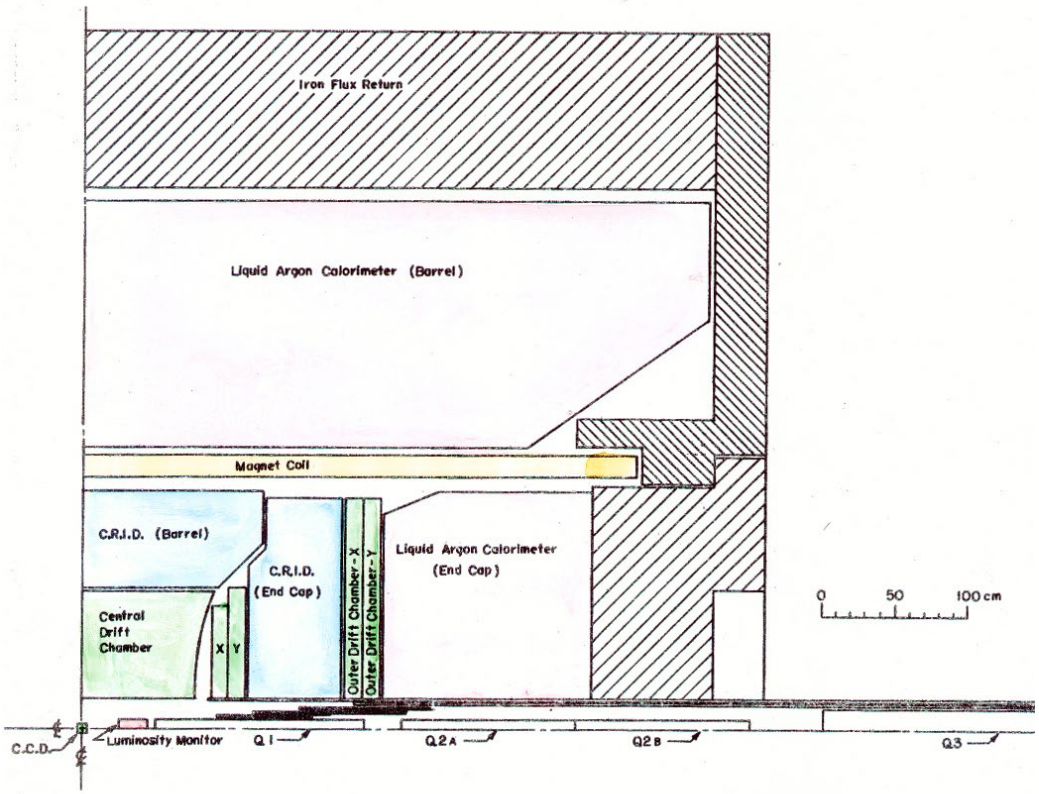
SLD – A History

Martin Breidenbach

5 October 2001

6 Stages

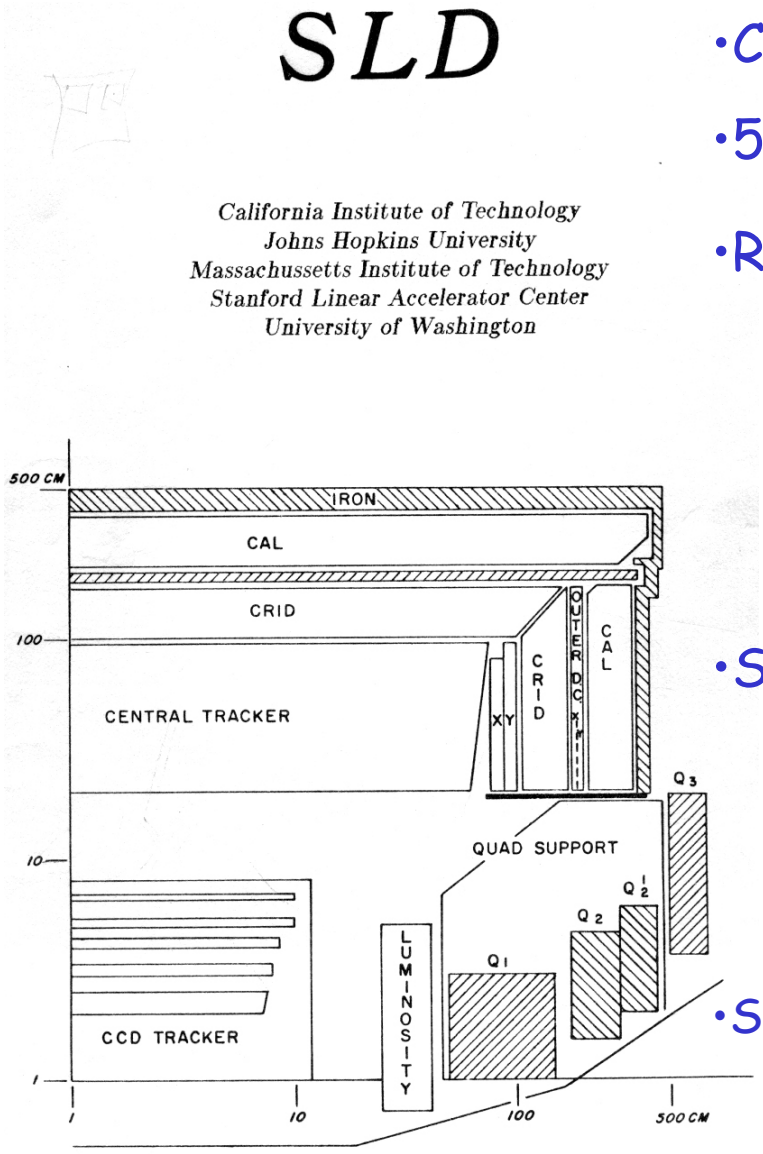
- Existential Crises
- Technical Dilemmas
- The construction years
- Natural Disasters
- Social Problems
- The End



SLD LETTER OF INTENT

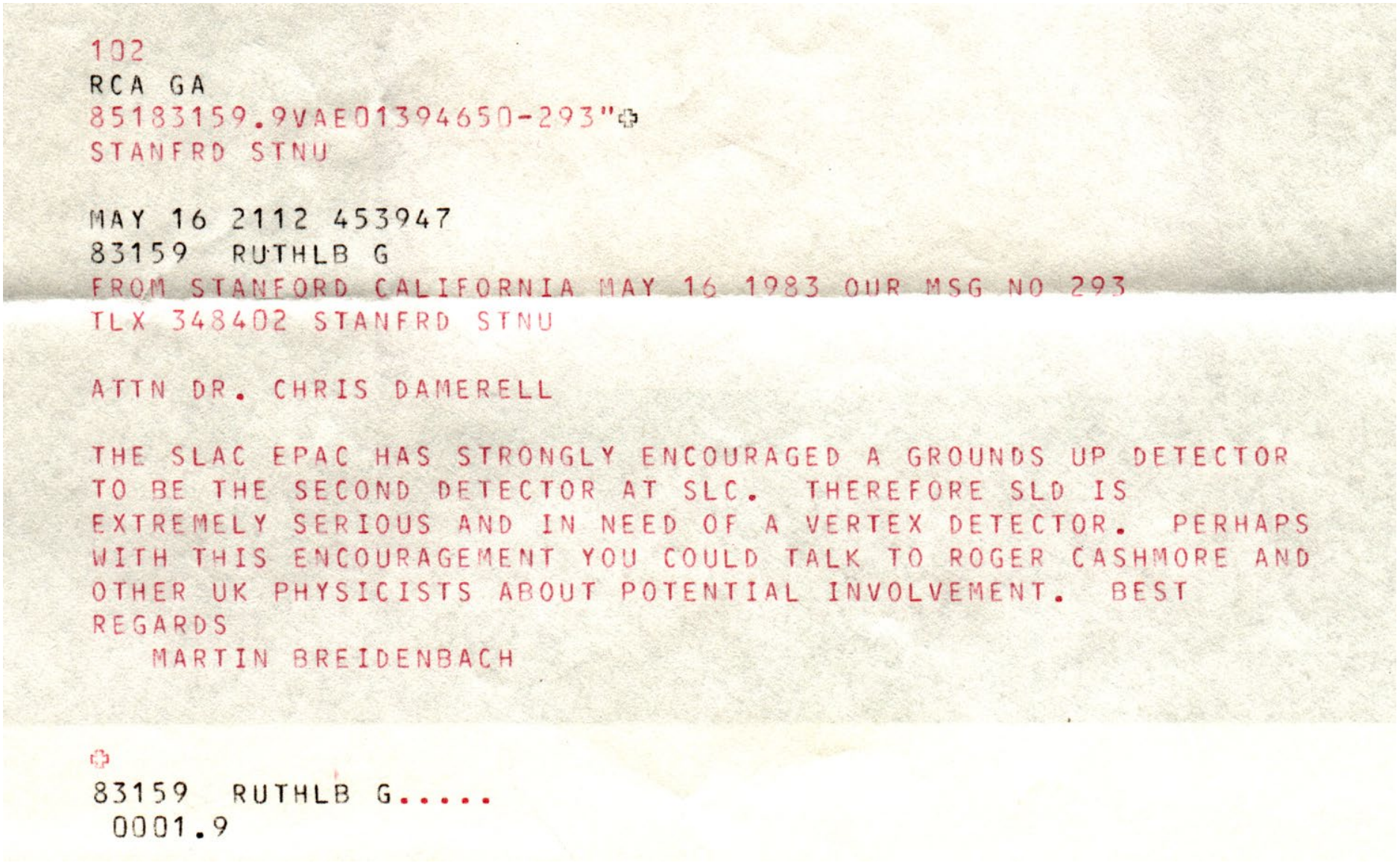
NOVEMBER 82

SLD Letter of Intent



- Circa 1982
- 5 Institutions, ~30 people
- Reasonable forecast of SLD, except:
  - U based calorimetry, with LDLA option
  - Superconducting 1 T Solenoid
  - Cost estimate of $26M + $5M contingency
- Struggle for approval
  - New detector?? TPC??
  - Wit Busza convinces SLAC EPAC (May 83)
  - HEPAP worries about SLD + D0 $$
- Signers here today:
  - MB, H. Lynch, C. Prescott, & B. Ratcliff

Collaboration Building



102
RCA GA
85183159.9VAE01394650-293"
STANFRD STNU

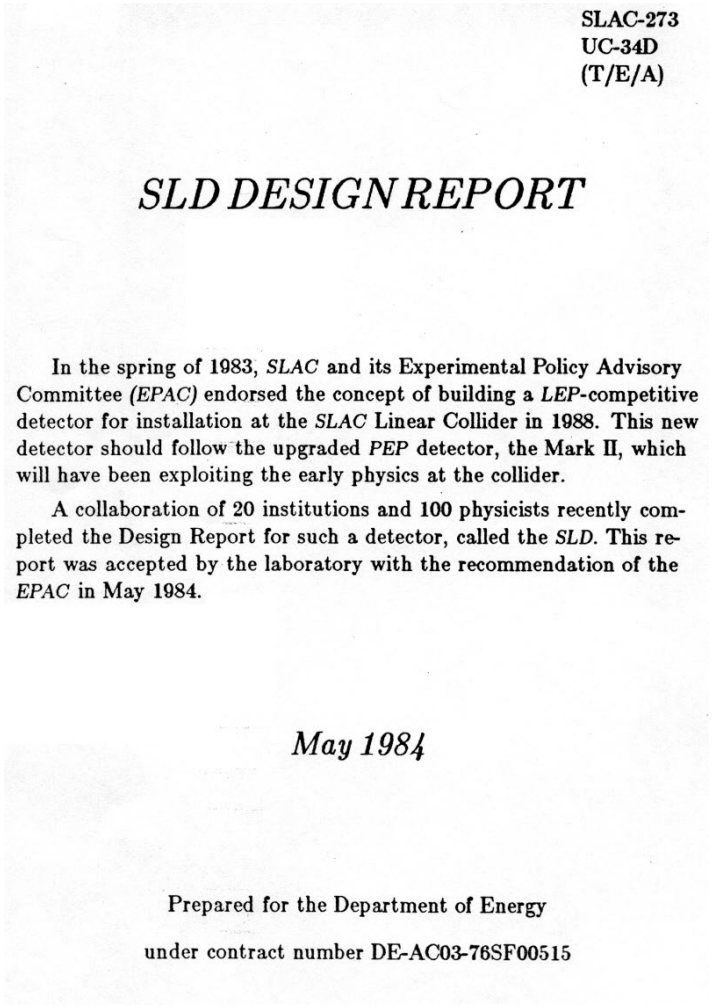
MAY 16 2112 453947
83159 RUTHLB G
FROM STANFORD CALIFORNIA MAY 16 1983 OUR MSG NO 293
TLX 348402 STANFRD STNU

ATTN DR. CHRIS DAMERELL

THE SLAC EPAC HAS STRONGLY ENCOURAGED A GROUNDS UP DETECTOR TO BE THE SECOND DETECTOR AT SLC. THEREFORE SLD IS EXTREMELY SERIOUS AND IN NEED OF A VERTEX DETECTOR. PERHAPS WITH THIS ENCOURAGEMENT YOU COULD TALK TO ROGER CASHMORE AND OTHER UK PHYSICISTS ABOUT POTENTIAL INVOLVEMENT. BEST REGARDS
MARTIN BREIDENBACH

83159 RUTHLB G.....
0001.9

SLD Design Report - 1984



SLAC-273
UC-34D
(T/E/A)

SLD DESIGN REPORT

In the spring of 1983, *SLAC* and its Experimental Policy Advisory Committee *(EPAC)* endorsed the concept of building a *LEP*-competitive detector for installation at the *SLAC* Linear Collider in 1988. This new detector should follow the upgraded *PEP* detector, the Mark II, which will have been exploiting the early physics at the collider.

A collaboration of 20 institutions and 100 physicists recently completed the Design Report for such a detector, called the *SLD*. This report was accepted by the laboratory with the recommendation of the *EPAC* in May 1984.

May 1984

Prepared for the Department of Energy

under contract number DE-AC03-76SF00515

Printed in the United States of America. Available from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. Price: Printed Copy A17, Microfiche A01.

- Accurate description of SLD, except:
  - Superconducting Coil
  - Uranium – Liquid Argon calorimetry.
- ~120 people, 26 Institutions, including Columbia and C.B. as co-spokesman
- Budget of $35M + $14M contingency
- Schedule showing completion in late 89

The Tough Decisions

- Superconducting Coil
  - Temple Review questioned SC cost estimates
  - Richter cut budget and demanded more contingency
  - General Dynamics (likely US coil fabricator) wants "Cost Plus" contract and "Our lawyers are better than your lawyers"
  - Prescott suggests Al coil & better tracking resolution – Done!
- Calorimetry
  - "SLD plans to make use of the method developed at CERN, wherein fission amplification in depleted uranium is used to compensate for the normally invisible hadronic energy expended in nuclear breakup." (SLD Design Report)
  - Jim Brau & Tony Gabriel simulations raise serious doubts, but are challenging well accepted "facts".
  - Before adequate beam tests *, a decision is needed. Brau et al lead us away from Uranium!
- Money
  - Starting with only $1M in FY86.

Press Coverage

SLAC discounts danger in getting scrap uranium

By Paul Engstrom
Mercury News Staff Writer

About 300 tons of scrap uranium bound for a new atom smasher at the Stanford Linear Accelerator Center will pose little risk to human beings or the environment, SLAC and Department of Energy officials said Thursday.

The solid uranium sheets, which will be shipped by truck and may begin arriving later this year, will only be "mildly" radioactive because most of the radioactive isotope U-235 will have been removed, those officials said. U-235 is used to make enriched uranium for nuclear weapons and nuclear power plants.

Thousands of the sheets, each measuring 8 feet long, 6 feet wide and one-sixteenth of an inch thick, will be installed over a period of 18 to 24 months in a $113 million linear collider at SLAC. The collider is scheduled to begin operation in late 1988.

'It's very mildly radioactive.'

— Martin Breidenbach, SLAC physicist

More than twice as dense as iron, the uranium plates will slow down subatomic particles such as electrons and positrons so scientists can study them.

"It's very mildly radioactive, relative to any kind of nuclear reactor waste," said Martin Breidenbach, a physicist at SLAC. "The weapons people have gotten all they want out of it, which is U-235. What's left over is the depleted uranium."

He said that the sheets probably will arrive in wooden crates and that handlers need only wear cotton gloves. Like lead, the uranium metal is poisonous.

Cost is a big reason that SLAC has been negotiating for about two years to get the scrap uranium from the Y-12 nuclear weapon parts plant in Oak Ridge, Tenn., said Richard Taylor, associate director of SLAC.

"What we want is heavy metals to stop particles," Taylor said. "We'd be perfectly happy to use gold or platinum, but that gets pretty expensive."

The uranium will be melted down to form ingots, then rolled into thin sheets. Because the Department of Energy funds both SLAC and the Oak Ridge plant, SLAC will pay only for milling and transporting the uranium in batches to California.

Still, no one seems certain of how much the uranium will cost SLAC. SLAC's Taylor estimated the cost at

Continued on Page 3B

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- Money
  - Starting with only $1M in FY86.

Cutting Steel at Kawasaki

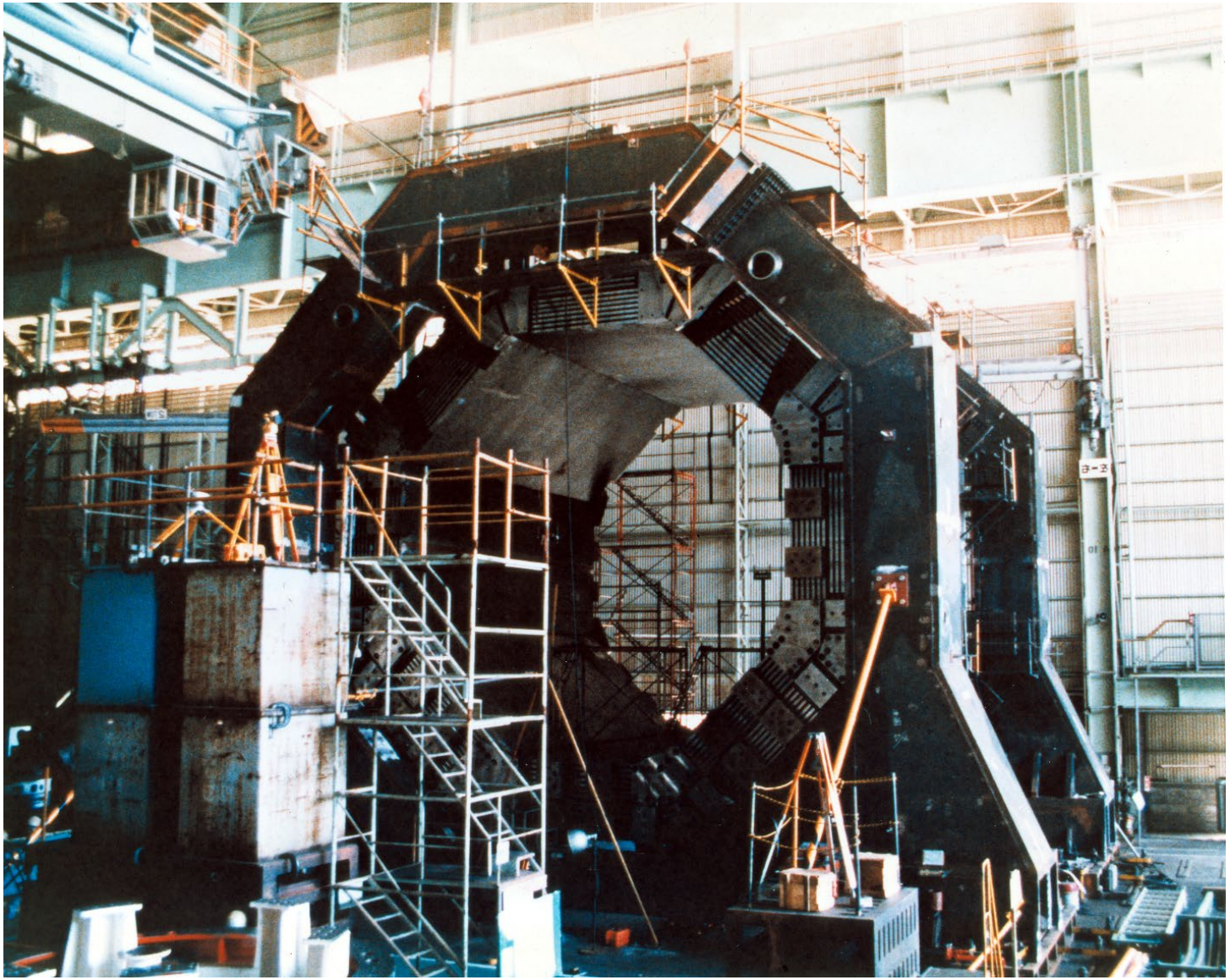
SLAC/SLD go worldwide for bids

Won by Kawasaki Heavy Industries

SLAC nervous about its first large contract overseas, DOE calm.

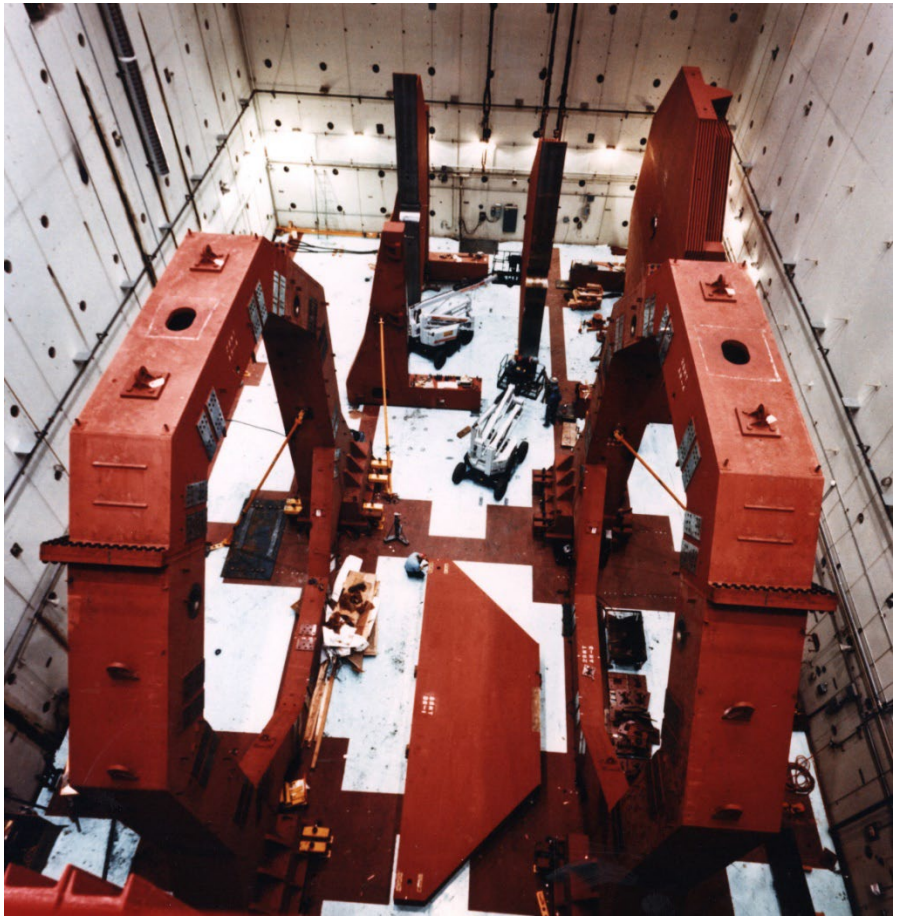
KHI does great work!!

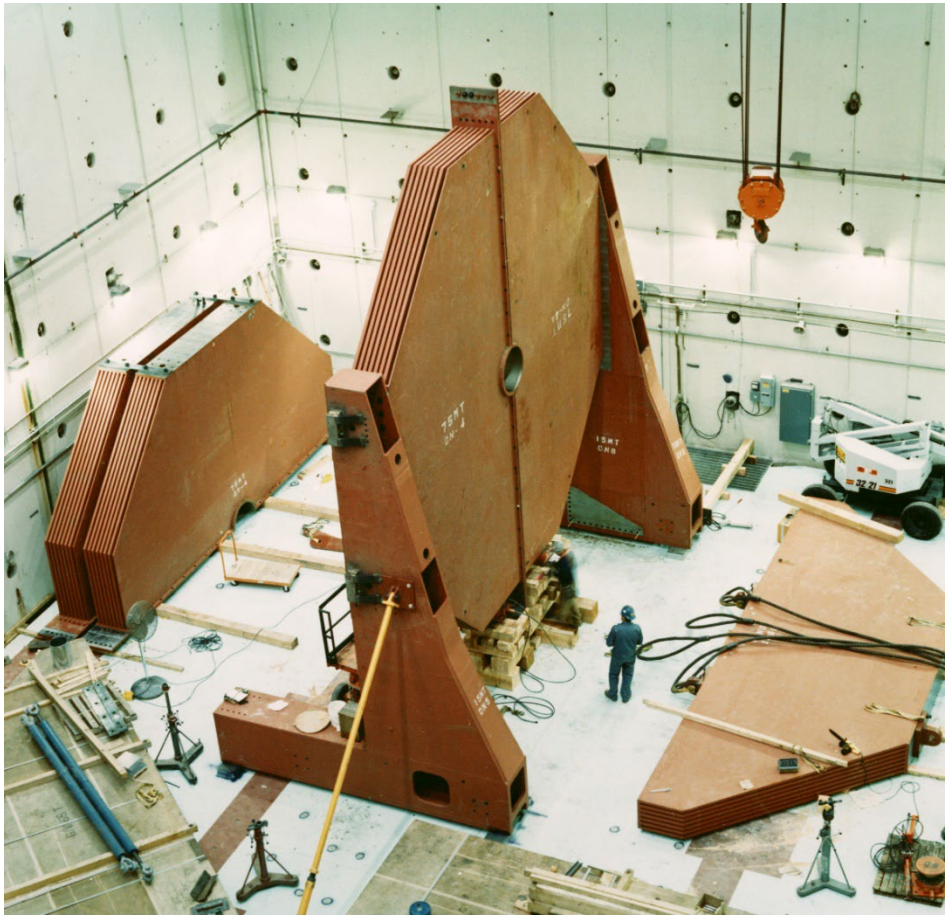
Steel Erection at Kawasaki Heavy Industries



The Ruth Lykes delivers the steel

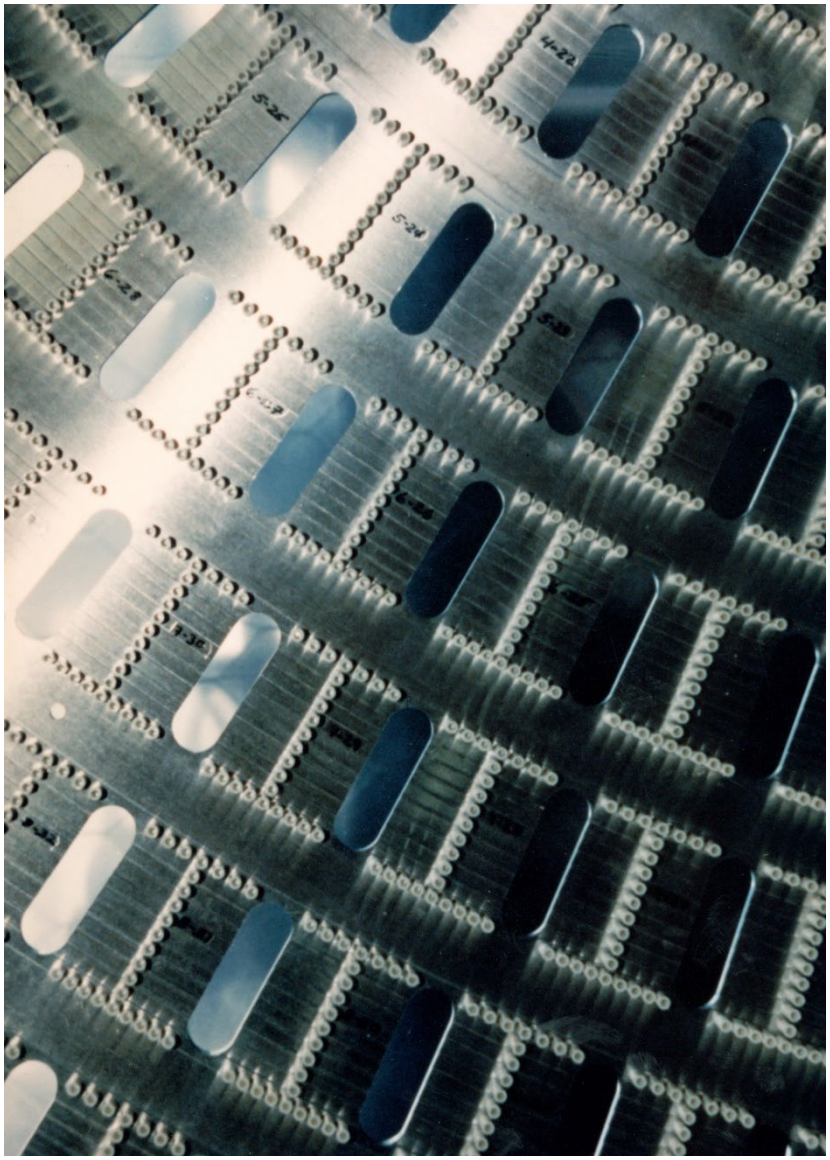
Iron in the Pit



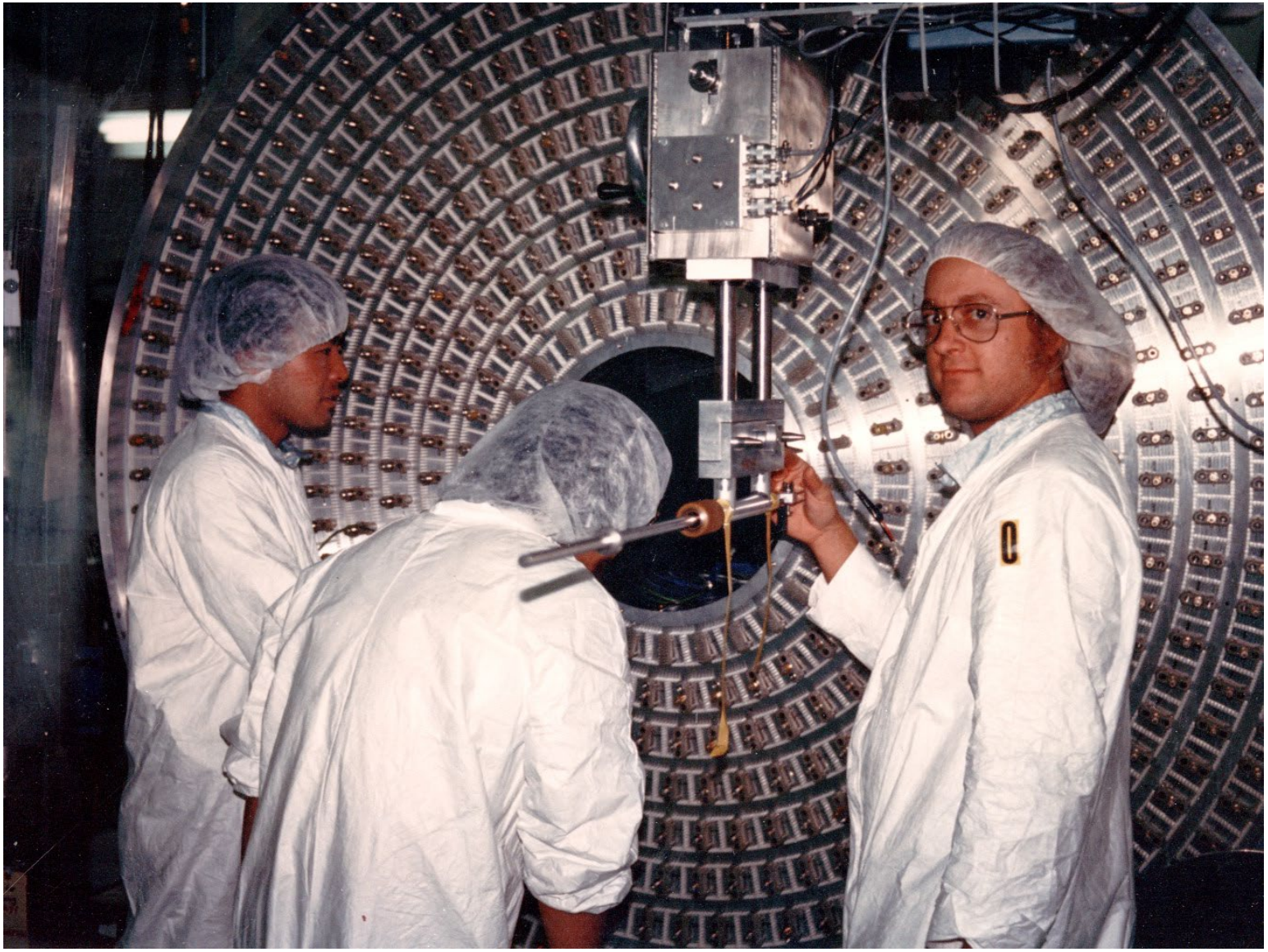


CDC Endplate emerges from Al forging

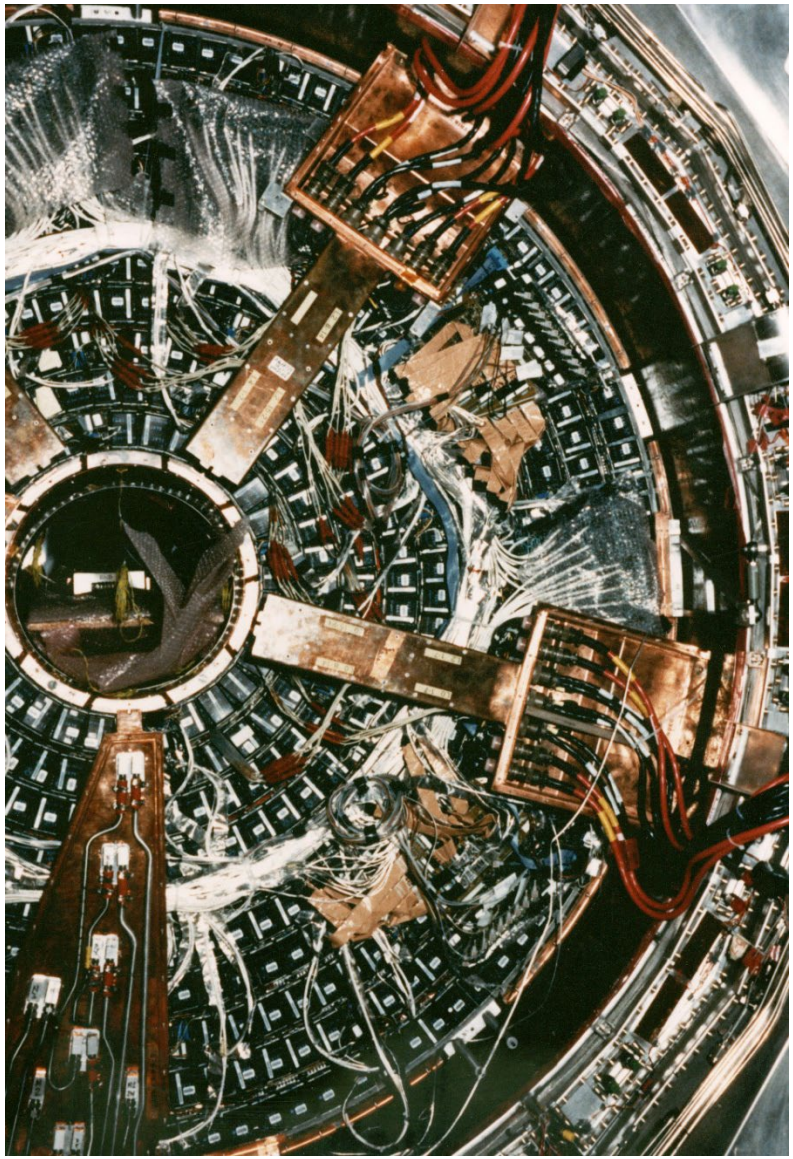
CDC Endplate, Inside and Out



CDC almost done!



Inside the CDC



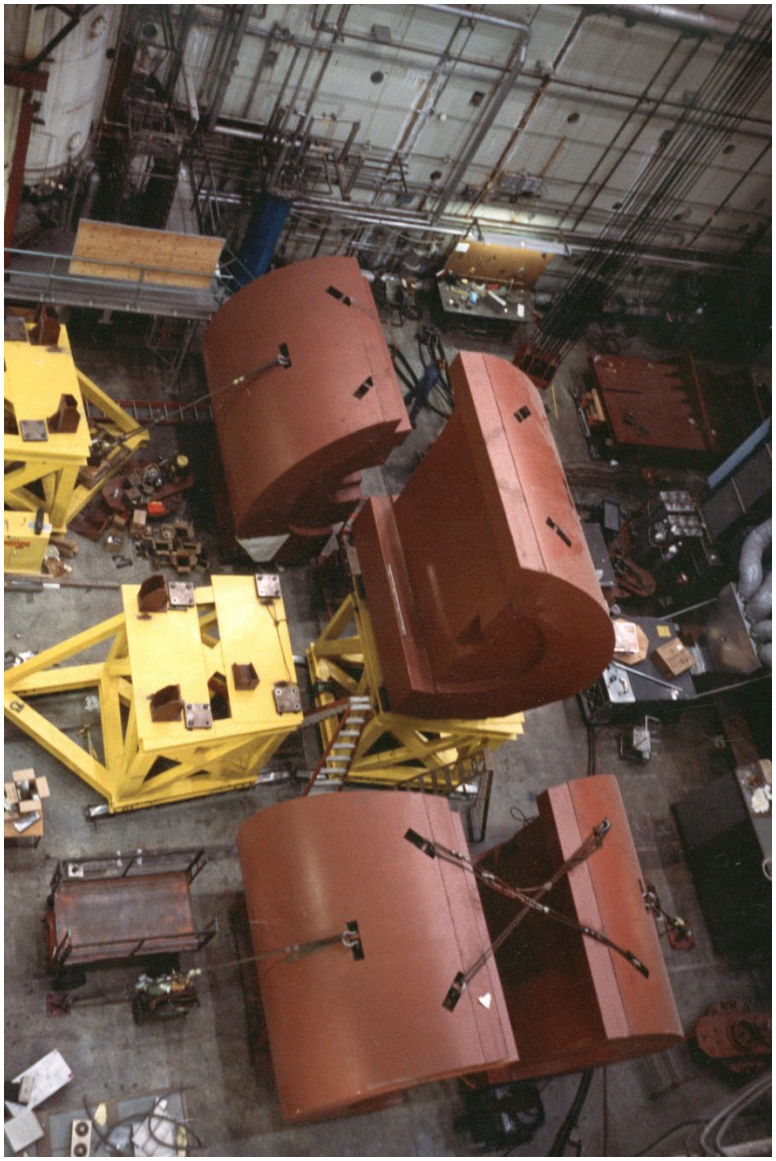
The high tech kapton HV distribution cables spark!

- Mike Fero rescues us with wire!

- 1998 – The first (and only) wire break.

- Almost 2 weeks of round-the-clock effort to find the right ends. Endoscopic surgical removal successful.

Pacmen



Retractable shielding for the triplets.

Only serious injury during construction – contract welder falls from ladder into web of rebar.

Coil Winding at Mitsubishi

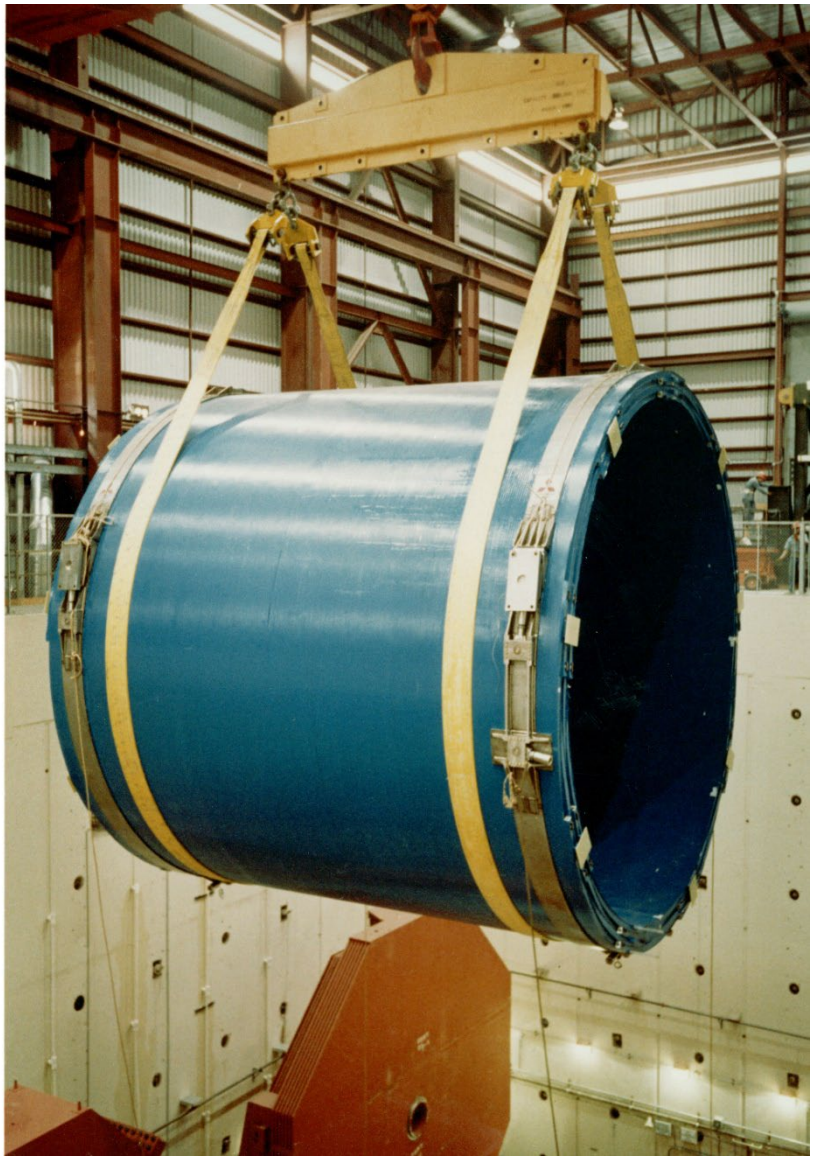
Bill Ash coordinates second major procurement in Japan

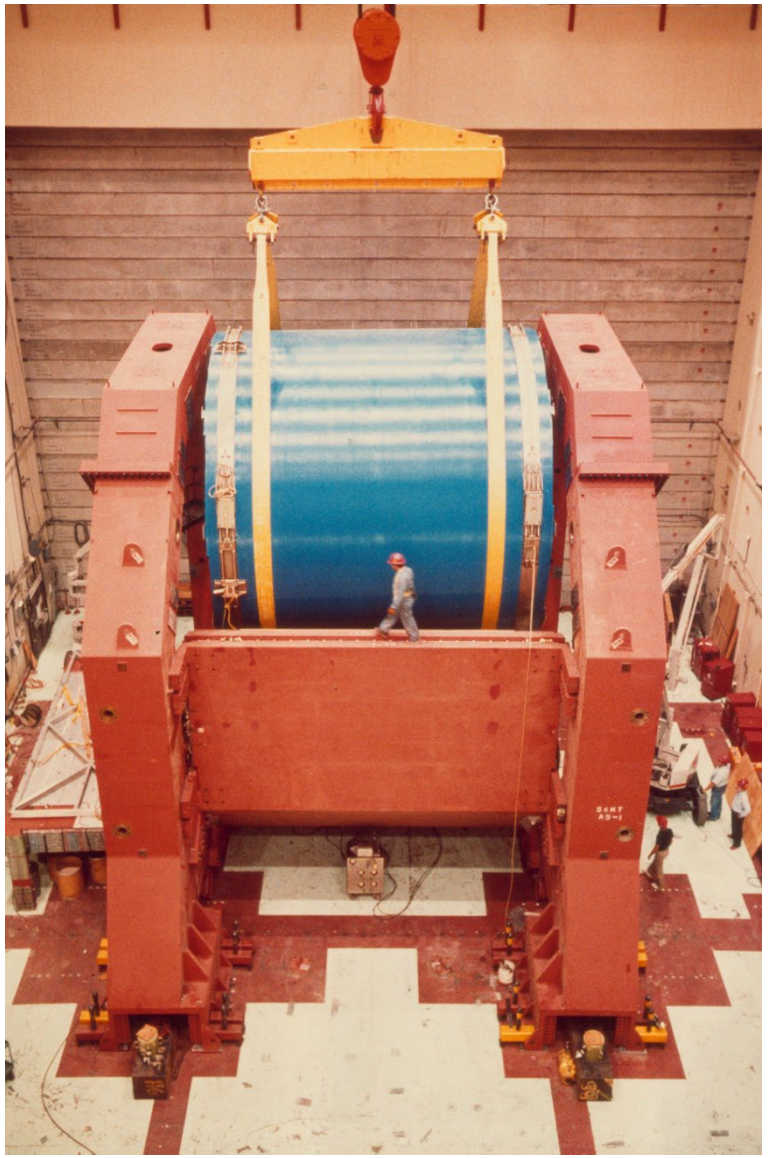
Coil Delivery

El Camino

280 Convoy

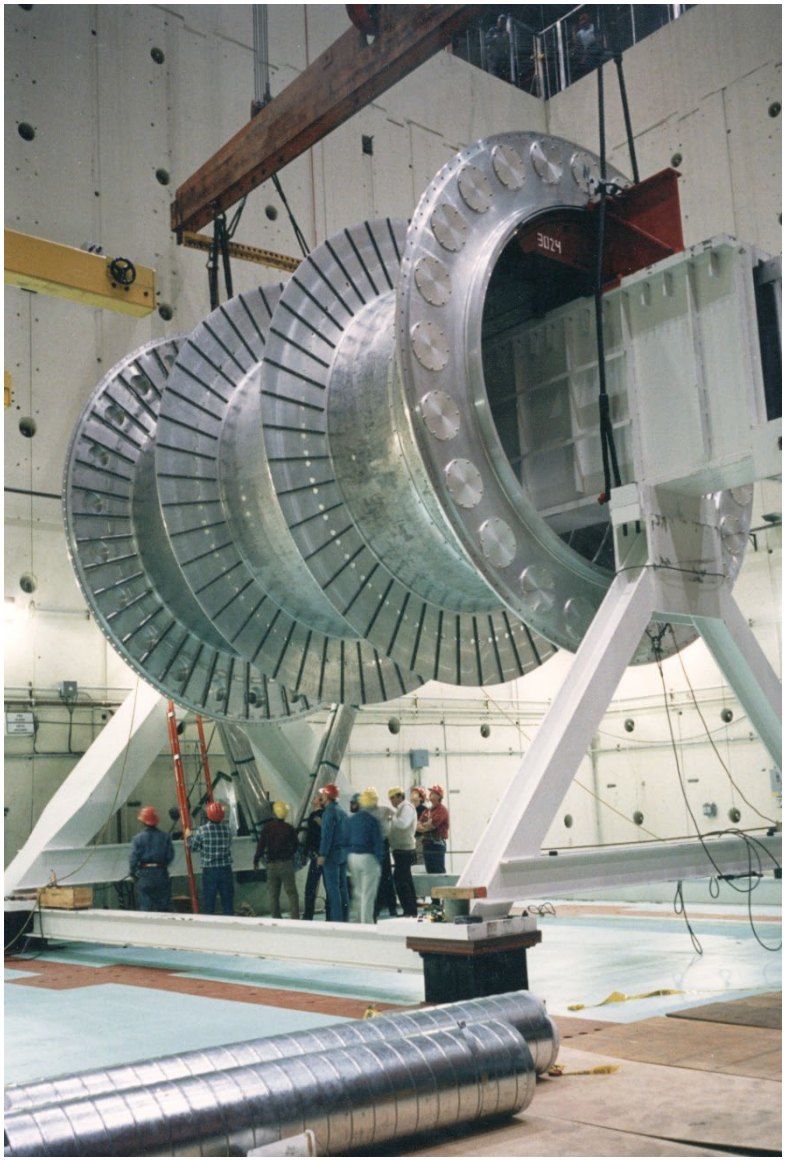
Lowering the coil



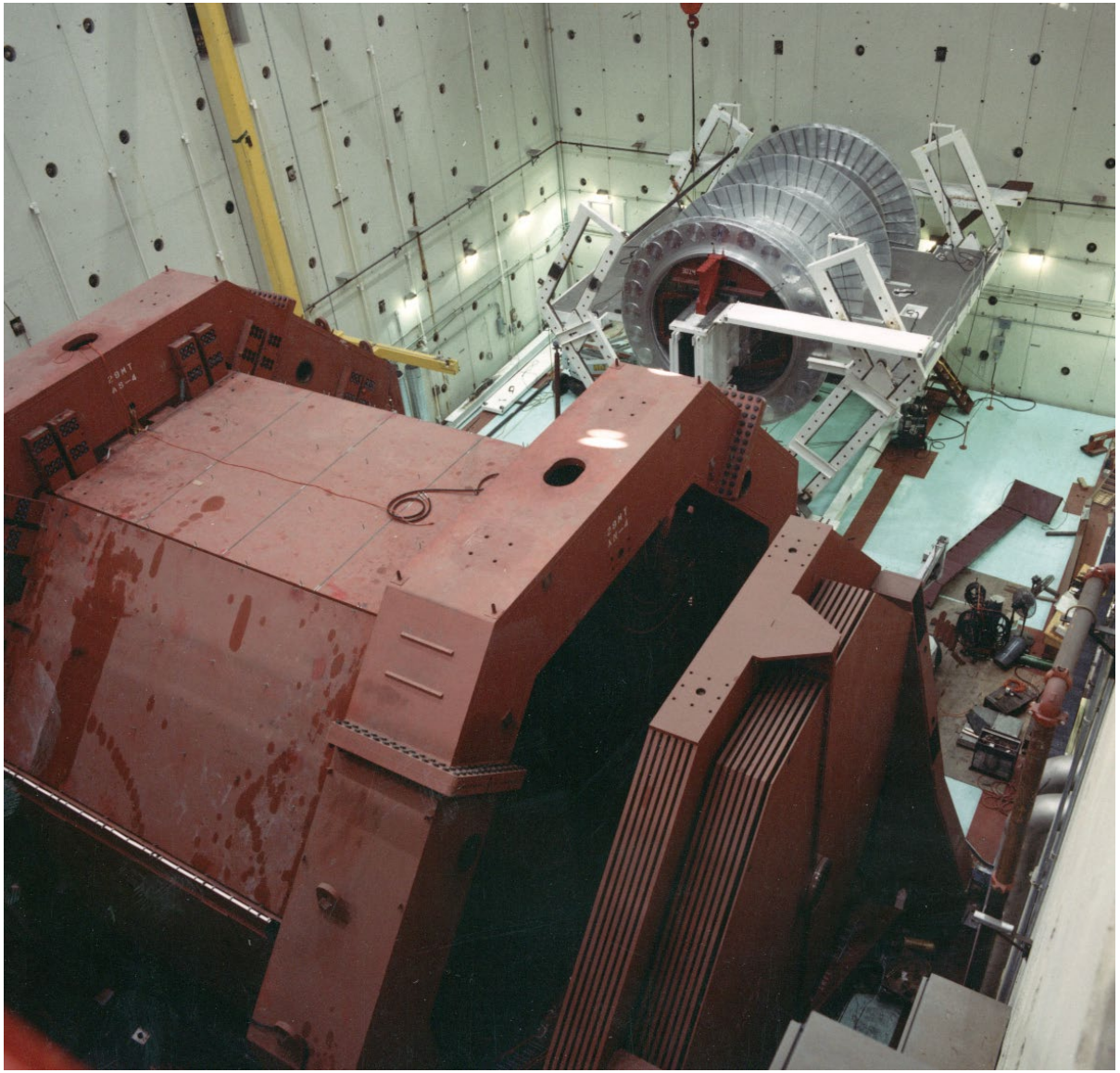


LAC Vacuum & Argon Cans

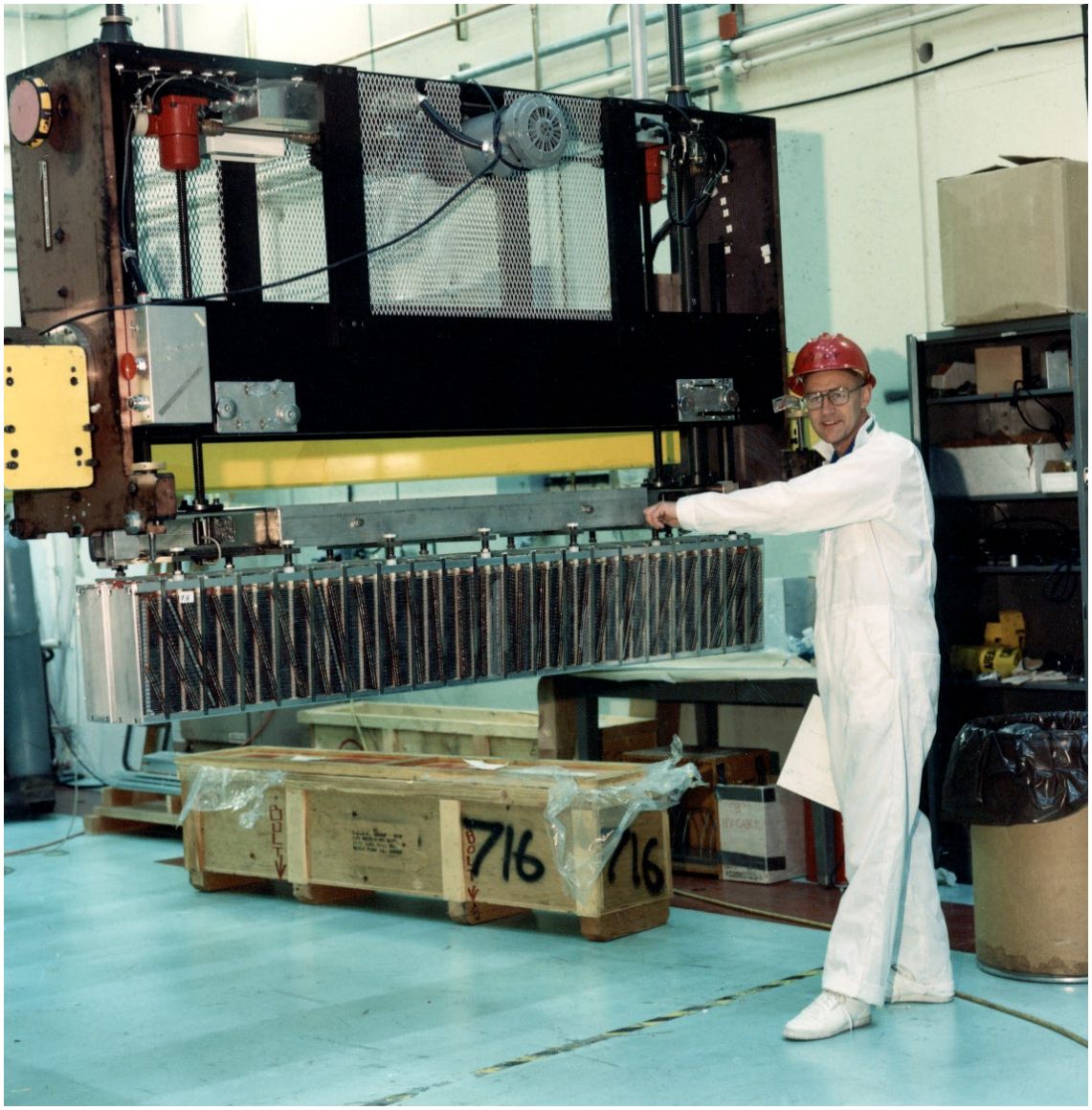
The LAC Spool



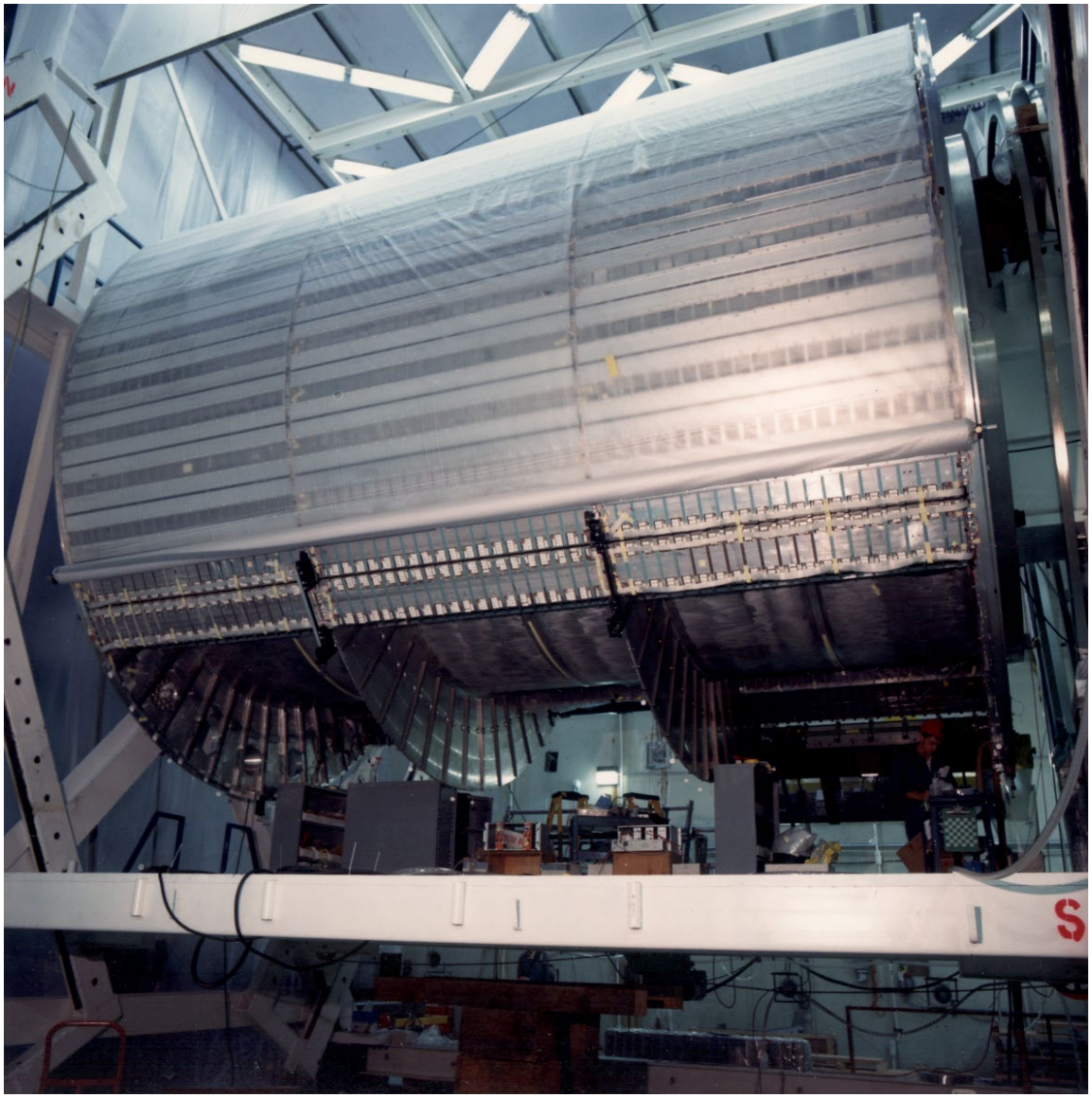
LAC module installation soon



Knut VII delivers EMCal

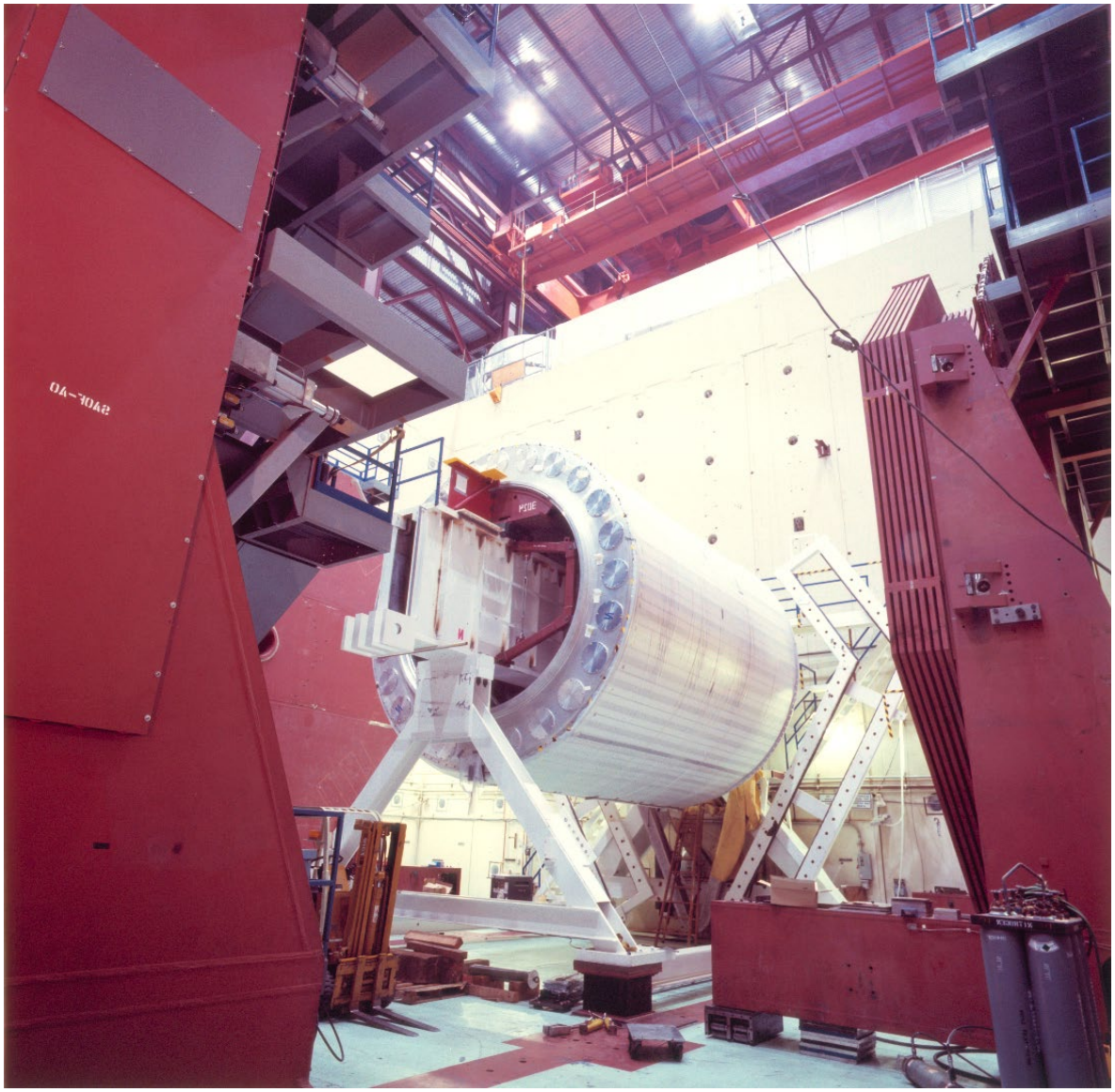


Barrel LAC Assembly

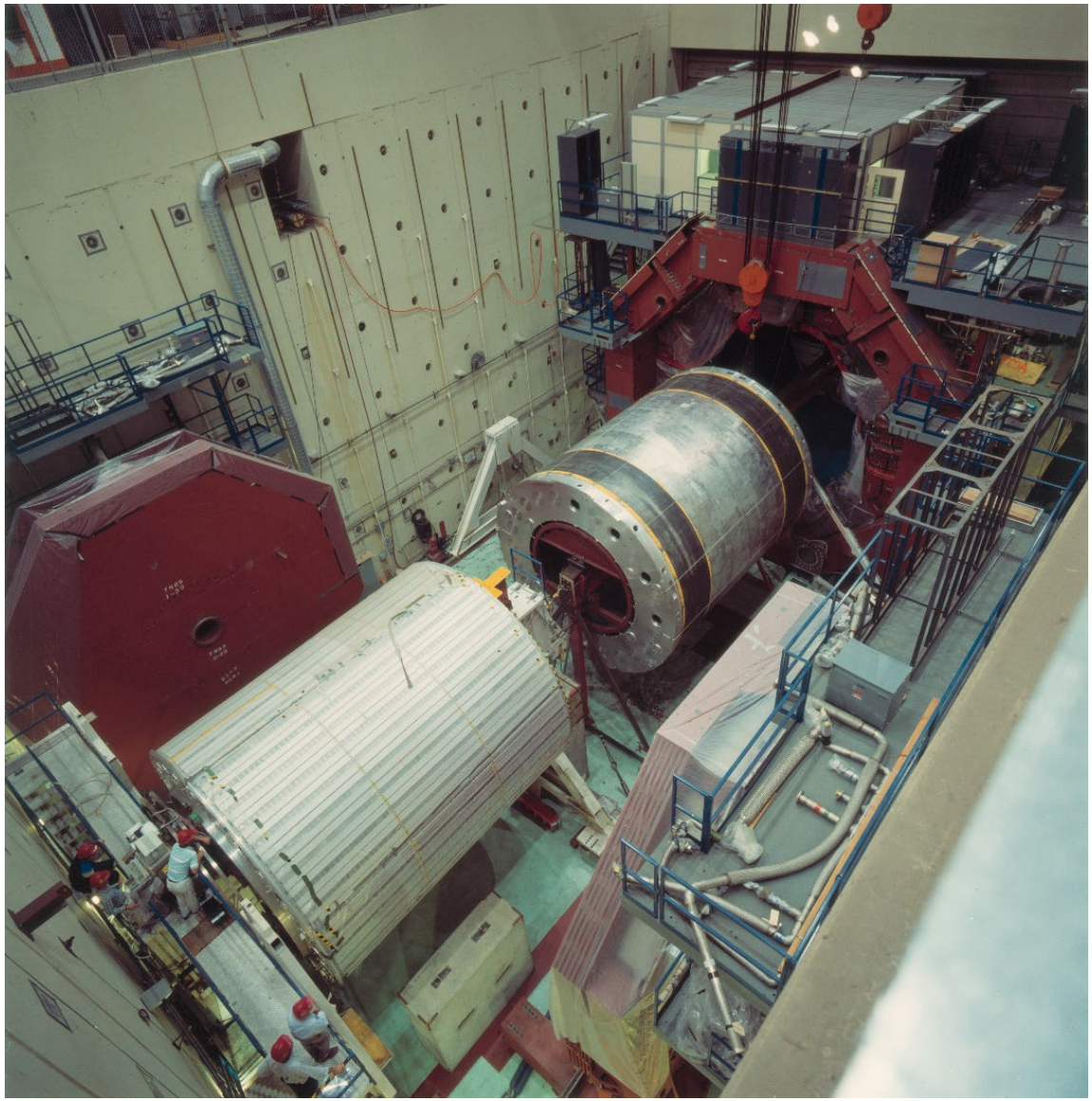


Barrel LAC

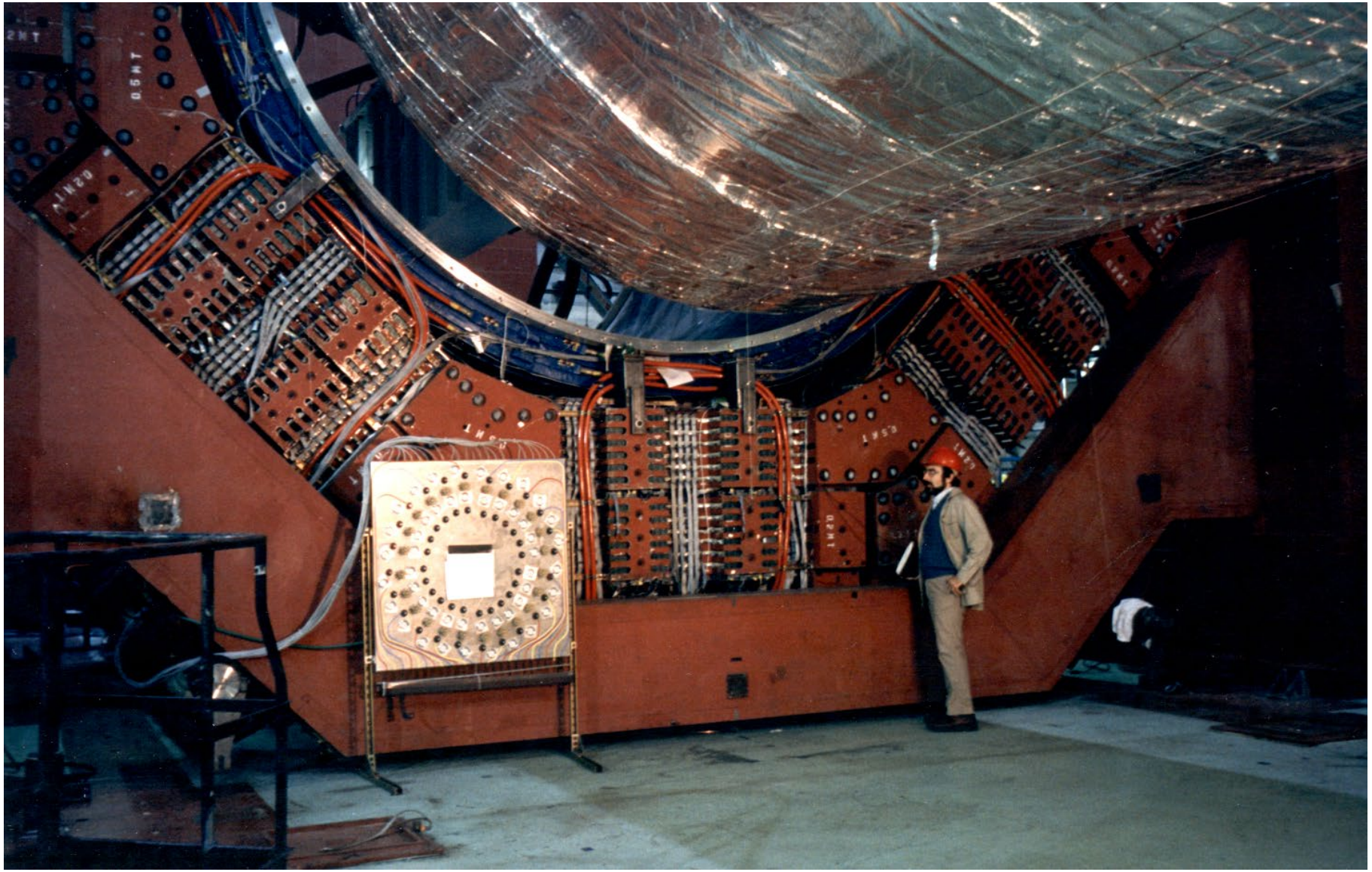
All the modules home



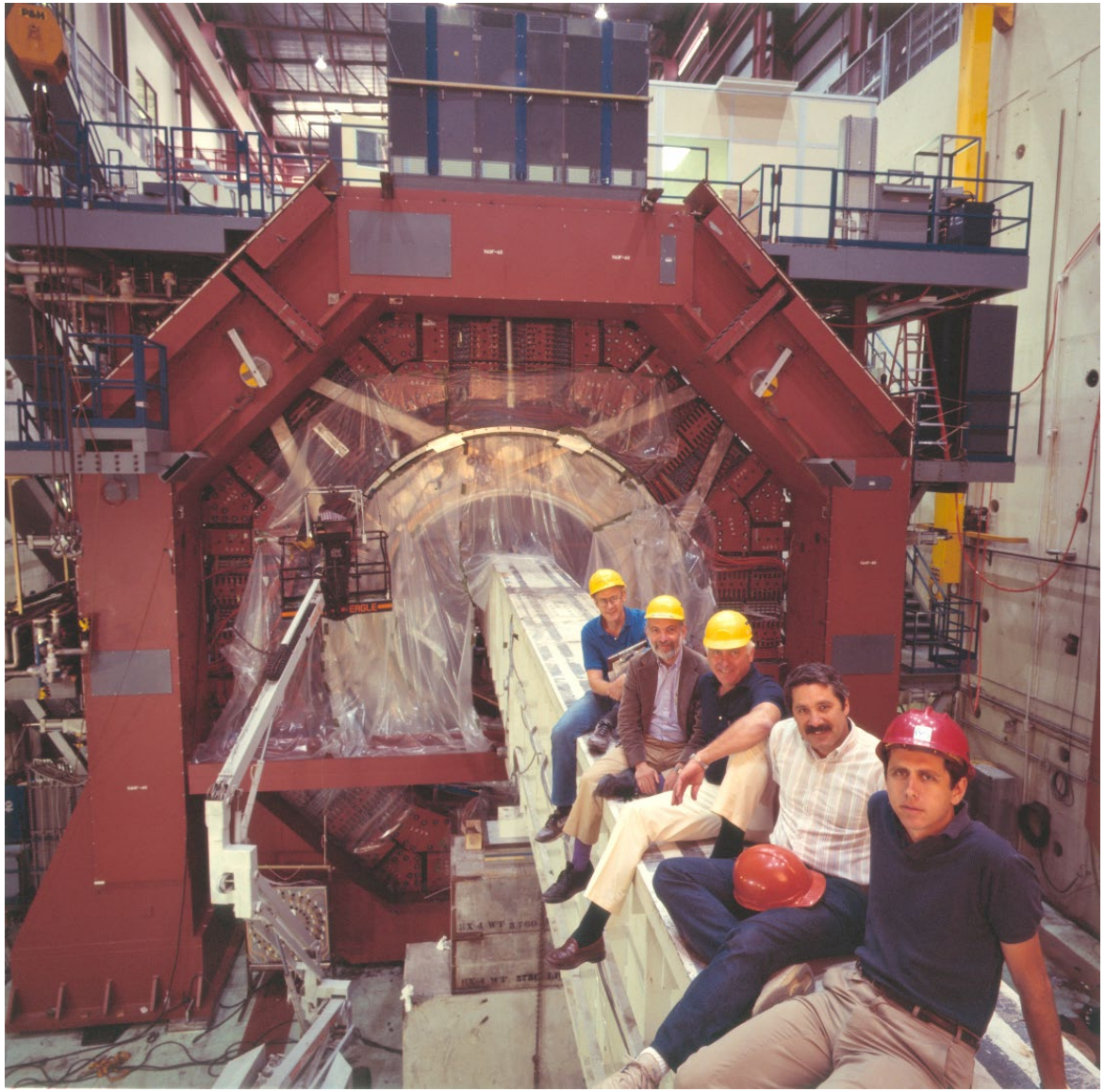
LAC Installation



Rafe checking if LAC will fit!



Knut got it right – everything fits!



Fixing the Argon Leak

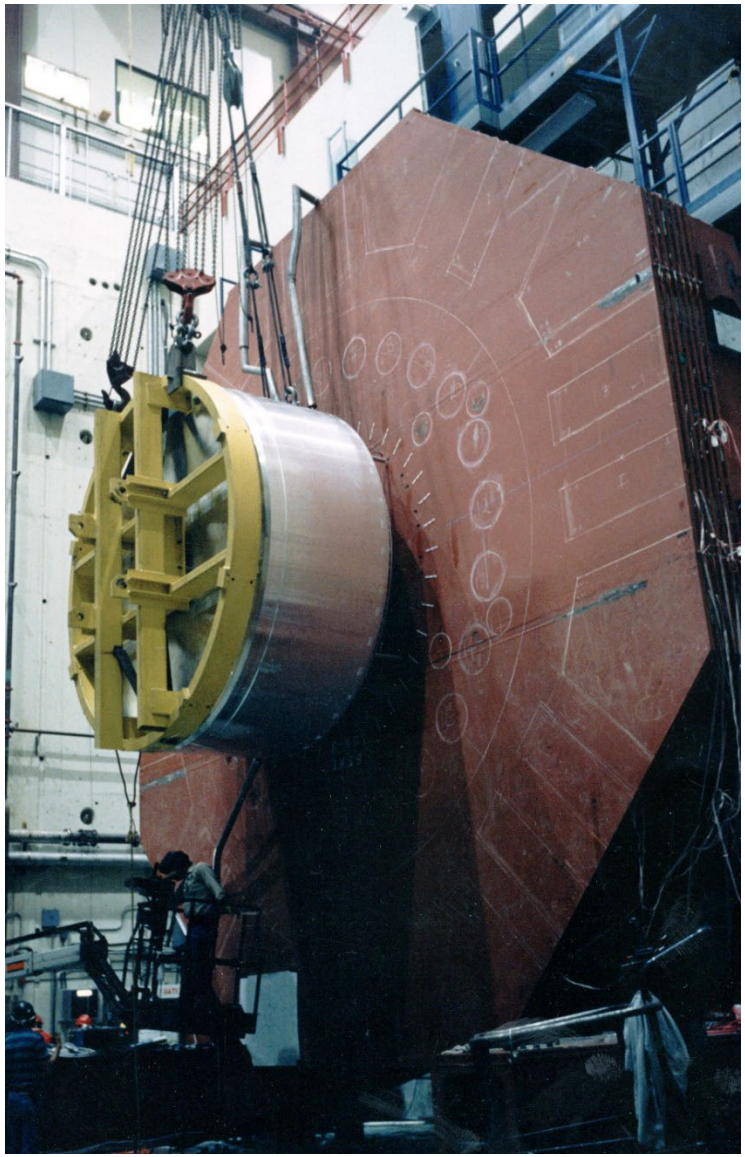
Lessons learned….

Welding aluminum is hard. Welding exotic Al alloys harder than 6066.

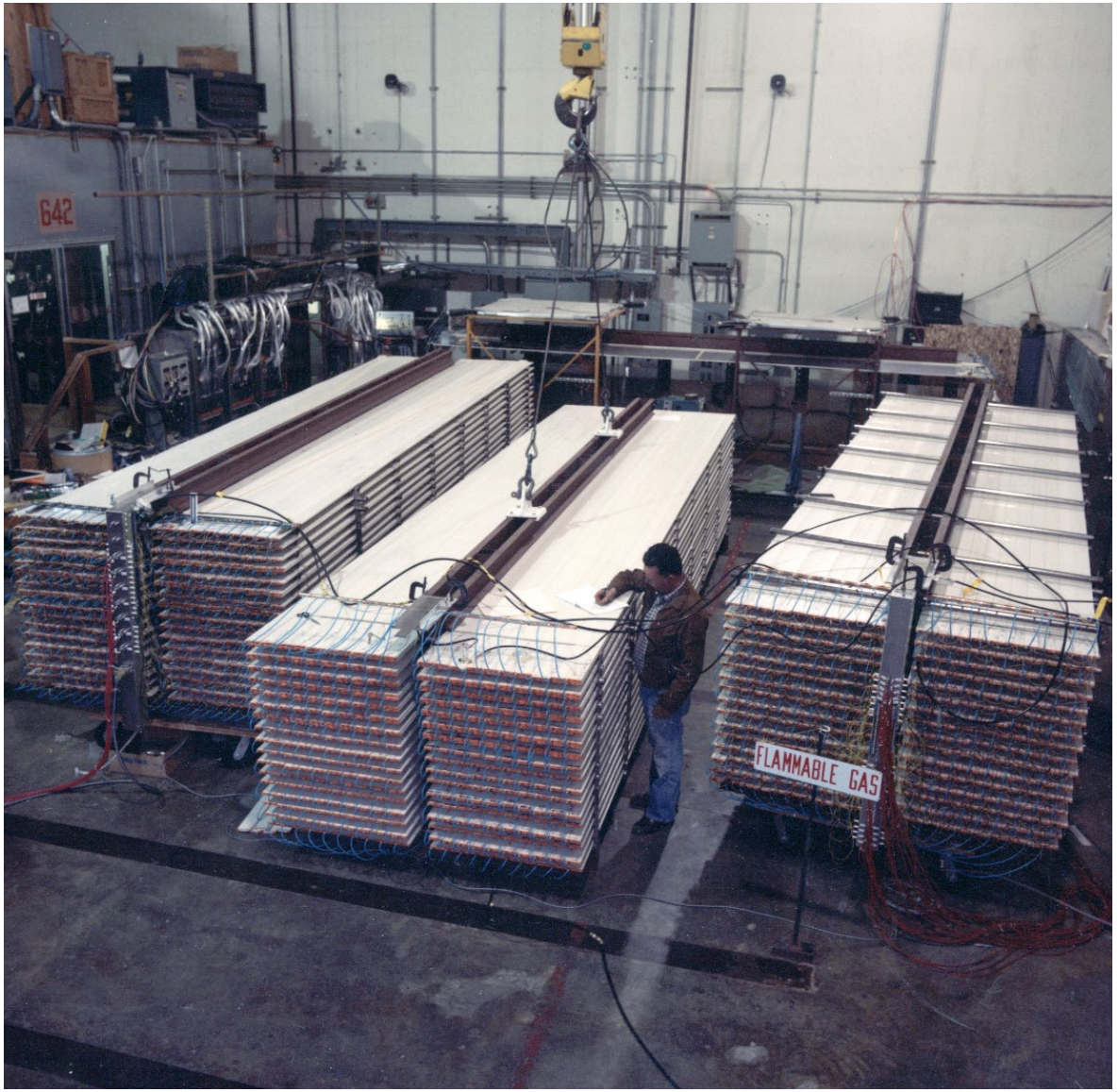
Always X-ray co-axial cryogenic lines

Lessons forgotten…

Mounting the Columbia Endcap LAC



WIC Production



WIC Testing

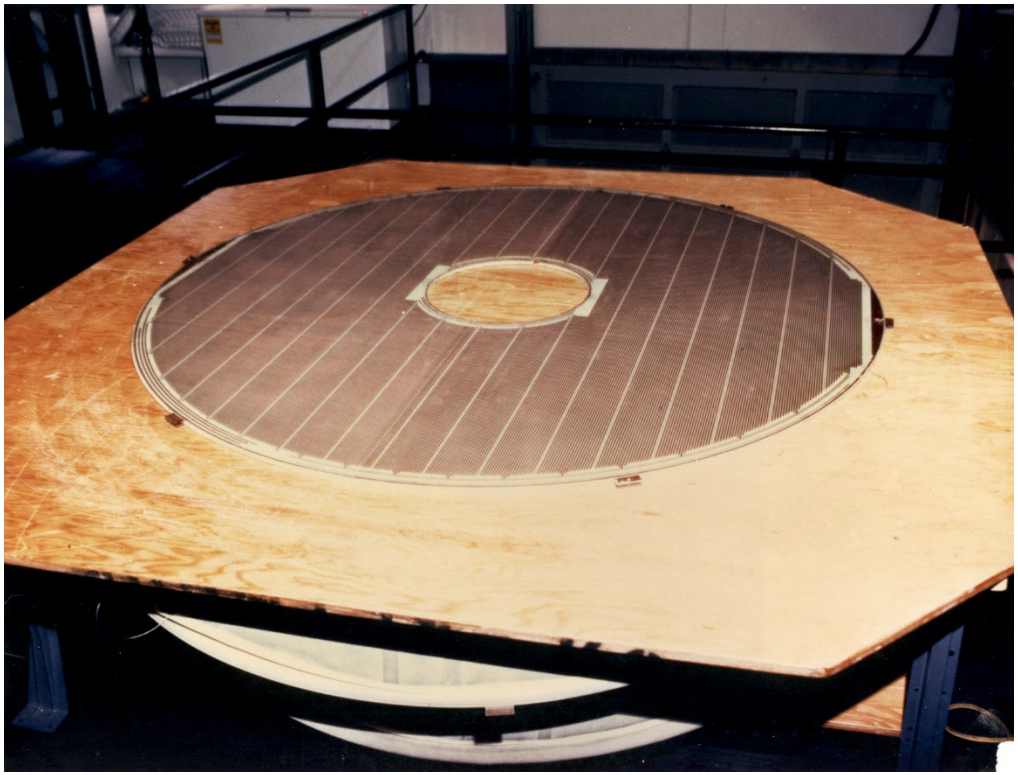
Trucking

WIC Octants Waiting

Note the slots in the spacer blocks!!

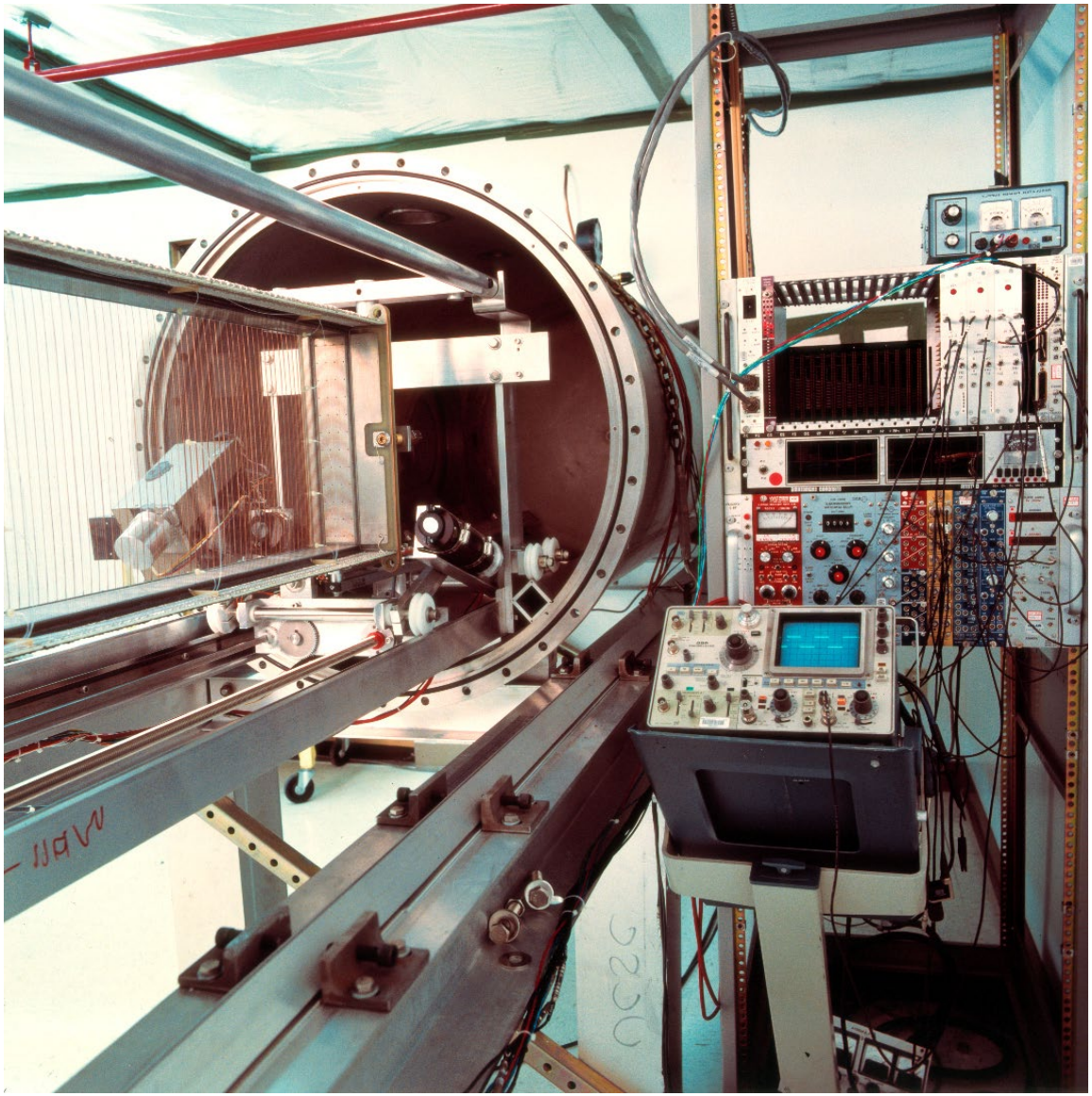
More Endcaps!!

Colorado, Yale, and Rutgers



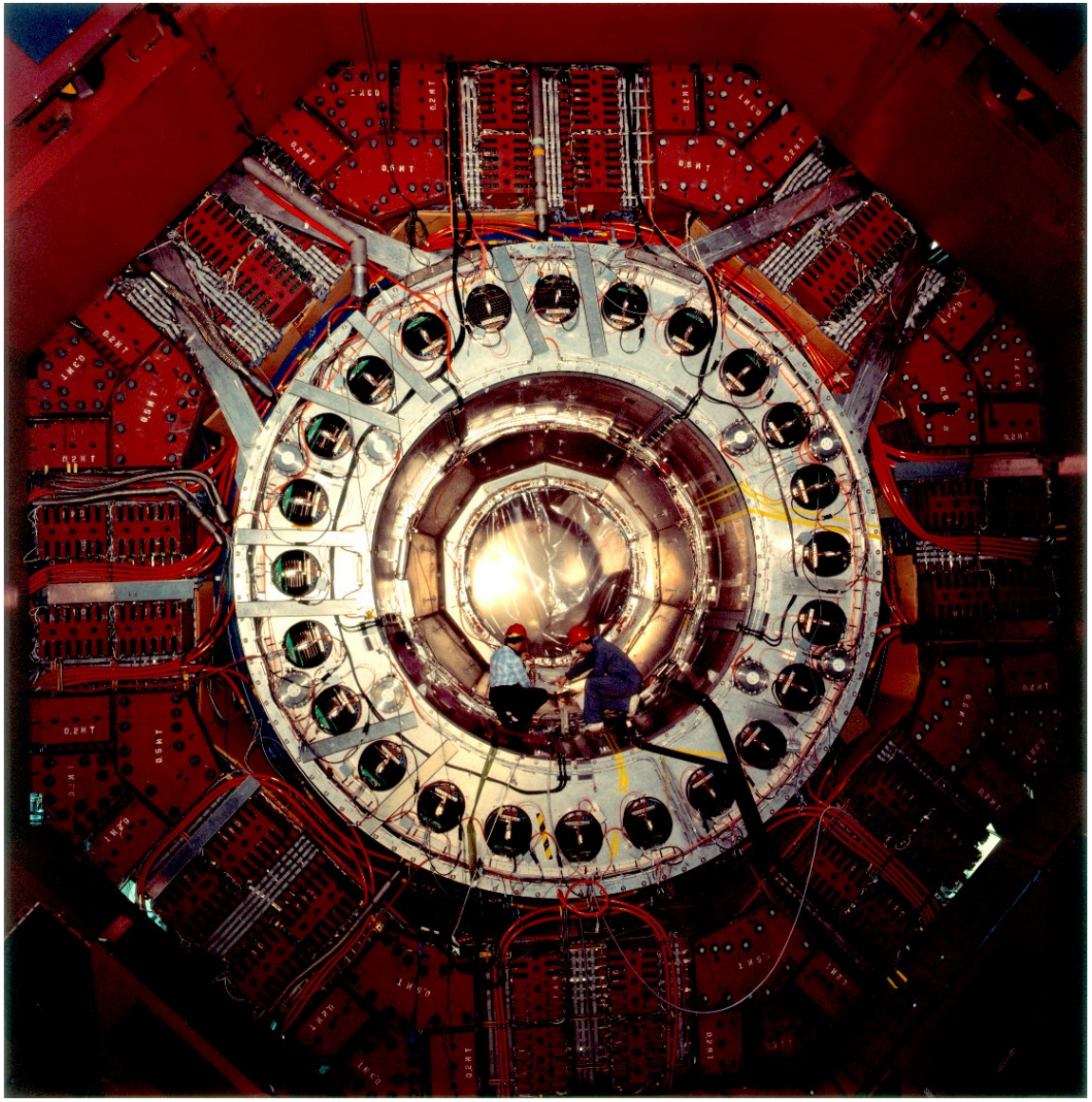
CRID HV Cage

Jaroslav's Sewer Pipe

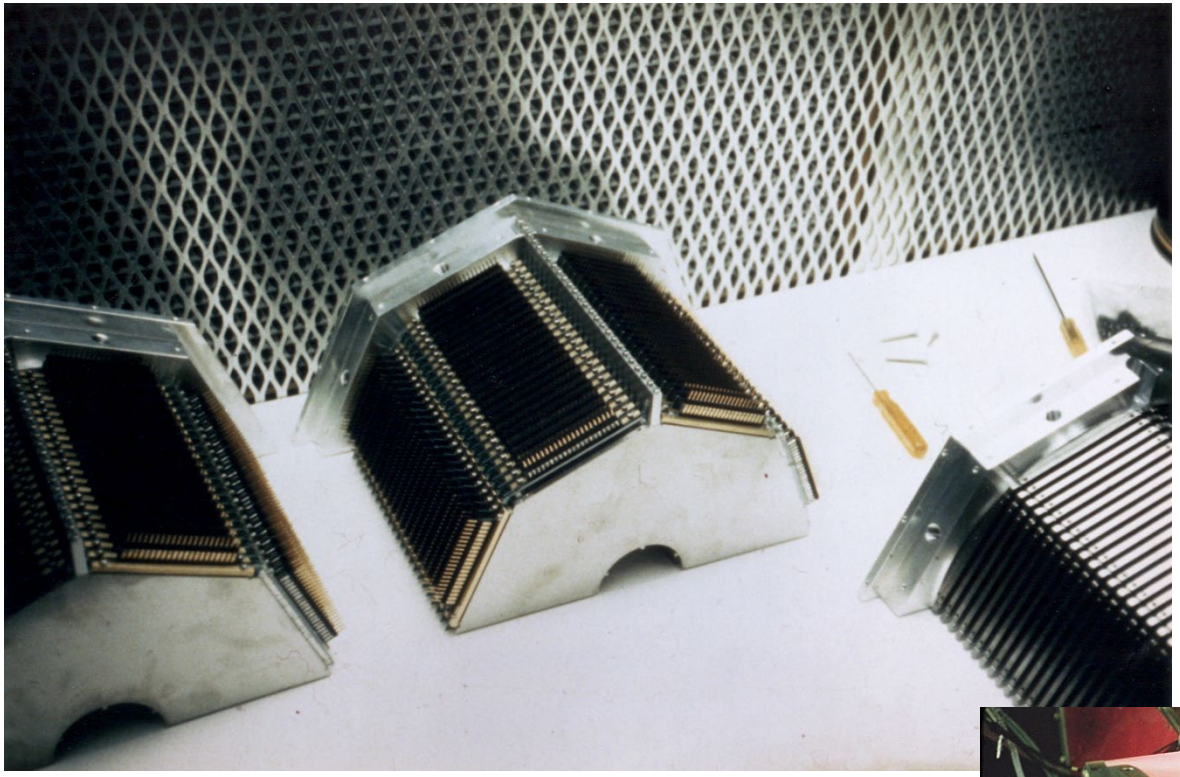


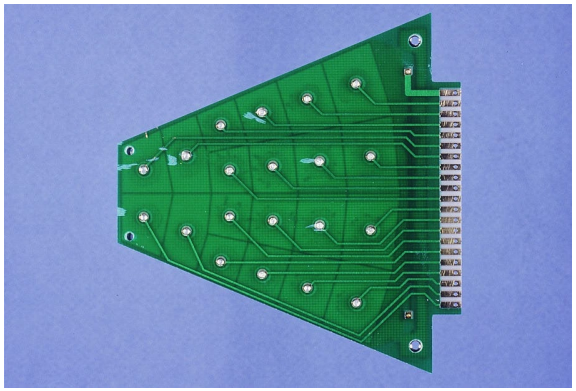
CRID Innards

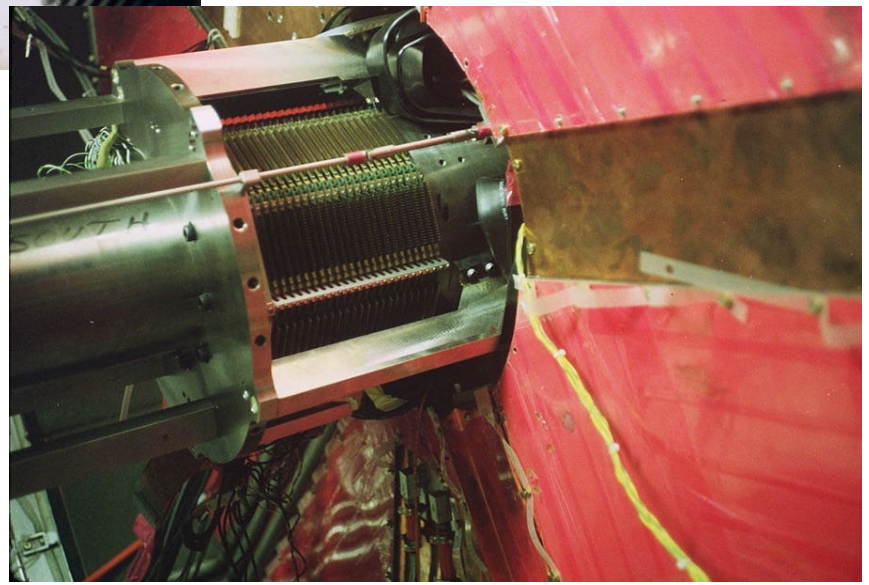
Ready for the CDC



Luminosity Monitor



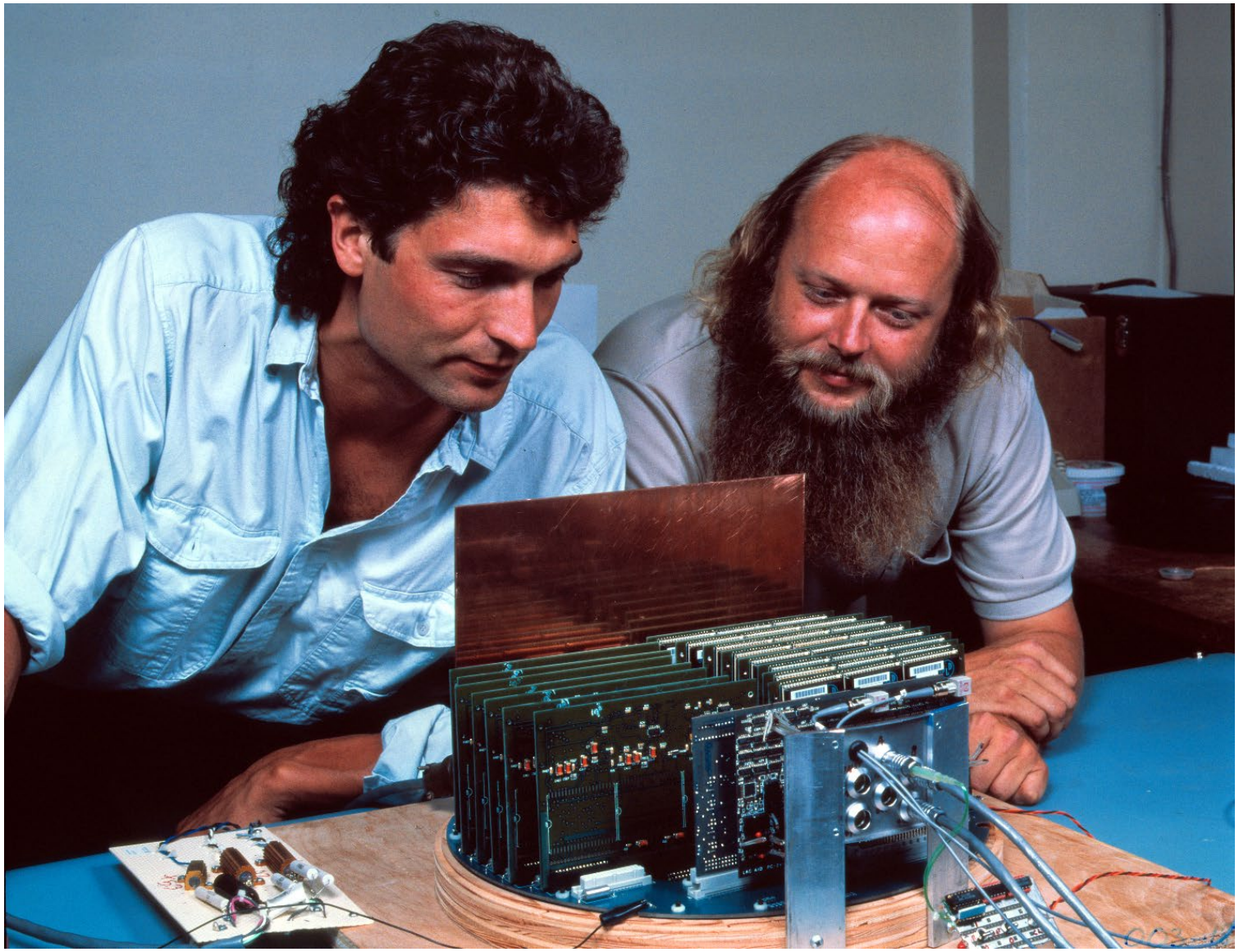




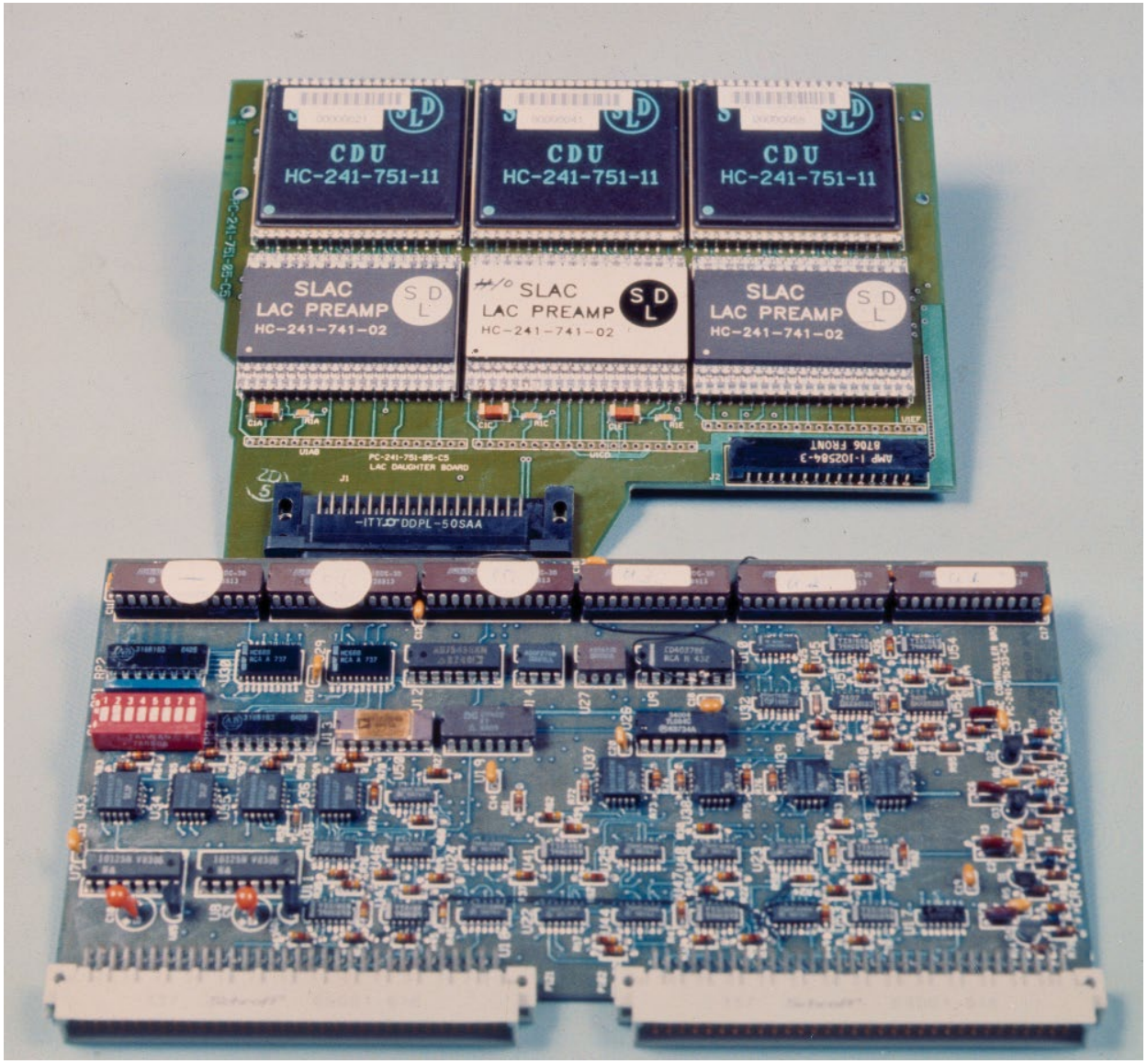
U of Oregon builds pixellated Si-W calorimeters for high precision luminosity measurements.

First detector use of Si-W calorimeter.

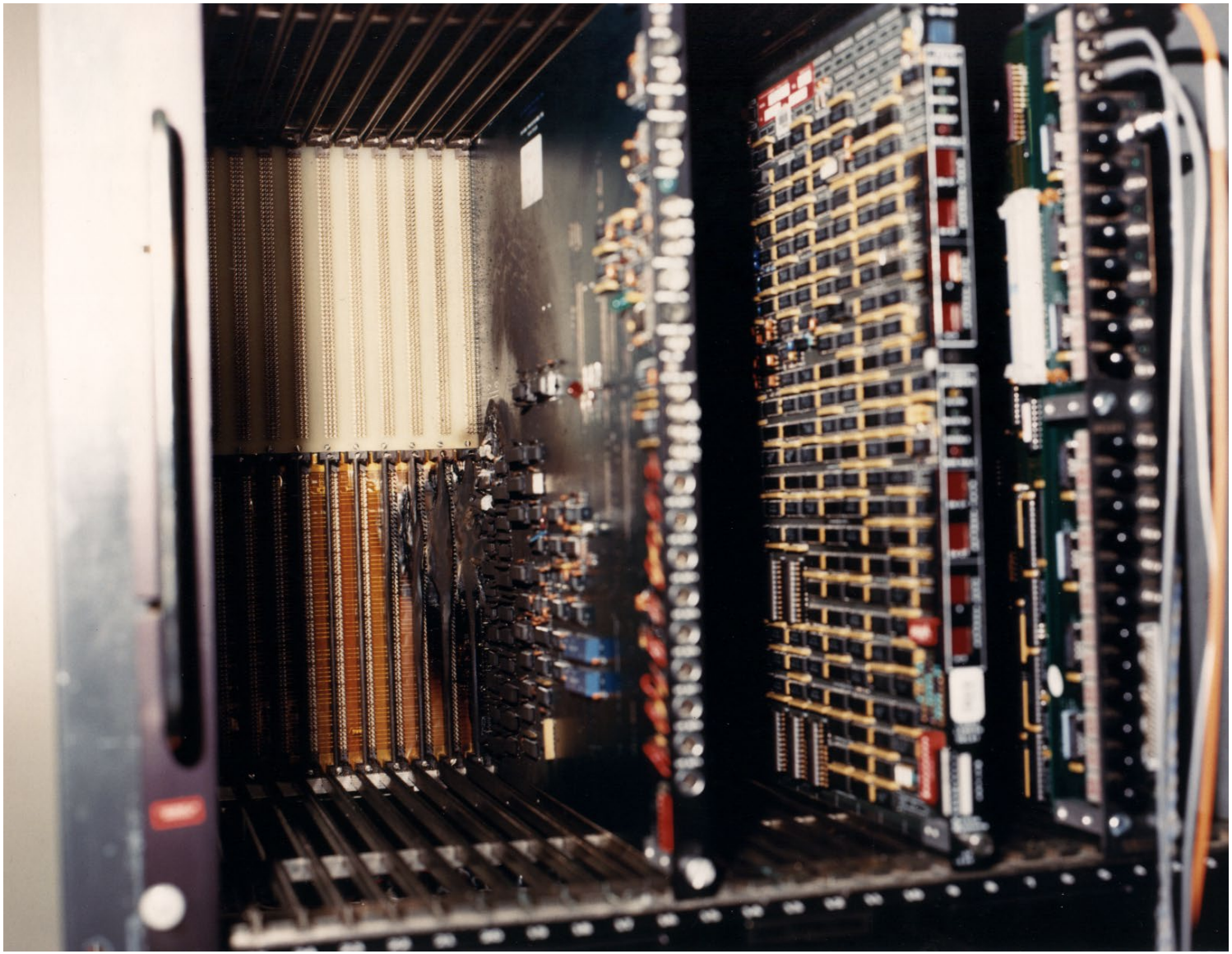
LAC Electronics



1980's High Tech Electronics



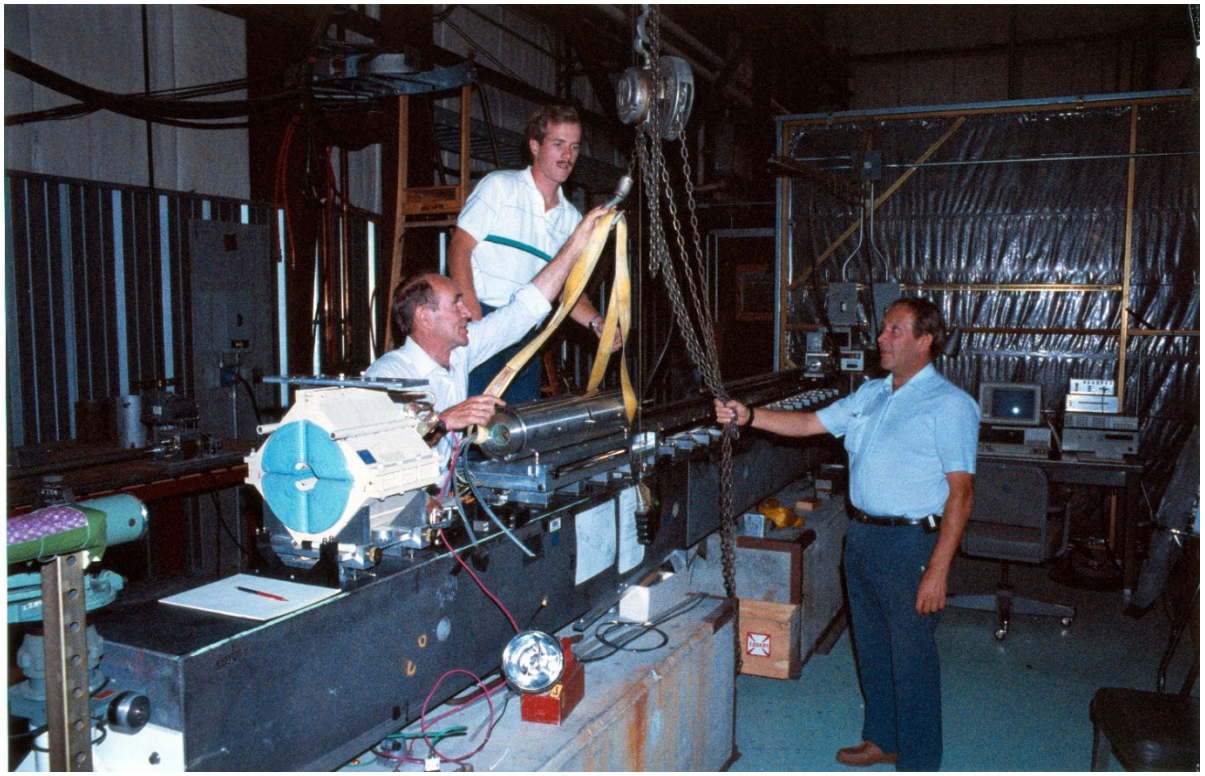
Fire in the Fastbus!

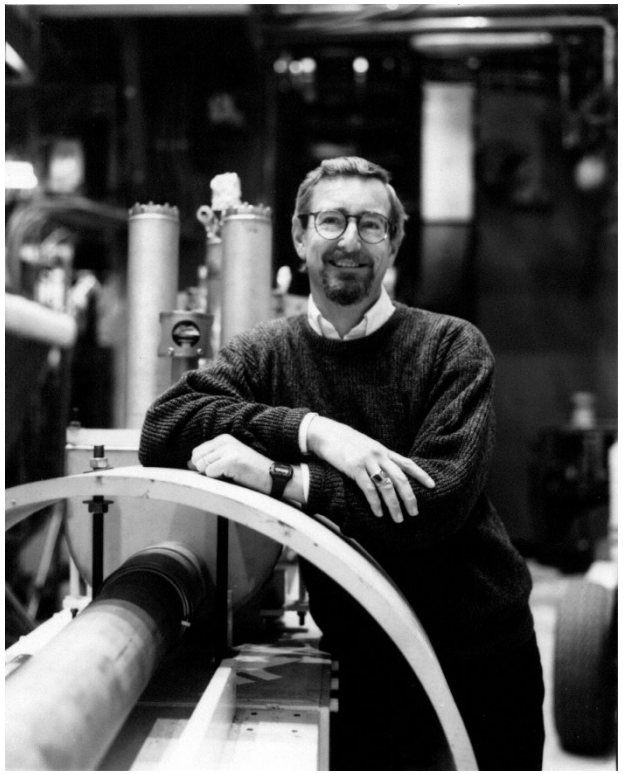


Below the Line….

Domain of JJ, Mike, Joanne…

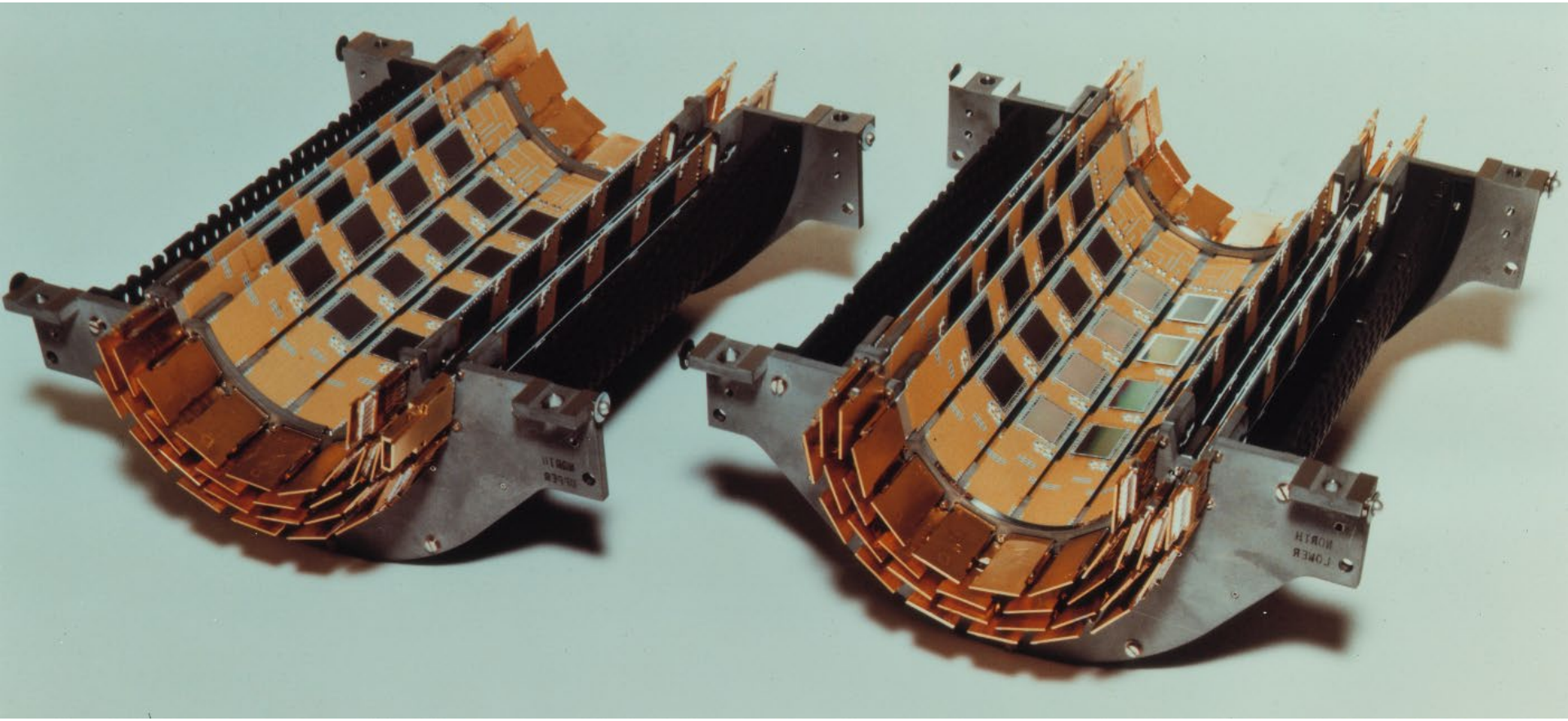
Superconducting Quadrupoles





The helium wars…..

Old Technology vs new
The fight for the VXD3 proposal

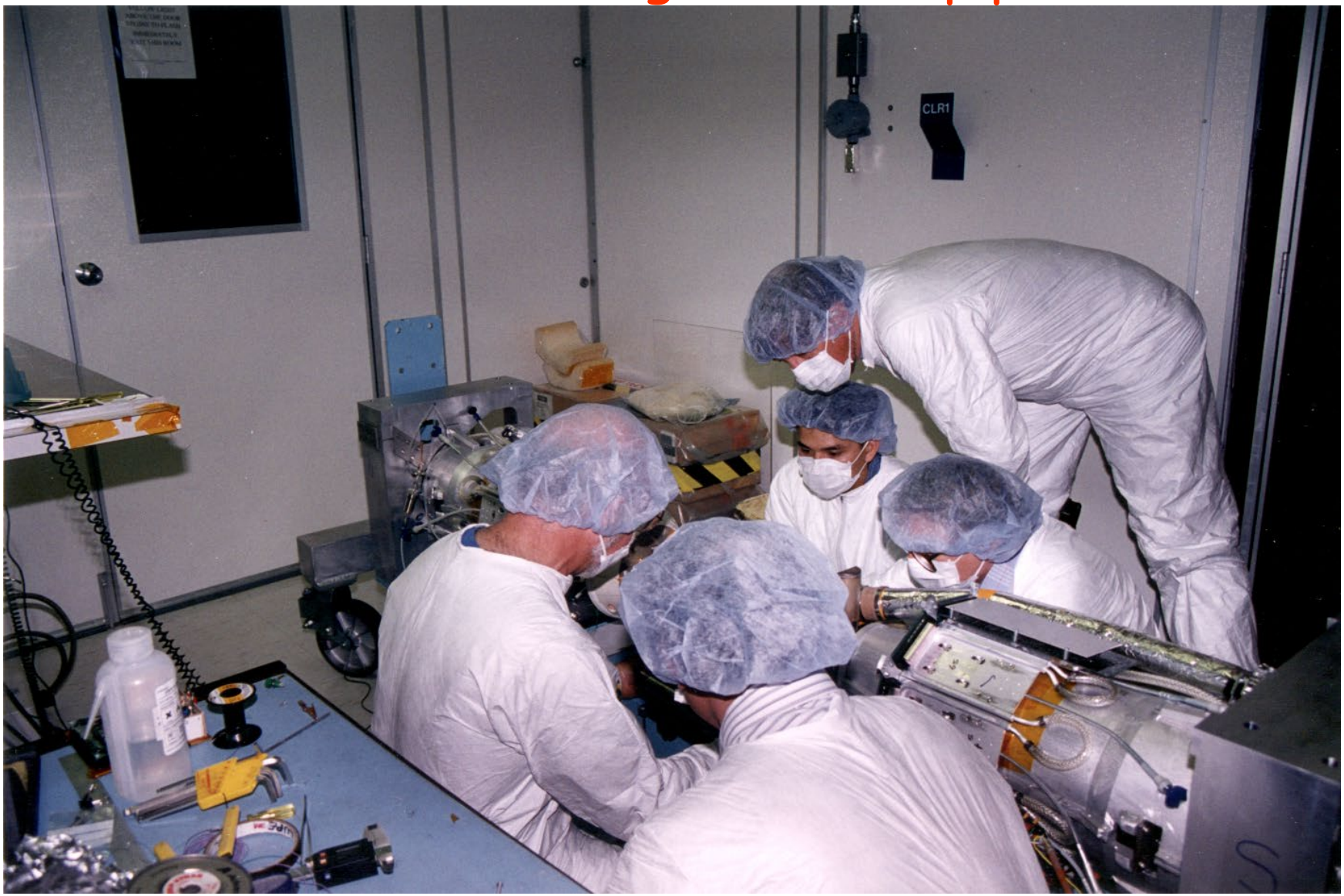


After a long struggle, Drell convinces Richter of merits of VXD3.

Strong collaboration of RAL, Yale, MIT, Oregon, SLAC, Brunel, U Mass, Col State, Washington, Wisconsin, Nagoya, Tohoku and Fedex build components.

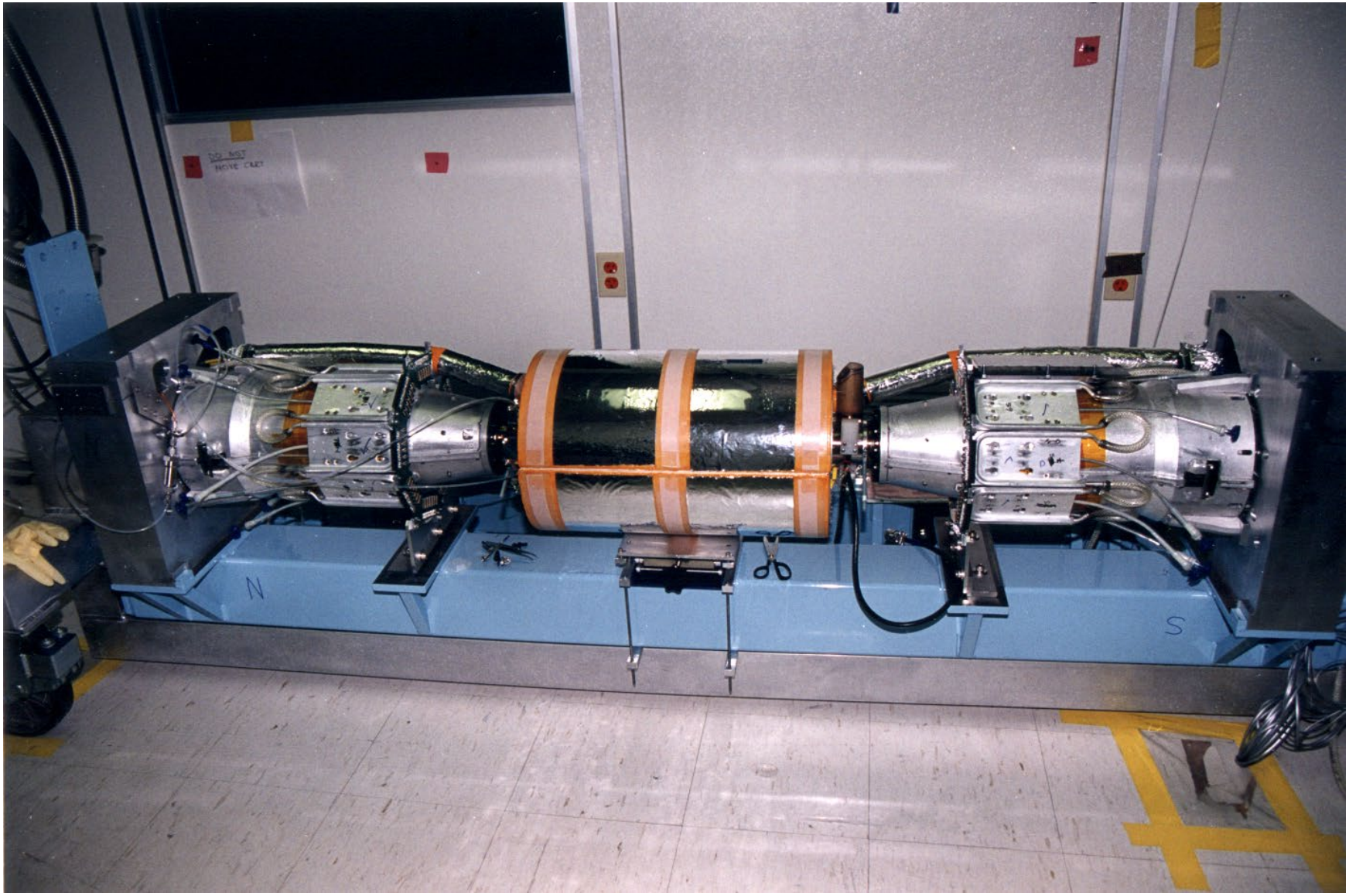
VXD3 Connections

VXD3 meeting the beampipe



Steady hands and many spotters!!!

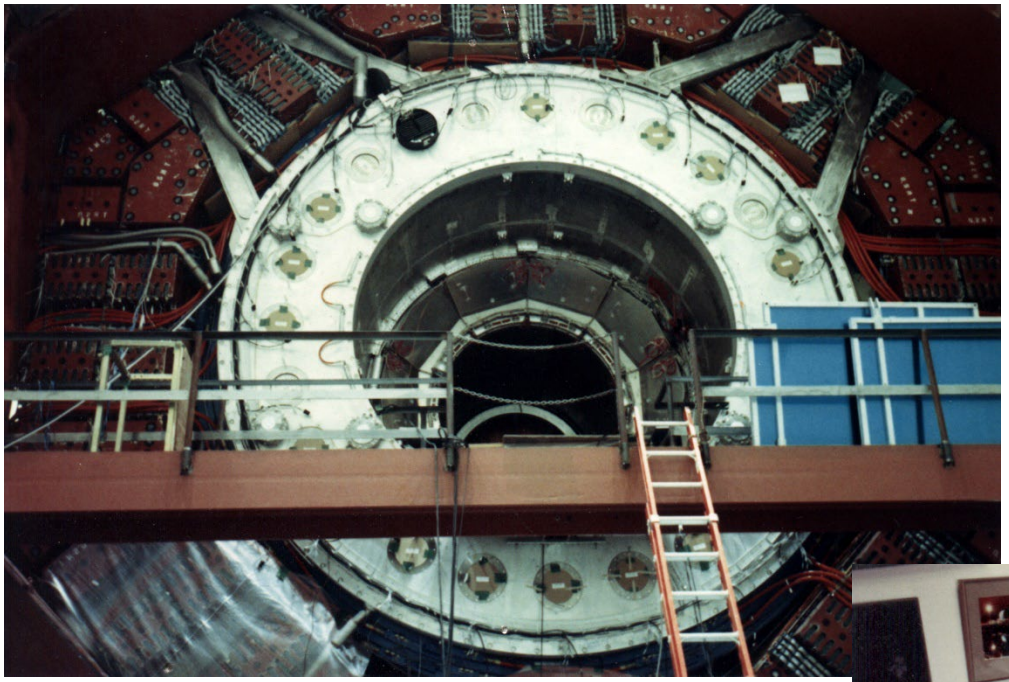
VXD3 Ready to go…



Natural Disasters

- The Great Freeze
  - In 1991, 100 year freeze hits the Bay Area during Christmas break. Most exterior pipes with stagnant water burst.
  - SLD damage almost nonexistent – LCW make-up water pipe lost.
  - SLAC damage amazing. ~All linac flowmeters (glass) break. Lots of plumbing. Most exterior sprinkler pipes.

Loma Prieta



SLD was earthquake braced

The LAC shock absorbers (restrain the cold mass with negligible heat leak) worked perfectly.

Frightening, but no damage

Minor disarray in Central Lab Annex!

But significant misalignment of SLC.

Social Issues

- Software
  - The Line – Above and Below
  - Tracking Code
  - The Great Unix Conversion
- People
  - Collaboration, not Confederation
- Royalty
  - The Emperor's Visit

Collaboration Meetings with (Found) Proceedings

• Mar 87	UCSC	
• May 88	Cal Tech	Best Food
• Dec 88	SLAC	
• July 89	Kirkwood	Physics Week
• Mar 90	Bend	
• Dec 90	SLAC	
• Aug 91	Squaw Valley	
• Apr 92	Chateau La Cresta	
• Sep 92	SLAC	
• May 93	Chateau La Cresta	
• Feb 94	Chateau La Cresta	
• Aug 94	SLAC	
• Feb 95	Chateau La Cresta	
• Aug 95	Kirkwood	
• May 96	Holbrook Palmer Park	
• Oct 96	Kirkwood	
• June 97	Chateau La Cresta	
• Feb 98	Chateau La Cresta	

Missing…

Monterrey

Stanford

Boulder

U. Washington

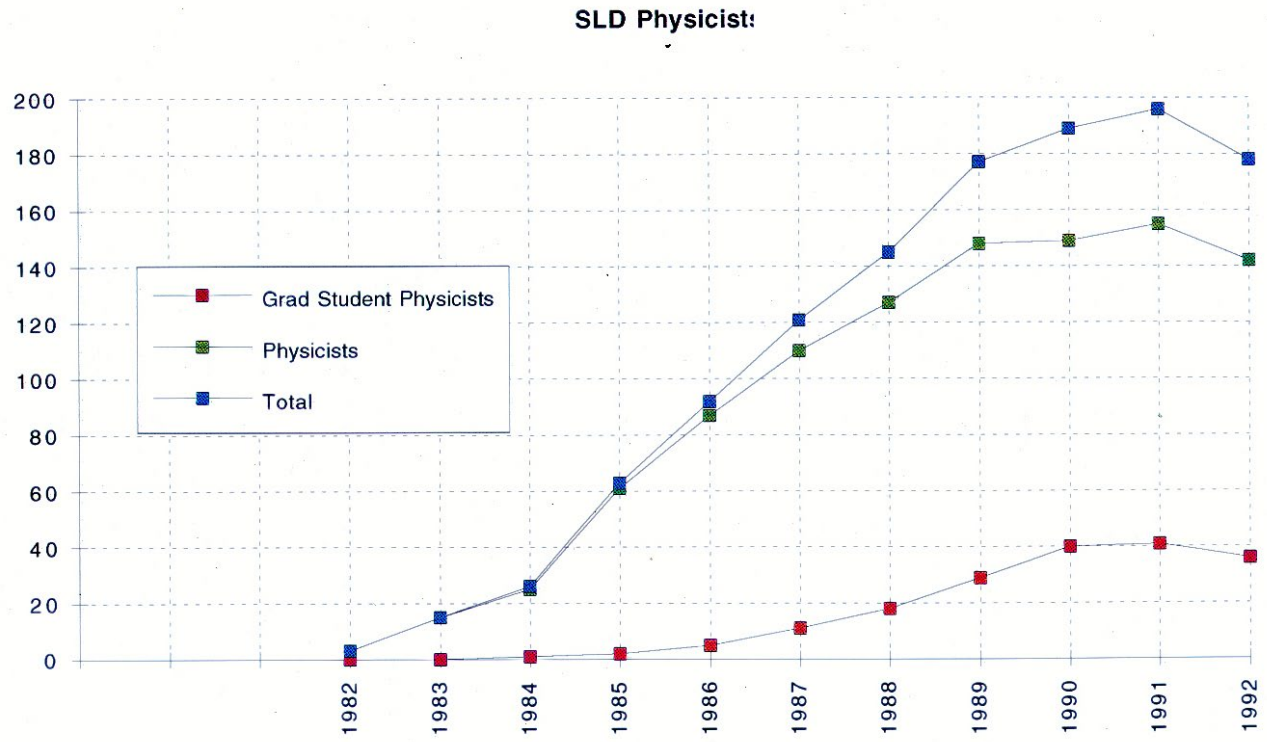
Elks Club

???

SLD People

A small but amazingly coherent collaboration.

Much closer to an old fashioned collaboration than today's huge confederations….



Preparations – the SLD Data Assembly Room

Before…

After…

Burton Leads…on the red carpet…towards the elevator-

Phil greets the Empress

Lots of Limo's, Lots of Security

Where are Gil and Mike?

After the Emperor's Visit

The normal crowd….

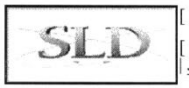
Great Expectations…

EXPECTATIONS FOR THE 1989 SPRING RUN

$$\mathcal{L} = f\frac{N^- N^+}{4\pi\sigma_x\sigma_y}$$

	$\mathcal{L}$ Now	High $\mathcal{L}$
f	30 Hz	60 Hz
N^-	1.1×10^{10}	2.2×10^{10}
N^+	1.1×10^{10}	2.2×10^{10}
σ_x	3.5μm	3μm
σ_y	3.5μm	3μm
$\mathcal{L}(\mathrm{cm}^{-2}\mathrm{s}^{-1})$	2.3×10^{27}	2.6×10^{28}
Z_0 Rate	.26 per hour	2.8 per hour

The End – of the e^+ target, SLC, & SLD



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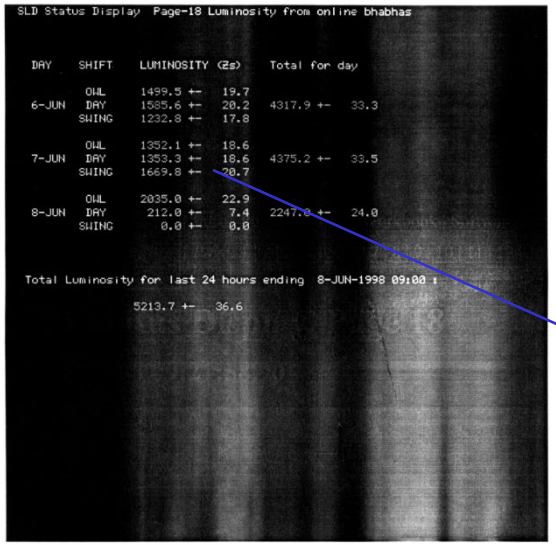

Status/WWW interface made possible by the gd package.