ILC Engineering Design Phase

WPs for Cavity (DRAFT)

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Notes:

General WP on cost reduction and/or performance improvement?

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

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

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

1.2.3 Treat 10-20 cavities with fresh EP (should put tumbling as first preparation step somewhere as WP).

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

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

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

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

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

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

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

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

NbCu need cost evaluation etc.

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

2.3.2 EBW specification (need to include other fabrication steps e.g. trimming, cutting method)

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

3.2 Alternatives

3.2.1 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

Low-quality water

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 (if 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~~2.2.1~~

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