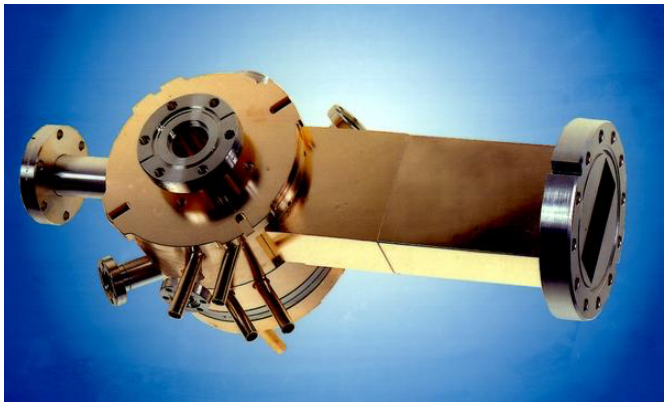
AE63 – [PHY542] Advanced Accelerator Lab

by Mikhail Fedurin, Dmitry Kayran and Diktys Stratakis

October 26, 2016 ATF User Meeting

Accelerator Test Facility (ATF) academic potential

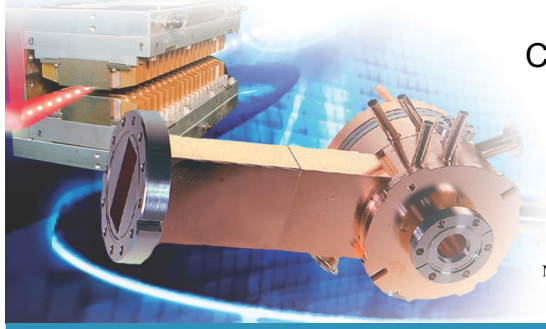
- ATF as facility with modest size advanced electron beam accelerator has unique capability to provide graduate students with hands-on experience with an operational accelerator
- Students learn the basics of the accelerator physics principles, accelerator operation and equipment
- Students come in touch with advanced acceleration concepts – accelerator physics of 21st century
- ATF scientific program committee approve this course as important part of the ATF mission



Goals of the course

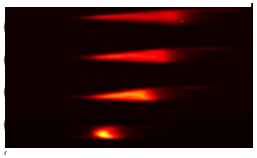
- Introduce students to the field of experimental Accelerator Physics
- Demonstrate e-beam techniques and diagnostics used in Advanced Accelerator Concept experiments at Accelerator Test Facility
- Teach students to model experiments, compare model results with measurements.

Advanced Accelerator Laboratory at Accelerator Test Facility (ATF), BNL, Spring 2015

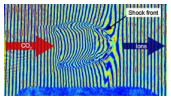


Course: PHY 542

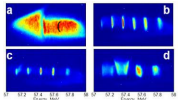
Experimental Demonstration of a Tunable De-chirper



Ion acceleration using laser driven shocks



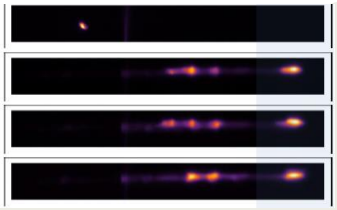
Beam Manipulation by Self-Wakefield



Topics covered:

- Design of accelerators and theoretical models
- Beam diagnostics
- Computational techniques
- High-brightness sources
- Novel ways of acceleration

"The ATF is a perfect place to learn how to deal with 21st century accelerators. You would have hands-on experience with modern accelerators and will learn how to tune and operate it"



3 Credits!
Register Now!

Contact Information:
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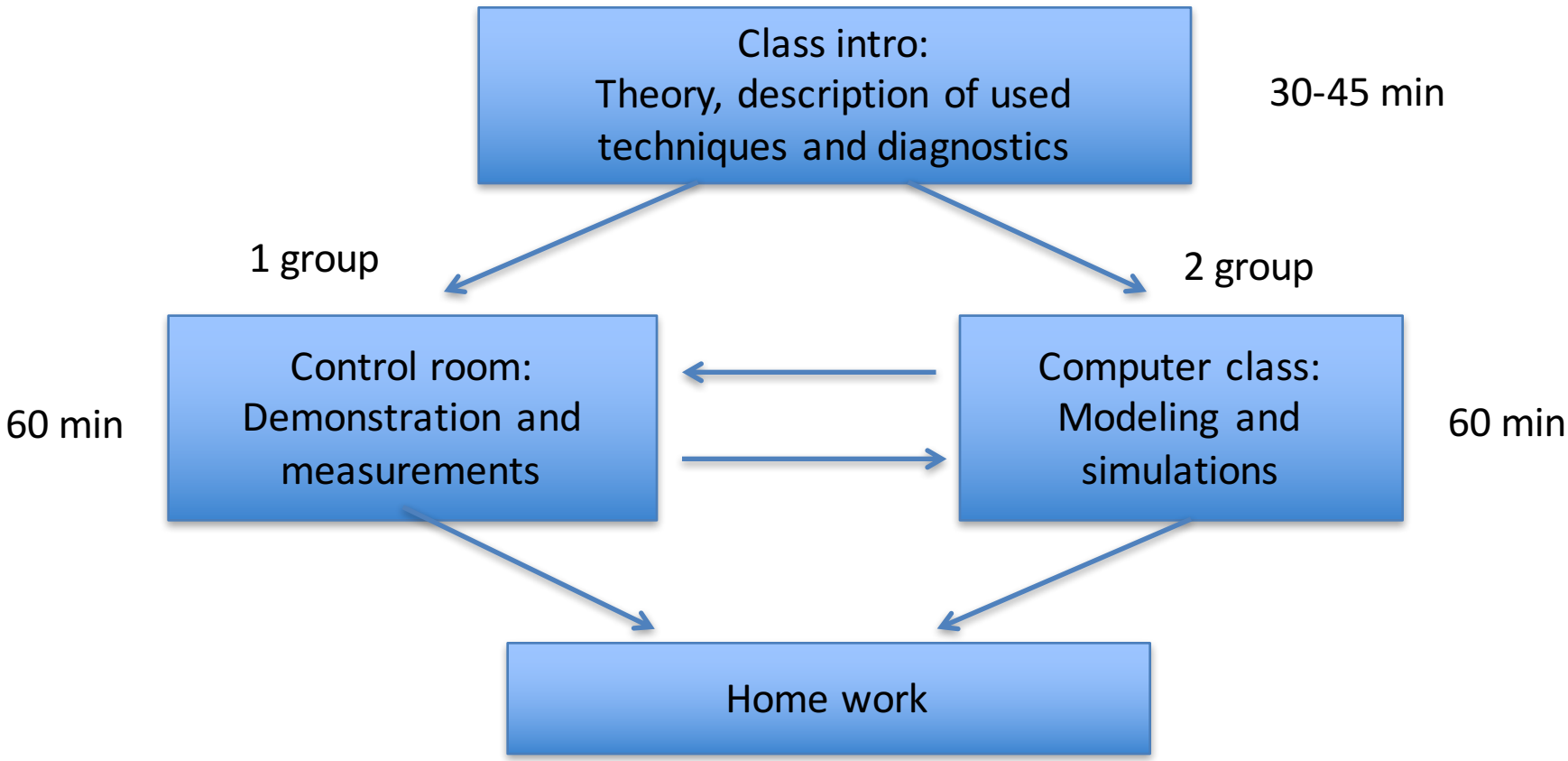
Syllabus (spring 2016)

- Course overview, administrative issues.
- Introduction to photo-injectors
- Modeling photo-injectors
- Transport of particle beams, Beam Acceleration
- Beam Diagnostics, emittance measurement techniques
- Dispersion and Masking Techniques
- Computer Lab
- X-ray production using IFEL and Compton
- Coherent Synchrotron Radiation (CSR). Experimental demonstration of CSR; magnetic bunch compression
- Finishing Simulation in Comp. Lab

PHY542 web page:
http://case.physics.stonybrook.edu/index.php/PHY542_spring_2016

Class structure



Evaluation (spring 2016)

- ✓ Student's performance was evaluated based on:
  - ✓ active involvement in the laboratory (25% of final grade);
  - ✓ lab report (60% of final grade);
  - ✓ presentation of a project topic (20% of final grade).

- ✓ Students did prepare Report and one Presentation during semester
  - ✓ Report and Presentation from one of lab class (see syllabus)
  - ✓ Content should include: 1) theory of the experiment and explain the objectives; 2) technique used to obtain data; 3) detailed data analysis; 4) conclusion remarks

- ✓ Presentation was made at the end of semester. Required better preparation. Presentation was performed at front of the class. To avoid the overlap topics was distributed at beginning of semester among students

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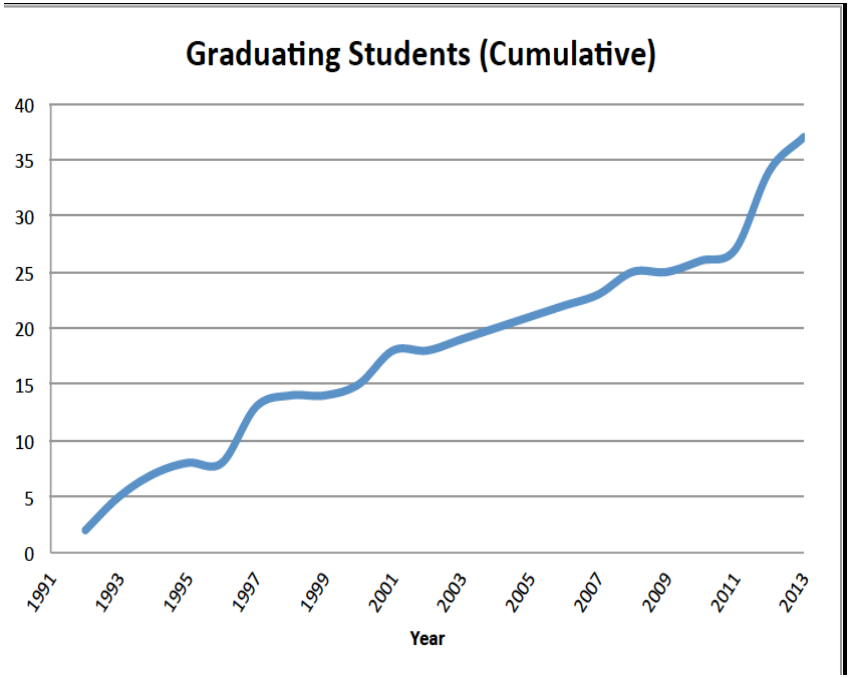
Support materials

Accelerator Stewardship program

Students who worked at ATF (in 2012)

1.	B. Allen	USC
2.	E. Arab	UCLA
3.	S. Barber	UCLA
4.	K. Boratay	UT Austin
5.	N. Cook	SUNY SB
6.	J. Duris	UCLA
7.	Yu. Fang	USC
8.	A. Nause	Tel Aviv University
9.	B. O'Shea	UCLA
10.	F. O'Shea	UCLA
11.	A. Ovodenko	SUNY SB
12.	L. Shao	UCLA
13.	E. Threlkeld	UCLA
14.	O. Williams	UCLA
15.	C. Brenner	Strathclyde Univ
16.	D. Carrol	Strathclyde Univ
17.	N. Dover	Imperial college
18.	A. Flacco	Ecole Polytechnique
19.	S. Kahalu	Ecole Polytechnique
20.	C. Palmer	Imperial college
21.	M. Streeter	Imperial college
22.	F. Sylla	Ecole Polytechnique

The ATF and graduate education



Center for Accelerator Science and Education at SUNY SB. Director – Prof. V. Litvinenko

New hands-on graduate course

At the 2013 BNL Young Researcher Symposium, **Nathan Cook,** awarded for his talk, "Impurity Free Ion Beams Accelerated by a 1 TW CO2 Laser".

nature physics LETTERS

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Beating the shot-noise limit

Avraham Gover[1]*, Ariel Nause[1], Egor Dyunin[1] and Mikhail Fedurin[2]

Ariel Nause, Tel-Aviv Univ., winner of the 2014 RHIC & AGS Thesis Award for his thesis "Beating the Shot-Noise Limit: Collective Interaction Optical Noise Suppression in Charged Particle Beam".

Stony Brook University