

KLC-Note 1
SLAC
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- I. NLC SCENARIOS
- II. RF SYSTEM STATUS: NOW, EXPECTED BY LC'95, AND
PROJECTED FOR THE NLC

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Table I
NLC Scenarios

Center-of-Mass Energy	NLC-I		NLC-II			
	0.5 TeV	1.0 TeV			1.5 TeV	
	A	B	C	D	E	F
Active Str. Length (km)	13.6	15.7	13.9	21.0	21.0	25.0
Accel. Grad. ⁽¹⁾ (MV/m) Unloaded/Loaded	50/37	88/66	100/74	67/55	100/74	34/62
No. of 7.2 m Modules	1890	2180	1930	2910	2910	3472
Particles per Bunch (10^{10})	0.65	1.15	1.30	0.87	1.30	1.09
Repetition rate (Hz)	180	120	120	120	120	120
Bunches per RF Pulse	90	75	75	75	75	75
RF Pulse Length (ns)	250	225	225	225	225	225
Pulse Comp. System(')	SLED-II X5	SLED-II X5	BPC x s	BPC X8	BPC x s	BPC X8
Pulse Comp. Pwr. Gain ⁽³⁾	3.6	3.6	6.5	6.5	6.5	6.5
Kly. Pulse Length (μ s)	1.25	1.13	1.8	1.8	1.8	1.8
Kly. Peak Power ⁽⁴⁾ (MW)	48	2 x 75	107	47	107	75
PFN Stored Energy (J) per Module ⁽⁵⁾	253	658	605	266	605	426
Net RF Sys. Efficiency(')	0.325	0.35	0.50	0.50	0.50	0.50
Wall Plug Power (MW)	91	197	144	95	216	181

- (1) Threshold gradient for dark current capture is 61 MV/m.
- (2) If a X-SLED-II system is used for cases C, D, E and F, the klystron peak powers become: 193 MW, 85 MW, 193 MW and 135 MW respectively. The net rf system efficiency is reduced from 50% to 44% and the wall plug powers become: 162 MW, 106 MW, 241 MW and 204 MW.
- (3) Includes allowance for power transmission loss.
- (4) Assumes 2 klystrons per 7.2 m module.
- (5) For cases C through F (grid-switched klystron) this is the switched energy assuming 2-1/2% switching loss. It is assumed that storage element (containing perhaps 5 times switched energy) is charged with 2-1/2% loss from AC line.
- (6) Case B assumes NLC-I efficiencies for klystron and pulse compression.

Table II
Summary of RF System Status

	Now ⁽¹⁾ (7/94)	LC'95 ⁽²⁾ (3/95)	NLC/Proposal ⁽³⁾ (7/96)	NLC-II ⁽⁴⁾ (>2000)
Klystron Peak Power (MW)	50	50	50	75
Klystron Pulse Length (μ s)	1.5	1.5	1.25	1.8
Klystron Efficiency	0.43	0.50	0.60	0.65
Modulator Efficiency	0.60	0.60	0.75	0.95
Pulse Compression Efficiency (Incl. Power Transmission)	0.56	0.66	0.72	0.81
Net RF Efficiency	0.145'	0.20**	0.325	0.50

*Decreases to 9.9% with 2 x 25 kW klystron focus solenoids per 7.2 m module.

** Decreases to 12.2% with klystron solenoids included.

Notes

- (1) Klystron: demonstrated. Modulator: Cassel simulations of NLCTA mod. give $\eta = 0.55$ to 0.70 , depending on series inductance. Pulse compression: based on sum of measured components.
- (2) Klystron: estimated performance of XL-2 from simulations; parameters for NLCTA. Modulator: same as (1). Pulse compression: assumes improved power transmission efficiency with "tuning" of line sections between flower petal mode converters.
- (3) Klystron: Based on simulations of low perveance PPM focused tubes. Modulator: Based on Cassel simulation of high-efficiency modulator (SLAC-PUB-5851); efficiency will be demonstrated with operating prototype by LC'95. Pulse compression: assumes further improvements in FP converter.
- (4) Klystron: grid-switched beam with 95% switching η . Pulse compression: 3-stage BPC with loaded delay lines and $\eta = 0.95$ per stage. Power transmission: $\eta = 0.94$, same as (3). If a X5 SLED-II pulse compression system is used, RF efficiency is 44% and klystron peak power is 135 MW.