



NLC - The Next Linear Collider Project

NLC All Hands

“Views from a Rocky Mountain High”

D. L. Burke

August 9, 2001

Views from a Rocky Mountain High



SNOWMASS 2001

the future of particle physics

A great success ...

“At Snowmass 2001, a widespread feeling has emerged that the world community should move urgently to construct a TeV-scale linear collider as an international project.”

– Chris Quigg (Fermilab), Snowmass 2001 Chair

“Plans for Next Big Collider Reach Critical Mass at Snowmass”

– Science Magazine

“There are fundamental questions ... that cannot be answered without a physics program at a Linear Collider overlapping that of the Large Hadron Collider. We therefore strongly recommend the expeditious construction of a Linear Collider as the next major international High Energy Physics project.”

– *ad hoc* statement of all Physics Working Groups at Snowmass

Views from a Rocky Mountain High



SNOWMASS 2001

the future of particle physics

We learned a lot ...

“The NLC/JLC-X and TESLA designs and technology are sufficiently developed and either could be used to build a 500 GeV collider.”

– Summary of the Linear Collider Working Group

R. Brinkmann, T. Raubenheimer, N. Toge, Chairs

A terrific job.

A major goal for us was to learn about TESLA – and we did ...

Superconducting gradients – excellent progress.

Site preparation in Hamburg well advanced.

Still 2-3 years away from demonstrating the cryo-module that
is the basic building unit of the 500 GeV cms accelerator.

Major issues in beam dynamics in sources, linac, and IR.

Views from a Rocky Mountain High



SNOWMASS 2001

the future of particle physics

Some observations ...

The physics case is made.

... the SLC/SLD is an essential part of this.

JoAnne Hewett was a rock.

The Young Physicist's Forum (no, Tor Raubenheimer is not a young physicist) was instrumental in getting the U.S. community off its ass ...

... they want something better than second-class.

We have company.

TESLA is both a big plus, and a tough competitor.

Past accomplishments will not guarantee future leadership.

... we have achieved a lot, but still have work to do.



Views Beyond a Rocky Mountain High

Pursuit of a broad R&D program has made excellent progress ...

Electron polarization and positron target analysis.

Damping ring design and ATF results.

X-Band power sources.

Main linac rf timing and phase control.

Accelerator structure design and manufacture.

BBA and dispersion-free steering.

Collimation.

Final focus and IP design.

Ground motion, component stabilization, and fast beam feedback.

Beam instrumentation.

YY

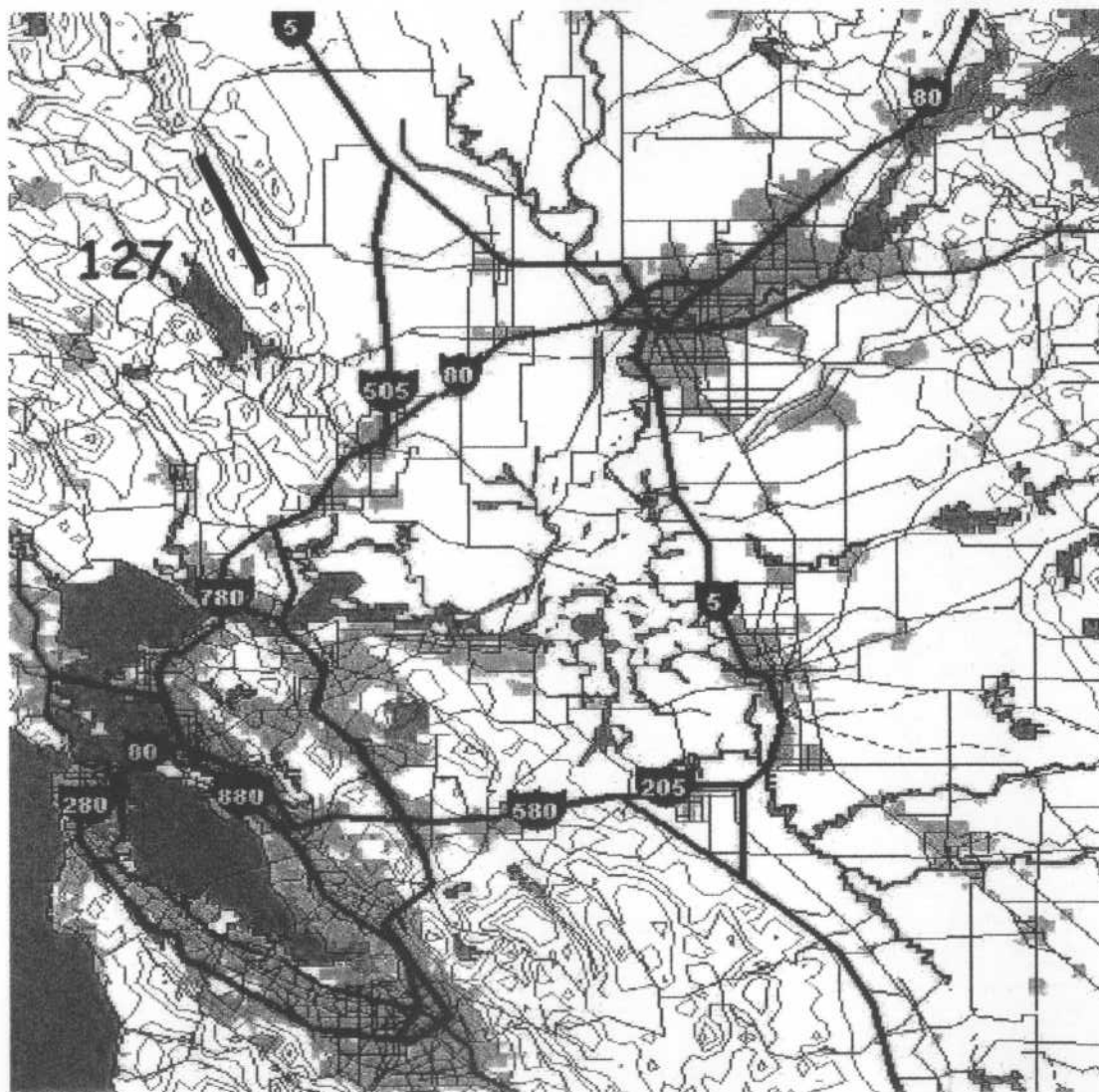
Conventional construction.

Mature overall configuration and design.

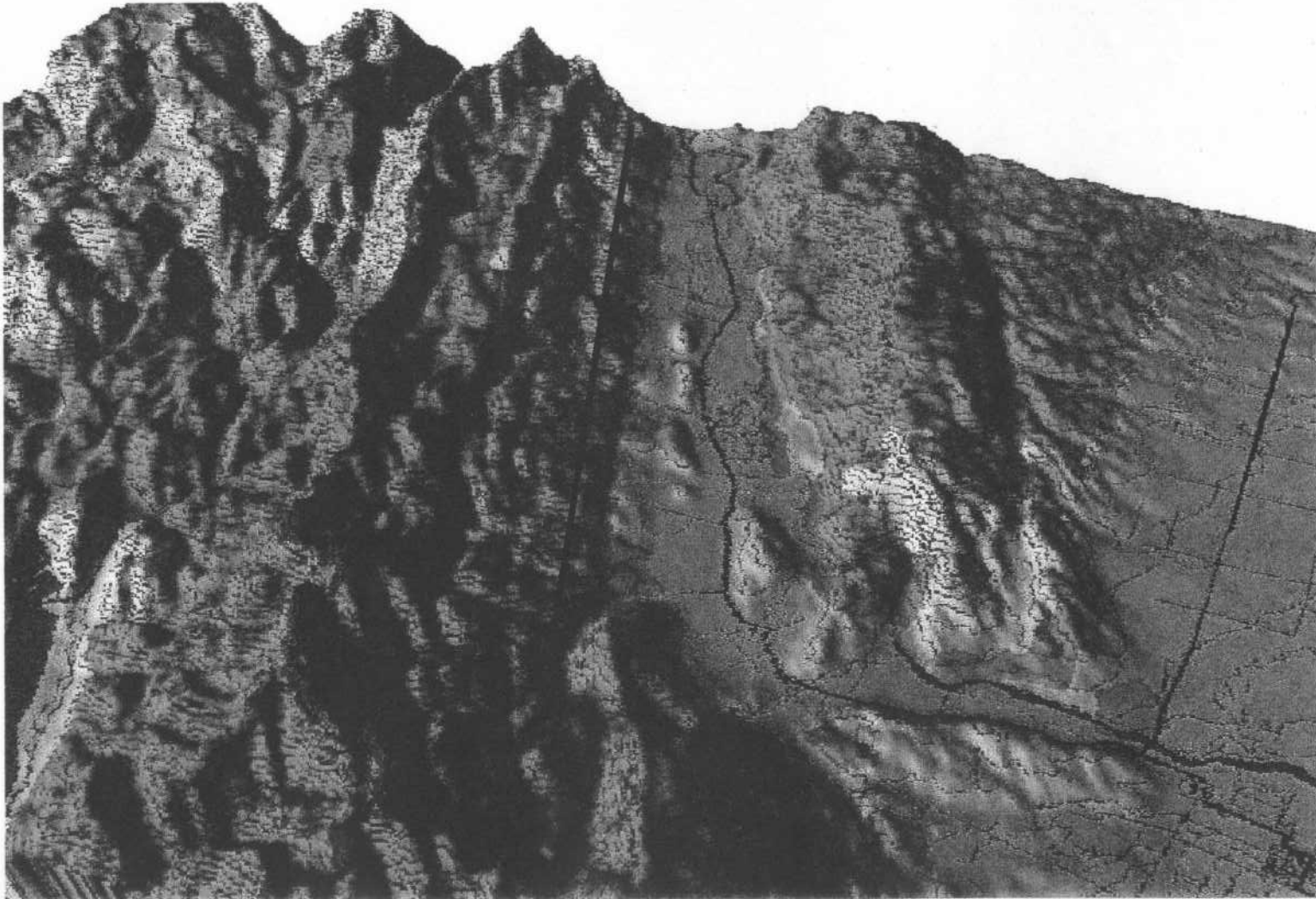
... no one else out there comes even close!

... and yes, we have a site ...

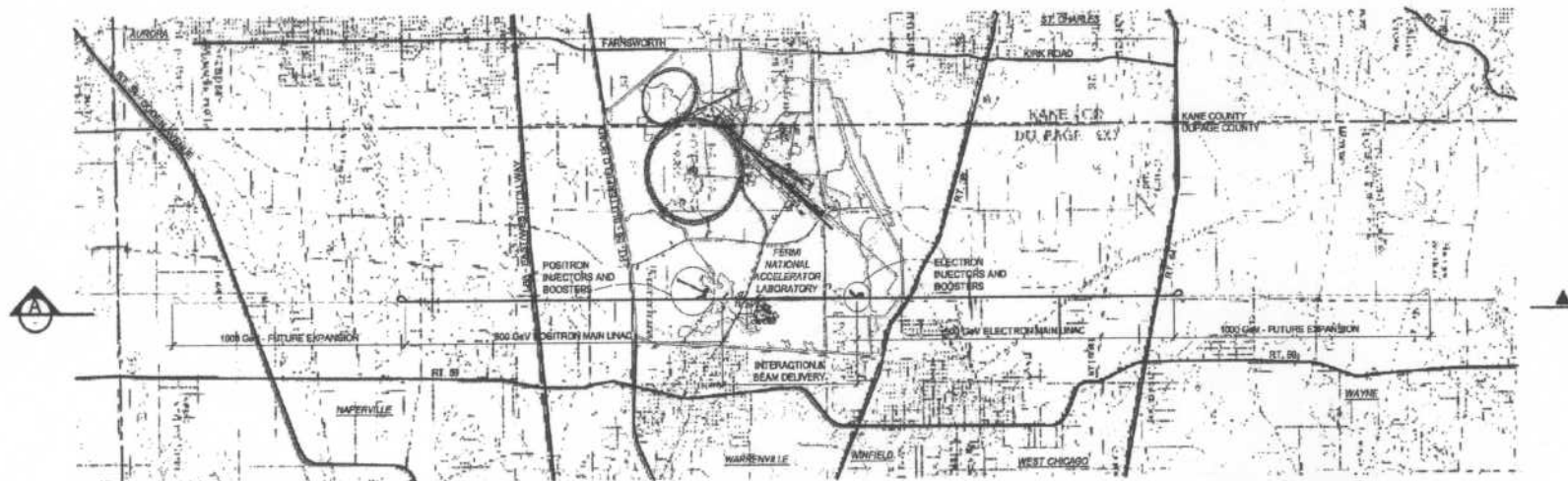
NLC in California



Site 127

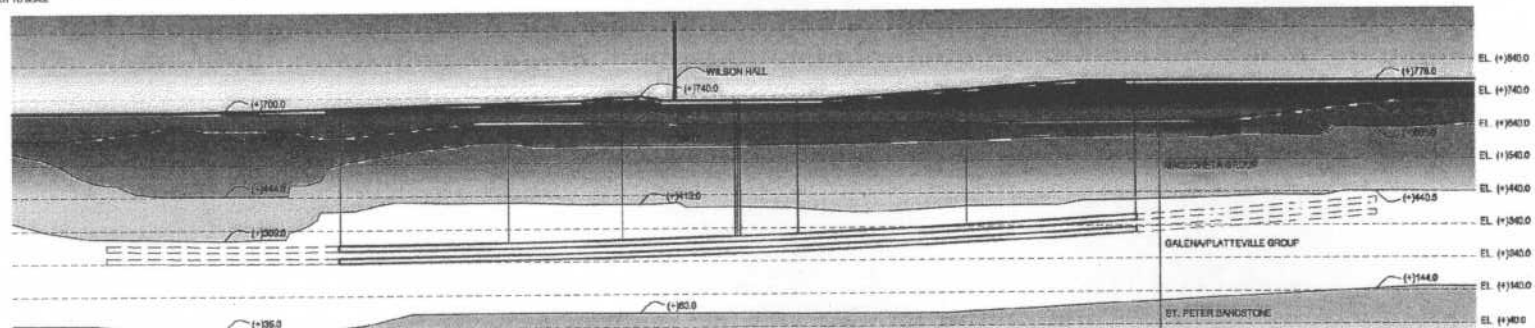


Fermilab "N-S" Deep Tunnel Study



OVERALL PLAN

NOT TO SCALE



OVERALL SECTION

NOT TO SCALE



NOTE: ELEVATIONS DERIVED FROM A SECTION AT THE CENTER OF THE TUNNEL

NOTE: VERTICAL DIMENSIONS ARE EXAGGERATED BY 20 TIMES

Views Beyond a Rocky Mountain High

We must, however, solve the accelerator gradient problem ...

The aggressive program of the past year will continue.



The Slide

And we are ready to begin integration of the “TeV” rf system ...

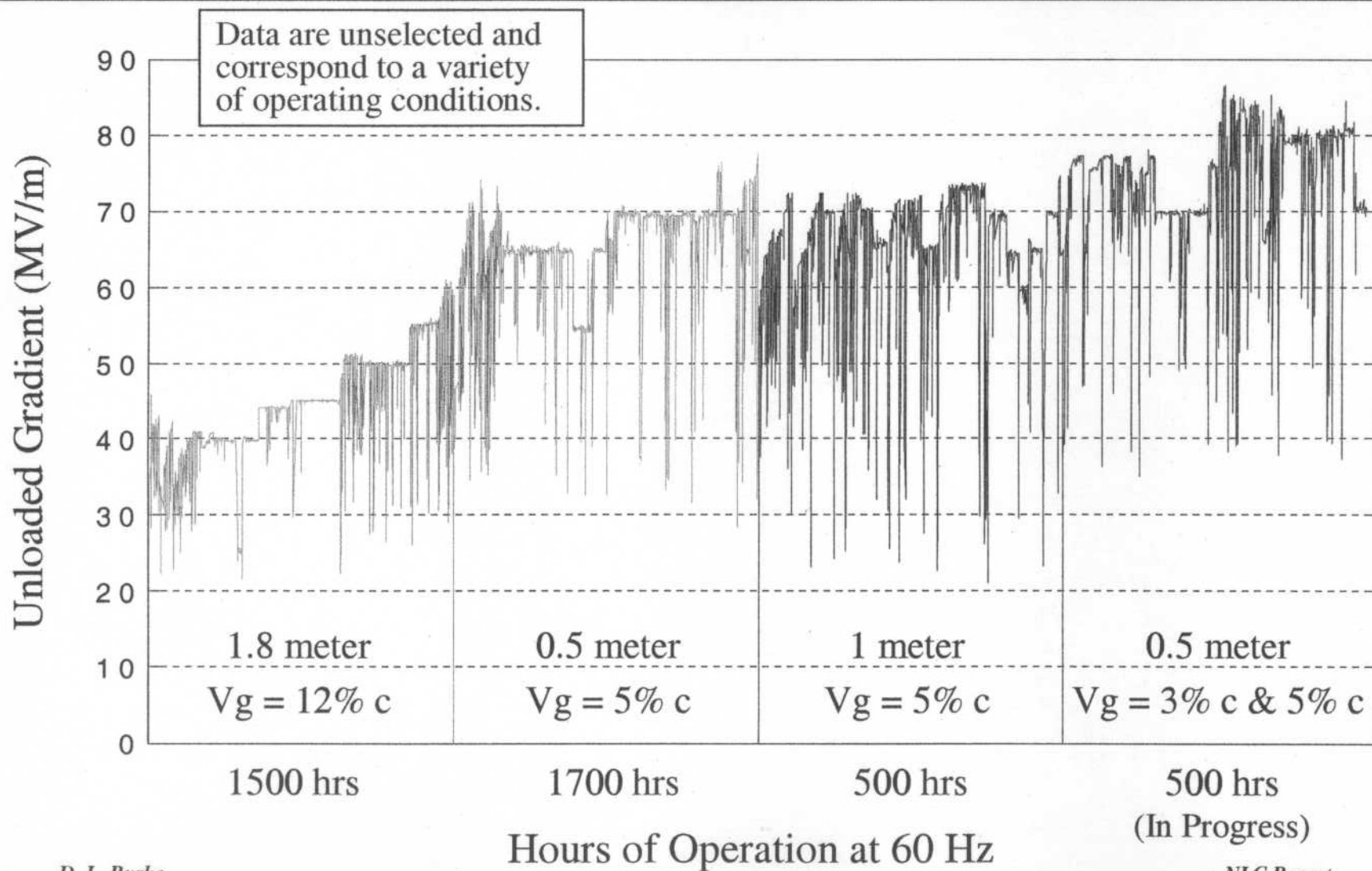
The “8-Pack” Project.

Demonstrate before the end of FY02 the capability to build a 500 GeV linear collider.

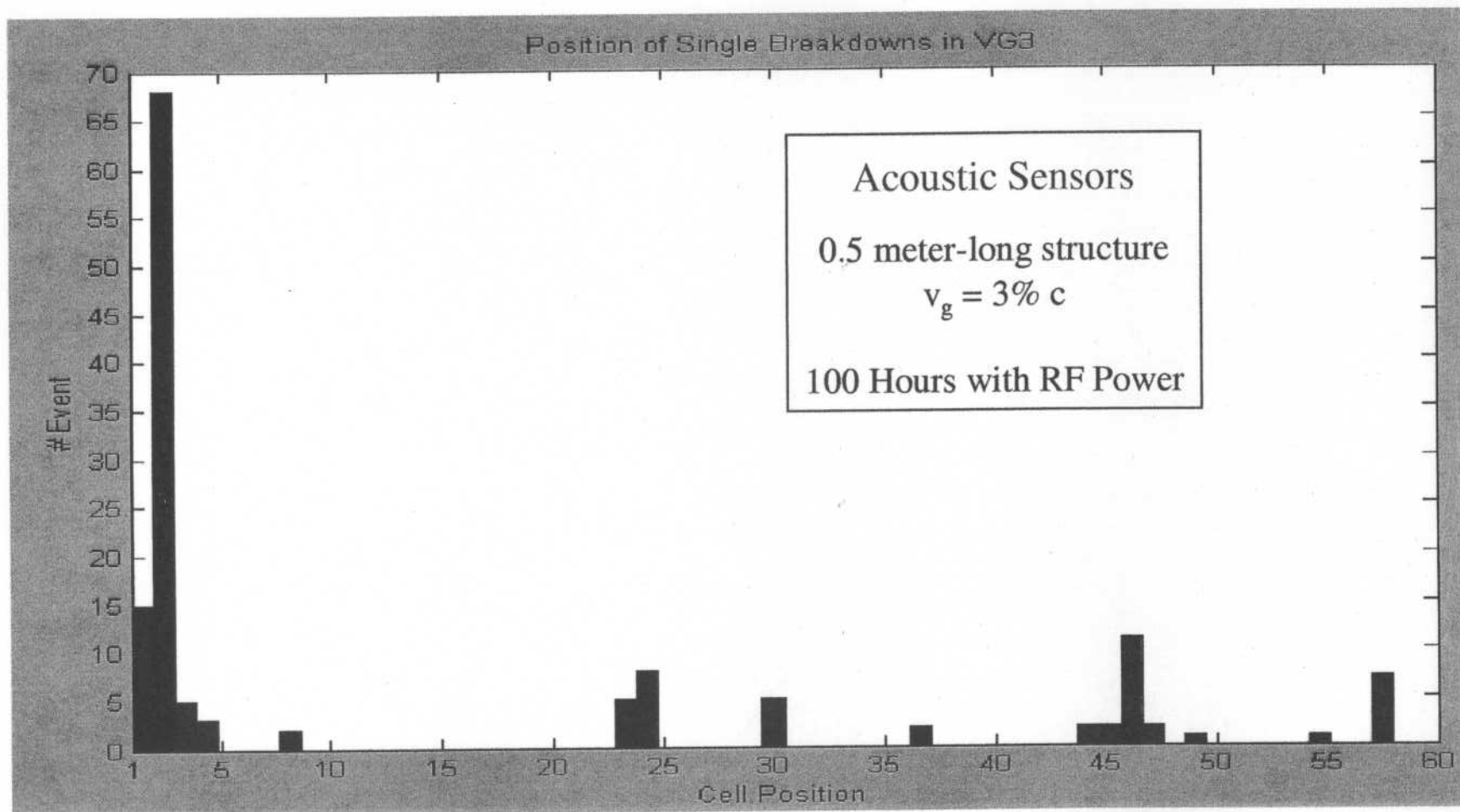
Demonstrate before the end of FY03 the NLC rf system optimized for 1 TeV center of mass energy.



Operational History of Test Structures



Localization of Breakdowns Along the Structure



High-Gradient R&D

Summary

- We are not “home” with this problem. Work continues on all fronts: theory and modeling, accelerator design, manufacture/QC, and operations.
- We are confident that technology optimized for construction of a 1 TeV collider will be demonstrated soon.
- We have manufactured and tested meter-long structures (with $v_g < 5\% c$) that reach our design goal of 70 MV/m -- but there is little overhead.

We are testing standing-wave structures, and will bring on-line in September a traveling-wave structure with an improved input coupler.

Fabrication of advanced traveling-wave and standing-wave structures has started, and these will be in test by the end of the year.

NLC Linac RF Unit

Low Level RF System

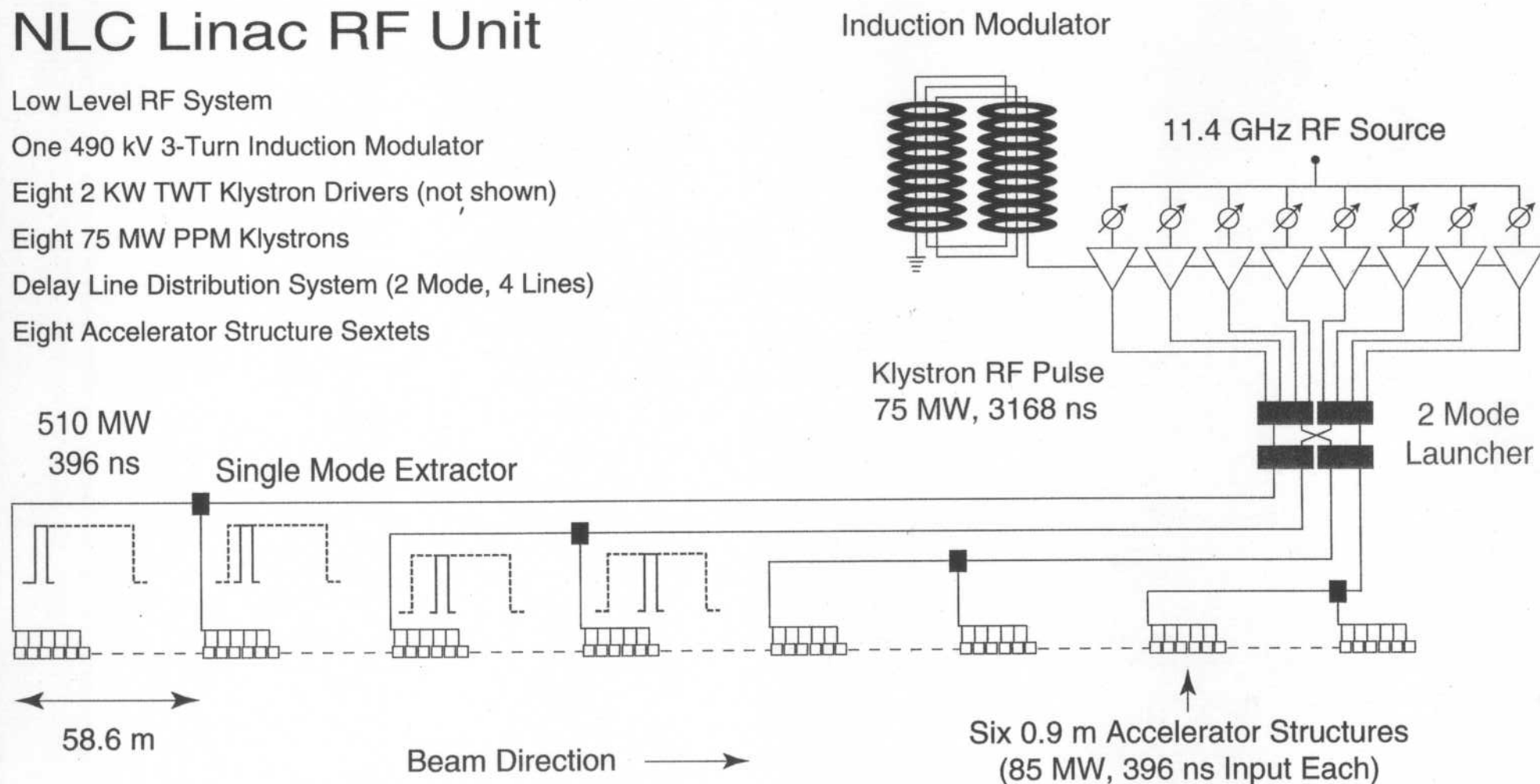
One 490 kV 3-Turn Induction Modulator

Eight 2 KW TWT Klystron Drivers (not shown)

Eight 75 MW PPM Klystrons

Delay Line Distribution System (2 Mode, 4 Lines)

Eight Accelerator Structure Sextets



NLCTA RF System Test Setup

Low Level RF System

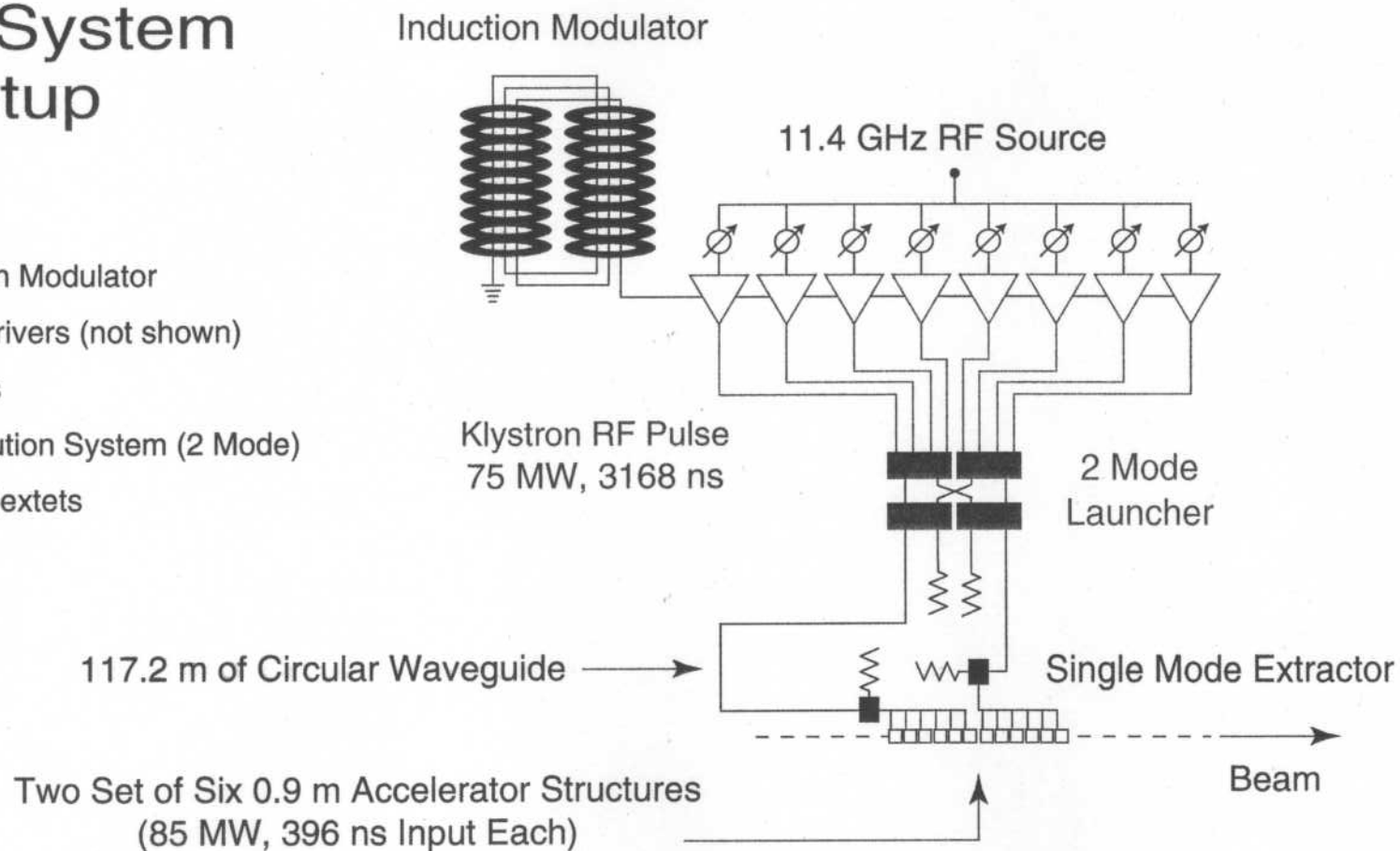
One 490 kV 3-Turn Induction Modulator

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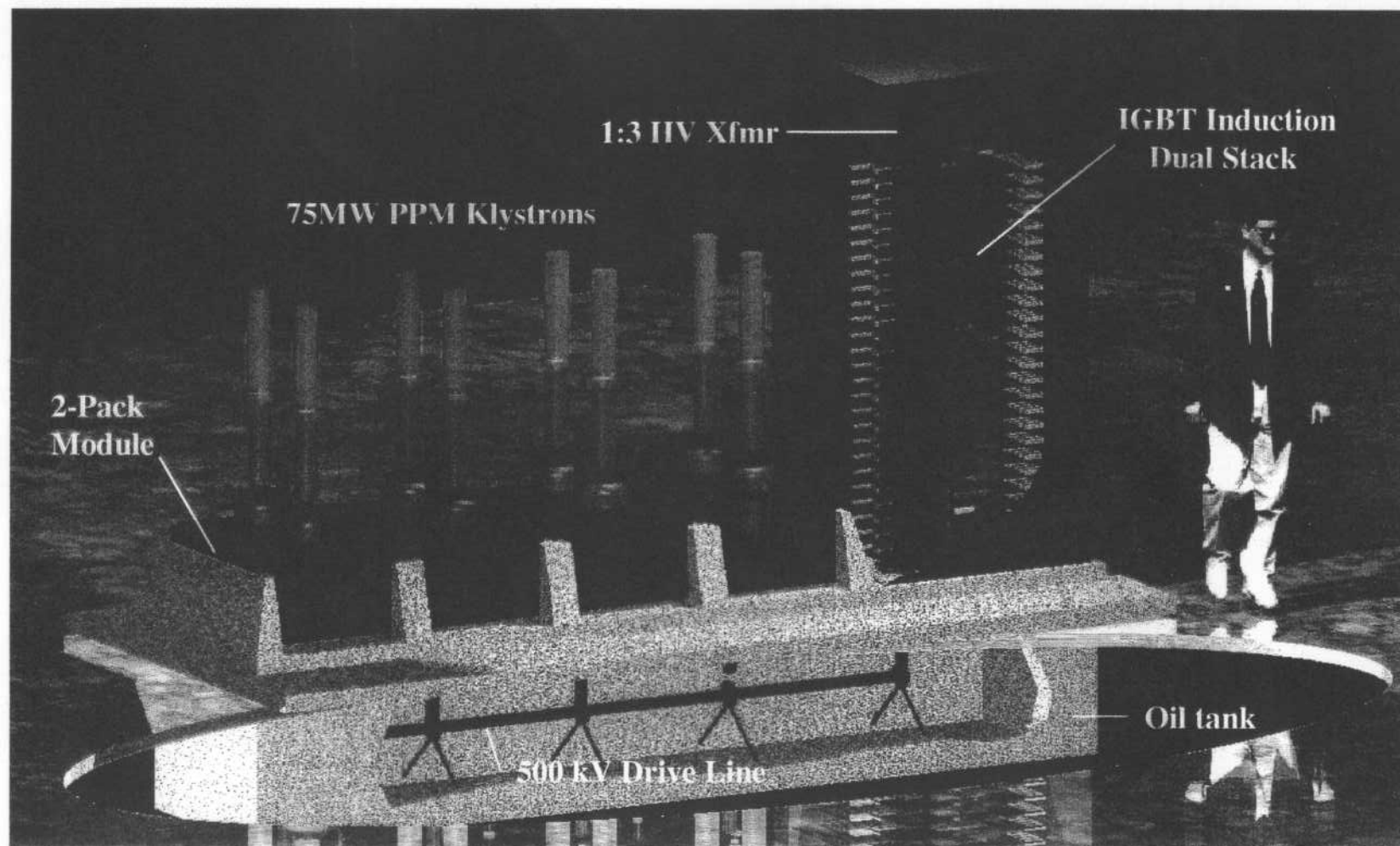
Reduced Delay Line Distribution System (2 Mode)

Two Accelerator Structure Sextets



NLC - The Next Linear Collider Project

Solid-State Induction Modulator-Klystron 8-Pack

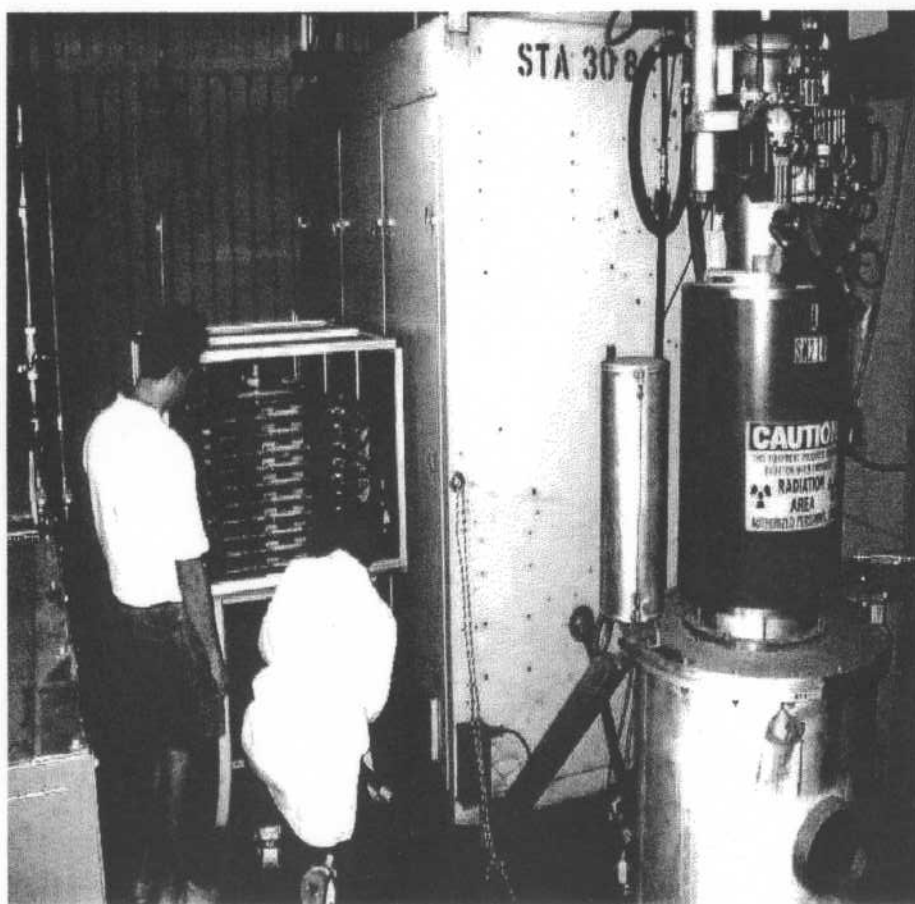


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NLC Report

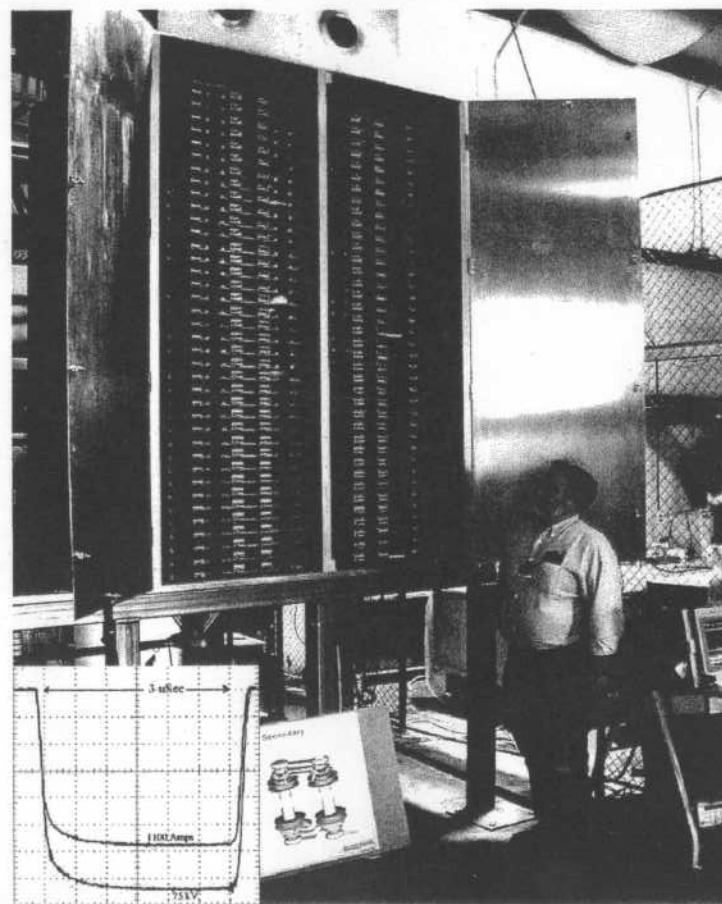
Solid-State Induction Modulator R&D

10-Stack in Linac Gallery



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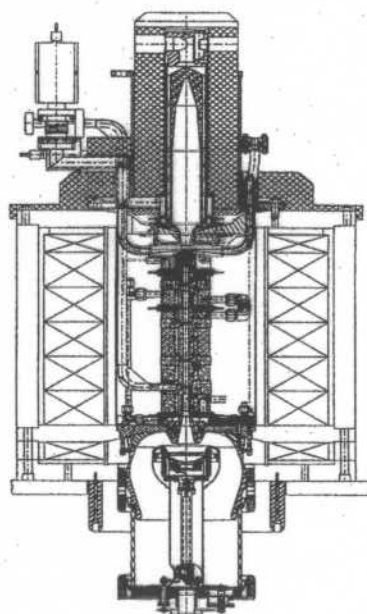
Full-Scale Prototype



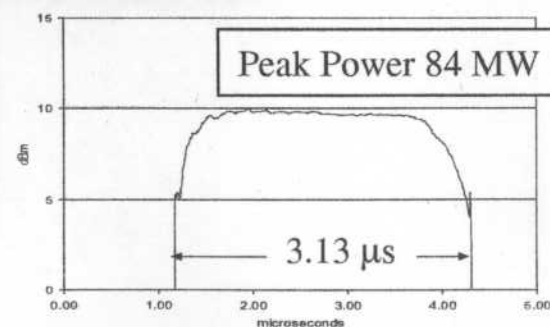
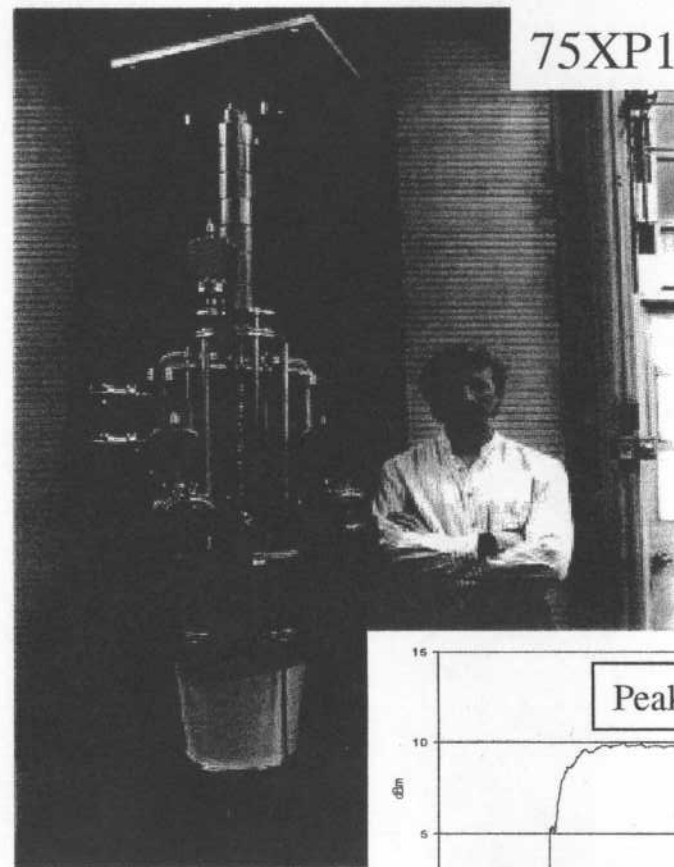
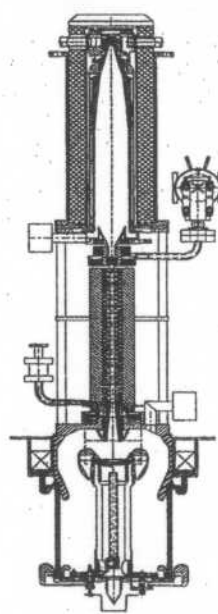
NLC Report

Permanent Magnet Focused (PPM) Klystrons

Solenoid-Focused
Workhorse



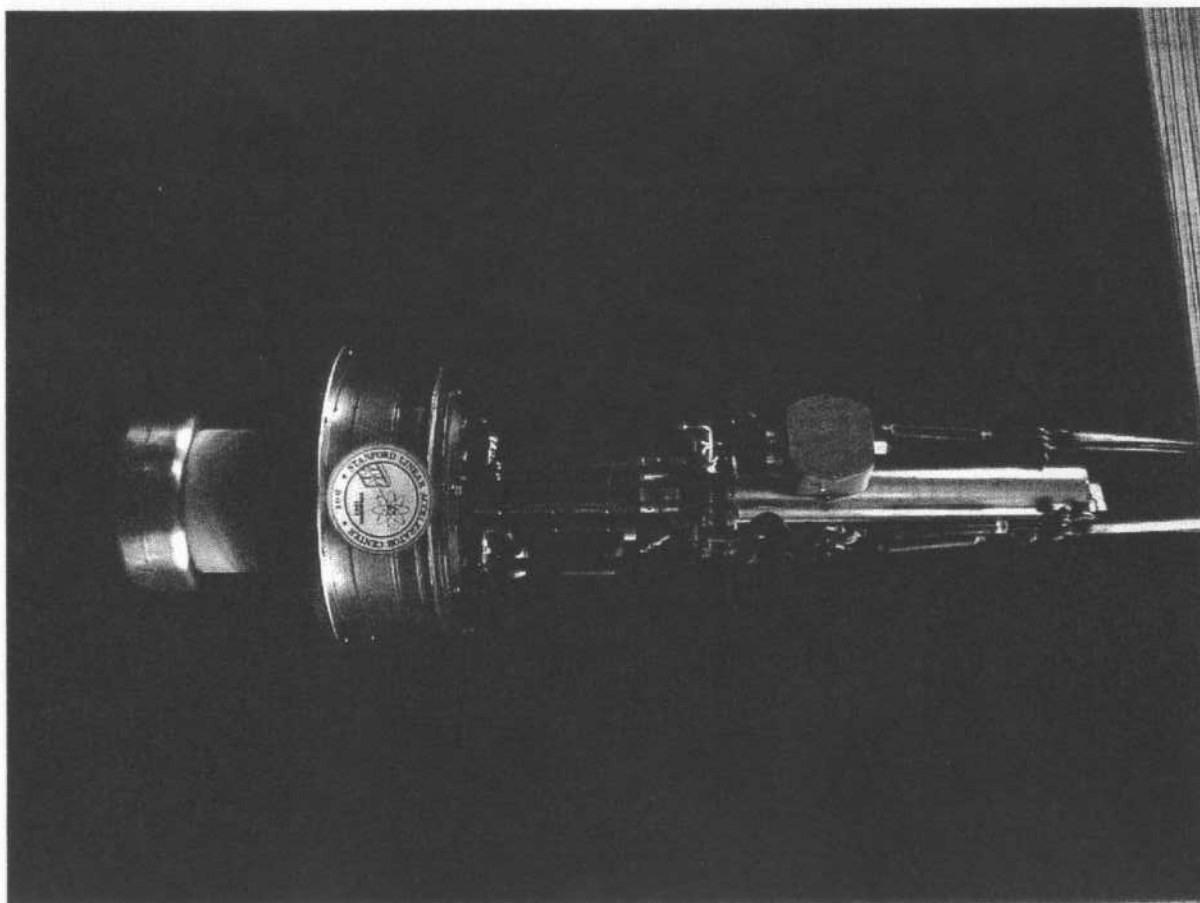
PPM
Development



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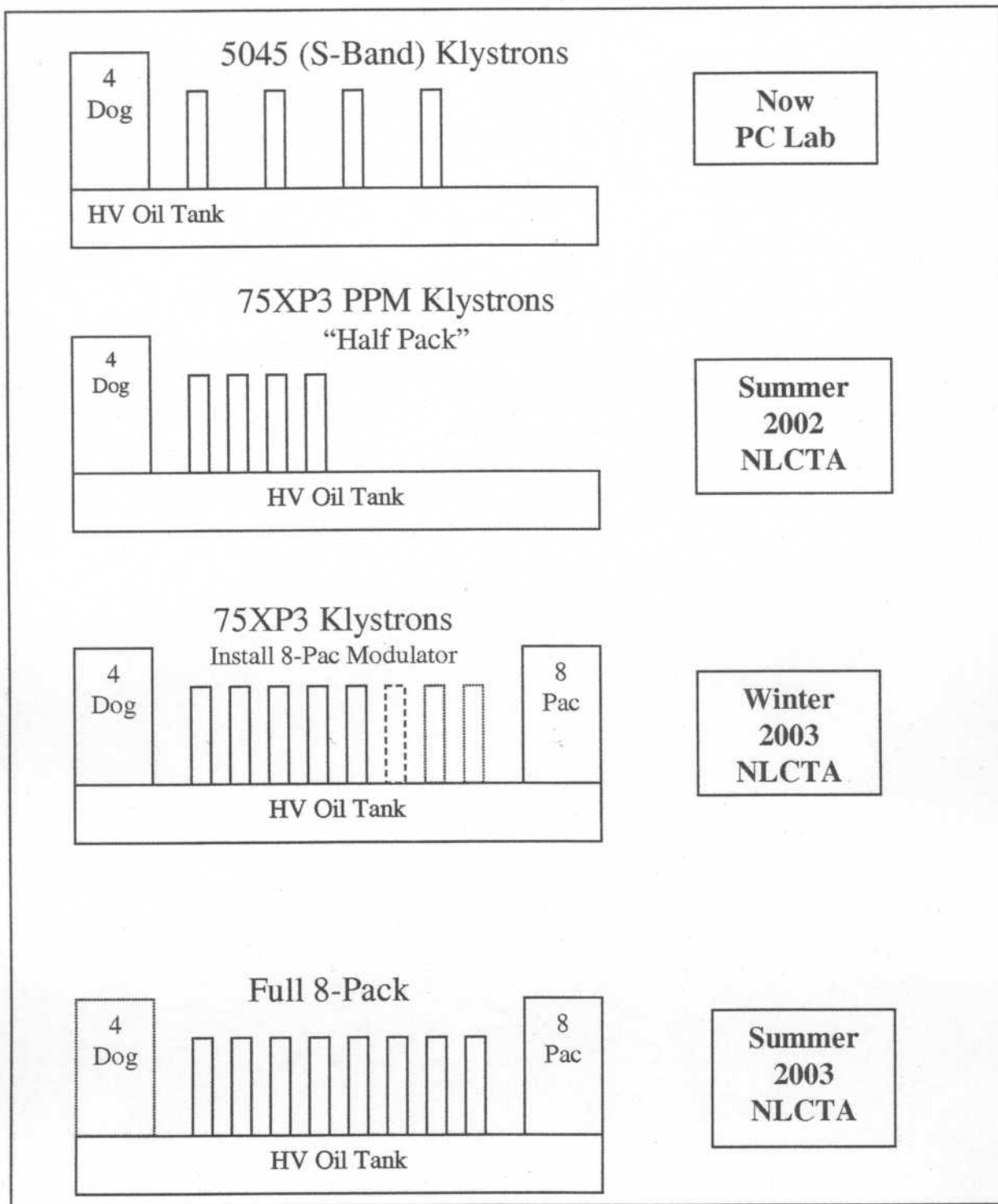
XP-3 Diode

XP-3 Diode



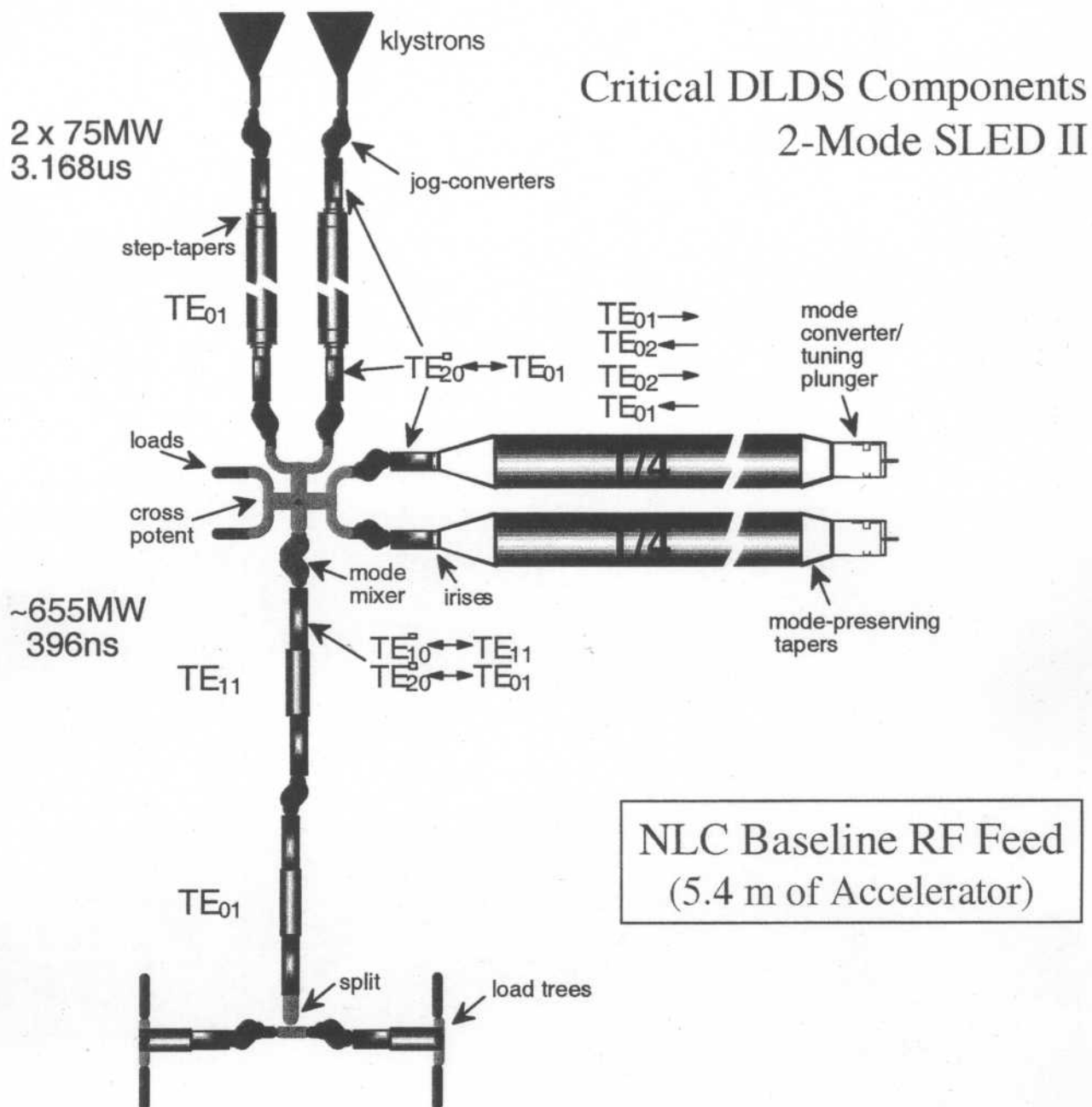


Evolution of the 8-Pack RF Power Source



"Single Feed" Test

NLCTA Summer 2002

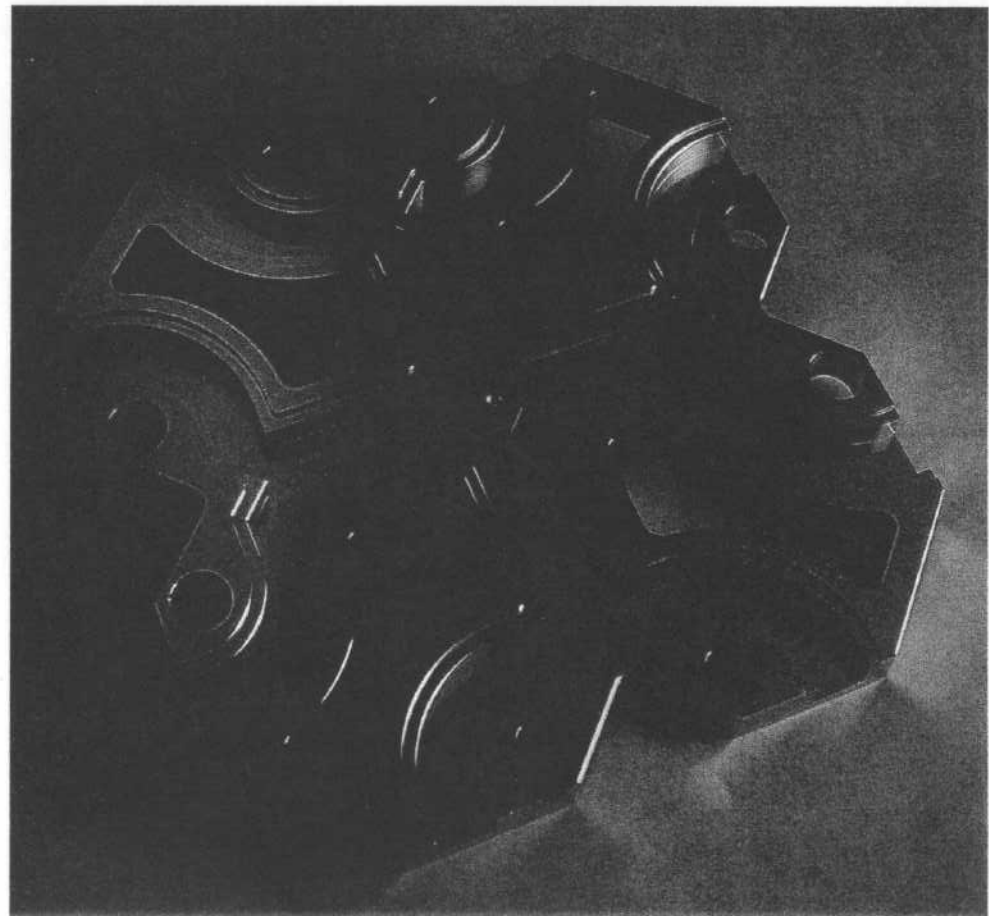


Cross-Potent Hybrid

Routing of phase-encoded power
from four inputs to any of four
outputs.

Can also be used to combine
power.

Nantista/Tantawi



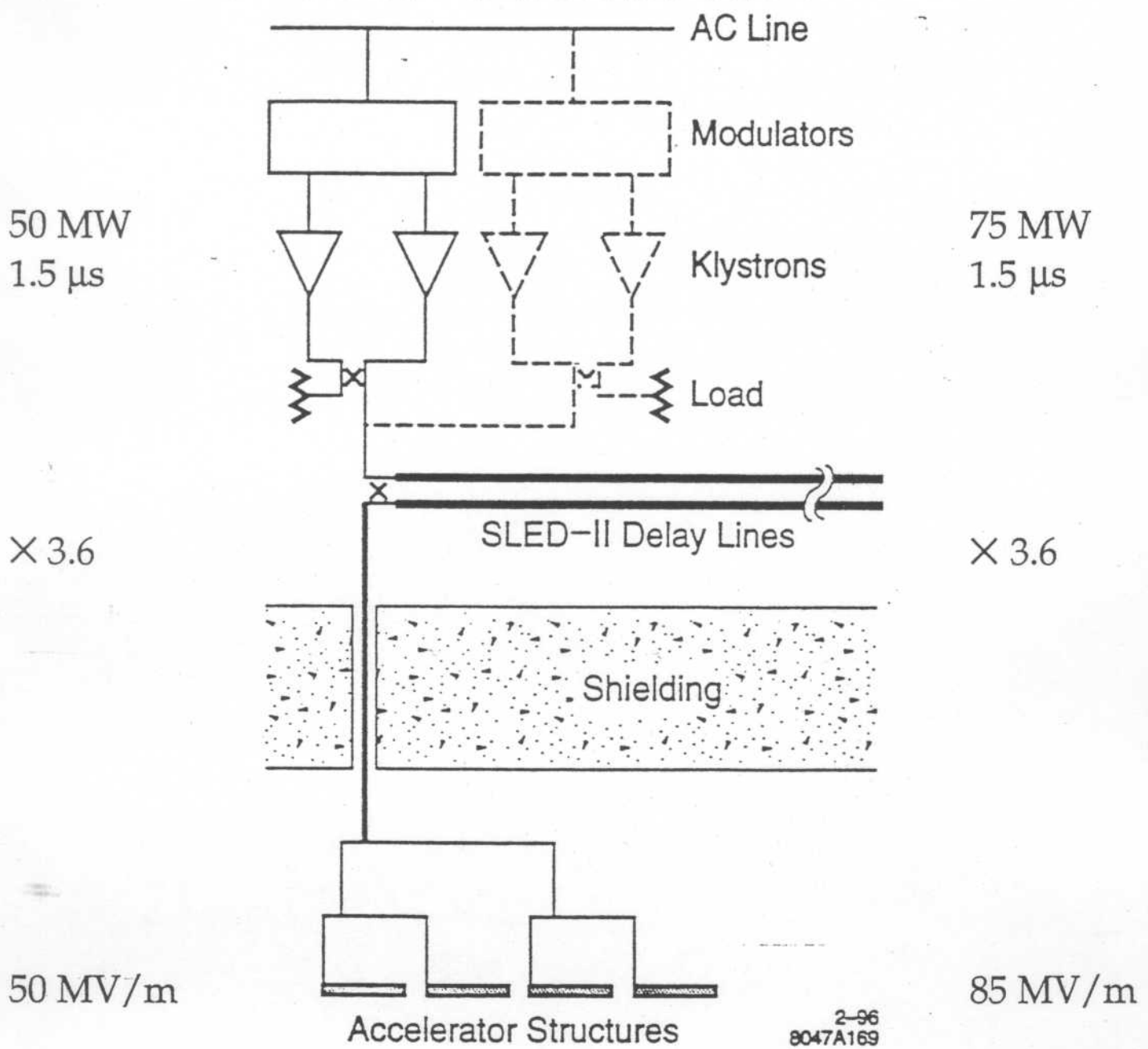
Cross Potent Cold-Test Model

(ZDR)

X-Band RF System

500 GeV

1 TeV



The 8-Pack Project

NLC Collaboration-Wide Effort

D. Schultz (SLAC) will provide overall coordination of system integration and installation.

- Complete 8-Pack MK Module
 - Integration with new NLCTA EPICs [SLAC]
 - Full-spec Induction Modulator
[SLAC/LLNL/Bechtel-Nevada]
 - 75MW PPM klystrons [SLAC/Industry?]
 - LLRF [SLAC]
- 2-Mode DLDS [SLAC/Fermilab]
- Girders of High-Gradient NLC Structures
[SLAC/KEK/Fermilab]
- Infrastructure and Utilities [SLAC]

Upcoming Dates

<u>Date</u>	<u>Milestone/Event</u>
October 2001	HEPAP Sub-Panel Report MAC (LBNL)
November 2001	ISG (KEK)
December 2001(?)	U.S. Physics-Detectors
... we need a U.S. NLC Collaboration meeting.	
February 2002	LC02 (SLAC)
June 2002	EPAC (Paris) – The “Loew” Report