High Power Tests at NLCTA: 800 MW Component Test and Eight-Pack System Test
Next Linear Collider Test Accelerator: Exterior Rear View

Proposed Eight-pack Site

800 MW Test Site
NLC Main Linac
Two Mode RF Power Flow

Eight klystrons each provide 75MW, 3µsec

Power combined in Cross Potent, each arm’s output is 300MW, 1.5µsec, 450 Joules

Power combined again in Launcher, each arm’s output is 600MW, .76 µsec, 450 Joules

Extractor redirects one mode into a new feed, the other mode continue unperturbed

600MW $TE_{12}$ or $TE_{01}$

To accelerator structures
800 MW DLDS Component Test

- **Purpose:**
  To provide a high power test of critical Delay Line Distribution System components
- **Will include:**
  - Circular to Rectangular Taper
  - Launcher Assembly
  - Extractor Assembly
  - Two-mode Pumping Ports
  - Two-mode Flange
  - High Peak Power Load
- **Test site:**
  - NLCTA Test Facility
High Power Test of DLDS Components in NLCTA Planned for 2001

- 11.424 GHz RF Reference
- Station Phase Control
- RF Amplitude Control
- TW Ts
- Relative Phase Control
- 50 MW XL4 Klystrons

Launch TE01 or TE12 Modes

400 MW

800 MW, 0.25 s 200 J

200 MW, 1.5 s 300 J

450 J thru DLDS Components
225 J from 75 MW PPM

NLC

K. Fant
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DLDS Components High Power Test

(Red indicates components seeing 800MW)

- New High Power Load
- WC 293 Pump Port
- Circular Directional Coupler
- WC 160 Pump Port
- WC 160 Waveguide
- WC 293 Waveguide
- Square Bend
- 100MW Load
- Rectangular Directional Coupler
- Launcher

Phase 1: Components transmit modes TE01 & TE11
Phase 2: Components transmit modes TE01 & TE12

From SLED System
400 MW max
250 nsec

From SLED System
400 MW max
250 nsec
800 MW Test Site

- Existing Station 2 RF Feed
- Station 1 RF Feed
- Launcher and Extractor Location
- SLED Lines
800 MW Critical Issues

- Cold test the circular to rectangular two-mode taper
  - Novel device, tight tolerances for RF and manufacturing
  - Two designs available, “best” selection required for launcher & extractor

- Design and fabricate new high power load (600-800MW)
  - Cost Savings: Test requires sixteen 100MW loads at cost of $250K
  - Improved Reliability: 100MW loads tested to 100MW at 300nsec and 50MW at 1500nsec. Successful peak power, but some erosion at posts and likely average power problems
Cold Test of Circular to Rectangular Taper

Mode Conversion from TE01 to TE20

Mode Conversion from TE11 to TE10
Test Layout with Load Trees
800 MW Test Status and Plans

- FY01:
  - Design and build phase 1 components (~$670K)
    - Finish RF design (80% complete)
    - Finish mechanical design (5% complete)
    - Fabricate components (0% complete)
    - Cold test components
- FY02:
  - Install and test Phase 1 components (Modes TE01 & TE 11)
  - Design and fabricated Phase 2 components (Modes TE01 & TE12)
- FY03:
  - Install and test Phase 2 components
  - Prepare for 8-pack test
Eight-Pack System Test

• **Purpose:**
  To provide an integrated test of Main Linac RF components

• **Will include:**
  – Induction Modulator
  – Eight Klystrons assembled into Two-pack Assemblies
  – Low Level RF Control Systems
  – Two-Mode DLDS Feed
  – High Gradient Accelerator Structures on girders

• **Test Site:**
  – NLCTA Test Facility
    • Substantial infrastructure improvements required
Eight Pack System Test

- IGBT Modulator
- Four Two-Pack Klystrons
- DLDS Two Mode RF Feed
- Accelerator Structures
Eight-Pack System Test

Critical Issues

• Resources:
  – Funding levels (multi-million $ project)
  – Increases needed in engineering and design personnel
• Industrial development & delivery klystrons
• Successful DLDS high power component test
• Continuing structures development & production
Eight-Pack Test Status and Plans: FY01

- **Klystrons:**
  - Test XP-3’s
  - Design XP-4
  - Design Two-pack assembly (klystron)

- **Modulators:**
  - Design and procure parts for 8-Pack Modulator
  - Design Two-pack assembly (modulator)

- **DLDS:**
  - High power test of components
  - Design two-mode arm for 8-pack

- **Structures:**
  - Continue high gradient studies
  - Design high gradient structure

- **Facilities:**
  - Design facilities for 8-pack
Eight-Pack Test Status and Plans: FY02

- **Klystrons:**
  - Build and test XP-4
  - Contract eight XP-4’s to industry
  - Build Two-pack assembly (klystron)

- **Modulators:**
  - Build & test subassemblies for 8-Pack Modulator
  - Build Two-pack assembly (modulator)
  - Assemble and install 8-Pack Modulator at NLCTA

- **DLDS:**
  - Continue high power test of components, improve design as required
  - Build two-mode arm for 8-pack

- **Structures:**
  - High gradient long-term testing, continued structure production
  - Design high gradient structure girder

- **Facilities:**
  - Procure and install facilities for 8-pack
Eight-Pack Test Status and Plans:
FY03

- **Klystrons:**
  - Receive and test XP-4’s from industry
  - Assemble Two-packs (klystron)
  - Install at Two-packs NLCTA (as available)
  - Install TWT’s
- **Modulators:**
  - Commissioning 8-Pack Modulator with water loads at NLCTA
  - Install Low Level RF, test new controls
  - Commissioning 8-Pack Modulator RF tubes at NLCTA
- **DLDS:**
  - Install two-mode arm for 8-pack
- **Structures:**
  - Build high gradient girder for NLCTA
  - Install high gradient girder at NLCTA
- **Facilities:**
  - Begin system test