My Action Packed LPS Grad Student Adventure 1972-1976

John Sethian

In the early 1970's, LPS had many experimental programs in fusion energy oriented research.

- Electron beam heating of linear plasma– Chuck Wharton
- Electron beam heating of toroidal plasmas- Bruce Kusse
- Electron beam generated microwaves- John Nation
- Ion / electron beam plasma confinement Hans Fleischman

Chuck Wharton's lab

- Prof C.B. Wharton; My Thesis advisor /the head of the group
- Fred Sandel; Introduced me to gin and Jaguars
- Mike Greenspan: My contemporary and fellow grad student. ……Who only tried to kill me once
- Milt Johnson: Worked in the corner on an experiment on Whistler Waves
- Pete Brown: The highly competent technician
- Peter Korn: Post Doc #1
- Carl Ekdahl: Post Doc #2, a mentor, lifelong friend, colleague
- A twelve foot long glass tube full of hydrogen cyanide

Cornell Relativistic Electron Beam heating experiment (Prof Chuck Wharton)

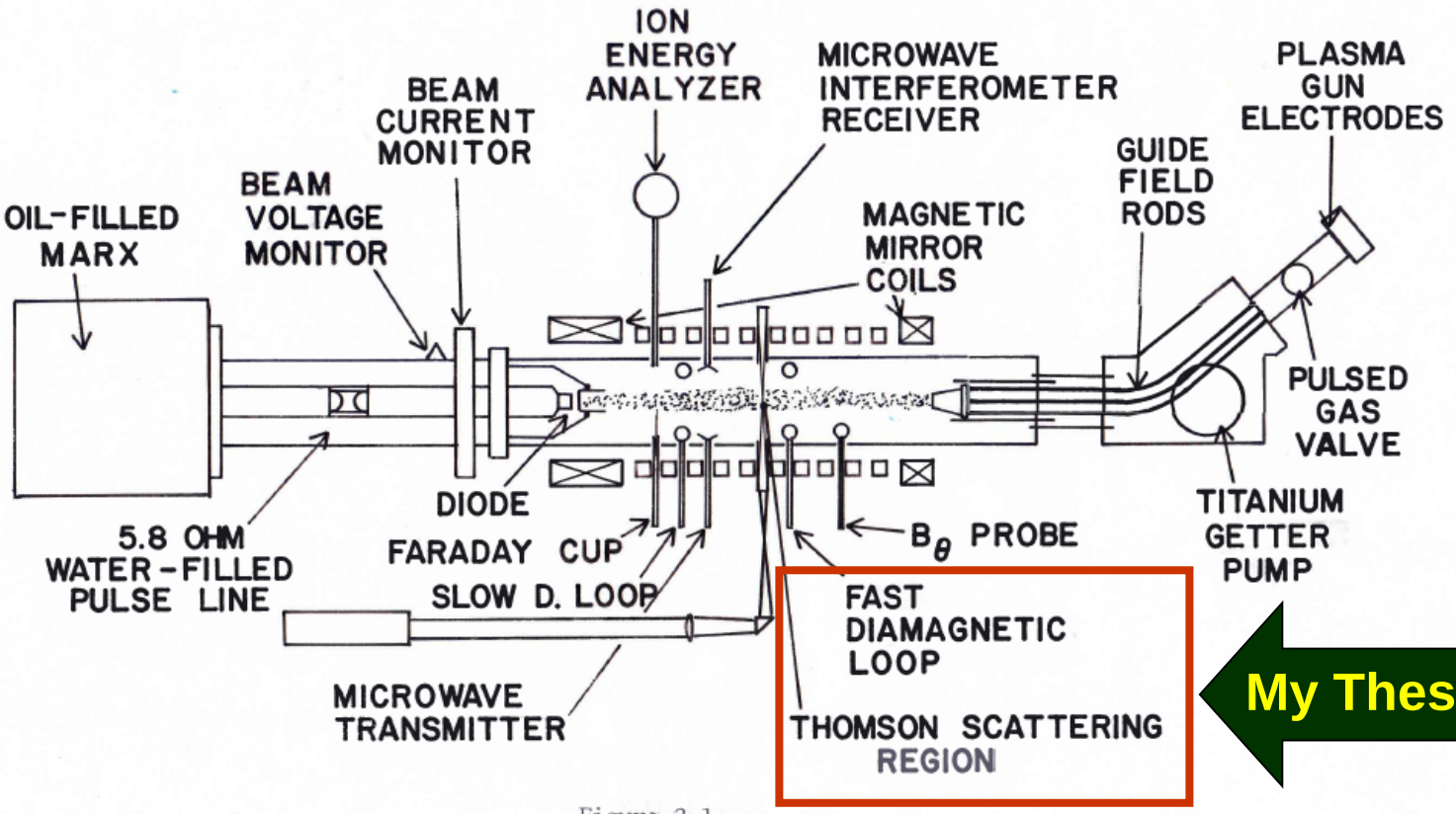
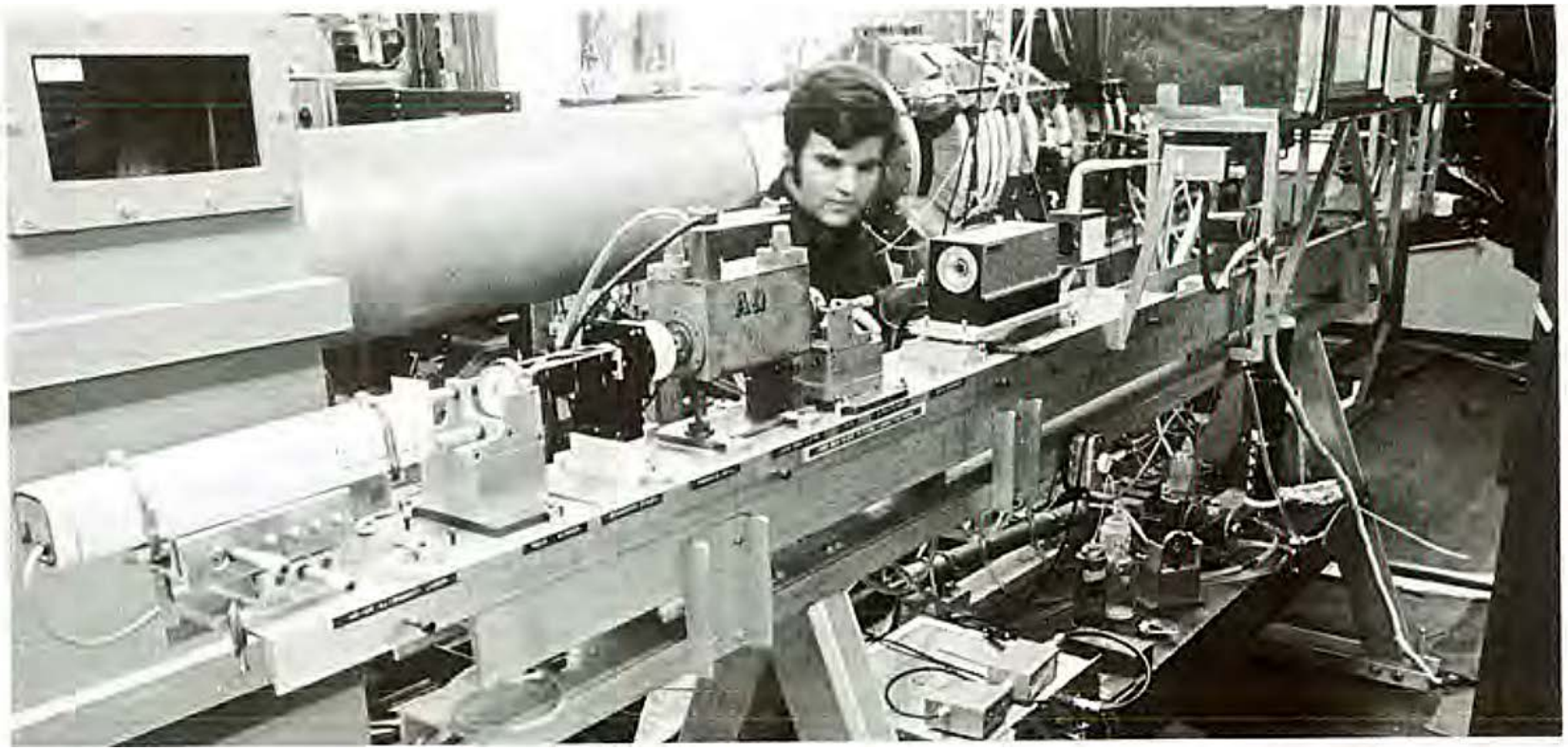


Figure 2.1
The Cornell Relativistic Electron Beam - Plasma Experimental Facility

DL easy

Cornell Thompson Scattering System-

a much bigger task than I thought



The door

The LPS Poker Alliance

Carl Ekdahl
Stan Humpries
Tom Lockner
Dick McKee
Bob Meger
Evan Rose
Chip Smith
Dave Woodall

On defenses:
Candidacy, Thesis, and Other

Scattered light derailed my business career

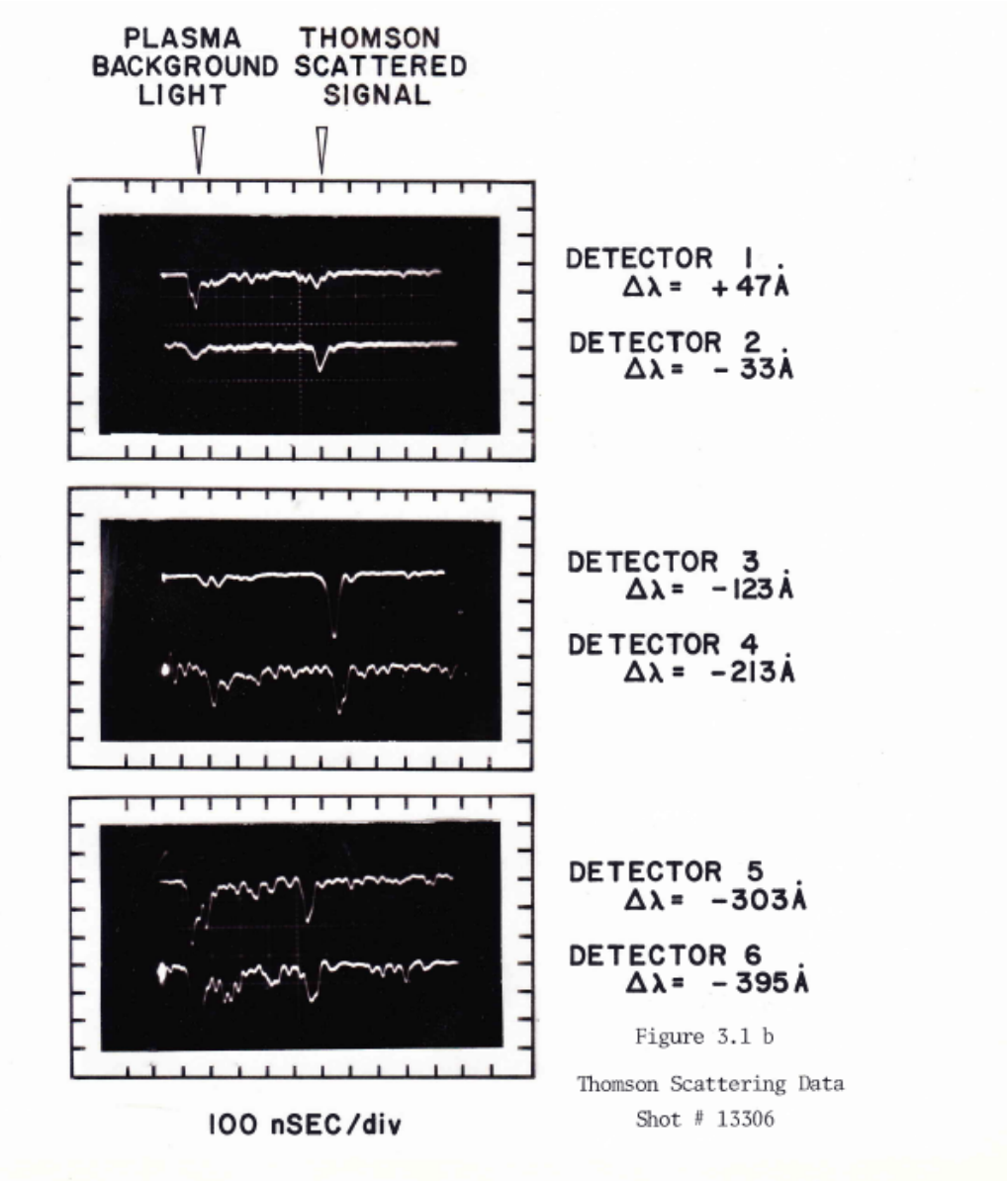


Figure 3.1 b

Thomson Scattering Data

Shot # 13306

pipe

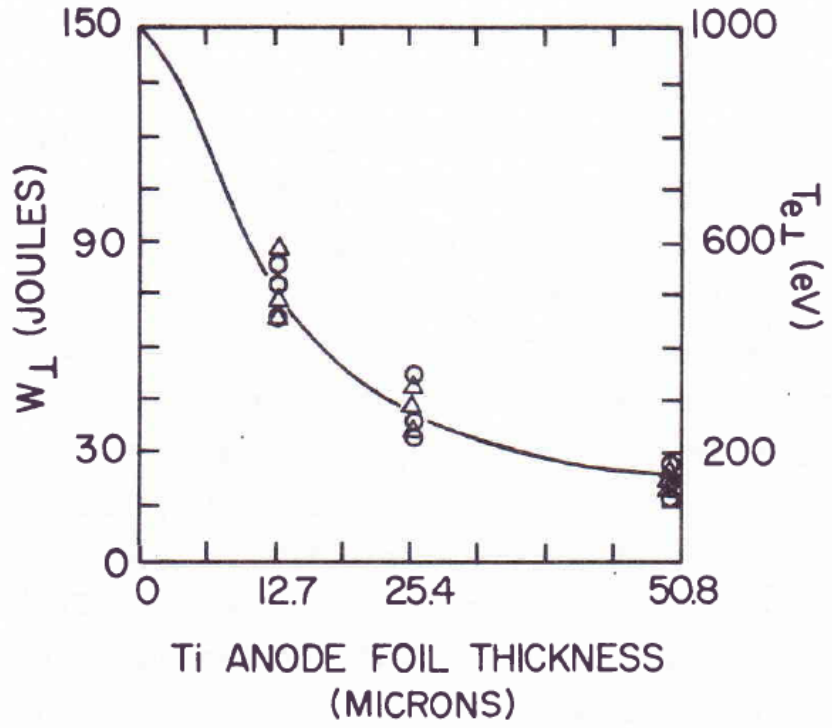


FIG. 3. Variation of energy transferred to plasma with foil thickness. The theoretical prediction (solid curve) is proportional to $\Delta n/n_b$ and has been normalized to the data for 25.4-μm Ti anode foils. Circles represent measurements of total perpendicular plasma energy with diamagnetic loops, and triangles represent measurements of plasma electron energy with Thomson scattering.

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Effect of Beam Scattering on Plasma Heating with Relativistic Electron Beams

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(Received 20 December 1978)

A fully ionized plasma column was heated with a relativistic electron beam. Experiments in which plasma heating was dominated by the beam-plasma two-stream interaction demonstrated a scaling of energy deposition with the beam-to-plasma density ratio and the beam angular scatter in accordance with a theorectial model of the two-stream instability. Beam-to-plasma energy-transfer efficiencies exceeding 25% and plasma electron temperatures of 600 eV were observed.

The availability of high-power relativistic-electron-beam (REB) generators has stimulated interest in their use for the rapid heating of plasma targets.[1,2] Because energy transfer from the REB to the plasma by means of Coulomb collisions is negligible for the plasma densities and

Life after Cornell

Ithaca hurt my car

Worked at The Naval Research Laboratory (38 yrs)
Using pulsed power, electron beams, and their applications

Fusion

- Reversed magnetic field configuration with rotating beams
- Dense Z-pinch from frozen deuterium. TWICE
- KrF lasers for direct drive fusion energy
- Ran National program for IFE based on direct drive
  - Kicked out of four different DOE fusion programs

Other

- Repetitve durable pulsed power and electron beams
- Collective Acceleration of ions
- Charged particle and laser beam weapons
- Material modification with electron beams
- Eliminating NOx (and possibly CO_2) in fossil fuel power plants

Now: Building a laser shock facility for Washington State University at the Dynamic Compression Sector, Argonne National Lab