

# HLRF RDR Cost Effort Brief Overview

Ray Larsen  
16 May 2006  
For the HLRF Technical Systems  
Group

# HLRF Area Systems Summary

HLRF Area Requirements Summary 051606-rsl-R1											
Area	Main Linacs		Sources		RTML		BDS		Damping Rings		Totals
RF Stations	e-	e+	e-	e+	e-	e+	e+	e-	2xe+	e-	
10 MW RF Station, 1.3 GHz, Cryomodules	315	315	6	7	21	21					685
10 MW RF Station, 1.3 GHz, RT Cavities, 500 MeV Keep alive			8	31							39
<b>Total 10 MW RF 1.3 GHz RF Stations</b>											<b>723</b>
5045 S-Band Stations Un-sledded					2	2					4
5045 S-Band Stations Sledded					1	1					2
<b>Total 5045 S-Band Stations</b>											<b>6</b>
e- Ring CW RF Stations, 650 MHz, 5 GeV, 4MW beam power, 8 - 500kW RF Stations										8	8
e+ Ring CW RF Stations, 650 MHz, 2 Rings for 5 GeV, 4MW beam power, 16-250kW RF Stations									16		16
<b>Total 650 MHz CW RF Stations</b>											<b>24</b>
10 -40kW CW RF Stations, Details TBD (A. Seryi)											

## 10 MW RF Station Scope

(685 Cold + 39 RT = 724 Total)

- HVAC Power Xfmr & Switchgear
- Charging Supply
- Modulator
- Output Pulse Transformer
- 10 MW Klystron
- Local/Remote controls & monitoring, interlocks, protection
- Racks, Interface w/ Controls, LLRF, Vacuum, monitoring

– *Note: Assume LLRF variant for RT cavities*

## 10 MW Station Cost Model

- Components procured or built to specification<sup>1</sup>
  - **Commercially available off-the-shelf**
    - HV AC transformer, switchgear
    - Charging supply rack modules
  - **Build to spec/print**
    - Modulator, HV cables, Pulse Xfmr
  - **Build to spec**
    - Klystron, klystron magnet
  - **Procure from Systems Integrator house**
    - PLC controller, safety interlocks, controls interface
    - Integrated tested rack assembly

1. See Neubauer/Larsen presentation DESY 051106

## S-Band Stations

- Two versions, SLED and Normal
  - 5045 tube manufacturing, costs well established – procure from SLAC
  - Differences in distribution system for energy doubling based on SLAC model
  - Modulator will assume solid state Induction Stack (designs operational, cost estimates available)
  - Standard support systems well developed.

## Damping Rings 650 MHz RF

- DR Area group model contains 8 klystrons per ring, each driving 32 cavities (or 28 w/ one station off), 24 stations total
- PEPII and KEKB models
  - Models well characterized, costs will be extrapolated from existing commercial klystrons, semi-commercial HV supplies.

## Related Systems

- Controls & LLRF
  - In progress, models in development based on recent systems – J. Carwardine et al
- Vacuum
  - Klystron vacuum understood; no information yet on per-station cryo vacuum; commercial or custom commercial design – Contact TBD
- Racks
  - Anticipate 6-8 racks, some instrumentation racks & possibly all water cooled; commercially available as build to spec. – Contact R. Downing

## WBS Status – Cost Methodology

- Draft top level WBS for all Areas developed
  - Need resource to develop next level of detail, begin adding cost data
- Costs will be developed in Excel format
  - Establish, document all cost basis, database for cost books
  - Enter into master top-level WBS sheets



## Working Decisions

- HLRF working decisions are documented
  - ♦ Tunnel size ♦ Station Footprint ♦ Penetrations – Modulator Power Source Xfmr ♦ Charging supply input voltage ♦ Rack Power ♦ Rack Subsystem – DC Emergency power ♦ Separate Klystron oil tank ♦ Klystron windows orientation ♦ Integrated WG and Cryomodule ♦ Cooling water & air loads.
- Changes affecting cost models will require agreement from all parties
  - Probably unimportant for cost accuracy required for Vancouver – Stick to BCD baselines and established understandings with tunnel, civil, accelerator POC's

## Additional Cost Study Briefings

- 5-10 min each on Cost Status, plans, resources
  - C. Jensen-- Modulators
  - S. Fukuda-- Klystrons & Distribution, DR's
  - M. Neubauer-- Klystrons & Distribution
  - J. Carwardine/B. Chase-- Controls & LLRF