Procedure to Set up CW Beam to Injector Dump

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Technical Custodian: Bob Legg (7592)

Estimated Time to Perform: 4 hours

Procedure Overview

To allow setup of CW beam from the injector to the first light dump

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Prerequisites

9 MeV/c @1100µA peak, line sync'd, pulsed beam on the dump target
Optics downloaded throughout the injector
All Injector BLM's verified for proper placement and operation
Read this entire procedure

Procedure Steps

Establishing CW Beam

1. Verify from the Beam Current Monitoring cavity versus the dump picoammeter read-back that there are no gross beam losses in the injector between the cryounit and the injector dump.

2. Check the horizontal beam sigma at ITV0F06 OTR and verify beam size of less than 4 mm FWHM horizontal. If the beam does not meet this spec, the energy spread out of the cryounit is too large. Recrest the cryounit. If this doesn't solve the problem, call the Optics On-Call person.

3. Using the horizontal corrector MBH0F06H, find the center of the chicane using the downstream BLM (BPM wire sum?) after dipole MDU0F02 as the feedback signal. Sweep the beam across the aperture, recording the corrector settings for the 90% full scale readings on either side of the aperture. The physical aperture width is 0.0375 (+/-375 G-cm) in meters. This exceeds the limit on the correctors, so no loss may be seen at either extreme and the setup is still acceptable. If loss is seen, then it is the dynamic aperture and may be somewhat smaller than the physical aperture because of the field in the dipoles and true beam size, if it is different than the physical aperture by more than 30%, then the dipole field should be adjusted. Iterate between changing the field integral and sweeping the aperture until the dynamic aperture is at least 70% of

the physical aperture of 3.75 cm. Center the beam in the aperture by setting the corrector to the median of the two corrector settings where loss occurred.

4. Verify all BLM high voltages and setpoints.

5. Set up the dump using the "Injector Dump Setup" procedure available from the www FEL documentation site.

6. Insert the viewers one at a time and record the spot size in the table below. Values should match to a factor of 1.5 with scaling allowed; i.e. we are looking for a gross variation from the nominal betatron functions. The spot sizes are calculated from the relation, $\sigma = (\varepsilon * \beta)^{0.5}$ using a nominal emittance of 13 mm-mrad. If the emittance measured by the multislit is different, adjust the sigmas by the squareroot of the difference. If an aberration appears, call Optics on Call (?).

Table 1: Beam Spot Sizes vs. Modeled Values

Viewer	Modeled σ X, mm	Experimental σ X, mm	Modeled σ Y, mm	Experimental σ Y, mm
ITV0F04	1.8		1.3	
ITV0F06	0.64		1.45	
ITV0G01	0.49		2.49	

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7. Start graphing dump ion pump current, VIP0G03A, H_2O loop flow and temperature, and beam current, IDC0G00.

8. Unmask the FSD inputs for the BLM's and verify their operation with the test pulse.

9. On the drive laser "DRVMASTER" MEDM screen, start the laser phase rotater stepping through the phase offsets. Record the phase at which any BLM trips occur. Set this phase into the laser and try to improve the aperture using the BLM analog signal to guide you. After each resteer, restart the phase rotater from zero degrees to step through the entire 360 degree cycle. When no trips occur, proceed to the next step.

10. Lower the pulse repetition frequency to 1 MHz and go CW on the pulse control. Increase the pulse repetition frequency until a) we are CWat 18.7 MHz, or b) the BLM system trips. If the BLM system does not trip, goto Step 16.

11. Record the pulse repetition frequency that the BLM tripped at. The gun current is proportional to the pulse repetition frequency, so roughly the current trip occurred at is 59 microamp/ MHz of prf.

12. Reset the pulse repetition rate to a minimum and reset the BLM FSD. Mask the BLM FSD inputs. Go to pulsed mode.

    a. Check the beam orbit in the vicinity of the BLMs that tripped. Use the BPM's and viewers where possible to get an idea of the beam shape and position. If

the wiring is done, use the AMS to look at the BLM signal directly on a scope and resteer the orbit to reduce interception.

13. Continue iterating on steps 9, 10, 11 and 12 until the MPS BLM FSD input no longer trips in step 11.

14. Call the Radiation Control Office as soon as CW beam >3 minutes is achieved to the dump.

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