

Experiment Safety Review Form

Review Number: AD-010-2014-MAY-22

PRINCIPAL INVESTIGATOR: Andrey Ovodenko

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LIFE NUMBER: Z8676

Project Title: Inverse Compton Source for Extreme Ultraviolet Lithography (EUL). (AE59)
Location(s): 0820
Area(s): ATF BEAMLINe #1

SIGNATURES:

Principal Investigator: Andrey Ovodenko	Date:
Experiment Review Coordinator:	Date:
Co-PI or Alternate Contact (s): Kusche, Karl	Date: 7/23/2014
Reviewer: Asher Etkin	Date: 8/1/2014
Reviewer: Karl Kusche	Date: 7/23/2014
Reviewer: Mikhail Fedurin	Date: 7/28/2014
Reviewer: Frank Craner	Date: 7/17/2014
Review/Approval (ERC) Comments:	
Walkthrough Signature:	Date:
Next Annual Review Date: 7/20/2015	
FUA Change Required? No	
Fire Rescue Run Card Changes Required? No	
Has a NEPA Review been Performed for this Project? Don't Know	
Required Approvals (i.e., IACUC, IBC, etc.):	
Project Termination Acceptance Signature:	Date:
Comments:	

I. Define the Scope of the Work

A. Description

EUL experiment aims to achieve a significant increase of the average power output of single-shot ICS by enabling the interaction of a

long CO2 laser pulse train with multi-bunch electron beam.

An intense several picosecond long CO2 pulse is injected into an active optical cavity where it is developed into a long pulse train by a local regenerative amplifier. A portion of the laser cavity containing the focusing optics is built directly into the EUL chamber, allowing the beam to propagate through it multiple times and focus the energy of the pulse train on the interaction point (IP). At the same time, a set of permanent quadrupole magnets is used to focus the long electron beam pulse train on the other side of the IP.

Through the use of the motorized OAP mirrors, delay line and various beam diagnostics, a precise overlap is eventually achieved at the interaction point, generating Compton EUV-photons output for the duration of the macropulse. The resulting light is then directed and captured on the existing diagnostics station at the end of the beamline.

Please see attachment for further details & equipment.

Equipment manuals or procedures that are controlled documents:

None.

B. Human Performance Factors

None.

C. Waste Minimization/Pollution Prevention

None.

D. Materials Used /Waste Generated

Materials Used	Disposal Method	Amount per Use	Amount per Year	Comments
Helium gas	Point Source	1.00 ft3	25.00 ft3	Vent to outside.
Nitrogen Gas	Point Source	1.00 ft3	25.00 ft3	Vent to outside.
Carbon Dioxide gas	Point Source	1.00 ft3	25.00 ft3	Vent to outside.

II. Identify and Analyze Hazards Associated with the Work

The following hazards were identified:

Physical Hazards:

- Compressed gases (lecture bottles, cylinders, gas lines) (Area: ATF BEAMLINE #1)
- Pressurized vessels or systems with operating pressure greater than >15 psi and/or with largest dimension (length, width or diagonal) >6 in (Area: ATF BEAMLINE #1)

Chemical Hazards:

- Storage or use of Beryllium or Beryllium articles. Attach [Beryllium Use Review Form](#) if checked. (Area: ATF BEAMLINE #1)

Ionizing and Non-ionizing Radiation Hazards:

- Class 1M, 2/2M,3R lasers (Area: ATF BEAMLINE #1)
- Class 3B (nonvisible >15mW) or 4 lasers (Area: ATF BEAMLINE #1)
- Static magnetic fields >5 G and <600 G (attach exposure form) (Area: ATF BEAMLINE #1)
- ATF linac 50-75MeV (Other) (Area: ATF BEAMLINE #1)

Biological Hazards:

- None (Area: ATF BEAMLINe #1)

Offsite Work:

- None (Area: ATF BEAMLINe #1)

Other Issues (Security, Notifications, Community, etc.):

- None (Area: ATF BEAMLINe #1)

Significant Environmental Aspects

- None (Area: ATF BEAMLINe #1)

III. Develop and Implement Hazard Controls and Assess Risk

A. Physical Hazards, Tasks and Controls

Hazard, Default Controls, Task Specific Info	Risk Level
<p>Hazard: Compressed gases (lecture bottles, cylinders, gas lines)</p> <hr/> <p>Default Controls:</p> <ul style="list-style-type: none"> • Any systems >15psi must be SME Approved • Transport cylinders using a cylinder cart • Secure cylinders to a fixed object/wall • Use regulator, hoses, and components compatible with gas • Use hoses and clamps rated for maximum regulator output or use pressure relief device • Wear safety glasses with side shields when installing/removing/or adjusting regulator • Label piping/tubing <hr/> <p>Task Specific Info:</p> <p>Fill CO2 amplifier with helium, nitrogen and carbon dioxide gases to total pressure 4 atm. Vent/pump to outside using existing piping.</p>	<p>Negligible (0-20)</p>
<p>Hazard: Pressurized vessels or systems with operating pressure greater than >15 psi and/or with largest dimension (length, width or diagonal) >6 in</p> <hr/> <p>Default Controls:</p> <p>ASME stamped or reviewed and approved by SME Comply with Subject Area "Pressure Safety"</p> <hr/> <p>Task Specific Info:</p> <p>Existing CO2 amplifier pressure vessel.</p>	<p>Negligible (0-20)</p>

B. Chemical Hazards, Tasks and Controls

Hazard, Default Controls, Task Specific Info	Risk Level
<p>Hazard: Storage or use of Beryllium or Beryllium articles. Attach Beryllium Use Review Form if checked.</p> <hr/> <p>Default Controls:</p> <p>Engineering Controls</p> <p>Administrative Controls</p> <ul style="list-style-type: none"> • Complete the Beryllium Use Review Form. • Machining of beryllium prohibited <p>Training:</p> <ul style="list-style-type: none"> • Beryllium Use at BNL (TQ-BERYLLIUM1) <p>PPE: Nitrile glove Comply with the SBMS Subject Area: "Beryllium".</p>	<p>Negligible (0-20)</p>

Task Specific Info:

Be article mounted on 2-3/4" Conflat flange, installed at the end of beamline #1. BURF is same for approved experiment AD-007-2014-FEB-3.

C. Environmental Hazards, Tasks and Controls (include on/off site transportation and products/services)

None

D. Radiation Hazards, Tasks and Controls

Hazard, Default Controls, Task Specific Info	Risk Level
<p>Hazard: Class 1M, 2/2M,3R lasers</p> <p>Default Controls: Administrative Controls • Complete registration form and laser use permit for laser(s), submit to Laser Safety Officer (LSO) • Contact LSO for posting requirements Comply with Subject Area "Laser Safety"</p> <p>Task Specific Info: Visible HeNe lasers used for alignment.</p>	<p>Negligible (0-20)</p>
<p>Hazard: Class 3B (nonvisible >15mW) or 4 lasers</p> <p>Default Controls: Administrative Controls • Complete registration form, submit to Laser Safety Officer(LSO) • Complete Laser Controlled Area SOP, submit to LSO • Contact LSO for posting requirements • Obtain baseline Laser eye exam • Training: Laser Safety (TQ-LASER) Engineering Controls • Beam barriers/blocks • Interlocks are required for Class 4 Laser Controlled Areas * PPE as specified in SOP</p> <p>Task Specific Info: ATF CO2 laser system, covered under approved SOP (C-AD document 820-2_CO2_SOP_.pdf). Operated by ATF laser operator in posted areas with laser interlocks.</p>	<p>Acceptable (21-40)</p>
<p>Hazard: Static magnetic fields >5 G and <600 G (attach exposure form)</p> <p>Default Controls: Administrative Controls • Request SMF survey through SHSD • Complete JAF or Non-Employee Static Magnetic Field Questionnaire for exposed employees/workers • Training: TQ-SMF (supervisors) • Appropriate posting (see Subject Area)</p> <p>Task Specific Info: In-vacuum magnets (PMQ) handled only during installation into vacuum chamber. Not possible to fit fingers inside. External fields up to approx. 600 G.</p>	<p>Negligible (0-20)</p>
<p>Hazard: ATF linac 50-75MeV (Other)</p> <p>Default Controls:</p>	<p>Negligible (0-20)</p>

Task Specific Info:

ATF linac operations covered under approved procedures: (<http://www.bnl.gov/atf/procedures.php>)

E. Biological Hazards, Tasks and Controls

None

F. Offsite Work Hazards, Tasks and Controls

None

G. Other Issues (Security, Notifications to Other Organizations, Community Involvement, etc.)

None

H. Recommended Exposure Monitoring

- None (Area: ATF BEAMLINe #1)

Description or comments:

I. EPHA Determination

Chemical Name	Quantity (lbs, gal)	Location (Bldg/Room#)
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IV. Perform Work Within Controls**A. Recommended Training and Medical Surveillance Summary**

- (JTA) ATF User (GE-53A)

B. Personnel Training, Qualification, and Authorization List

Employee/Guest Name	Life/Guest#	Dept	Required Training Course(s)	Signed
Andrey Ovodenko	Z8676	DB	(TQ-LASER) [EXPIRES: 11/9/2014] (TQ-SMF) [EXPIRES: 11/15/2016] (OM-MEDSURV-LASER) [EXPIRES: NEVER] (JTA) ATF User (GE-53A) [COURSE NOT FOUND]	
Igor Pogorelsky	19752	AD	(TQ-LASER) [EXPIRES: 8/5/2015] (TQ-SMF) [EXPIRES: 6/12/2016] (OM-MEDSURV-LASER) [EXPIRES: NEVER] (JTA) ATF User (GE-53A) [COURSE NOT FOUND] (TQ-COMPGAS1) [EXPIRES: 2/8/2016]	
Karl Kusche	19960	AD	(TQ-COMPGAS1) [EXPIRES: 1/8/2016] (TQ-BERYLLIUM1) [EXPIRES: 5/6/2015] (TQ-LASER) [EXPIRES: 5/7/2015] (TQ-SMF) [EXPIRES: 4/5/2016] (OM-MEDSURV-LASER) [EXPIRES: NEVER] (JTA) ATF User (GE-53A) [COURSE NOT FOUND]	
Mikhail Fedurin	23594	AD	(TQ-LASER) [EXPIRES: 5/26/2015] (TQ-SMF) [EXPIRES: 5/23/2015] (OM-MEDSURV-LASER) [EXPIRES: NEVER] (JTA) ATF User (GE-53A) [COURSE NOT FOUND]	

C. Emergency Procedures

Existing procedures for the ATF linac and CO2 laser system will be followed. <http://www.bnl.gov/atf/procedures.php> Existing LEP will be followed. ATF operator is acting LEC. <http://www.c-ad.bnl.gov/ESSHQ/SND/OPM/Ch03/03-31.pdf>

D. Transportation

None

E. Logistical Interactions

None

F. Termination/Decommissioning

Items in or attached to vacuum beamline require activation check prior to release from experimental hall.

V. Provide Feedback

None

VI. Attachments

Attachment provided by PI.

Additional personnel will be added in the future.

Attached Files:

[RBT-2EUL-ESR-v1 6.docx](#)