Monthly Report from Project Managers

December, 2007

Marc Ross

At the end of December, the Project Managers are faced with a substantial reevaluation of our ongoing efforts because of severe budget actions in the UK and the US. In the US, the focus is on preparation for next year's budget (starts October 1) and how to bridge the gap between now and then. In the UK, the regional director, Brian Foster, is working with the group, institutional managers and funding agency managers to develop a near term plan.

Please look for updates in the *Newsline* Director's Corner in the next week or so.

EDR R & D Plan: Our R & D Plan was presented to the funding agency group 'FALC/RG' on 18 December.

TTC: The Tesla Technology Collaboration will meet in mid-January at DESY. While the TTC is not directly, formally, linked to ILC, their activities form the backbone of much of our SCRF program. For example, much of the 'S0' High Gradient R&D program is based on a written recommendation from TTC. Please see their agenda: https://indico.desy.de/conferenceDisplay.py?confId=401

ILC GDE Controls and LLRF PM Progress Report

December, 2007

Electronics Platform and High Availability

- STF issued a purchase order was issued for a control system platform of LLRF. Two offers of ATCA systems which met our requirements have been compared between a Motorola product and a combination of Japanese CPU and switch cards and foreign products. The former one was chosen.
- Desy has selected Zone 3 connectors (to connect RTM module with downconverters to the ATCA carrier board) and defined pinout for signals (including timing and rf)
- Cryoelectra has developed layout for RTM carrier board with 8 channel downconverter mezzanine boards. Prototype of 8 channel downconverter expected in February for XFEL.
- DESY got three prototypes of their AMC module running including:
    1. FGGA programm to read/write from PCIexpress over the backplane
    2. PCIexpress driver for the CPU in the µTCA crate
    3. DOOCS server to access the DESY AMC module
    4. DOOCS server to read an ADC-IP-module on a AMC-IP-carrier from Tews
    5. complete IPMI implementation on the DESY AMC module (MMC)
    6. DOOCS server to read ATCA, µTCA and AMC modules data via IPMI
- IHEP has started the procedure of ordering the ATCA system, including the CPU boards, switches, shelf managers crate etc. We have discussed with Claude Saunders at APS and got a lot of help from him for selection of the product and find a company that may offer ATCA. Currently we are focusing to one or two companies and continue the negotiation. Another one is to find operating system and a suitable middleware software for the HA system, the Openclovis is the first choice. We are reading the document to know its components and functionality.
- The PANDA DAQ ATCA board is in final layout. The HPCN board aims for feature extraction and pattern recognition in trigger system and data packaging in DAQ for PANDA experiment and BES future upgrade. There on the board are 5 Virtex-4 FX FPGAs with 2Gb DDR2 each, 8 optical transceiverrs via RocketIO, 5 gigabit Ethernet, and 13 RocketIO to ATCA mesh plane. So it is a powerful ATCA compliant computer node. This work is a collaboration between IHEP and Giessen University. The optical data transmission rate is defined as 2Gbps, and a final check for schematics is made. PCB will be produced in Factory in January 2008.
- December 3-4 2007 DESY XFEL Workshops on LLRF and Standard Crates conducted by S. Simrock and K. Rehlich respectively. R. Larsen attended by video and R. Downing presented a talk on relevant developments in the ATCA and Micro-TCA standards. The workshops appear to have met the goals intended by the originators. In general ACTA standards and custom transition module connector designs appear to be strong contenders for XFEL implementation.
- SLAC completed an updated version of the ATCA for Physics Profile along with an implementation plan for discussion and sent to a small group for comments. Once comments are received intend to post an invitation to participate to FNAL Wiki website.
- Phase I SAIC VME-ATCA Adapter (SLAC) has been completed which met all requirements and was approved for billing to SLAC. Discussed plans for plans for Phase II which involves layout, fabrication and testing of final boards, firmware and software. Meanwhile, orders have

come down to curtail ILC work and therefore Phase II is on hold pending further funding. The project is a key element in future evaluations so is highly important to complete. It is also of interest to the DESY XFEL and other programs.

- OpenClovis retraining session was attended at FNAL, with much improved content and instructor.

Architecture

- At KEKB a development of the Wireshark network packet analyzer plug-in for EPICS CA was started between KEKB-Linac, Ron and Cosylab.   It was aimed at field analysis of control network issues.
- At KEKB recent version of EPICS software of the event-timing system was evaluated at KEK-Linac with Lei Ge and Xu Guanglei from IHEP-Beijing. The version was provided by Eric Bjorklund at LANL, and many others helped our evaluation including Timo Korhonen and Jukka Pietarinen.
- VME Interlock System for Klystron testing (SLAC): The future of the program needs to be redefined in terms of implementation on a test stand with Marx modulator and Toshiba klystron. The VME design is very close to complete and our goal is to finish a board and implement on a prototype test stand. New funding has to be found to make this possible.
- OpenHPI was configured to access ATCA shelf manager. Primary functions of sensor reads and hot swap events were accessed through HPI API..

Test Area Updates

STF-0.5 : KEK RF (1.3 GHz), LO (local oscillator) and clock (~ 40 MHz) generator is designed and ordered to the company as a spare of STF-0.5 operation.
The previous LLRF experiments at STF-0.5 are still underway.

Engineering

Project Management

We revisited our list work packages now that expressions of interest have been collated and have almost completed the process of collapsing them down to a sensible number based on the actual number of FTEs available. We still need to assign work package lead institutions. We are beginning to detail the deliverables in each of the work packages.

The whole project was thrown a loop by the Omnibus appropriations bill in mid December which has cut out ILC funding in the US for the remainder of FY2008. This has left the labs doing controls (FNAL, SLAC, and ANL) scrambling and the outcome is still not clear. The UK pullout from has had no noticeable impact on controls.

We have followed up with RPATH in pursuing a SBIR next fiscal year to use a virtual machine mechanism as a way of setting up a job execution environment for controls production and development. It sounds very promising.

Workshops and conferences:

Participated in XFEL LLRF Review in December

Participated in XFEL electronics standards workshop in December.

Continued planning for ATCA workshops at Sendai GDE meeting in March 2008 and Dresden IEEE Nuclear Science Symposium in November 2008.

Monthly Report (15nov07-21dec07) for monthly_report_21dec07.doc
Project Management Office – Cost and Scheduling (C&S) and International Costing Group (ICG)
reported by Peter H. Garbincius – 19nov07

Since I am taking vacation, this report covers the period through the end of 2007, but hopefully not through the end of US participation in ILC. Due to the unfavorable budget authorization, we at Fermilab, have been told to immediately stop all activities on ILC.

I sent initial thoughts on change control template, emphasizing changes in the cost estimate, the Chairman of Engineering Management Group. Nobu Toge then distributed a DRAFT change control template, incorporating (almost) all of my suggestions, and requested feedback from the project management team.

Documentation of the RDR Cost Estimate continued. The last outstanding lower level details of the Asian and European Conventional Facilities and Siting cost estimate were received. Although there are still a few outstanding questions on the Asian underground construction and the European electrical estimates, these updated estimates will be incorporated into the web-retrievable estimating files, with the still outstanding questions flagged. A single, simple to use, web-page, linking all of these estimating files was started.

We are (still) evaluating Apple/MacIntosh access to an external computing host for Primavera. Windows-based PC access works fine. The promised date for decision was November 30.

We received three bids from qualified companies for the project management consulting contract for implementation of Primavera and other tools and procedures. Barry, Marc, and Peter met with lowest cost bidder. We decided to sign the contract and begin work, but this was put in limbo/on hold by US ILC budget situation.

It was intended that the Cost Engineers perform a drill-down review of the Work Packages and EDR plan before presentation to FALC Resource Group. These documents were not available in time for review.

Peter completed an easier to use web-page for the Project Managers to link to the estimating matrix and the backup materials for the estimate.

To do over the next month(s): - if Fermilab continues to work on ILC

Complete documenting RDR cost estimate as far as possible
Finalize contracts for external hosting of Primavera & sign contract for project management consulting.
Define and start implementing Project Management tools, procedures, and training
Complete the Business Model for ILC
Drill-down review of the Work Packages and EDR plan report for FALC

Happy Holidays!

Peter

Monthly Report for ILC Project Management Office

Damping Rings

December 2007

Part I: Summary of Damping Rings R&D Mini-Workshop

The Third Mini-Workshop on ILC Damping Rings R&D was held at KEK, 18-20 December 2007. Topics discussed included: electron cloud; fast injection/extraction kickers; impedance and impedance effects. There was also discussion on progress towards a baseline design for the lattice. Slides from presentations made at the workshop are posted at: https://wiki.lepp.cornell.edu/ilc/bin/view/Public/DampingRings/KEKWorkshopTalks

Baseline Lattice Design for the EDR

Studies for the RDR were based on a lattice design using "theoretical minimum emittance" (TME) cells in the arcs. Issues uncovered during the RDR studies, as well as changes resulting from the move to a central-injector configuration, led to some requirements for modifications to this lattice. The latest version of the TME lattice, OCS8, includes all the required modifications, and was presented at the KEK workshop. An alternative design, using FODO cells in the arcs, has also been developed, and may provide some advantages in terms of tuning flexibility and reduced numbers of magnets. Despite the advantages of the FODO lattice, there were some concerns that there is insufficient space between components in the RF and wiggler sections. Another important issue was raised by recent studies of impedance-driven instabilities, the results of which were presented at the workshop. These studies suggest that there would be a considerable margin between the nominal operating parameters and the instability thresholds. Therefore, the possibility of returning to a 6 mm rms bunch length without increase of rf voltage can be considered: this would have considerable technical advantages and potential cost savings for the bunch compressors downstream of the damping rings. After some discussion, it was agreed to defer selection of the baseline lattice design for the EDR until shortly before the March 2008 GDE meeting, to allow re-specification of the damping rings parameters, and associated modification and evaluation of the TME and FODO lattice designs.

Electron Cloud

Experimental studies into electron cloud build-up and mitigation techniques are starting or continuing at PEP-II, KEKB, DAΦNE and CesrTA. Key issues include build-up of electron cloud in wigglers, and the effectiveness of low secondary yield coatings and grooved surfaces at suppressing the build-up. Recent studies of grooved chambers in field-free regions in PEP-II show very promising reduction in the secondary yield. It is hoped to repeat this success in the CesrTA wigglers (which have very similar parameters to those specified for the ILC damping rings). CesrTA should also be able to achieve beam parameters similar to those needed for the ILC, thus yielding important results on the interaction between the beam and the cloud in the ultra-low emittance regime. Simulation studies by Christine Celata and her colleagues at LBNL indicate a potential enhancement of cloud density in a wiggler, resulting from a resonance between the cyclotron motion of the cloud electrons in the wiggler field and the passage of bunches in the beam. This effect could have important implications for the design of the wiggler section in the ILC damping rings.

Key milestones to the EDR include:

- evaluation of electron cloud mitigation techniques (coatings, grooves, clearing electrodes) in existing accelerator beamlines;

- characterisation of electron cloud build-up and instabilities in the ILC positron damping ring using simulations codes that have been benchmarked in a relevant regime;
- specification of electron cloud mitigation techniques in the damping rings, with consideration given to side-effects (such as additional vacuum chamber impedance).

Fast Injection/Extraction Kickers

Recent studies into a number of different fast high-power switch technologies have demonstrated the feasibility of the present damping rings specifications, but further development is needed before the full requirements can be satisfied. Promising technologies include fast ionization dynistors (FIDs), drift step recovery diodes (DSRDs), and MOSFET switches in an inductive-adder configuration. It seems likely that some hybrid of these technologies may be used to achieve the required performance specifications. The goal is to demonstrate rise and fall times of less than 3 ns, with sufficient amplitude, stability, pulse repetition rate and reliability. There have been promising tests using low-amplitude kickers with beam at KEK-ATF, where the technique of using pre-pulses to ensure zero-amplitude kick for preceding and trailing bunches has been demonstrated. Ultimately, fast kickers will be needed in the ATF damping ring to provide a beam with ILC-like time structure for ATF2. Experience with fast kickers being installed in DAΦNE will also be highly relevant for ILC. The key milestone for the EDR is demonstration of a fast pulser meeting all specifications for rise and fall times, amplitude, stability, pulse repetition rate and reliability. However, attention also needs to be given to the design of the strip lines that deliver the deflecting field to the beam: issues include field quality and the impedance seen by the beam.

Impedance and Impedance Effects

Progress has been made on constructing an impedance model for the damping rings, and characterising the impedance-related effects, particularly the instability thresholds. Until a baseline lattice is selected and technical designs developed for the key components, the impedance models and instability estimates should be regarded as provisional; nevertheless, sufficient information already exists (including, for example, component models adapted or scaled from existing machines) to provide considerably greater confidence in the recent results than in the results obtained using crude estimates for the configuration studies. An important step has been the compilation of a list of components in the vacuum chamber, a prioritization of their importance for the impedance, and identification of appropriate technical designs for wake field modelling. Powerful (parallel) codes for wake field computation are available at SLAC, and have already been applied to the rf cavities and bpms. Using the wake field model developed so far, estimates of the instability thresholds have been made using a Vlasov solver at LBNL. Results have indicated a significant margin between the nominal operating parameters and the onset of any instability; this allows the possibility of re-specifying the damping rings parameters for a shorter bunch length, with technical and cost benefits for the damping rings and for the bunch compressors (see above). Progress has also been made in understanding the effect of long-range wake fields on coupled-bunch instabilities, and on injection transients. The approach being taken for the impedance studies, and the plans for the engineering design phase, allow for "iterative" improvement in the wake field models and vacuum component designs; this provides flexibility so that the eventual level of detail can be matched to the technical requirements for the EDR and the resources available.

Part II: Technical Reports from Work Packages

Wiggler (Work Package 3)

Significant progress was made in December (LBNL/Cornell) to finalize the design of a wiggler vacuum chamber, for use in a CESR-c superconducting wiggler, which incorporates electron cloud diagnostics. A meeting between SLAC, LBNL, and Cornell collaborators reviewed several EC mitigation options for this chamber and key details of the proposed fabrication methods. The first beam test of the "thin" retarding field analyzer technology needed for these chambers was successfully conducted at Cornell. Overall progress was consistent with a start of chamber fabrication by the end of January, 2009 for use in CesrTA. At Cornell, work continued to finalize details (associated with pole shape and coil configuration) of the 3D magnetic field model of an optimized ILC wiggler design. The rate of progress on this effort is consistent with an updated set of field maps being available for evaluation on the timescale of the DR baseline lattice selection.

Instrumentation and Diagnostics (Work Package 4)

Further improvements, tests and beam studies on the ATF damping ring BPMs were carried out during December. Another BPM (#54) was temporarily equipped with the new digital read-out system, and (as first prototype) with an analogue downconverter having automatic online calibration and remote control functionality. Beam tests in high resolution, narrow-band mode successfully demonstrated the online calibration, which automatically compensates drifts due to temperature changes or aging of components in the gain stages; without calibration, such drifts would result in an offset error. BBA studies verified the improvement. The automatic calibration was active in the simultaneous presence of the narrowband beam measurement.

Beam studies in wideband, turn-by-turn mode were initiated to study optics, coupling and dispersion, using the 20 upgraded BPMs. Results from these studies indicated two issues on the BPM system:

1. Fake harmonic lines at n×9.7 kHz in the Fourier spectrum, probably caused by electromagnetic interference from the ATF main power station. The grounding and power supply AC blocking of the analogue downconverters in the ATF tunnel need to be improved to counteract this effect.
2. Synchronization issues between VME crates and between BPM channels within individual crates were observed, leading to unexpected results from turn-by-turn data. Part of the problem can be analyzed and handled remotely; ultimately, more dedicated beam study time may be needed fully to resolve the problem.

A plan for upgrading the complete ATF damping ring BPM system was discussed, but due to the recent US ILC funding issues it needs to be revised.

Power Systems (Work Package 8)

No technical problems have surfaced or been identified during the reporting period.

OCEM in Italy delivered the first set of power modules for the KEK ATF2 project. SLAC is currently testing the systems. Delivery and installation of these systems into the ATF2 test facility will occur in April 2008. Some photographs illustrating the systems should be included in the next report.

The ILC will also need bipolar systems. The SLAC Power Conversion Department (PCD) had an approved Work Package to develop a 5A to 125A high-availability bipolar power supply. Work was just getting underway, but in view of the recent US funding cuts, it is unclear how much more can be accomplished this fiscal year.

SLAC PCD was successful in persuading an American manufacturer to submit a Small Business Innovation Research (SBIR) proposal for high availability bipolar power supplies. The intent is to have this effort augment SLAC's internal efforts. If DOE awards an SBIR Grant to this manufacturer, updates will be provided in future reports.

The acting WP Manager has contacted the Controls and Power System personnel at IHEP, who have expressed an interest to participate in the Damping Rings Power System design. IHEP will be provided with information on the present status of the design, and will be involved in discussions to determine how they can be of help.

INTEGRATION GROUP REPORT

November/December 2007

E+/- Timing Issues

The problem of e+/- timing has been revisited with the most up to date path lengths in the present ILC layout and several discrepancies have been uncovered. These are being addressed by the "deck masters" team, see below.

Using the best data with path lengths correct to +/- 10%, there is still a sizable problem, of the order of 2km. This is for the case where one wishes to maintain the most flexible operating regime with self reproducing bunches in the damping ring. Several alternate accelerator system layouts which can correct the problem (without DR changes) have been examined along with their pro's and con's. This will be presented to the project managers and area system leaders some time in January. As all these solutions imply an increase in cost (longer e+ path length), and consideration will have to be given on what we will assume for the EDR design.

Lattice Design

At present there is no self consistent "end to end" lattice design for the whole machine. This is not a technical feasibility problem but rather one of detail definition of parameters and system interfaces. Peter Tenenbaum has put together a team of "Deckmasters", representing the different ILC area systems, (edr_deckmasters@fnal.gov) who are addressing a punch list of problems and are having regular meetings.
http://www.slac.stanford.edu/accel/ilc/lattice/edr/doc/LatticeFilesPunchList.html
Their goal is to have an end to end lattice by March 2008 which will be consistent with the system technical requirements and the CFS layouts. One output of this work will be an accurate e+/- path length estimate for a self consistent design.

Luminosity Parameters

The RDR and other documents have ranges of possible parameters which go along with possible luminosities at different energies. A team, led by Ewan Paterson, has been assembled to review these parameters with several goals.

These are, by January 2008, to propose a base set (limited) of parameters at energies between 90 GeV and 1 TeV which can be used by everyone for simulations and modeling of detector systems. Then next is, over the next few months, to examine the proposed ranges of parameters for consistency with the present technical system design and on a continuing basis to work with the program managers and system leaders in evaluating the technical risk versus performance of these different ranges or parameter sets.

ILC EDR Phase

Main Linac SCRF Cavity Preparation Workpackage
Lutz Lilje
Report 12/2007

1 Organizational Issues

1.1 Work package descriptions

1.1.1 General

The work package (WP) descriptions are available (see Appendix A). The S0 taskforce R&D plan has been transformed into the work package group C1.
Additional work packages deal with the development of a consistent set of specifications for cavity material, fabrication (C2) and preparation (C3).
The last work package will deal with the implementation of the 'plug-compatible' concept and the specification of the outer envelope. In addition, within this work package guidelines for the evaluation of alternative cavity shapes and the Lorentz-force detuning concept should be developed. Finally, the work package is the interface to the main linac integration work packages.

1.1.2 Issues

Manpower

So far, the expressions-of-interest (EOIs) have not been collected. Although candidate labs are clearly identified, it is currently not clear what manpower is available and who will be the responsible persons for this..

Commitments

Some efforts – especially in the WP C1 – are already known despite the lack of formal EOIs. The list below is not yet exhaustive. Some additional interests are currently being discussed and evaluated.

- DESY
    - See Appendix B
- FNAL (EOI received)
    - S0 Production-like effort with the cavities arriving end of 2007
    - S0 Tight-loop with AES and ACCEL cavities available
    - Coordination of the US effort
- KEK
    - S0 Tight-loop preparation and testing
        - Esp. with cavities made available from other regions
- JLab
    - Participation in the surface preparation investigations
    - S0 Tight-loop preparation and testing
- ANL

- o S0 Tight-loop preparation and testing

2 R&D Results

2.1 Cavity tests

2.1.1 Vertical tests

A recent re-test of the ICHIRO-shape cavity without HOMs at JLab has shown that the maximum gradient achieved in this cavity was 30 MV/m (and not 40 MV/m) as reported earlier.
An AES cavity (AES 2) has reached 30 MV/m. This is the second cavity of this batch which has reached similar performance levels to what has been seen in the ACCEL cavities treated at JLab earlier.

2.1.2 High-power tests

The first high-power test of TESLA-like nine-cell cavity was successfully performed at KEK. Despite some enhanced field emission the gradient achieved is identical with vertical test result within the measurement errors (19-20 MV/m). Coupler performance was good with short processing. The Lorentz-force was compensated at the maximum gradient.

2.1.3 Module assemblies

The module assemblies either have finished (at FNAL) and will be finished soon (at DESY next week).

Appendix A

ILC Engineering Design Phase

WPs for Cavity
Lutz Lilje
Nov 1, 2007

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1 WP C1: Gradient Performance

1.1 Tight-loop effort

1.1.1 Finalize the tight-loop process.

Abstract

Package should demonstrate repeatability with in each participating lab. Then an inter-laboratory comparison should follow facilitated by cavity exchange. Re-evaluation whether second loop is needed

Deliverables from Work Package

Cavity treatment and testing. Measurement data. Data comparison.

Major Milestones

All cavities tested by mid of 2008
Data comparison by fall 2008
Re-evaluation by fall 2008

Resources required

2-3 SCRF labs, 3 cavities per lab, 3 tests each cavity

Candidate labs

FNAL, JLab, KEK, DESY

1.2 Production-like effort

1.2.1 Treat 30 cavities with EP + ethanol process.

Abstract

Repeat process (íf needed in case of underperformance) at least once. Apply T-map on as many cavities as possible, at least all cavities below 30 MV/m.

Deliverables from Work Package

Cavity treatment and testing. Measurement data.

Major Milestones

All cavities tested by end of 2008

Resources required

SCRF lab, 30 cavities

Candidate labs

FNAL, DESY

1.2.2 Treat 20-30 cavities with EP, Degrease.

Abstract

Repeat process (íf needed in case of underperformance) at least once. Apply T-map on as many cavities as possible, at least all cavities below 30 MV/m.

Deliverables from Work Package

Cavity treatment and testing. Measurement data.

Major Milestones

All cavities tested by end of 2008

Resources required

SCRF labs, 20-30 cavities

Candidate labs

FNAL, JLab, KEK, DESY

1.2.3 Treat 10-20 cavities with fresh EP.

Abstract

Repeat process (íf needed in case of underperformance) at least once. Apply T-map on as many cavities as possible, at least all cavities below 30 MV/m.

Deliverables from Work Package

Cavity treatment and testing. Measurement data.

Major Milestones

All cavities tested by end of 2009

Resources required

SCRF lab, 10 cavities

Candidate labs

JLab, KEK

1.3 Preparation for ultimate cavity batch

1.3.1 Evaluate data from tight-loop and production data

Abstract

Overall evaluation of data available by end of 2009.

Deliverables from Work Package

Report on data comparison. Recommendation for ILC cavity process.

Major Milestones

Report and recommendation by end of 2009.

Resources required

Database, Scientist

Candidate labs

FNAL

1.3.2 Treat 30 cavities with ILC process

Abstract

Repeat process (íf needed in case of underperformance) at least once. Apply T-map on as many cavities as possible, at least all cavities below 30 MV/m.

Deliverables from Work Package

Cavity treatment and testing. Measurement data.

Major Milestones

All cavities tested by end of 2010

Resources required

SCRF lab, 30 cavities

Candidate labs

FNAL, KEK

1.4 Single-cell program

To be discussed

1.5 Common performance evaluation

1.5.1 Database setup

Abstract

Develop basis for an ILC database. Review existing databases. Choose common database system.

Deliverables from Work Package

Database for cavity process and testing data.

Major Milestones

Evaluation by end of 2007
Choice of database by spring 2008
Database in place by mid 2008

Resources required

Scientist, IT engineer

Candidate labs

FNAL, JLab, KEK, DESY

1.5.2 Data evaluation between laboratories

Abstract

Develop schemes for inter-laboratory data evaluation. Evaluation of data sets available. Define data sets requested from labs. Compare data analysis done by participating labs. Evaluate data relevant for ILC project.

Deliverables from Work Package

Report on evaluation of existing data sets. Proposal for data sets.

Major Milestones

Report on evaluation by end of 2007.
Proposal for datasets by mid 2008.

Resources required

Scientist

Candidate labs

FNAL, JLab, KEK, DESY

1.6 Gradient proposal for the EDR

1.6.1 Definition of vertical test gradient specification for ILC

Abstract

Re-visit Snowmass and S0 specification. Take into account more flexible power distribution. Develop a final specification for vertical test assuming an operational gradient of 31.5 MV/m in the machine.

Deliverables from Work Package

Report on tolerable gradient spread in ILC (together with Main Linac and LLRF). Final specification.

Major Milestones

Report on tolerable gradient spread by end of 2007.
Final ILC specification for gradient spread in vertical tests by mid 2008.

Resources required

Scientists

1.6.2 Final proposal for ILC gradient

Abstract

Data evaluation of all existing data by end of 2009. Report with proposal for ILC gradient by end of 2009.

Deliverables from Work Package

Report

Major Milestones

Report by end of 2009.

Resources required

S0 task force

2 WP-C2. Fabrication

2.1 Material

2.1.1 Material specification

Abstract

Develop full specification for ILC baseline fine-grain niobium material. Review XFEL specification.

Deliverables from Work Package

Specification for cavity material.

Major Milestones

Specification ready by 2011

Resources required

Scientist, engineer

Candidate labs

FNAL, JLab, KEK, DESY

2.2 Alternative materials

2.2.1 Large grain cost evaluation

Abstract

Review available material on large grain niobium material cost. Investigate cost effective cutting methods.

Deliverables from Work Package

Report on cost difference for large-grain material

Major Milestones

Report ready by 2008

Resources required

Scientist, engineer

Candidate labs

FNAL, JLab, KEK, DESY

2.2.2 Large grain multi-cell cavity development and testing

Abstract

Built and test several multi-cell cavities. Repeat vertical tests (íf needed in case of underperformance) at least once. Apply T-map on as many cavities as possible, at least all cavities below 30 MV/m. Comparison of different surface treatments on multi-cell cavities.

Deliverables from Work Package

Cavity treatment and testing. Measurement data. Data comparison with baseline material, Report. Material specification.

Major Milestones

All cavities tested by mid of 2010
Data comparison by fall 2010
Final report by end 2010

Resources required

1-2 SCRF labs, ~10-20 cavities total, ~2 tests each cavity

Candidate labs

JLab, DESY

2.3 Fabrication method

2.3.1 Analysis of EBW performance

Abstract

Evaluate available data on performance of EB welds by both established and new cavity vendors. Include laboratory in-house fabrications where appropriate. Implementation of sufficient diagnostic capability in participating labs (e.g. temperature mapping). Development of cavity autopsy for the weld region on defective cavities (destructive or non-destructive).

Deliverables from Work Package

Report on performance of EB welds.
T-mapping for diagnostics.
Method for defect detection in weld region

Major Milestones

Report until mid 2008
T-mapping diagnostics by mid 2008
Method by 2009

Resources required

SCRF labs, scientist, engineer

Candidate labs

FNAL, JLab, KEK, DESY

2.3.2 EBW specification

Abstract

Review XFEL specification for EBW. Develop additional quality control for EBW at companies. Write specification.

Deliverables from Work Package

Specification

Major Milestones

Specification for end 2008

Resources required

Scientist

2.4 HPV regulation

Abstract

Develop common understanding of requirements to fulfil high-pressure vessel code regulations especially for how to deal with niobium material.

Deliverables from Work Package

Major Milestones

Resources required

3 WP-C3. Preparation

3.1 Baseline Process

3.1.1 Process Specification

Abstract

Develop full specification for ILC surface process. Review XFEL cavity surface process. See also WPs 1.3.1, 1.3.2 .

Deliverables from Work Package

Specification for cavity process. EP, HPR, assembly and QA thereof.

Major Milestones

Specification ready by 2011

Resources required

Scientist, engineer

Candidate labs

FNAL, JLab, KEK, DESY

3.1.2 Surface Analysis in support of baseline process

Abstract

Review ongoing R&D activities on niobium RF surfaces.
Develop program to improve QC for ILC surface process.

Deliverables from Work Package

Development of an R&D program. Managing program with supporting institutes.

Major Milestones

Program ready by mid 2008.

Resources required

Scientist, engineer

Candidate labs

JLab, Cornell

3.2 Alternatives

3.2.1 Tumbling

Abstract

Evaluate whether tumbling as an additional intermediate process step for a cavity is necessary to achieve more homogeneous performance.

Deliverables from Work Package

Comparative study on cavities with and without tumbling (possibly on single-cells)

Major Milestones

Report by end of 2008

Resources required

Scientist
Single-cell program

Candidate labs

KEK

3.2.2 Dry-ice

Abstract

Evaluate whether dry-ice cleaning as an additional intermediate process step for a cavity with main coupler is feasible. Demonstrate proof-of-principle.

Deliverables from Work Package

Report on feasibility.
Proof-of-principle

Major Milestones

Report by end of 2008

Resources required

Scientist

4 WP-C4. Cavity Design

4.1 Specification of outer envelope

4.1.1 Outer diameter, length

Abstract

Evaluation of existing designs. Technical comparisons of the designs. Define the outer boundary of the cavity

Deliverables from Work Package

Specification

Major Milestones

Complete Specification by Sendai meeting

Resources required

Engineer

4.1.2 Sealing technology

Abstract

Review existing seal designs. Make technical comparison. Make recommendation for common interface. Finalise specification.

Deliverables from Work Package

Review report
Recommendation
Specification

Major Milestones

Complete Review Report by Sendai meeting

Resources required

Engineer

4.1.3 Input port diameter

Abstract

Review existing port designs and high power couplers. Make technical comparison (needs definition of criteria). Make recommendation for common coupler port. Finalise specification.

Deliverables from Work Package

Review report
Recommendation
Specification

Major Milestones

Complete Review Report by Sendai meeting

Resources required

Engineer

4.2 Preparation for the cavity shape decision

4.2.1 Definition of tests

Abstract

Review existing cavity designs. Define required testing based on Cavity KOM discussion. Develop a detailed schedule to prove a cavity shape can be used in ILC.

Deliverables from Work Package

Review report, report on required testing, Schedule.

Major Milestones

Review report by end of 2007.
Report on required testing by 2007.
Detailed schedule by mid 2008

Resources required

Scientist, Engineer

4.2.2 Testing of cavity shape alternatives

Abstract

Design ILC-compatible alternative shape cavity. Build and test compatible cavities with alternative shapes. Preparation and surface preparation of a number of cavities required by WP above. Repeat vertical tests (íf needed in case of underperformance) at least once. Apply T-map on as many cavities as possible, at least all cavities below 30 MV/m.

Deliverables from Work Package

Design of an ILC compatible alternative shape cavity
Cavity treatment and testing. Measurement data.

Major Milestones

Alternative design by beginning of 2008
Additonal milestones according to what has been defined in WP above.

Resources required

One SCRF lab per cavity shape, number of cavities according to WP 4.2.1

Candidate labs

JLab, KEK, Cornell

4.3 Lorentz detuning concept

4.3.1 Evaluation of tests

Abstract

Review existing Lorentz-force compensation concepts. Comparison of technical concepts including the relevant tuner design. Proposal for a common concept

Deliverables from Work Package

Review report, Proposal for a common concept

Major Milestones

Review report by end of 2007.
Proposal by mid 2008

Resources required

Scientist, Engineer

4.4 Beam dynamics

4.4.1 HOM Concept

Abstract

Deliverables from Work Package

Major Milestones

Resources required

4.4.2 Wakefields

Abstract

Deliverables from Work Package

Major Milestones

Resources required

4.4.3 Alignment

Abstract

Deliverables from Work Package

Major Milestones

Resources required

4.4.4 Straightness

Abstract

Deliverables from Work Package

Major Milestones

Resources required

Appendix B

DESY Activities in 2008

Lutz Lilje

Overview

DESY's main activity is getting ready for the tendering process for the mass production of the large series of 808 cavities and 101 accelerator modules. For this an effort is made to prepare and test 30 cavities manufactured bay ZANON and ACCEL with a cost effective procedure usable for the large series. This is the last possibility for DESY to train industry and finalize the specification for the cavity treatment before the tendering process starts around mid 2008.

S0 – Cavity treatment

The most recent batch of 30 cavities (15 ZANON, 15 ACCEL) will be delivered to two companies for bulk Electropolishing (EP). The rationale is to train companies in this surface preparation process. The two companies are HENKEL and ACCEL.
After the reception at DESY the cavities will get an outside etch and an 800°C treatment. For the final process, several optimizations are planned. The sequence will be modified to have the helium tank welding before the vertical test, which is a likely scenario for the XFEL production. Thus a temperature mapping of these cavities will be not possible.
Furthermore, two final processes will be compared: Short etch and EP with subsequent ethanol rinse. The cavities will be split in 3 batches:

1. Short etch: 10 cavities
2. EP+ ethanol: 10 cavities
3. The treatment of the remaining 10 cavities will be decided after the results of the 20 cavities are available.
    - So far, it is planned to use EP+ethanol as well. Only when serious manufacturing errors will spoil the two samples described before, these remaining cavities will be used to complete the sample of 10 each.
    - In a second step, a test with short etching as a repair option is planned.

The time-scale for the testing of the 30 cavities is to have the results available by mid of 2008. These results will allow a better comparison of the final preparation processes of etching and EP+ethanol. At least 10 (possibly up to 20) cavities will get the EP+ethanol treatment which is a candidate process for the ILC. In addition, two cavity vendors can be compared directly. In terms of a mass production sequence, the tank welding at an early stage of production will be validated.

For the tight-loop effort three cavities are made available: AC71, AC74, AC80. These are cavities from the third production which will not further be treated at DESY. One important reason is that the cavities have all seen a lot of treatment (more than 400um) which would mean that they are very long if tuned to the correct frequnecy making installation into modules somewhat less straight-forward. For the tight-loop this is not an issue.

Cavity package: Alternatives

Later in 2008, 8 large-grain nine-cell cavities will become available. This important alternative for the ILC will be tested possibly until the end of 2008. At least a part of the available 11 large-grain cavities (8 new + 3 existing) will receive EP+ethanol as final treatment.

S1 – Module tests

Next year a series of modules will be assembled and/or tested:

1. M3* (TTF 2 type cryostat) in early 2008:
    - Test to conform with pressure vessel code (possibly destructive)
2. M8 (TTF 3 +) in spring 2008:
    - Normal module test including piezo tuners,
    - Transport
    - Second test to check performance
3. M3**
    - After repair with a gradient goal of at least 25 MV/m as spare for FLASH
    - Piezo tuners added
4. M10 (XFEL Prototype) assembly autumn 2008,
    - gradient goal >25 MV/m

At least the M8 string could deliver ILC-like performance. The test will be made by mid 2008, so that additional input for S1 would be available.
Independent of the module performance tests, both the transport test for M8 and the test for the pressure vessel code with M3* are of major importance for the ILC.