GDE ACCELERATOR ADVISORY PANEL REVIEW

CONVENTIONAL FACILITIES AND SITING GROUP

Process Water and HVAC

(Final)

Emil Huedem
and
Lee Hammond

Outline

Emil Huedem (7 minutes)

- VE
- KlyCluster

Lee Hammond (7 minutes)

- Comparison Assessment
- TDP effort & Information needed for TDP

VE (Process Water / HVAC)

- VE is one of the CFS TD Phase 1 goals
- Formal VE session in Nov 2007
  http://www.linearcollider.org/cms/?pid=1000212
- Focus on "First Cost"
- Main Linac Only
- Used RDR deep twin tunnel arrangement
- Used ML heat table updated in Oct 2007
- about 60 VE items.
- about 7 VE items selected by PM for further evaluations – terminated due to funding cut

Emil Huedem

VE (Process Water / HVAC)

- Re-started in fall 2008
- Only addressed specific VE items selected
- Evaluated various possible delta T
- Resultant cost delta vs impact matrix presented in GDE meeting Nov 2008.
- Data will be used by Project Management to assess the overall value vs impact
- Potential of about 30 -35% "first cost" reduction mainly due to (removal of chilled water system, LCW skids, decrease in thermal loads) and partially due to higher delta T configuration

Emil Huedem

MATRIX SUMMARY - Cost Savings vs Impact/Issues

E. Huedem 11/14/08

RF Water Delta T		ILC																
		25C ΔT (45F ΔT)									40C ΔT (72F ΔT)							Kly Cluster- Aug 2008
		Scheme 5			Scheme 6			Scheme 7			Scheme 5			Scheme 6			Scheme 7	
Impact / Issues (by others)		SS	CPVC	CS	SS	CPVC	CS	SS	CPVC	CS	SS	CPVC	CS	SS	CPVC	CS	SS	SS
Cost to be added (could be by others?)																		
Major IMPACT / Issues?																		
SS=Sch 10 304 Stainless in Tunnel only; CPVC=Sch 80 CPVC plastic pipe; CS= Std Sch (40) Carbon Steel																		
Overall Water Delta T	°ΔC	16.7			16.5			18.1			20.3			19.6			22.4	22.1
	°ΔF	30.1			29.7			32.6			36.5			35.2			40.4	39.8
"First-Cost" Savings in % - Process/Air Treatment WBS 1.7.3. & 1.7.5		-28%	-30%	-31%	-23%	-25%	-26%	-30%	-32%	-33%	-31%	-33%	-32%	-26%	-28%	-28%	-35%	-47%
RF Loads and Circulators reduced flow																		
RF Modltrs and Plse Transfm-flow/temp																		
Watercooled wvgde cooling design (by others)																		
Kly Clstr's RF Pipe Cooling by others																		
High Space Temperature ok?		-45°C (113°F)									-45°C (113°F)							
Equipment Insulations??																		
50% reduction in air heat load possible?																		
Finalize HLRF Heat Load table? Collector issue?																		
Rack chiller impact ok? / Rework rack armgmt??																		
Confirm reduced Heat load from racks?																		
Cost for increased maintenance due to high spaceT																		
Cost of portable cooling for maintenance work																		
Pump Recirc loop at Collector~ $2M??																		
Pump Recircloop (modul/P.Transfmr)~ $2M ??																		
Electrical Reduction		– (-2.3 MW)									– (-2.3 MW)							
Operational cost reduction		– (-??)									– (-??)							
Electrical addition					– +3 MW			– +1 MW						– +3 MW			–+1MW	??
Operational cost addition					+ ??			+ ??						+ ??			+ ??	
Pipe Press & Temp limit issues																		
"Clean Water" Compatibility Issue																		

Previously posted at ftp://fess-ftp.fnal.gov/public/ilc/agenda/VE%20Efforts/PROCESS%20WATER%20HVAC/VE%20Report%20Cover%20without%20COST%20Nov%2025%202008.pdf

Emil Huedem

VE (Process Water / HVAC)…RDR

- ***RDR Process, history, and basis of estimate documented on page 26 – 38 of*** ILC Note 2007 019 dated May 2007, Rev 0
- ***Thermal Loads was a snapshot in Oct 2006 and has not been updated since RDR, except for the ML in October 2007.***
- ***Thermal Load info at that time came from various point of contacts***
- ***IR was not included in RDR***

Emil Huedem

Klycluster (Process Water / HVAC)

- Evaluation in Sep 2008
- Very attractive cost reduction in process water/hvac systems
- Very preliminary data & assumptions used, info per email exchange with C.Adolphsen
- Presented in GDE meeting Nov 2008

Emil Huedem

Comparative Table of Current Accelerators - Highlights/Differences

- Purpose: Assembled data of current designs and technologies of various high energy physics accelerators in regards to CFS parameters, i.e., power requirements, tunnel depths and lengths, cooling water systems, and ventilation schemes
- ILC RDR, ILC post RDR, Kly Cluster, TESLA, XFEL, CLIC, Project X

Lee Hammond

Comparative Table - Highlights/Differences. cont.

- Near surface projects consider heat loss to the tunnel walls due to ground water. Deep tunnel projects are in substantially dry rock where wall heat absorption is minimal.
- Some projects use existing heat rejection plants.
- There are a number of Water system differences-e.g., ILC 2 systems, XFEL(TDR) 3 systems, ILC KLY Cluster 1 system.

Lee Hammond

Comparative Table - Highlights/Differences, cont.

- Parallel and Series Flow systems have been considered with some optimization.
- There is a wide range of pipe main sizes and delta Ts.
- Demarcation of RF Water system differs by project, i.e., in some projects LCW distribution is not in CFS costs.
- Wide range of watt/meter thermal loads

Lee Hammond

Comparative Table - Highlights/Differences, cont.

- Variances in site wetbulb influences available cooling water temperatures
- Obtained data from multiple sources...not all data at same level of development.
- Near surface shorter length projects able to locate concentrated heat loads in surface facilities.

Lee Hammond

TDP Effort (process water & hvac)

TDP1

- Will provide input to evaluation effort for various minimum machine design CFS assessments (similar to KlyCluster effort)
- Will need **rough** thermal loads, locations, criteria from area systems

TDP2

- Will need **more detailed** thermal loads and criteria (develop functional criteria template)
- Will update RDR design and cost

Lee Hammond