SCRF Monthly WebEx Meeting 2009-6-24

Agenda

1. Report from PMs
2. Report from Group Leaders
3. Topics
    1. Cavity Gradient and Yield re-evaluation
    2. Update of TDP R&D Plan (release 4)
    3. Status of S1-Global preparation
4. Further Plan and Meetings

Report from PMs

- Accelerator Design and Integration Meeting at DESY (Nick, Marc, and Akira)
  - A task force for the cavity gradient and yield
- TTC meeting
  - Progress at ILC-GDE, and acknowledgment to TTC.

Outline

- Cavity Gradient and Yield
  - A Taskforce starting to provide the yield curve based on common data-base
  - Discussions at TTC meeting and foreseeing
- Plug-compatibility
  - Discussion with Olivier Napoli with very positive exchange of views.
  - Cavity string Test (S1-Global)
- Preparation for industrialization
  - Discussion with Bob Kephart

AD&I Meeting (CFS and AS)

- Marc and Nick will summarize the meeting

PM "SB2009" Proposal

- A Main Linac length consistent with an optimal choice of average accelerating gradient
  - currently 31.5 MV/m, to be re-evaluated
- Single-tunnel solution for the Main Linacs and RTML,
  - with two possible variants for the HLRF
    - **Klystron cluster scheme**
    - **DRFS scheme**

- Undulator-based e+ source located at the end of the electron Main Linac (250 GeV)
- Reduced parameter set (with respect to the RDR) with n_b = 1312 and a 2ms RF pulse.
- ~3.2 km circumference damping rings at 5 GeV, 6 mm bunch length.
- Single-stage bunch compressor with a compression factor of 20.
- Integration of the e+ and e- sources into a common "central region beam tunnel", together with the BDS.

Cavity Gradient: Discussions

- What is our current understanding?
  - **Original S0 concept assumed:**
    - Surface can be reset according to the EP process, and
    - Multiple processes may be integrated for statistics.
  - **Several years of experience shows,**
    - Repeat processing may cause degradation
      - Possibly because of other reasons,
  - **Processing and Test recipe has been changing**
    - Complete the process and test only with the first cycle, and
    - Not to process more, if the result acceptable.
- How can we update the definition of yield evaluation?
  - **We need to discuss it, and need to organize a task force group with persons in charge**
    - to monitor and accumulate the data base in an agreed evaluation approach.

Cavity Gradient Evaluation

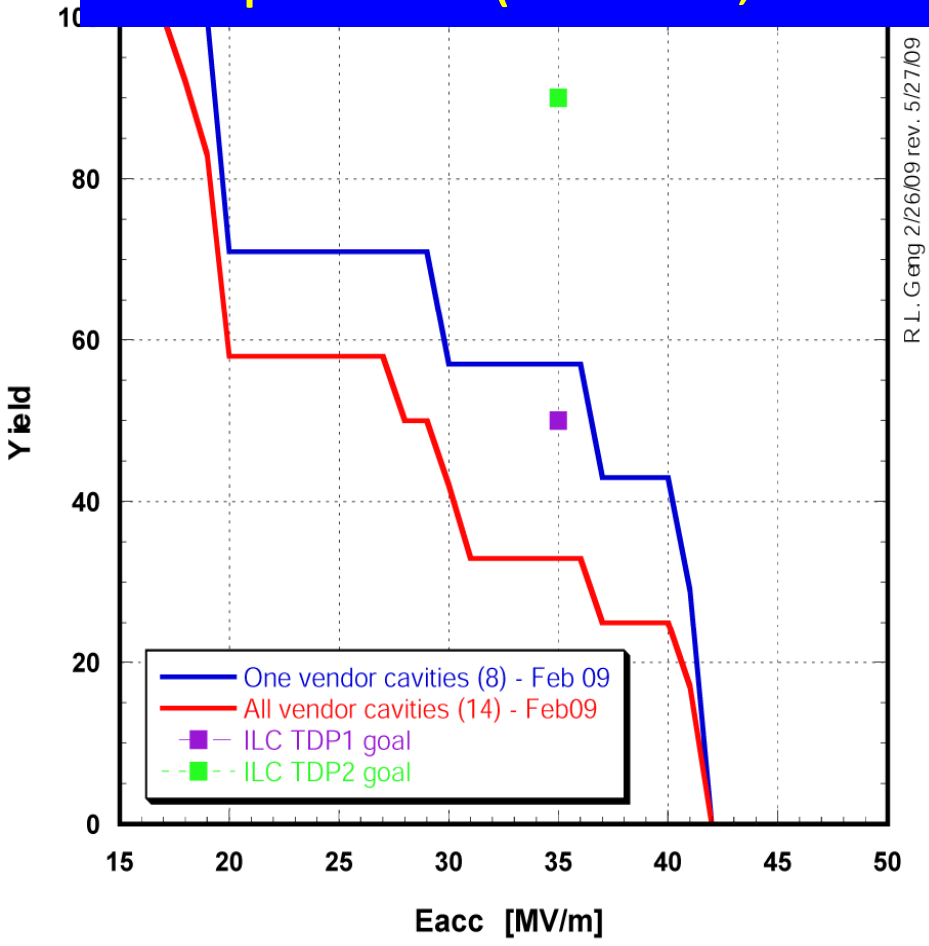
- Form task force to provide the yield and the progress, regularly,
- Camille (Ginsburg) **at Fermilab has been assigned to be the principal person in charge, and each lab assigned the person in charge:**
  - **FNAL/ANL: Camille Ginsburg (approved by Bob Kephart)**
  - **DESY: Sebastian Aderhold (approved by Eckhard Elsen)**
  - **Jlab: Rongli Geng (approved by himself, and by Andrew Hutton)**
  - **Cornell: Zack Conway (approved by Georg Hoffstaetter)**
  - **KEK: Yasuchika (Kirk) Yamamoto (approved by Kaoru Yokoya)**
  - **Others: TBD**
- The cavity gradient and yield progress may be informed at a occasion of SCRF webex meetings, and to be further reported at major GDE meetings.

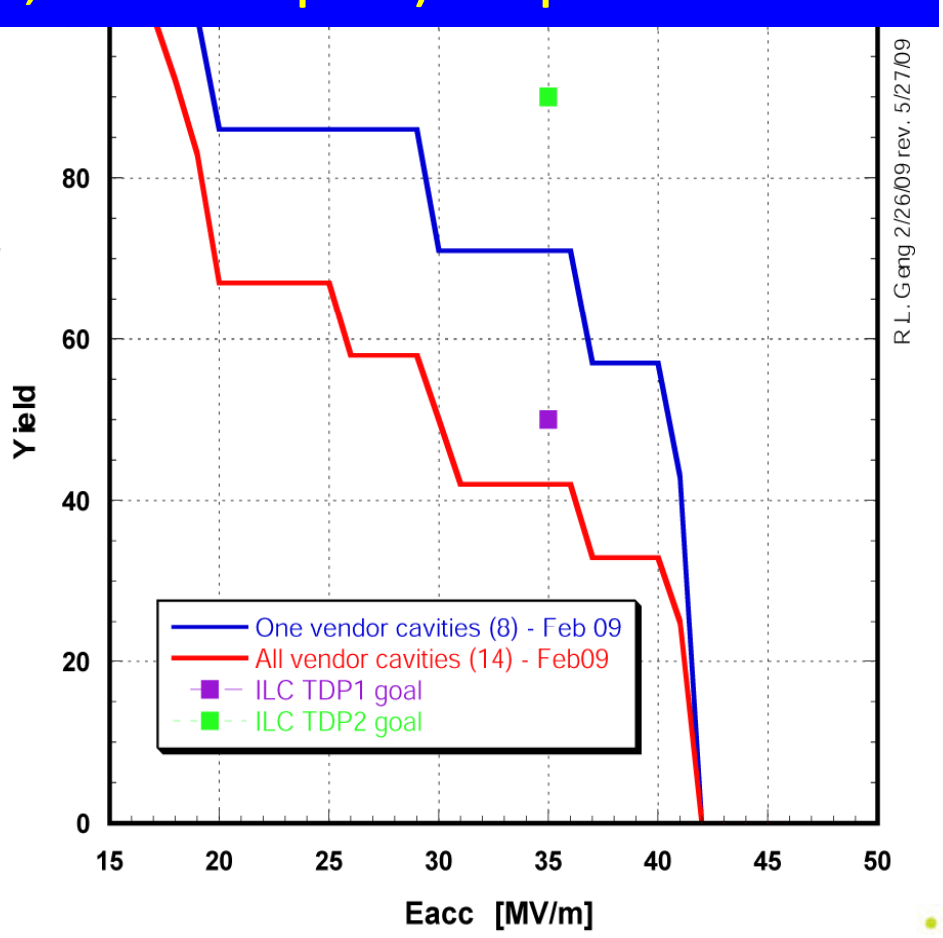
A Proposed Method for Gradient Yield

First-pass result decides path forward:

- Move on for S1 if spec met
- Re-process (Re-HPR; Re-EP; Local repair) if spec not met

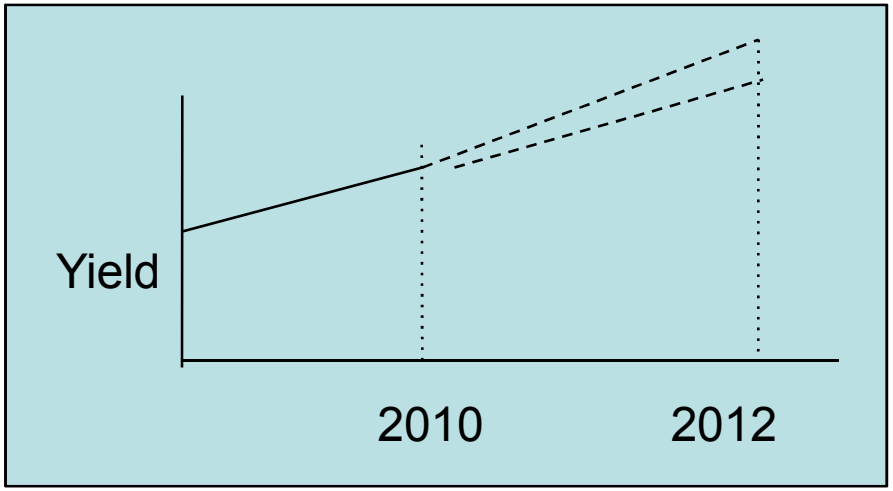
Sample data from JLab





How we may settle Re-baseline

- Re-establish yield definition
- Provide progress of the yield, periodically
- Figure out possible improvement, in future
- Set Re-baseline value:
  - **Field Gradient and Yield**



Possible R&D Plan and Strategy

(table to be improved)

Technical Approach	Mainly Carried out by	Time Scale
Fabrication		
Small-grain, role-plate, EBW assembly	Every institution Industrialization (main)	S0, S1, S2 (main effort)
Large-grain, sheet cut-out from ingot	Jlab, KEK,	Long term
Hydro-forming	KEK, DESY, (Fermilab)	Long term
Surface process		
EP	Every institution Industrialization (main)	(S0), Main Effort
Tumbling and BCP	KEK,	Long term
Large-grain, sheet, BCP	KEK, Jlab, DESY, .	Mid. term
Atomic Layer deposition	ANL	Long term
Plasma Processsing	ORNL	Long term

Industrialization and cost reduction

- Re-visit previous effort, and update the cost-estimate for production
  - **Review the RDR cost estimate (based on TESLA)**
  - **Include recent R&D experience (industry/lab)**

- Encourage R&D Facilities for industrialization
  - **Develop cost-effective manufacturing, quality control and cost-reduction in cooperation with industry**

- Reflect the R&D progress for cost-reduction
  - **Baseline ⇒ Forming, EBW, assembly work…**

Plan for R&D facilities and Preparation for Industrialization

- Bench-mark R&D facility (pilot plant) to study cost-effective manufacturing
  - **Forming and preparation machining,**
  - **Pre-surface treatment and preparation,**
  - **EBW process with efficient automation,**
  - **In-line Inspection during fabrication process for quick-feedback,**
- R&D facilities to be sited at Laboratories
  - **Effort to seek for the most cost-efficient manufacturing with keeping information to be open,**
  - **Development to seek for a bench-mark, manufacturing facilities (design and/or itself can be applicable for the real production.**
  - **It is important for industries to participate to the program since Day-1. for planning.**
- We may discuss a possibility
  - **An industrial meeting to be held as a satellite meeting at the 1st IPAC, Kyoto, May, 2010.**

Complementary Plans in Industrial R&D Priority

- In Asia (KEK) and Europe (DESY)
  - **Priority for the nominal manufacturing process using EBW technology at both laboratory and Industrial production.**
  - **Encourage advanced R&D such as hydro-forming (w/o EBW process) in limited effort**
  - **Large grain sheet with multiple.cutting may be in a parallel effort.**
- In Americas (FNAL according to B. Kephart)
  - **Priority for hydro-forming approach and others in Femilab leadership effort, in cooperation with American Institution**
- PM(SCRF) consideration
  - **It is important to encourage globally complementary R&D efforts**
  - **It is important to support the R&D program, positively, to each other.**

Relation of Industrial R&D to Cavity Basic Research

Improvement of cavity gradient base on basic R&D

Industrial R&D and preparation for the mass-production with Realistic cost-estimate

Time

Global Plan for SCRF R&D
A Summary

Calender Year	2007	2008	2009	2010	2011	2012
Technical Design Phase	TDP-1				TDP-2	
Cavity Gradient R&D to reach 35 MV/m		Process Yield > 50%			Production Yield >90%	
Cavity-string test: with 1 cryomodule			**Global collab.** For <31.5 MV/m>			
System Test with beam 1 RF-unit (3-modulce)		FLASH (DESY)			STF2 (KEK) NML (FNAL)	

R&D/prepare for Indusrialization

Advice Given by TTC, to ILC

TESLA Technology Collaboration
TTC-Report 2008-05

Final Surface Preparation for

Superconducting Cavities

An attempt to describe an optimized procedure

Reply to the

Request for Consultancy from TTC

raised by

the ILC R&D Board Task Force on High Gradients (S0/S1)

We would thank
the TTC Assessment ,
and
advice given to ILC

May 20, 2009

Professor Yoshishige Yamazaki
Professor Dieter Proch
TESLA Technology Collaboration

Dear Professor Yamazaki and Professor Proch,

Although this letter is overdue, we would thank for your kind assessment, guidance, and putting together the very useful report regarding SCRF cavity surface preparations, titled "Final Surface Preparation for Superconducting Cavities" published by TESLA Technology Collaboration (TTC-Report 2008-05). We received it in July 2008, as a reply to our request for advice from TTC raised by the LIC R&D Board Task Force on High Gradients (S0/S1) issued in early 2007. We sincerely thank your again for your effort, and we would have very usefully followed much of your guidance.

Recently, we have been realizing progress in achieving high gradients cavities and we are especially encouraged by recent progress reported by DESY and JLab. The yield of the field gradient is now approaching to ~ 50 % at 35 MV/m, which has been our long sought goal to be achievable as a major mid-point milestone (2010) toward our Technical Design Report in 2012.. For your information, we attach a figure showing the most updated performance. Much of this progress has been achieved based on your guidance, and we would like to state our appreciation.

We look forward to one of us (Yamamoto) having the opportunity to report our SCRF progress at the coming TTC meeting at LAL/Orsay. In addition to the gradient progress, we have recently made visits to the various cavity manufacturers around the world and will report on preparations for 'industrialization' for the ILC scale production.

With our best regards,
Barry Barish, Director of ILC GDE
Akira Yamamoto, GDE SCRF Project Manager

cc: TTC: M. Tigner,
cc. GDE PMs: M. Ross, N. Walker, A. Yamamoto
cc ILC=SCRF: R. Geng, H. Hayano, M. Champion, J. Kerby, T. Shidara

Global Design Effort
PO Box 500
Batavia IL 60510

Technical Summary by H. Weise

General studies / common topics

At the last TTC Meeting the TB decided to support the **HF free electro polishing** studies done at INFN Legnaro. CEA Saclay had/has also interest in further EP R&D and is looking into Buffered EP. For the latter R&D line see the talk of F. Eozenou / Saclay. For the first we unfortunately have no recent information and hope for the SRF workshop.

Excitation of other **pass-band modes** was observed in many cavity tests. So far there is some understanding of the excitation echanism. Is it multipacting? Where? Which modes are excited when / under which conditions? KEK and DESY have presented their findings. The DESY results are going to be published at the SRF workshop. The TB suggests to consider a summary report given at the next TTC Meeting together with a TTC Report.

Since the last TTC Meeting some progress was made wrt. **pressure vessel certification.** We have some additional information from all three regions. The TB will ask the relevant TB members to take care of the preparation of an overview at the next TTC Meeting. Participation in ILC GDE discussions is assumed.

Concerning the **usable gradient** the acceptable field emission limit was discussed. It was suggested to define a calibration procedure for existing Vertical Test Stands, i.e. a calibration source. Marc Ross is going to check if FNAL can work on **this**.

The **gradient yield** is important for all larger projects since lots of money is involved here. The TB supports the clear distinguishing between process and production yield. The definition of both exists. Important: whenever the definition can not be used in the strict sense, explanations should be listed together with the yield plot. The key issue is: why to exclude which cavities from the statistics?

General studies / common topics (cont.)

Around 2005 an **overview about existing Cavity Preparation Infrastructure** was produced. Since then two tables were established (KEK and within CARE, the EU funded projects). An update should be made for the next TTC Meeting with the help of the tables' authors.

Whenever projects arrive on the real axis **some excellent R&D plans have to be stopped or paused.** The TTC Meetings should be used to present the status of such activities with the hope that the baton can be passed to 'some good friends' in the SRF community.

The TB would be happy to include more **low beta cavity issues.** As also discussed in the Collaboration Board **the TB's expertise** should be strengthened as soon the relevant colleagues become regular participants of the TTC Meetings.

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Reports from Groups

- Cavity: Rongli absent, and
  - Camille to present the cavity yield discussion.
- Cavity Integration (H. Hayano)
- Cryomodule (N. Ohuchi)
- Cryogenics (T. Peterson)
- HLRF (S. Fukuda)
- ML (C. Adolphsen)

Cavity Yield: common evaluation

- Camille provides her presentation

TDP R&D Plan (Release 4)

- The Release 4 to be ussued in middle July.
- Possible update of SCRF
  - Re-baseline of receipt for cavity process and test,
  - Number of Cavity to be further developed by the end of TDP-2,
  - Cluster Klystron or DRF system
  - Resources (M&S)
- Plan need to complete the Release 4 before July 13 (FALC).

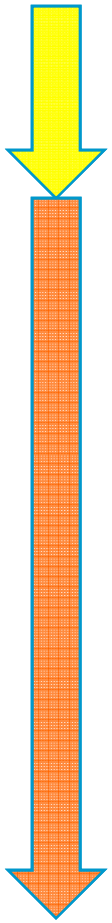
Definition of Yields to be updated

- We may need to
  - update the Definition of “Process” and “Production” Yield given in R&D Plan (releae 3, page 9)

For the purpose of evaluating progress towards producing cavities with a reproducible gradient near our goal, we have separated the concept of yield into two distinct definitions for the TD phases:

- For TD Phase 1, we define ‘process yield’ as the number of accepted cavities divided by the number of chemically processed cavities which fulfil some specified and justifiable criteria, such as those ordered from a qualified vendor or those passing specified mechanical test criteria. This allows us to separate fabrication-related defects, such as the pits or bumps in the vicinity of the electron-beam weld, from chemical surface treatment and cleaning-related problems. Final chemical treatment and rinsing is often done at an institution, rather than in industry, and is tightly coupled to the final assembly and testing procedure.
- For TD Phase 2, definition of ‘production yield’ is the number of accepted cavities divided by the number ordered. Production yield, as defined in the Reference Design, makes allowance for 20% of the cavities to be re-processed.

Standard Procedure Established



	Standard Fabrication/Process
Fabrication	Nb-sheet purchasing
	Component Fabrication
	Cavity assembly with EBW
Process	EP-1 (~150um)
	Ultrasonic degreasing with detergent, or ethanol rinse
	High-pressure pure-water rinsing
	Hydrogen degassing at > 600 C
	Field flatness tuning
	EP-2 (~20um)
	Ultrasonic degreasing or ethanol (or EP 5 um with fresh acid)
	High-pressure pure-water rinsing
	Antenna Assembly
	Baking at 120 C
Cold Test (vertical test)	Performance Test with temperature and mode measurement

Key Process

Fabrication

- Material
- EBW
- Shape

Process

- Electro-Polishing
- Ethanol Rinsing or
- Ultra sonic. + Detergent Rins.
- High Pr. Pure Water cleaning

Numbers of R&D Cavities for ILC

partly from the TDP R&D Plan (release 3)

Order	Bef TDP	2008	2009	2010	Sum 2010	~ 2012
Ams (FY)	34	20	40	15	109	TBD
AS (FY)	15	3	13+1*	17+2	48+3	TBD
EU (CY)	68		26 (+808)**		94 (+808)	TBD
Sum	117	23	48 (+808)	34	222 (+808)	

- Japan + China
- ** 26 specific for ILC-R&D, 808 for XFEL mass production
- Order in 2010 and later is to be subject to budget available

Tests			2009	2010	2011	2012
Ams (FY)			45	70	TBD	TBD
AS (FY)			12	14	TBD	TBD
EU (CY)			15	10	20	TBD
Sum			72	94	TBD	TBD

Further Plan and Meetings

- SCRF monthly webex meetings
  - July 22, Aug. 19, Sept. 16, Oct. 14, Nov. 11, Dec. 9,
- SRF conference/workshop at Berlin
  - Sept. 21 – 25
- American LC Phys. Group (ALCPG'09) and ILC-GDE meeting at Albuquerque
  - Sept. 29-Oct. 2 (or 3),
  - Milestone for Cavity yield re-evaluation,
  - Note
    - We may organize summary talks from SRF with limited number of participants, specially for SCRF.