Availability meeting Notes – June 30 / July 1, 2009

Marc Ross, Chair

Notes provided by Nick Walker. This summary was written by Marc and lists his conclusions.

Attendees: Adolphsen, Elsen, Fukuda, Himel, Paterson, Ross, Shidara, Yamamoto, Yokoya

Presentation material by Tom.

Indico meeting location: http://ilcagenda.linearcollider.org/conferenceDisplay.py?confId=3704

Note that the Availability Task Force has a dedicated area with ILC-EDMS.

NEXT Availability meeting: July 7 (2100 SLAC, 2300 Fermilab)/July 8 (0600 DESY, 1300 KEK) 2009.

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The meeting consisted of a presentation by Tom and a short discussion with Shigeki concerning his presentation at the next meeting.

Review:

The goal of the availability task force is to provide viable availability models for SB2009. These are to be presented at the upcoming GDE meeting "ALCPG09", Sept 29 - Oct 3, 2009 for review and comment by the GDE community at large. The models (possibly revised) will be submitted to the Project Director by the end of 2009 along with the recommendation that they become part of the ILC TDP2 baseline. It is important to note that the components of SB2009 which most strongly impact ILC availability are the ML single tunnel, the low power option and the two HLRF options (KCS and DRFS) and the task force work will be limited to these dominantly ML issues. *Work on combinations of SB2009 components and Reference Design – RDR - components, (for example a single tunnel high power configuration), will be very limited.*

Summary:

(What follows is perhaps more a set of highlights than a summary and reflects Marc's conclusions. See the Q/A listed in the Discussion section, below.)

Tom's presentation includes his first results from Task Force-related work. He started from the RDR results (see below and see RDR 2.9.1). Configuration information is available for the

'Klystron Cluster Scheme', so Tom started with that. (DRFS configuration information and updates to the KCS are due next week). An important item to note is that the RDR one vs two tunnel comparisons compared equipment accessibility extremes in ALL regions, including the BDS and DR. Thus in the 'RDR two tunnel' Availsim runs, virtually all ILC support equipment is accessible during operation and in the 'RDR one tunnel' runs, none of the support equipment is accessible. The RDR Availsim results are included in talks Nick linked (see mail message June 19) and are reflected in Tom's presentation slide 6.

This is important because our SB2009 Working Assumption is that *only the linac* is configured with a single tunnel, since that is change which gives the most substantial cost saving. The support equipment housing in the central complex will be a topic for the 'CRI' group to study. Tom modeled this SB2009 WA somewhat artificially ('Idealized Klystron Cluster') by setting a very long MTBF for all cluster components. (Since almost all active cluster hardware is accessible during operation, this is a meaningful strategy). The results are very encouraging.

Shigeki asked about how to develop equipment performance parameters for the two HLRF schemes. Of special relevance is the expected performance of the 'MA Modulator', a low power anode modulation pulser needed for each 730 KW klystron. See Shigeki's AAP talk: (http://ilcagenda.linearcollider.org/getFile.py/access?resId=0&materialId=0&contribId=6&sessionId=1&subContId=5&confId=3154), slide 13. In this case, an important item to note is our approach to the development of the DRFS, which requires R & D on component engineering resulting in lightweight, low cost HLRF power components that can have much better performance than their full power counterparts. It should be practical, given that the first set of DRFS component MTBF / MTTR parameters will be presented July 8, to effectively iterate them using Availsim and come with achievable, consistent goals. Thus for ALCPG09, we will have a clear set of performance targets for the HLRF R & D program.

The simulation includes an assumed Operations and Maintenance Model (OMM) that can be used, for example, to simulate a realistic situation where the number of people in the tunnel during maintenance periods is limited and to estimate the operational impact of long downtimes. It is important to note that limitations and parameters included in the OMM may increase the simulated downtime.

Discussion:

(Key Q/A raised during Tom's presentation).

Q: Does the table showing downtime attributed to given components include the needed MTBF improvements?

A: Yes. See the cut/paste table caption from the RDR below.

Q: For the results presented, how much downtime can be attributed to each region or system? This will help explain why the RDR '2 tunnel MTBF A' and the Idealized KCS are so similar.

A: See the pie-charts below for the RDR simulation results. Availsim can be used to generate these for the Task Force test cases.

Q: How is the low power DRFS configured?

A: It is natural to expect a 730KW klystron would feed power to four cavities. This should be described at our next meeting.

Q: How should Klystron Cluster failure modes be included in Availsim?

A: The Klystron Cluster HLRF distribution system can be subdivided into three subsystems: 1) in-the-tunnel components including motorized phase shifters, loads and interlock sensors (same as the equipment in the beam housing tunnel in the RDR), 2) support building equipment including the power source, controls and utility infrastructure (also similar to the RDR support tunnel equipment) and 3) the overmoded waveguide and the couplers which feed and remove power from it. Only failures in subsystem 3) cause common mode failures. Faults in 1) and 2) have the same impact as they would in the RDR simulations. The KCS will be configured with waveguide valves that enable klystron replacement during nomina operation. A similar system is in use at FLASH and at SLAC.

Task force planning and homework:

At the next meeting we will have a report from the HLRF Technical Area Group (Shigeki). The Availsim input table was shown in Tom's presentation (slide 9).

Specific homework is for the group to review these notes and Tom's presentation material.

I believe two face-face meetings (~1 1/2 day elapsed time) would useful during this initial phase (up to ALCPG09) of the task force:

1) At Slac - with a focus on initial Availsim output and analysis.

2) At kek - with a focus on Hlrf and subgroup 3 activities. I am planning to be at KEK Aug 26-28.

John has asked the meeting time be moved to Friday, and perhaps shifted to the usual slot. I will summarize his request at our next meeting.

TABLE 2.9-1
This table shows the MTBFs that were used to obtain the desired 15% downtime. Note that the desired MTBF is the product of the nominal MTBF and the improvement factor. The nominal MTBFs give a rough idea of what has been achieved at present accelerators. The third column shows the percentage downtime caused by the devices with the MTBF improvements given in the second column. These can be used to estimate the effect of not meeting one of the MTBF goals.

Device	Needed improvement factor	Downtime to these devices (%)	Nominal MTBF (hours)	Nominal MTTR (hours)
Power supplies	20	0.2	50,000	2
Power supply controllers	10	0.6	100,000	1
Flow switches	10	0.5	250,000	1
Water instrumentation near pump	10	0.2	30,000	2
Magnets - water cooled	6	0.4	3,000,000	8
Kicker pulser	5	0.3	100,000	2
Coupler interlock sensors	5	0.2	1000,000	1
Collimators and beam stoppers	5	0.3	100,000	8
All electronics modules	3	1.0	100,000	1
AC breakers < 500 kW		0.8	360,000	2
Vacuum valve controllers		1.1	190,000	2
Regional MPS system		1.1	5,000	1
Power supply - corrector		0.9	400,000	1
Vacuum valves		0.8	1,000,000	4
Water pumps		0.4	120,000	4
Modulator		0.4	50,000	4
Klystron - linac		0.8	40,000	8
Coupler interlock electronics		0.4	1,000,000	1
Vacuum pumps		0.9	10,000,000	4
Controls backbone		0.8	300,000	1

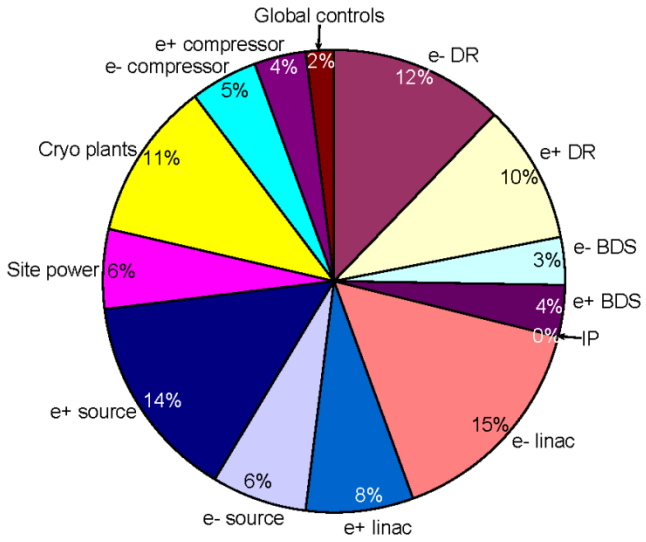

FIGURE 2.9-1. This shows how the total downtime of 17% is distributed among the various regions of the ILC.

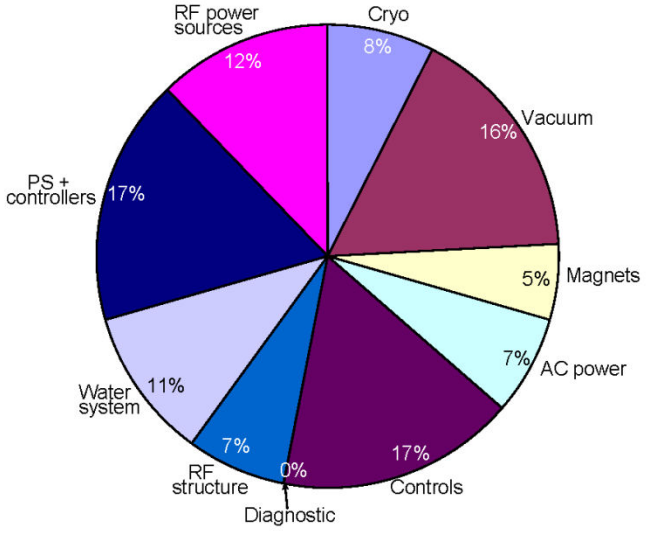

FIGURE 2.9-2. This shows how the total downtime is distributed among the various systems of the ILC. Note that the global system (site power, cryo plants, site-wide controls) are not shown in this chart.