
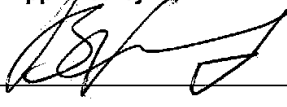
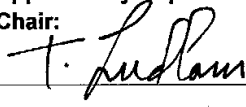


BROOKHAVEN NATIONAL LABORATORY		Number: PO-P-ATF-0025	Revision: 0
PHYSICS DEPARTMENT		Effective: 08/17/2011	Page: 1 of 2
Subject: ATF Procedure for Laser-based Cathode Cleaning		Prepared by: Marcus Babzien	
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ATF Procedure for Laser-based Cathode Cleaning

Important : Before starting laser cathode cleaning, verify that the gun RF system is off and take possession of the linac operator keys.

Note : The magnification of the cathode monument leads to a pixel scale of 9.8 mm/pixel.

1. On a frame grabber or analog monitor, mark the square area covered by the full laser spot using the cathode monument grid illumination.
2. Switch repetition rate to 3 or 6 Hz.
3. Reconfigure gun hutch optics:
 - a) Remove diffraction grating and replace with regular mirror.
 - b) Open beam shaping iris.
 - c) Reduce laser spot size on cathode by exchanging kinematic lenses in gun hutch.
 - d) Adjust final iris in gun hutch to produce more uniform spot without long tails.
 - e) Try to achieve 100-250 pixels² rms spot size on cathode monument with unsaturated image. This corresponds to $1-2.5 \times 10^{-4} \text{ cm}^2$. Use larger spot sizes for faster cleaning with a "dirtier" cathode, and smaller spot sizes for higher intensity with a "cleaner" cathode.
 - f) Adjust the cathode monument camera iris to achieve a moderately saturated image of the laser spot for more stable beam positioning by the cleaning algorithm.
4. Close the gun vacuum valve and note starting vacuum level on the ion gauge.
5. Set the laser energy by scanning outside the cleaning area with progressively higher energy until the vacuum rises 10-20% above the starting level. Typical laser energies range from 20-70 mJ and, including the variation in spot size, fluences of 80-700 mJ/cm².
6. Begin the automated procedure with the following parameters:

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- a) 2 or 3 shots per point.
 - b) Step size in PIXELS (or mm) comparable to the laser rms size in the horizontal (X) direction. Step size in motor COUNTS $\sim 1.2x$ laser rms PIXEL size.
 - c) Note that the number of motor COUNTS/PIXEL is $\sim 3x$ smaller in X than Y because of oblique incidence on the cathode.
 - d) Step size in PIXELS (or mm) comparable to the laser rms size in the vertical (Y) direction. Step size in motor COUNTS $\sim 6x$ laser rms PIXEL size.
 - e) Upper left and lower right corners corresponding to the area marked in first step.
7. Monitor laser energy and vacuum, adjusting laser energy to maintain a minimum detectable vacuum rise of $\sim 1-3 \times 10^{-11}$ torr.
8. Note that gun starting vacuum tends to improve for some time, therefore a slight downward trend is expected in vacuum as cleaning proceeds. To verify, close UV shutter briefly to re-establish starting vacuum level.