

Development and Testing of the ILC Marx Modulator at SLAC

G.E. Leyh, Nevada Lightning Laboratory

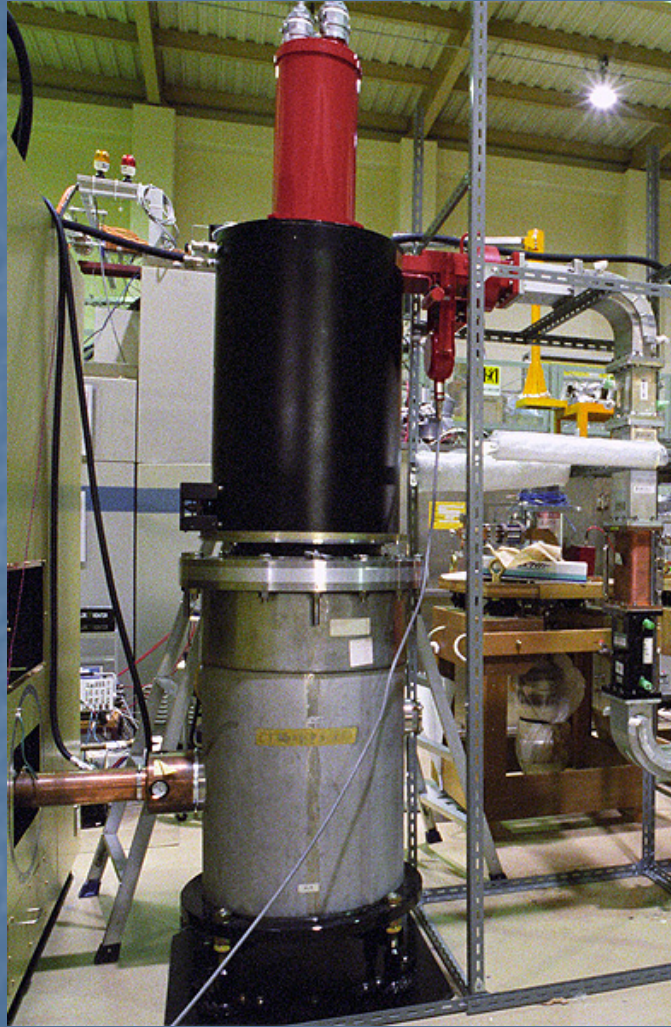


A Marx Bank at the Technical Museum, Munich

ILC Marx Program – Objectives

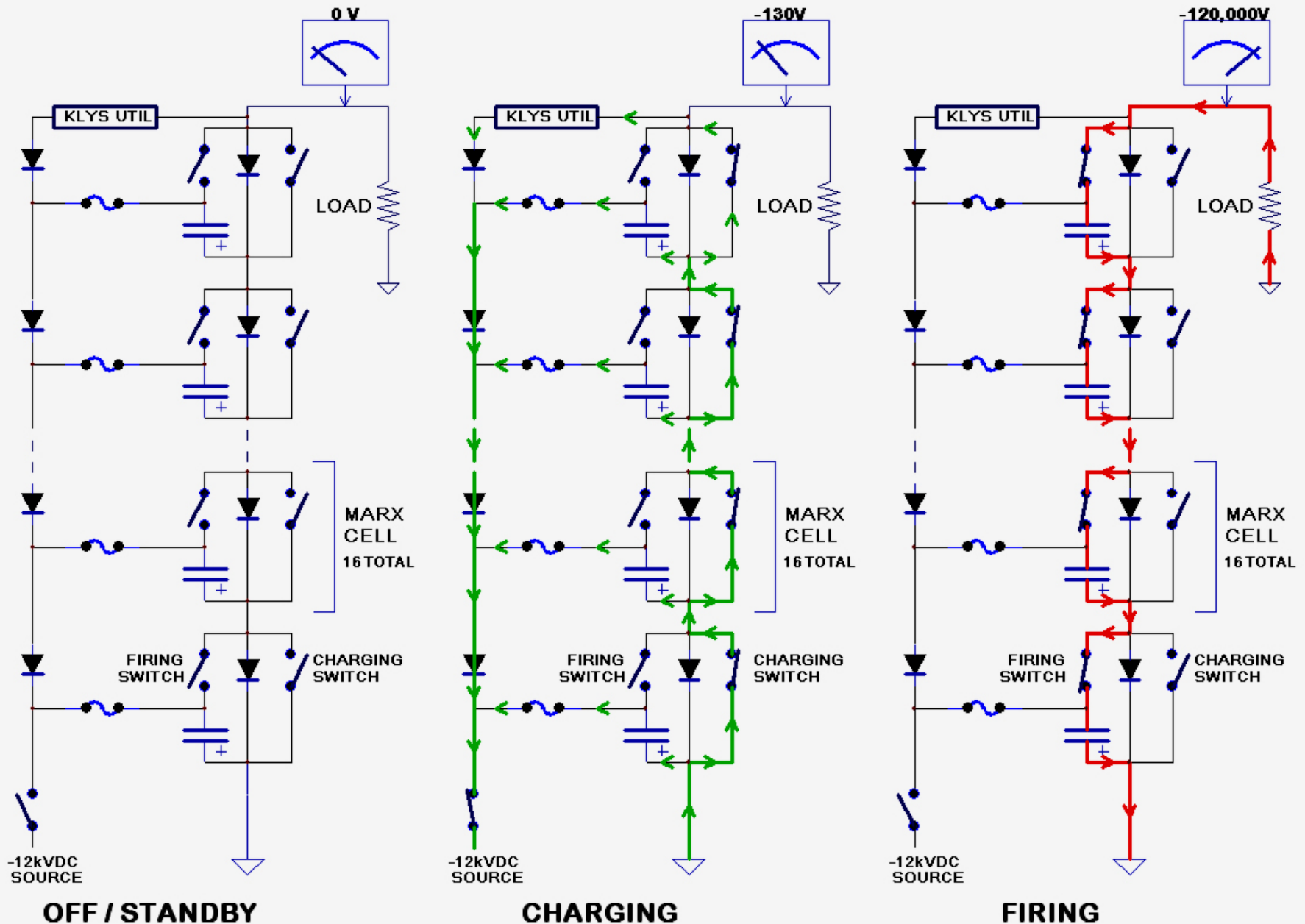
- Explore advantages of Marx approach
 - Oil-free operation
 - Compact mechanical layout
 - Cost-effective PCB 'step-and-repeat' design
 - Cellular design increases machine availability
- Construct a 'Reference Design' prototype
 - Fast-track program determine overall feasibility
 - Develop cost models
 - Provide power to 10MW klystrons under development
- Encourage participation by industry

ILC Klystron Requirements

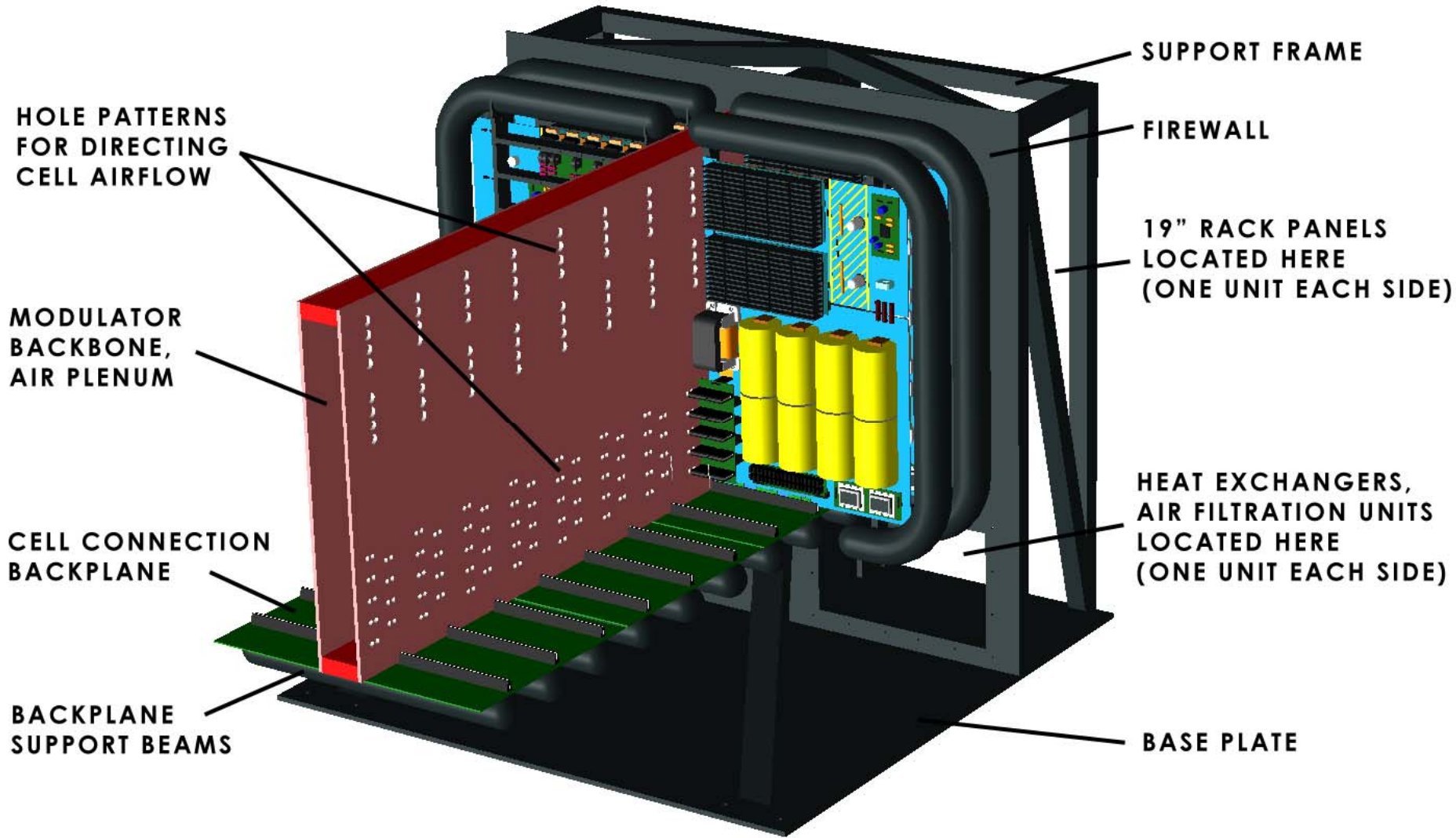


Pulse Voltage	120 kV
Pulse Current	140 A
Pulse Length [flat-top]	1400 usec
Total Pulse Charge	0.2 C
Total Pulse Energy	23,500 J
Repetition Rate	5 Hz
AC Input Power	125 kW
Total # of Stations	576

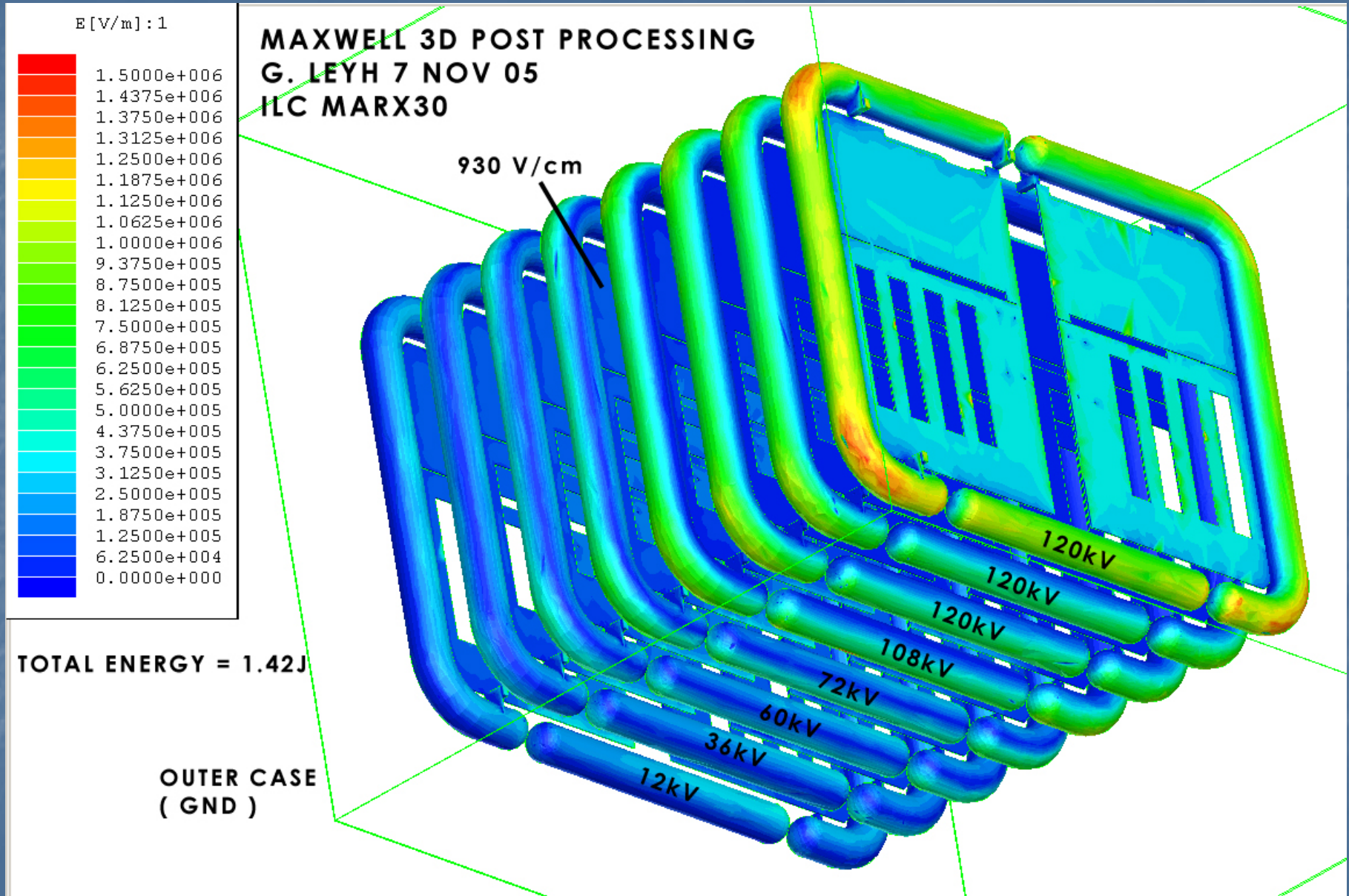
ILC Marx Topology – Basic Modes Of Operation



Modulator Core – Physical Layout



Electric Field Control



ILC Marx Modulator Prototype

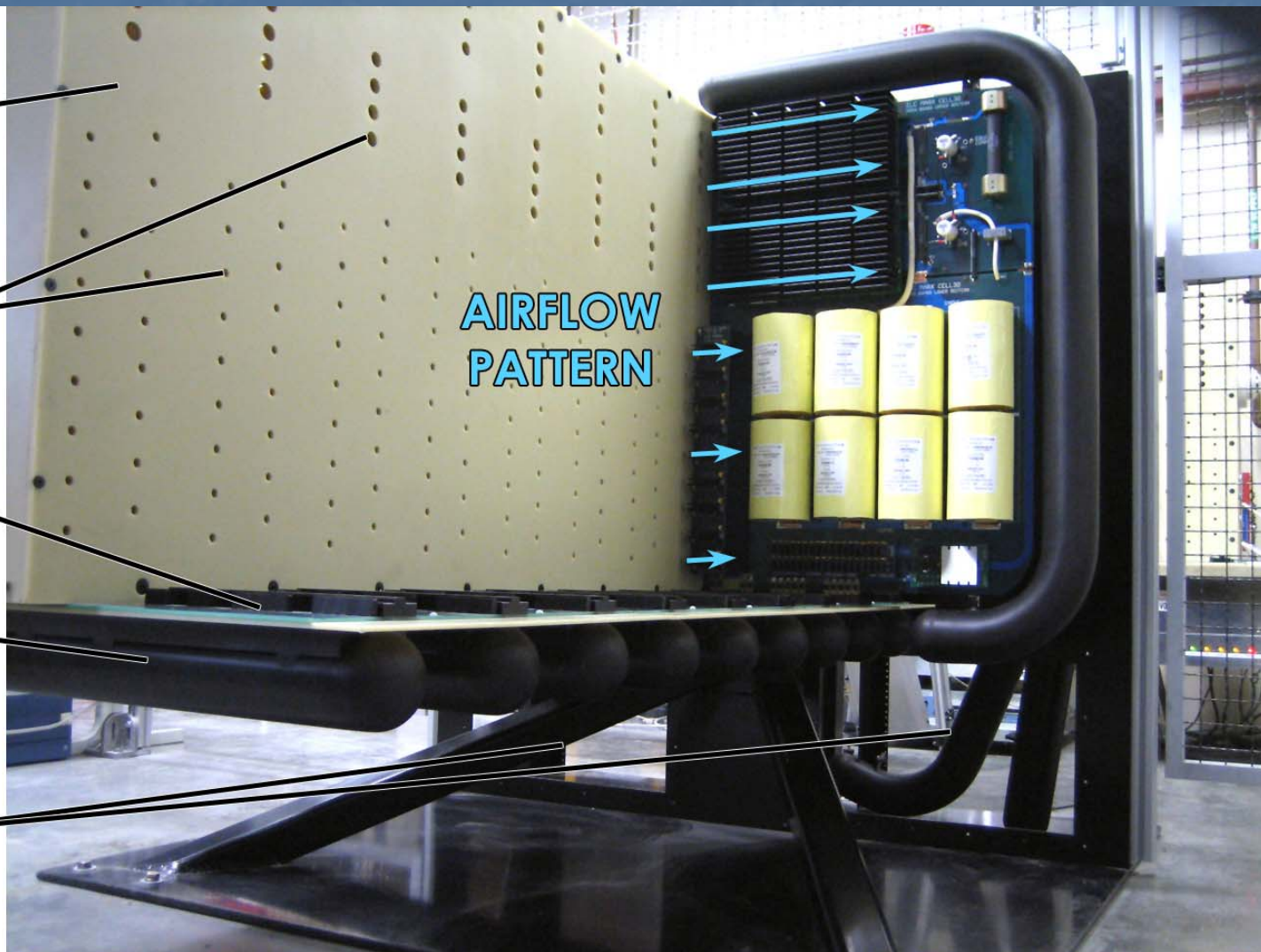
MAIN CANTILEVER
SUPPORT BEAM,
WITH INTERNAL
AIR PLENUM

AIRFLOW APERTURES
FOR AIR COOLING
TO MARX CELLS

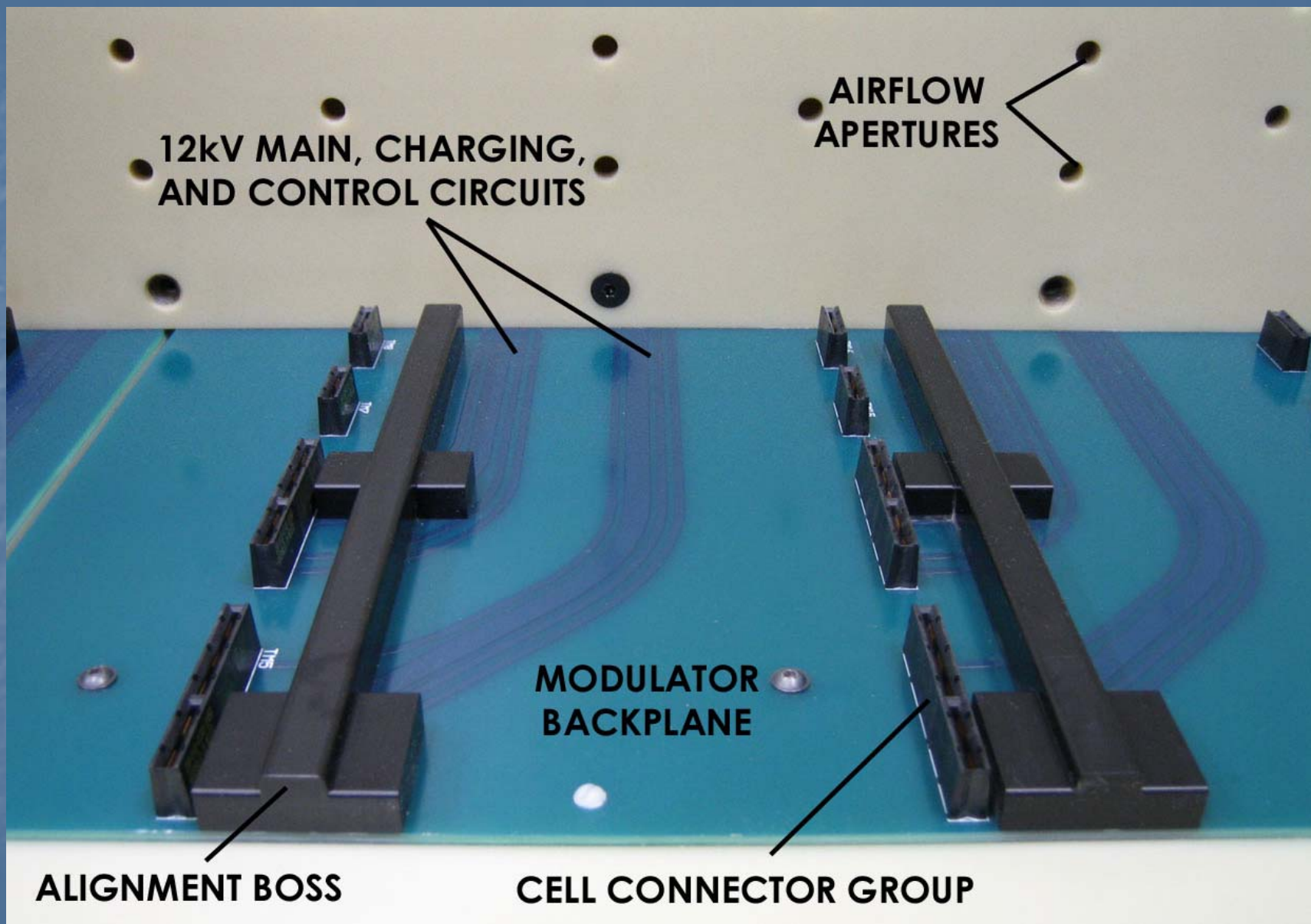
BACKPLANE

BACKPLANE SUPPORT
BEAMS, CONTOURED
FOR ELECTRIC FIELD
CONTROL

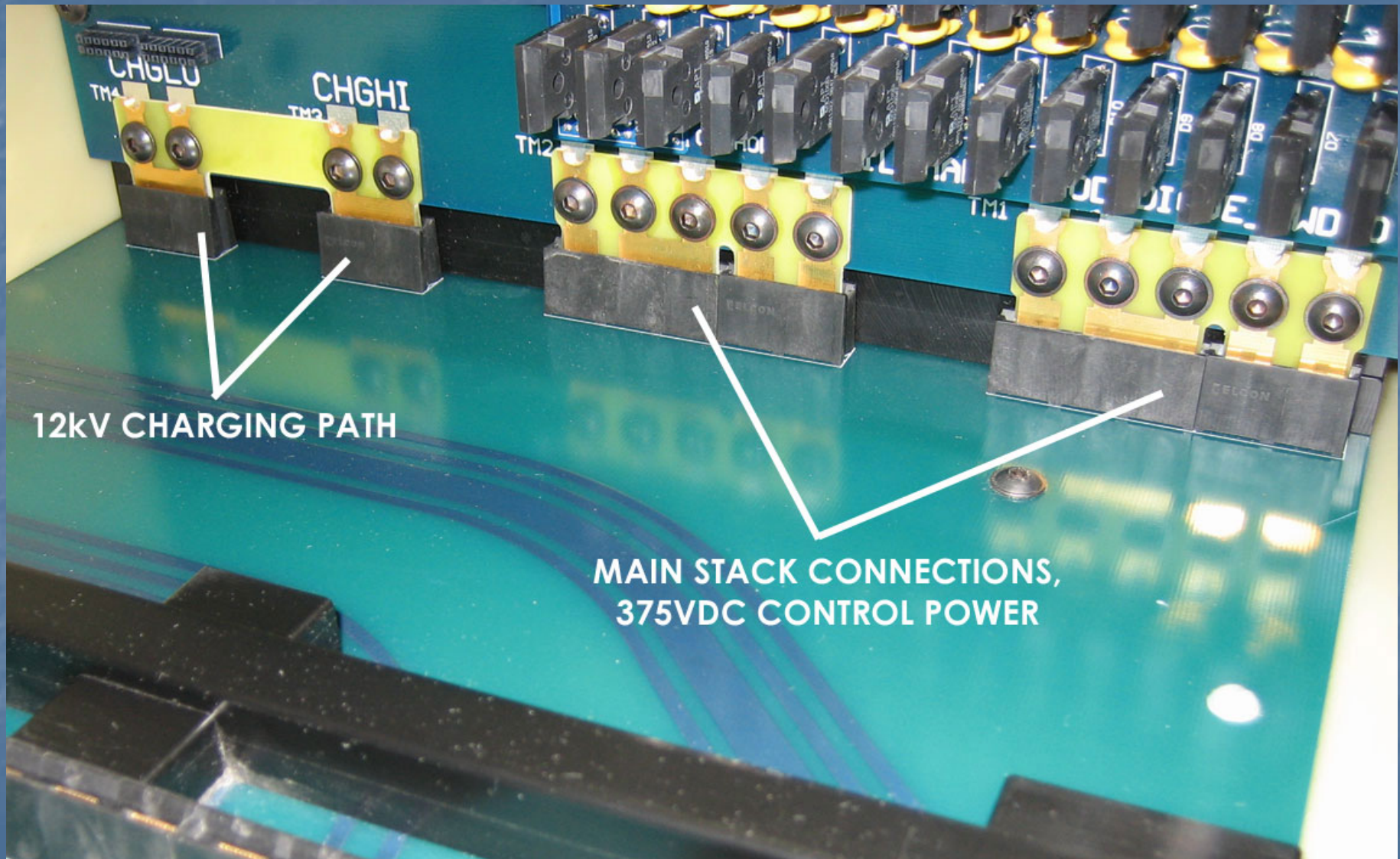
AIR INTAKE PORTS
IN FIREWALL



Backplane Detail – Marx Cell Socket



Connections from Cell to Backplane



The 12kV Marx Cell

**CHARGING
IGBT ARRAY**

**FIRING
IGBT ARRAY**

**ENERGY STORAGE
CAPACITORS**

**CHARGING
DIODES**

**FWD DIODE
ARRAY**

**CONNECTOR GROUP
TO BACKPLANE**

**BANK DISCHARGE
RESISTOR**

**CELL ISOLATOR
RELAYS**

**CURRENT SENSOR,
HV DIVIDERS**

**EQUIPOTENTIAL
RING STRUCTURE**

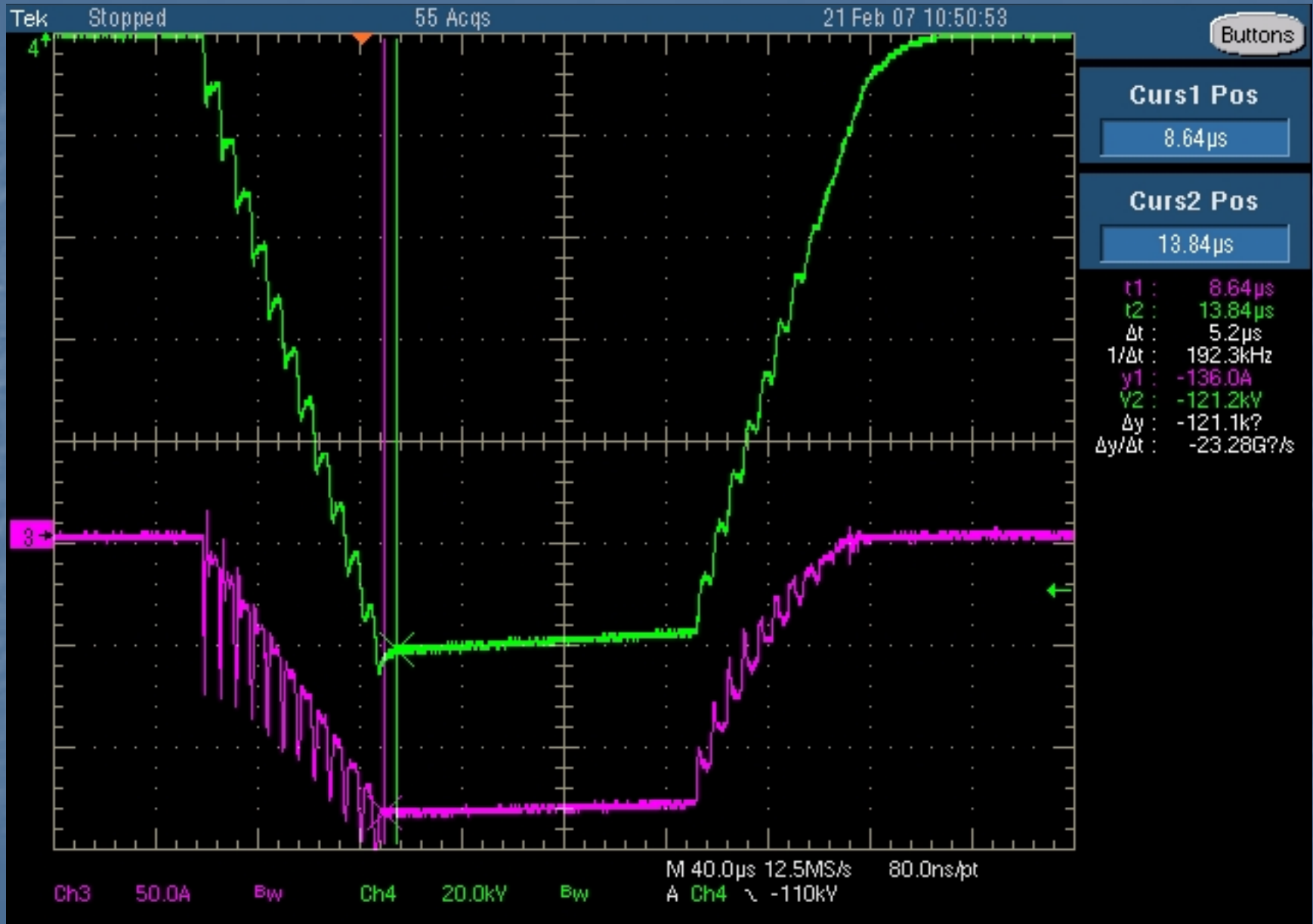
**375VDC CONTROL
VOLTAGE CONVERTER**



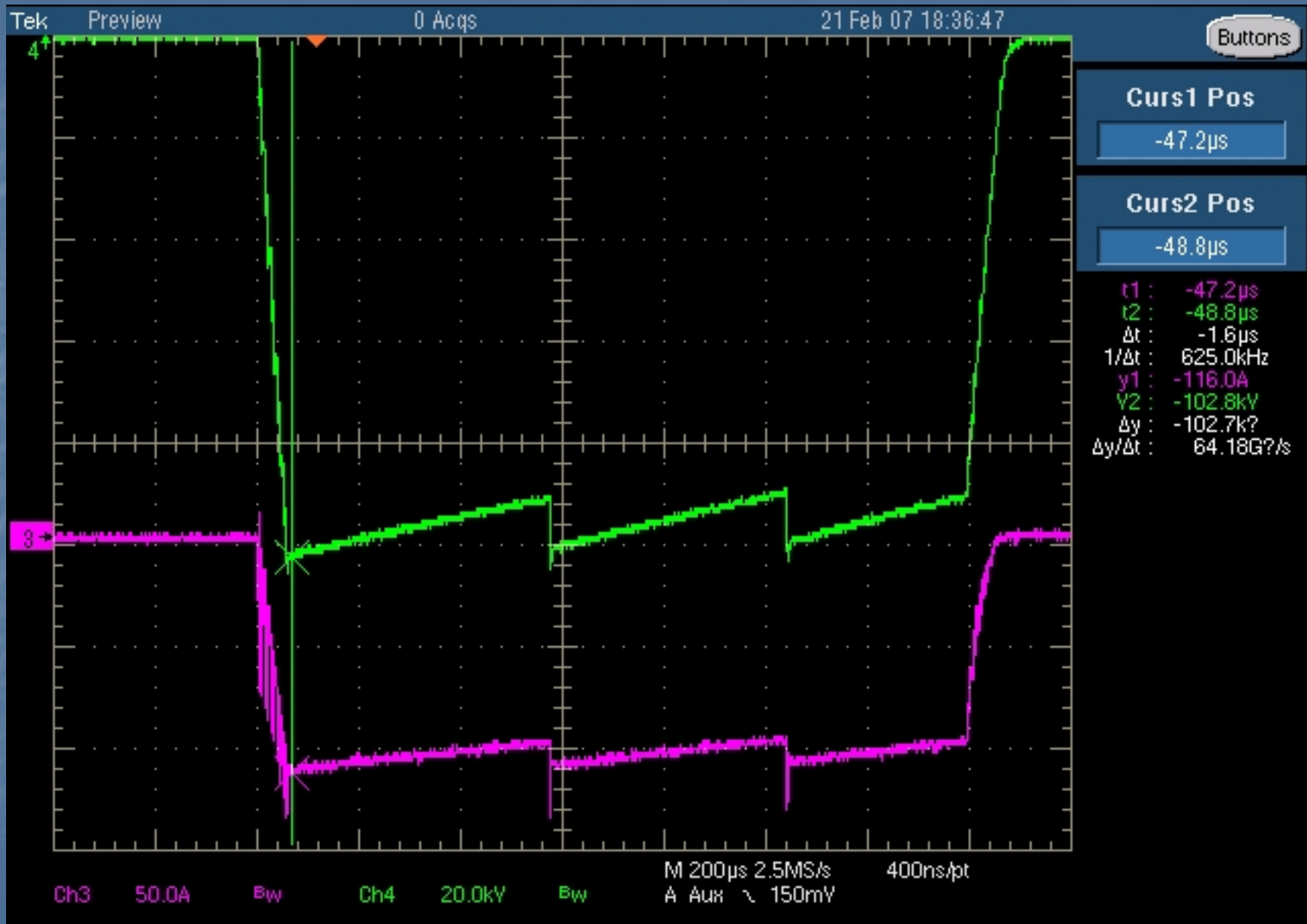
Modulator Test Area



Short-pulse Operation at 120kV, 140A



Long Pulse, with Delayed Cell Leveling



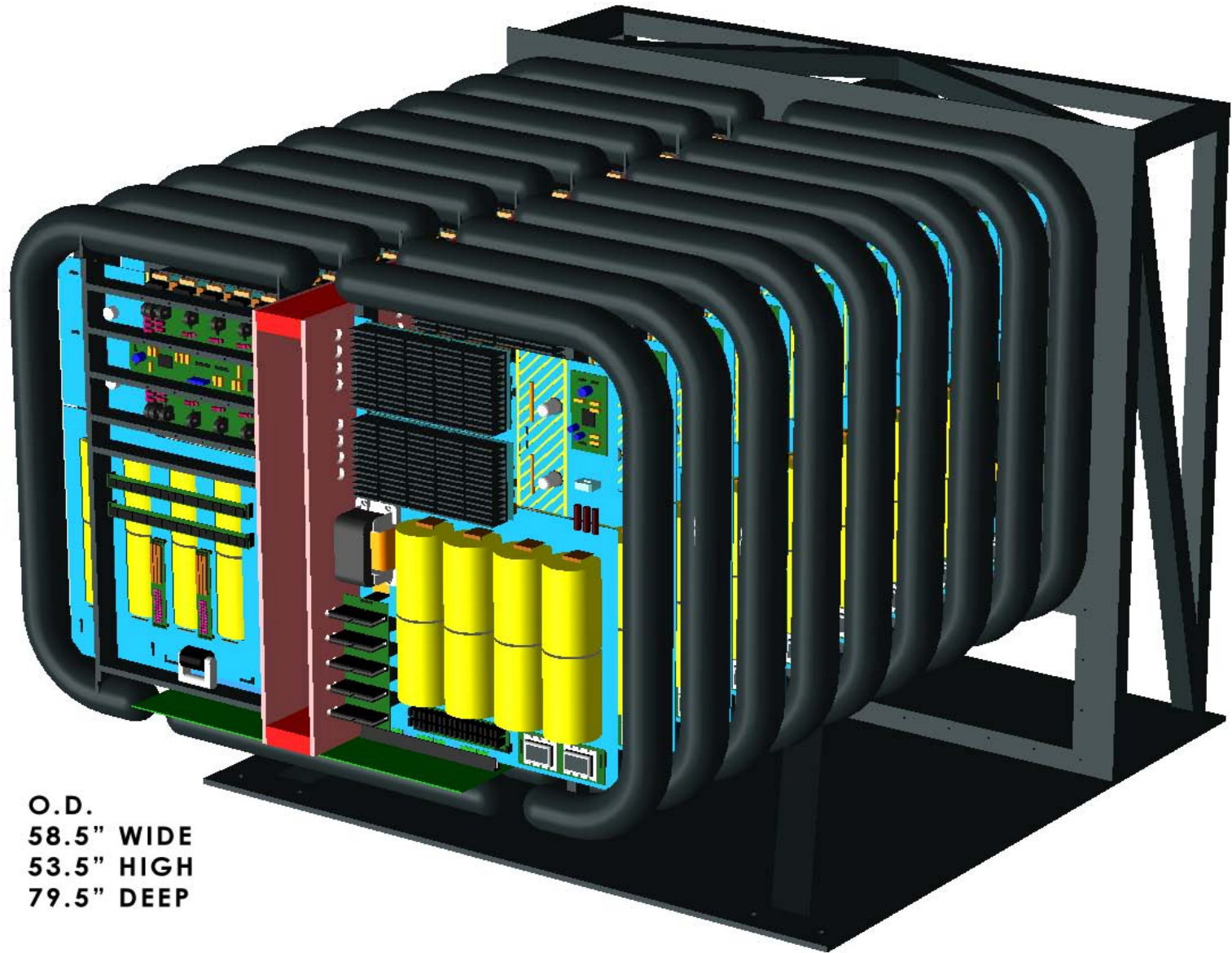
Major Design Contributors

Jeff Olsen	SLAC
Piotr Blum	SLAC
Craig Burkhart	SLAC
Stan Cohen	LANL
Craig Brooksby	LLNL
Gourab Majumdar	Mitsubishi Electric
Howie Pfeffer	FNAL

Industrial Partners

Diversified Technologies	Bedford MA
MK Machine	Oakland CA
ISA Corp	Dublin CA
Standard Metal Products	San Francisco CA

END OF SLIDES



O.D.
58.5" WIDE
53.5" HIGH
79.5" DEEP