Brookhaven National Laboratory

U.S. DEPARTMENT OF ENERGY

25th Annual

Accelerator Test Facility (ATF) Users' Meeting

ID: 312804

“Theory to Practice: Hands-On Experience with the Latest Accelerator and Laser Systems”

BNL&CASE@SBU: Mikhail Fedurin (PI), Dmitry Kayran, Mikhail Polyanskiy, Navid Vafaei-Najafabdi, Vladimir Litvinenko

CUNY: Viviana Vladutesku

Accelerator Facilities Division

@BrookhavenLab

03/01/2023

AE63 “Stony Brook Accelerator Laboratory Course CASE@ATF” + classes and tours for MSI + training for other institutions

The purpose of this proposal to extend AE63 “Stony Brook Accelerator Laboratory Course CASE@ATF” with capability to advertise and train other institution students

Objective of AE63: Training, growing and educating of the next generation of accelerator physics using unique advance accelerator capabilities at ATF

Objective of Extension: Advertise accelerator science research in Brookhaven National Laboratory for MSI (classes and tours in CUNY) and potential to conduct training for students of other institutions

CASE at SBU, Ernest Courant Traineeship

CASE – The Center for Accelerator Science and Education has been established established as a Type I Institute within the University on November 19, 2008 as a Joint venture of BNL and SBU,

- To train scientists and engineers with the aim of advancing the field of accelerator science;
- To develop a unique program of educational outreach that will provide broad access to a research accelerator; and,
- To attract Federal and industrial funding for an expanding interdisciplinary research and education program that utilizes accelerators.

The Stony Brook University / BNL connection provides an ideal educational environment. The close proximity to BNL and the BSA connection provides for a superb combination of both university and national laboratory environment.

http://case.physics.stonybrook.edu/index.php/Main_Page

Stony Brook Research | myRESEARCH

Award Letter Received

Grant ID:	FP00002274
PI Name:	Vladimir Litvinenko
Title:	Ernest Courant Traineeship in Accelerator Science and Technology
Sponsor:	US Department of Energy

We would like to inform you that our office has received your award notice referenced below which is being forwarded for processing to your Grants or Contracts Specialist in the Office of Sponsored Programs.

$2.9M over 5 years

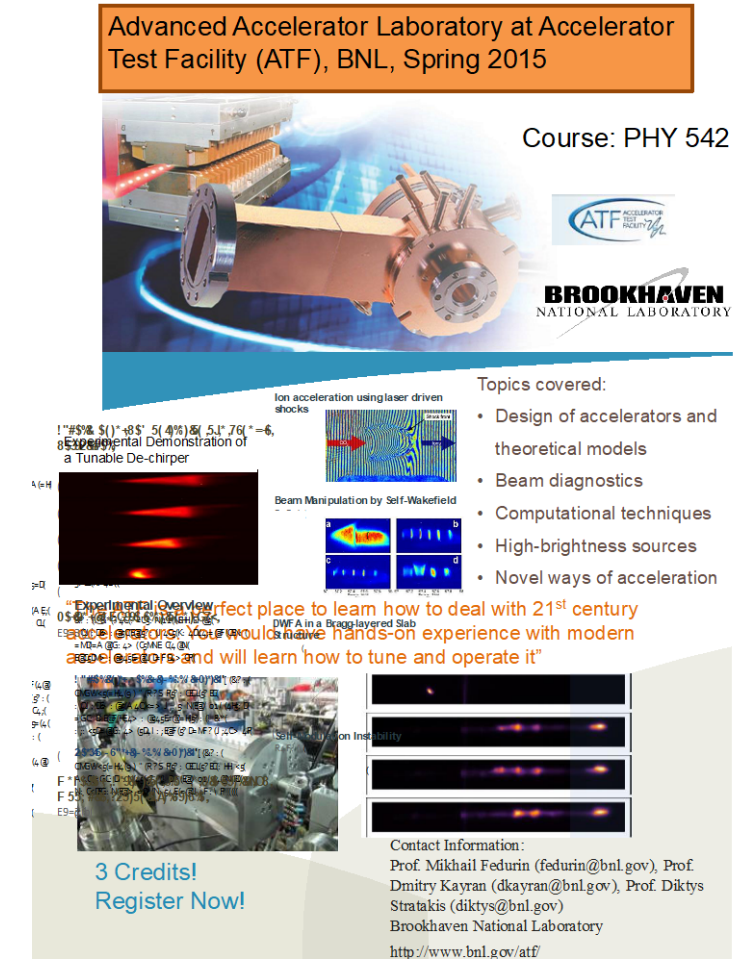
Collaboration of BNL, FNL, Cornell and Stony Brook Universities

Brookhaven National Laboratory

PHY542 “Fundamentals of Accelerator Physics and Technology with Simulations and Measurements Lab”

- 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.

http://case.physics.stonybrook.edu/index.php/PHY542_spring_2023



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City University New York tours at ATF

Starts in spring 2019 AE63 was extended to give introductory Advance Accelerator Laboratory course for CUNY students

AE63 extension was supported by BNL diversity program:

- Round trip travel expenses from NYC to BNL was covered for 18 students
- 32 hours /year presentations and tours dedicated accelerator and laser physics by Mikhail Fedurin and Mikhail Polyansky

Summer intern training at ATF

Since 2020 ATF provides summer intern training for students by "Ernest Courant Traineeship for Accelerator Science and Technology" (CASE@SBU) funding

http://case.physics.stonybrook.edu/index.php/Ernest_courant_traineeship_main

List of students in summer program at ATF:

Roshni Patil (SBU, 2020)

Neil McCarthy (SBU,2021)

Apurva Gaikwad (SBU,2021-2022)

Evan Trommer (SBU, 2022)

Brianna Romasky (Rutgers Univ. 2022-2023)

SBU + CUNY+?? >> “Training program at ATF”

..with training program goals:

- Introduce students from SBU,CUNY, MSI, college or staff from other national facilities to the field of experimental Accelerator Physics
- Demonstrate students e-beam and laser physics, techniques and diagnostics used in Advanced Accelerator Concept experiments at Accelerator Test Facility
- Teach students to model experiments, compare model results with measurements.
- Summer intern training at ATF

http://case.physics.stonybrook.edu/index.php/Ernest_courant_traineeship_main

Electron Beam Requirements

Parameter	Units	Typical Values	Comments	Requested Values
Beam Energy	MeV	50-65	*Possibility to redistribute energy gain in linac acceleration sections (phase shifter control)*	35-55
Bunch Charge	nC	0.1-2.0	*for QE measurements 0 -2nC, 0.5nC for other*	0.1-2.0
Compression	fs	Down to 100 fs (up to 1 kA peak current)	*(for 0.5 nC bunch) Compression demonstration, Enhance CSR effect*	700-1500
Transverse size at IP (σ)	μm	30 – 100 (dependent on IP position)	*Convenient beam size to deliver beam to spectrometer at end of beamline*	100-500
Normalized Emittance	μm	1 (at 0.3 nC)	(at 0.3 nC or at 0.5nC)	1 - 3
Rep. Rate (Hz)	Hz	1.5	*3 Hz also available if needed*	1.5
Trains mode	---	Single bunch	*Multi-bunch mode available. Trains of 24 or 48 ns spaced bunches.*	Single bunch

CO_2 Laser Requirements

Configuration	Parameter	Units	Typical Values	Comments	Requested Values
CO_2 Regenerative Amplifier Beam	Wavelength	μm	9.2	*Wavelength determined by mixed isotope gain media*	--
	Peak Power	GW	~3		--
	Pulse Mode	---	Single		--
	Pulse Length	ps	2		--
	Pulse Energy	mJ	6		--
	M^2	---	~1.5		--
	Repetition Rate	Hz	1.5	*3 Hz also available if needed*	--
	Polarization	---	Linear	*Circular polarization available at slightly reduced power*	--
CO_2 CPA Beam	Wavelength	μm	9.2	*Wavelength determined by mixed isotope gain media*	--
Note that delivery of full power pulses to the Experimental Hall is presently limited to Beamline #1 only.	Peak Power	TW	5	*~5 TW operation will become available shortly into this year's experimental run period. A 3-year development effort to achieve >10 TW and deliver to users is in progress.*	--
	Pulse Mode	---	Single		--
	Pulse Length	ps	2		--
	Pulse Energy	J	~5	*Maximum pulse energies of >10 J will become available within the next year*	--

Other Experimental Laser Requirements

Ti:Sapphire Laser System	Units	Stage I Values	Stage II Values	Comments	Requested Values
Central Wavelength	nm	800	800	*Stage I parameters are presently available and setup to deliver Stage II parameters should be complete during FY22*	--
FWHM Bandwidth	nm	20	13		--
Compressed FWHM Pulse Width	fs	<50	<75	*Transport of compressed pulses will initially include a very limited number of experimental interaction points. Please consult with the ATF Team if you need this capability.*	--
Chirped FWHM Pulse Width	ps	≥50	≥50		--
Chirped Energy	mJ	10	200		--
Compressed Energy	mJ	7	~20	*20 mJ is presently operational with work underway this year to achieve our 100 mJ goal.*	--
Energy to Experiments	mJ	>4.9	>80		--
Power to Experiments	GW	>98	>1067		--

Nd:YAG Laser System	Units	Typical Values	Comments	Requested Values
Wavelength	nm	1064	*Single pulse*	--
Energy	mJ	5		--
Pulse Width	ps	14		--
Wavelength	nm	532	*Frequency doubled*	--
Energy	mJ	0.5		--
Pulse Width	ps	10		--

Special Equipment Requirements and Hazards

Electron Beam

- Mask for mask technique demonstration, Bunch compressor for demonstration

CO_2 Laser

- Possibility to conduct tour

Ti:Sapphire and Nd:YAG Lasers

- None

Hazards & Special Installation Requirements

- None

Experimental Time Request

CY2023 Time Request

Capability	Setup Hours	Running Hours
Electron Beam Only	none	48
Laser* Only (in Laser Areas)	Tour	8 down post hours for tour
Laser* + Electron Beam	none	56

Total Time Request for the 3-year Experiment (including CY2023-25)

Capability	Setup Hours	Running Hours
Electron Beam Only		144
Laser* Only (in Laser Areas)		24 down post hours for tour
Laser* + Electron Beam		168

* Laser = Near-IR or LWIR (CO_2) Laser

Questions?