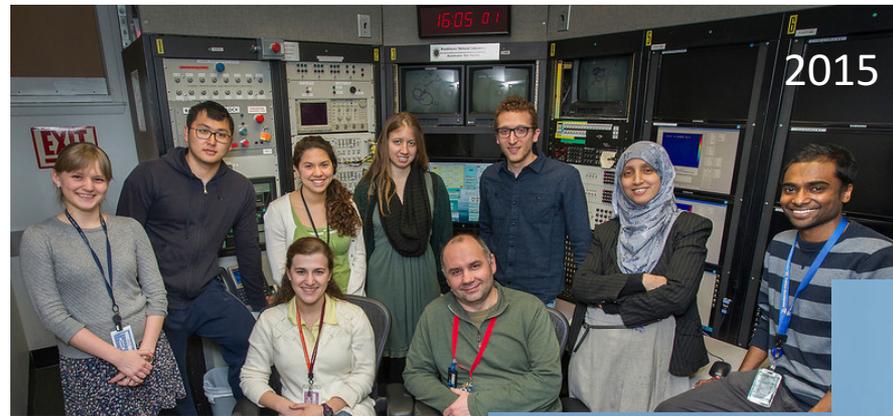


# AE63 – [PHY542]

## Advanced Accelerator Lab

by Mikhail Fedurin  
and Dmitry Kayran



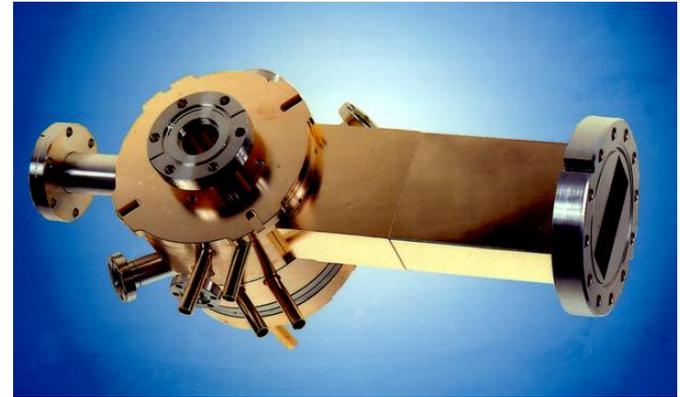
2016



2017

# 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 21<sup>st</sup> century
- ATF scientific program committee approve this course as important part of the ATF mission

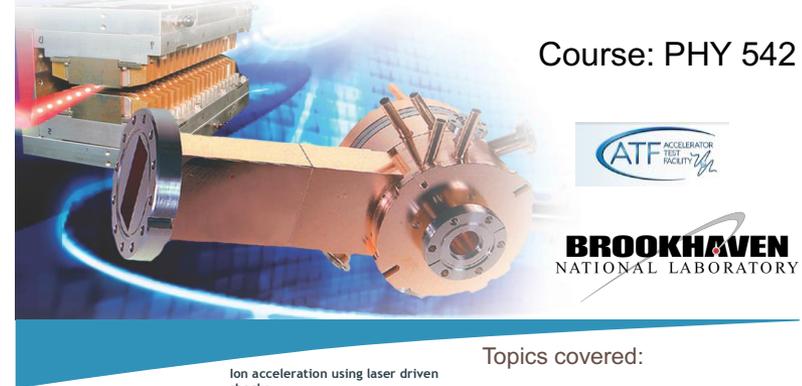


# Goals of the course

- 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

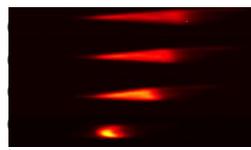
Course: PHY 542



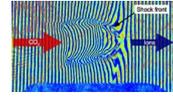
Topics covered:

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

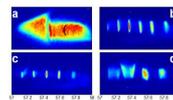
Experimental Demonstration of a Tunable De-chirper



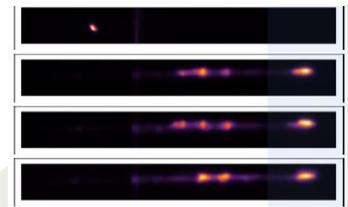
Ion acceleration using laser driven shocks



Beam Manipulation by Self-Wakefield



“The ATF is a perfect place to learn how to deal with 21<sup>st</sup> 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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Brookhaven National Laboratory  
<http://www.bnl.gov/atf/>

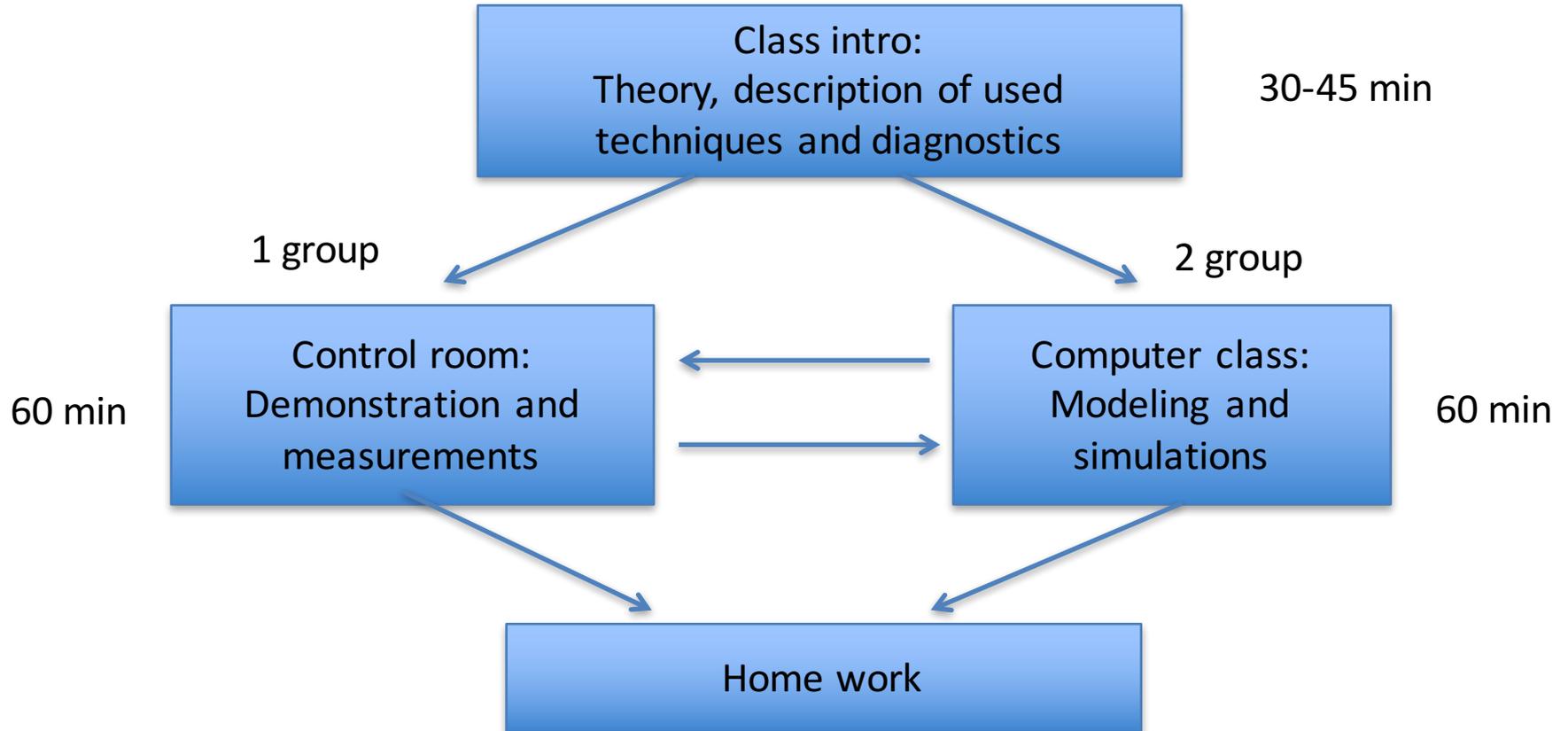
# Syllabus (spring 2017)

- 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](http://case.physics.stonybrook.edu/index.php/PHY542_spring_2016)

# Class structure



# Evaluation (spring 2017)

- ✓ 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

PHY542 web page:

[http://case.physics.stonybrook.edu/index.php/PHY542\\_spring\\_2016](http://case.physics.stonybrook.edu/index.php/PHY542_spring_2016)

# Time request

- 40 hours total of e-beam time distributed over:
  - every Monday from 3pm to 7pm
  - except national holidays, spring break and snow storm impact
- Estimate start date – January 29
- Estimate finish – end of April

# 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

Imperial College  
London



University of  
**Strathclyde**  
Glasgow

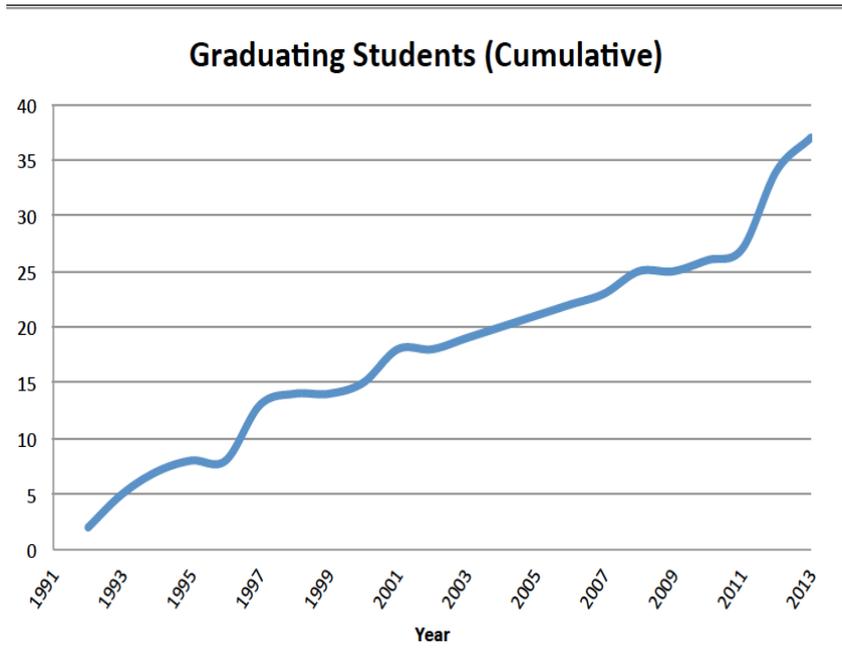


## The ATF and graduate education

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

PUBLISHED ONLINE: 14 OCTOBER 2012 | DOI: 10.1038/NPHYS2443

## Beating the shot-noise limit

Avraham Gover<sup>1\*</sup>, Ariel Nause<sup>1</sup>, Egor Dyunin<sup>1</sup> and Mikhail Fedurin<sup>2</sup>

**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".

