TRC R2 # 2

> These klystrons should be tested with the NLC modulator (at full specs and including arcing tests) and form part of a linac subunit test. The latter should also comprise the dual-moded SLED-II complete system, several damped and detuned structures, installed in the accelerator environment (with temperature control, for instance), and LLRF and controls systems. The test should be made with beam. The present plan is to perform this sort of test with a full girder of structures (some of them being detuned and damped) in 2004.

Summary:

The 8-Pack project at SLAC in Phase I has successfully met the R1 #2 requirement by generating 475MW (580 MW was stably attained) 400 ns pulses in the SLED-II pulse compression system. In 2004, the GLC/NLC groups will proceed with Phase II of this project, to address the R2 #2 issues by pursuing two separate paths, which will culminate in a test of a full GLC/NLC rf unit:

1. High power RF components will be added to take the power from the existing SLED-II system into the NLCTA beam housing, and distribute it to four 60-cm long structures (Phase IIa) and later to 8 structures (Phase IIb). The plan is to operate the system for 2000 hours through the spring and summer of 2004.
2. A prototype NLC '2-pack' modulator with two PPM klystrons will be operated separately starting in spring 2004. Power from this system will later be directed to the SLED-II system and structures, possibly starting in late 2004.

Expected R&D:

The SLED-II system, as built for Phase I, continues to be a core part of the test facility in Phase II. It will still use four 50 MW SLAC XL4 klystrons, which are very reliable. They have not shown any operational problems in a decade of operation at NLCTA and other test stands, and can deliver more than enough power to perform all aspects of the Phase II tests. The existing modulator will also be used, although it is limited in repetition rate to 60 Hz due to cooling issues with the IGBTs.

The high power rf components needed to bring the power from the SLED-II system to the structures have been designed and are in fabrication. The majority of the components are identical to elements which are now in use in the SLED-II system or in the NLCTA, and have thus been fully tested. Successful designs of Phase I components with some improvements are applied to the Phase II power splitters. These will be rf cold tested starting in January 2004.

The control system built for Phase I is fully capable of conducting Phase II operation. The LLRF system will continue to undergo development (as it has in Phase I) as the functional requirements for operating the SLED-II system become better understood.

The four accelerator structures installed initially (Phase IIa) will be units which have been previously high-power processed in the High Gradient Structure program at NLCTA. The structures currently available include several which are damped and detuned. The installation of the second half of the 8 structures (Phase IIb) will occur later in 2004, coordinated with the schedule of the High Gradient Structure program which shares the same beam line housing. The structures to be installed are physically interchangeable, and it will be desirable to install structures which are electrically equivalent as soon as a full complement becomes available.

Permanent magnet klystrons will be life-tested in this same time period with the new '2-Pack'

modulator. A discussion of this program is included in the section on R2 #1. The 2-Pack modulator is the next generation solid state device, designed to power two PPM klystrons at full power and repetition rate. The modulator has already been assembled and is currently being commissioned. The PPM klystrons have been shown to be capable of delivering the peak and average power required for the GLC/NLC. The candidate klystrons for this program will first be tested individually at full power. Ultimately the power from two klystrons driven by this modulator will be directed to the SLED-II system and used to power the accelerating structures, replacing the four 50MW XL4 tubes and the present modulator. This change could occur late in calendar 2004.The table below summarizes the hardware configurations for the different phases of the project and expected completion dates.

	Achieved	In Progress	In Preparation	
	Phase-I	Phase-IIa	Phase-IIb	2-Pack
Klystrons	4 x Solenoid-focusing type (50MW, 1.6μs)	4 x Solenoid-focusing type (50MW, 1.6μs)	4 x Solenoid-focusing type (50MW, 1.6μs)	2 x PPM-focusing type (75 MW, 1.6μs)
Modulator	IGBT-based ('8-pack')	IGBT-based ('8-pack')	IGBT-based ('8-pack')	IGBT-based ('2-pack')
SLED-II	Fully installed (max 580 MW, 400ns at 30 Hz)	Fully installed (580 MW, 400ns at 60 Hz)	Fully installed (580 MW, 400ns at 60 Hz)	Not connected
Acc Structure	Not connected	4 x 60cm structures with HOM damping and detuning (60 – 65 MV/m)	8 x 60 cm structures with HOM damping and detuning (60 – 65 MV/m)	Not connected
LLRF, I&C	Fully installed	Fully installed	Fully installed	Minimal
Beam	None	Yes	Yes	None
Date	Dec. 2003	Scheduled for April, 2004	Scheduled for Summer, 2004	Spring, 2004
Note	R1 #2 achieved	2.4m-long active acceleration section	4.8m-long active acceleration section. One full unit at NLC/GLC	Parallel effort. Will connect to SLED-II system when ready.

References:

"8-Pack Phase 2 Update", D. Schultz, at ISG-XI meeting (12/03)
http://www-proc.kek.jp/Str/8-Pack%20Phase%202%20update%20-%20ISG.pdf
"DFM Induction Modulator program", R. Cassel, at ISG-XI meeting (12/03)
http://www-proc.kek.jp/ISG-XI%20Proc/WG%20f/Modulator-2-Pack%20discussion.pdf