# USPAS – *Simulation of Beam and Plasma Systems*

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## Lecture: Use case: sub-fs diagnostic

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http://uspas.fnal.gov/programs/2018/odu/courses/beam-plasma-systems.shtml

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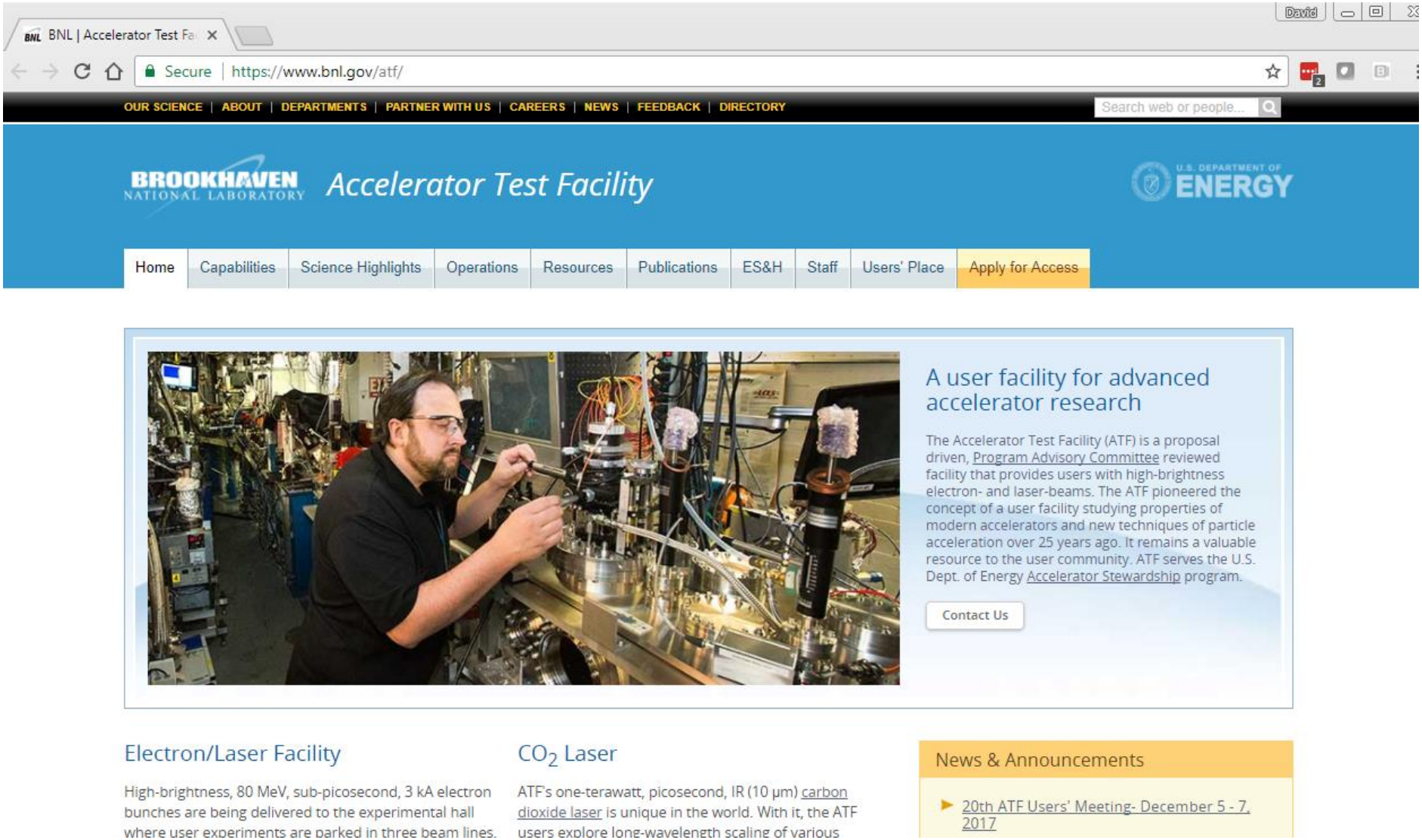
# *Goals*

- Learn a little about the Accelerator Test Facility (ATF) at BNL
  - bright electron beams, lasers, plasmas
- Consider an experiment to demonstrate fs diagnostics of e- beams
  - simulation and planning of the experiment using Sirepo/elegant

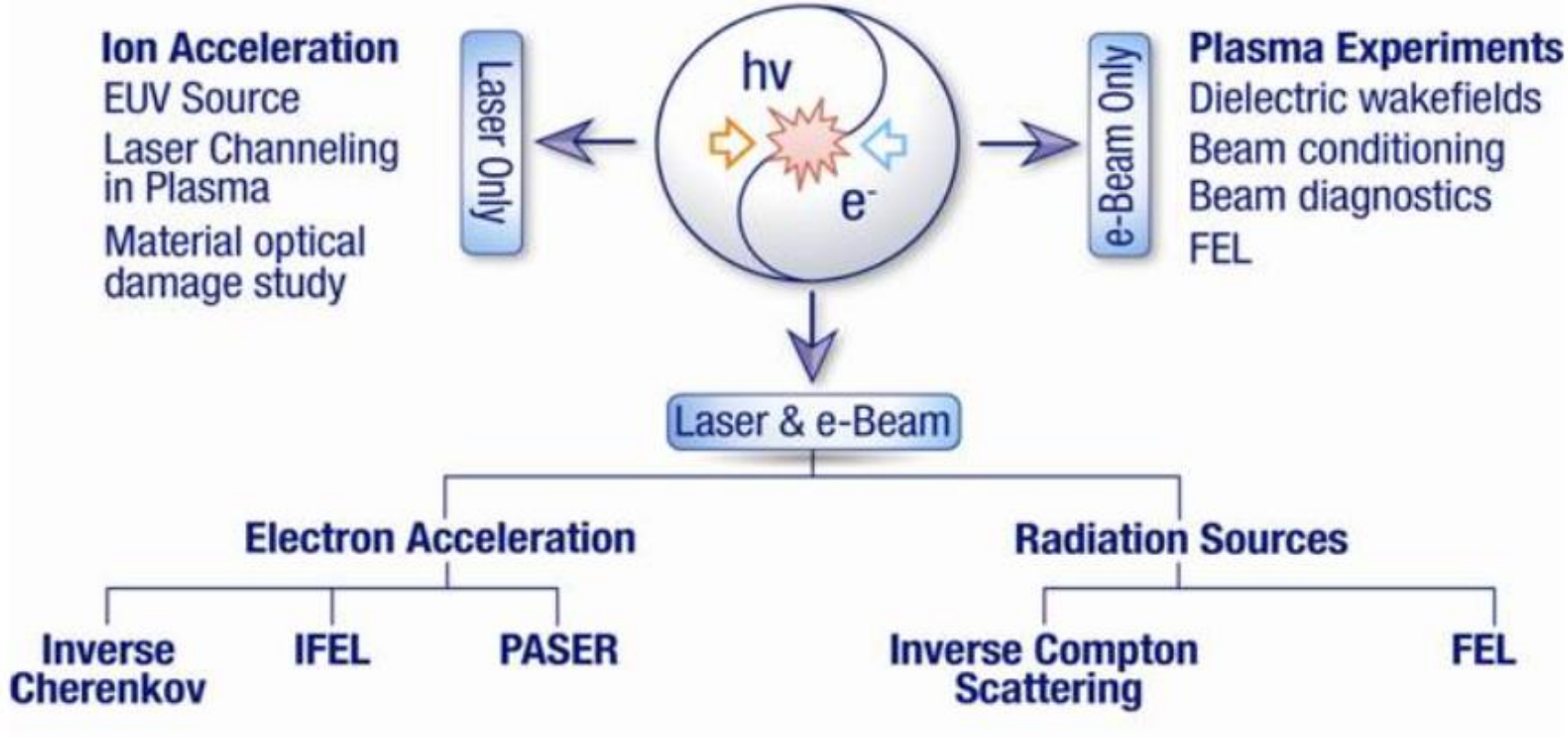
# The Accelerator Test Facility at BNL

https://www.bnl.gov/atf



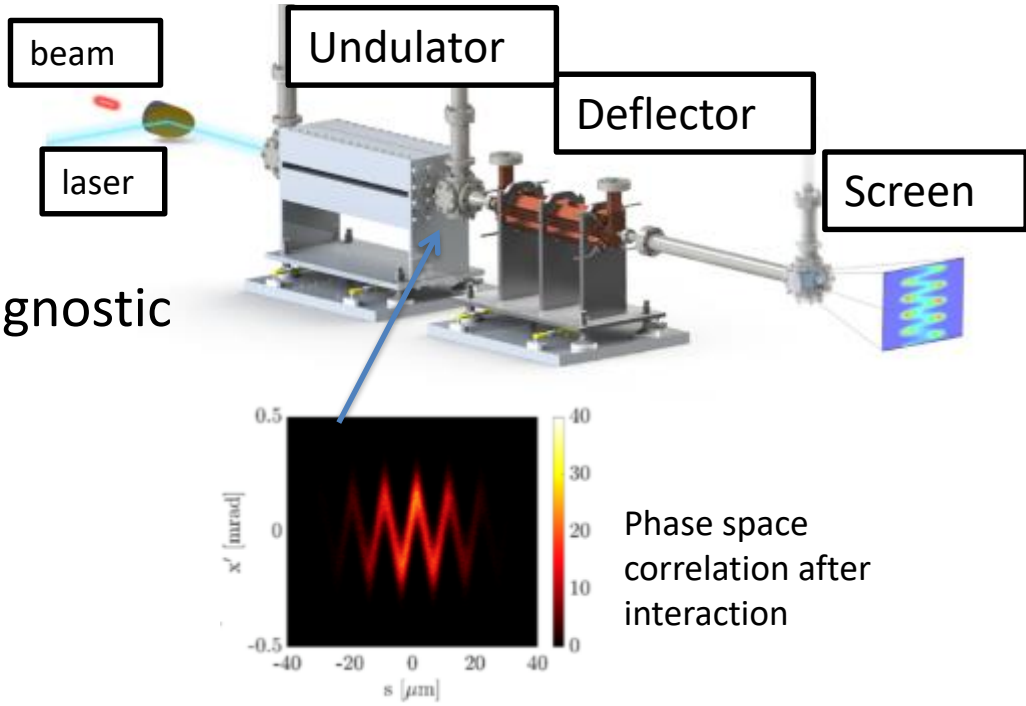
# ATF – Overview

- Proposal-driven user facility, enables R&D into the physics of beams
- Unique experimental capabilities:
  - high-brightness e gun, 85 MeV Linac
  - high-power lasers, beam-synchronized at the ps level
  - high-brightness X ray source



# Use case: sub-fs diagnostic at ATF

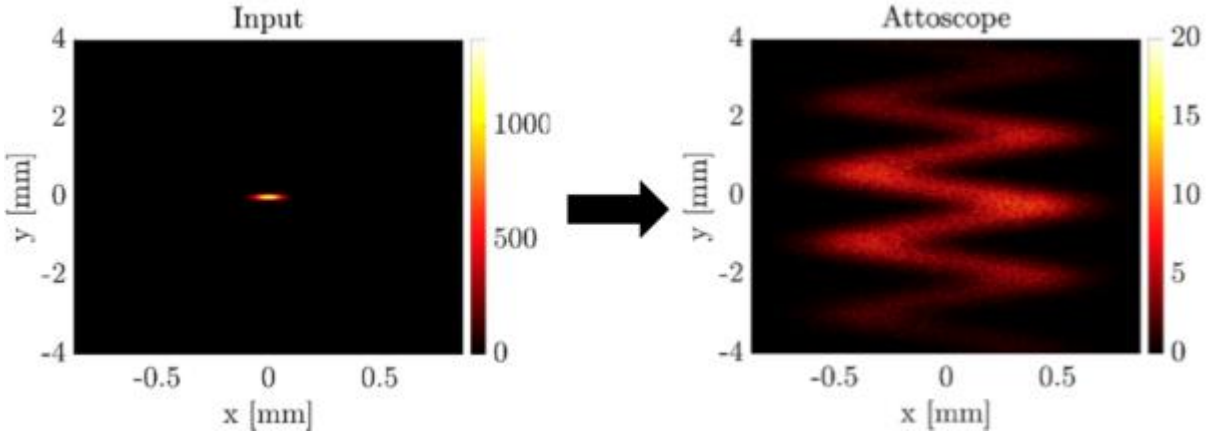
Slide courtesy of
G. Andonian & N. Sudar




- High-resolution bunch length diagnostic
  - Laser modulator (TEM10 mode)
  - RF deflecting cavity
  - Potential for sub-fs resolution
- Experiment at BNL ATF
- Images with Sirepo/elegant




Phase space correlation after interaction




Distribution after deflector

# *Class discussion:*

- Any questions at this point?

- The rest of this lecture is a Sirepo/elegant simulation
  - we'll consider the full "Attoscope" beamline
    - **courtesy of G. Andonian (UCLA, RadiaBeam Technologies) and N. Sudar (UCLA)**
  - multiple beamline definitions
  - use of diagnostics
  - export / import of simulations via zip files

- Begin the demo…