



LCLS Physics Requirements Document # 1.3-010	Linac	Revision 0
<u>S-BAND RF REQUIREMENTS</u>		
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Brief Summary: This specification summarizes RF requirements for the S-band RF systems used in the L1, L2 and L3 LINAC sections.

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S-Band RF System Requirements

The LINAC sections L1, L2 and L3 are located as shown in Figure 1 and essentially comprise accelerating structures and klystrons from the existing SLAC LINAC.

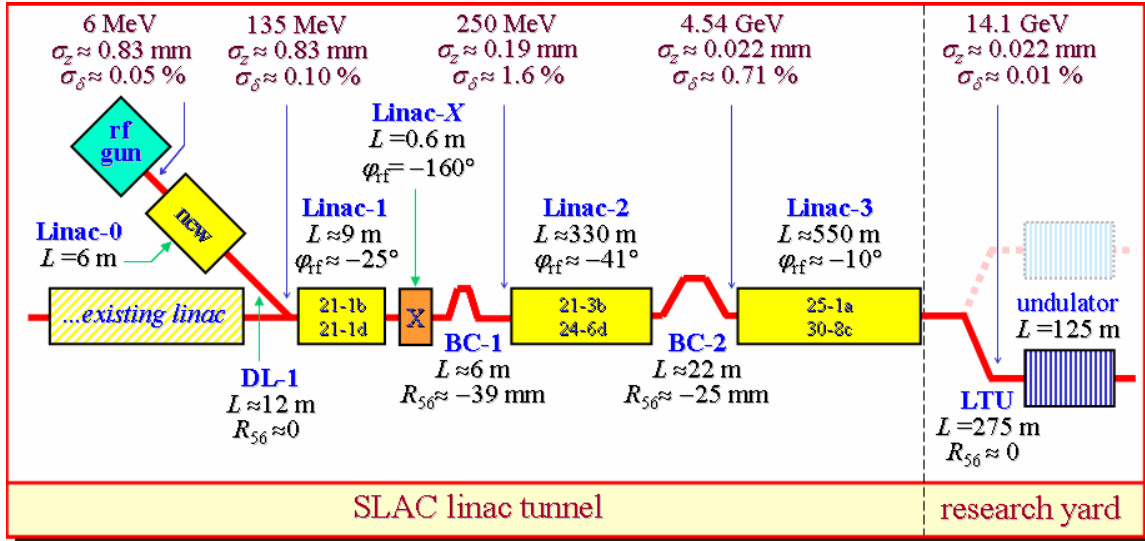


Figure 1 LCLS LINAC RF System Layout

Mark Woodley's note [1] details the modifications required for the various LINAC sectors (21-30) to achieve the required beam energies of 268 MeV from L1, 4.54 GeV from L2 and 14.1 GeV from L3. The phase and amplitude stability requirements for each LINAC section is shown in Table 1.

Table 1 S-Band RF System Stability Requirements

Parameter	Symbol	LCLS	Units
Mean L1 RF Phase	φ_1	0.1	deg
Mean L2 RF Phase	φ_2	0.07	deg
Mean L3 RF Phase	φ_3	0.15	deg
Mean L1 RF Amplitude	$\Delta V_1/V_1$	0.1	%
Mean L2 RF Amplitude	$\Delta V_2/V_2$	0.1	%
Mean L3 RF Amplitude	$\Delta V_3/V_3$	0.08	%

A single 5045 S-band klystron will feed 3 accelerating structures in L1 and will operate at ~5% below saturation to allow for sufficient amplitude feedback, whilst the phase stability margins will be met by precise feedback control of the klystron output phase, coupled with strict control of the accelerating structure frequency tuning by precise temperature regulation.

For the L2 LINAC section, 26 klystrons will be employed plus 2 klystrons as operational stand-by units if needed. All but 2 of the 26 klystrons will be operated in full saturation mode, whereby no amplitude feedback can be implemented for these klystrons. The remaining 2 klystrons (at the end of L2) will operate in a similar way to the klystron in L1 i.e. at ~ 5% below saturation to enable amplitude feedback regulation at high energy. Global phase control will be made with phase-feedback on final sector in L2 to provide precise control of the average L2 phase.

The LINAC L3 section will operate with 45 klystrons (plus 3 stand-by) and in a similar manner to that of L2, amplitude control will be performed using the last 2-3 klystrons at high energy and global phase control will be done on the final sector in L3 to ensure that the average L3 phase stability meets LCLS requirements.

[1] M Woodley note, "Modifications to the SLAC LINAC for LCLS", March 7th 2002.