Modifications to the SLAC Linac for LCLS

Mark Woodley
Author

Paul Emma
Author

Eric Bong
Injector/Linac WBS Manager

David Schultz
E-Beam System Manager

Paul Emma
System Physicist

Darren Marsh
Quality Assurance Manager

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Brief Summary

This note describes modifications to the existing SLAC linac which are required for LCLS installation, based on the LCLS design of August 1, 2005 (LCLS01AUG05). Installation of completely new components, such as the off-axis injector, the X-band structure in LI21, and the bunch compressor chicanes (and their nearby new matching quadrupoles), is not discussed. Relocation of existing corrector dipoles is also not discussed. Assignments of klystrons and modulators to LCLS RF components are included.
Change History Log

<table>
<thead>
<tr>
<th>Rev Number</th>
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<th>Sections Affected</th>
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<tr>
<td>000</td>
<td>August 24, 2005</td>
<td>All</td>
<td>Initial Version</td>
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<tr>
<td>001</td>
<td>August 29, 2005</td>
<td>“Sector 24-25”</td>
<td>An error was corrected describing the installation of just one RF section. Now the text read: “Two standard 10-foot DLWG RF sections will be installed at 25-1c and 25-1d”</td>
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**Sector 20**

- the 20-6 klystron and modulator will be used to power the rf-gun
- the 20-7 klystron and modulator will be used to power the first L0 10-foot section (L0a)
- the 20-8 klystron and modulator will be used to power the second L0 10-foot section (L0b)
- the output power from the 20-5d RF section will be used to power the transverse deflecting structure, TCAV0, in the off-axis injector

**Sector 21**

- The 21-1b and 21-1c disk-loaded-waveguides (DLWGs) will be shortened from 10-foot sections (3.0441 m) to 9.4-foot sections (2.8692 m), as was done for SLC in sector 2 (e.g., 2-4a,b,c); five cells will be removed from the downstream ends of the structures, and the upstream ends will remain located precisely at their present positions (there will be a new quadrupole magnet and BPM installed between 21-1b and 21-1c, and between 21-1c and 21-1d, and an X and Y corrector dipole magnet placed adjacent to each new quadrupole); 50% of the power from klystron 21-1 will feed 21-1b, while 21-1c and 21-1d will each receive 25% (this is the present power feed arrangement, with no change necessary)
- The 21-3a 10-foot DLWG will also be removed to make room for new wire scanners; 50% of the power from klystron 21-3 will feed 21-3b; the power feeds to 21-3c and 21-3d will remain as they are (25% each)
- The 21-2 modulator will be used to power the X-band structure, through an XL4 klystron, immediately downstream of 21-1d
Sectors 24-25

- The 24-3d 10-foot DLWG will be removed to make room for a new wire scanner just upstream of quadrupole Q24401, as was done for SLC in sector 28 (e.g., 28-1); quadrupole Q24401 will remain where it is; 50% of the power from klystron 24-3 will feed 24-3c; the power feeds to 24-3a and 24-3b will remain as they are (25% each)

- The 24-4d 10-foot DLWG will be removed to make room for a new wire scanner just upstream of quadrupole Q24501; quadrupole Q24501 will remain where it is; 50% of the power from klystron 24-4 will feed 24-4c; the power feeds to 24-4a and 24-4b will remain as they are (25% each)

- The 24-5d 10-foot DLWG will be removed to make room for a new wire scanner just upstream of quadrupole Q24601; quadrupole Q24601 will remain where it is; 50% of the power from klystron 24-5 will feed 24-5c; the power feeds to 24-5a and 24-5b will remain as they are (25% each)

- Both 24-7 and 24-8 40-foot DLWGs, and all components in the 24-9 drift space, will be removed to make room for the BC2 chicane; linac quadrupole Q24701 will be replaced by two closely spaced (10 cm) ‘QE’ quadrupole magnets (with the first of the two unchanged in z-location and retaining its associated BPM); linac quadrupole Q24801 and its associated BPM will be removed as part of the BC2 installation; linac quadrupole Q24901 will be replaced by two closely spaced (10 cm) ‘QE’ quadrupole magnets (with the first of the two moved downstream in z-location by 2.397400 m, and the associated BPM placed in the second quadrupole).

- All NPI components (e.g., wrap-around quadrupoles) from the exit of the 25-1b DLWG to immediately upstream of linac quadrupole Q25701 will be removed (linac quadrupole Q25701 will not be altered)

- Two standard 10-foot DLWG RF sections will be installed at 25-1c and 25-1d (the old NPI injection point), making 25-1 a standard 40-foot accelerator section; each of the 10-foot DLWG sections (25-1a,b,c,d) will receive 25% of the power from klystron 25-1

- The 25-2d 10-foot DLWG will be removed to make room for an 8-foot transverse deflecting structure (presently in sector-29) just upstream of quadrupole Q25301; quadrupole Q25301 will remain where it is; 50% of the power from klystron 25-2 will feed 25-2c; the power feeds to 25-2a and 25-2b will remain as they are (25% each)

- The 24-8 klystron and modulator will be used to power the transverse deflecting structure, TCAV3, at 25-2d
• The 25-3d 10-foot DLWG will be removed to make room for a pulsed horizontal magnet (BXKIK) and an insertable OTR screen (OTR22) just upstream of quadrupole Q25401; quadrupole Q25401 will remain where it is; 50% of the power from klystron 25-3 will feed 25-3c; the power feeds to 25-3a and 25-3b will remain as they are (25% each)

Sector 27

• The 27-6d 10-foot DLWG will be removed to make room for a wire scanner just upstream of quadrupole Q27701; quadrupole Q27701 will remain where it is; linac wire scanner LI28 44 will be moved from the 27-9 drift section to this location; 50% of the power from klystron 27-6 will feed 27-6c; the power feeds to 27-6a and 27-6b will remain as they are (25% each)

Sector 28

• The 28-7d 10-foot DLWG will be removed to make room for a wire scanner just upstream of quadrupole Q28801; quadrupole Q28801 will remain where it is; linac wire scanner LI28 544 will be moved from 28-5d to this location; 50% of the power from klystron 28-7 will feed 28-7c; the power feeds to 28-7a and 28-7b will remain as they are (25% each)

• A standard 10-foot DLWG will be installed at 28-5d, making 28-5 a standard 40-foot accelerator section; each of the 10-foot DLWG sections (28-5a,b,c,d) will receive 25% of the power from klystron 28-5