Main Linac (SCRF) Technology Area

Guidelines for the Meeting

Akira Yamamoto

Parallel Session

ILC-GDE Meeting, Fermilab, Oct. 23-24, 2007

Make sure
“what we are requested?”

- Specifications to be listed:
  - Based on BCD from RDR, and as of today,
  - Quantitative enough toward EDR, (including acceptable range or tolerance),
  - Functions and Interface/envelope clear enough, and plug-compatible to other components/systems,
  - Plug compatible ACD may be inclusive, as back-up “to meet the requests” or “to reduce the cost”,

Parameters and Interface
Example: Cavity

Category	Item	Parameters	Notes
RF properties	Freguency	1.3 GHz	
	Number cels	9	
	Gradient, Q0	31.5 MV/m, 1.0 E10	In operation
		35 MV/m, 0.8 E10	In vertical test
	HOM damping	Q =	
		R/Q =	
	Short range wake	TBD	
	Temperature	2 K	In operation
Phys. Properties	Length	(1.36) m	
(interface)	Aperture	(60/80) mm	
	Alignment acc.	300 um	
	Wall thcikness	2.8 mm	
	Stiffness		
	Flange/seal system	Material ?	
	Max pressure		
	Lorentz F detuning	1.00 kHz	with flat top at 35 MV/m
	…	….	

How we may plan the work toward EDR?

- Work-packages
  - Technical subjects clear enough,
  - Time scale,
  - Work sharing,
  - Resource,
- Organization
  - Organization chart
  - Mailing list (Shidara-san working on)

Project Management Structure

Area: Main Linac Technology (to be completed)

Regional/Intsitutional Effort: - Director-US: Mike Harrison - Director-EU: B. Foster - Director-AS: M. Nozaki			Technical Effort (ML (SCRF) Technology): - Project Manager: A. Yamamoto - Associate Managers: T. Shidara, J. Kerby, * Group leader, ** Co-leader					
Regions	Institute	Institute Leaders	Cavity (Process) L. Lilje*	Cavity (Prod./Int.) H. Hayano*	Cryomodule N. Ohuchi* -H. Carter**	Cryogenics T. Peterson	HLRF S. Fukuda*	ML Integr. C. Adolphsen
US	Cornell Fermilab SLAC ANL J-lab	H.Padamsee R. Kephart T.Raubenhaimer	H.Padamsee	C.Adolphsen	H.Carter	T.Peterson	O. Nezhevenko R. Larsen/ C.A.	C. Adolphsen
EU	DESY CERN Saclay Orsay INFN Spain	R.Brinkman J. Delahaye O. Napoly A.Variola C. Pagani	L.Lilje	C. Pagani	Parma Franco Pal.	Tavian	S. Choroba	
AS	KEK Korea Inst. IHEP India Inst.	K.Yokoya	Noguchi, Saito	Hayano	Tsuchiya/ Ohuchi	Hosoyama/ Nakai	Fukuda	

High Level RF Groups

Organization for EDR-tasks

		Modulator	Klystron	PDS	Control	,,,
US	Cornell Fermilab SLAC ANL J-lab	C. Jensen R. Larsen C. Burkhart	 C. Adolphsen E. Jongewaard	 C. Nantista	O. Nezhevenko B. Chase R. Cassel	
EU	DESY CEA-Saclay -Olsay INFN Spain CERN	V. Vogel	S. Choroba	V. Katalev		
AS	KEK Korea Inst. IHEP India Inst.	M. Akemoto T. Shidara	S. Fukuda M. Yoshida H.S. Kim	S. Fukuda/S. Kazakov		

Excerpts -- work package table

Cryogenics
T. Peterson
5-Sep-07

Work Package Summary

Work package leader highlighted in yellow
A few names have been inserted by Tom Peterson just as a start for discussions

		WP 1 Heat loads	WP 2 Cryoplant design	WP 3 Reliability, repair	WP 4 Venting	WP 5 Surface impact
America	Fermilab	Peterson	Klebaner		Fermilab-AD	
	SLAC					
	TJNL		Ganni			
Europe	CERN	Parma	Tavian			
	DESY				Petersen	
Asia	KEK	Ohuchi				
	India					
Description		Static, dynamic, non-module, distibution, uncertainty	Includes contract with industry	Segmentation, load-sharing, maintenance	Loss-of-vacuum, distribution of reliefs, vessels and pipes	Grouping compressors, plants, trade-offs with dist'n
Major interface		Accelerators, RF, cryomodules, WP 2, WP 7	Cryomodule, WP 7	CF&S, cryomodule	WP 7, CF&S (extra pipe in tunnel?)	CF&S, WP 2, WP 7
Minimum effort (FTE in FY08)		0.30	0.30	0.00	0.10	0.00

Work package table - part 2

		WP 6 ODH	WP 7 Cryobox design	WP 8 Liquid control	WP 9 Optimization	WP 10 2K heat exch
America	Fermilab SLAC TJNL				Peterson	
Europe	CERN DESY				Parma	
Asia	KEK India		Hosoyama		Ohuchi	
Description		Oxygen deficiency, surface buildings and tunnel	Distribution and tunnel end and bypass boxes	2-phase flow control, dynamic load changes, heaters	Trade cryomodule complexity and cost for cryosystem load	4 K to 2 K heat transfer to pumped vapor, pre-cool liquid supply
Major interface		CF&S	CF&S, vacuum	Cryomodules, WP 7	Task is combined with cryomodule design	A university and /or industrial design task
Minimum effort (FTE in FY08)		0.00	0.50	0.00	0.30	0.10

Work package table - part 3

		WP 11 Standards	WP 12 Sources	WP 13 Damping rings	WP 14 BDS	
America	Fermilab SLAC TJNL					
Europe	CERN DESY					
Asia	KEK India					
Description		Regional, code compliance, hardware transfer	e- and e+ source linacs, undulators	Tunnel system unique and separate from Main Linac	Tunnel system unique and separate from Main Linac	
Major interface			e- and e+ source area leaders	Damping ring area	BDS area	Total
Minimum effort (FTE in FY08)		0.10	0.20	0.20	0.10	2.20

Meeting Plan, this week

- Joint parallel-sessions,
  - Makes sure the tasks(today)
  - Combine specification/work-package (tomorrow)
- Parallel Sessions
  - Work in two groups (CCC, MLI-HLRF)
- Plenary Session Report
  - Important to appeal how we kick-off of the EDR work
- Special Evening/afternoon Sessions
  - Cavity management meeting (Tuesday)
  - Cavity technical meeting (Wednesday, proposed)
  - Cryomodulce/cryogenics meeting (Friday, proposed)

Progress and Finding from EDR Kick-off Meetings

Project Managers:
Akira Yamamoto, Nick Walker and Marc Ross

Group Leaders Meeting,
ILC-GDE Meeting, Fermilab, Oct. 22, 2007

Tasks at KOM

- Review of RDR (BCD)
  - Verify design parameters and interfaces
- Discuss BCD and/or ACD
  - Unified design and/or plug-compatibility
  - Technical direction toward EDR
    - Industrialization and further basic R&D
- Develop Work Packages toward EDR

Progress of KOMs

Technical Group	Day, (Place)	Chaired / Supported by	
Controls	8/20 ~ (ANL)	J. Carwadine (ANL)	
CFS-US	8/22 ~ (FNAL)	V. Kuchler (FNAL)	
RTML	8/27 ~ (FNAL)	P. Tenenbaum (SLAC)	
CFS-EU	9/03 ~ (CERN)	J. Baldy / J. Osborne (CERN)	
CFS-AS	9/10 ~ (KEK)	A. Enomoto (KEK)	
Cryomodulde & Cryogenics	9/12 ~ (KEK)	H. Hayano, N. Ohuchi (KEK) T. Peterson (FNAL)	
Cavities	9/19~ (DESY)	L. Lije (DESY), H. Hayano (KEK)	
E-source	9/24 ~ (SLAC)	A. Bachmann (SLAC)	
Main Linac Int.	9/27 ~ (FNAL)	C. Adolphsen / T. Shidara (SLAC)	
HLRF	10/1~ (SLAC)	R. Larsen (SLAC), S. Fukuda (KEK)	
E+source	10/8 ~ (Cockroft Inst)	J. Clarke (CCRC), J. Urakawa (KEK)	
Beam Del. Sys.	10/11~ (SLAC)	A. Seryi (SLAC)	
Damping Ring	11/5~ (Cockroft Inst)	A. Wolski (LBNL)	planned

We deeply thank RDR/EDR group leaders and chair (support) persons

General Finding from KOMs (1)

- Design parameters to be verified:
  - Parameters lists of each component,
  - Interface between components,
- Plug-compatible concept critically important to allow:
  - Improvement of base-line design during EDR,
  - ACD with keeping plug-compatible interface,

- Complimentary R&D important
  - Learn most effective industrialization experience from XFEL
  - Further advanced/basic R&D to be complementary carried out
    - For upgrade of the BCD design based on the previous industrialization experience (with less additional demonstration)

Technical Findings from KOMs (2)

Technical Group	Day	Finding (technical topics)
Controls & LLRF	8/20 ~	High availability control and redundancy
CFS-US	8/22 ~	ACD development
RTML	8/27 ~	Common housing/integration, beam dynamics (emit. Preservation)
CFS-EU	9/03 ~	Experience at LHC, Safety, IR Hall structure, exp. from Olympic
CFS-AS	9/10 ~	Time scale required to reach construction, exp. from ITER
Cryomodule & Cryogenics	9/12 ~	Important plug-compatible interface definition, Thermal balance optimization b/w cryomodule and cryogenics, exp. at LHC.
Cavities (process, and production)	9/19~	< E> 30 toward 35 MV/m, Process, Shape, compatibility, Industrialization (XFEL exp.+ ,,) & further improvement (BCD/ACD)
E-source	9/24 ~	Cathode demonstration and vacuum R&D crutical
Main Linac Int.	9/27 ~	Beam dynamics (HP/HOM), Quad. alignment, dE/E acceptable?
HLRF	10/1~	Marx Gen. (ACD) encouraging, Effic. RF distributor, Min. remote cntl
E+source	10/8 ~	Target survivability, undulator, flux concentrater,
Beam Del. Sys.	10/11~	Crab and IR geometry, extendable to 1 TeV
Damping Ring	11/5~	Expect – beam dynamics

Parameters and Interface
Example: Cavity

Category	Item	Parameters	Notes
RF properties	Freguency	1.3 GHz	
	Number cels	9	
	Gradient, Q0	31.5 MV/m, 1.0 E10	In operation
		35 MV/m, 0.8 E10	In vertical test
	HOM damping	Q =	
		R/Q =	
	Short range wake	TBD	
	Temperature	2 K	In operation
Phys. Properties	Length	(1.36) m	
(interface)	Aperture	(60/80) mm	
	Alignment acc.	300 um	
	Wall thcikness	2.8 mm	
	Stiffness		
	Flange/seal system	Material ?	
	Max pressure		
	Lorentz F detuning	1.00 kHz	with flat top at 35 MV/m
	…	….	

Summary

- Design parameters and Interfaces to be well defined,
  - Plug compatible interface to be fixed,
- Industrialization and further basic R&Ds
  - Complementary efforts important

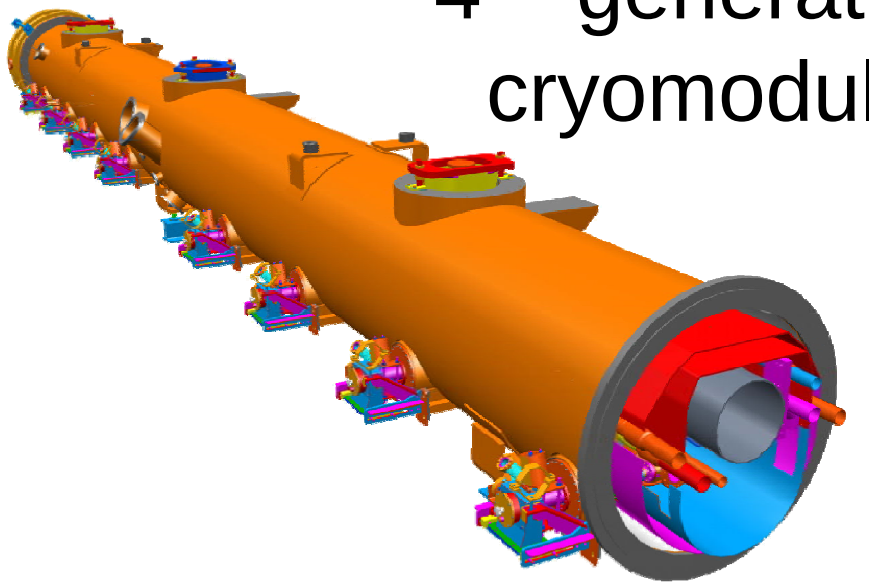
- Work packages to be established,
- Technology to be established with saving/optimizing cost, towards EDR
  - To be well discussed in parallel sessions,

Appendix

Cavities & Cryomodules

Producing Cavities

4th generation cryomodule



Subdivision	Length (m)	Number
Cavities (9 cells + ends)	1.326	14,560
Cryomodule (9 cavities or 8 cavities + quad)	12.652	1,680
RF unit (3 cryomodules)	37.956	560
Cryo-string of 4 RF units (3 RF units)	154.3 (116.4)	71 (6)
Cryogenic unit with 10 to 16 strings	1,546 to 2,472	10
Electron (positron) linac	10,917 (10,770)	1 (1)