CO_2-laser-driven wake-field accelerator with external injection

ATF experiment AE71

V.N. Litvinenko (SBU)
W. Lu (Tsinghua U)
C. Joshi, W. Mori (UCLA)
M.C. Downer, R. Zgadzaj (UT Austin)
I. Pogorelsky (BNL)
Y. Hao, Y. Jing (SBU/BNL)

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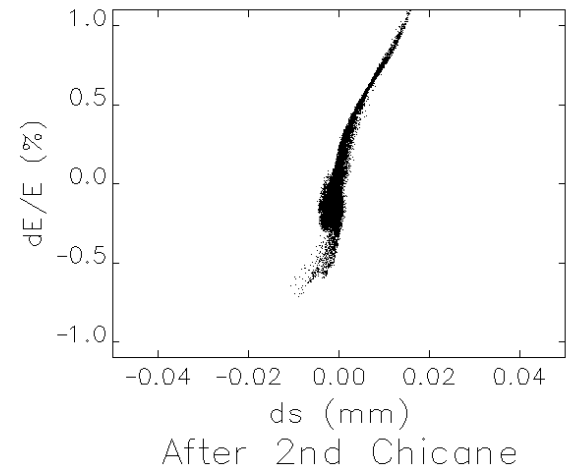
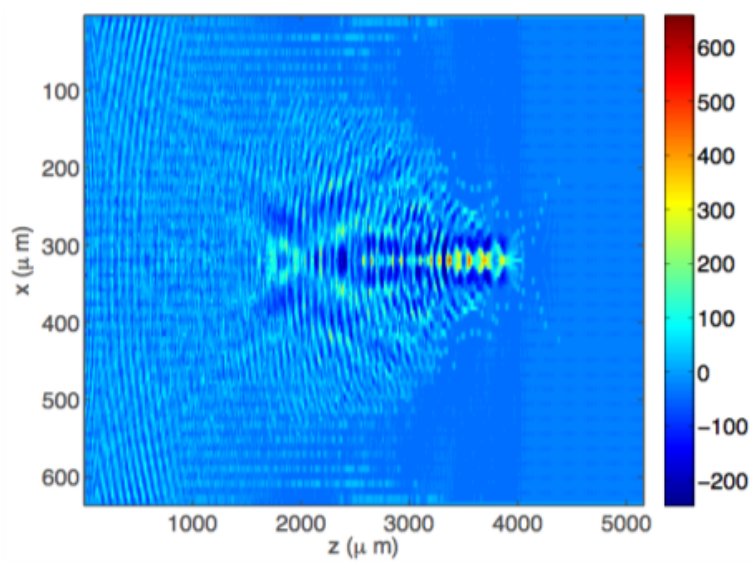
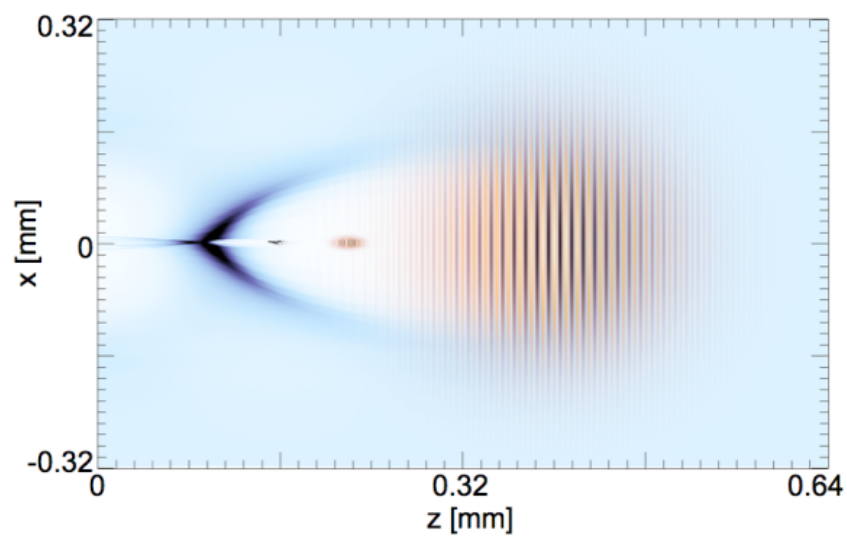
Collaborators:
J. Byrd , L. Doolittle , G. Huang , R. Wilcox (LBNL)

- We would like to explore large (e.g. psec or 0.5 mm) length of "bubble" in CO_2-laser driven plasma wake-field accelerator
- Matching injecting of an external high quality electron bunch with duration ~ 10 fsec and synchronizing it with the "bubble" should allow us to accelerate high quality electron beams with energy stability an spread reaching towards 10^{-4}
- CO_2-laser power upgrades are in progress at BNL, independently from this project
- Use visible diagnostics (since plasma is designed for CO_2-laser)
- Our project is devoted towards developing key components necessary for such experiment:
  - Plasma source with ramp-up and ramp-down density profiles
  - Electron bunch compressor to 10 fsec with emittance preservation
  - Visible laser diagnostics for the plasma

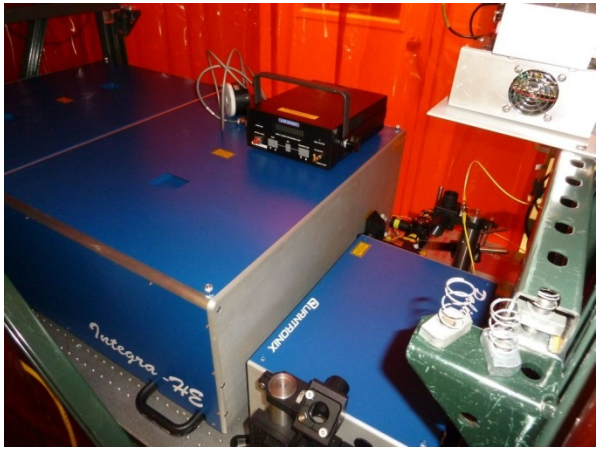




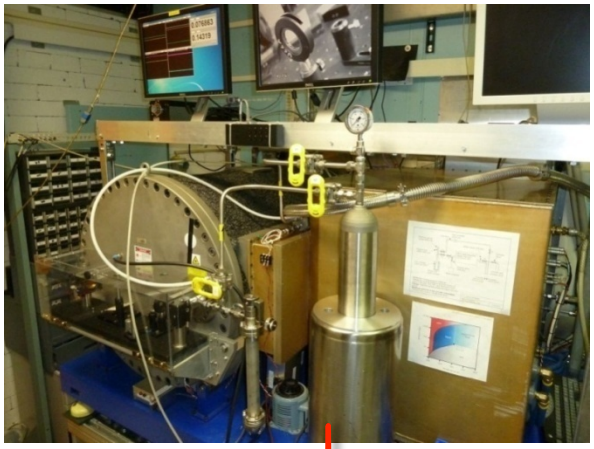


2 TW BNL CO_2 laser system

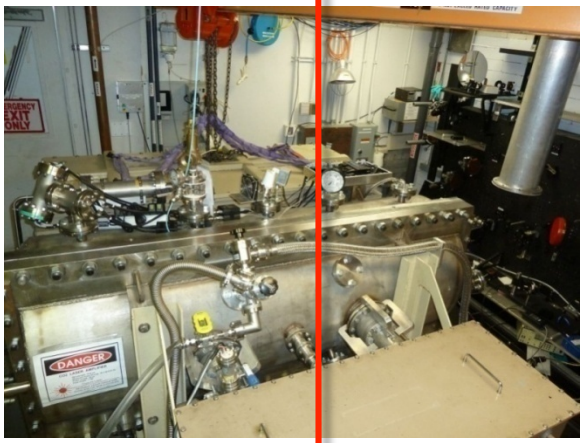
SOLID-STATE
OPA INJECTOR

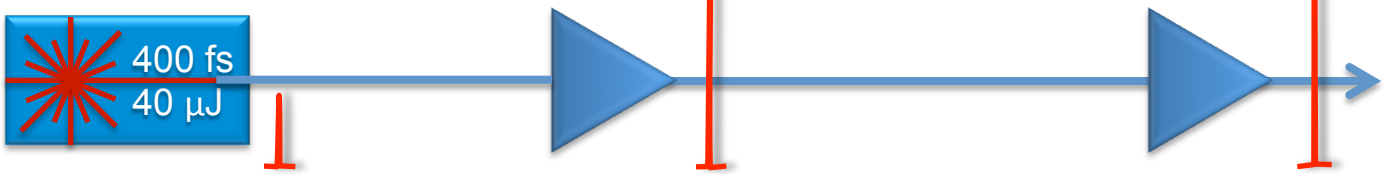


REGENERATIVE
ISOTOPIC AMPLIFIER



MAIN AMPLIFIER



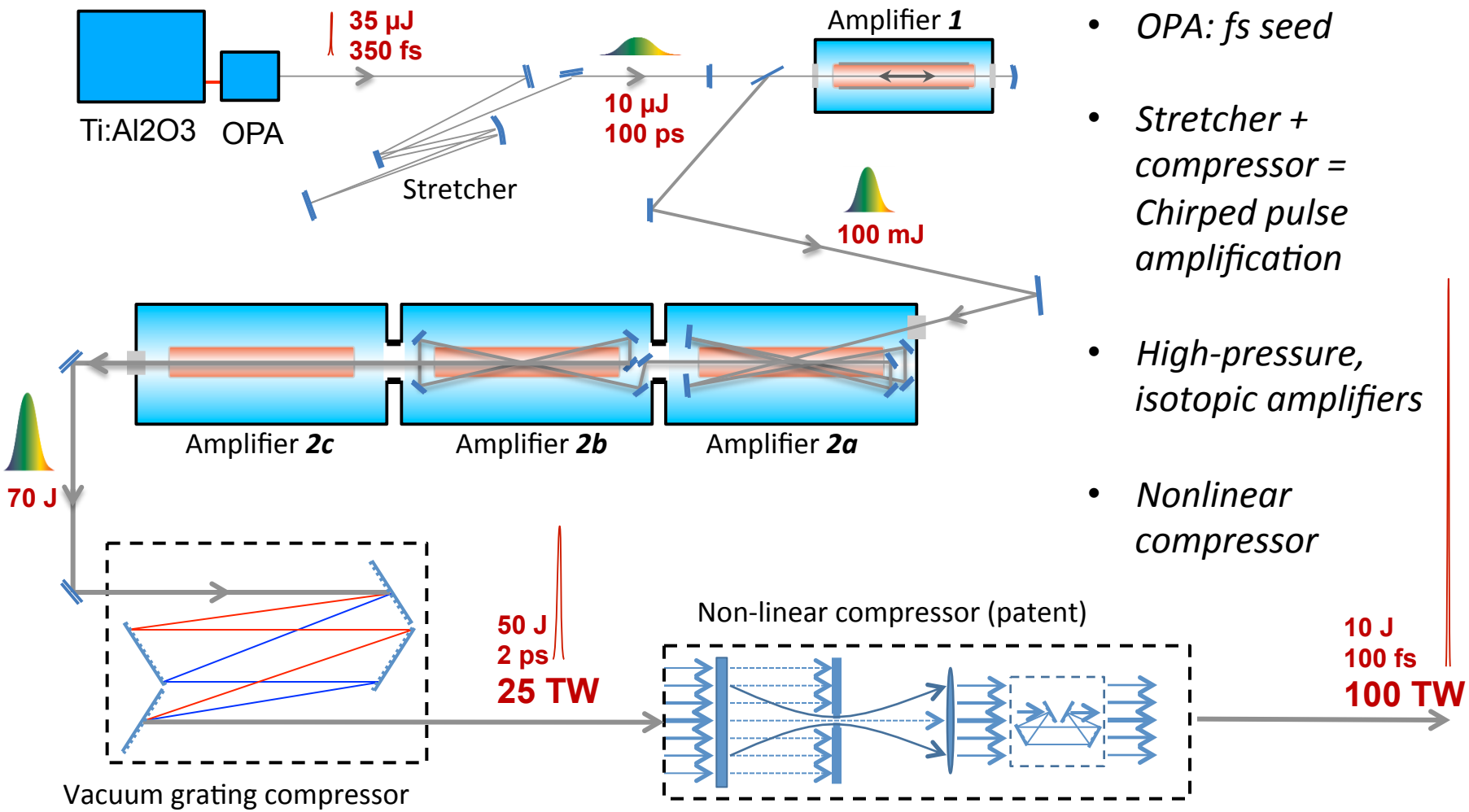


2 ps
10 mJ

3 ps
6 J

I. Pogorelsky

New concept of 100TW CO_2 laser



Collection of innovations:

- *OPA: fs seed*
- *Stretcher + compressor = Chirped pulse amplification*
- *High-pressure, isotopic amplifiers*
- *Nonlinear compressor*

I. Pogorelsky