FNAL ILC LLRF Controls
FY07 Preliminary Cost Estimate

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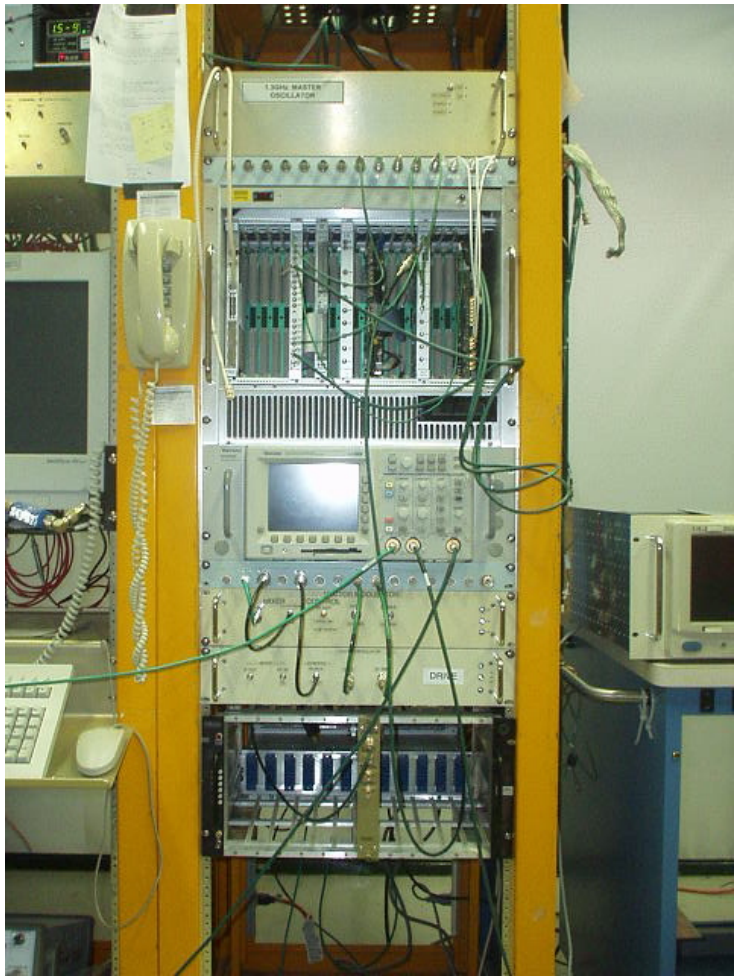
FY07 LLRF Controls

- The following documents describe the Fermilab ILC LLRF Controls Program:
  - B. Chase, G. Cancelo, R. Carcagno, “ILC Fermilab R&D - LLRF Controls R&D Program,” 2/24/06 (Rev. 5)
  - B. Chase, G. Cancelo, R. Carcagno, “ILC Fermilab R&D - ILCTA LLRF Short-Term Development Project,” 2/24/06 (Rev. 2)
- Location:
  - http://ilc-dms.fnal.gov/SMTF Systems/Low Level RF Subsystem/ILCTA-LLRF

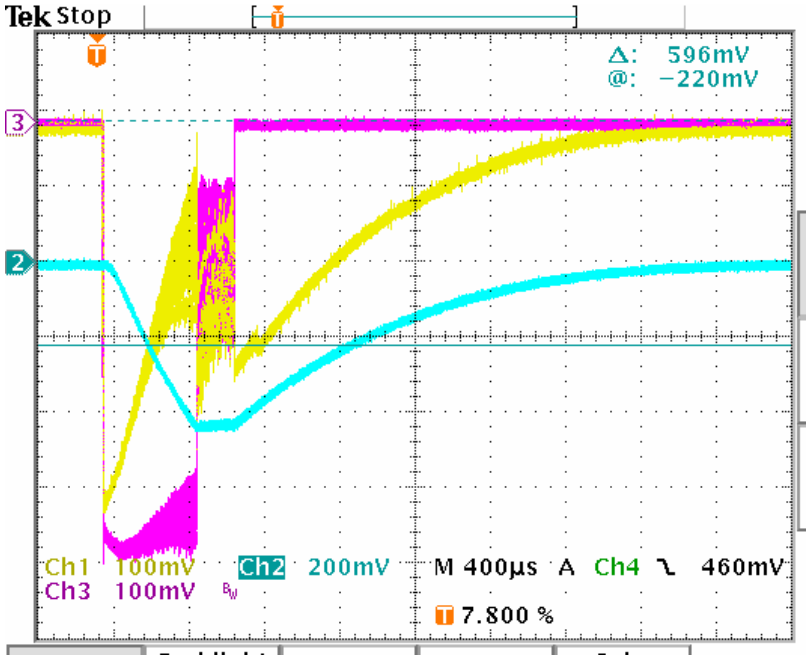
FY06 ILCTA LLRF Deliverables

- ILCTA_MDB_HTS
  - A working 1.3 GHz system based on DESY's Simcon 3.1 LLRF system is available (tested at both A0 CC1 and MDB CC2)
  - A 3.9 GHz up/down converter box is being fabricated to support 3.9 GHz coupler conditioning and 3.9 GHz cavity testing at ILCTA_MDB
- ILCTA_IB1_VTS
  - Design based on Jlab VTS LLRF system
  - Procurement in Q3FY06

CC2 LLRF System – Based on Simcon 3.1



O'scope persistence set to 30 events:



BLU = P-Trans = Gradient YEL = P-Ref

RED = P-Fwd

LLRF System compensated for frequency changes due to cryogenic pressure fluctuations.

CC2 successfully operated in closed-loop mode to 28 MV/m

FY06/07 LLRF R&D

- **Short-term (< 18 months): Improvements to Simcon 3.1 system**
  - Board hardware modifications to improve noise performance
  - Board firmware modifications to improve functionality
  - Board control interface to EPICS
  - Develop high intermediate frequency (IF) capability (better performance)
  - Design and fabricate high quality downconverter to high IF
  - Start work on automation, exception handling, fast tuner integration, etc
  - Evaluation of commercial alternatives (e.g., Lyrtech board)
- **Long-term (> 18 months): development of a new generation 24-Ch LLRF board for an ILC RF unit**
  - Collaboration with DESY, SNS, LBNL, UPenn, and industry

FY07 LLRF ILCTA Deliverables

- ILCTA_NML
  - Photoinjector: LLRF upgrade of A0 photoinjector based on improved Simcon 3.1 system (RF Gun, CC1, CC2)
  - First ILC cryomodule: LLRF system based on improved 8-Ch Simcon 3.1 system
  - Beyond FY07: ILC RF unit (three cryomodules): LLRF system based on a new generation 24-Ch LLRF module
- ILCTA_IB1_HTS
  - LLRF system for a two-cavity HTS facility based on improved Simcon 3.1 system

FNAL FY07 ILC LLRF Controls – ILCTA Deliverables

BASELINE LLRF SYSTEM	
VME Crate	$6,000
VME CPU	$5,500
Simcon 3.1	$6,000
Timing Board	$1,550
Fast ADC	$2,000
Downconverter	$2,500
Vector Modulator	$1,500
Misc. Hardware	$5,000
TOTAL	**$30,050**

TUNER CONROLLERS	
Piezo Amplifiers	$2,000
3-stub tuner controller	$1,500
Stepping Motor Controller	$1,500
TOTAL	**$5,000**

RF PHASE REFERENCE LINE	
Drive Amplifier	$10,000
Directional Couplers	$10,000
Temperature Control	$5,000
Miscellaneous Hardware	$5,000
TOTAL	**$30,000**

FY07 Deliverables to ILCTA			
	Qty	Unit Cost	Cost
ILCTA_MDB			
Upgrades	1	$30,000	$20,000
ILCTA_NML			
LLRF Photoinjector	3	$30,050	$90,150
LLRF ILC Cryomodule	1	$30,050	$30,050
Tuner Controllers	10	$5,000	$50,000
RF Phase Reference Line	1	$30,000	$30,000
ILCTA_IB1			
LLRF HTS	1	$30,050	$30,050
Tuner Controllers	2	$5,000	$10,000
TOTAL			**$260,250**

RF TEST EQUIPMENT	
Scope (x3)	$30,000
Power Meters (x3)	$20,000
Network Analyzer (1)	$50,000
Miscellaneous RF Components	$5,000
TOTAL	**$105,000**

FNAL FY07 ILC LLRF Controls –Development

DEVELOPMENT SOTWARE	
RTL Precision (FPGA advanced compiler)	$25,000
Altium 6 Designer	$15,000
Matlab/Simulink license	$8,000
Modelsim	$5,000
Matlab RF toolbox	$2,000
Simulink RF Blockset	$2,000
Maintenance fees	$5,000
TOTAL	**$62,000**

TRAVEL	
AD (3@4K)	$12,000
CD (3@4K)	$12,000
TD (3@4K)	$12,000
TOTAL	**$36,000**

DEVELOPMENT HARDWARE	
Improved Simcon 3.1 boards (x3)	$18,000
VME CPUs (x3)	$15,000
New 24-ch LLRF board prototype	$20,000
Commercial Board Evaluation	$20,000
TOTAL	**$73,000**

FTEs	
Accelerator Division	3
Computing Division	4
Technical Division	3
TOTAL	**10**

FNAL FY07 ILC LLRF Controls –SWF Detail

TECHNICAL DIVISION	LLRF	Fast Tuner
Ruben Carcagno	0.1	0.1
Darryl Orris	0.2	0.2
Joe Ozelis	0.1	
Andrzej Makulski	0.3	0.1
Roger Nehring	0.2	0.2
Engineer II		0.1
Yuriy Pischalnikov		0.3
Jerzy Nogiec	0.1	
Dennis Shpakov	0.2	
Fred Lewis	0.05	0.1
Dan Eddy	0.05	0.1
Steve Helis	0.05	0.1
Other	0.2	0.2
TOTAL FTE	1.55	1.5

ACCELERATOR DIVISION	
Brian Chase	
Julien Branlard	
Ed Cullerton	
Tim Koeth	
Mike Kucera	
Dennis Nicklaus	
(Need more input)	
TOTAL	3

COMPUTING DIVISION	
Gustavo Cancelo	0.9
Ken Treptow	0.6
Rick Kwarcyany	0.3
Bill Haynes	0.5
Ted Zmuda	0.5
Stefano Rapisarda	0.5
Greg Deuerling	0.3
Other (Tech.)	0.4
TOTAL FTE	4

TOTAL FY07 FTEs ~ 10

FNAL FY07 ILC LLRF Controls – Summary

FNAL FY07 ILC LLRF Controls - M&S	
Deliverables to ILCTA	$260,250
RF Test Equipment for ILCTA	$105,000
Development Software	$62,000
Development Hardware	$73,000
Travel	$36,000
TOTAL	**$536,250**
FNAL FY07 ILC LLRF Controls - FTEs	**10**