

# SCRF Meeting

Fermilab, April 21-25, 2008

*Draft agenda updated, April-19*

## General Agenda:

- 4/21: Cavity: Gradient R&D, performance, diagnostics (S0),
- 4/22: Cavity: Integration, Tuner, Coupler and String-Test (S1, S1-global)
- 4/23: Cryomodule: plug-compatible interface, high-pressure, 5K-shield
- 4/24: HLRF/LLRF and MLI: Modulator, distribution, Beam-handling
- 4/25: Summary, TDP R&D plan, and work-assignment

# What discussed in Tohoku GDE-Meeting?

- Cavity:
  - S0/S1 status and replan for TDP reported,
  - S1-global' concept and the technical feasibility at STF discussed,
- Tuner design
  - discussed on how to compare each tuner design.
- Coupler design
  - discussed on possible elimination of tunability.
- He vessel design
  - Agreed: design pressure, 2 bar,
  - Consensus: desired material to be St. Steel and necessary R&D,
- Cryomodule
  - Plug-compatibility and boundary conditions discussed,
  - 5K shield design discussed, if necessary or not,
  - Agreed: vacuum vessel diameter unchanged,
- Quad design, location, and other beam related issue
  - Agreed: to locate at center, with alignment tolerance  $<0.3$  mm

# Objectives of SCRF Meeting at Fermilab, April 21-25, 2008

- Reach consensus on
  - SCRF functional design parameters
  - Plug-compatible interface parameters
- Update TDP R&D plan and milestone
  - Cavity:
    - Achieve 9-cell cavity performance of 35 MV/m (S0),
    - Achieve cavity-string performance of 31.5 MV/m in cryomodule (S1)
  - Cryomodule and Cryogenics
    - Establish plug-compatible design and optimum thermal balance,
  - HLRF/LLRF:
    - Establish efficient power source and distribution system,
  - MLI:
    - Establish beam-handling design and boundary conditions
  - System Engineering
    - Achieve Cryomodule-String Test in one RF unit and with beam (S2)

# Advices given by AAP

Here are my suggestions ([Hasan Padamsee](#)) for inclusion in your Agenda for Fermilab meeting

- Status report on XFEL cavity production and testing (any results?),
- Report on the Results of the One-cavity module test at KEK and status of next one-cavity module test (Phase 0.5)
- Prepare Comparison tables for desired specs for tuner/ with expected (or test) numbers for the specs
  - KEK slide jack tuner- KEK ball screw tuner (if still an ILC candidate)
  - Blade Tuner- Saclay tuner
- Prepare comparison tables for desired specs for coupler/with test results (or expected results) for
  - TTi-III coupler-
  - XFEL- coupler
  - KEK two disc window coupler
  - KEK Kazakoff demountable coupler- Any other viable coupler candidates

# Advices (cont.)

- Preparation for cavity discussion for S0.1 (final preparation yield) and S0.2 (production yield) and S1 Make a table of cavities available for S0.1 and S0.2 and S1 programs with the aim of filling in the next step for these cavities
- Here is a starting example for such a Table: the entries from my memory probably need lots of corrections
- Fermilab cavities
  - A6/ tight loop 4 tests Jlab done/ E (MV/m) 35 MV/m +- 5 MV/m,/ He vessel? ,/' Cryomodule at Fermilab?/
  - A7/ tight loop 4 tests Jlab done/ E (MV/m) 35 MV/m +- 5 MV/m/ He vessel? /global Cryomodule/
  - A8/ qualified at Cornell/grad +/- confirm results at Jlab/ grad +/-, /what next?
  - A9 /qualified to 25 MV/m at Cornell,/FlashEP once/gradient/ FlashEP again?
  - AES1/ 4 tests Jlab/, manuf defect located/ Send to KEK for inspection/what next?AES2 ...
  - AES3...AES4...A10...A11,.....A15
- KEK Cavities
  - TESLA-like 1/ 4 tests done/ CMphase0.5
  - TESLA-like 2/ 4 tests done/ CMphase0.5
  - TESLA-like 3/ 4 tests done/ CMphase0.5
  - TESLA-like 4/ 4 tests done/ CMphase0.5
  - Ichiro1
  - Ichiro2
- DESY cavities

# General Agenda for SCRF Fermilab Meeting, April 21-25

Day	Subject	Goal
4/21	Cavity: preparation High gradient R&D (S0)	Plan for 35 MV/m (S0)
4/22	Cavity: Integration and Test in cryomodule (S1)	Tuner, Coupler, and Plan for S1, S1-global
4/23	Cryomodule and Cryogenics	Plug-compatible IF, HPG, 5K shield,
4/24	HLRF and Main Linac Integration	Efficient RF powering Beam handling
4/25	Summary and TDP R&D, work assignment, further meeting plan	R&D organization, Interim review plan

# April 21: Cavity-Process

Time	Title	Presented by
9:00	Opening Remark / Introduction	A. Yamamoto
9:30	<p>Highlights from regions:</p> <ul style="list-style-type: none"> <li>-S0, process and test for Ichiro-5 Cavity</li> <li>-Optical inspection device,</li> <li>-Add lab talks here if needed</li> </ul>	R. Geng Y. Iwashita
10:30	Break	
11:00	<p>Study Status , Concise, focus on standard for understanding</p> <ul style="list-style-type: none"> <li>-Asia</li> <li>-Americas</li> <li>-Europe (XFEL)</li> </ul> <p>Speakers should address the current capabilities, e.g. achieved resolution in t-map, limitations of existing t-maps, achieved average gradients, results on passband mode measurements (when available)</p>	E. Kako / F.Furuta C. Ginsburg L. Lilje
12:30	Lunch	
13:30	<p>Vertical test plans in each region for CY2008 and CY2009</p> <ul style="list-style-type: none"> <li>US</li> <li>Asia (KEK, Kyoto)</li> <li>EU</li> </ul> <p>Collect the information for the available cavity tests, including definition of a 'complete' test including t-mapping</p>	Champion, Hayano, Iwashita Lilje
15:30	Break	
16:00	<p>Strategies for Global R&amp;D Plan (S0)</p> <ul style="list-style-type: none"> <li>-35 MV/m with yield of 50 % for TDP-1 and</li> <li>-35 MV/m with yield of 90 % for TDP-2</li> </ul>	Led by Lilje
17:30	Comments	H. Padamsee (AAP)

# April 22: Cavity-Integration

Title	Subjects	Presented/organized by
7:30	PM meeting	PMs+Barish
9:00	<b>Tuner:</b> -Lorentz detuning, and discussions -Ball-screw-tuner test results (for LL cavity) -Blade-tuner (update) and/or any others status/proposal? -Reliability of the motor and the Maintainability	Y. Yamamoto T. Saeki C. Pagani and TBD S. Noguchi
10:30	Break	
10:45	Discussions for tuner <b>functional specification</b> and comparison table Base-line designs and necessary R&D/evaluation in TDPs <b>Maintainability</b> (Piezo, Motor location → Life test plan?), !!	Led by H. Hayano
12:30	Lunch	
13:00	<b>Coupler:</b> -XFEL <b>coupler: industrial assessment</b> , and industrialization -Fixed/variable coupler : cost difference - : technical issues - Requirements from RF power distribution system in view of MLI Discussions on coupler specification and interface	S. Prat S. Noguchi E. Kako C. Adolphsen Led by H. Hayano
16:00	"Project X R&D at Fermilab" , joint session with Muon Coll. WS).	S. Holmes
17:00	<b>Cavity-string test in cryomodule (S1 and S1-global)</b> -S1 plan at FNAL -S1-global plan - Work required at KEK and global assembly (technical feasibility) - Cooperation with FNAL / Cooperation with DESY	S. Mishra/M. Champion N. Ohuchi and D. Mitchell S. Mishra / L. Lilje
18:30	Evening Session ? on "High gradient R&D"	



# April 23: Cryomodule/ Cryogenics

Time	Title	Presented by
8:00	CF&S Technical Area WebEx Meeting	Marc Ross et al.,
9:00	Cryomodule: functional parameters and interfaces	N. Ohuchi/H.Carter
9:30	<b>Plug-compatibility</b> (for cavity and cryomodule, HLRF): -Interfaces (CAD-work boundary condition) of plug-compatible design - (expected) Compatibility of ILC and Project-X cryomodules -Parameters tables for interfaces	D. Mitchell S. Nagaitsev H. Hayano and N. Ohuchi
10:45	Break	
11:00	Discussions Conclusion/Consensus ( <b>Table filled</b> ) and Further study required	Led by Ohuchi and Carter
12:30	Lunch	
13:30	High Pressure Gas Regulation -Requirements and the regional constraints (How to handle Nb: summary of survey based on e-mail communication). - Comments and discussions for further works	T. Peterson H. Nakai, K.Jensch
15:00	Break	
<b>16:00</b>	<b>Thermal balance in cryomodule/cryogenics</b> -5 K shield study at TTF cryomodule design -5 K shield study at STF cryomodule design -Lowering radiation shield (80K) temperature Discussions and conclusion/consensus	P. Pierini N. Ohuchi N. Ohuchi led by Ohuchi/Peterson)
18:00	SCRF dinner ??	9

# April 24: HLRF (& LLRF), MLI

Time	Title	Presented by
9:00	HLRF: functional parameters and interfaces	S. Fukuda
9:15	<b>RF Power Sources:</b> -R&D status of SBK, and Marx Generator -Progress with MBK (test results?) -Discussions and strategy to reflect the work for TDP R&D activities,	TBD from SLAC TBD from DESY Led by Fukuda
10:30	Break	
10:45	<b>Power Distribution System with tunability and Plan for Test Facilities:</b> - Design and R&D status (including circulator, tunability in relation with coupler) - Plan for NML at FNAL - Design and R&D status at KEK and preparation for STF and S1-global - Necessary cooperation with LLRF; status and requirements (TBD) - LLRF cooperation expected to STF and S1-global work at KEK - Discussions and strategy to reflect the work for TDP R&D activities,	TBD from SLAC S. Nagaitsev S. Noguchi, S. Fukuda B. Chase S. Michizono Led by Fukuda
12:45	Lunch	
13:45	<b>Main Linac Integration (MLI):</b> Functional and interface parameters, (possible gradient distribution, confirmed) Quadrupole R&D and Test Progress/Plan Alignment and the requirements; Quadrupoles/BPM BPM and diagnostic: R&D status and various options, beam current change?	C. Adolphsen C. Adolphsen/TBD C. Adolphsen TBD
15:45	Break	
16:00	Discussions and consensus for further R&D strategy,	Led by Adolphsen 10
18:30	Work to prepare for Summary	

# April 24, HLRF/LLRF and MLI

Time	Title	Presented by	Webex
9:00	HLRF: functional parameters and interfaces	S. Fukuda	
9:15 9:15 9:35 9:55 10:10	Power distribution system jointed by LLRF/HLRF - Brain's talk on using same Q's for all cavities (TBD) - Talk on RF overheads at TTF (TBD) - Maximum Gradient Operation (TBD) - LLRF for ILC and S1	Led by Fukuda B. Chase/J.Branlard (S. Simrock) S. Noguchi S. Michizono	web
10:25	Plan and time tables of LLRF and NML	B. Chase	
10:35	Discussion with following subjects -Necessary cooperation with LLRF: status and requirements, -LLRF cooperation expected to STF and S1-global work at KEK, -Discussions and strategy to reflect the work for TDT R&D activities,	TBD	
10:50	Coffee break		
11:15	HLRF progress for the XFEL		
11:40	Power distribution System with tunability and Plan for Test Facilities -Design and R&D status at SLAC and plan for NML (incl. circulator, tunability, -Design and R&D status at KEK and preparation for STF and S1-g.	C. Nantista  S. Fukuda	web
12:20	Lunch		
13:30	RF power sources -Status of the SBK development -Status of the Marx generator development -Discussions and strategy to reflect to the work for TDP R&D	E. Jongewaard C. burkhart	Web Web
15:00	Coffee break		
15:30	Main Linac Integration (MLI) -Gradient for various RF distribution systems and cost of dist. Components, -Overview of quad. And BPM development at SLAC, -Quadrupole R&D at FNAL and CIEMAT -Progress on BPM development at FNAL and Saclay -Update of Beam Dynamics studies relevant to the Main Linac -Discussion	Led by C. Adolphsen C. Adolphsen C. Adolphsen V. Kashikhin M. Wendt P. Lebrun	
17:40	Adjourn		11

# April 25: Summary & Work Assignment

Time	Title	Presented by
7:30	PM meeting	PM + Harrison
9:00	Requirements for the Summary and Work Assignment	A. Yamamoto
9:30	Cavity-Process Cavity-Integration	L. Lilje H. Hayano
10:30	Break	
10:45	Cryomodule and cryogenics HLRF MLI	N. Ohuchi/T.Peterson S. Fukuda C. Adophsen
12:30	Lunch	
13:30	General Summary -Functional Parameters -General guide-line for plug-compatibility -Common interface parameters (consensus) -Works for further consensus General Comments Closing Remark	Led by Yamamoto  H. Padamsee (AAP) A. Yamamoto
15:30	Ajorn	
16:00	Group leader meeting for further planning	Group Leaders
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# Replan of ILC-SCRF R&D

updated, March 4, 2008

- **TDP1 by 2010:**
  - **S0:** achieve 35 MV/m with 9-cell cavities at the yield 50 % under well defined processing-base,
  - **S1-Global:** achieve <31.5 MV/m> with cryomodule-assembly
    - with global cooperation (for example, 4-AS, 2-US, 2-EU).
    - Note: the S1 achievable also, if 3 Tesla-type cavities added to the existing 5 cavities in CM2 at Fermilab.
  - **Cryomodule design:** establish “plug-compatible interface and design
- **TDP2-by 2012:**
  - **S0:** achieve 35 MV/m with 9-cell cavities at the yield 90 % under well defined processing-base.
  - **S1:** achieve <31.5 MV/m> with full cavity-assembly (similarly processed) in single cryomodule, CM3 or CM4 (at Fermilab, US)
  - **S2:** achieved <31.5 MV/m> with 3 cryomodule assembly to be powered by 1 RF unit, and with beam acceleration, in STF-2 at KEK.
  - **Industrialization:** Learn from XFEL, & Cooperation with Project-X

# Global R&D Plan

Calendar Year		2008	2009	2010	2011	2012
EDR	TDP1			TDP-II		
S0: Cavity Gradient (MV/m)	30	35 (> 50%)			35 (>90%)	
KEK-STF-0.5a: 1 Tesla-like/LL						
KEK-STF1: 4 cavities						
S1-Global (AS-US-EU) 1 CM (4+2+2 cavities)			CM (4 <sub>AS</sub> +2 <sub>US</sub> +2 <sub>EU</sub> ) <31.5 MV/m>			
S1(2) -ILC-NML-Fermilab CM1- 4 with beam				CM2	CM3	CM4
S2:STF2/KEK: 1 RF-unit with beam			Fabrication in industries		STF2 (3 CMs) Assemble & test	

# Further Meeting Plans

## 2008:

- April 2-4
  - Visit and meeting at SLAC and FNAL (by AY)
- **April 21-25**
  - **SRF Main Linac Technology Meeting at Fermilab**
- June 4-6 JINR
  - GDE Meeting (Dubna): ILC CFS Workshop
  - SCRF: No working group meeting organized
- July-September
  - Visit to Cornell, INFN, CIEMAT, J-lab (for future: Korea, China)
- October 20-24
  - TTC (Delhi)
- **November 16-20**
  - **LCWS / GDE Workshop (Chicago)**

## 2009:

- **January-February, 2009?**
  - **AAP: SCRF interim-review (To be discussed)**

# SCRF Area Organization in TDP

as of April 5, 2008

Regional Effort: Harrison, Foster, Nozaki			SCRF Technical Effort: Yamamoto, Shidara, and Kerby					
	Institute	Institute Leaders	Cavity: Process Lilje	Cavity: Integ. Hayano	Cryomod ule Ohuchii/C arter	Cryogenics  Peterson	HLLRF (LLRF) Fukuda ( )	M LI  Adolphsen
<b>A M S</b>	Cornell	Padamsee	Padamsee	Champion	Champion	Peterson		
	Fermilab SLAC ANL J-lab	Kephart Raubenheimer Gerig Rimmer	Champion  Kelly	Champion Adolphsen	Champion	Peterson	Larsen	Adolphsen
<b>E U</b>	DESY	Brinkmann	Lilje	L. Lilje				
	CERN Saclay Olsay INFN CIEMAT	Delahaye Dael Wormser Pagani		Prat Pagani	Parma  Pierini	Tavian		
<b>A S</b>	KEK	Yokoya	Hayano	Hayano	Tsuchiya/O huchi	Hosoyama / Nakai	Fukuda	Hayano
	Korea IHEP RRCAT/BAR T IUAC VECC	Gao Sahni Roy Bhandari						



# Summary and Remark

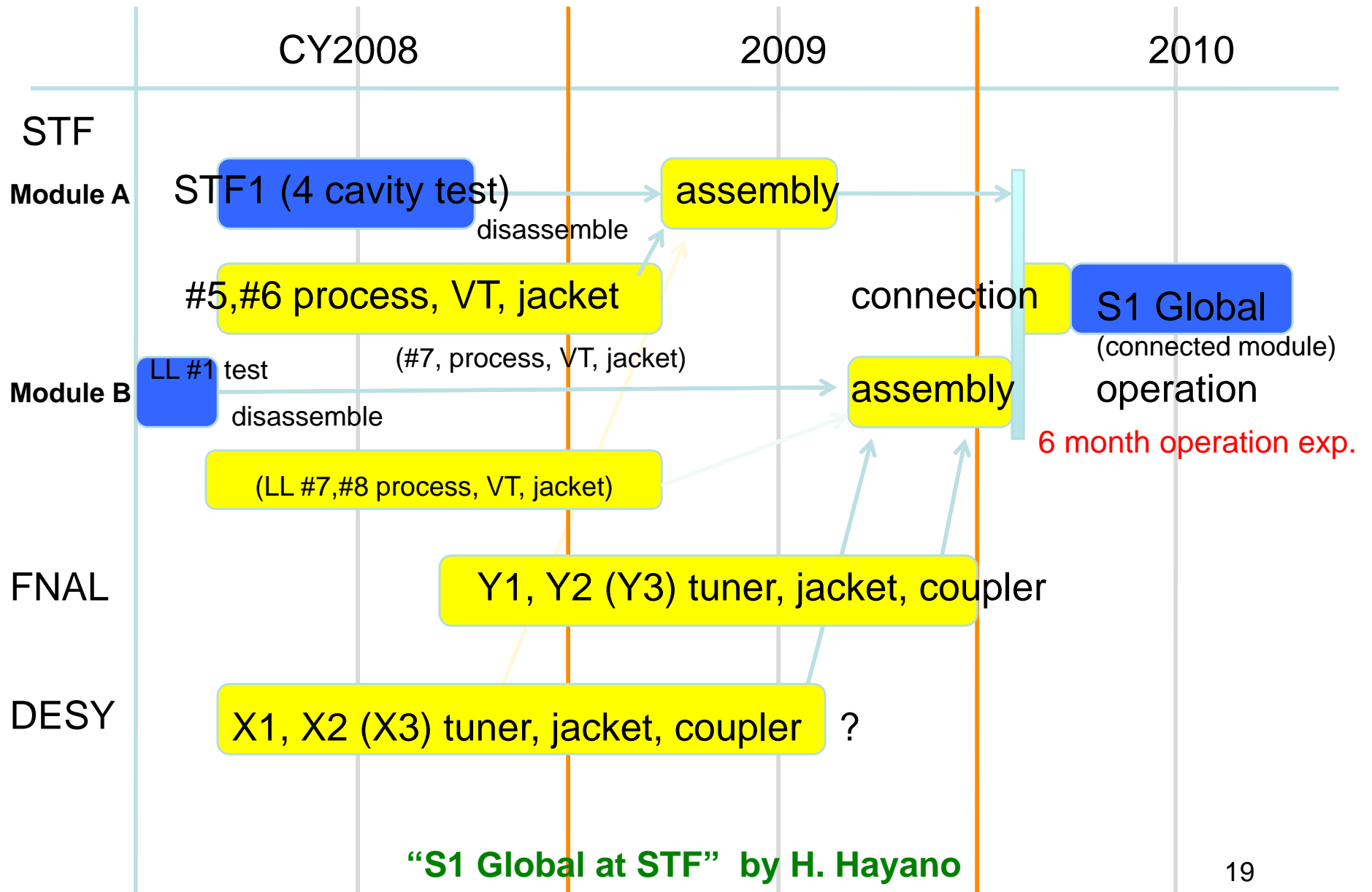
- The SCRF meeting is going to be organized to discuss:
  - Cavity gradient R&D plan,
  - Functional specification and Plug compatible interface,
  - S1 and S1-global plan,
  - Cost effective power distribution and optimum tune-ability.
  - Static and dynamic tolerance in MLI and beam dynamic
- Need to reach:
  - **Basic consensus** in Summary, Friday,
  - **TDP R&D plan** including work-sharing to be updated
    - We may organize some **evening sessions** to prepare well for the consensus and plan ( Monday/Tuesday and Thursday),
- Thank you for your cooperation

# backup

- STF schedule at KEK
- General 5 year schedule at Fermilab

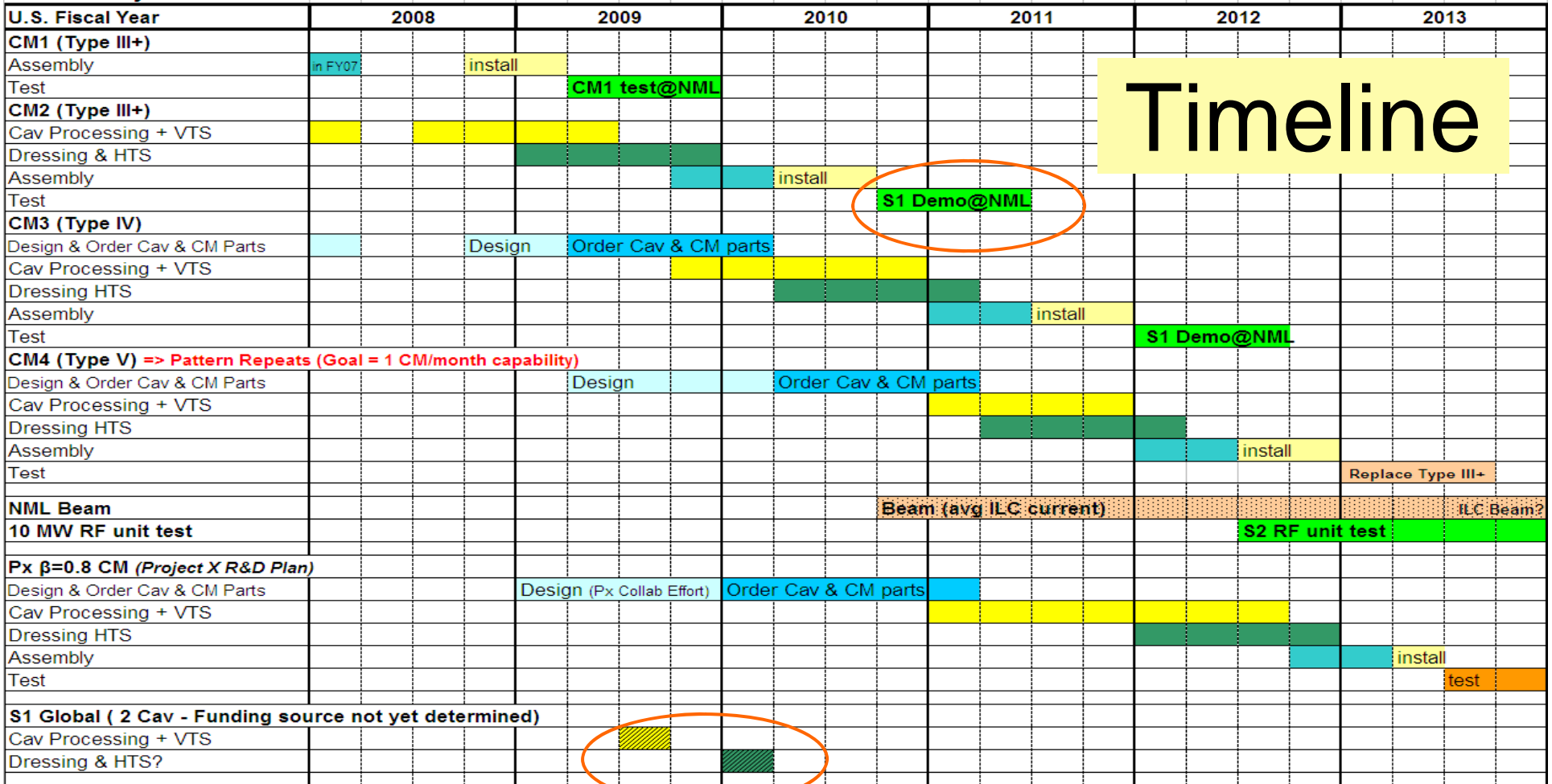
# Possible Schedule plans

\*\*Revised after discussion



“S1 Global at STF” by H. Hayano

### 1.3 GHz Cryomodules



Timeline

### New SRF Infrastructure Construction (funding limited)

