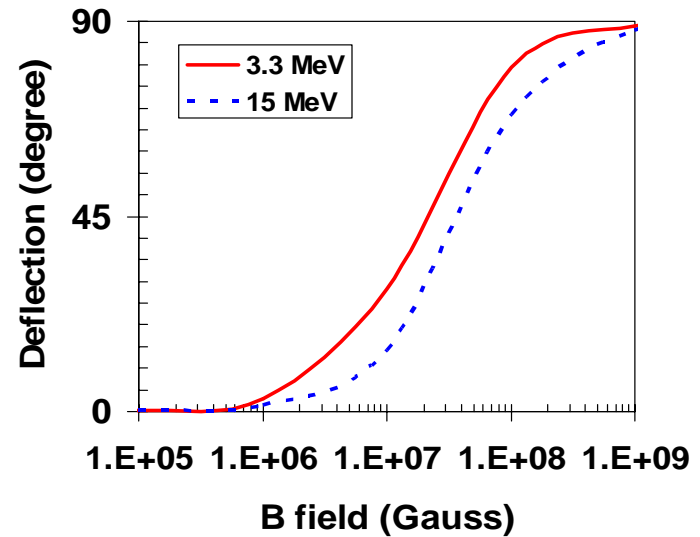
Fast ignition
(Short pulse)



The face-on radiograph is sensitive to the B field

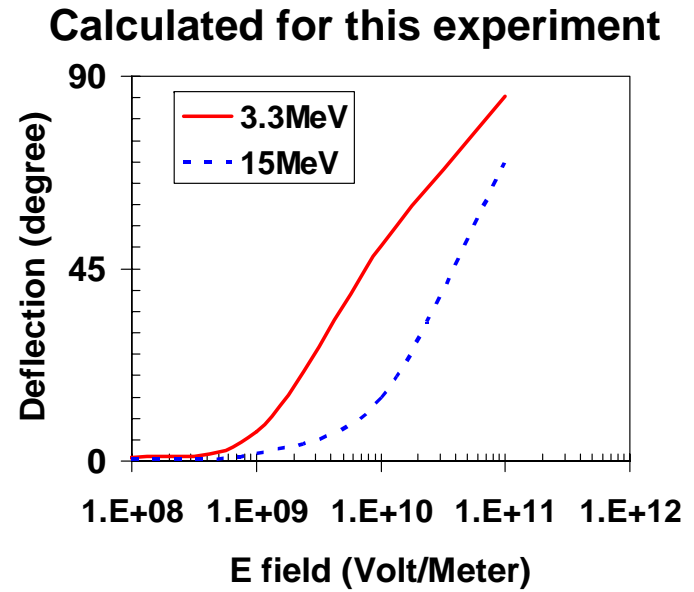
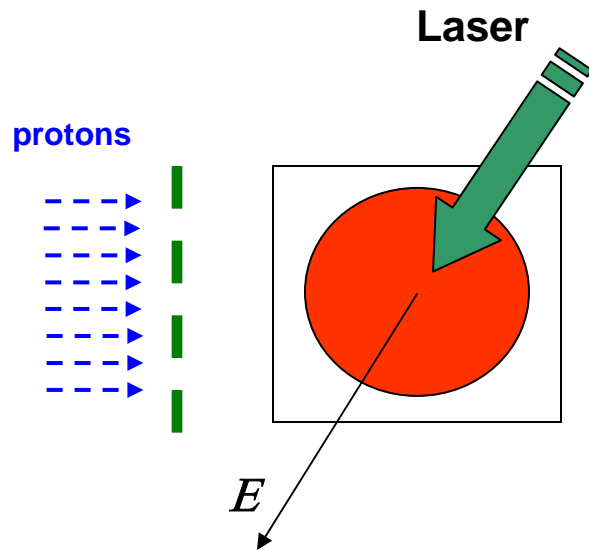


Calculated for this experiment



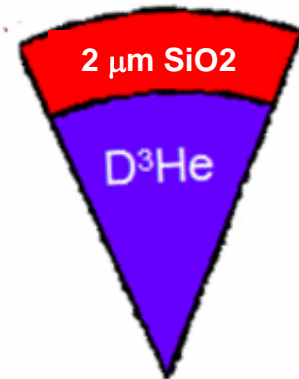
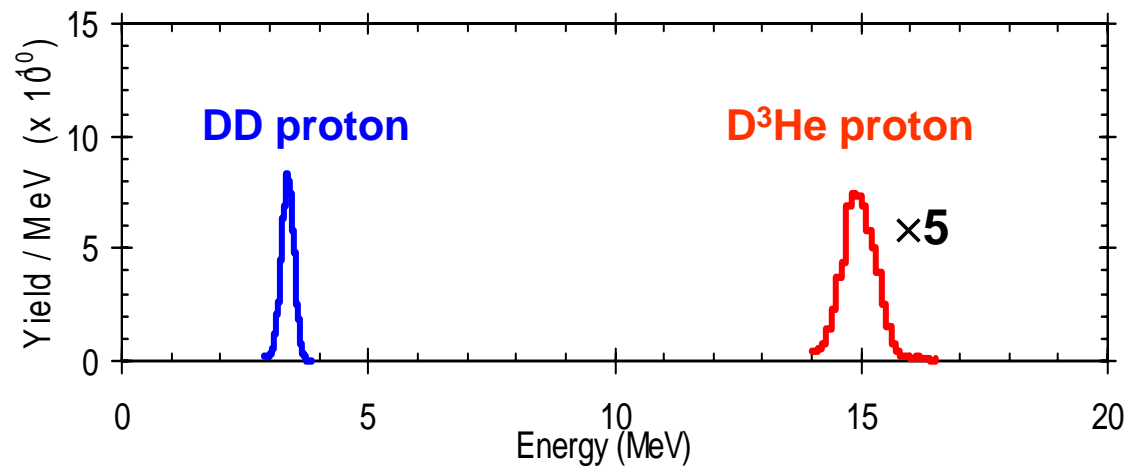
B field: deflection $\sim v_p^{-1}$

The side-on radiograph is sensitive to the E field



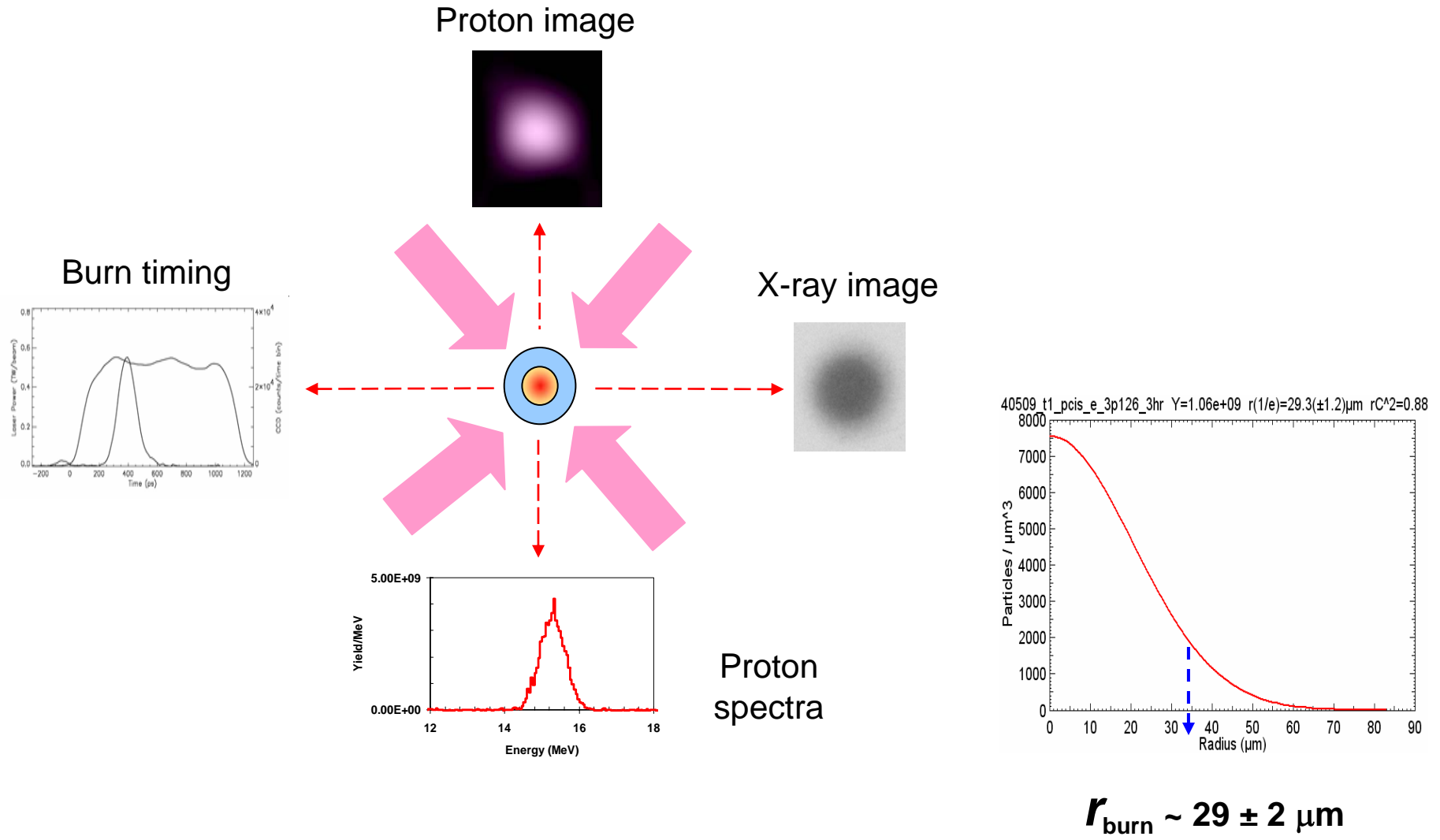
E field: deflection $\sim v_p^{-2}$

For quantitative study of $E+B$ field structure, monoenergetic DD and D^3He protons have unique advantages compared to a broad energy spectrum

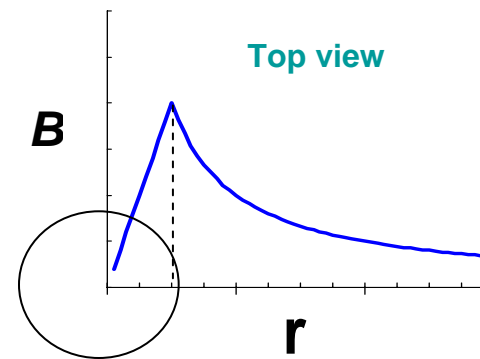
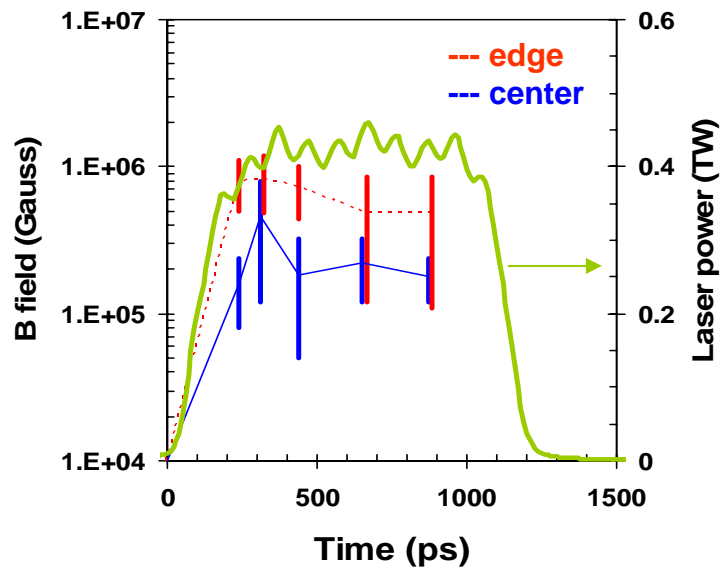
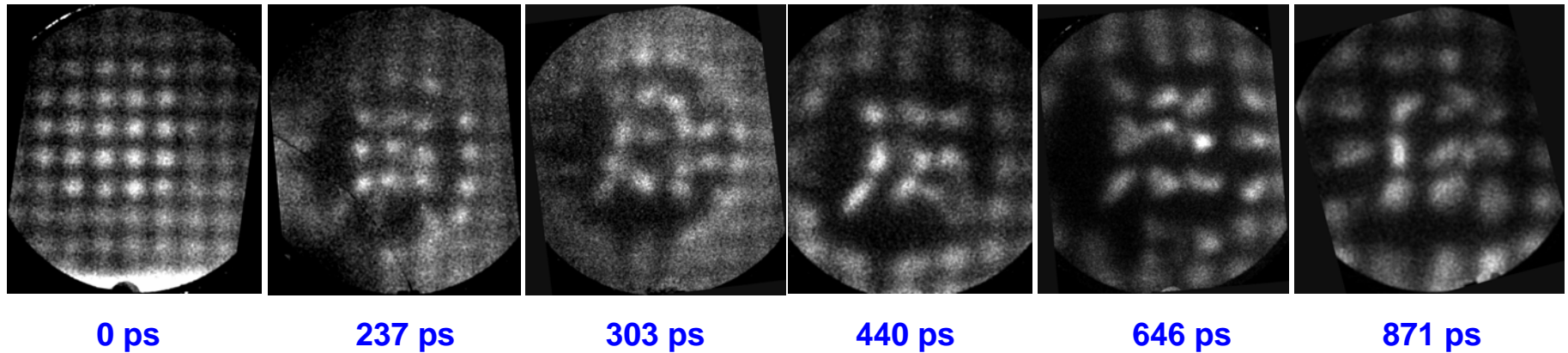


$$\mathbf{F} = q (\mathbf{E} + \mathbf{V} \times \mathbf{B})$$

Several nuclear and x-ray diagnostics were used to characterize the proton backlighter



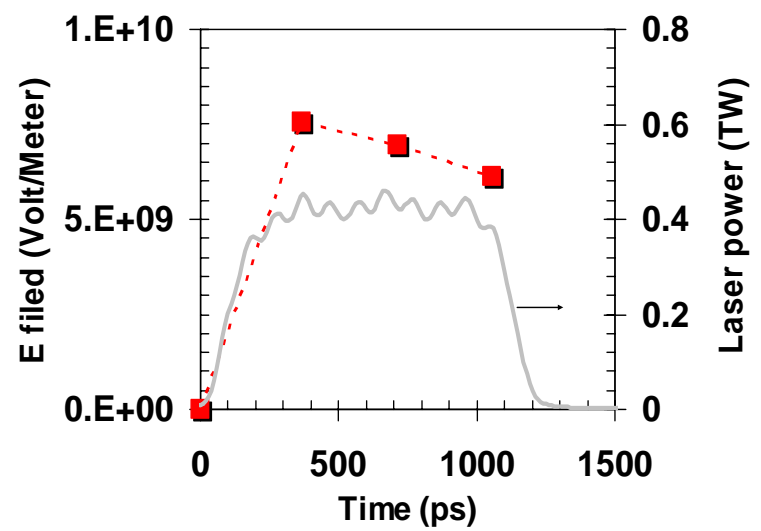
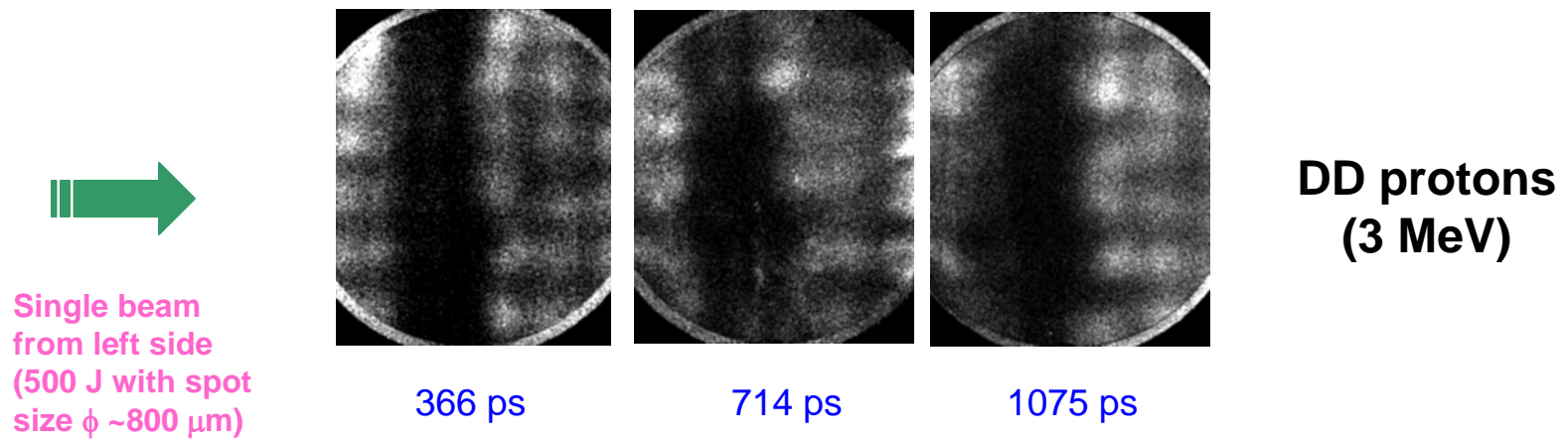
The time dependent D^3He proton deflections reflect the temporal evolution of the B field



Larger deflections at the edge of laser spot indicate stronger B fields around the plasma “bubble” edge

Preliminary estimate

Because of their lower energy, 3.0 MeV DD protons are more sensitive to the E fields



Preliminary estimate

Summary

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