

ILC-EDR Kick-off Meeting
Cavities
Organization and Charges

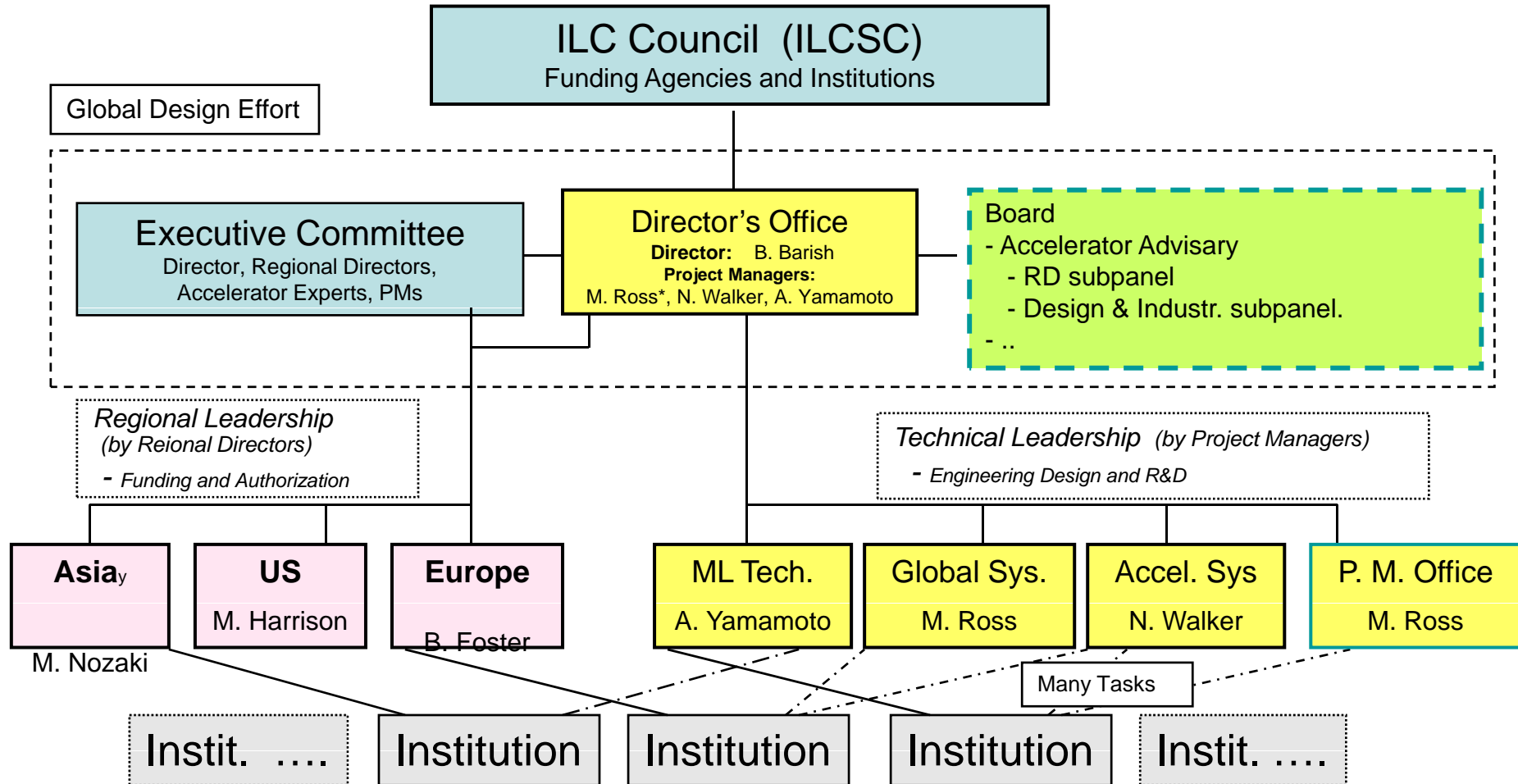
Sept. 19, 2007

Akira Yamamoto

ILC-EDR Kick-off Meeting, Cavities
Held at DESY, Sept. 19-21, 2007

ILC Project Management

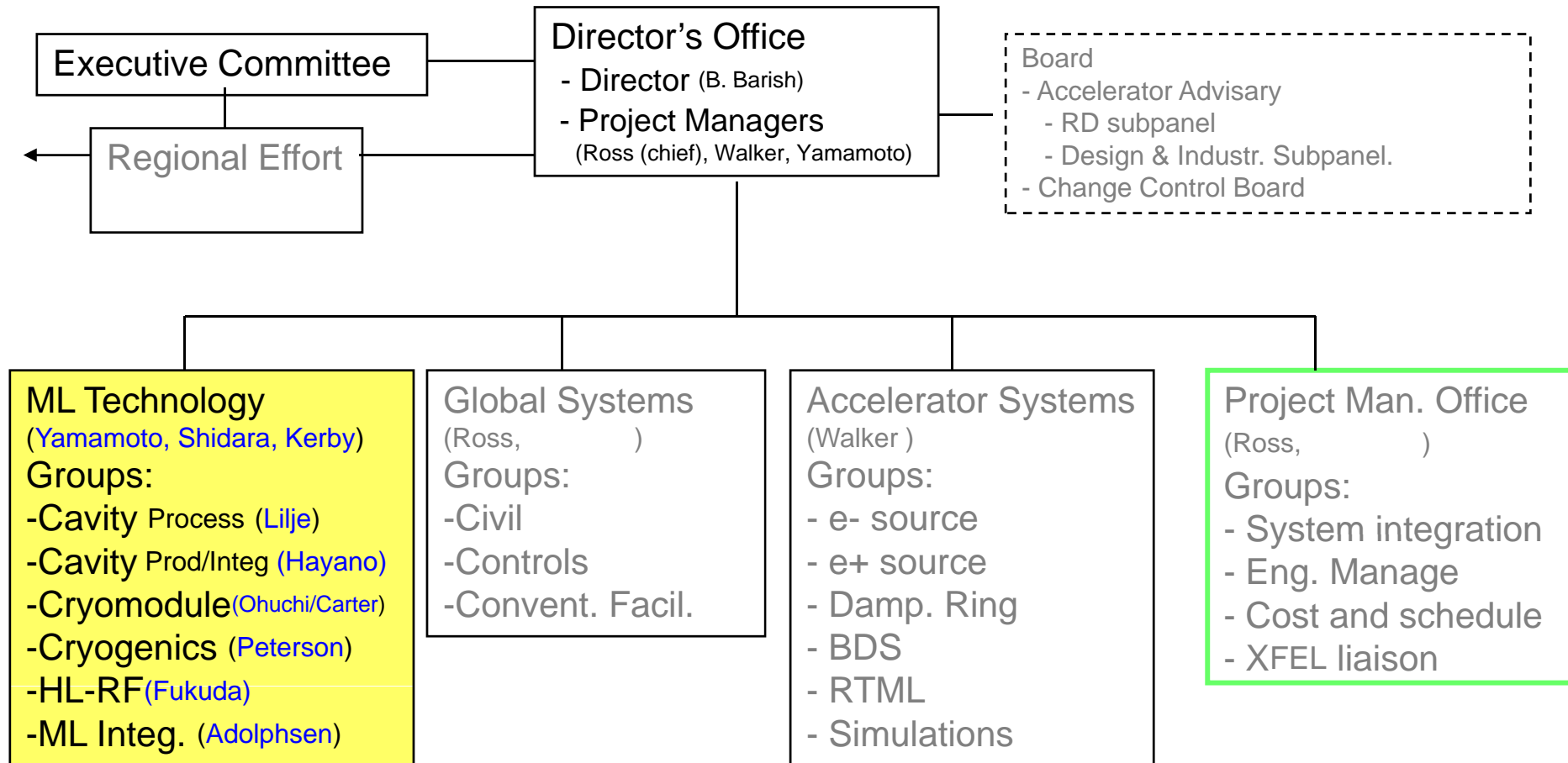
as a proposal for the organization toward EDR



ILC Project Management and Sharing Responsibilities

- **Project Managers** responsible for
 - Leading the world-wide technical development effort
 - efficiently and effectively
 - Setting technical direction and executing the project toward realization of the ILC
 - Day-to-day project execution and communication
- **Regional Directors and Institutional Leaders** responsible for
 - Promoting, funding and authorizing the cooperation programs.
 - Formality to start institutional activities, and periodical oversiting the technical progress,

Project Management Structure (baseline)



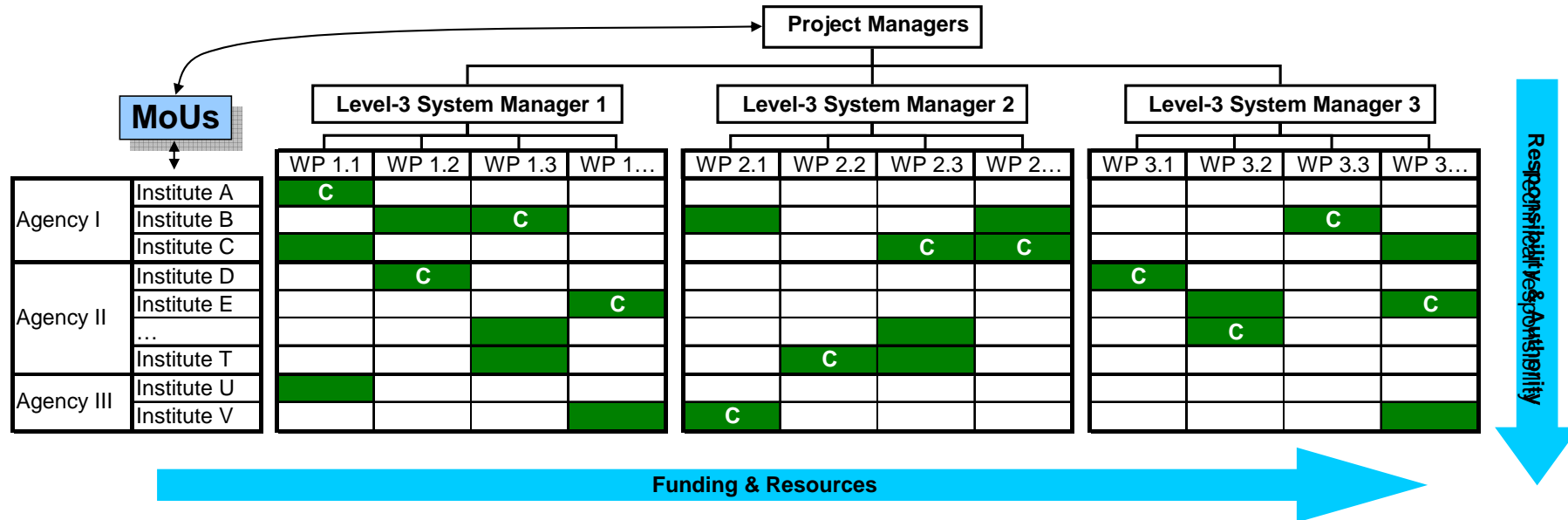
Project Management Structure

Area: Main Linac Technology (to be completed)

Regional/Intsitutional Effort:			Technical Effort (ML (SCRF) Technology):					
- Director-US: Mike Harrison - Director-EU: B. Foster - Director-AS: M. Nozaki			- 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	R. Larsen	C. Adolphsen
EU	DESY CERN Saclay Olsay INFN Spain	R.Brinkman J. Delahaye O. Napoly A.Variola C. Pagani	L.Lilje	C. Pagani	Parma Franco Pal.	Tavian		
AS	KEK Korea Inst. IHEP India Inst.	K.Yokoya	Noguchi, Saito	Hayano	Tsuchiya/ Ohuchi	Hosoyama/ Nakai	Fukuda	

Technical Responsibilities :

(from RDR Chapter 7)



- Green indicates a commitment:
 - institute will deliver
- MoUs facilitate connection:
 - Project Management (authority and responsibility) and institutions (funding and resources).
- The 'C' → coordinating role in a WP
 - Each WP has one coordinator.

Cavity-Groups Organization

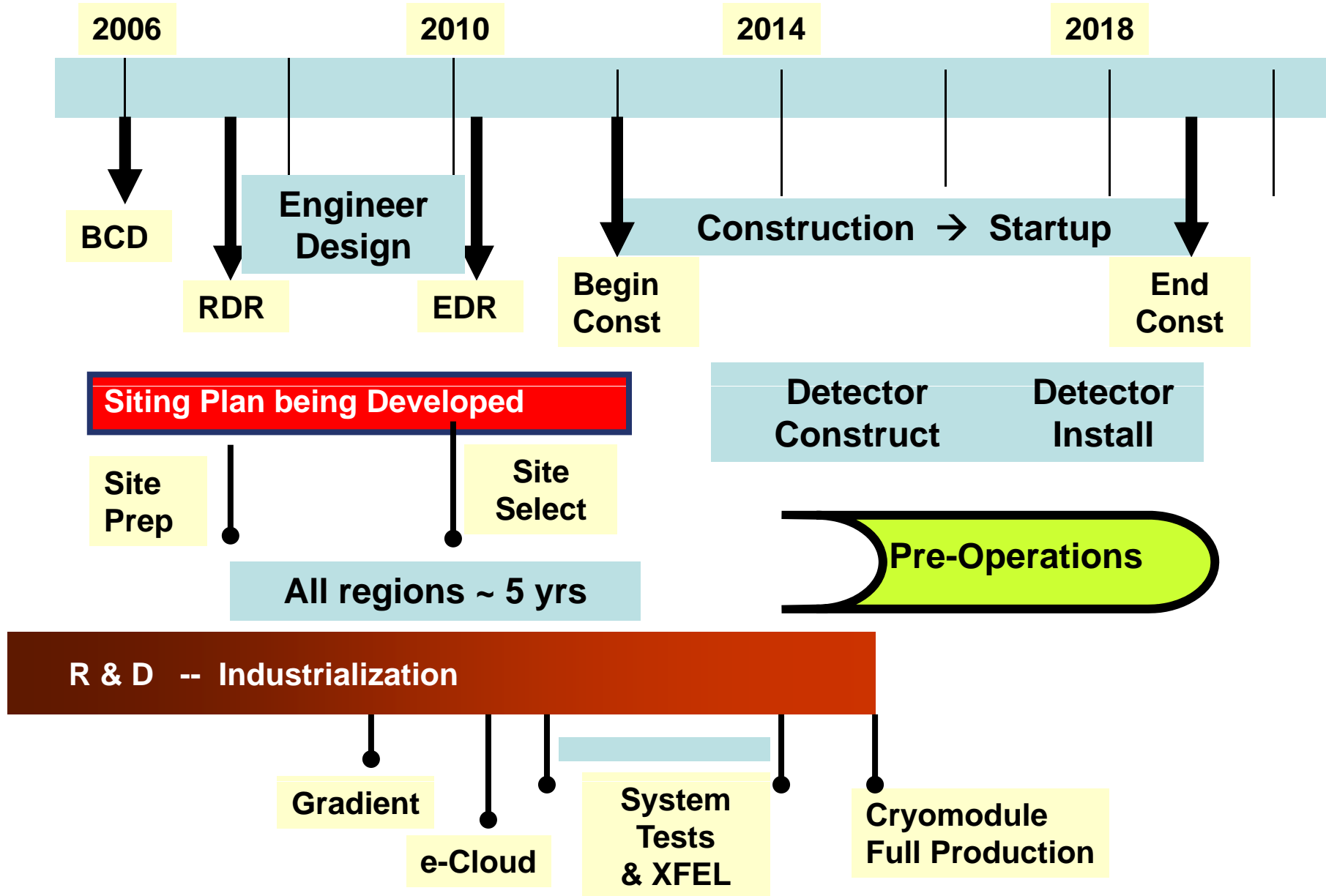
for EDR-task cooperation to be formed

		Cavity (L. Lilje)	Cavity (Production/Integration) (H. Hayano)			
		Process	Integration	Tuner	Coupler
US	Cornell Fermilab SLAC ANL J-lab					
EU	DESY CEA-Saclay -Olsay INFN Spain CERN					
AS	KEK Korea Inst. IHEP India Inst.					

Technical efforts to EDR

- Complete the critical R&D
 - as identified by the (R & D Board and) S0, S1, S2 task forces.
- Establish the base-line design,
 - Technologies to be chosen and to be demonstrated through pre-mass-production
- Learn industrialization
 - Obtain the maximum benefit from the realized project
 - Learn real industrialization mass production experience,
- Encourage alternate design and development
 - with “Plug-compatible” concept, and
 - for maximizing performance/cost (value-engineering)

Technically Driven Timeline



2007/08 EDR Milestones

- Aug. – Korea ILCSC:
 - New EDR organization start,
- Aug. to Oct. – EDR Kick Off Meetings
- Oct – Fermilab ILC-GDE meeting
 - EDR Work Packages to be discussed
- Jan. to Feb. 08 – EDR RD Meetings
- March 2008 – Tohoku (Japan) GDE Meeting

Cavities – Kickoff Discussions

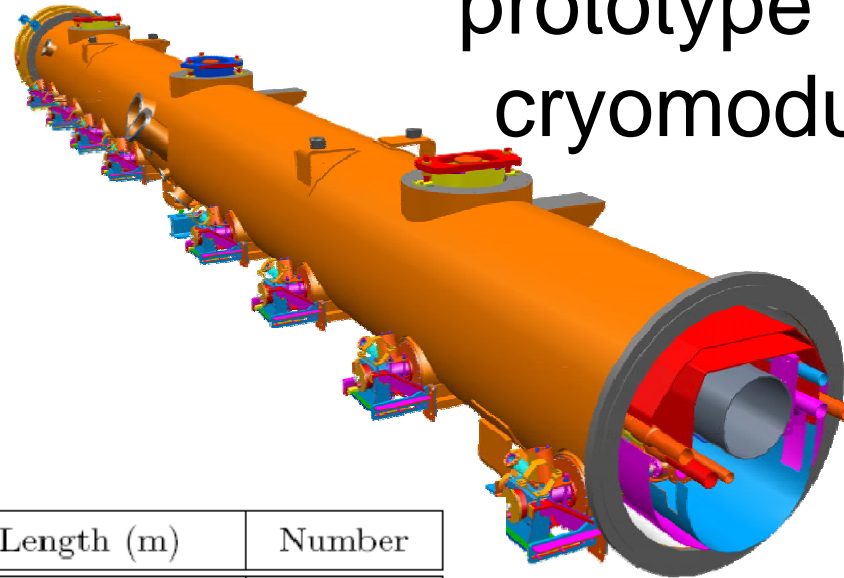
- Design and interface parameters to be verified,
 - Functional parameters and interface conditions to be unified,
- Most critical Goal in basic R&D:
 - Demonstrate 31.5 MV/m before EDR
 - Otherwise, need to reduce the gradient or adjust the machine design
 - We need a vital program of both R&D and demonstrations
 - Necessary basic R&D effort to be verified
- How to learn mass production !
 - Scale of pre-mass production to be justified,
 - Necessary multiple suppliers (institution and vendors)? ,
- Unified design and/or Plug-compatible concept
 - Maintaining a baseline...
 - Unified design and/or plug compatibility in EDR and/or Construction?
- Task-sharing
 - How the tasks shared technically, and regionally (institutionally)

Cavities & Cryomodules

Producing Cavities



4th generation
prototype ILC
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)

Consensus from Cryomodule Kick-off meeting

- Parallel CM development and industrialization in each region should be encouraged. Ongoing activities should be integrated into EDR planning.
- All ILC production CMs should be built to a single (functional and interface) design regardless of the number of regions contributing CMs.
- Consensus for cryomodule requirements & specifications must be established.
- CM plug compatibility standards need to be established:
 - To ensure groups are working to common specifications.
 - To facilitate exchange of components and assemblies.
- Treaty points and interfaces need to be worked out:
 - Between cryomodule assembly and other systems.
 - Cryomodule sub-assembly to sub-assembly.

Summary for Charges

- Functional performances and Interfaces to be verified,
- EDR design work and R&D (goal)
 - Basic R&D to be completed
 - Learning mass production
- Discussions towards
 - “unified design/specification” and/or “plug-compatible design/specification
- Task sharing and schedule

Reserved for further discussions

- To be discuss later

Getting Started on the EDR:

- *Re-organize* collaboration
 - Project management-based structure,
 - For day-to-day activities,
 - Definition, scope and possible resources
- *Re-look (self-review) RDR & plan EDR*
 - EDR kick-off meetings as a starting point

Preparing for Construction

- **Crucial R&D Milestones**
 - S0/S1 task force - globally coordinated program to demonstrate gradient for EDR by 2009
 - S2 task force – RF unit test and string tests by construction
- **Project Tools**
 - Primavera and other costing tools will be implemented
 - An earned value system will be employed during EDR
 - We are implementing an EDMS system for carrying out and documenting the design
- **Industrialization**

The Task Forces

- **The Task Forces were put together successively over a period of five months:**

S0/S1-Cavities, Cryomodule

S2 -Cryomodule String Tests

S3 -Damping Rings

S4 -Beam Delivery System

S5-Positron Source

S6-Controls, not yet active

S7-RF

- **Working in close collaboration with the Engineering and Risk Assessment team.**

Cavity Gradient – Goal

- Current status: Nine 9 cell cavities have been produced with gradients > 35 MV/m. Not reproducible and needs several attempts at final processing.
- Goal: After a viable cavity process has been determined through a series of preparations and vertical tests on a significant number of cavities, achieve 35 MV/m at $Q_0 = 10^{10}$ in a sufficiently large final sample (greater than 30) of nine-cell cavities in the low power vertical dewar testing in a production-like operation e.g. all cavities get the same treatment.
 - The yield for the number of successful cavities of the final production batch should be larger than 80% in the first test. After re-processing the 20 % underperforming cavities the yield should go up to 95%. This is consistent with the assumption in the RDR costing exercise.

Module Test – Goal

- Intermediate goal
 - Achieve 31.5 MV/m average operational accelerating gradient in a single cryomodule as a proof-of-principle. In case of cavities performing below the average, this could be achieved by tweaking the RF distribution accordingly.
 - Auxiliary systems like fast tuners should all work.
- Final goal
 - Achieve > 31.5 MeV/m operational gradient in 3 cryomodules.
 - The cavities accepted in the low power test should achieve 35 MV/m at $Q_0 = 10^{10}$ with a yield as described above (80% after first test, 95% after re-preparation).
 - It does not need to be the final cryomodule design

Rough S2 Schedule

Phase	Completion date	Description
0	2005	TTF/FLASH, not final cavity design, type 3 cryomodule, not full gradient, has beam
0.5	2008	Extra tests at TTF/FLASH with same type cryomodules as phase 0
1	2008	1 cryomodule, not final cavity design, type 3 cryomodule (and/or) STF type cryomodule, not full gradient, no beam
1.1	2009	1 RF unit, not all final cavity design, not all type 4 cryomodules, not full gradient, beam not needed for tests, but should be built so it and the LLRF are debugged for the next step
1.2	2010	1 RF unit (replacing cryomodules of phase 1.1), final cavity design, full gradient, type 4 cryomodules, with beam
1.3	2011	1 RF unit (replacing cryomodules of phase 1.1), final cavity design, full gradient, type DFM cryomodules, with beam
1.4	2011	Tunnel mockup above ground. 1 RF unit perhaps built with parts taken from earlier tests. Includes RTML and e+ transport, no beam
2	2013	N RF units at one site (of the final ILC?) as a system test of final designs from multiple manufacturers, no beam
3	2013	XFEL

Integrating parallel CM activities

- Two models discussed for ILC construction
 - Allow different CM designs to co-exist in the main linac. (Could result in significant compatibility problems.)
 - Support parallel development efforts, integrate best of each into a single design prior to construction, all regions deliver identical CMs using the same design.
- Both models require plug compatibility standards:
 - To ensure physical & functional compatibility.
 - To allow sharing of prototypes across regions
- At what level of detail is plug compatibility required...?

Procurement & Industrialization

- Working assumption that ILC production cryomodules [cavities] will be contributed by more than one region.
- Minimize project risk by having at least two qualified vendors worldwide
 - All regions are developing at least one vendor.
- Minimize cost through competitive bid process
 - Demands an international (inter-regional) call for tender if there is only one qualified vendor in each region.

Strawman CM work package list

- Develop ILC cryomodule requirements & specifications, tolerances, and acceptance test criteria
- Develop plug compatibility standards for inter-regional cryomodule collaboration
- XFEL Cryomodules
- ILCTA Cryomodules (include Type-IV CM as a sub-package)
- STF Cryomodules (include ACD CM as a sub-package)
- Develop a plan for converging multiple CM designs into a single design for ILC construction.
- ILC_1 (First Article) CM design and production engineering (include “Type-V” CM as a sub package)