Linac High Intensity H+ Beam Test

M. Popovic

Linac Proton Test

- Why?
- How?
- When?
- Results

Why Protons?

- **We need more than 10^{14} H- out of Linac**
- 10^{14} ~ 16000 mA-μs
- Linac Runs ~48mA
- Pulse length ~80μs Source, ~100μs DTL ~120μs High Energy Linac
- **Long Pulse Length ~ $$$**

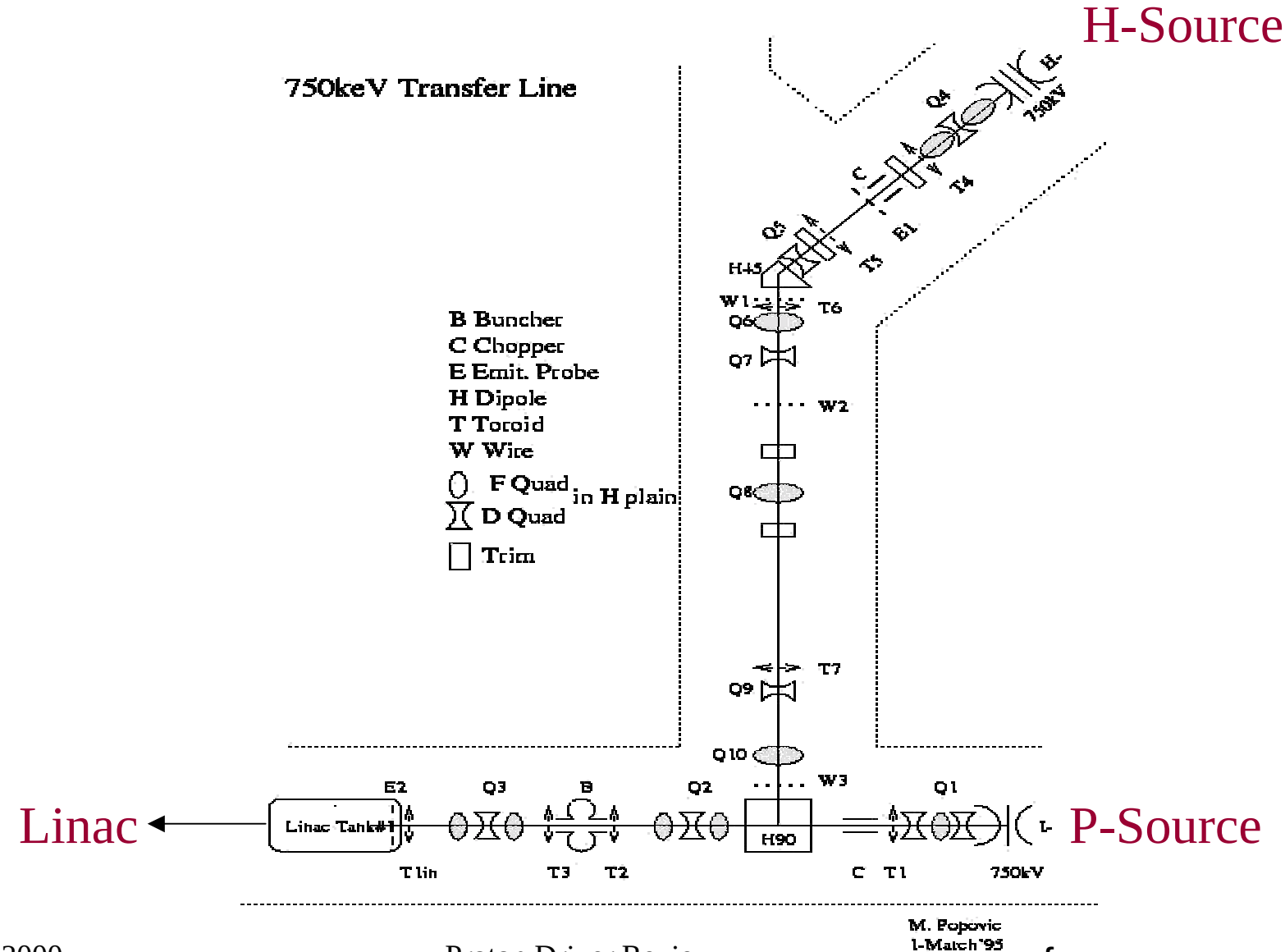
Why Protons?

- **What is Limit on Peak Current in Fermi Linac?**
- Low Energy Linac Design for 100 mA.
- High Energy Linac Design for 50 mA.
- Linac Runs ~48mA, record 52mA of H-
- Limited by H- Ion Source!
- **Proton Ion Source can produce >200mA**

How?

- **Proton Ion Source can produce >200mA**
- H- Line Running H- Source for Normal Operation (Main Injector Commissioning)
- I- Line Dome House Proton Source (Temporary)
- Linac Tuned for Protons.

Experimental Setup



People

- **Linac**, L.Allen, A.Moretti, H.Ma, M.Popovic, C.Schmidt, K.Carlson, J.Wendh, R.Hren, L.Wahl
- **Mechanical Group**, B.Ogert, D.Douglas, M.Petkus
- **Beam Physics**, C.Ankenbrandt, W.Chou, E.McCrory
- **RF&Inst**., Z.Qian
- **Operations**, T.Sullivan and Whole Group
- **Controls Group**, M.Kucera, B.Florian, B.Goodwin, M.Shea

When

- From 24 February to April 1, 1999
- Two Weeks for Setup of Proton Source.
- Two Weeks for Tests/Experiments.
- One Week for Recovery (H- Operations)
- NTF Tue. Wed. Fri.
- NTF and Booster Studies.

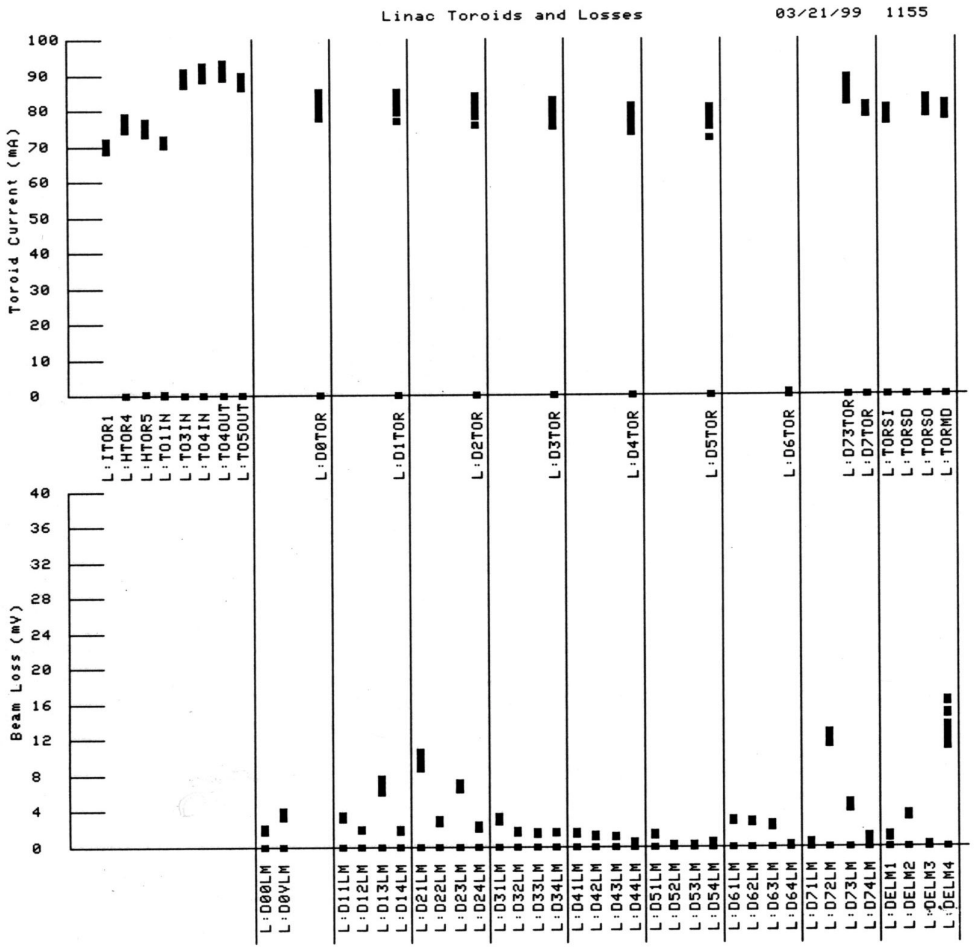
Operating Conditions-Tuning

- Beam Pulse Length 10μs
- Repetition Rate 1Hz
- Beam Current >50mA
- Tuning for higher Transmission Rate
- Tuning out high Losses - Larry Allen,
  . - Todd Sullivan,
  . - Operators

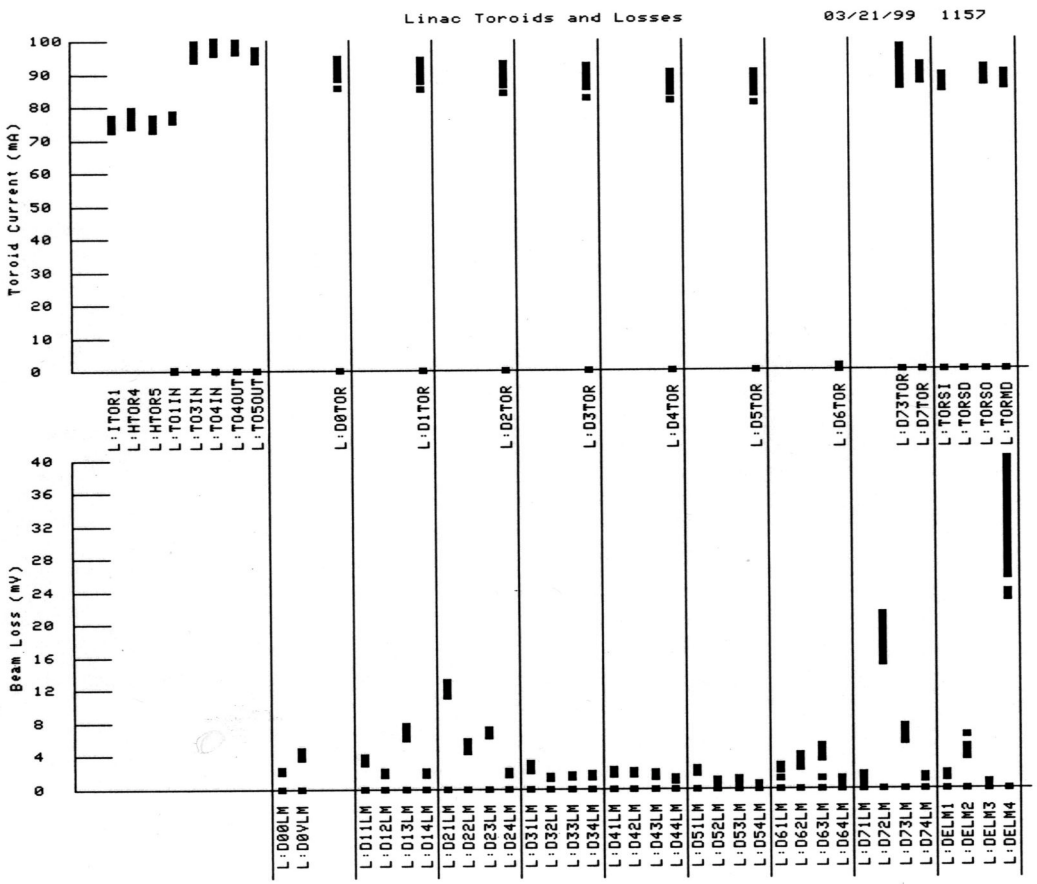
Linac Input Emittance -Protons

3/18/99	Emittance in pi-mm-mr		E.McCrory	
	Probe Tank#1In	LinacOut(mA)	E(95%Norm.)	
	Horizontal	78	2.4	
		82	2.4	
		88	2.8	
		92	2.4	
	BuncherOFF		2.2	
	Vertical	78	3.1	
		82	2.9	
		88	2.9	
		92	3	
	BuncherOFF		3.1	
	BunchLengthHWHM	11.5	Degree@805	

Peak Current Limit ~85mA

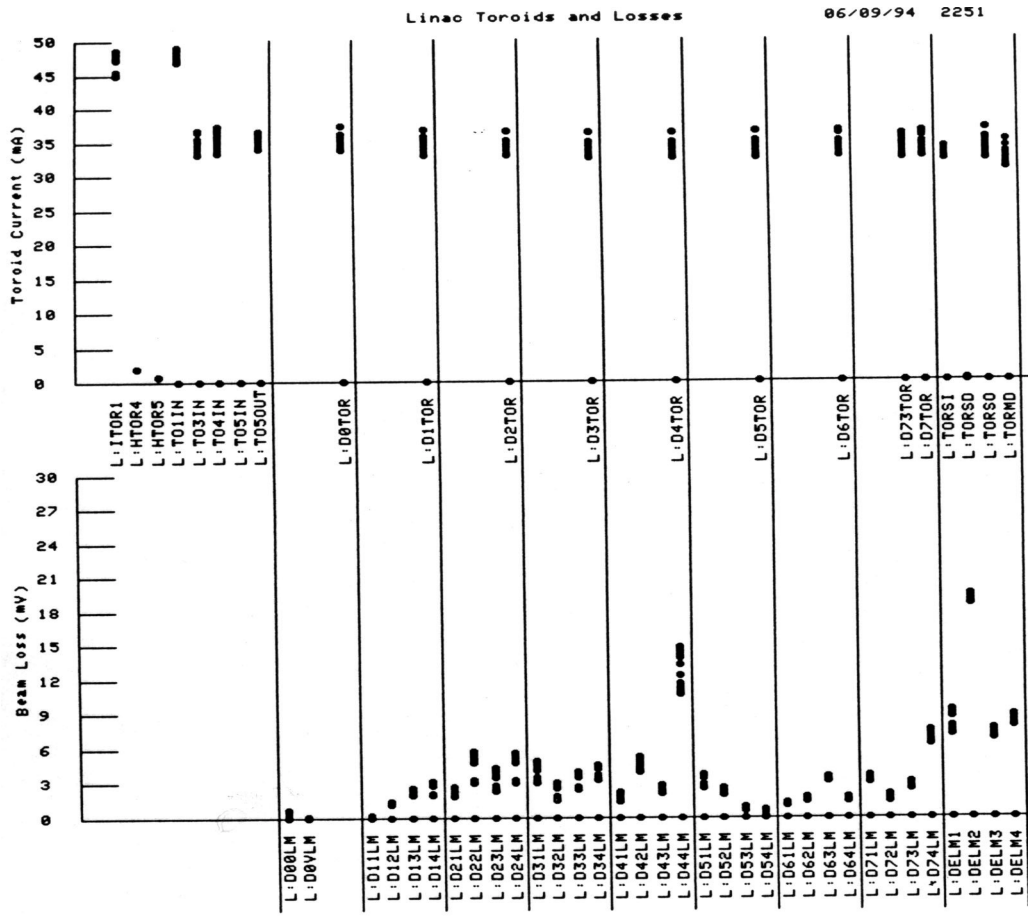


Peak Current Limit ~93mA



Peak Current ~35mA

One Year After Linac Upgrade, This was “Low Loss, High Current”



Conclusion and So What?

- Present Linac Can Accelerate 85mA!
- We Need a “Hotter” H- Source!
- Is It an Accident That Booster Intensity Records are Correlated with Linac Intensity Records?