

CesrTA Machine Studies Task Overview

I. Experiment Description

Experimental Topic	Optics functions vs. bunch current																	
Classification*	LET																	
Coordinator/ Experimenters	JSh	DLR, JSh, MPE																
Primary Goals	Measure betatron coupling, orbit, and dispersion (AC and DC) vs. bunch current from 0.1 to 8mA; establish a correction algorithm as a function of bunch current																	
Description†	<p>Electrons or positrons, 2.085GeV (XR40M_CD optics)</p> <p>To be done prior to IBS studies:</p> <p>Some BPM guidelines</p> <table> <thead> <tr> <th>Current (ma)</th> <th>Gain Setting</th> </tr> </thead> <tbody> <tr> <td>0-0.25</td> <td>10</td> </tr> <tr> <td>0.25-0.5</td> <td>9</td> </tr> <tr> <td>0.5-1</td> <td>8</td> </tr> <tr> <td>1-2</td> <td>7</td> </tr> <tr> <td>2-3</td> <td>6</td> </tr> <tr> <td>3-6</td> <td>5</td> </tr> <tr> <td>6-10</td> <td>4</td> </tr> </tbody> </table> <p>- Correct gains at current/gain setting in advance</p> <ul style="list-style-type: none"> • • • • • • • • • • 		Current (ma)	Gain Setting	0-0.25	10	0.25-0.5	9	0.5-1	8	1-2	7	2-3	6	3-6	5	6-10	4
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* Machine Studies Classifications:

- EC – Electron Cloud
- LET – Optics Correction and Low Emittance Tuning
- IBS – Intra-beam scattering studies
- xBSM – x-ray Beam Size Monitor
- INST – Instrumentation (BPM development, RFA development, other)
- MDEV – Machine Development (includes injection configuration, injection tuning, custom orbit setup, instrumentation preparation, etc.)
- MREC – Machine Startup (recovering conditions after down period or access)

† Attach additional pages for experimental description if needed

	<ul style="list-style-type: none"> • Correct optics (orbit, phase/coupling, dispersion) to achieve minimum emittance at 0.5mA (BPMs in fixed-gain mode) <ul style="list-style-type: none"> ○ Switch BPMs to variable-gain mode. ○ -Take orbit, coupling meas at overlapping currents for each gain setting as <p>Current Gain setting</p> <table> <tr><td>0.5</td><td>fixed</td></tr> <tr><td>0.5</td><td>8</td></tr> <tr><td>1.0</td><td>8</td></tr> <tr><td>1.0</td><td>7</td></tr> <tr><td>2.0</td><td>7</td></tr> <tr><td>2.0</td><td>6</td></tr> <tr><td>3.0</td><td>6</td></tr> <tr><td>3.0</td><td>5</td></tr> <tr><td>5.0</td><td></td></tr> </table> <p>-----</p> <ul style="list-style-type: none"> ○ At currents: 0.1mA, 0.5mA, [1mA:8mA in 1mA steps], do the following: <ul style="list-style-type: none"> ▪ Measure: orbit, betatron phase/coupling, dispersion (AC and DC) ▪ Correct orbit at each current ▪ Re-measure orbit, betatron phase/coupling, and dispersion ▪ Verify with xBSM that correction was successful ▪ Save csr after each successful correction • Using the save sets recorded at each current, create an algorithm for compensating current dependence of the orbit (and thus coupling and dispersion) <ul style="list-style-type: none"> ○ Determine how many save set loads would be necessary to reduce the current dependence without excessively hystering the steering magnets • Establish a hysteresis loop: <ul style="list-style-type: none"> ○ Permute through the selected save sets three times, then verify the corrections at each stage are still valid. If the correction is not valid, re-run orbit correction and save csr; use this new save set in the final hysteresis loop. 	0.5	fixed	0.5	8	1.0	8	1.0	7	2.0	7	2.0	6	3.0	6	3.0	5	5.0	
0.5	fixed																		
0.5	8																		
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2.0	7																		
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3.0	6																		
3.0	5																		
5.0																			

Special Needs/Requests		
Prerequisites[‡]	Personnel	Description
BPM gain correction	DLR, MR	Correct gains at higher currents
xBSM functionality	NTR, JSh et al.	xBSM setup, calibration, and verification
Time Requested[§]	No. Shifts	Principal Tasks
4 hr	1	Measure optics functions vs. bunch current; set up hysteresis loop

[‡] Indicate other machine work that is required in preparation for this machine studies experiment.

[§] Indicate the principal shift topics and estimated number of shifts required

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II. Machine Studies Assignments

Reserved for Project Management Team Use		
Topic ID		
Priority**		
Shift Assignments	Date	Shift

** Priority Scale:

1. Critical – results are necessary for preparation for subsequent down/run periods
2. Very high – results are strongly desired for achieving program milestones or in preparation for subsequent down/run periods
3. High – results are of immediate interest but not require
4. Moderate – results should be pursued at the first convenient opportunity
5. Low – results are not presently a high priority for either project milestones or planning