



ACD Down-Select Criteria and Time Scales for HLRF

ML-KOM

FNAL September 27, 2007

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For the ILC HLRF Collaboration**

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HLRF Collaboration

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Outline

Many slides are based on the Ray's talk in DESY, June 14, 2007.
More detailed discussion will be performed at HLRF KOM held in Oct.1-2, 2007

- I. EDR Working Definition
- II. Proposed HLRF Work Packages
- III. Example Work Package
- IV. Industrialization Assumptions
- V. HLRF Factory Model Assumptions
- VI. Conclusions



I. EDR Working Definition

- EDR should be completed in two years, i.e. **2010(?)**.
- Detailed technical and cost plans are to be considerably more mature than RDR.
- Schedule, new cost estimate, funding profile are clarified.
- We should provide solid basis for international funding requests, implying
 - *Technology down-selects recommendations in hand*
 - *Industry based cost estimates in hand to compare with estimates*



- *Management Level Tasks*
 1. **Develop Work Packages for R&D**
 2. **Develop specifications as basis for bid packages**
 3. **Identify industrial vendors for advanced prototypes (Design for Manufacture, DFM)**
 4. **Procure pre-production prototypes**
 5. **Complete EDR documentation**
 6. **Recommend technology down-selection**



EDR Tasks 2

R&D to Pre-Production, 2007-10

- *R&D Tasks (in parallel)*
 1. **Complete Alternate Conceptual Design prototypes**
 2. **Complete DFM designs, specifications, bid packages**
 3. **Evaluate industrial DFM prototypes**



II. Proposed Work Packages (WP's)

- Prepare Separate WP's for *Modulator, Klystron, Distribution*
 - **Common WP's for BCD and ACD in the three regions**

How to establish the regional collaboration?

- Common WPs are made by Project Manager.
- Real WP is deeply related by DOE budget profile in USA, while other region (ex. Japan) has a different style. Especially treatment of human resource is quite different.
- Example (Next slide)



- Example

Level-3 System Manager

MoUs		WP Modulator				WP KLYSTRON			
		WP:Base Line	WP:MARX	WP Cont /Interblock	WP Mod Industrialization	WP Base Line Klystron	WP 20MW MAG	WP RBK	WP SBK
EU-DESY-XFEL		C				C			
US-DOE	SLAC		C	C	C (US)			C	
	FNAL								
	LLNL		MoU						
	UNV					C	C		
JAPAN	KEK				C (ASA)				C
	UNV								
KOREA	POHAN								
	UNV								

Green shows the contribution supported by some budgets, and C Shows the central contribution for the WP's technology.



Proposed Work Packages (WP's)-*Cont.*

- Prepare Separate WP's for *Modulator, Klystron, Distribution*
 - Develop DFM design, build prototype, execute test program
How to establish the regional collaboration?
 - Develop specifications for bid packages
 - Ideally each region lets bid for evaluation unit or units, shares costs, testing experience
NML(FNAL)/ SLAC/ STF(KEK)/ XFEL(DESY)
 - **Note: These could be different designs!**
 - Procure, test, apply to L-Band test programs
 - Modify bid packages for pre-production quantity procurement



Proposed WP's -cont.

- Charger system, Controls-Interlock system also WP candidates for delivery of pre-tested integrated systems
 - **Could also be part of modulator, klystron systems respectively**



III. Work Package Table (Lutz table) -1

	EDR goal/task description	Milestone	Start date	Finish date	Proposer / requester	Possible benefit	Possible risk	Impact on whom	Tests needed to allow decision	Tests after decision	Expected deadline
Suggested entries						Cost, improved design, better performance		ILC Area or technical group name	demonstration, high-power test, integrated systems test, beam test, life-time test or		relative to EDR (assume 2010)
HLRF											
Modulators											
	Marx Modulator	Completion of 2000 hour test	Aug-07	Dec 2007	HLRF TS	Cost saving, higher reliability, space in tunnel	Fallback to BCD choice	CF&S, installation	Complete 2000 hours	Built and go to DFM	end 2007
		DFM design	Aug-07	Mar 2008	HLRF TS	Reconfiguration to fit tunnel, cost, mass production	Fallback to BCD choice	CF&S, installation	Built and test unit (partly in-house): <i>Hope to introduce in STF</i>	Built and test more, interregional	end 2009
	Baseline	Mass production of XFEL and FNAL effort	now	end 2009	HLRF TS	Industrialized version qualified	Added cost, DFM changes being introduced	CF&S	Performance demonstration	Mass production	end 2009



Work Package Table (Lutz table) -2

	EDR goal/task description	Milestone	Start date	Finish date	Proposer / requester	Possible benefit	Possible risk	Impact on whom	Tests needed to allow decision	Tests after decision	Expected deadline
Suggested entries						Cost, improved design, better performance		ILC Area or technical group name	demonstration, high-power test, integrated systems test, beam test, life-time test or		relative to EDR (assume 2010)
HLRF											
Klystron											
	Sheet beam	First prototype test	now	1-Jul-08	HLRF TS	Cost saving, space in tunnel	Fallback to BCD choice	CF&S, installation	Complete 2000 hours	Built and go to DFM	
		DFM design and construction	Jul-08	end 2009	HLRF TS	Industrialize, interregional	Fallback to BCD choice	CF&S, installation	Built in three regions and test	Long-time test on test stands	end 2010
	Baseline	XFEL horizontal tubes 1000h test	now	1-Jan-08	HLRF TS	Industrialized version qualified, fit to tunnel	Added cost, DFM changes being introduced	CF&S	Performance demonstration multiple vendor	Mass production	
		KEK and SLAC vertical tubes tests	2007/12/1 (SLAC)		HLRF TS						
		Test more horizontal tubes	2009/4/1 (KEK) ?(FNAL)		HLRF TS				Performance demonstration for ILC Spec	Mass production	end 2010



Work Package Table (Lutz table) -3

	EDR goal/task description	Milestone	Start date	Finish date	Proposer / requester	Possible benefit	Possible risk	Impact on whom	Tests needed to allow decision	Tests after decision	Expected deadline
Suggested entries						Cost, improved design, better performance		ILC Area or technical group name	demonstration, high-power test, integrated systems test, beam test, life-time test or		relative to EDR (assume 2010)
HLRF											
RF distribution											
	Non-circulator distribution	test at FNAL and KEK	now	Mar 2008	HLRF TS	Cost savings, space	Crosstalk of cavities, Fallback to BCD choice	CF&S, installation, LLRF	Operation (with beam?)		
	Variable tap-off	test at FNAL	now	Mar 2008	HLRF TS	Cost savings, space	RF breakdown, Fallback to BCD choice	CF&S, installation, LLRF	Operation (with beam?)		
	Integrated design	test with Type 4 cryomodule	now	Mar 2009	HLRF TS						



Work Package Table (Lutz table) -4 (Additional ACD)

	EDR goal/task description	Milestone	Start date	Finish date	Proposer / requester	Possible benefit	Possible risk	Impact on whom	Tests needed to allow decision	Tests after decision	Expected deadline
Suggested entries						Cost, improved design, better performance		ILC Area or technical group name	demonstration, high-power test, integrated systems test, beam test, life-time test or		relative to EDR (assume 2010)
HLRF											
Modulators											
	Marx Modulator (Lower voltage)	Next of High Voltage Marx (KEK)	Marx Collaboration		KEK	Cost saving, higher reliability, space in tunnel	Fallback to BCD choice	CF&S, installation	Show feasibility	Built and go to DFM	end 2011
Klystron											
	Super MBK	Show feasibility	Now 1/6 model	----	KEK	High Reliability Cost saving, space in tunnel	Fallback to BCD choice	CF&S, installation	Complete 2000 hours	Built and go to DFM	end 2011



IV. HLRF Industrialization Assumptions

- All major system components will be provided by industry
- Industrialization has at least two meanings:
 - 1. **Development & deployment of industry process for new designs of an exotic nature, e.g. SCRF structures, Sheet Beam Klystron, etc.**
 - 2. **Identification & qualification of vendors for new designs of non-exotic nature, e.g. Modulator, Charging System, Controls & Interlock Protection System**



General Procurement Strategy

- ILC is developing and will own designs from ACD process
- Specifications will be developed for “Build to Spec” procurement
- Vendors may choose to offer any design that meets specifications including ACD designs
- Owning designs important for long term future:
 - **Modulators, Distribution have virtually no follow-on business so future procurements could be problematical**
 - **Klystrons have significant follow-on business but much smaller; owning a design is excellent insurance against future vendor ability to deliver (e.g. PEP-II experience)**
- HLRF cost models assumed procurement split 50-50 between 2 vendors. (Actual ratios would vary.)



V. HLRF Factory Model Assumptions

- Factory Models developed for Modulators, Klystrons and Distribution for cost modeling in 2006:
 - **Factories to provide fully tested units essentially ready for final prep and installation to tunnels**
 - **Factories to be provided with necessary test equipment, support personnel**
 - **ILC inspectors at factory sign off on testing before shipment allowed**
 - **Delivery to on-site staging area for nominal inspection that no damage occurred in shipping, plus final prep before releasing to installation**



HLRF Factory Models 2

- Some Details:
 - All components to be built to specifications (electrical power, cooling, mechanical form factor, drive requirements, test procedures)
 - Modulator factory to be provided with fully instrumented test stations, test loads
 - Klystron factory to be provided with klystron test stations, RF driver system, water loads
 - Integrated Distribution systems to be delivered packaged for quick final assembly, mounting on cryo-module in staging area for cold tuning prior to moving to tunnel



VI. Conclusions

- EDR is window of opportunity for strong inter-regional growth in ILC HLRF
 - **HLRF has strong Alternate R&D program to improve costs, availability**
 - **Strong inter-region contributions can be advanced through shared Work Packages**
 - **WP's for major HLRF components R&D, industrialization proposed for discussion**
 - **Early collaboration agreements & commitments necessary for EDR success**