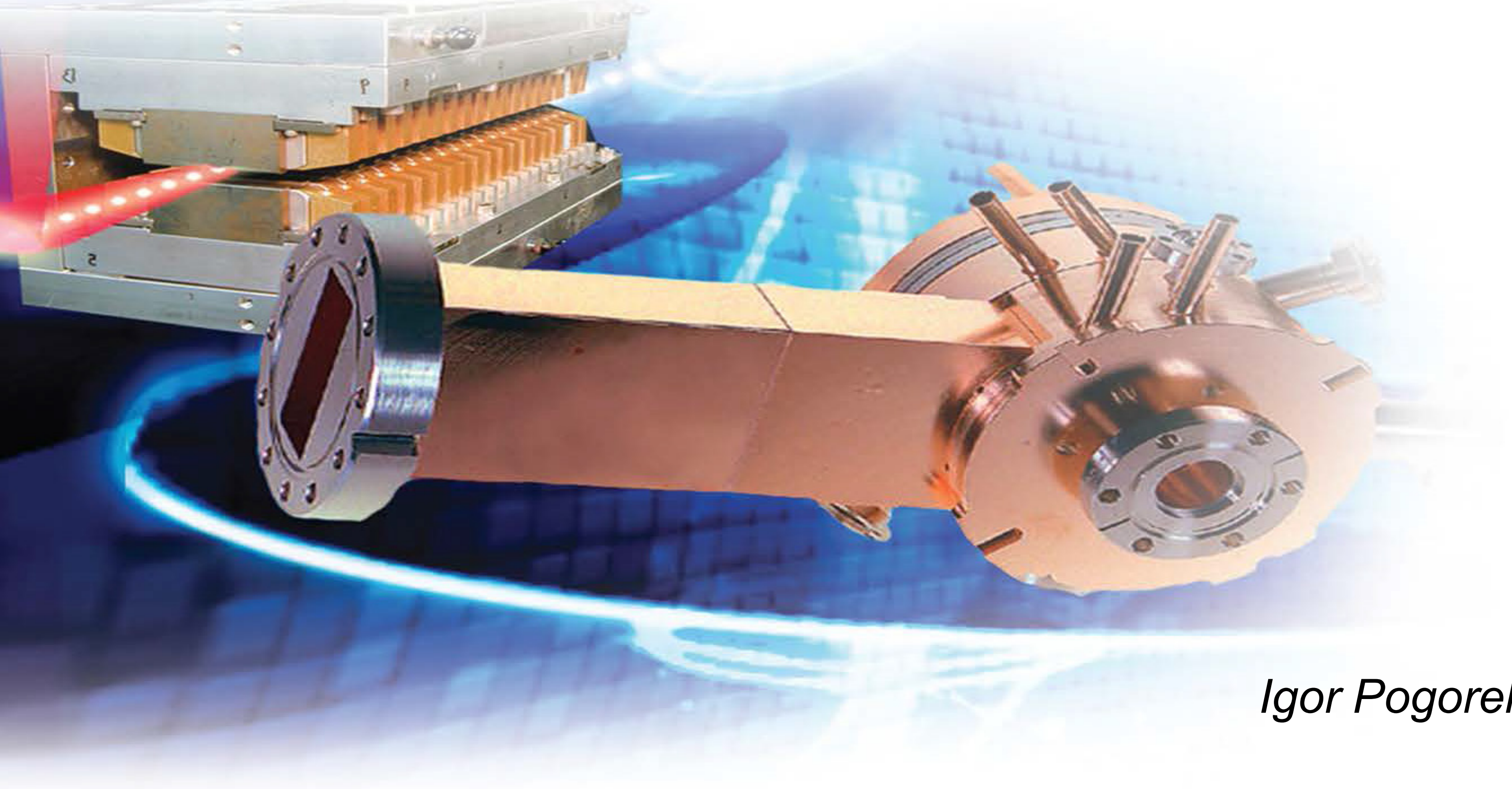
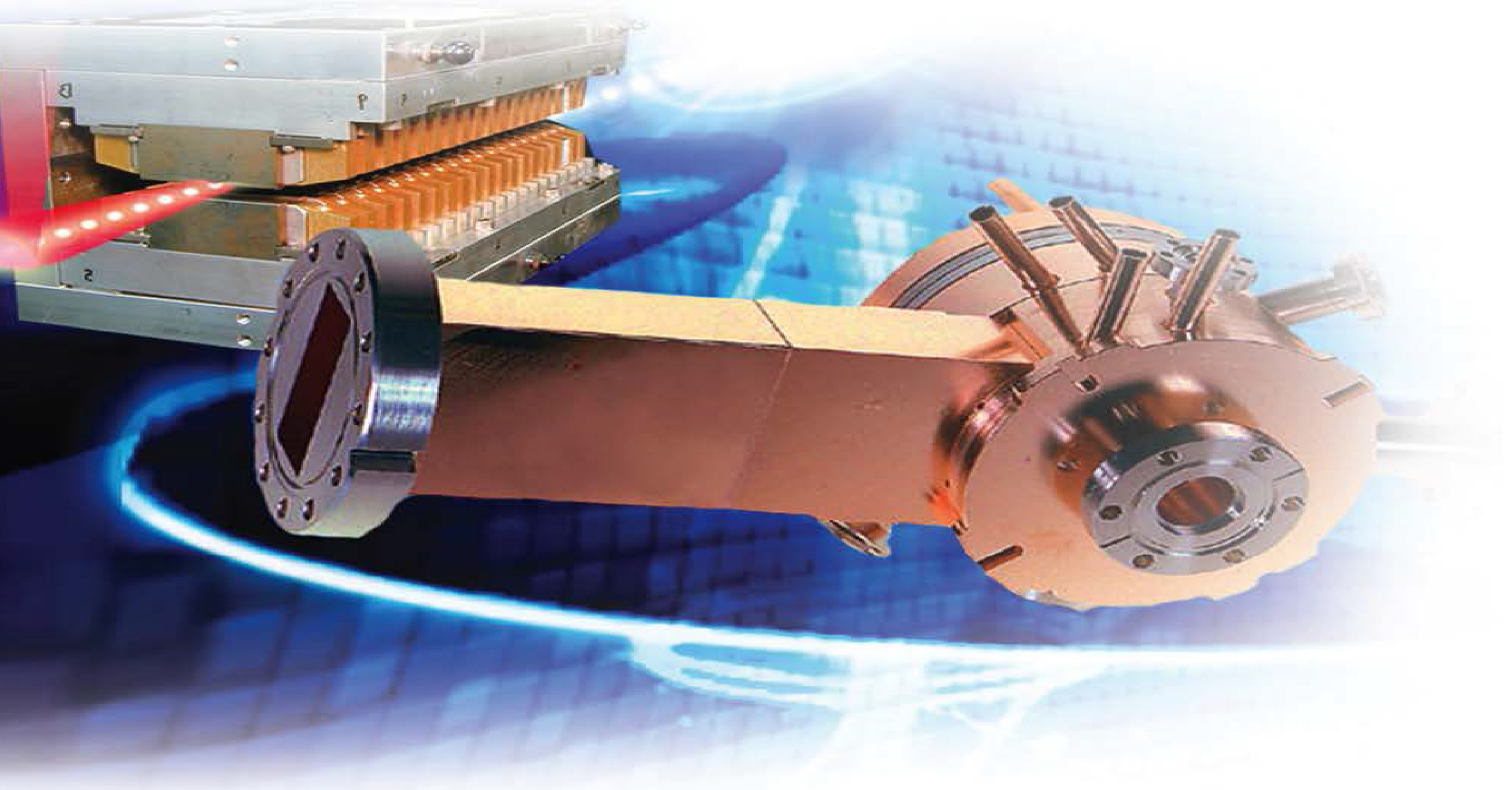
NAPAC 2016



Igor Pogorelsky

Fulfilling the mission of Brookhaven ATF as a DOE's flagship user facility in Accelerator R&D Stewardship

BROOKHAVEN NATIONAL LABORATORY
a passion for discovery
U.S. DEPARTMENT OF ENERGY | Office of Science



Introduction to the ATF and Accelerator R&D Stewardship

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A little bit of history

1980-1990
Establishing the proposal-based HEP program to support long-range accelerator R&D.
The ATF was founded as a part of this program.

1994
The “accelerator stewardship” concept emerged in HEPAP recommendations

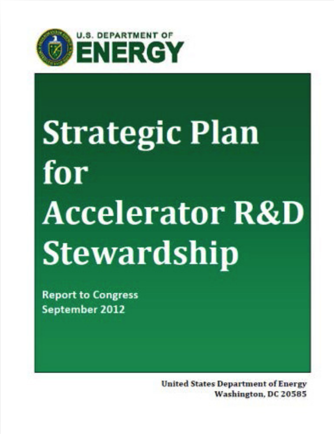
2009
The symposium Accelerators for America’s Future was extremely successful in showing the importance of accelerators for our nation and in making the case for Federal support.

In 2011 the Senate asked DOE to develop a 10-year strategic plan for Accelerator R&D

"The **United States Senate Committee on Appropriations** directs the Department to submit a strategic plan based on the results of the Department's 2009 workshop Accelerators for America's Future, …"

Senate Report 112-075

DOE responded with a strategic plan for Accelerator R&D Stewardship



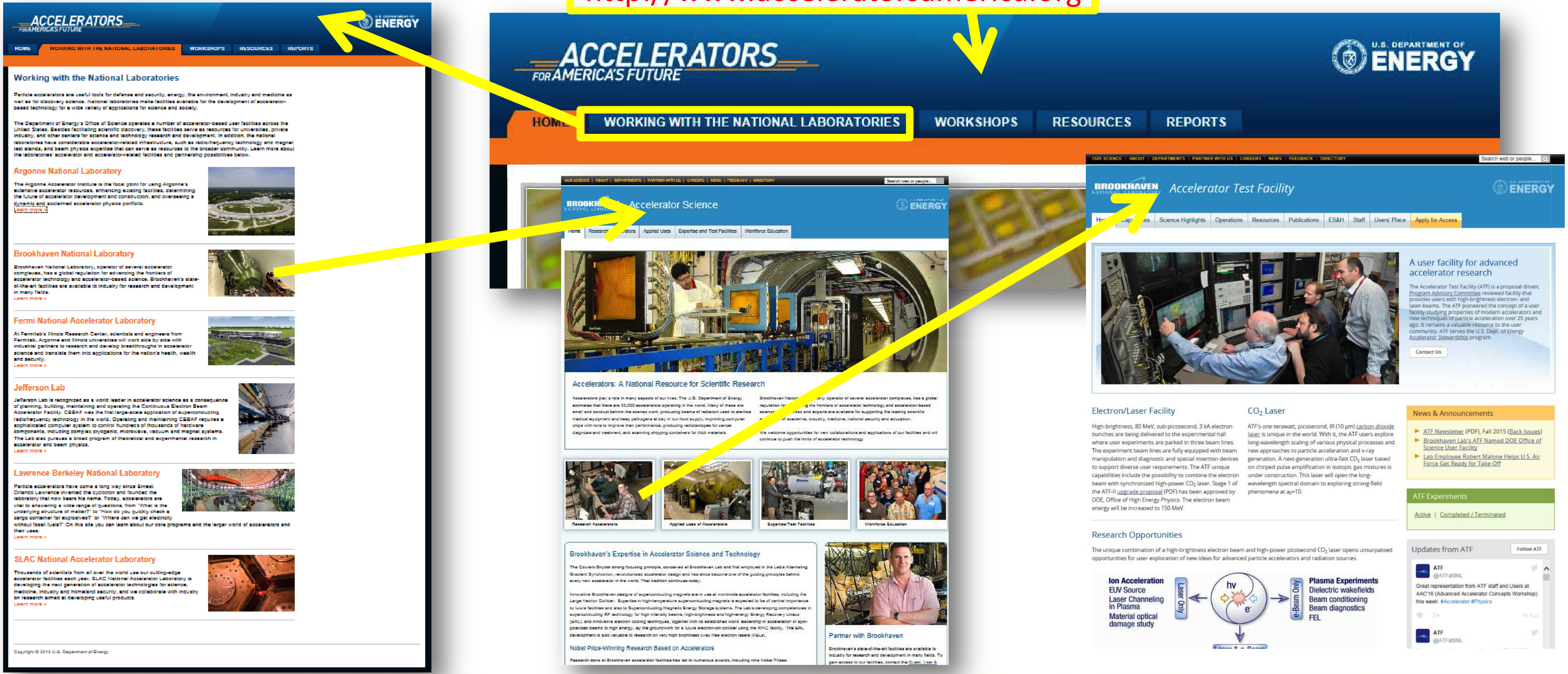
- **Accelerator R&D Stewardship Mission:**
  - Support fundamental accelerator science and technology R&D
  - Disseminate accelerator knowledge and training
- **Program Implementation:**
  - **Facilitate access to** national laboratory accelerator **facilities** and infrastructure **for industrial and U.S. government agency users/developers** of accelerators and related technology
  - **Support basic R&D** necessary for sustained innovation across a broad range of accelerator applications

Accelerator Stewardship Program Elements

- **Funding Opportunities with DOE**
  - Accelerator Stewardship Solicitations
    - 6 awards made in FY 2015
    - 9 awards made in FY 2016
  - SBIR/STTR Solicitations (Some topics tailored to mesh with AS program)
- **Accelerator R&D Test Facilities**
  - Brookhaven Accelerator Test Facility
    - Office of Science User Facility dedicated to Accelerator Stewardship use
    - Upgraded facility planning for first users in 2019
  - Accelerator Stewardship Test Facility Pilot Program
    - Pilot Program to assess demand for lesser-known SC accelerator capabilities
    - 7 lab/industry and lab/university partnerships seed-funded

Finding Accelerator R&D Capabilities at the DOE Office of Science National Laboratories

http://www.acceleratorsamerica.org



Accelerator Test Facility

- The ATF pioneered the concept of a user facility for studying new methods of accelerating electrons and ions
- Well established, proposal-driven, peer-reviewed, serves accelerator community for 25 years

Small staff, a lot of experience

- One-of-a-kind combination of e-beams and lasers
- Free facility access to qualified researchers
- A highly trained staff to support a broad array of user experiments

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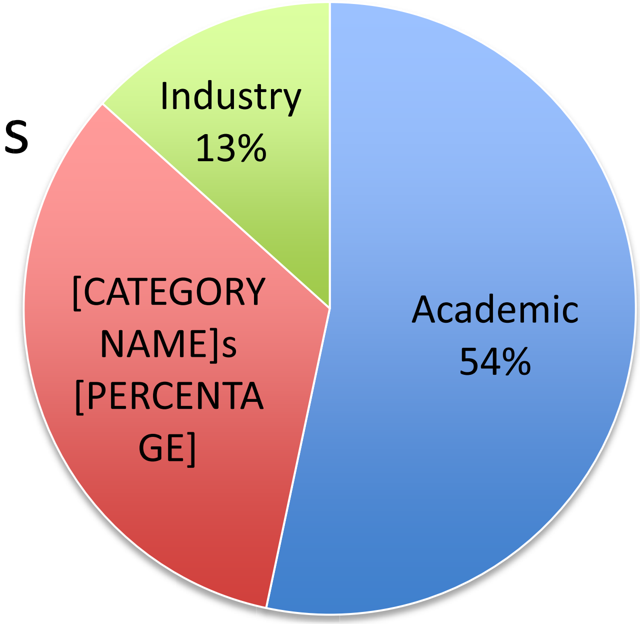
Unique powerful lasers

- One-of-a-kind combination of e-beams and lasers
- Free facility access to qualified researchers
- A highly trained staff to support a broad array of user experiments

Role of the BNL-ATF in Accelerator Stewardship

BNL-ATF has operated throughout its 25 year history as a user facility dedicated to advanced accelerator R&D, accepting user proposals based on scientific merit.

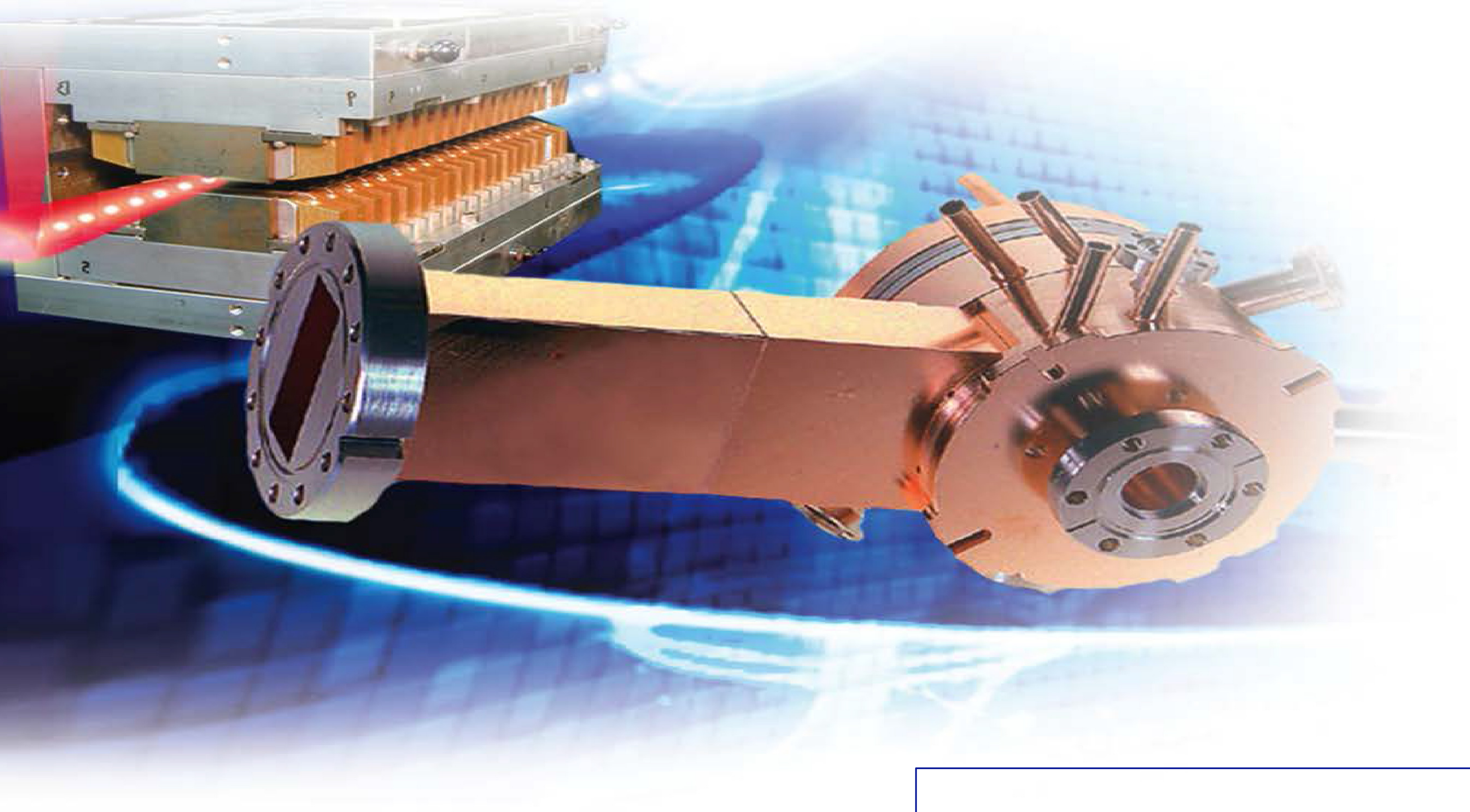
- ATF with staff of 10 currently supporting 22 experiments
- Serves a broad population of laboratory, university, and industry users
- Has a rich tradition of serving as a training ground for accelerator physicists



Accelerator Laboratory Course

What does ATF's inclusion in Stewardship mean?

- Increased priority for technology demonstrations
- HEP is a user of the facility like any other
- Stakeholders of ATF have broadened
- Designation of BNL-ATF as an Office of Science User Facility
- An upgrade to a larger facility



Present Capabilities and Ongoing Research at the ATF

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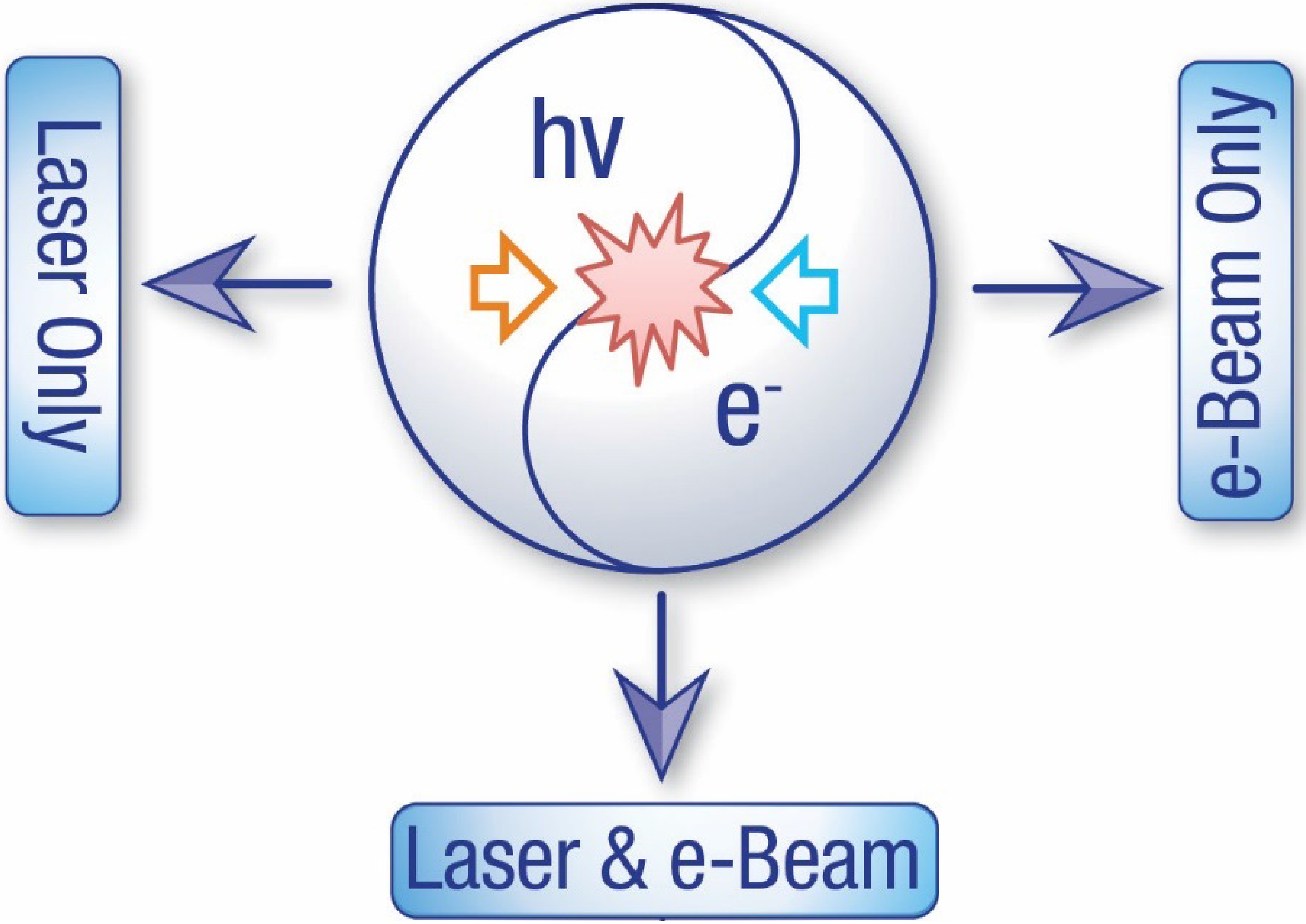
Unique combination of electron accelerator and picosecond CO_2 laser

CO_2 laser
λ=9-11 μm
2 TW
6J @ 3ps
0.05 Hz



High-brightness photocathode linac
80 MeV
Emittance - 1μm
Energy spread - 0.1%
Charge ~ 1 nC
Single bunch 10ps-200fs
Multi-bunch trains

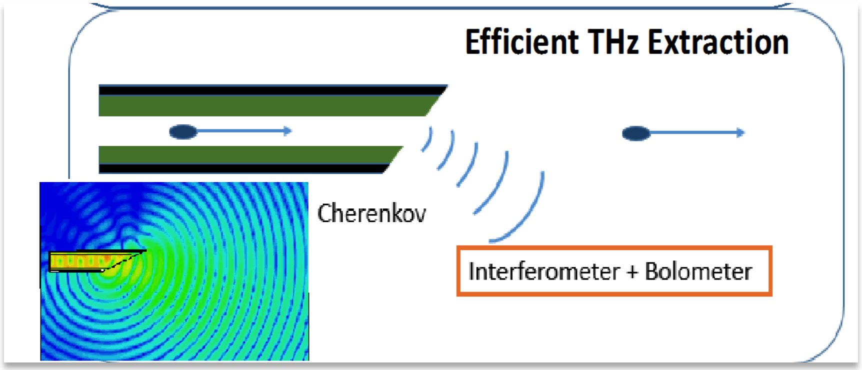
Active ATF Experiments

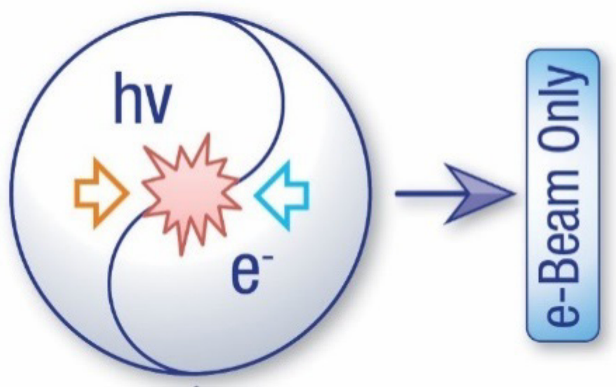
- AE39 - DWA - High Gradient, high field dielectric wakefield acceleration experiments at the ATF. Spokesperson: J. Rosenzweig, UCLA (2010)
- AE43 - PWFA Holography. Spokesperson: M. Downer/P. Muggli (2009)
- AE48 - Experimental study of electron-beam microbunching dynamics. Spokesperson: A. Gover, Tel-Aviv U. (2010)
- AE52 - Beam Manipulation by Self-Wakefield at the ATF. Spokesperson: S. Antipov/A. Kanareikin (2012)
- AF58 - ERL BPM Test. Spokesperson: R. Michnoff, BNL (C-AD) (2013) feasibility study
- AE59 - Inverse Compton Source for Extreme Ultraviolet Lithography, Spokesperson: A. Murokh, Radiabeam (2013)
- AE60 - Ultrafast High-Brightness Electron Source. Spokesperson: J. Park, Advanced energy systems (2012)
- AE62 - Sub-femtosecond beam line diagnostics, PI: G. Andonian, UCLA (2014)
- AE63 - Stony Brook Accelerator Laboratory Course, CASE@ATF, PI: Litvinenko, Stony Brook (2014)
- AE64 - Surface Wave Accelerator and Radiation Source Based on Silicon Carbide, PI: G. Shvets, U. Tex. (2010)
- AE65 - NOCIBUR: an inverse free electron laser decelerator experiment, PI: P. Musumeci, UCLA (2014)
- AE66 - Modification of Gas Jet Density Profile with Hydrodynamic Shocks for CO2 Laser Ion Acceleration Experiment, PI: A. Ting/Z. Najmudin, NRL/Imperial College (2014)
- AE67 - Space Radiation Effects Experiments, PI: Wousik Kim, NASA (2014)
- AE68 - Ramped Beam Generation Using Dielectric Wakefield Structures, PI: G. Andonian, RadiaBeam (2014)
- AF69 - Key physics study of LPI with NCD plasma using laser machined plasma structure, PI: Wei Lu, Tsinghua Univ., China (2014) feasibility study
- AE70 - Nonlinear Inverse Compton Scattering, PI: J. Rosenzweig, UCLA (2014)
- AE71 - CO_2-laser-driven GeV wakefield accelerators with external injection / Key Physics Study of Laser Wakefield Acceleration Utilizing Ultrafast CO_2 Laser and Electron Beam, Principle Investigators: V. Litvinenko/W. Lu, SUNY SB/Tsinghua Univ. (2014)
- AE72 - Interaction Physics of Pico-second far-IR Terawatt Laser with Materials, PI: A. Ting, NRL (2015) proprietary research
- AE73 - Energy Chirp Compensation in Plasma, PI: J. Osterhoff, DESY (2015)
- AE74 - Self-Channeling of CO_2 Laser in Air, PI: S. Tochitsky, UCLA (2015)
- AE75 - MEMS Undulator for EUV Lasers, PI: I. Gadjev, UCLA (2015)
- AE76 - High Duty Cycle FEL, PI: A. Murokh, Radiabeam (2015)

Legend:
- e beam only experiment
- combined e beam and laser
- laser only experiment

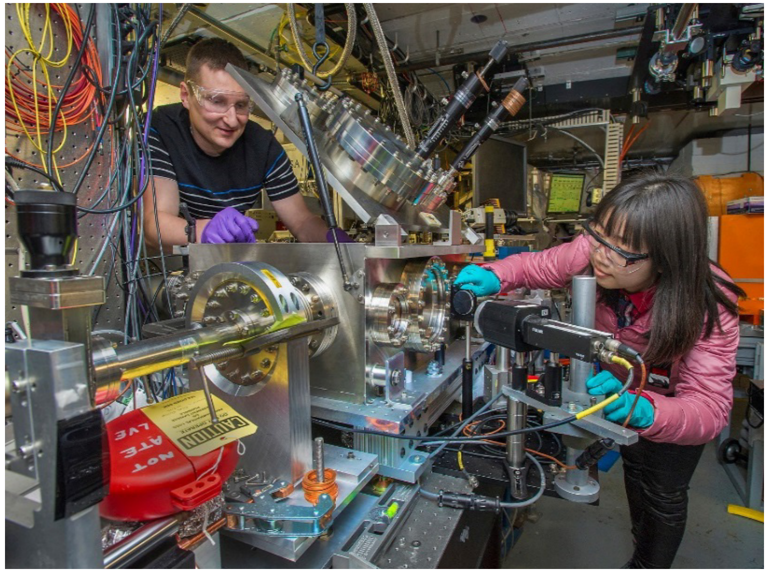
"E-Beam only" experiments

THz radiation

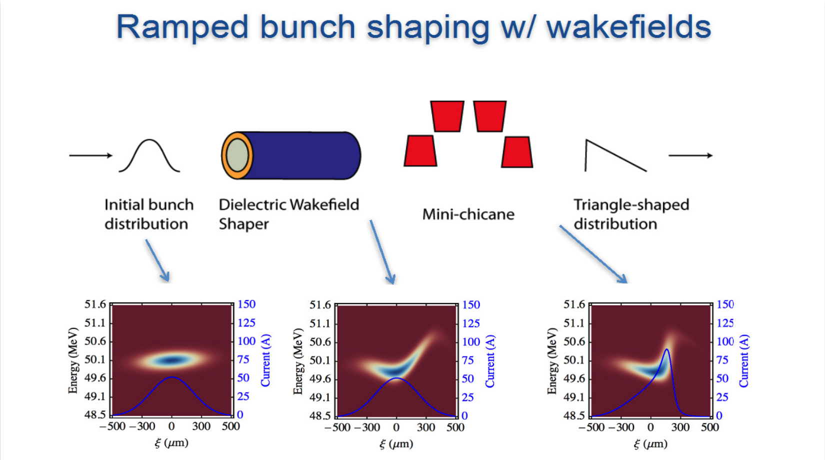




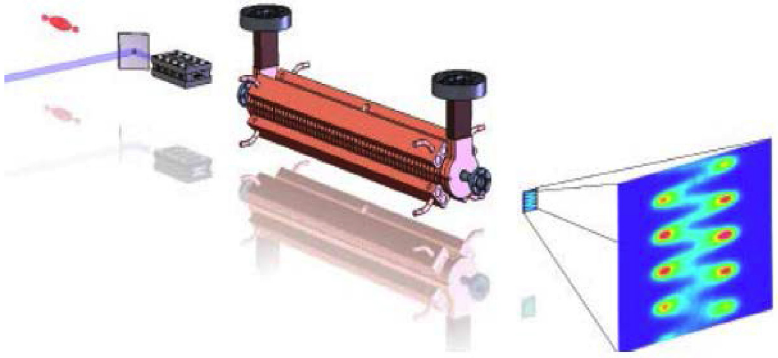
Radiation damage



Beam manipulation

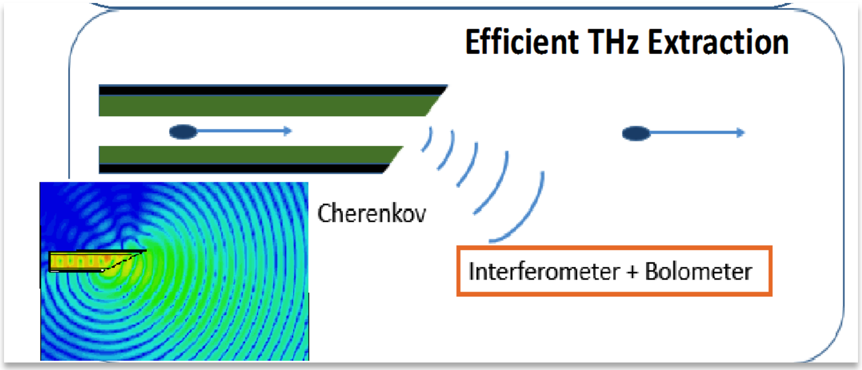


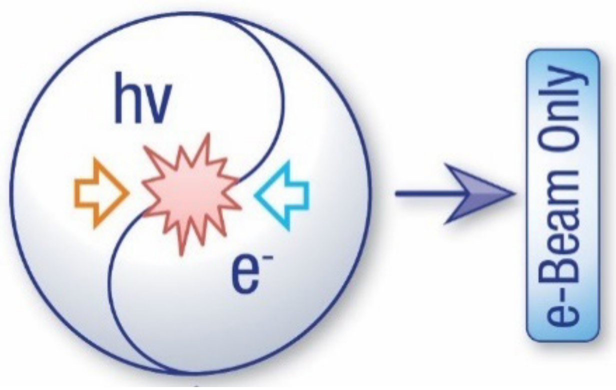
Femtosecond diagnostic



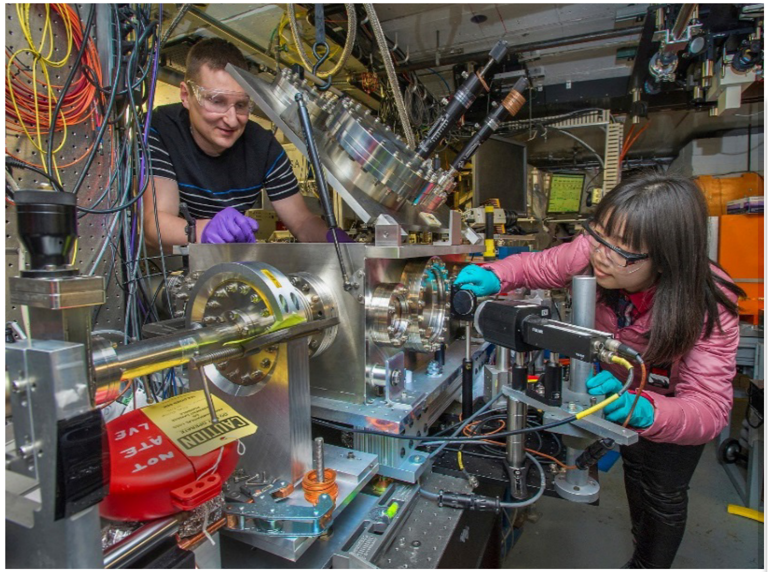
"E-Beam only" experiments

THz radiation

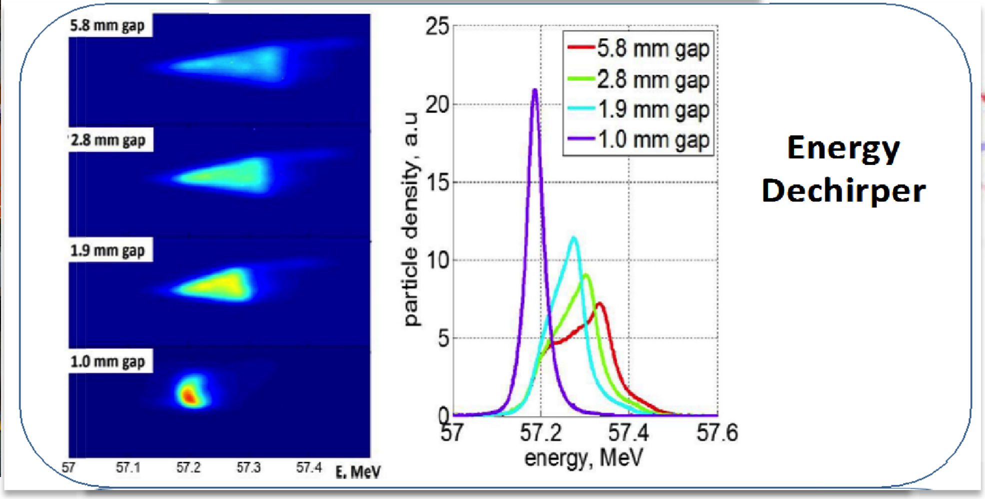




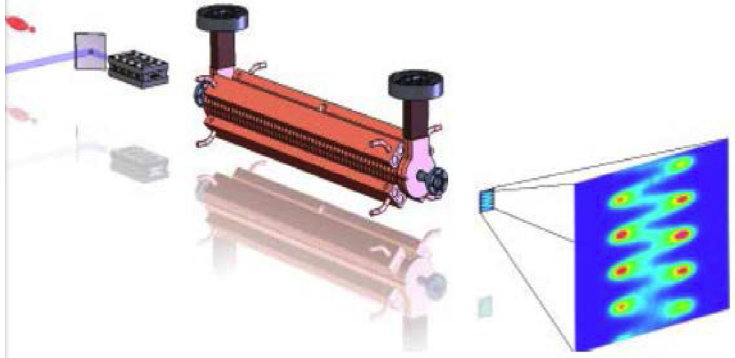
Radiation damage



Beam manipulation



Femtosecond diagnostic



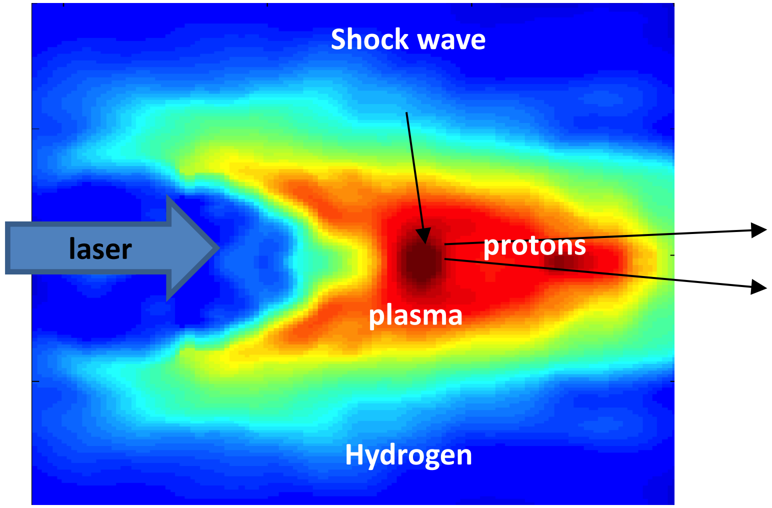
Present:

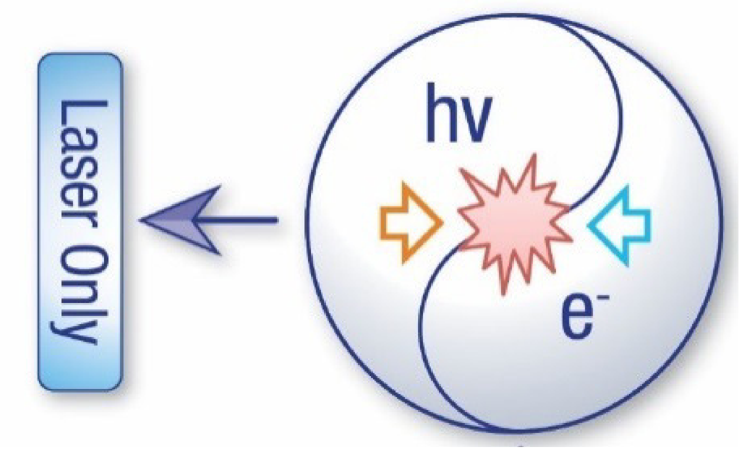
Shock wave Ion Acceleration

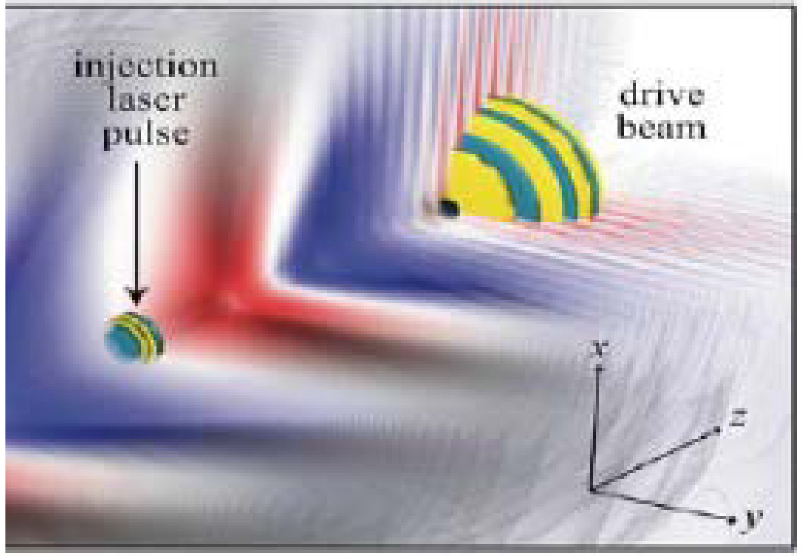
"Laser only" experiments

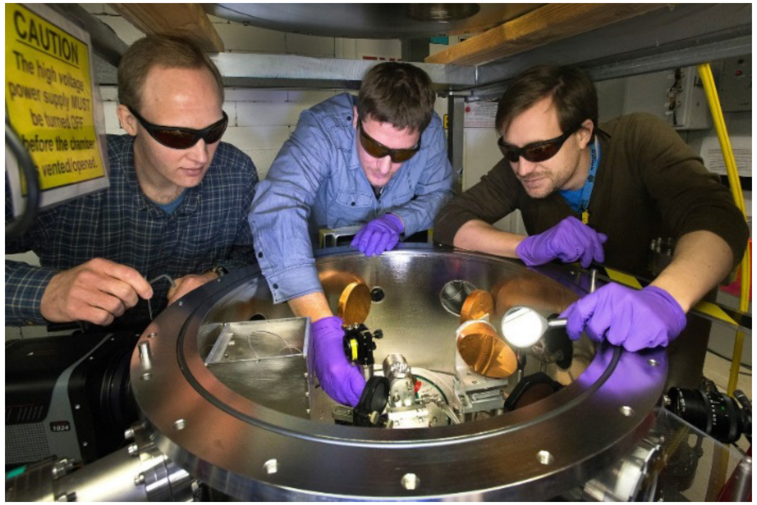
Future:

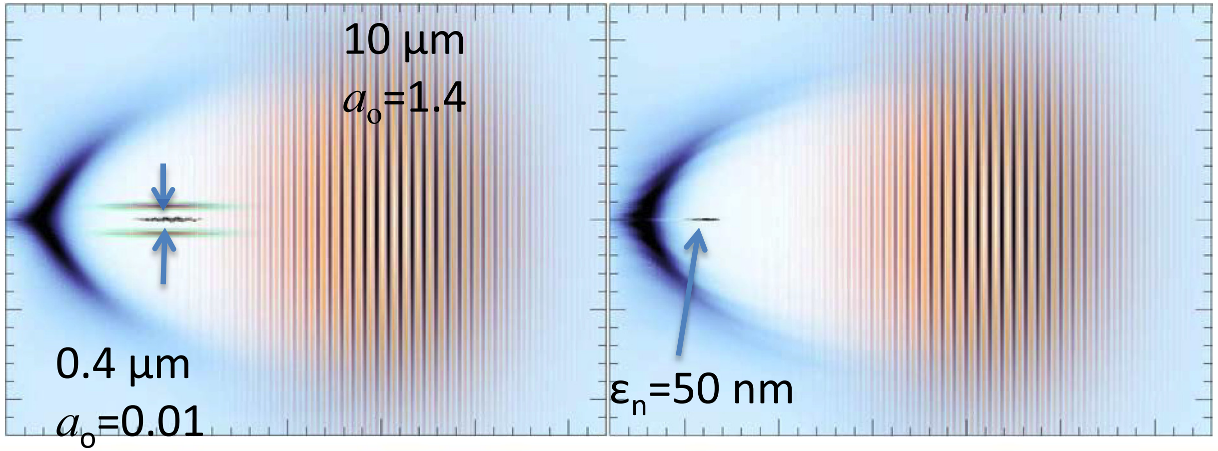
Two-color LWFA





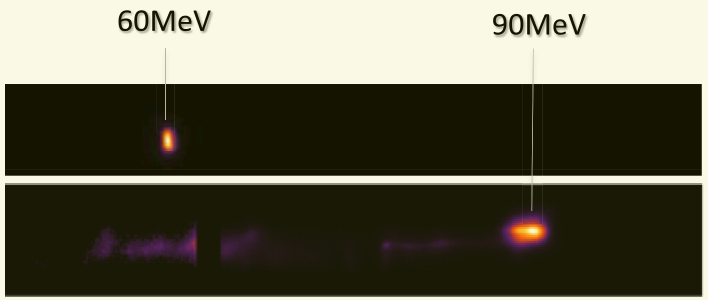


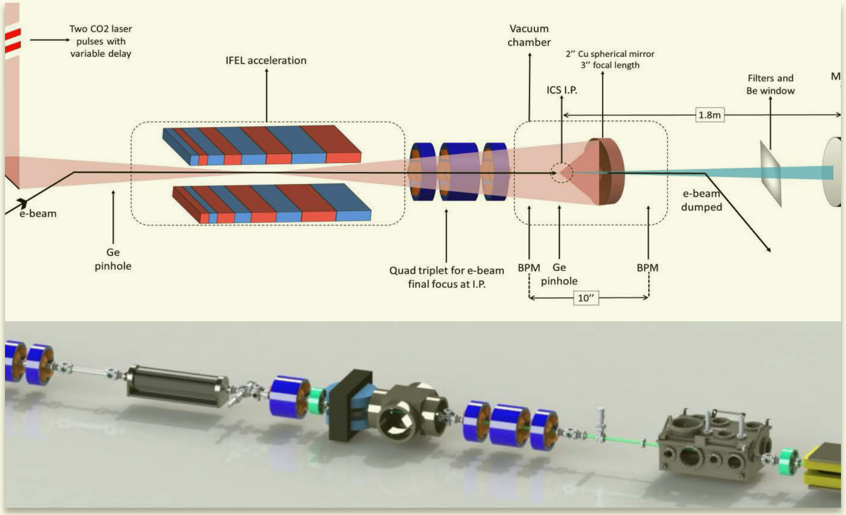


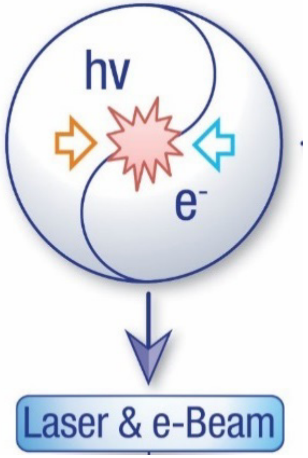


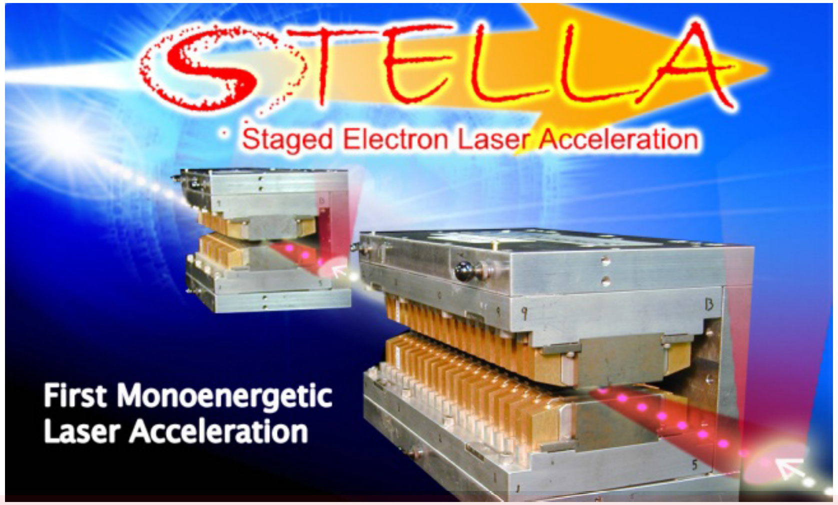
Combined Laser/E-Beam experiments

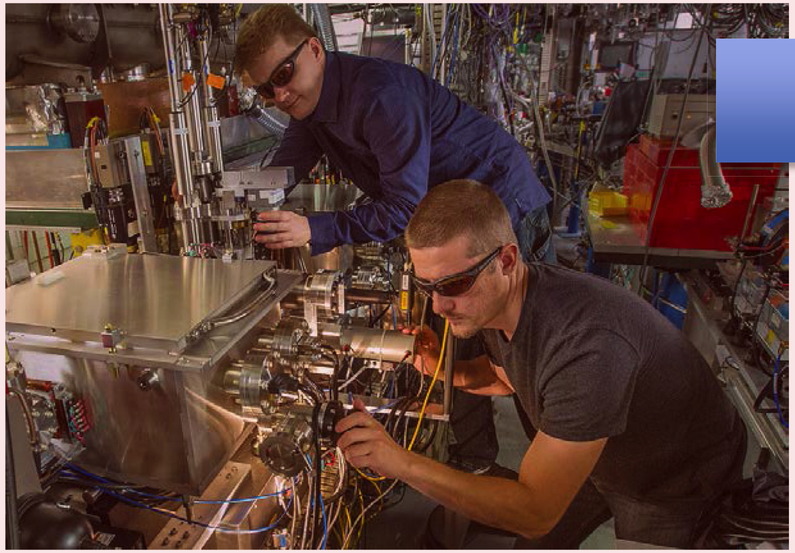
Combined IFEL-Compton



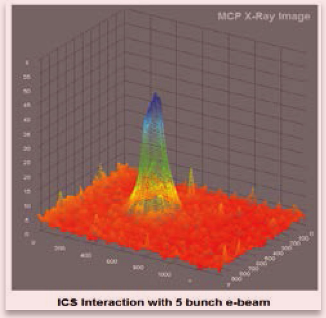


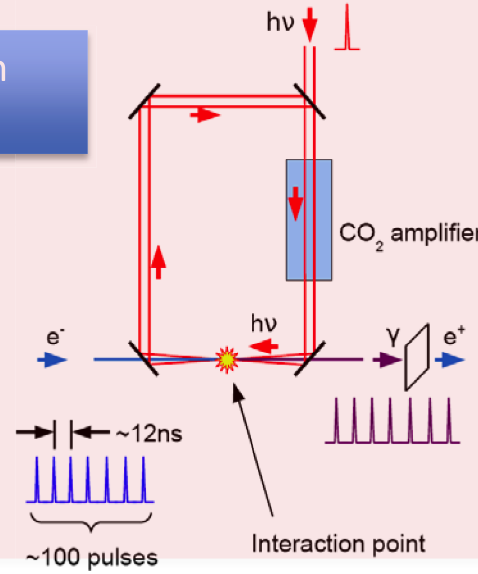






Compton scattering in recirculating beams

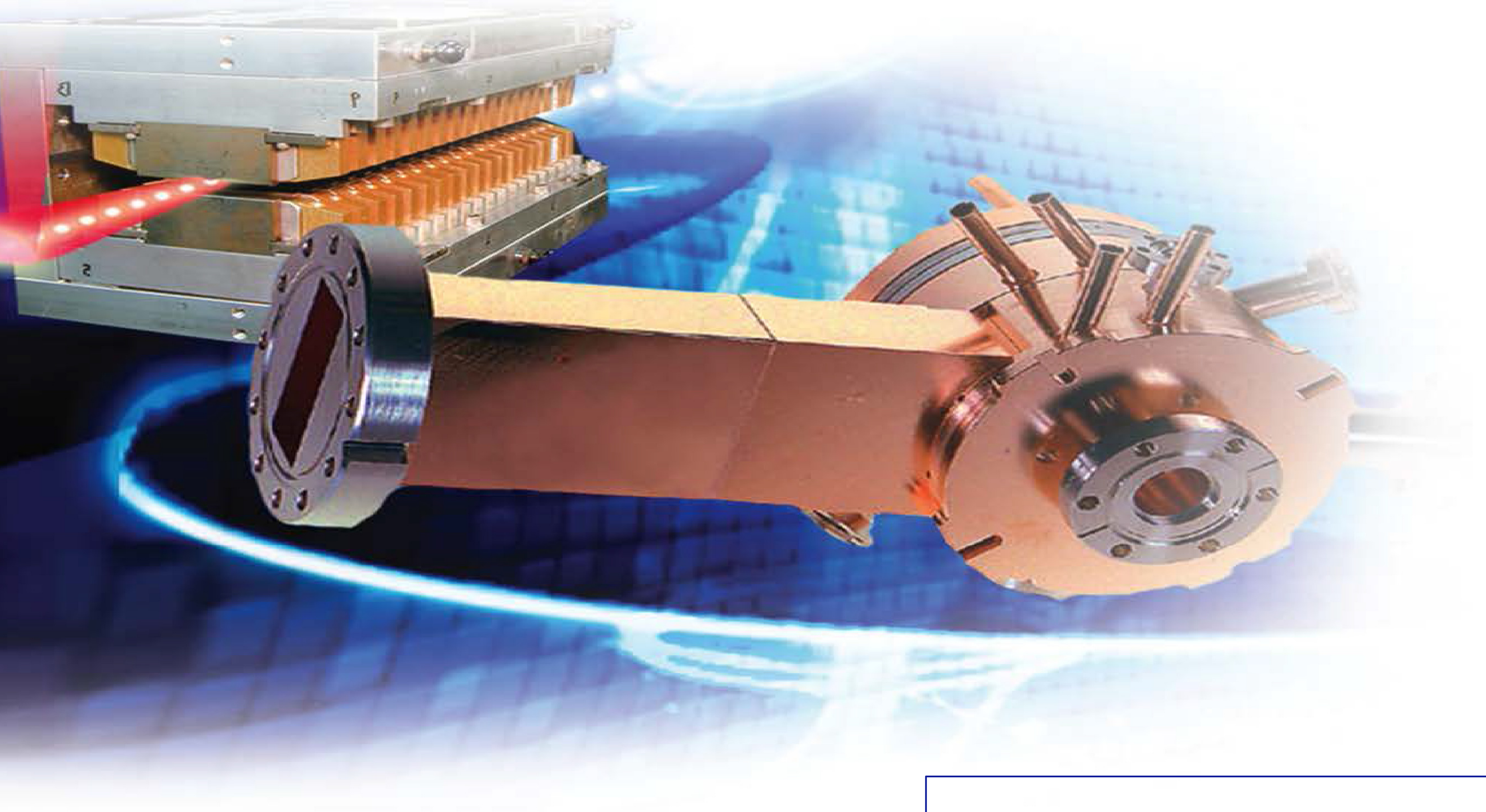




ATF User Testimony

radiabeam TECHNOLOGIES

- Accelerator Test Facility plays a crucial role to help US small businesses to invent, develop and test new products
- ATF is an ideal host facility for long term multi-institutional programs, which eventually can bring disruptive innovations to the market
- ATF is a part of the publicly funded infrastructure, which makes US businesses more competitive internationally



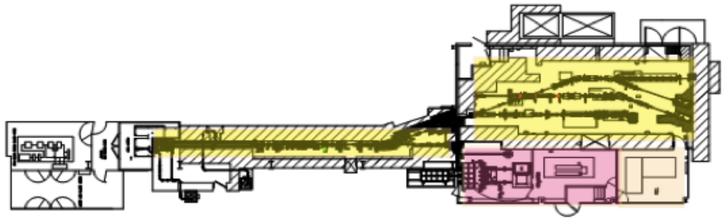
The ATF-II Upgrade

Brookhaven National Laboratory
a passion for discovery

U.S. Department of Energy | Office of Science

Funding of the ATF-II upgrade is an integral part of the Accelerator Stewardship Program

ATF (BLDG 820)



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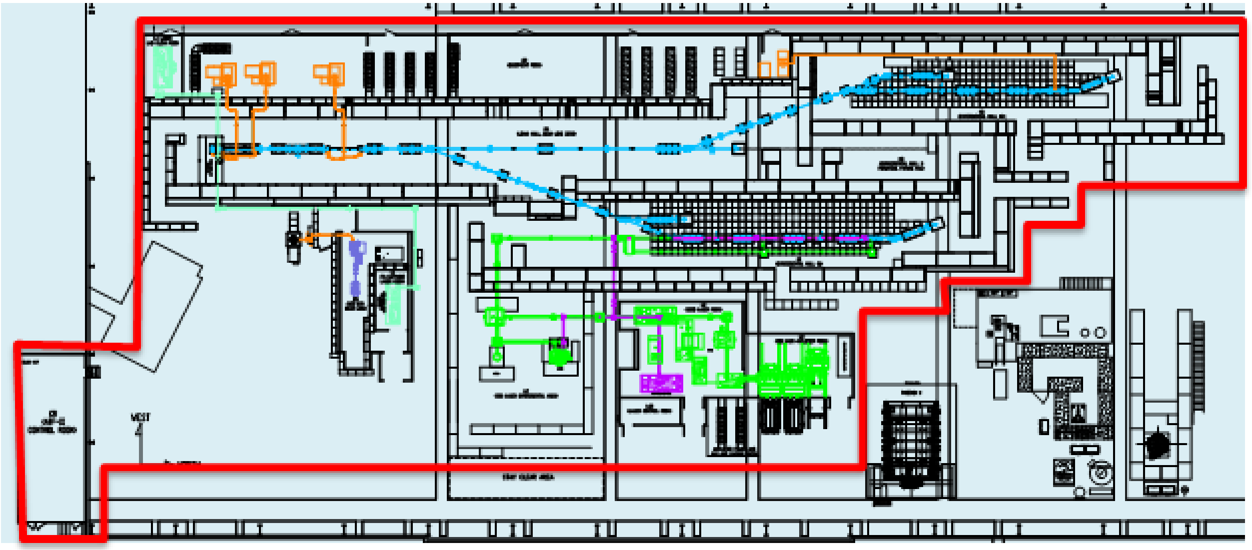
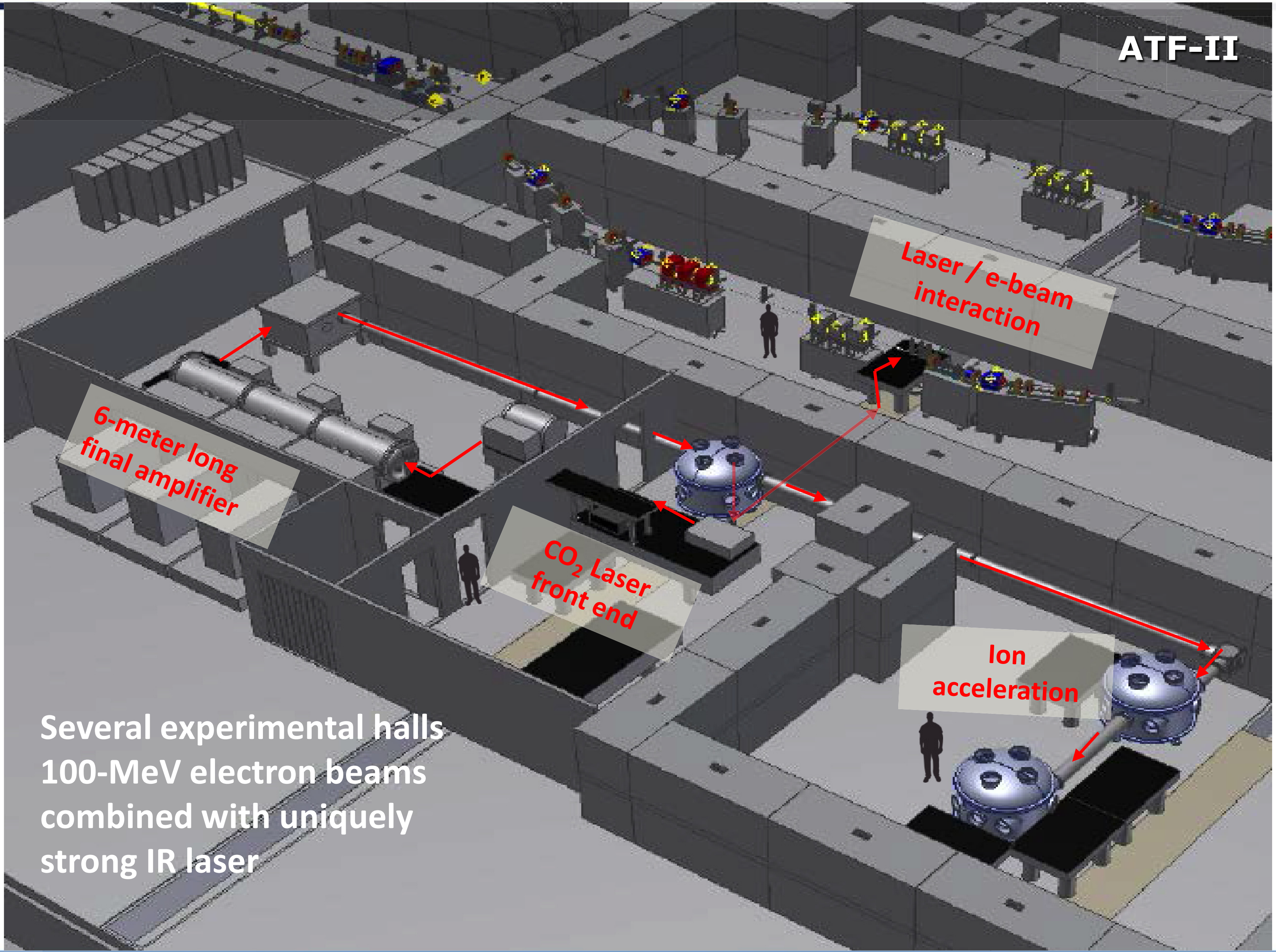
ATF-II (BLDG 912)



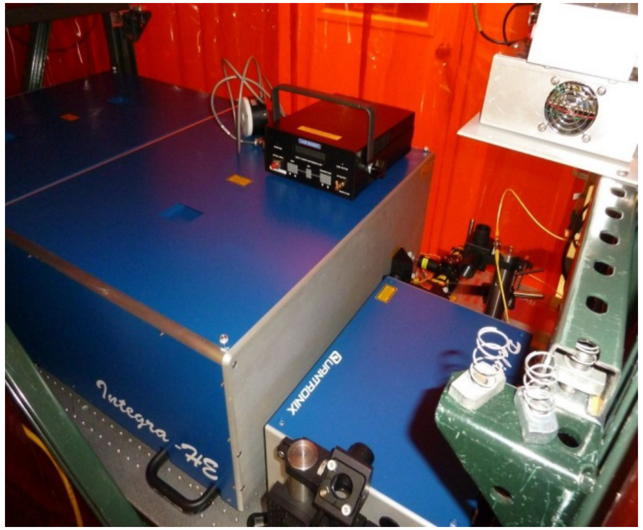
MOTIVATION:

- Provide a larger and more capable facility
  - Provide independently operable experimental halls
  - Enable significantly higher user throughput
  - Deploy more flexible beam-line space in which to carry out the next generation of user experiments
- Provide significantly upgraded e-beam and laser capabilities
  - CO_2 Laser - 1 TW class ⇨ 100 TW class:
    - Transformational for electron laser acceleration studies
    - Transformational for production of 10-200 MeV ion beams
  - Provide higher energy and high brightness electron beams
  - Support broader accelerator capabilities (e.g. Ultrafast Electron Diffraction facility)

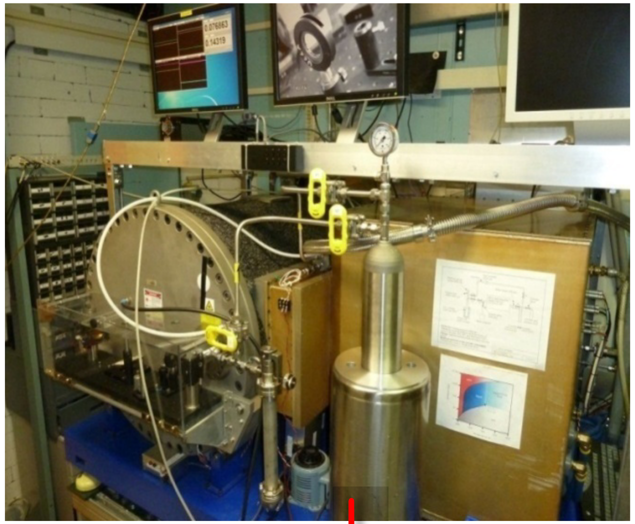

ATF-II
Laser / e-beam interaction
6-meter long final amplifier
CO_2 Laser front end
Ion acceleration
Several experimental halls
100-MeV electron beams
combined with uniquely
strong IR laser

Present 2 TW BNL CO_2 laser system

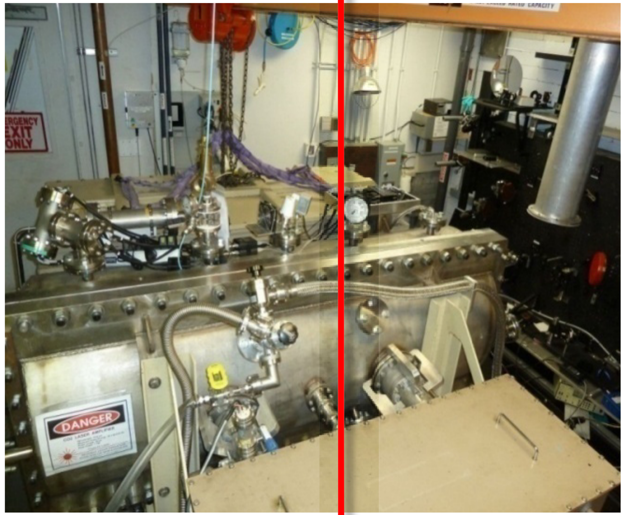
SOLID-STATE
OPA INJECTOR

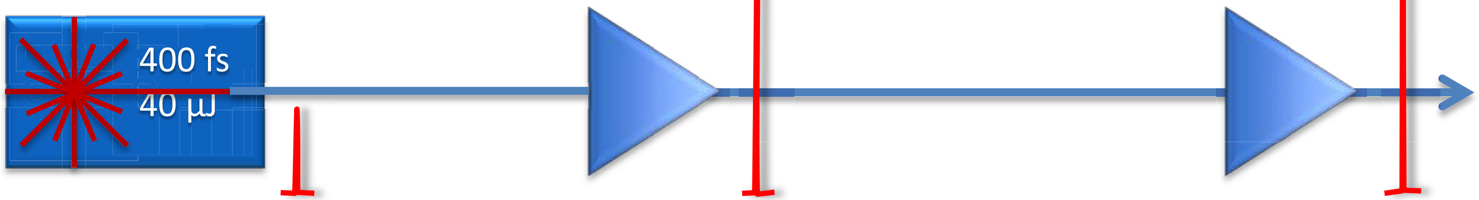


REGENERATIVE
ISOTOPIC AMPLIFIER



MAIN AMPLIFIER

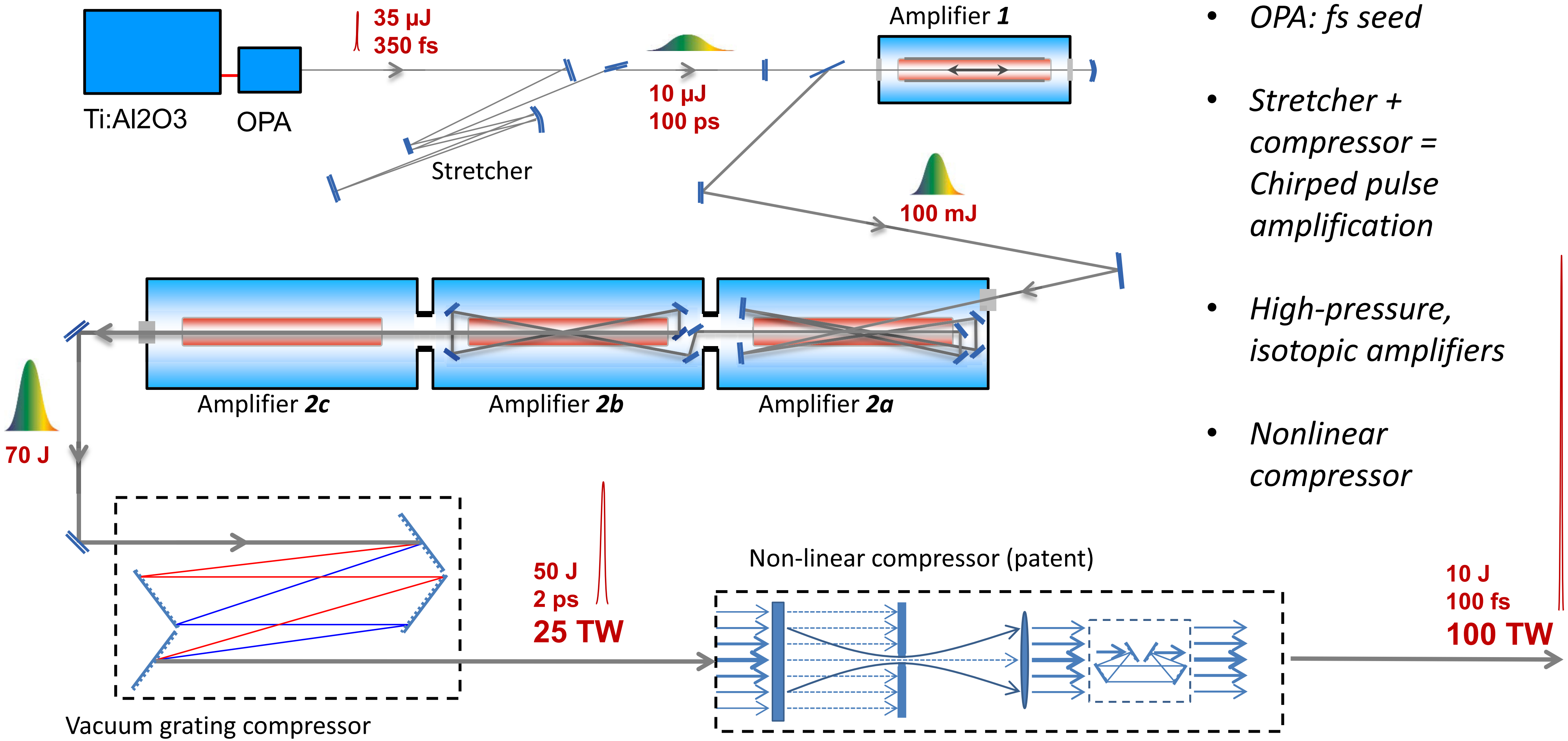




2 ps
10 mJ

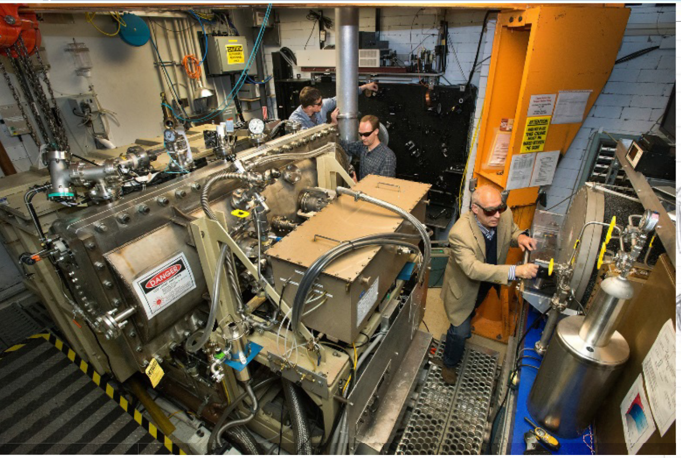
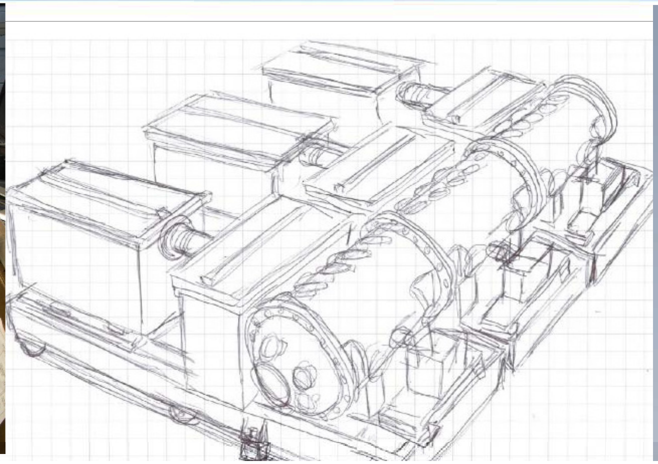
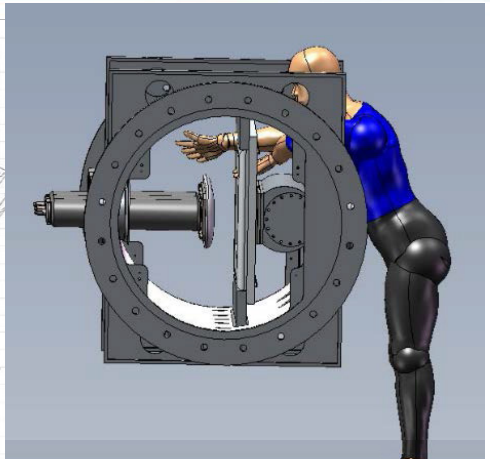
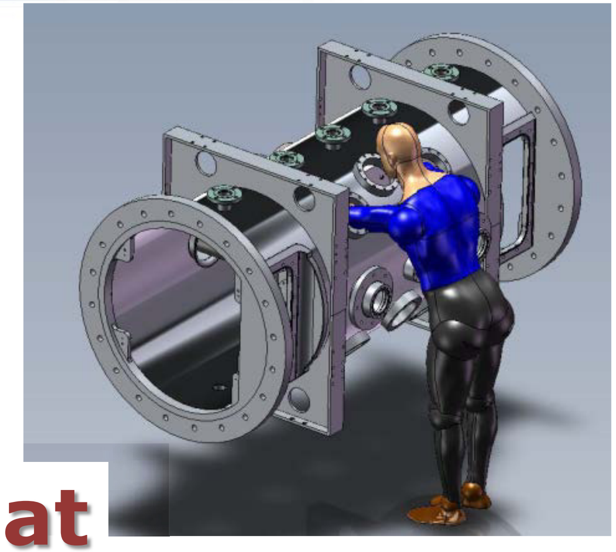
3 ps
6 J

Novel concept of 100TW CO_2 laser

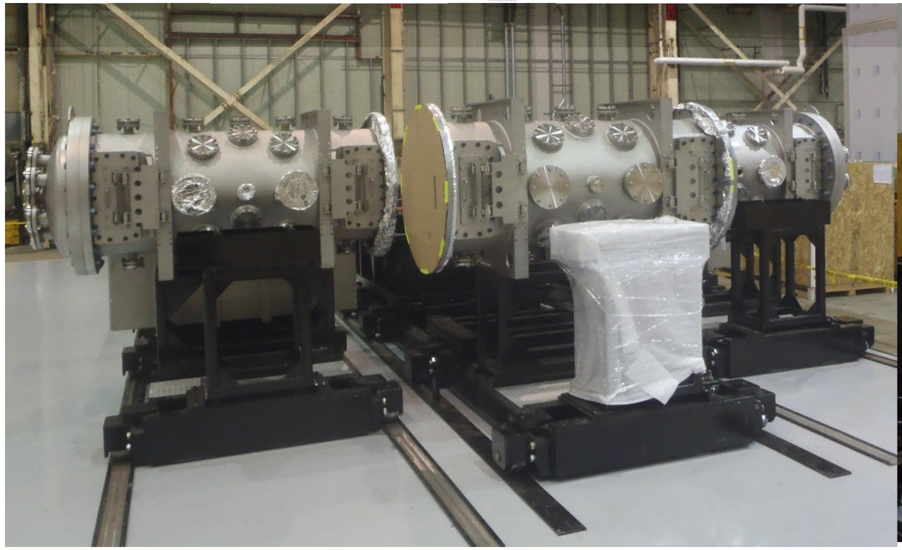


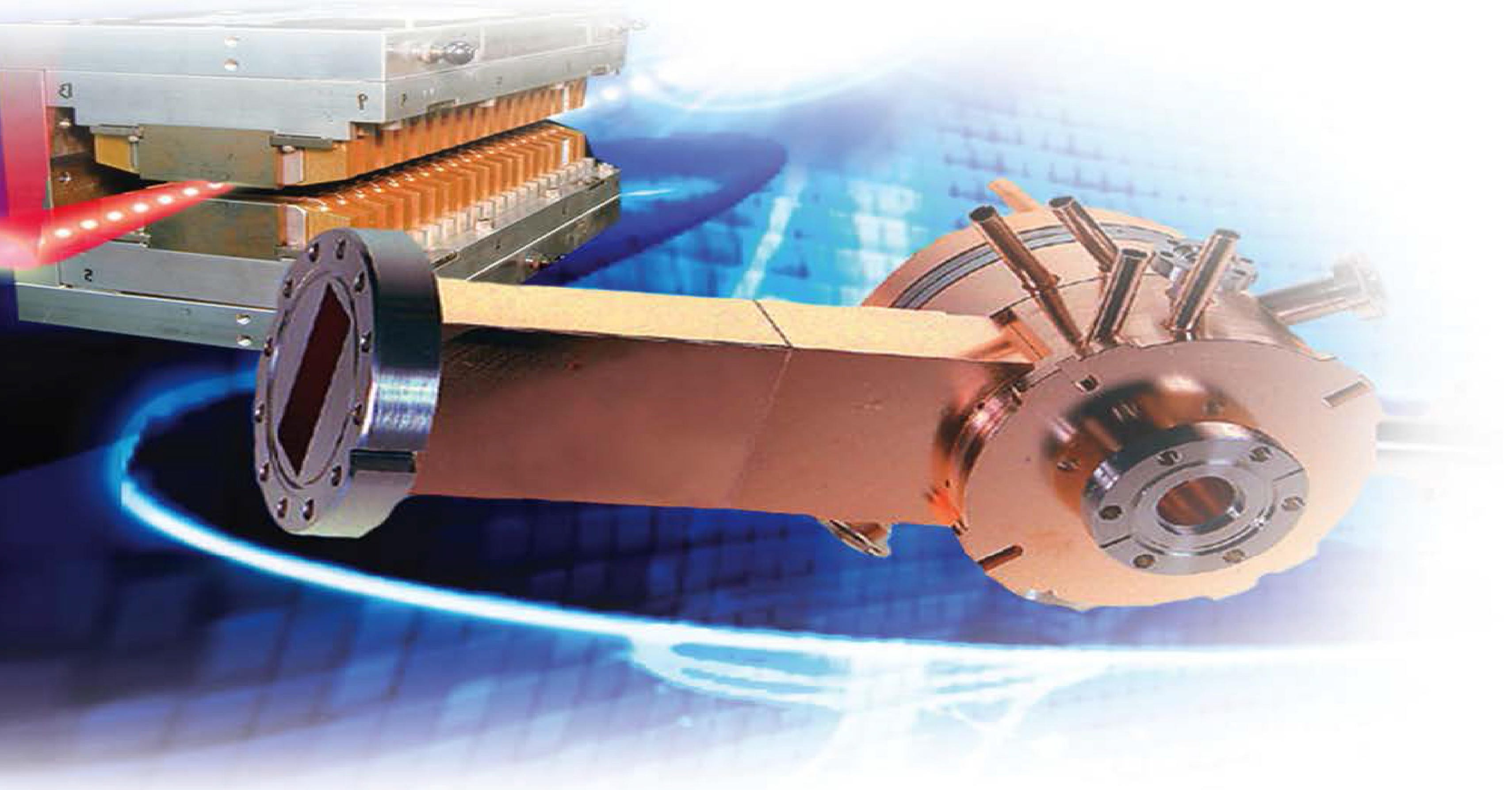
Collection of innovations:

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

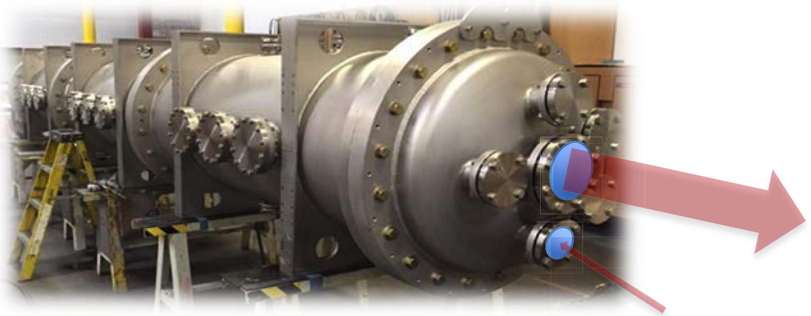
A 6-meter long high-pressure amplifier is at the heart of the 100-TW CO_2 laser upgrade

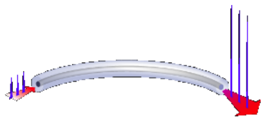



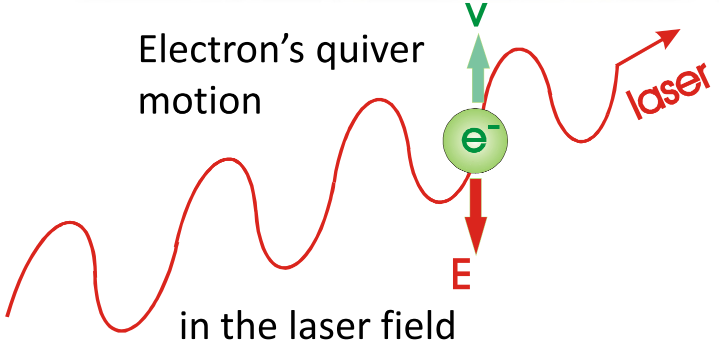



ATF-II Science Reach

CO_2 (λ=10 μm) scaling factors as compared to solid-state ($\lambda\approx$1 μm) lasers:







$$\dot{v} \sim \frac{eE}{m} \Rightarrow v \sim \frac{\dot{v}}{\omega} \Rightarrow \Phi = \frac{mv^2}{2} = \frac{e^2E^2}{2m\omega^2}$$

acceleration — velocity — energy

- 100 times stronger ponderomotive action at same laser intensity
- At the same power, CO_2 laser provides equal in energy electrons but within 1000 times bigger plasma volume.
- 100 times lower critical plasma density
- 10 times more photons per Joule

Bubble regime

Parameters for bubble accelerator driven with 1-μm and 10-μm lasers.

Parameter	1-PW YAG	100-TW CO_2
Laser wavelength (μm)	1	10
Laser pulse duration (fs)	150	500
Laser peak power (TW)	1000	100
Laser energy (J)	150	50
Normalized laser field	8	8
Plasma density ($\times 10^{16}$cm^{-3})	50	0.5
Bubble threshold (TW)	900	75
Critical laser power (TW)	43	43
Max acceleration length (cm)	10	30
Accelerating field (GeV/cm)	2	0.2
Number per bunch ($\times 10^{10}$)	3	10
Bubble volume (mm^3)	10^{-4}	0.1

$$P > P_{\text{bubble}} \approx P_{\text{rel}}(\omega\tau)^2$$

$$k_0 R \approx \left(\frac{n_{\text{cr}}}{n_{\text{e}}} a_0\right)^{1/2} \equiv \left(\frac{\omega^2}{\omega_p^2} a_0\right)^{1/2}$$

$$\tau \leq \frac{R}{c}, \quad \text{or} \quad \tau \leq \frac{\lambda}{2\pi c}\left(\frac{n_{\text{cr}}}{n_{\text{e}}} a_0\right)^{1/2}$$

$$P_{\text{rel}} = m^2 c^5 / e^2 \approx 8.5\ \text{GW}$$

$$a_o = eE / m\omega c$$

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Parameters for bubble accelerator driven with 1-μm and 10-μm lasers.

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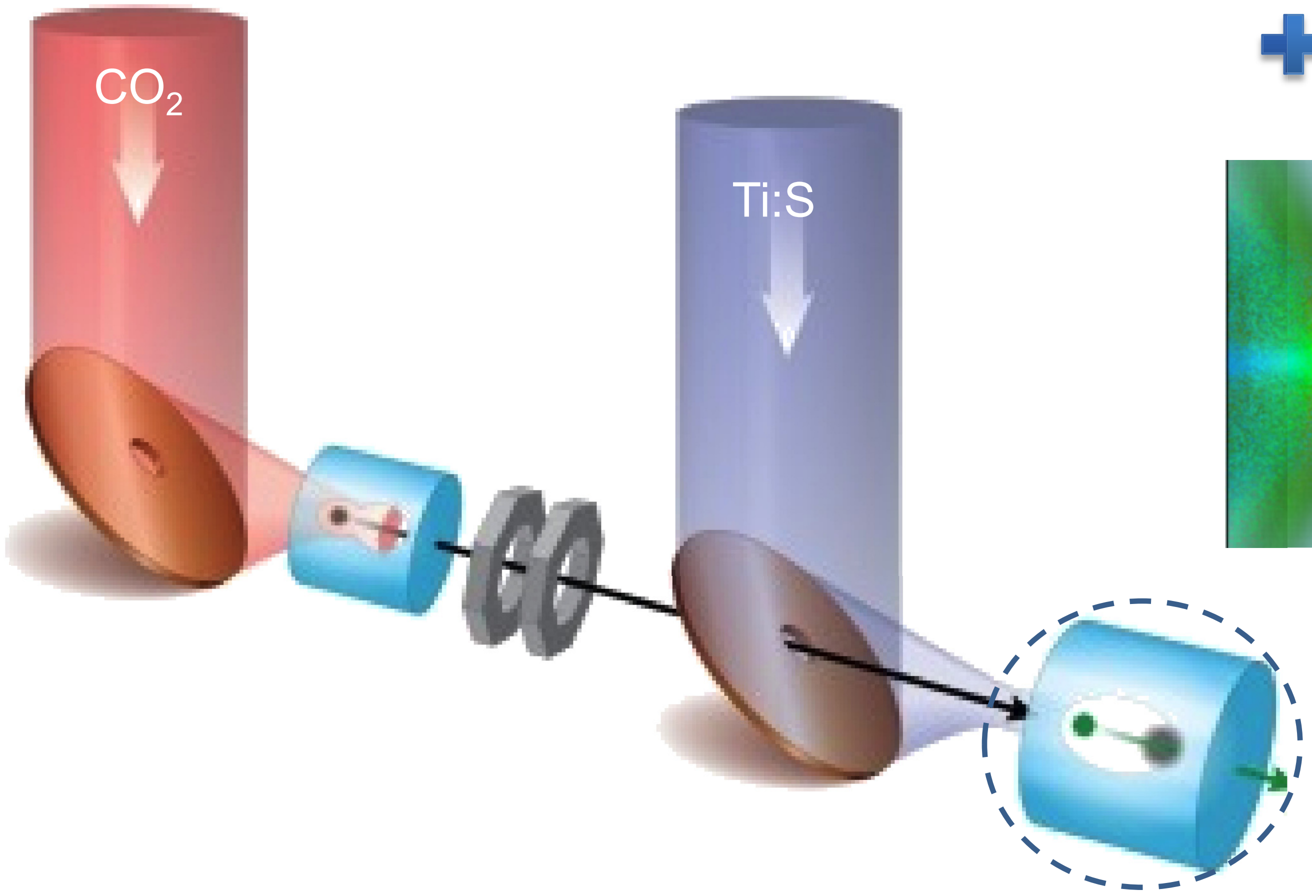
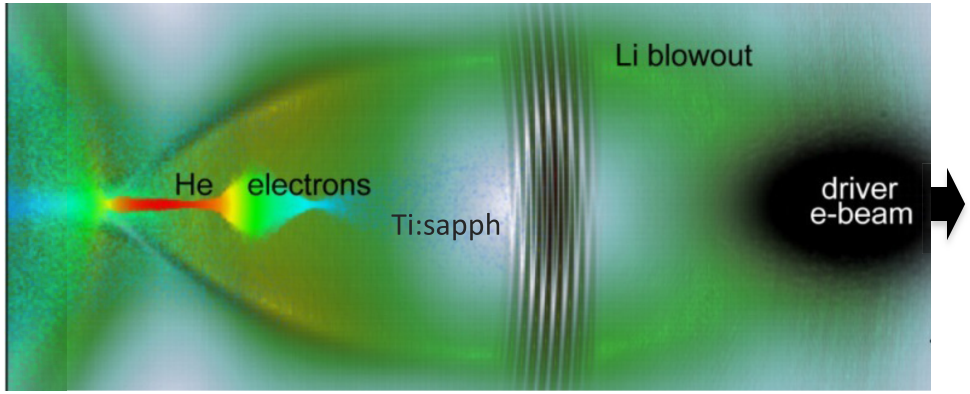
Conclusions:

- CO_2 needs lower $n_e \sim n_{cr}$
- E will be smaller
- but N_e - higher

All-optical "Trojan Horse" PWFA



- LWFA – *ponderomotive* action by a laser pulse results in electron heating to several MeV.
+ PWFA – electrons are expelled by the *Coulomb* force of the driver-bunch with negligible heating.



"Trojan Horse" – concept of brightness transformer predicts ε_n=30 nm

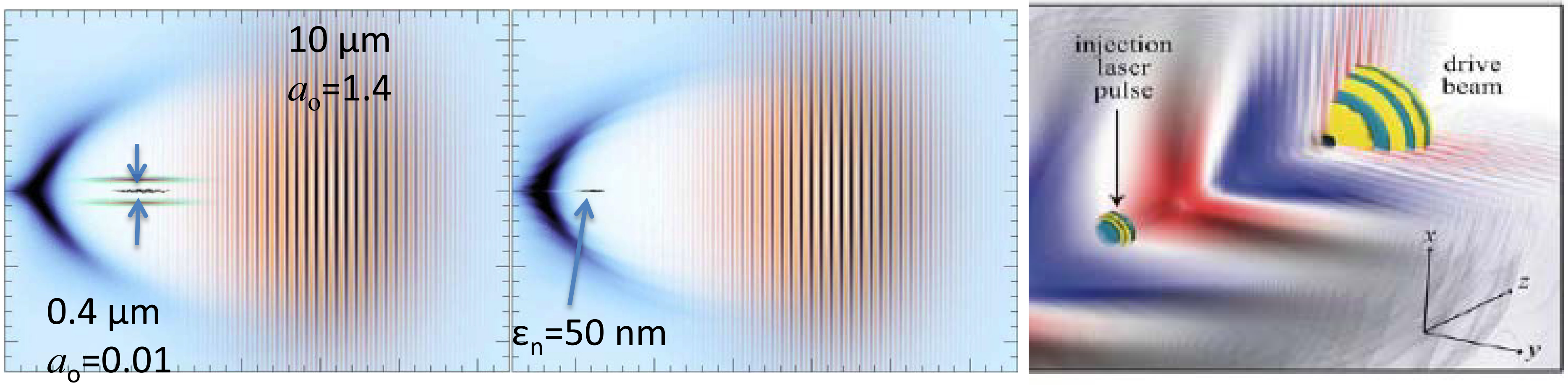
PRL **108**, 035001 (2012)

PHYSICAL REVIEW SPECIAL TOPICS - ACCELERATORS AND BEAMS **17,** 061301 (2014)

Low emittance electron beam generation from a laser wakefield accelerator using two laser pulses with different wavelengths

X. L. Xu, Y. P. Wu, C. J. Zhang, F. Li, Y. Wan, J. F. Hua, C.-H. Pai, and W. Lu*
Department of Engineering Physics, Tsinghua University, Beijing 100084, China

P. Yu, C. Joshi, and W. B. Mori
University of California Los Angeles, Los Angeles, California 90095, USA
(Received 21 February 2014; published 13 June 2014)



PHYSICAL REVIEW SPECIAL TOPICS - ACCELERATORS AND BEAMS **17,** 101301 (2014)

Thermal emittance from ionization-induced trapping in plasma accelerators

C. B. Schroeder,[1] J.-L. Vay,[1] E. Esarey,[1] S. S. Bulanov,[2,1] C. Benedetti,[1] L.-L. Yu,[3] M. Chen,[3] C. G. R. Geddes,[1] and W. P. Leemans[1,2]
[1]*Lawrence Berkeley National Laboratory, Berkeley, California 94720, USA*
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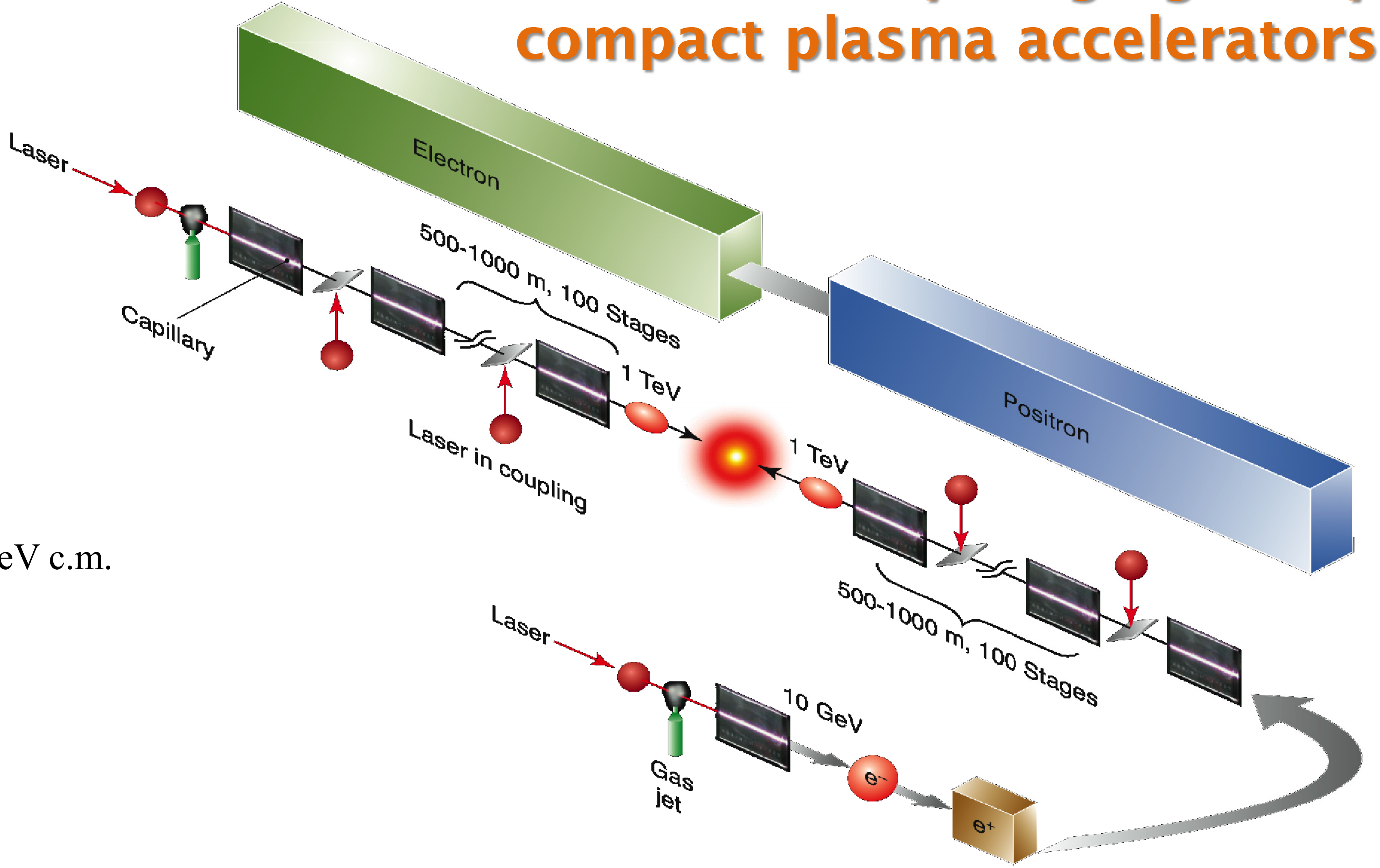
[3]*Key Laboratory for Laser Plasmas (Ministry of Education), Department of Physics and Astronomy, Shanghai Jiao Tong University, Shanghai 200240, China*
(Received 19 June 2014; published 3 October 2014)

Concept of a laser-driven linear collider by staging many compact plasma accelerators



$$\mathcal{L} = \frac{f N_e^2}{4\pi\sigma_\perp^2}$$

$\mathcal{L} = 10^{34}\ \mathrm{s^{-1}cm^{-2}}$ @ $\mathcal{E}_{cm}$=1 TeV c.m.
($\mathcal{L} \sim \mathcal{E}_{cm}^2$)

Example: $\sigma_\perp = 10$ nm
$f = 10$ kHz
$N_e = 3 \times 10^9$

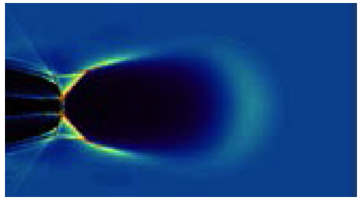
Plasma collider options in quasi-linear regime

From "Design considerations for a laser-plasma linear collider" C. B. Schroeder, 2008

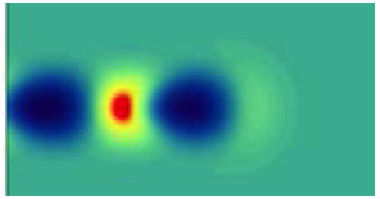
Parameter	TiS	CO_2
Laser wavelength (mm)	0.8	9.2
Plasma density ($\times 10^{16}$cm^{-3})	11	11
Plasma wavelength (mm)	99	99
Laser pulse duration (fs)	130	130
Laser radius (mm)	63	63
Laser peak power (TW)	300	2.3
Laser energy per stage (J)	40	0.3
Electrons per bunch ($\times 10^9$)	4	4
Single stage interaction length (m)	0.79	0.06
Accelerating field (GeV/m)	12.6	12.6
Energy gain per stage (GeV)	10	0.075
Number of stages	50	6666
Collision rate (kHz)	10	10
Average laser power per stage (kW)	400	3
Total laser power (MW)	20	20

Representative sets of laser and plasma parameters for LWFA 1-TeV c.m. e^-e^+ collider

Bubble



Quasi-linear



Quasi-linear regime provides better control over accelerating and focusing fields suitable to inject and accelerate both electrons and positrons

P/P_{cr}=1.1

$$L_d \propto \lambda_p^3/\lambda^2$$

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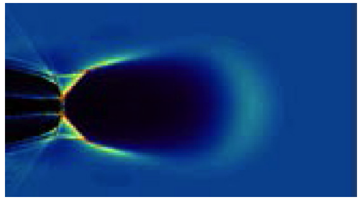

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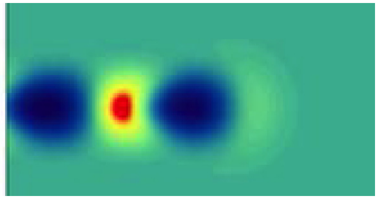

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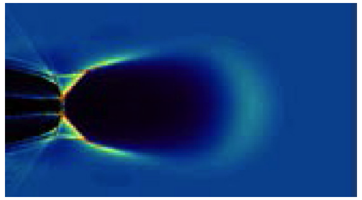

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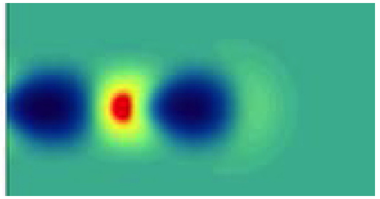

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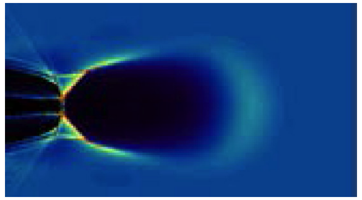

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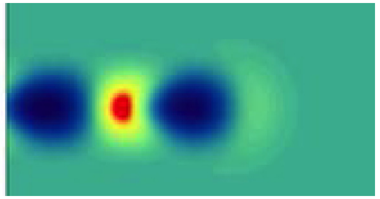

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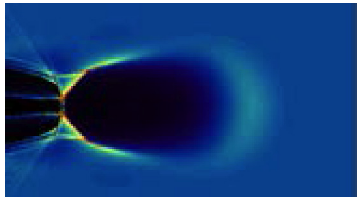
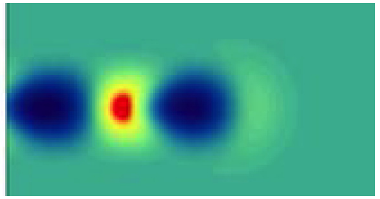


Quasi-linear



Quasi-linear regime provides better control over accelerating and focusing fields suitable to inject and accelerate both electrons and positrons

P/P_{cr}=1.1

$$L_d \propto \lambda_p^3/\lambda^2$$

Plasma collider options in quasi-linear regime

From "Design considerations for a laser-plasma linear collider" C. B. Schroeder, 2008

Parameter	TiS	CO_2
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Plasma density ($\times 10^{16}$cm^{-3})	11	11
Plasma wavelength (mm)	99	99
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Laser energy per stage (J)	40	0.3
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Single stage interaction length (m)	0.79	0.06
Accelerating field (GeV/m)	12.6	12.6
Energy gain per stage (GeV)	10	0.075
Number of stages	50	6666
Collision rate (kHz)	10	10
Average laser power per stage (kW)	400	3
Total laser power (MW)	20	20

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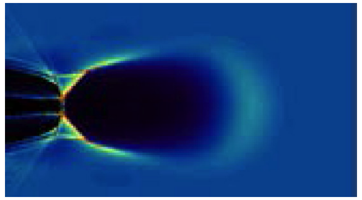
Bubble



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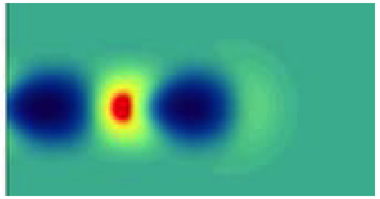

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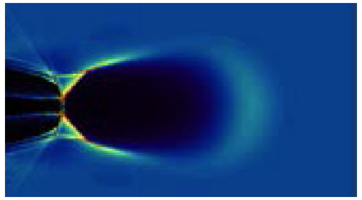
Bubble



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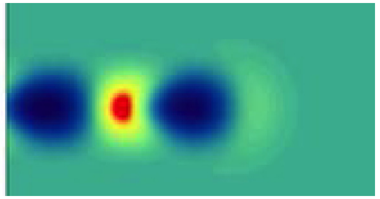

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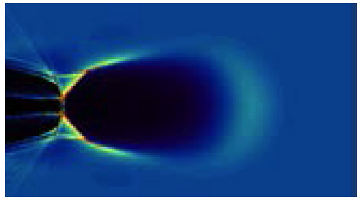
Bubble



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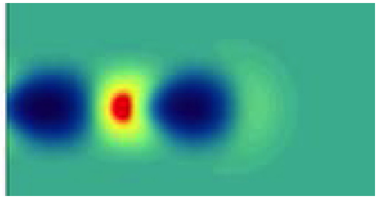

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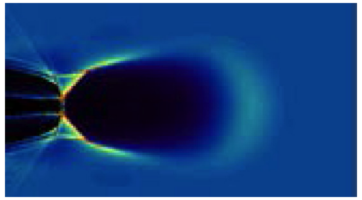
Bubble



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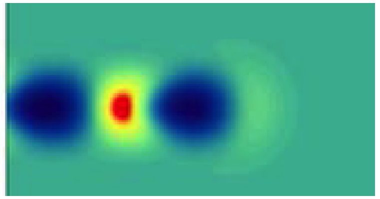

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Number of stages	50	6666
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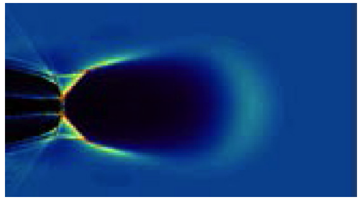
Average laser power per stage (kW)	400	3
Total laser power (MW)	20	20

Representative sets of laser and plasma parameters for LWFA 1-TeV c.m. e^-e^+ collider

Bubble



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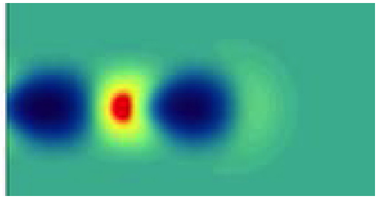

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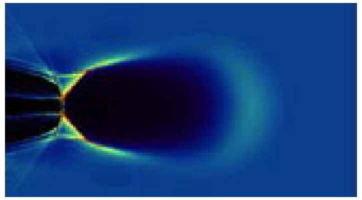
Representative sets of laser and plasma parameters for LWFA 1-TeV c.m. e^-e^+ collider

Bubble



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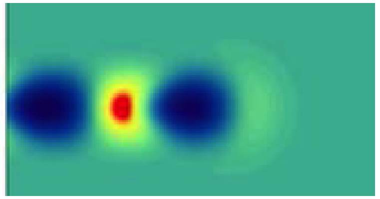

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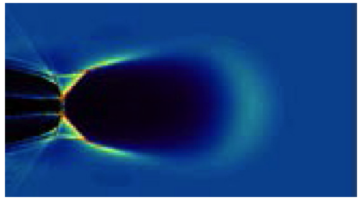
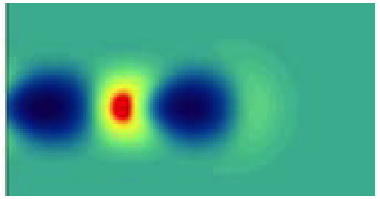
Parameter	TiS	CO_2 ☹	CO_2 ☺
Laser wavelength (mm)	0.8	9.2	9.2
Plasma density ($\times 10^{16} cm^{-3}$)	11	11	0.35
Plasma wavelength (mm)	99	99	560
Laser pulse duration (fs)	130	130	700
Laser radius (mm)	63	63	360
Laser peak power (TW)	300	2.3	75
Laser energy per stage (J)	40	0.3	52
Electrons per bunch ($\times 10^9$)	4	4	23
Single stage interaction length (m)	0.79	0.06	1.1
Accelerating field (GeV/m)	12.6	12.6	2.2
Energy gain per stage (GeV)	10	0.075	2.4
Number of stages	50	6666	208
Collision rate (kHz)	10	10	0.3
Average laser power per stage (kW)	400	3	16
Total laser power (MW)	20	20	2.6

Representative sets of laser and plasma parameters for LWFA 1-TeV c.m. e^-e^+ collider

Bubble



Quasi-linear



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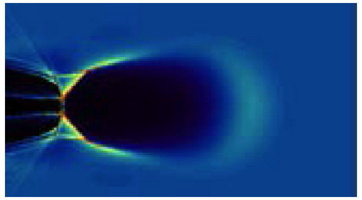
Representative sets of laser and plasma parameters for LWFA 1-TeV c.m. e^-e^+ collider

Bubble



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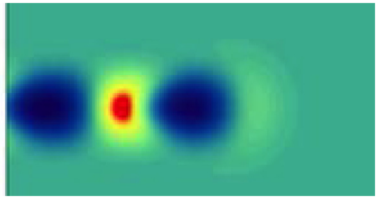

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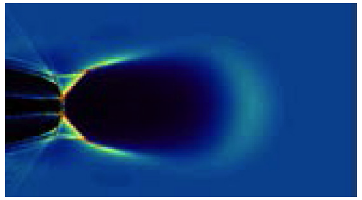
Representative sets of laser and plasma parameters for LWFA 1-TeV c.m. e^-e^+ collider

Bubble



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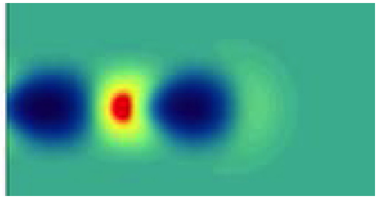

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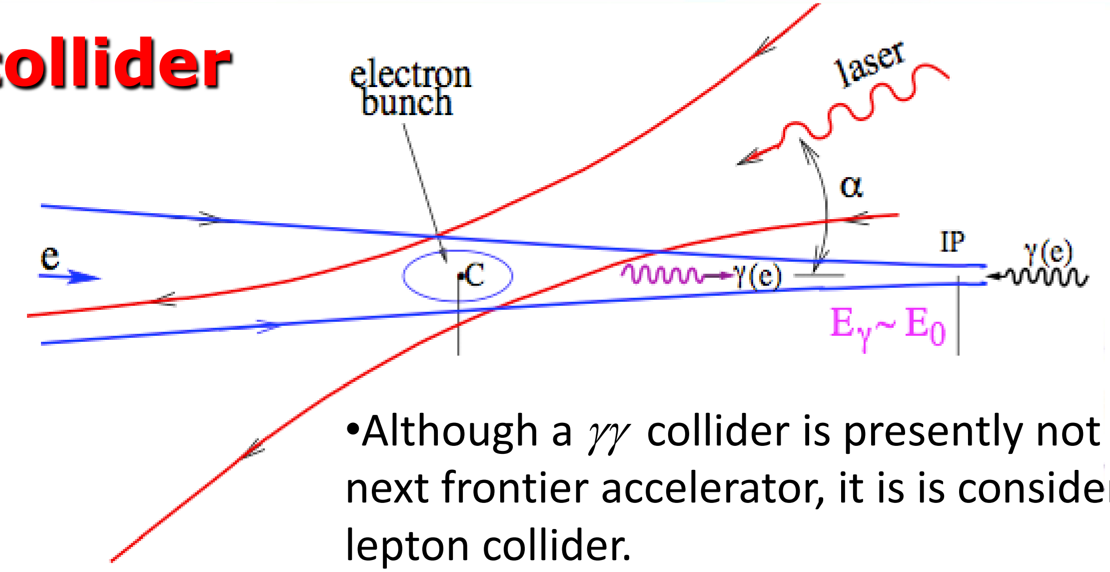
Gamma collider



•Lepton linear collider can be converted to photon collider by ICS.

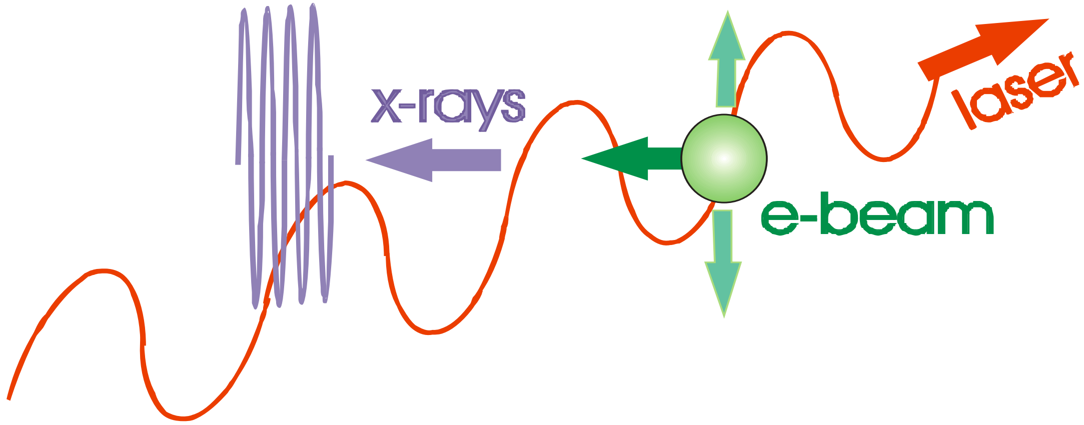
•This offers a possibility to study lepton-γ and $\gamma\gamma$ interactions in addition to $e^{-}e^{+}$ collisions.

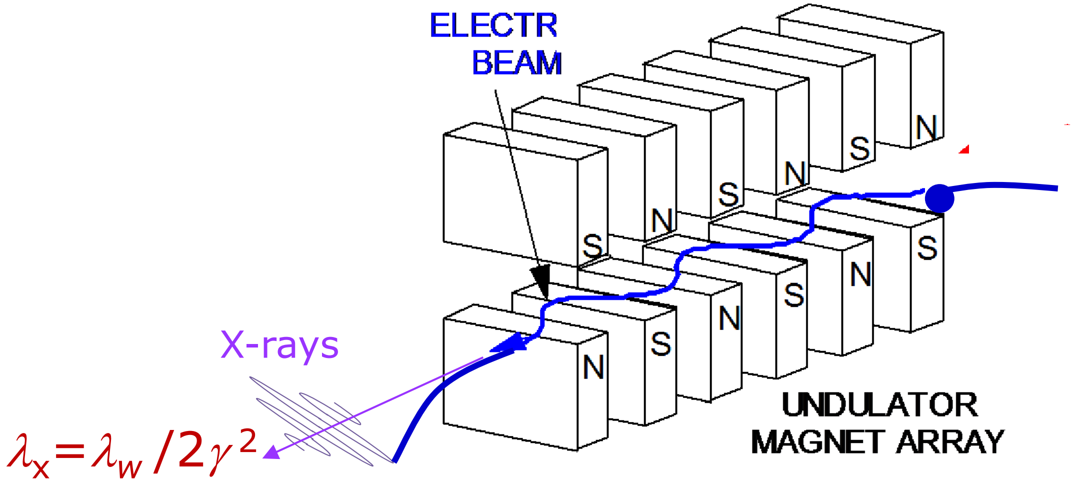
•Although a $\gamma\gamma$ collider is presently not among the prime options for the next frontier accelerator, it is is considered as a valuable extension to a lepton collider.

- Re-scattering of Compton photons by the laser beam into $e^{-}e^{+}$ pairs defines the minimum laser wavelength $\lambda[\mu m] = 4.2\mathcal{E}_e[TeV]$ $\omega\omega_\gamma > m^2c^4/\hbar^2$
- For example, for the $\mathcal{E}_e$=0.5 TeV, the laser with λ=2 μm is required, which changes to λ=9.2 μm for 2.2 TeV.
- For efficiency of the process, we shall satisfy conditions : $\frac{2\pi^2R^2}{\lambda} \geq c\tau$ and $p = n_L\sigma_C\tau c = 1$
- This results in $P \equiv E_L/\tau = \hbar c^2/\sigma_C \cong 1\,TW$ and $\tau[ps] \approx \frac{0.7\lambda[\mu m]}{a_0^2}$
- For λ=10 μm and $a_0^2 = 0.1$, we have τ=70 ps, E_L=70 J

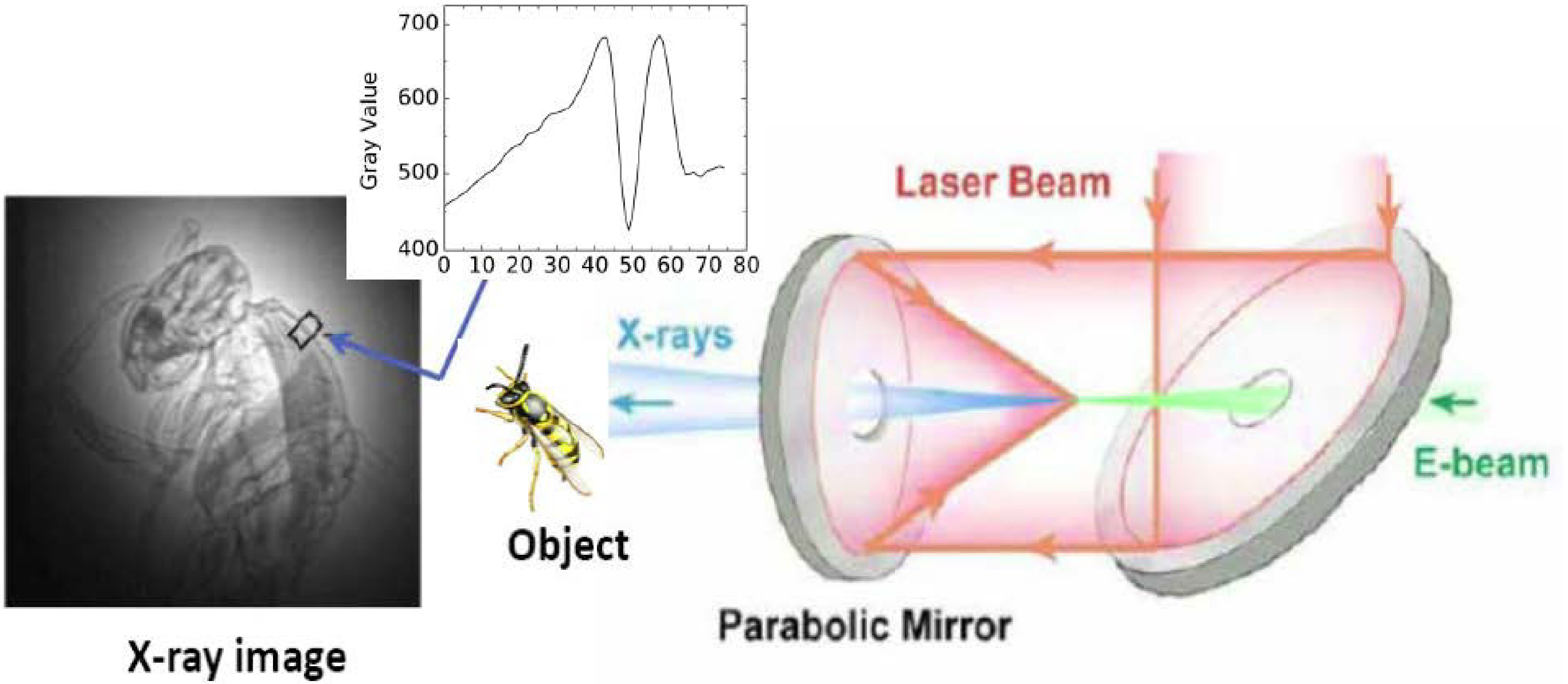
Compact Light Source

With λ_w ~ several centimeters, attaining XUV requires electron energy in the GeV region delivered by a stadium-size accelerator.





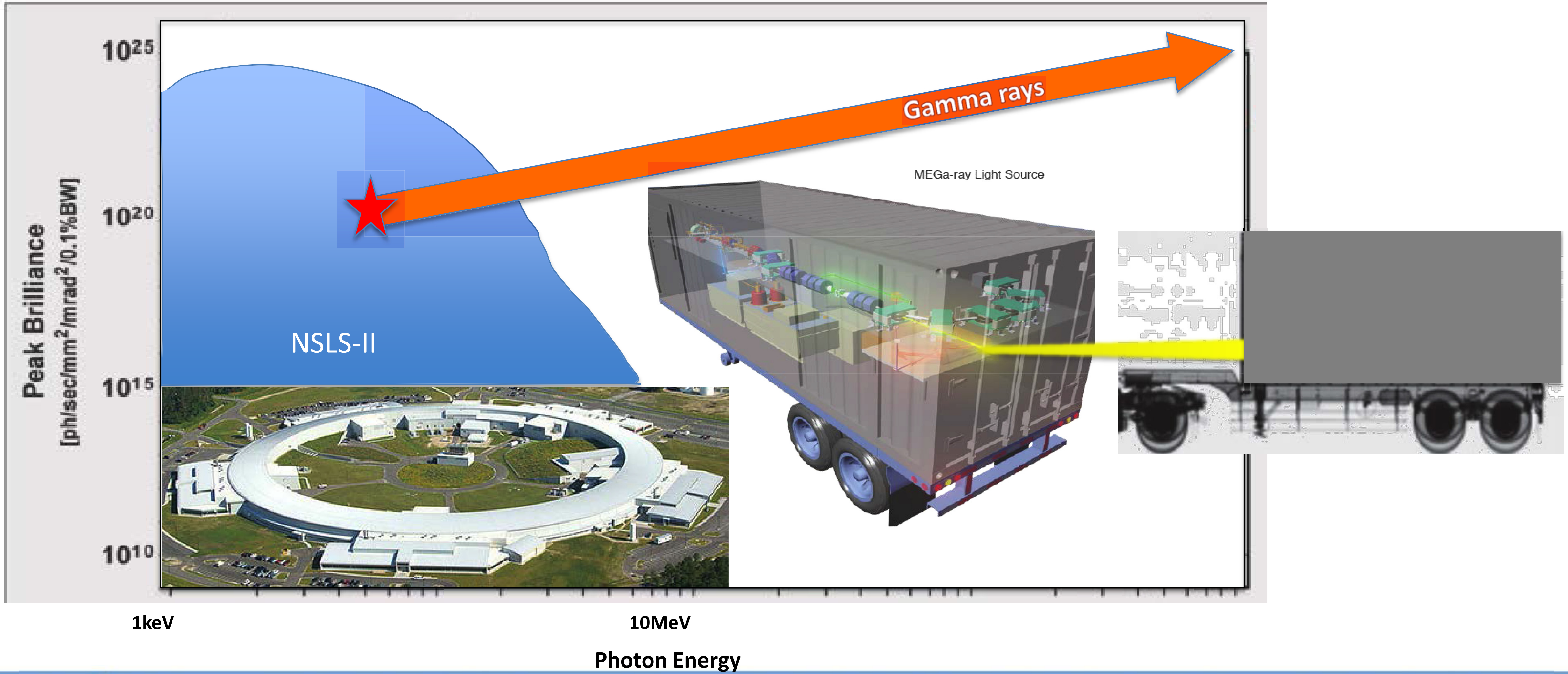
Phase contrast tomography



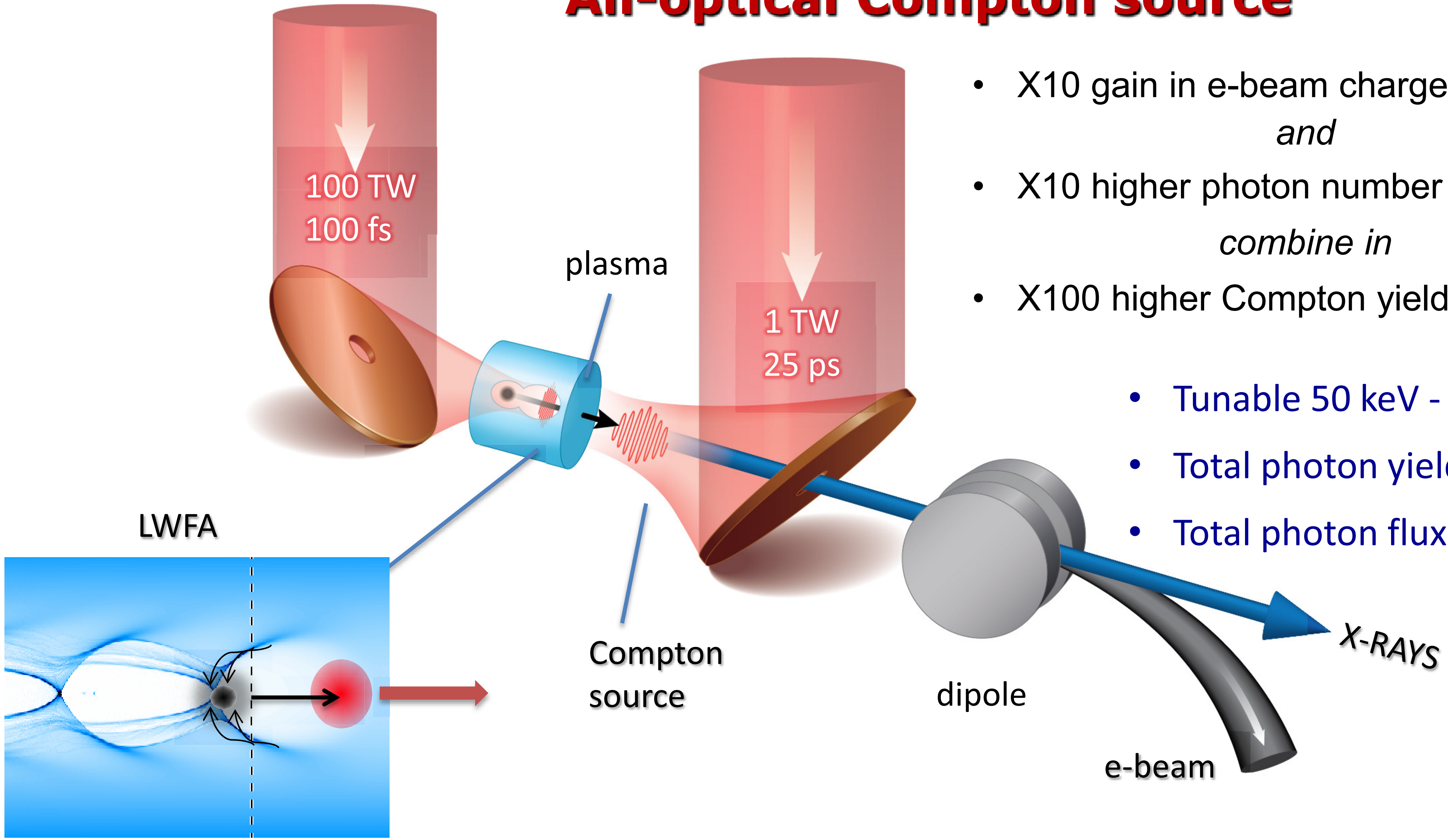
Single-shot phase-contrast X-ray image with 1-ps exposure

P. Oliva, et al, Appl. Phys. Lett. 97, 134104 (2010).

Mobile gamma source



All-optical Compton source



- X10 gain in e-beam charge

and

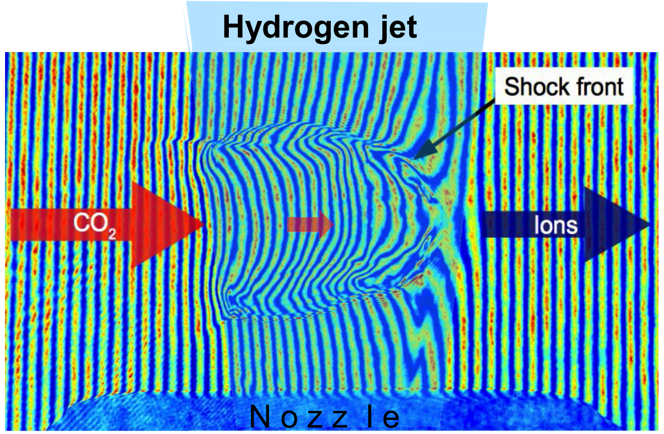
- X10 higher photon number per Joule

combine in

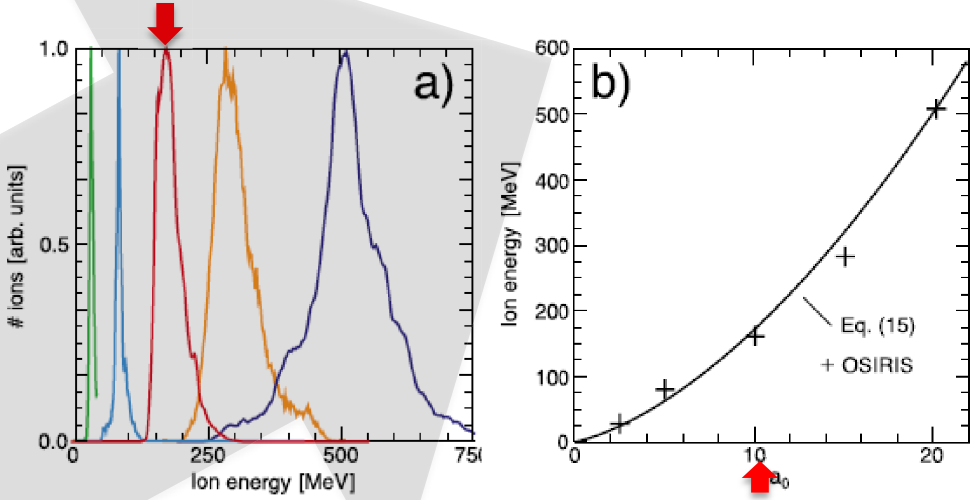
- X100 higher Compton yield

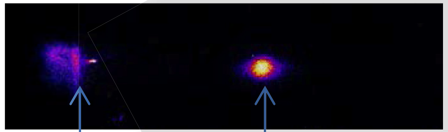
- Tunable 50 keV - 50 MeV
- Total photon yield 10^{11}
- Total photon flux 10^{24}/s

Shock Wave Ion Acceleration Studies



Laser-induced electrostatic shock reflects protons upon its propagation through the ionized H_2 jet.

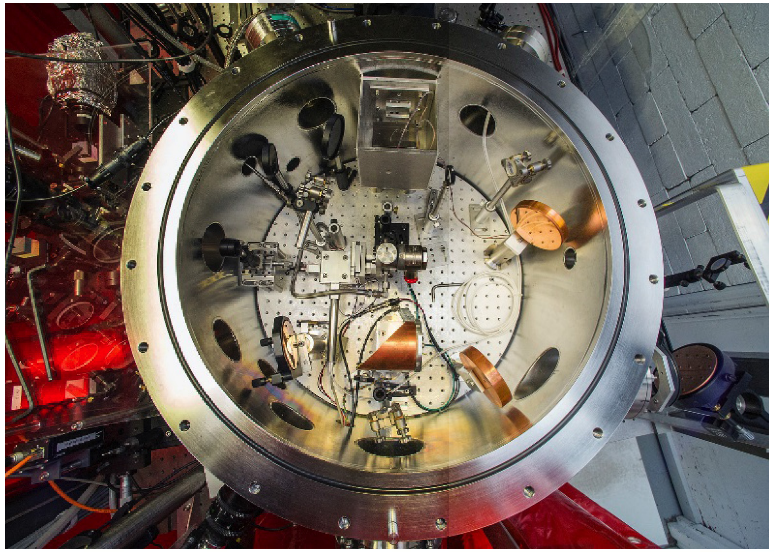




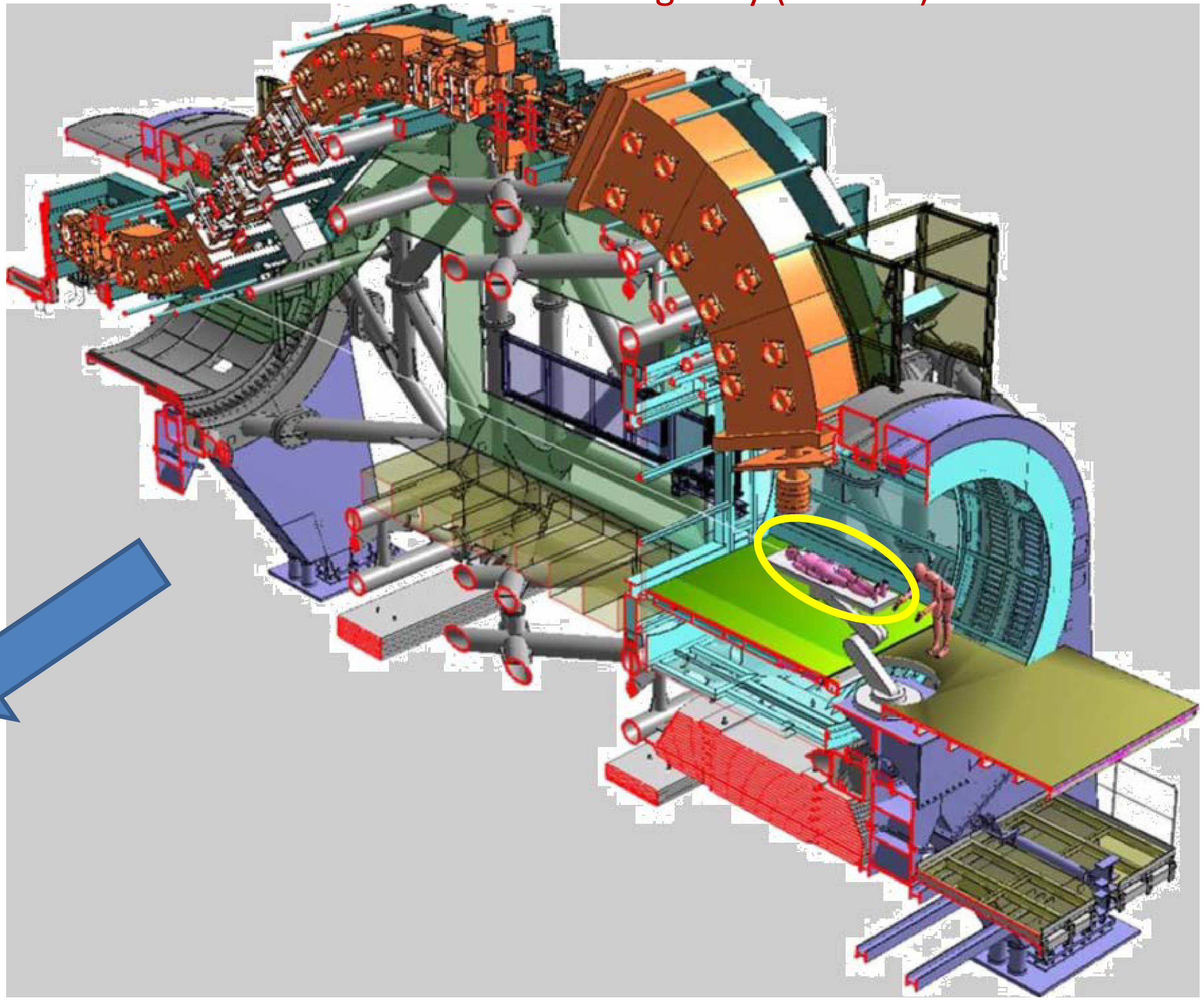
(light or neutrals)

1.7 MeV protons

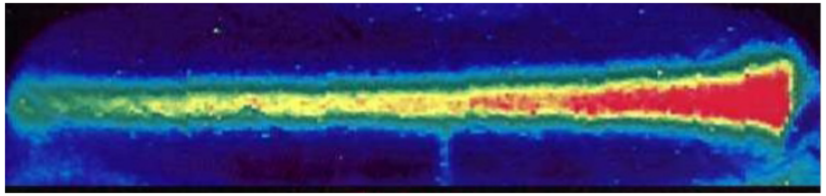
$$E_p \propto I / n_{cr}$$

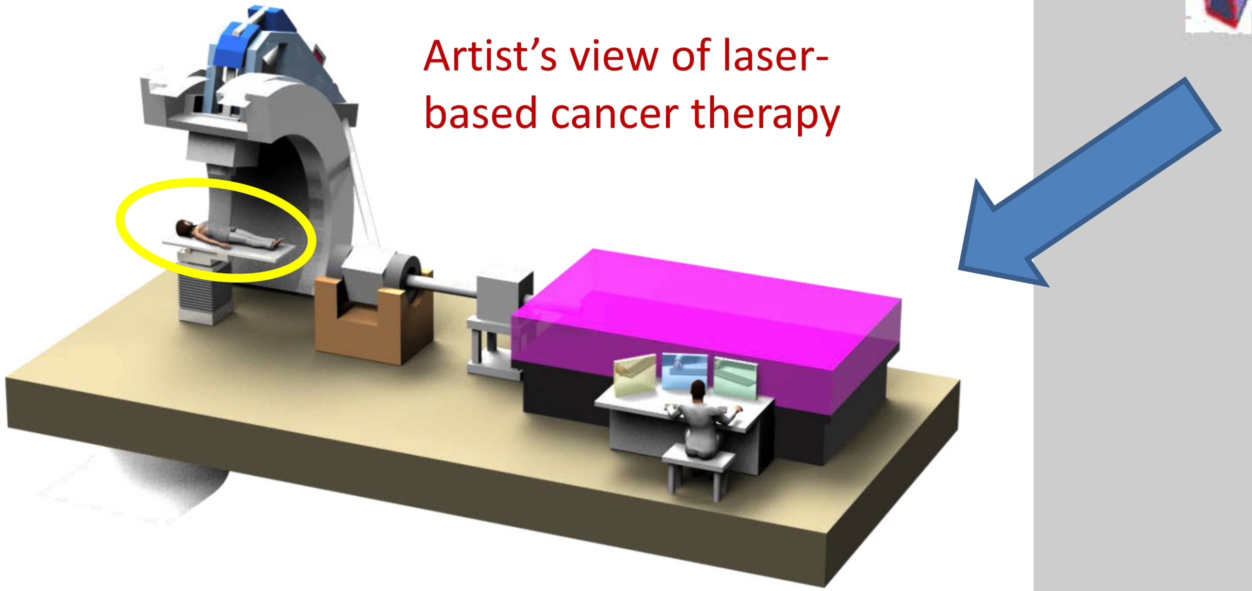


Conventional gantry (670 ton)



Bragg absorption of 200 MeV protons in 10-cm of water





Artist's view of laser-based cancer therapy www.bnl.gov/atf/ Apply → get approved → get beam time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BROOKHAVEN NATIONAL LABORATORY Accelerator Test Facility U.S. DEPARTMENT OF ENERGY

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A user facility for advanced accelerator research

The Accelerator Test Facility (ATF) is a proposal driven, Program Advisory Committee reviewed facility that provides users with high-brightness electron- and laser-beams. The ATF pioneered the concept of a user facility studying properties of modern accelerators and new techniques of particle acceleration over 25 years ago. It remains a valuable resource to the user community. ATF serves the U.S. Dept. of Energy Accelerator Stewardship program.

Contact Us

Electron/Laser Facility

High-brightness, 80 MeV, sub-picosecond, 3 kA electron bunches are being delivered to the experimental hall where user experiments are parked in three beam lines. The experiment beam lines are fully equipped with beam manipulation and diagnostic and special insertion devices to support diverse user requirements. The ATF unique capabilities include the possibility to combine the electron beam with synchronized high-power CO_2 laser. Stage 1 of the ATF-II upgrade proposal (PDF) has been approved by DOE, Office of High Energy Physics. The electron beam energy will be increased to 150 MeV.

CO_2 Laser

ATF's one-terawatt, picosecond, IR (10 μm) carbon dioxide laser is unique in the world. With it, the ATF users explore long-wavelength scaling of various physical processes and new approaches to particle acceleration and x-ray generation. A next-generation ultra-fast CO_2 laser based on chirped pulse amplification in isotopic gas mixtures is under construction. This laser will open the long-wavelength spectral domain to exploring strong-field phenomena at a_0=10.

News & Announcements

- ATF Newsletter (PDF), Fall 2015 (Back Issues)
- Brookhaven Lab's ATF Named DOE Office of Science User Facility
- Lab Employee Robert Malone Helps U.S. Air Force Get Ready for Take-Off

ATF Experiments

Active | Completed / Terminated

Research Opportunities

The unique combination of a high-brightness electron beam and high-power picosecond CO_2 laser opens unsurpassed opportunities for user exploration of new ideas for advanced particle accelerators and radiation sources.

Ion Acceleration
EUV Source
Laser Channeling in Plasma
Material optical damage study

Laser Only | hν | e⁻ | e-Beam Only

Plasma Experiments
Dielectric wakefields
Beam conditioning
Beam diagnostics
FEL

Laser & e-Beam

Updates from ATF Follow ATF

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Great representation from ATF staff and Users at AAC'16 (Advanced Accelerator Concepts Workshop) this week. #Accelerator #Physics

04 Aug

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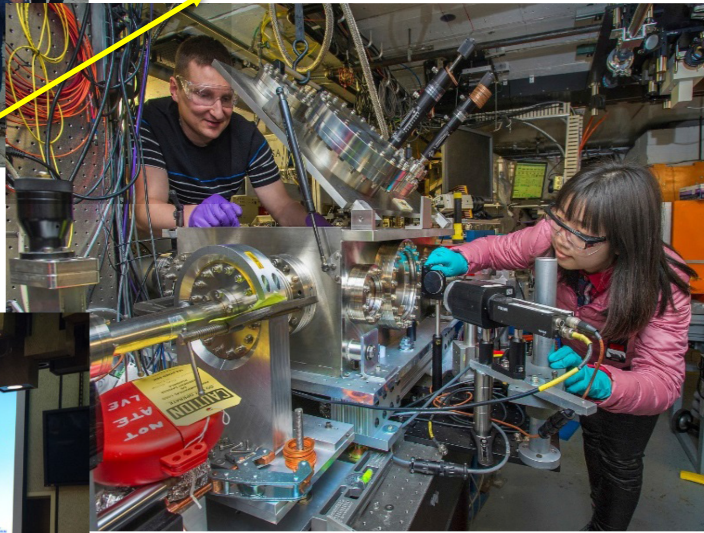
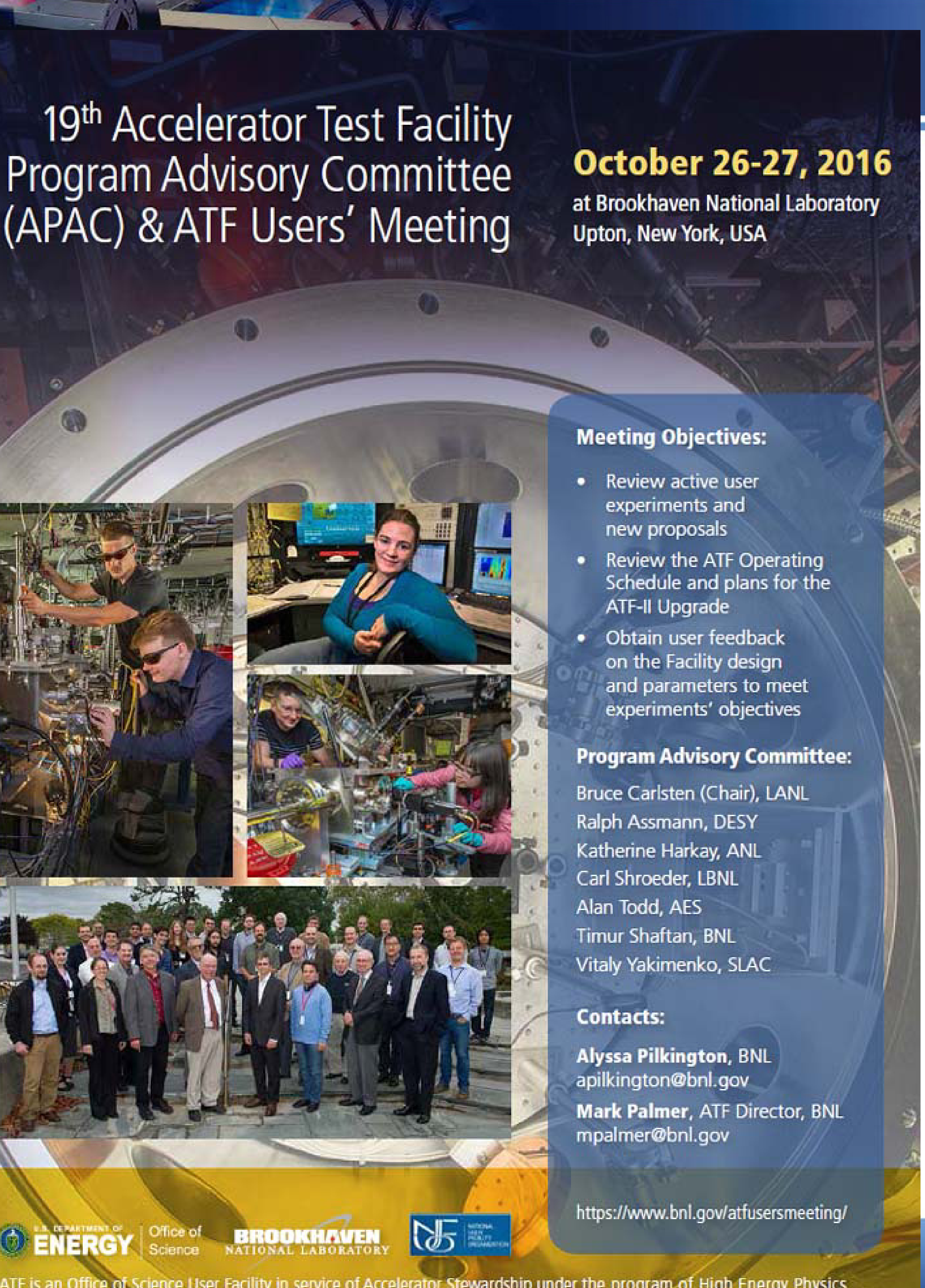
User's and Proposal Steering Committee meetings

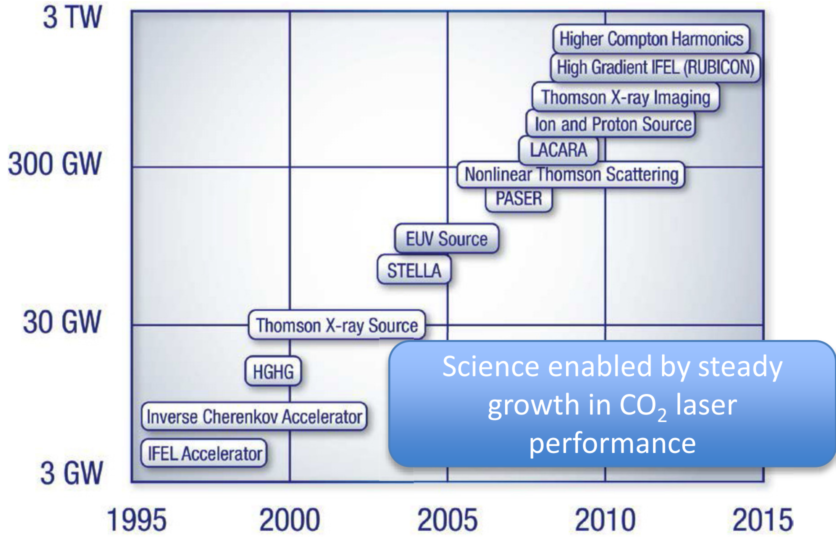
Your experiment





CONCLUSIONS

- The ATF has provided 25 years of continuous accelerator R&D output
- The availability of a unique CO_2 laser capability in combination with high brightness electron beams offers a unique set of research opportunities for the community
- The ATF team aims to continue the trajectory shown at the right by providing upgraded capabilities with the new ATF-II facility



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