Detail plan of S1-Global

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Proposal of S1-Global mission

Mission of the S1-global

The mission of the S1-Global is to facilitate the international collaborative work on the production and operation of cryomodules in the framework of ILC-GDE and to aim at operating at least one cryomodule with an average accelerating gradient of 31.5MV/m. Specific goals of the S1-global include the following:

(1) To advance the implementation of the 'plug-compatibility concept' for the cavity packages, by installing up to 8 cavities from laboratories across the world into a common module, and by operating them with pulsed RF power at a cryogenic temperature of 2K.

(2) To examine the engineering designs of cavity packages from participating parties by assembling them into a common module and by following through the alignment procedures.

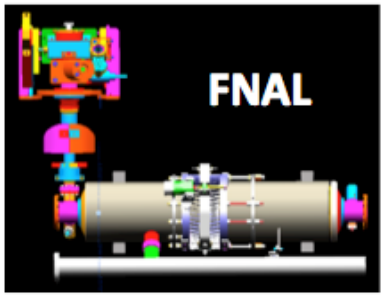
(3) To demonstrate that the specifications on the heat loads for the cavities and the cryomodules can be met as per RDR.

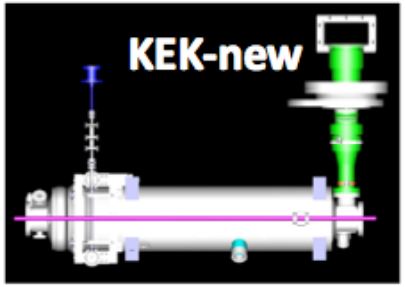
(4) To conduct comparative studies of performance of cavities from the participating parties, in particular, in the area of Lorentz detuning and its compensation in a common setting.

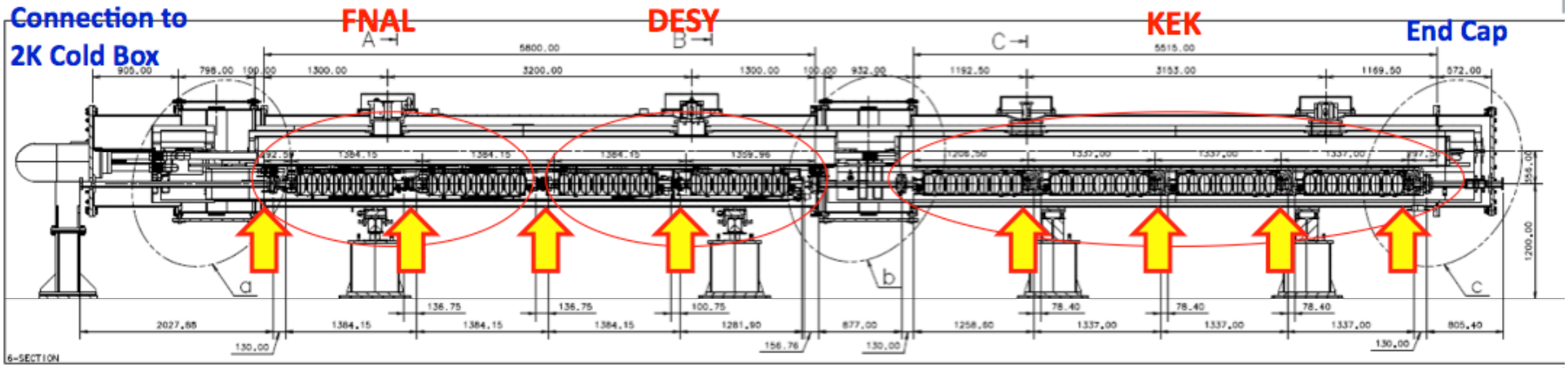
(5) To attempt to attain an average accelerating gradient of 31.5MV/m in a pulsed RF operation at 5 Hz with 1 ms flat-top length, 0.07% rms amplitude variation and 0.35 degree rms phase variation.

S1-Global cryomodule

General Design of Cryomodules



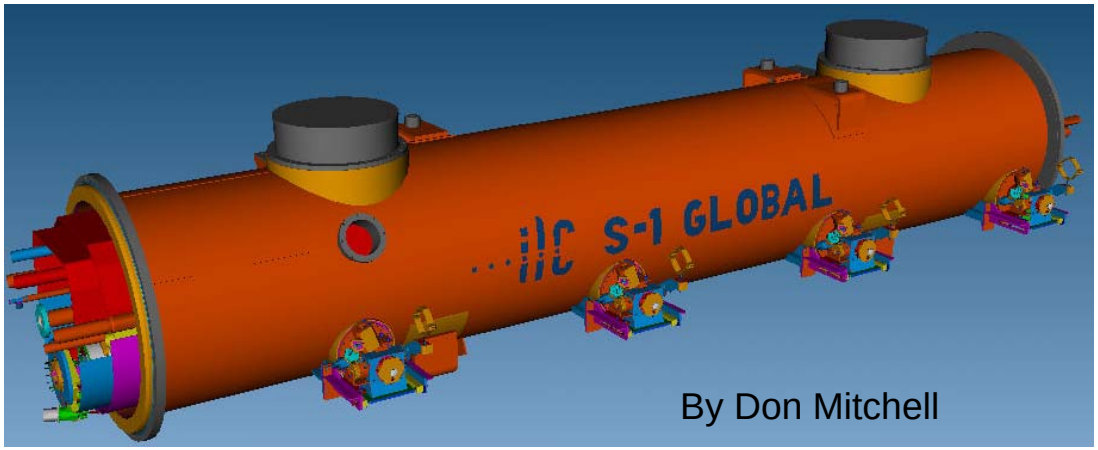




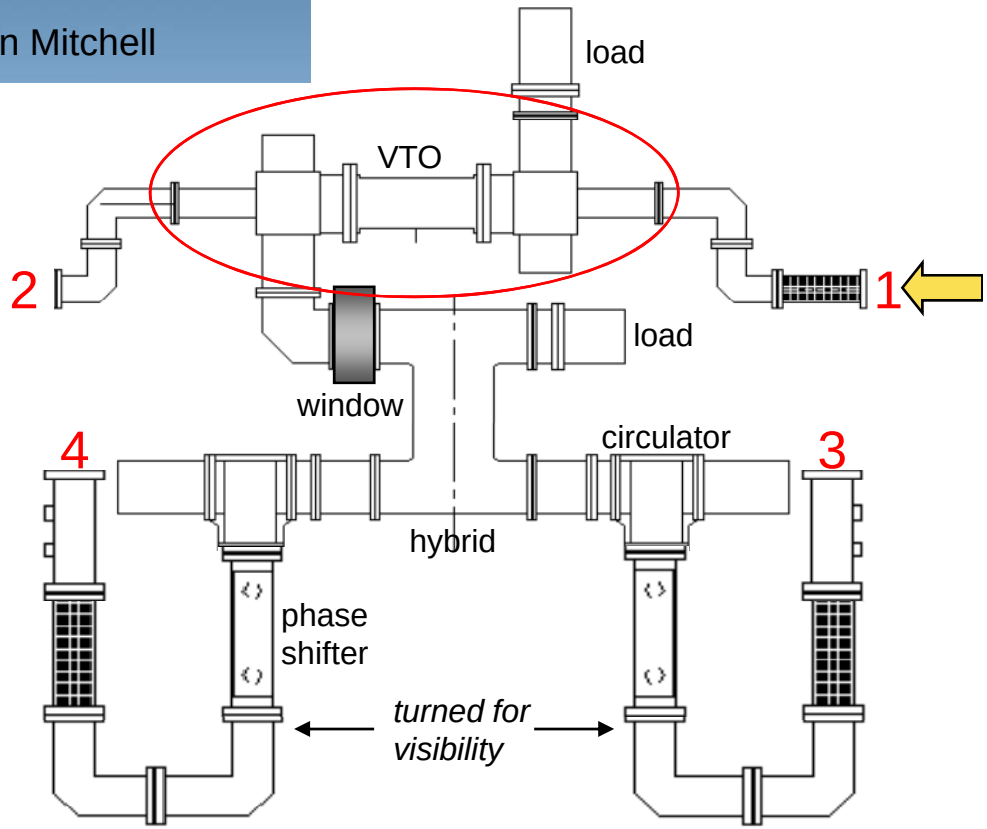
- Module C: 2 FNAL cavities and 2 DESY cavities, Module A: 4 KEK Tesla-like cavities
- The total length=14778mm
  - Module-C = 5800 mm, Module-A = 5515 mm
  - Vacuum bellows to 2K cold box = 795 + 100 mm, Vacuum bellows between modules = 932 + 100 mm
  - Connection to 2K cold box = 905 + 28 mm, End cap = 572 + 28 mm

S1-Global cryomodule

Cryomodule C (INFN design and fabrication)



two VTO for 4 cavities
from SLAC? (Chris Adolphsen)



S1-Global experiment preparation

1 module assembly

module C:INFN cryostat + FNAL cavities + DESY cavities

module A:KEK cryostat + KEK cavities

installation of coupler cold window, connection of cavities &bellows &gate valves, cavity rotation alignment, pumping down, hung on GRP, alignment of cavities, He pipes connection, sensors connection, super-insulator shield installation, slide into cryostat.

2 installation in tunnel

connection of modules, cryogenics, vacuum port with pumps, wire stretch of WPM, cryostat alignment, coupler warm window, wave-guide connection.

3 coupler RF process at room temperature

RF process from narrow pulse to full pulse

4 cool down to 2K

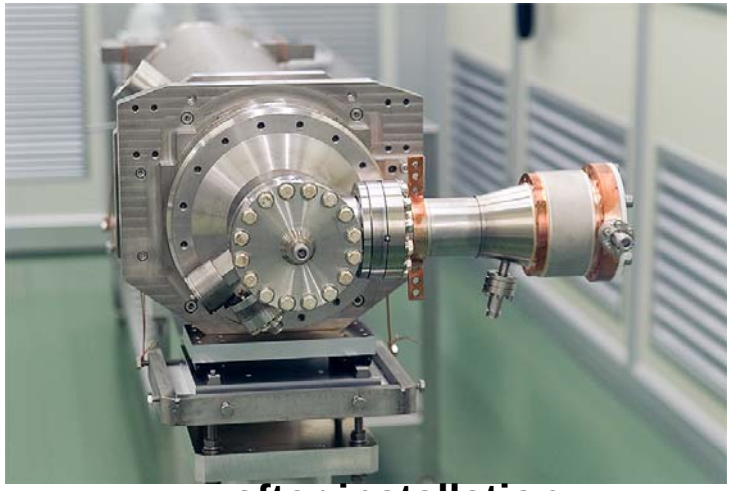
5 coupler + cavity RF process at 2K

6 cryomodule performance measurement

Assembly of cavities in Clean room

dressed cavity as received

input coupler (cold window) installation



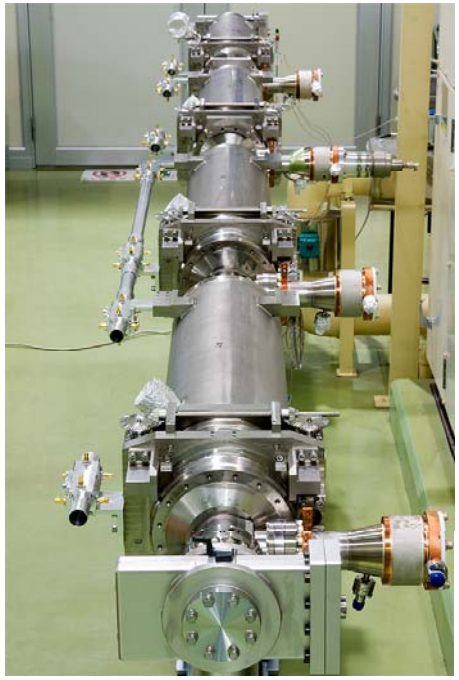
after installation
(jigs to mount support pillar of rail system)

gate valve and beam pipe bellows installation

Assembly of cavities into cryomodule (1)

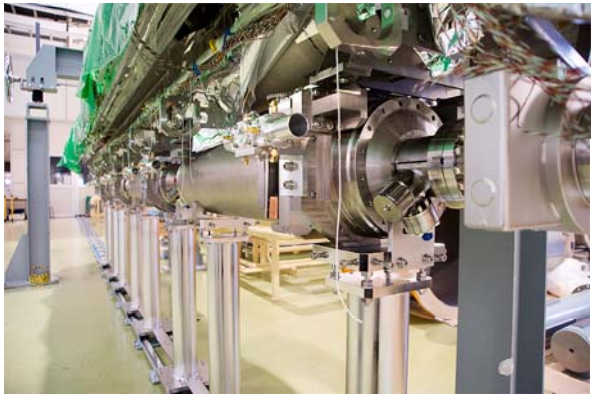
4 cavities connection

taking out from clean room



tuner, WPM installation

alignment



hanging up to GRP

He supply pipe welding

Assembly of cavities into cryomodule (2)

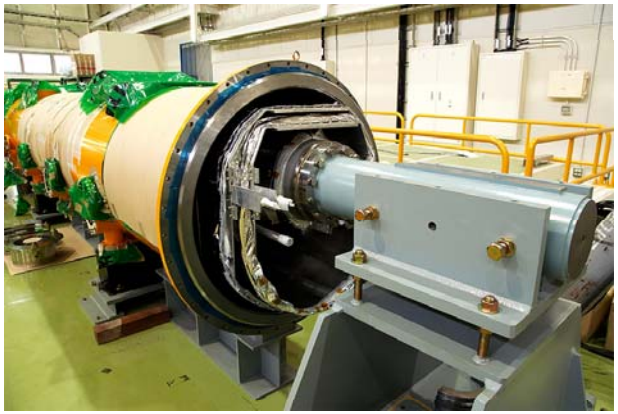
Temp sensor, 5K shield, thermal anchor installation

wrap Super-Insulator

hang cold-mass

pull down onto slider

dismount support post

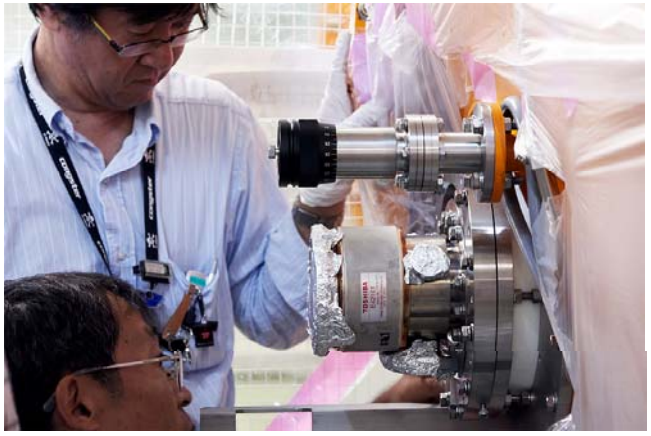


slide into cryostat

Cryomodule installation in Tunnel

crane down into tunnel

module connection

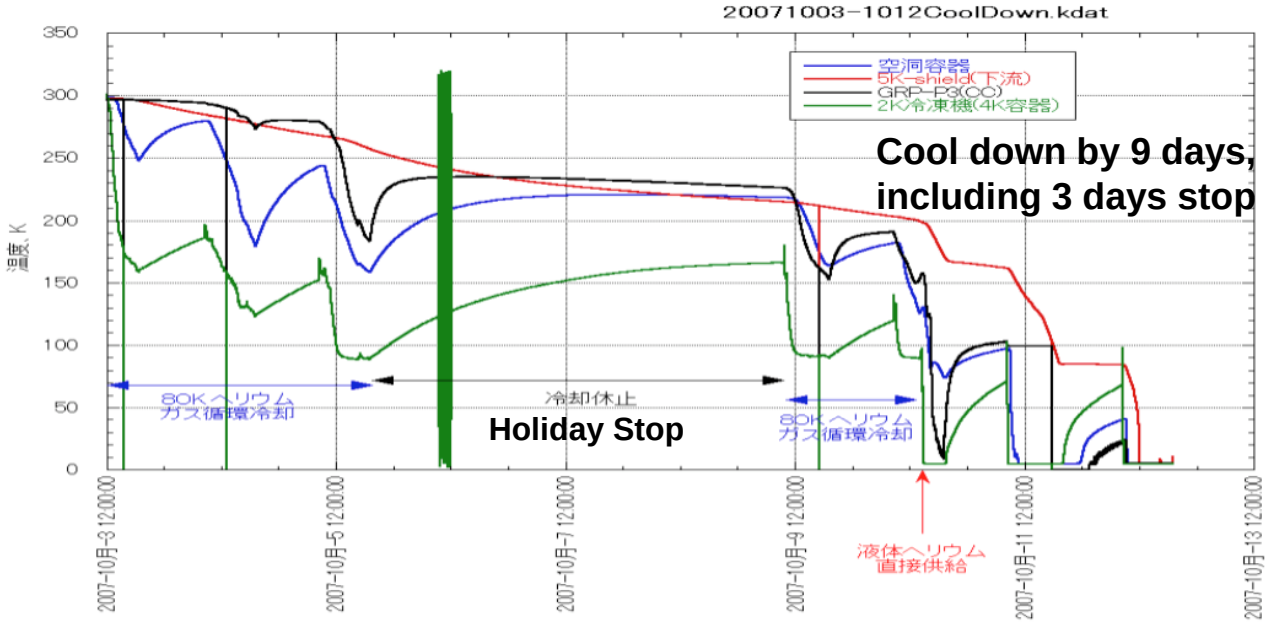


coupler warm window installation

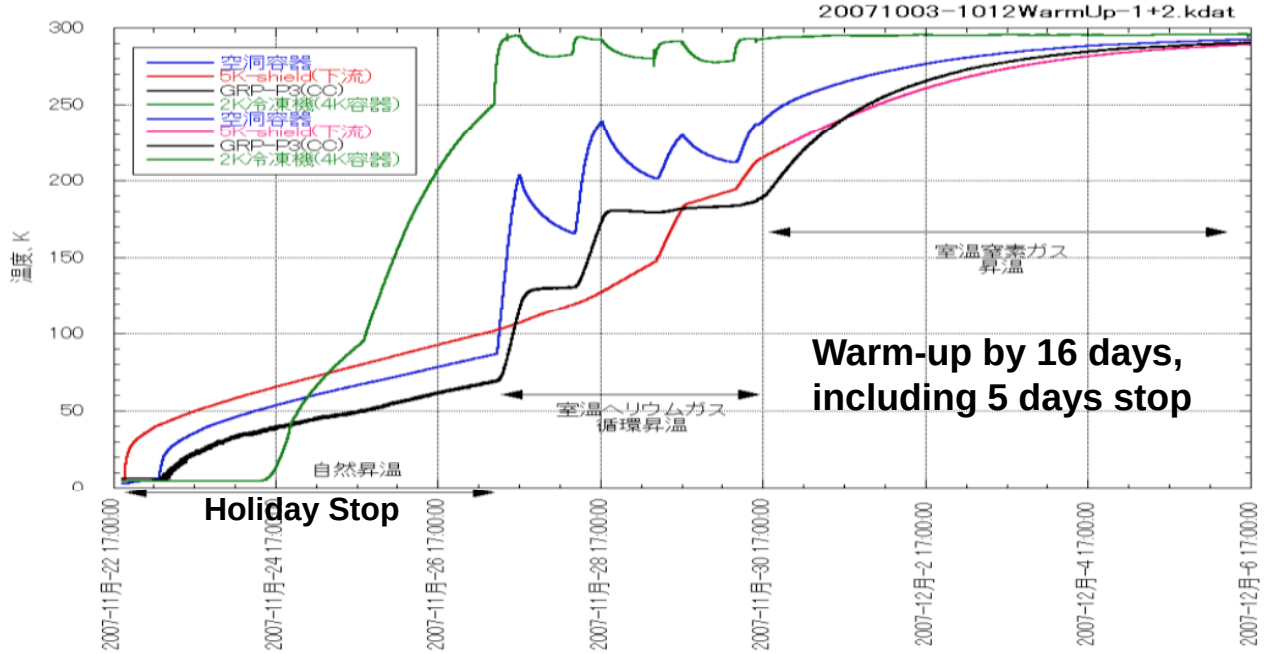
ready for coupler RF process

cryogenics connection

Examples of cool down, warm up

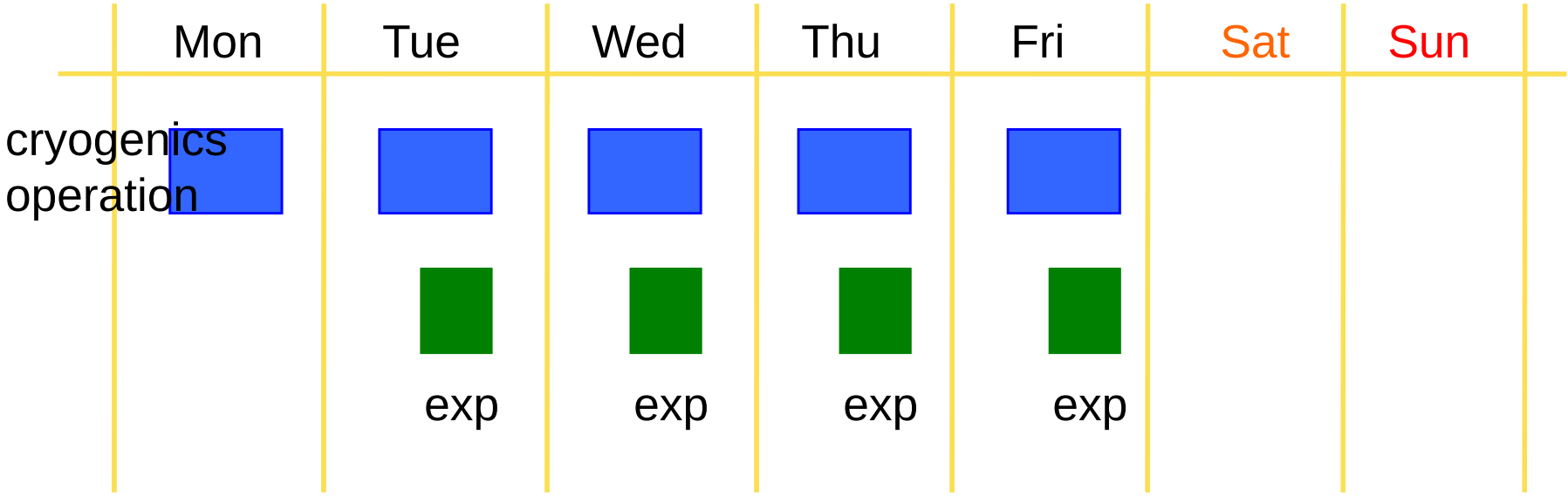


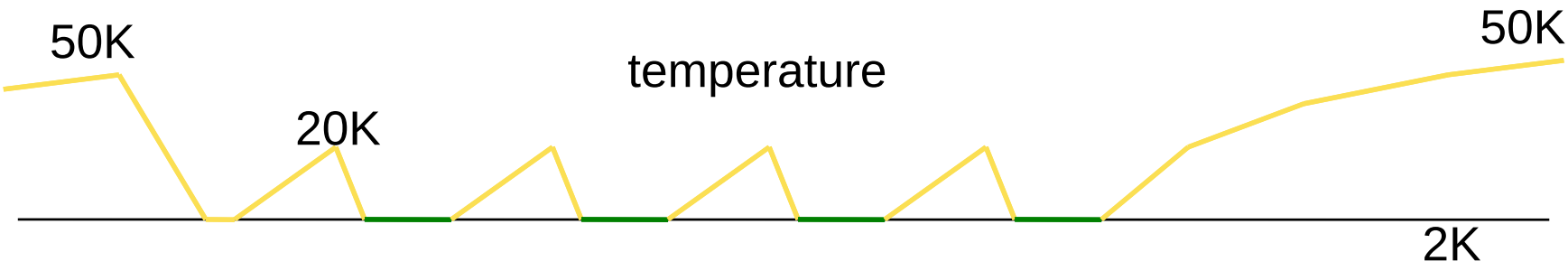
Cool down by 9 days,
including 3 days stop



Warm-up by 16 days,
including 5 days stop

cryogenics operation plan (weekly)





weekday, day time cryogenics operation: 8:30 – 19:00

experiment: 13:00 – 19:00 (6 hours)

Experiment time assignment

Assume June 1, 2010 start;

room temp. coupler process: 4 weeks (two cavity/week)

cool down process: ~1 week

2K coupler & cavity process: 4 weeks (two cavity/week)

regular maintenance and inspection of cryogenics: 4 weeks (August)

re-cool down process: ~1 week

September 8, 2010 experiment start until December 24, 2010;

2K experiment: 16 weeks (16 weeks x 4 days x 6 hours = 384 hours)

48 hours / cavity, including heat load, HLRF, LLRF, vector sum operation

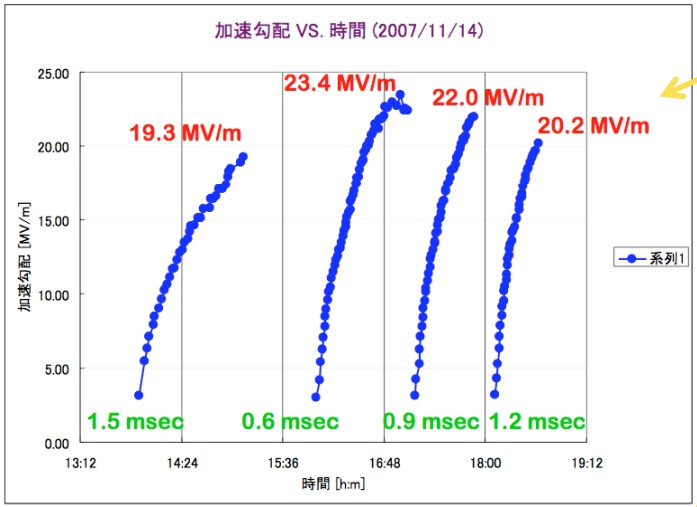
It is very tight, need efficient, prioritized exp. program

Experiment Item candidates

(1) Gradient reach (vector sum)
(2) amplitude & phase control (vector sum)
(3) Heat load measurements
(4) Each Cavity fundamentals(Q,Eacc,f0, tuner, etc..)
(5) Lorentz detuning (each cavity)
(6) Piezo compensation (each cavity)
(7) Mechanical vibration meas. (each cavity)
(8) power distribution study
etc.

Examples of measurement

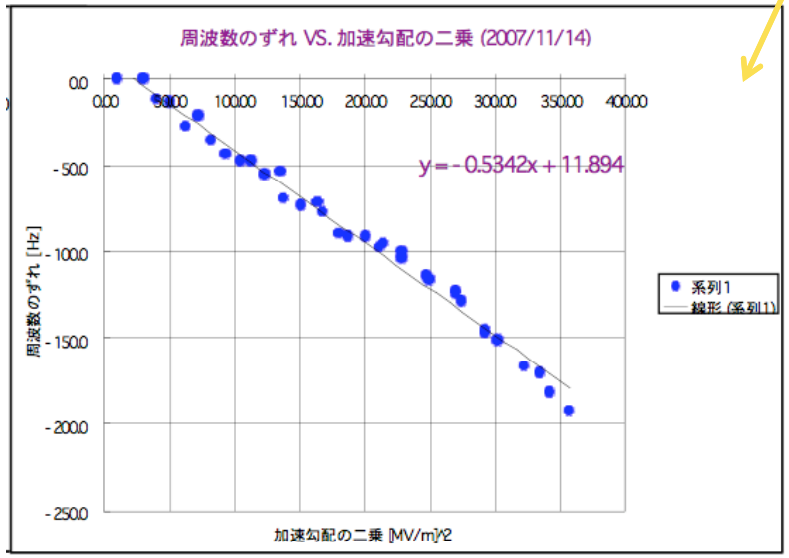
Achieved Eacc,max



RF process of cavity and coupler

Lorentz detuning measurement

LD compensation study



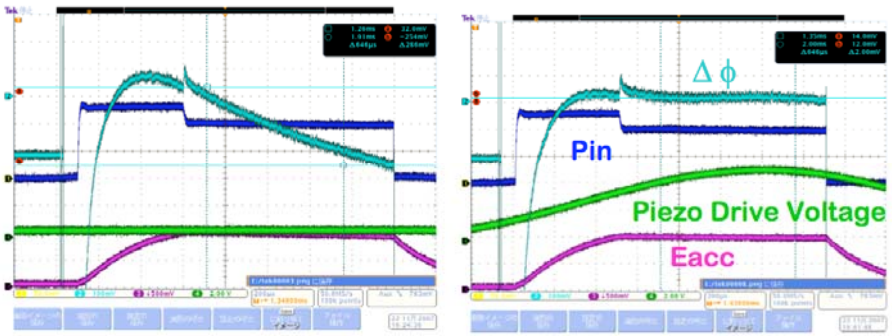
K = - 0.5 Hz/(MV/m)²

Flat-top Lorentz detuning

Compensation by Piezo (1) ; higher Tension

Eacc = 18. MV/m
Piezo / OFF

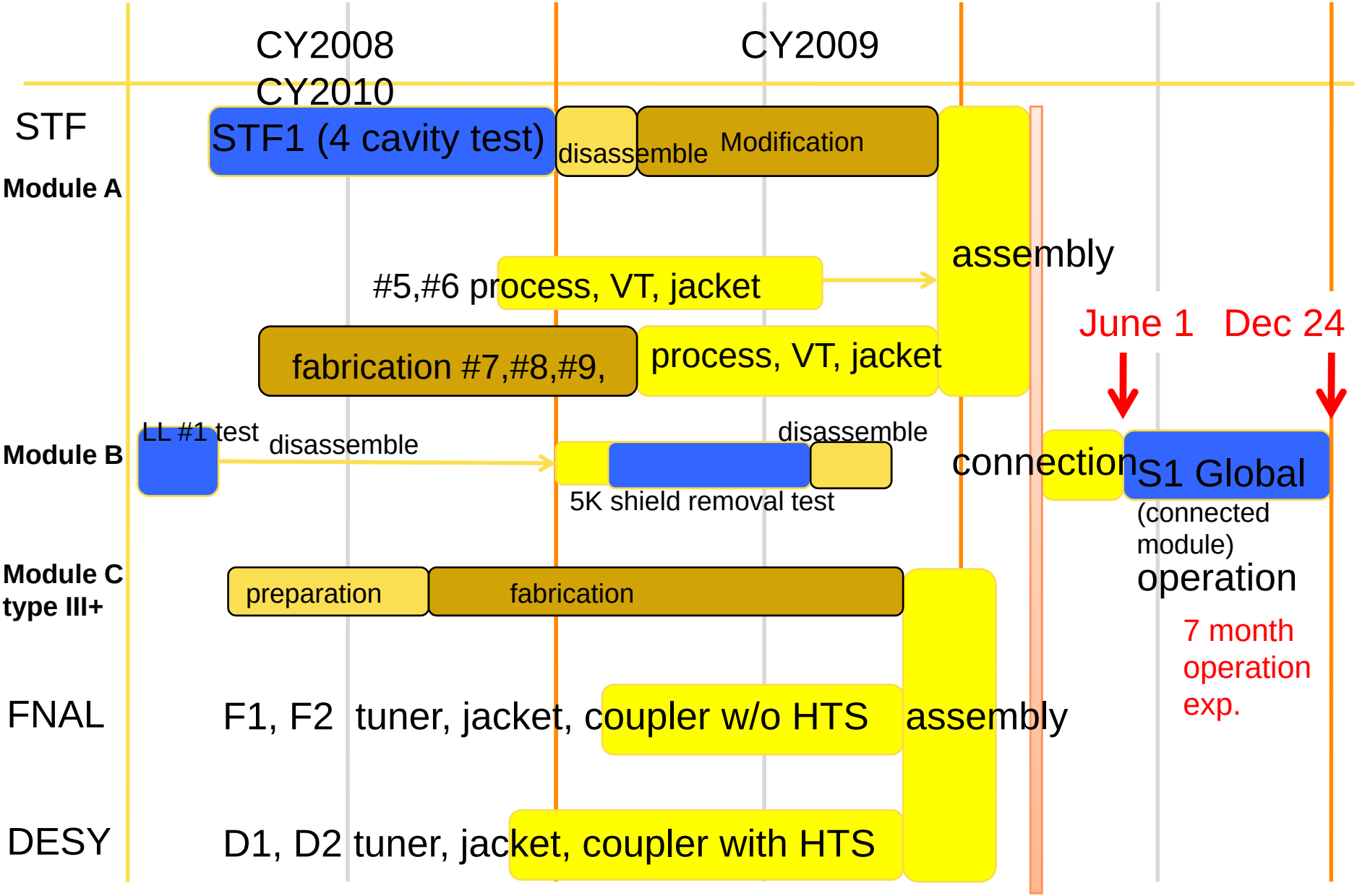
Eacc = 18. MV/m
Piezo / ON
300 Hz, 500 V, - 700 μsec



$\Delta\phi$ = - 15 °

$\Delta\phi$ = ~ 0 °

S1 Global overall Plan



End of slides