

The BNL Accelerator Test Facility: 10 years of service.

- The ATF is a **proposal-driven, program / advisory committee reviewed, USER'S FACILITY** for long-term R&D in Accelerator and Beam Physics.
- The ATF features high-brightness electron beams synchronized to high-power lasers in 4 beam lines with state-of-the-art instrumentation.
- The ATF serves the whole community: Universities, industry, National Laboratories and international collaborations.
- The ATF is a great contributor to Graduate Education in Beam Physics.
- In-house R&D on photoinjectors, lasers, diagnostics, computer control and more.
- Support from DOE, (HEP and BES), BNL Directorate and our users.
- Great demand for our services.

Feature in Nature
Physics Portal

The screenshot shows a web page from the Nature Physics Portal. The main article is titled "Laser accelerators gang up" and is dated 10 April 2001. The text discusses the development of multi-stage laser-driven electron accelerators, specifically mentioning the STELA experiment at Brookhaven National Laboratory. It describes how a CO₂ laser is used to drive two inverse free-electron lasers (IFELs) in series. The first IFEL pre-accelerates electrons, and the second IFEL, synchronized with the laser wave, further accelerates them. A schematic diagram of the STELA experiment is included, showing the path of the electron beam and the laser pulses. The article also notes that while STELA did not achieve very high acceleration gradients, it demonstrated a crucial step towards practical multi-stage laser accelerators.

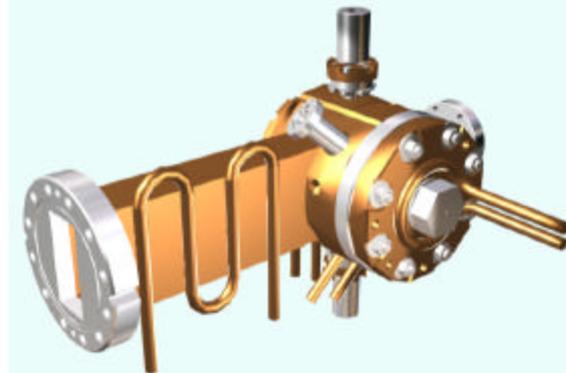
What is the purpose of the ATF?

- The long-term approach to accelerators: to explore revolutionary new methods of acceleration, generation of radiation and associated subjects.
- Provide everybody a place to carry out such R&D without having to invest in basics.
- Collaborate with universities and other national laboratories and help them carry out their mission.
- The success of this approach has been recognized, leading to initiatives on similar facilities:
 - ORION An Advanced Accelerator Research Facility at SLAC, February 2000 (Bob Siemann, SLAC)
 - NICADD, Northern Illinois Center for Accelerator and Detector Development, a forefront accelerator R&D user facility, February 2001 (Helen Edwards, FNAL)

ATF Timeline

Initial concept, start R&D	1987	Ballistic compression	1996
Start development of Gun Ia	1987	Gun IV (BNL / KEK)	1997
GPP construction of exp. Hall	1988	First IR / visible SASE	1998
Start operations Gun Ia	1989	Femtosecond microbunching	1998
LDRD funding	1989-1990	Magnesium cathode	1998
First experiments approved	1989	Phase-space tomography	1998
ATF DOE users facility	1990	Single-shot spectral emission	1999
ATF operational, 45 MeV	1992	Microwave cavity BPM	1999
Laser - Beam Interactions	1993	Thomson scattering X-rays	1999
Gun II (Industry)	1993	HGEG Experiment	2000
Inverse Cerenkov accelerator	1993	STELLA experiment	2000
Gun III (BNL/SLAC/UCLA)	1994	Saturation from VISA	2001
First PRL from experiment	1995	Development of LCLS gun	2001
IFEL laser accelerator	1995	CO ₂ laser power upgrade	2001
Slice emittance measurement	1996		

LCLS 120 Hz
Photoinjector



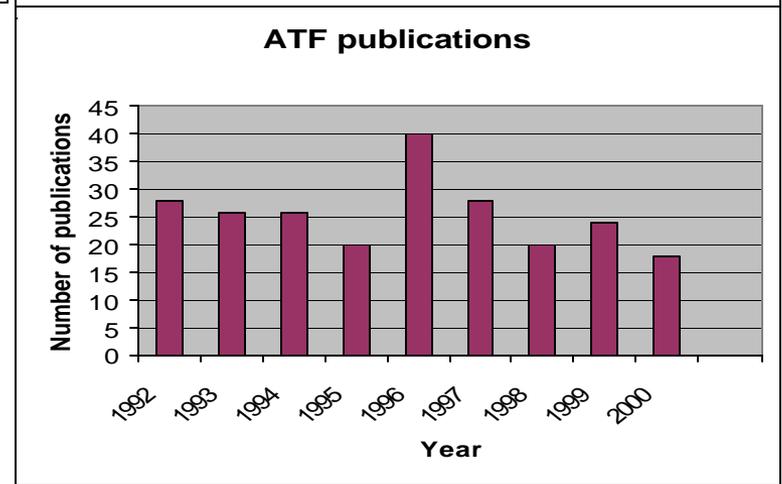
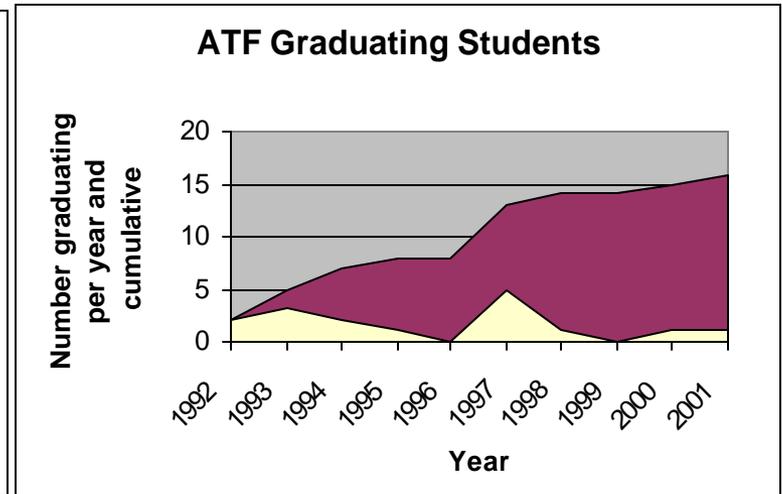
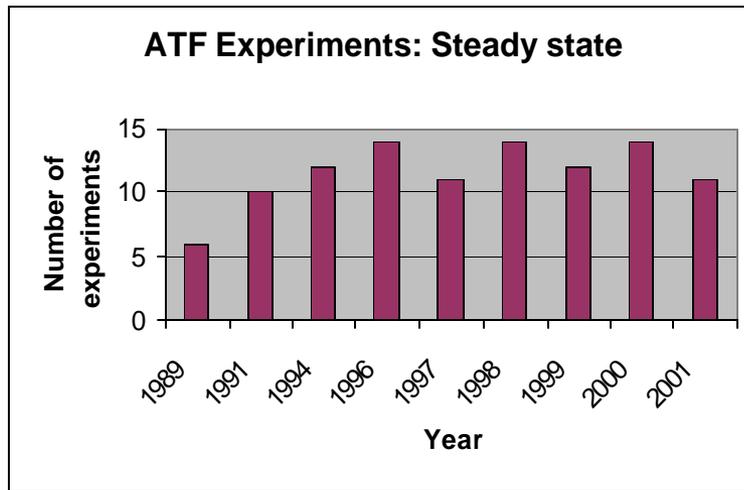
Making a better facility:

- Continuous brightness improvement.
- Continuous stability improvement
- Computer control system upgrade.
- New amenities for users.
- Terawatt picosecond CO₂ laser.
- High safety standards.
- Ultra-short bunch generation and diagnostics.
- Energy upgrade: Up to 72 MeV now, 100 MeV near future.
- Communications with users: Long-range schedule, web-based information, e-mail newsletter, training...

HAL 8500



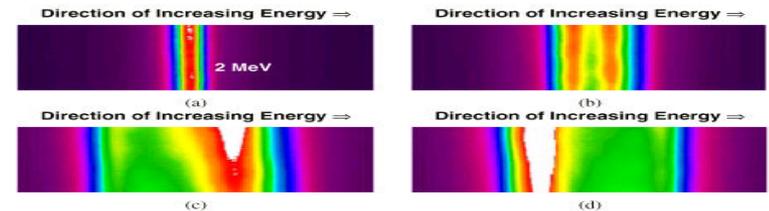
ATF Statistics



Run time: ~ 1100 hour / year
 (much more last year)
 Graduated students: 16
 Current number of experiments: 12
 Staff members: 8
 Phys Rev X: > 2 / year

12 currently active experiments: 12 experiments completed: **Steady state**

- Nonlinear-Compton Scattering
- Smith-Purcell Radiation
- Photocathode R&D
- Beam Position Monitors for Linear Colliders
- Stimulated Dielectric Wakefield Accelerator
- Staged Electron Laser Accelerator
- Compton Scattering of ps Electron and CO₂ Beams
- Ultra-fast Optical Detection of Charged particles
- A SASE-Free Electron Laser Experiment
- Laser Driven Cyclotron Autoresonance Accelerator
- Electron Beam Compression Based Physics at the ATF
- Structure-based Laser Driven Acceleration in a Vacuum

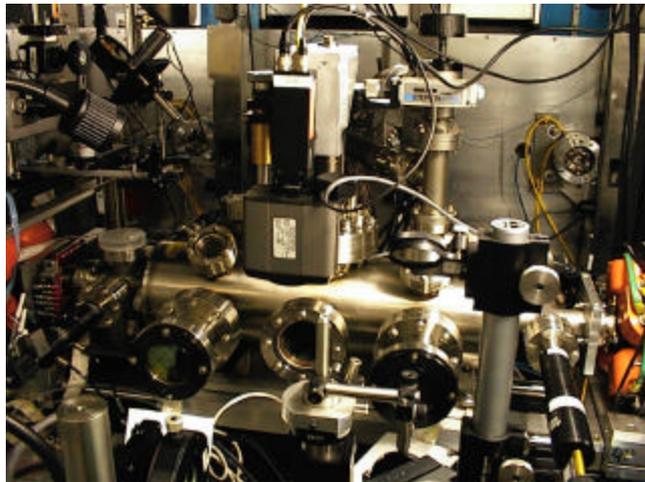
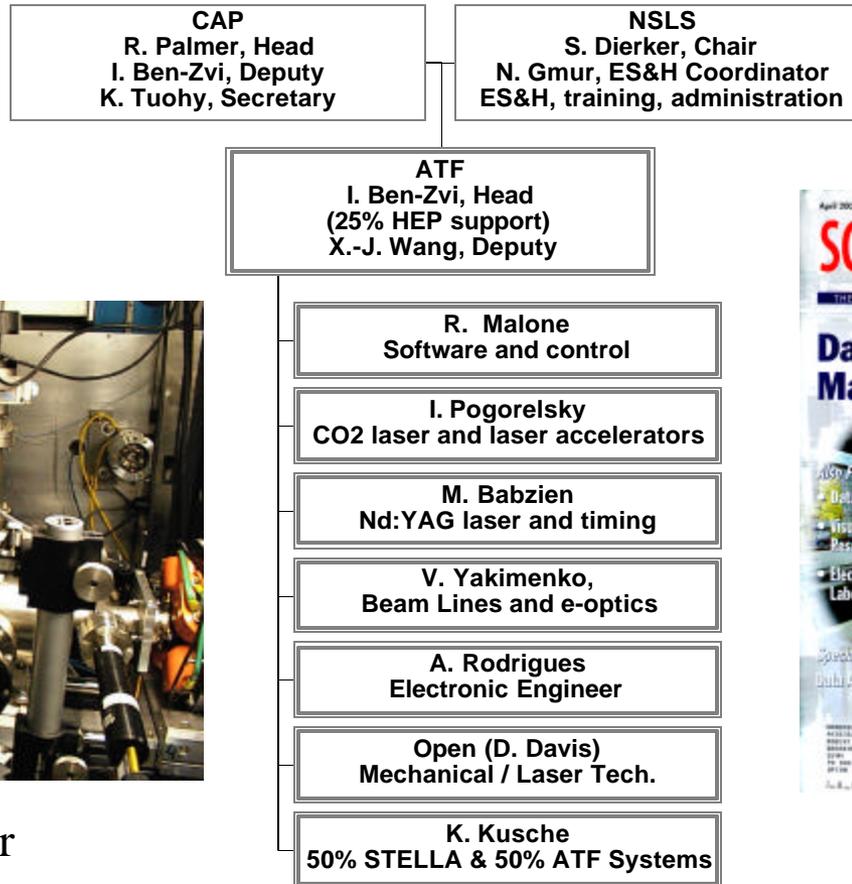


STELLA spectra

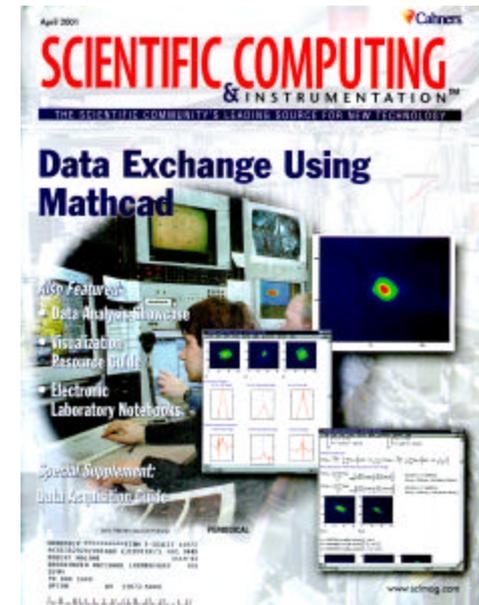
DOE Comments on ATF

- **Iran L. Thomas**, Director, Division of Material Sciences, BES, wrote in April 3, 1996 to Michael Hart the following: "... **The Accelerator Test Facility is becoming recognized as a unique and valuable resource for the country.**" This is even before HGHG, VI SA, Compton and recent gun brightness records.
- **John R. O'Fallon**, Director, Division of High energy Physics, wrote on October 30, 2000 to Thomas Kirk the following: "**Brookhaven's ATF is widely recognized as a unique and highly valuable resource for accelerator R&D efforts, which has not only produced fundamental research in accelerator physics and technology, but also has provided an excellent training ground for many young physicists.**"

Our Staff 7.75 FTEs. Surprisingly small!



Compton chamber



Front Cover on
Control System

BUDGET CONCERNS

- Support does not keep up with inflation – reduction of staffing level.
- Staffing level is inconsistent with needs.
- Aging equipment.
- No spares for critical systems.
- The facility is underutilized. Add 7 FTE's to double the operational time from ~1100 hours/year to ~2200 hours/year AND increase turnover rate.

This morning:

9:50 - 10:10 The ATF Operations, Performance and Upgrades

X. Wang

10:10 - 10:40 * Coffee Break *

10:40 - 11:00 The ATF Lasers

I. Pogorelsky

11:00 - 11:20 The ATF Computer Control System

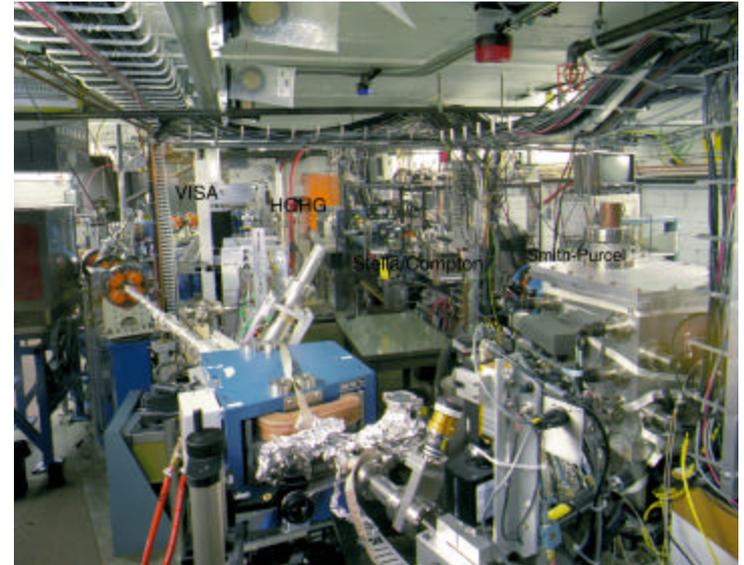
R. Malone

11:20 - 11:40 Small Beams and High Brightness

V. Yakimenko

11:40 - 12:00 Surface Roughness / Emittance vs. Uniformity

F. Zhou



ATF Experiment Hall

Afternoon, before coffee

1:00 - 1:15 VISA Experiment C. Pellegrini

1:15 - 1:30 Staged Electron Laser Acceleration (STELLA), K. Kusche

1:30 - 1:45 High-Gain Harmonic-Generation FEL (HGHG), L-H. Yu

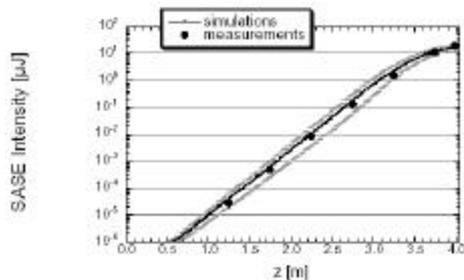
1:45 - 2:00 Ultrafast Detection of Relativistic Charged Particles by Optical Techniques,
Y. Semertzidis

2:00 - 2:15 Structure-Based Laser Driven Acceleration in a Vacuum, Y.-C. Huang

2:15 - 2:30 MINOS Beam Monitoring Detectors, M. Diwan

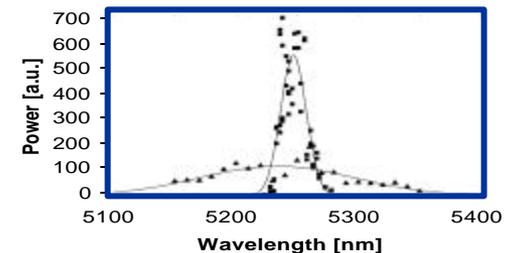
2:30 - 2:45 Stimulated Dielectric Wakefield Acceleration, T. Marshall

2:45 - 3:00 LACARA Experiment, J. Hirshfield



VISA Saturation

HGHG spectra



Afternoon, after coffee

3:30 - 3:45 Compton Scattering of ps Electron & CO₂ Beams T. Hirose

3:45 - 4:00 Beam Position Monitors for Linear Colliders V. Yakimenko

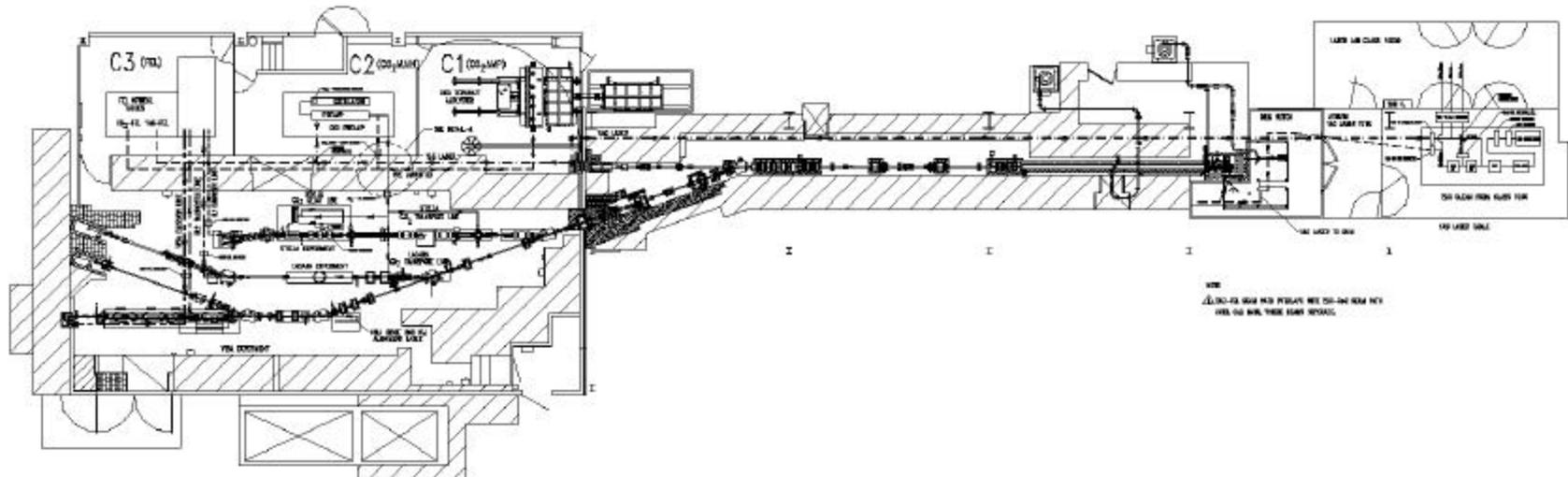
4:00 - 4:15 Smith Purcell Experiment H. Brownell

4:15 - 4:30 Pulse Compression Based Physics J. Rosenzweig

4:30 - 4:45 Photocathode R&D T. Srinivasan-Rao

5:00 - 6:30 ATF Tour

The experiments cover subjects relevant to both HEP, BES missions,



Friday: New proposals

8:30 - 9:00 Particle Acceleration by Stimulated Emission of Radiation, L. Schachter

9:00 - 9:30 Atto-Second Electron Bunches Production Experiment, M. Zolotarev

9:30 - 10:00 Optical Diffraction-Transition Radiation Interferometry

Diagnostics for Low Emittance Beams, R. Fiorito

10:30- 11:00 In Vacuum Laser Acceleration of Electrons at BNL's ATF,

V. Yakimenko

1 International / Univ., 2 National Labs, 1 University / small business