GDE WG2:
SRF discussion summary

H. Hayano (KEK)

discussion item

1. S0/S1 status.

   reported by Lutz and Shekhar.

2. ‘S1 global’ concept proposal.

   Akira proposed the concept. Possibility at STF is reported by Hayano, Fukuda, Ohuchi.

3. ‘Plug compatibility’ concept.

   discussion.

4. Tuner design

   discussion on how to compare each tuner design.

5. Input coupler design

   discussion on elimination of tunability.

6. He vessel design

   discussion on material and junction.

7. 5K shield design

   discussion on possibility to eliminate 5k shield.

8. Quad design and other beam related issue

   reported by Chris.

“S0/S1 Next steps” by Lutz Lilje

Status : (1) Field emission has been reduced
by three approach ; ethanol, degreaser, fresh-EP.
(2) Still rather large gradient differences
are observed due to thermal breakdowns.

- The basic R&D goals for S0 have not changed. The timescale has changed.
- End of 2008:
  - need to enhance T-map & high-res optical inspection worldwide
  - use welded single-cells to 'calibrate' these two methods for mapping and inspection
  - use tight-loop to set up preparation facilities (ANL, KEK)
  - cost advantage large grain evaluation
  - continue production-like effort
- Mid of 2009
  - large-grain detailed study after EP and BCP
  - comparison seamless with welded
  - Flash EP on multi-cells in Cornell (and KEK?)
- TDP1: technical feasibility by 2010
  - Gradient (S0) in progress to reach 35 MV/m w/ yield 50 %
- TDP2: technical credibility by 2012
  - Gradient (S0) to reach 35 MV/m w/ yield 90 %

"ILC Cavity and Cryomodule (S0-S1-S2) R&D in USA" by Shekhar Mishra

- US plan for ILC Cavity and Cryomodule remains same as projected during the RDR phase with the following exception
  - We have considerably reduced the number of Cavities we will fabricate, process and test.
  - We have reduced the number of CM to ~1/yr.
- We would continue to develop infrastructure to test 1 RF Unit with electron beam (not ILC beam)
- We would continue to develop infrastructure for
  - Cavity processing and testing
  - Cryomodule fabrication and testing
- Our goal is to be ready for "a" project by 2012

Cavity: 26 cavities on order, 15 cycles of proc to be use to CM2 in FY08.
60 cycles of process & test are planning in FY09.
S1 Global: US provide 2 cavities with proc & test at end of FY09, w/o dress.

"S1 Global concept" by Akira Yamamoto

A Goal for CM and SI

- **A goal: E=31.5MV/m with system engineering**
  - with a series of 8-cavities in a full cryomodule,
  - We need a general test facility including Cryogenics, RF and the power distribution system, diagnostics,

- **S1: where?**
  - The original plan ?
    - One of cryomodules to be developed at Fermilab,
  - A back-up plan necessary:
    - one of cryomodules to be developed anywhere else
      - We need global effort potentially at KEK or DESY
  - Qualified cavity units (cavity + vessel + tuner), couplers, quad., BPM to be sent to the S1 hosting lab.
  - should be organized as a global effort.

“S1 Global concept” by Akira Yamamoto

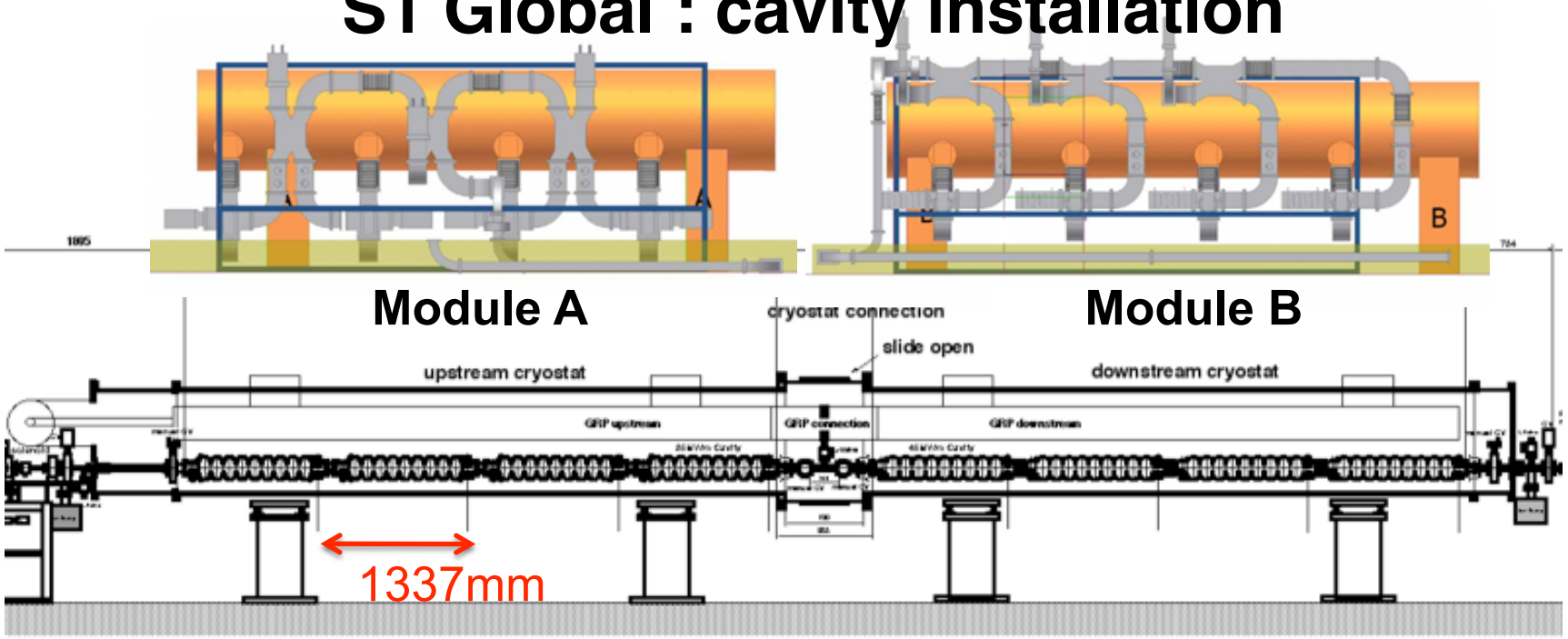
A possible plan at KEK-STF

as AY’s personal view

- **STF-1 extension**
  - **2 x STF1 (2 x 4-series cavities) to become S1**
  - **Re-use of vacuum vessels (w/ modification)**
  - **Gather, globally, qualified cavities**
    - **Plug compatibility is essentially required,**
  - **S1 test to be carried out as “temporary test” in view of high pressure system operation,**
    - **For practical reasons,**
  - **The program may become feasible after the current STF-0.5 and STF-1 program at KEK,**
    - **JFY-09 and later, and before STF-2 assembly work at the KEK-STF site.**

"S1 Global at STF" by H. Hayano

S1 Global : cavity installation



TESLA-style

STF1	#3	#4	#2	#1
2008.4-10	20MV/m	20MV/m	29MV/m	21MV/m

Not yet decided for next

If we go S1 global for next

S1 Global

TESLA-style

(DESY or US)	#2	#5	#6
	>32MV/m	29MV/m	??MV/m	??MV/m

(or TESLA-style#7?)

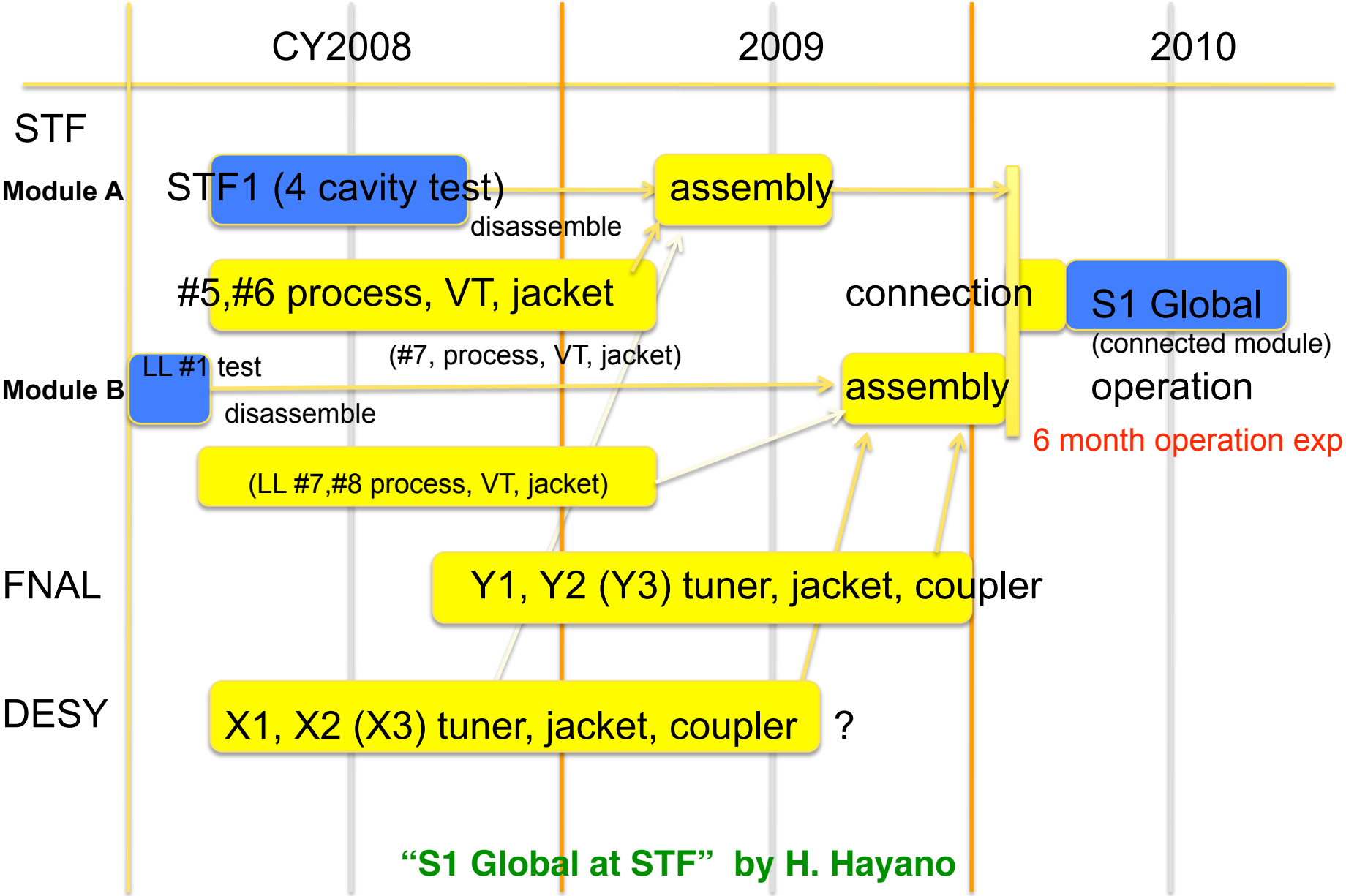
TESLA

DESY1	DESY2	FNAL1	FNAL2
>32MV/m	>32MV/m	>32MV/m	>32MV/m

(or LL #7? #8?)

Possible Schedule plans

**Revised after discussion



"S1 Global at STF" by H. Hayano

“Plug compatibility concept”

N. Ohuchi :

(1) List up of C1-level, C2-level, C3-level compatibility for cryomodule.
(2) Must work on C1-level compatibility: ‘cryomodule’.
(3) C3-level is not considered, so far.
(4) As for C2-level, think about ‘cavity string’ rather than ‘cavity package’
-> people feel to consider ‘cavity package’, not string.

Discussion with 3D-CAD viewer by D. Michel :

(1) Where the interface is for cavity package.
(2) plug compatible will against cost reduction?
to give freedom within compatibility introduce variety, cost increase?
good for inclusion of technology improvement.
Think to unify flange system?
Think about cramp flange?, assembly?, process?, qualification?....

Tuner design discussion

H. Hayano :

(1) Tuner specification profile table update:

(2) Tuner performance comparison table, for next step.

Y. Yamamoto :

(1) Calculation of cavity voltage vector evolution assuming two mechanical mode excitation by LD.

(2) Explanation of STF cavity and DESY cavity.

-> still need more precise calculation, stiffness comparison should be done after full understanding of calculation and observation.

S. Noguchi:

(1) Slide-jack tuner performance.

L. Lilje :

(1) XFEL tuner performance:

(2) Blade tuner performance.

T. Himel:

(1) Estimation of tuner motor MTBF : > several M-hours. or should have easy to repair in situ.

Coupler design discussion

H. Hayano :

(1) Coupler specification profile table update:

(2) Think about tunability fixed is cost-effective or not.

S. Noguchi :

(1) Grouping of cavities having gradient spread,
combination high gradient module with two low modules.

(2) Power tuning has benefit rather than coupler + power tuning.
(coupler tuning fixed)

G. Wormser :

(1) Cost reduction of XFEL coupler: 808 by three venders.

(2) Cost is almost in target by detail reduction
for every parts and process.

He vessel design discussion

K. Tsuchiya :

(1) Ti/SS transition study by friction welding, by HIP method.
(2) HIP transition was used in STF.
(3) Nb/SS transition by HIP method was used in LL cavity.

F. Bedeschi :

(1) Study of tube explosion bonding on Ti/SS transition.
(2) Possibility to use for larger transition part like He vessel.

L. Lilje :

(1) He vessel pressure test was performed:
6.2 bar at 2K, 5.3 bar at 295K were only elastic deformation.

5K shield elimination

N. Ohuchi :

(1) (5K shield cost) – (Δ(10 years operation cost) + cryogenics reinforce)
= 10% of cryomodule cost : means 'cost reduction' .
(2) Vessel size reduction by this elimination
-> unable to keep distance to 300K.
(3) Need to evaluate to use 60K cooling for 80K shield.

P. Pierini :

(1) Thermal calculation of TTF module :
15 - 55% cost increase of 2K line operation : w/o 5K shield.
(2) Thermal analysis of M3* module will be done, next.

T. Peterson :

(1) 5K shield elimination on LHC-dipole was decided mainly by simplicity, not by cost : cost diff. was small.
(2) Lowering 80K shield temperature is under analysis.
-> able to reduce 2K heat load.

Quad design and other beam related issue

C. Adolphsen :

(1) Quad alignment specification :
<200μm to module axis, <100nm vibration >0.1Hz.
<300μrad for rotation.

(2) Temp change affect Quad motion
by ~6μm when beam on/off.
by ~160μm bow/deg module top-to-bottom temp change.

(3) Cos 2-theta design for 2/3 of linac, 0.6m length 90mm aperture.
however superferric design is good for mag center stability.

(4) <200μm fuducialization required.

(5) Alignment windows may need to monitor quad position secure.

(6) Manual module adjustability, at minimum,
cm-level range, 50μm level positioning.

(7) BPM performance,

(8) HOM & coupler kick will be minimized to move symmetric.

(9) HOM polarization rotation will be a problem.

(10) Beamline HOM absorber study.

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Next

Efforts for Plug-Compatible Cryomodule Design

- SCRF Meeting at DESY (Jan. 18, 2008)
  - Understanding various design options,
  - Home-work assigned,
- Meeting at CERN (Feb. 7, 2008)
- Visiting and Meeting at J-lab (Feb. 14-15, 2008)
- SCRF webex Meeting (Feb. 20, 2008)
- GDE Meeting at Tohoku/Sendai (March, 2008)
  - Interim reports and discussions,
  - Further home-work assignment,
- Visiting Indian Laboratories, (March, 10-14, 2008)
- Some other visiting and meeting (TBD)
- SCRF Meeting at Fermilab (April, 21-25, 2008)
  - To reach agreement on the plug-compatible interfaces for further component developments

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