ILC Controls Global Group Tele-Meeting with Linac Area Group
Minutes for April 20th 2006
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The minutes are broken down into topics based on the original agenda points from John Carwardine. Supporting documents can be found on the Indico meetings server at:

http://ilcagenda.cern.ch/conferenceDisplay.py?confId=403

The meeting was held via tele-conference and WebEx. Participants included:

SLAC: Chris Adolphsen, Andrew Young, Bob Downing, Ray Larsen
Fermilab: Brian Chase, Sergei Nagaitsev, Sharon Lackey, Vince Pavlicek, Patty McBride, Jim Patrick, Manfred Wendt, Paul Joireman, Erik Gottschalk, Margaret Votava
ANL: John Carwardine, Claude Saunders, Frank Lenkszus

KEK: Marc Ross, Shinichiro Michizono, Kazuro Furukawa, Shigeki Fukuda, Hitoshi Hayano

Topics

1. Review the latest RF System diagram. Make sure we have all the right elements and agree on the list of signals and controls

Manfred Wendt (FNAL) described the changes he made to the top level RF diagram based on comments from the April 18th RDR meeting. These included:

a) Reducing the number of penetrations from accelerator to service tunnels to 3.
b) Moving the LLRF and power penetrations to "near" the center waveguide penetration
c) Correcting the number of cable counts.

Confusion about the connection to the 3-stub tuners and the number was clarified and the suggestion made to break out this part into greater detail in a sub-diagram.

In response to a question regarding placement of arc detectors on the circulators, RL stated that this had not been discussed, only arc sensors on the couplers was planned.

A question was raised regarding the tuning knobs on the klystron hybrids, as to whether they would be manually adjusted or adjusted using an additional motor. The response was that, it is hoped that these can be operated in a "set and forget" fashion, only needing to be set once.

Discussion moved on to the pressure sensors and whether they would be part of the radiation protection system. RL said this would not be the case, this would not be part of the personnel protection system. The waveguide system will be pressurized

to a much lower pressure than the 3 bar used at TTF (which would have prevented the use of flexible waveguide sections). The extent of the waveguides to be pressurized to this value has not been clearly decided.

Discussion then moved to a consideration of the two boxes on the diagram labeled with "Klystron interlock" and what functionality each crate contains. Discussion on this was not conclusive and it was tabled in favor of counting the number of signals accurately for costing purposes. It was decided to change the LLRF Crate 2 designation to "RF Interlocks" and Manfred agreed to make this change.

The discussion moved to a consideration of the number of cavity tuner motors and piezo controllers. The numbers broke out as follows

- 48 Piezo controllers – each cavity piezo controller is duplicated for redundancy purposes for a total of 16 per cryomodule or 48 total.
- 24 cavity motor controllers – each cavity has a tuning motor, 8 per cryomodule and 24 total.
- 72 3-stub tuner motors – each RF distribution point has 3 motors on the 3-stub tuner, 24 per cryo-module or 72 total.
- 24 RF coupler motors – 1 per cavity.

Discussion moved to a consideration of other control points, the "white boxes", on the diagram, cryo, vacuum and klystron and what interfaces are needed for these crates.

- Jim Patrick is working with Tom Peterson to specify this more completely.
- Contact points for the vacuum system (John Noonan, ANL) were identified

2. Multi-conductor cables and connectors for piezo and motor drives

Discussion moved to cables and how to use multi-conductor cables to reduce the number of cable pulls and connection difficulties. Manfred Wendt proposed that for every motor we would need a multi-wire cable carrying the drive and also return sensor signals. The detail of the motors was unknown and a contact person was needed.

Manfred also will speak with Peter Prieto next week to further specify the cable requirements for the PMT, e- field, temperature and arc detector signals to help with costing.

The group discussed cabling and connector costs. Brian Chase has made a start on costing out cables and connectors for one klystron station as described on the RF diagram although this is still preliminary. The costing may not get to a very detailed level but we should use experience from other labs, SNS and TTF, to help in this exercise.

It was generally agreed that the cables should be fire retardant although this would drive up the cost of the cables by approximately 25 to 30 %.

Discussion moved into a consideration of power load and heat dumped. It was suggested that the drive motors should have zero holding current and should require zero power when they are not being driven. This is the general the plan. The question arose as to whether a readback is needed from these motors as the effect of the motor movement should be observable from the RF.

Discussion then moved to a consideration of costing strategy: is it bottom up or top down? John Carwardine stated that we come up with a standard hardware model, standard components, count these and then cost this out. So the strategy is bottom up generally but for more complex boards has to be more complex. Don't need great detail on bottom up. We need to look at other installations such as (SNS and TTF) to make sure we are not far off. We need to have some knowledge of the extent of the control system.

The issue of how to integrate a given RF system into the whole was raised. This involves setting the whole single klystron system up with the 3 cryomodules and integrating into the whole system. How does this get costed out? There has been some discussion within the Controls Global Group about the need for test facilities but it is not clear how we include the cost, or if they are included elsewhere. Where does installation, pre-testing labor get costed out, do we need to include this?

Brian Chase suggested that all construction, assembly and testing for a klystron station take place on the surface, and all cables should have easy to attach connectors. Only final assembly, primarily cable connection, should be done in tunnel. Ray Larsen agreed and proposed that we need to develop our own installation model ourselves. We should focus on base costing and then get some general rules for these other costs (test facility, etc.)

3. Allocation of penetrations and relay rack layout.

The total number of racks for controls and LLRF on the on the diagram is 5. Ray Larsen said that there were some missing racks, which might include magnet power control, BPMs and vacuum control, which may drive the total number up to 8 for the complete system. Bob Downing noted that the LLRF system may need two relay racks instead of the one shown on the diagram. Fukuda-san asked for a total count of relay racks from Controls and LLRF. Controls GG will review, and then provide the number to Linac Group. If we assume ATCA crates we may only be able to get 2, at most 3 crates, per rack.

It was generally agreed that the cable runs for the LLRF related signals have the highest priority, should have the shortest runs and determine where racks are situated geographically. Ray Larsen has begun work on the allocation of relay racks in the

linac tunnel. It was noted that the tightest area for space in the service tunnel is in the area where the positron linac and main linac co-exist.

4. Relay rack power management and cooling

Some concern was expressed about water cooling the racks, but this is a detail, we need to estimate accurately how much the power load is, civil engineering people know this. KEK people have estimated these numbers but the assumptions made in the estimate need to be improved with input from others. It was noted that DESY has done some detailed modeling, and that their information would be invaluable in determining the power losses. Brian Chase agreed to contact Stefan and Kay to see what numbers they have available. KEK people also need to know the total number of racks. We need to go through another iteration to determine how many racks we need but we are close.

Brian suggested that we need to be very thoughtful about how design is done and always take power minimization into consideration as this can be a significant cost driver. There has been some discussion and comments from Keith Jobe relative to Brian's note on power costs relative to cooling.

5. Other devices in need of controls interface

Much of this discussion occurred previously with the exception of the MPS system which is not defined in a lot of detail. Marc Ross stated that Tom Himel is concerned about what level of protection is needed. In the linac we need to make sure the energy is correct. Some kind of system built into LLRF to ensure this, probably small. There needs to be further discussion on the integrated MPS system.

Manfred raised the point that we have not discussed warm sections which have different instrumentation, including laser wires, which has different costs. The UK and KEK people are working on this costing. It was suggested that we need to have a special session on the warm section.

Brian raised the question: Are beam loss monitors going to be part of MPS? YES

Most of MPS work is how to protect machine from single bunches.

Most BLMs will be placed in warm section and undulator sections

It was agreed that we need a separate discussion on the MPS but this is not a high priority.

John stated that we will start compiling a spreadsheet of control system interfaces for feedback to Linac group.

6. Data collection rates from LLRF system.

Claude Saunders raised the question: Do you see LLRF data collection as a direct to disk operation locally? Ray responded: No but it would be “nice” to be able to do this. Probably won’t be done routinely, more like a diagnostic.

It was agreed that Controls GG would propose data collection rates and storage capacities, based on expected operational needs from the LLRF system.

The KEK people raised the question: Is RF Reference line the tunnel copper or fiber? The baseline design is a fiber distribution from a central point to several distribution points and copper distribution to local RF stations. This baseline should be more completely documented, since there are several schemes under consideration that require study and development.

Brian Chase raised the point that the reference was placed in the beam tunnel to eliminate any first order drift in temperature. Primary comparisons then need to be done in the tunnel but this isn’t bad since there are only 3 cables.