STF status Mar. 25, 2005

H. Hayano, KEK

STF Phase 1 Test Accelerator

DC gun : 200kV CsTe photocathode for quick start
+UV(262nm) Laser (337ns spacing, 2820bunches)

Test Cryomodule
: 4x 9cell TESLA SC cavity (5m cryomodule), 35MV/m
4x 9cell LL SC cavity (5m cryomodule), 45MV/m
(4x 350kW + 4x 450kW = 3.2MW, 1.5ms klystron, 5Hz)

RF power source
: 2x 5MW klystrons and modulators
LLRF control

Beam line
: energy analyzer, emittance, position, intensity monitors
HOM monitor, beam dump

STF Infra-structure

EP: build new EP(Electro chemical Polishing) facility

HPR : move High Pressure Rinse from L-band test stand

Clean room
: build new clean room for cavity assemble

Vertical Test Stand
: build new stand,
deep enough for superstructure cavity

Coupler Test Stand
: 5MW, 1.5ms klystron, 5Hz
(switch use between Test Cryomodule)

He Plant : 600W at 4K plant moving from AR-East building
(adding new 2K system)

STF Sub-group organization

Cryogenic plant : Team K. Hosoyama (7)

High Power RF (inc.LLRF) : Team S. Fukuda(11)

Cryomodule

- **Cryostat : Team K. Tsuchiya(2)**
- **SC-Cavity (base-line) : Team S. Noguchi(4)**
- **SC-Cavity (high gradient) : Team K. Saito(14)**

Electron Gun : Team S. Osawa(4)

Control & Operation : Team ATF(9) & Team XTF(5)
organizer : H. Hayano & N. Terunuma

Surface Process Facility (EP & Clean room) :
organizer : A. Enomoto

2005 budget is allocated to

STF Phase 1

1. 4 of High Gradient cavities with jacket, tuner, input coupler.
2. 4 of Base-line cavities with jacket, tuner, input coupler,
   by full co-op. with industries.
3. 2 of 5m cryostat (for 4 cavities).
4. 20W 2K He plant (using moved 600W 4K plant).
5. 5MW klystron system using existing modulator, and LL-RF development.
6. DC-gun installation and beam monitors fabrication.
7. Control system start-up (for input coupler processing).
8. Existing EP-facility maintenance and new clean room.

ATF & ATF2

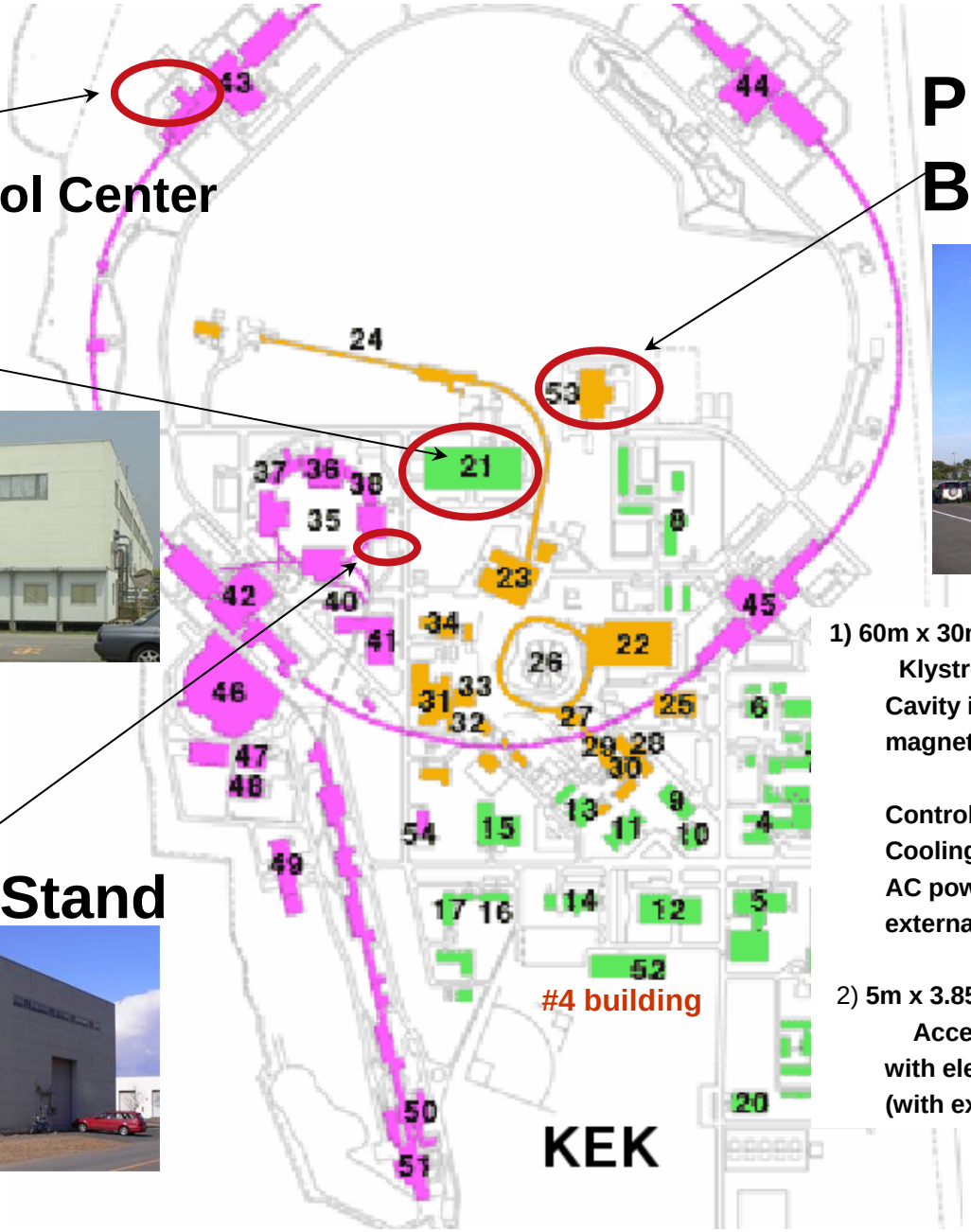
1. ATF operation.
2. Improvement of ATF (High res. Ring BPM, feedforward to Ext-line, etc).
3. 1/3 of ATF2.

Location of Test Facilities

KEK-B
He Plant Control Center

ATF

L-band R&D Stand

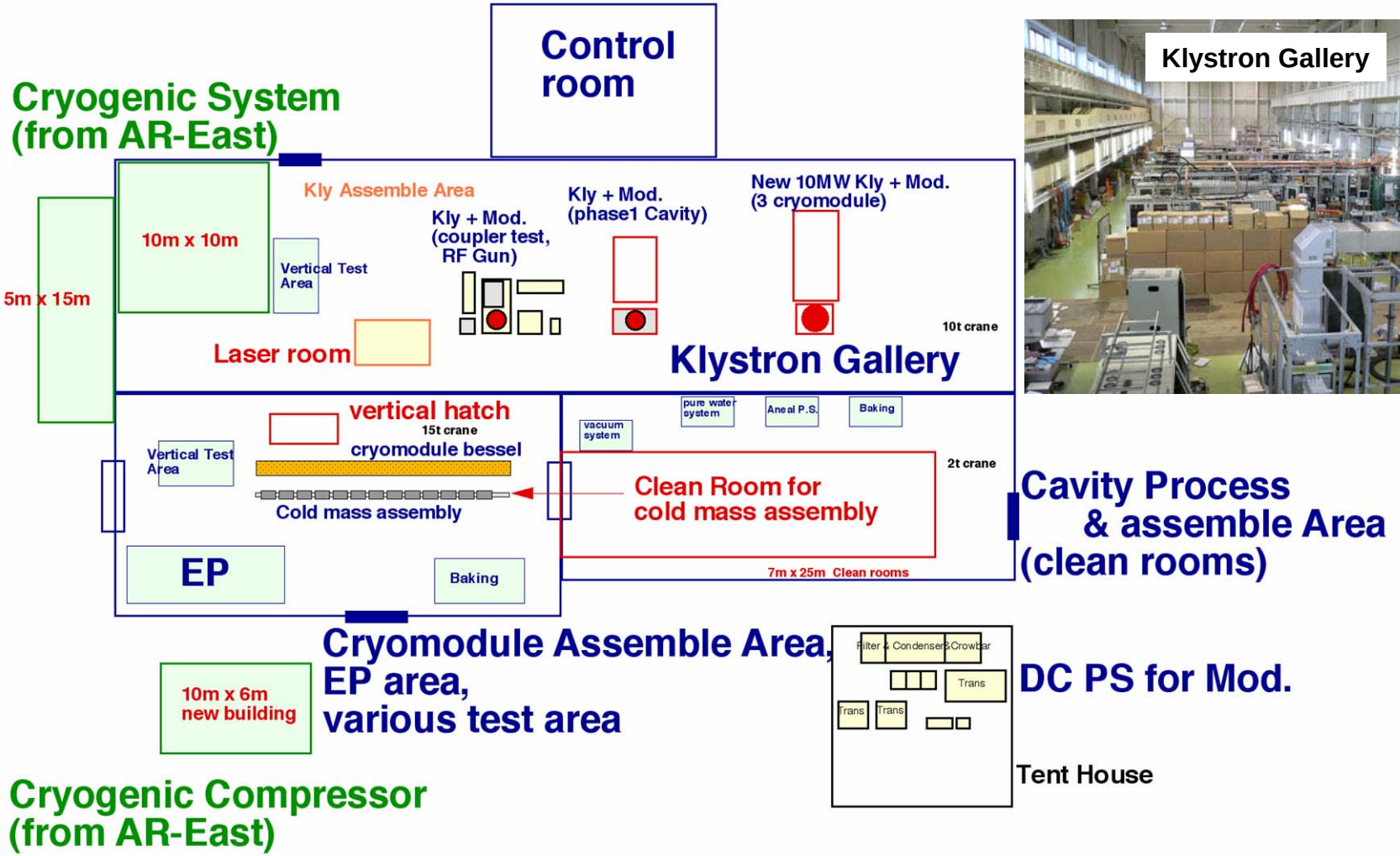


Proton Linac Building(STF)

1) 60m x 30m building:
- Klystron Gallery (with extendable space)
- Cavity installation room
- magnet power supply room (with extendable space)
- Control room (with extendable space)
- Cooling water facility
- AC power yard
- external Tent House

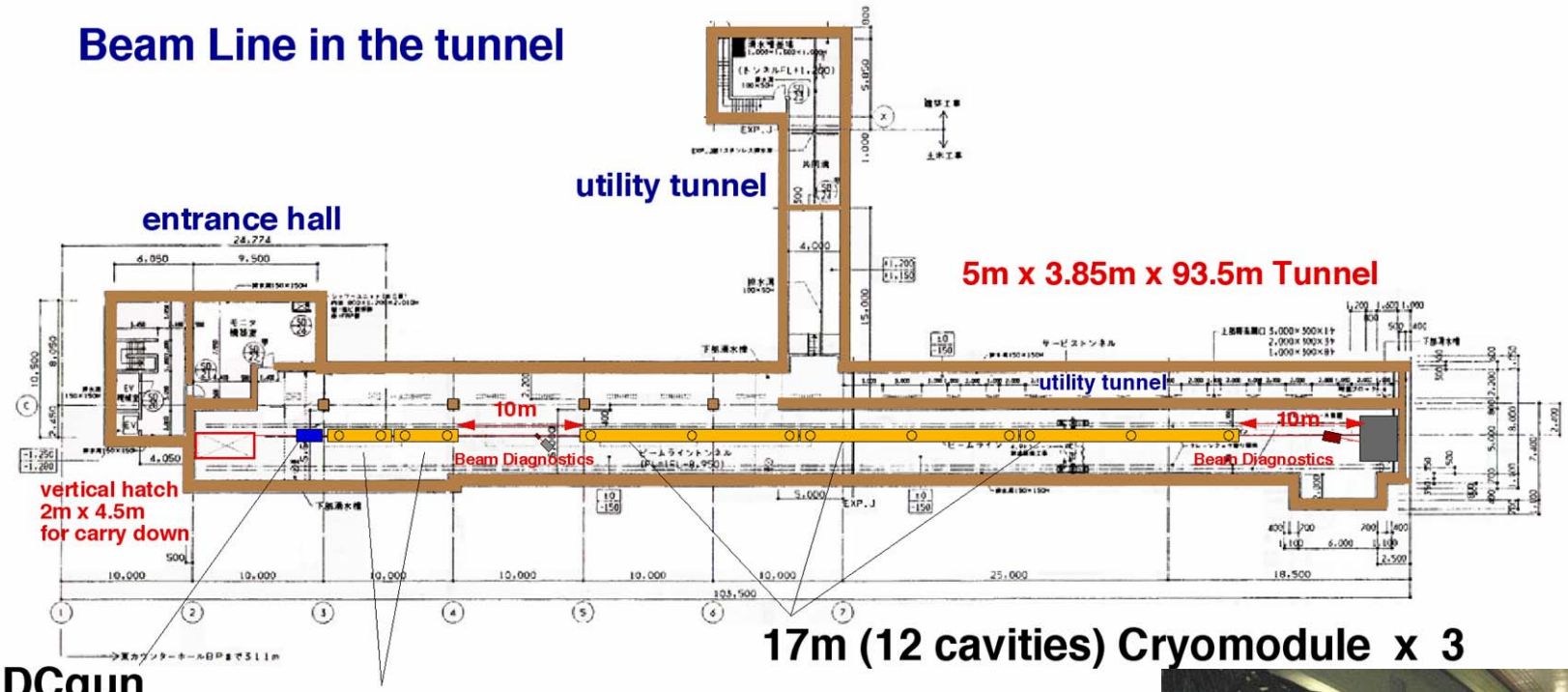
2) 5m x 3.85m x 93.5m tunnel:
- Access hatch only 2m x 4.5m with elevator (with extendable space)

STF Building plane view



V3.0 Hitoshi Hayano, 02/20/2005

STF underground tunnel plane view



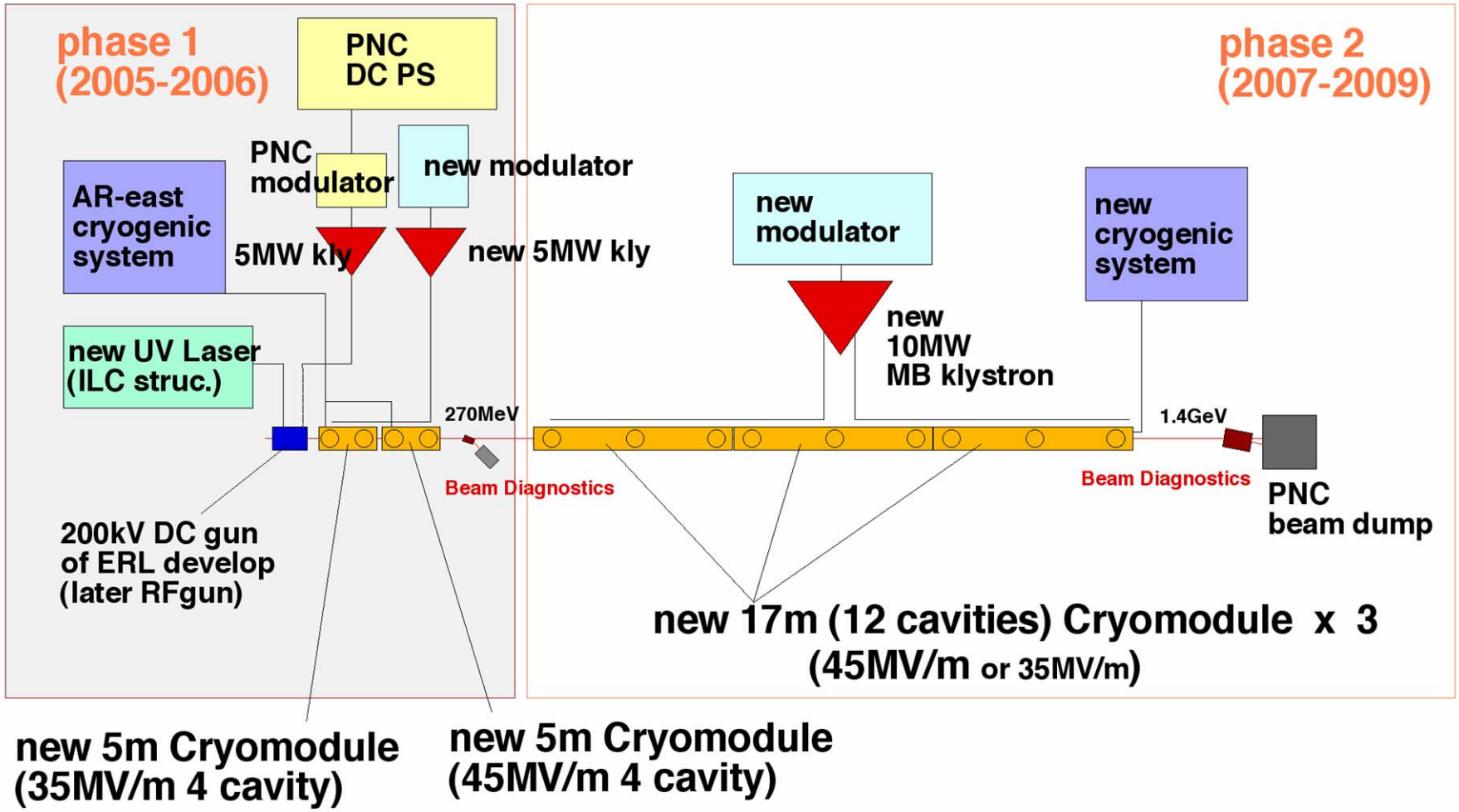
Tunnel underground

Moving Plan of J-PARC Linac

1. Disassemble of control racks : end of April
2. Moving klystron power supply(RFQ, DTL1,HVPS#2) : April 25 - 29
3. Moving Solid-state amp(buncher, chopper) : May 16-20
4. Moving control racks(42 racks) and instruments : May 9 - 20
5. Moving Klystrons(5 kly.) : June
6. Moving High-power waveguides : June
7. Moving Ion-source : July & August
8. Moving RFQ, MEBT, DTL1 in tunnel : June, July, August

9. Moving Q-mag power supplies : September
10. Clean-up of SDTL assembly room : November, December
11. Klystron, klystron power supply and controls for DTL3 : moving in Jan. 2006

Plan of Superconducting RF Test Facility (STF)



V1.2 Hitoshi Hayano, 2/20/2005

STF Modulator, klystron plan

1. Buy 5MW Thales Klystron, Build Pulse trans, Modify PNC Modulator putting bouncer circuit in it.

For driving cavities & Input coupler Test stand, later for RF-gun.

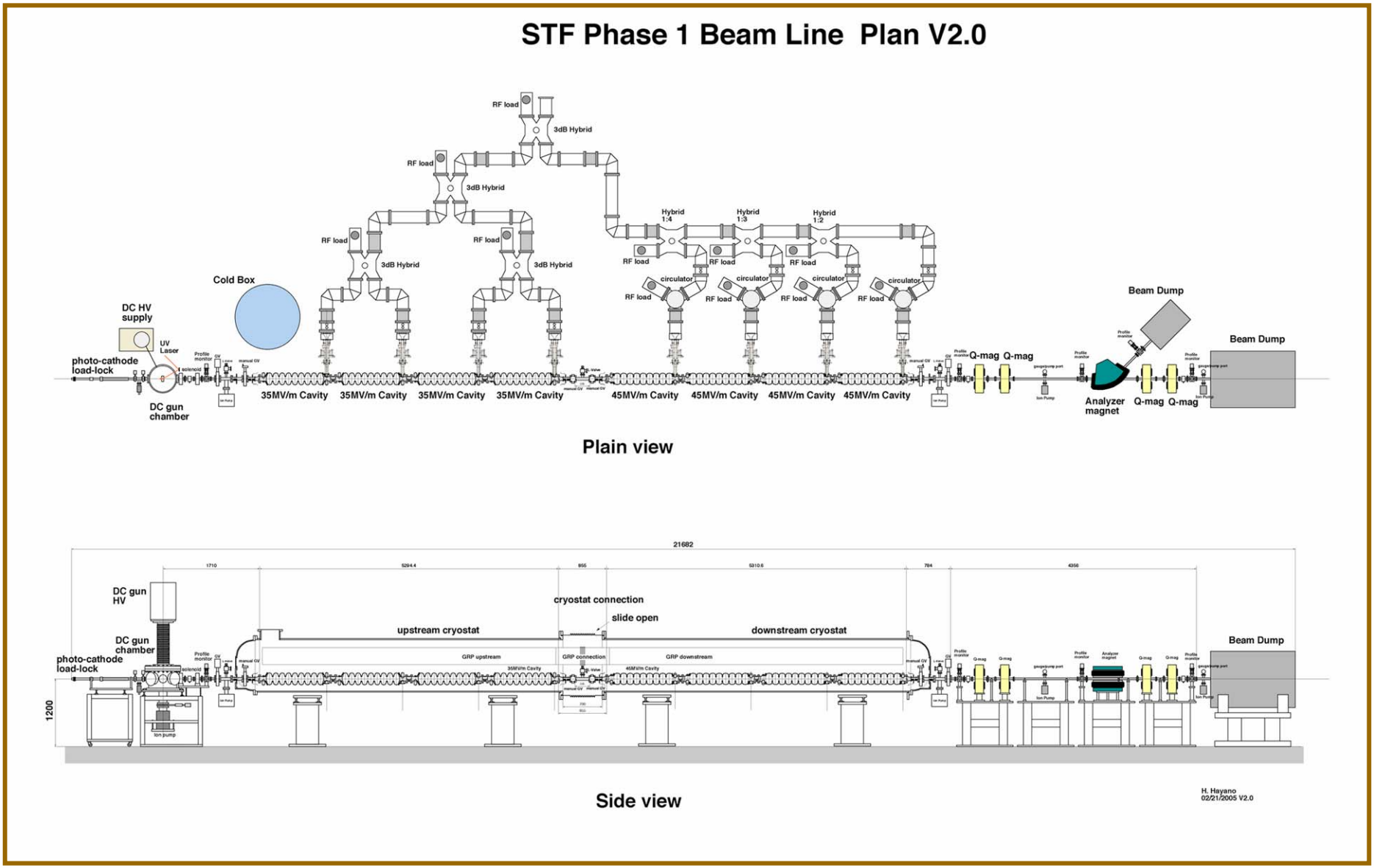
PNC modulator

TH2104C

Additional PT+Bouncer circuit
allows to use TH2104C.

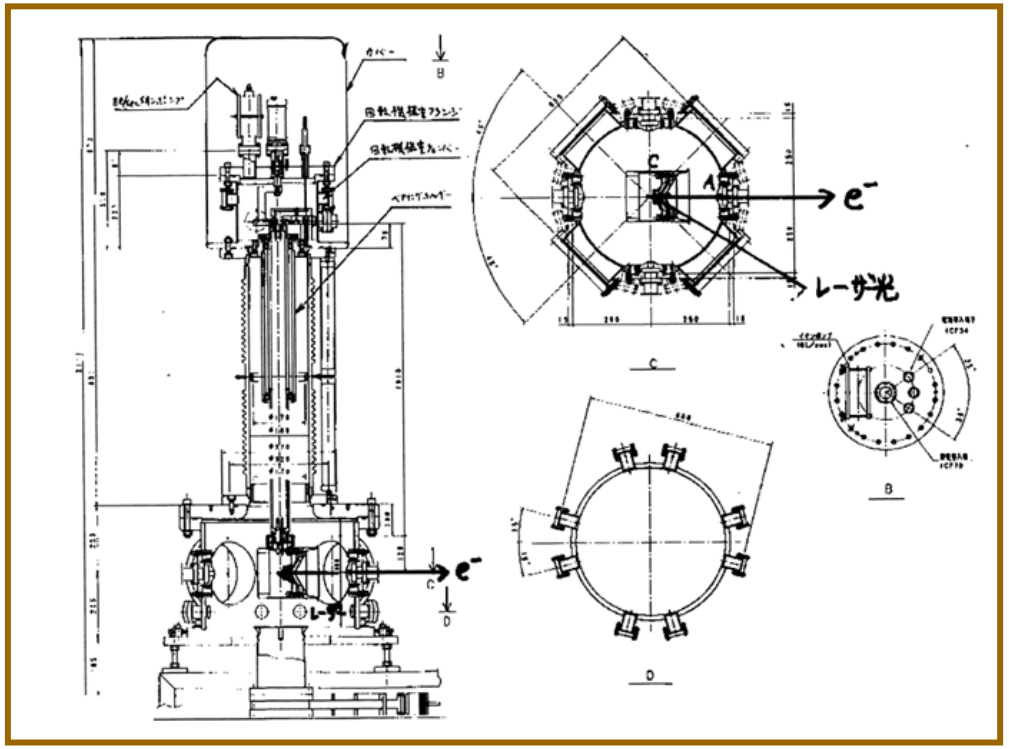
2. Build one more modulator (ILC spec.) for cavity driving (in 2006).
start investigation of technology for bouncer modulator/IGBT modulator.

STF Phase 1 Beam Line Plan



STF Beam source Plan

1. **Photo-cathode DC-gun (from ERL development)**



2. **RF gun cavity design & fabrication (KEK machine shop in 2005)**

3. **Photo-cathode Load-lock System (extension of ATF load-lock from ERL development)**

4. **Laser Development (in 2006)**

Conceptual design of cryomodule

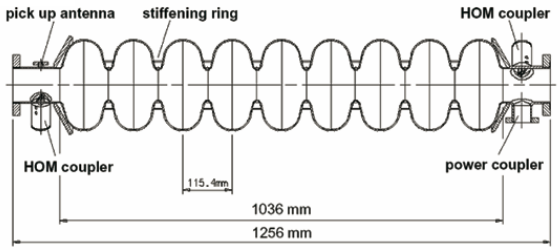
Valve Box

STF Phase 1

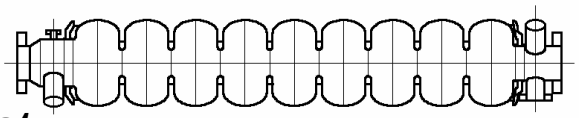
Why two module and connection?
->5m carry hatch,
->Establish weld connection in tunnel.

Weld connection

35MV/m TESLA design cavities

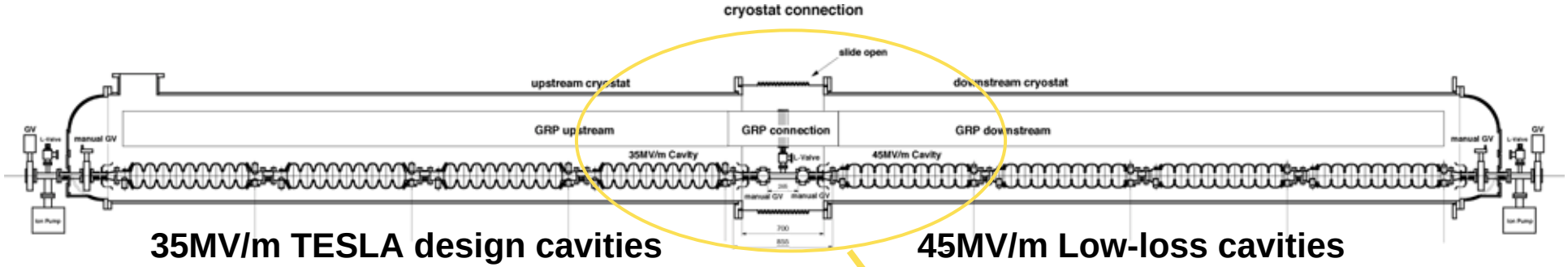


45MV/m Low-loss cavities



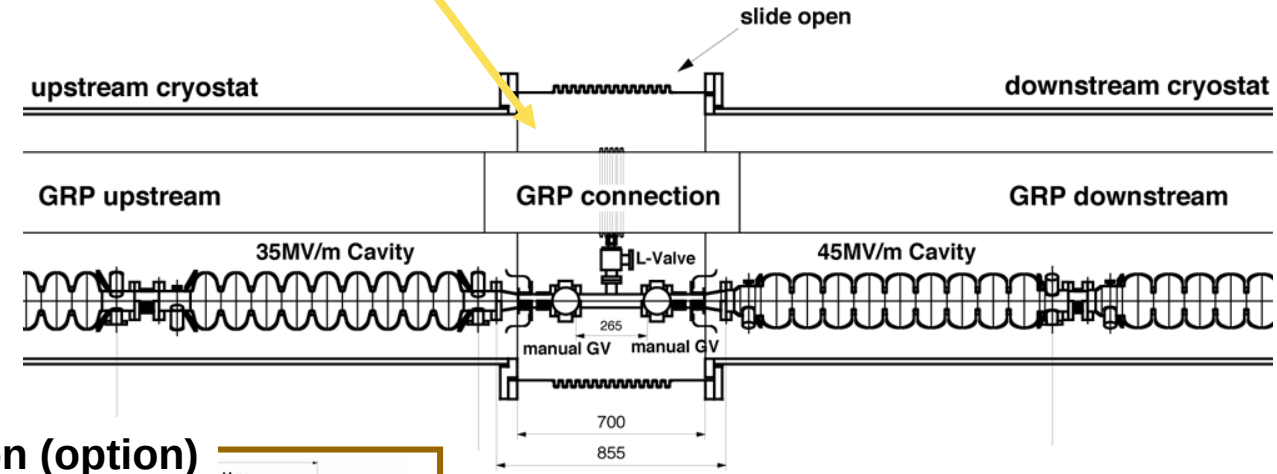
Become to 8 cavities in one cryostat
Like TTF cryomodule

Preliminary design of cryomodule whole assembly

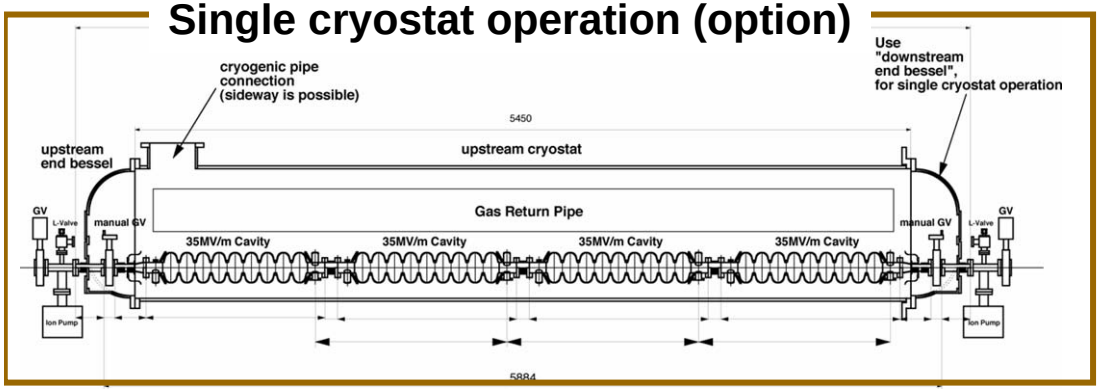


35MV/m TESLA design cavities

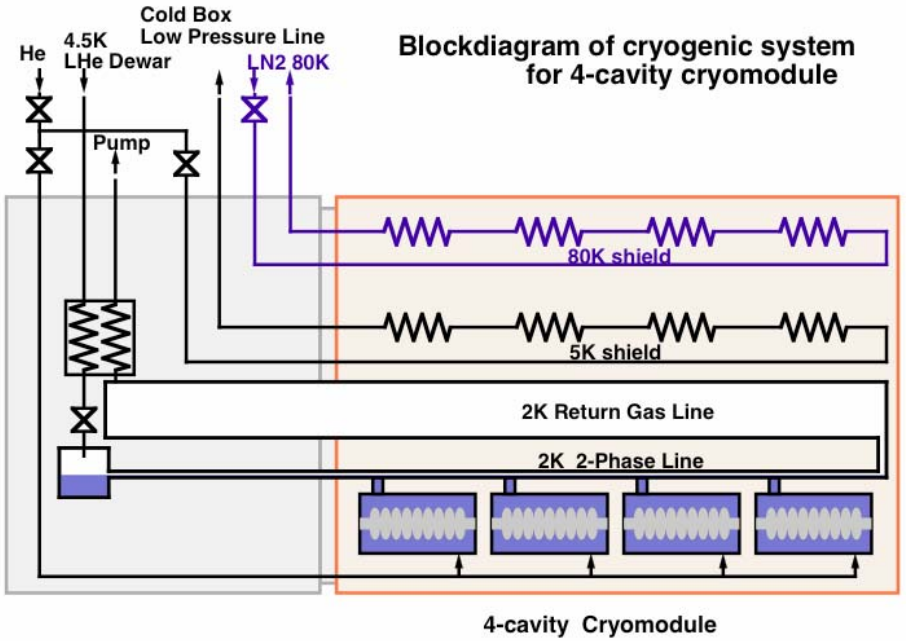
45MV/m Low-loss cavities



Single cryostat operation (option)

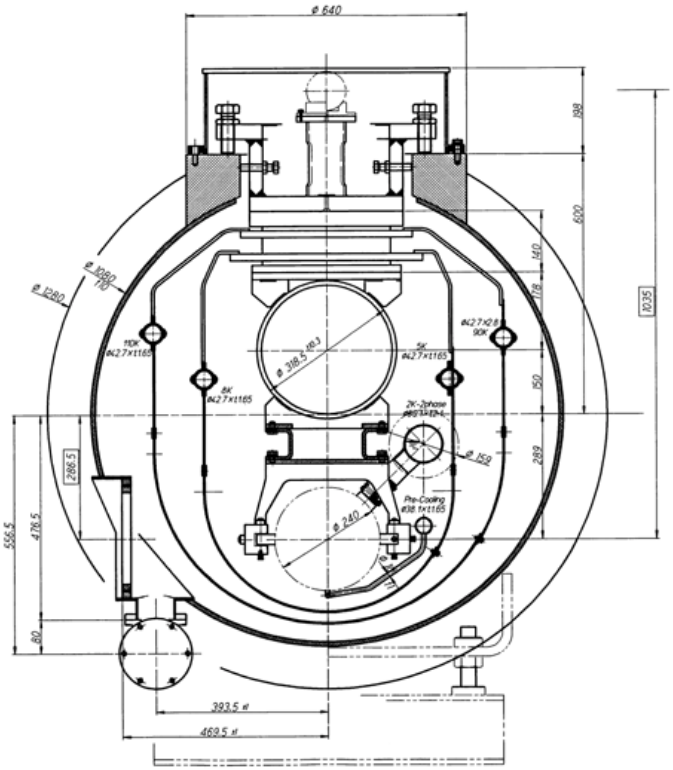


Cryomodule Cryostat Design status



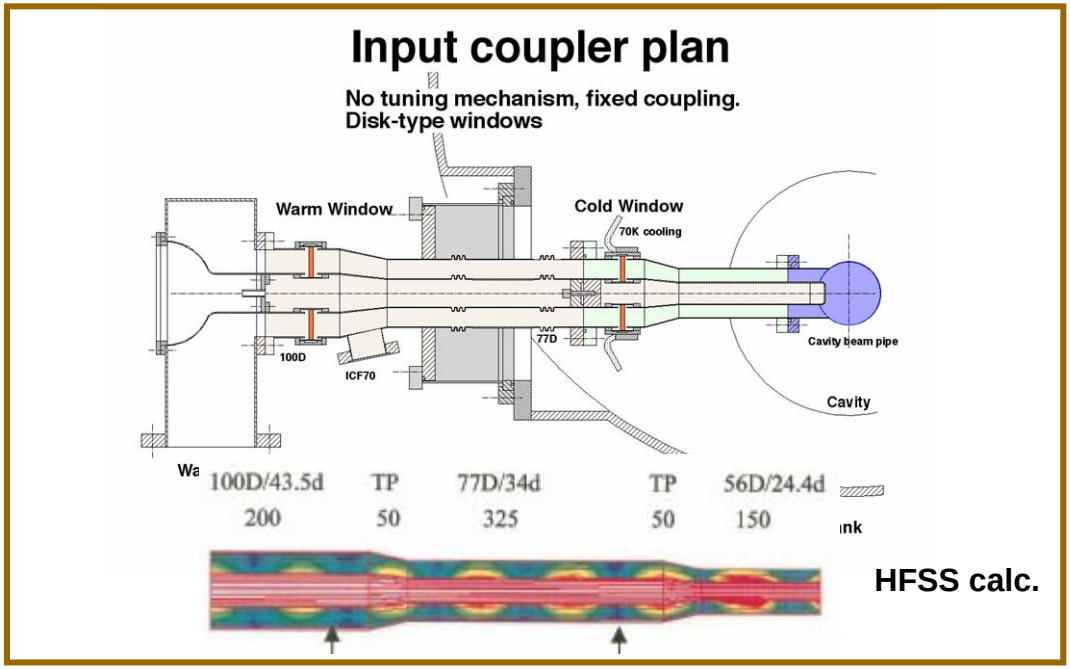
Description	OD (mm) STF	OD (mm) TESLA	Δt (mm) STF	Δt (mm) TESLA	Notes
Vacuum vessel	1016	965.2	9.5	9.52	carbon steel
2 K gas return	318.5	300	10.3	8	stainless steel
2 K two-phase supply	89.1		2.1		Ti
Cool down/ warm up	38.1	42.2	1.65	1.65	stainless steel
5 K shield supply	42.7	60.3	1.65	2.77	stainless steel
5 K shield return	42.7	60.0	1.65	5	stainless steel
90 K shield supply	42.7	60.3	1.65	2.77	stainless steel
90 K shield return	42.7	60.0	1.65	5	stainless steel

KEK cryomodule cross-section
Design is underway

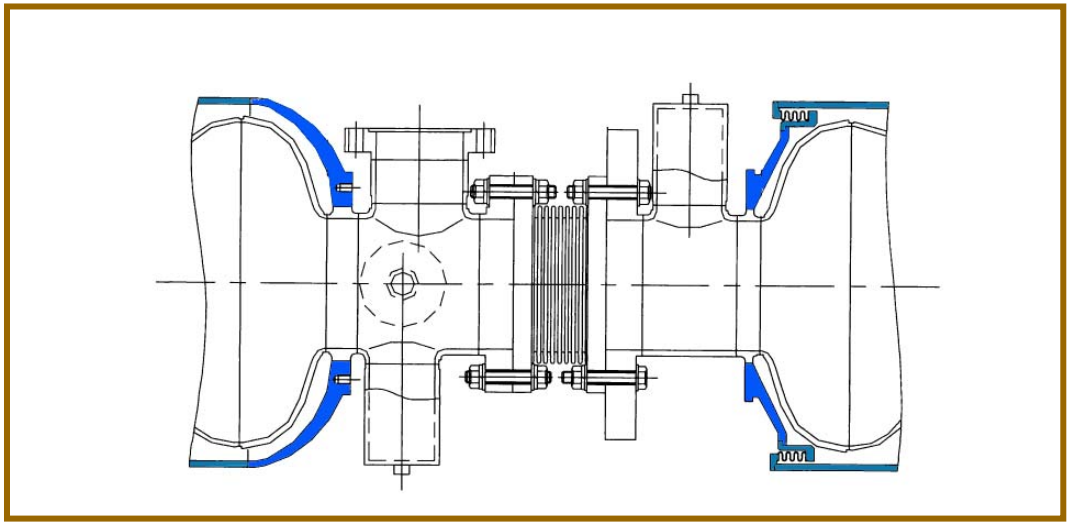


Base-Line Cavity Design status

1. **Input coupler improvement for simple & cost reduction (no tuning)**



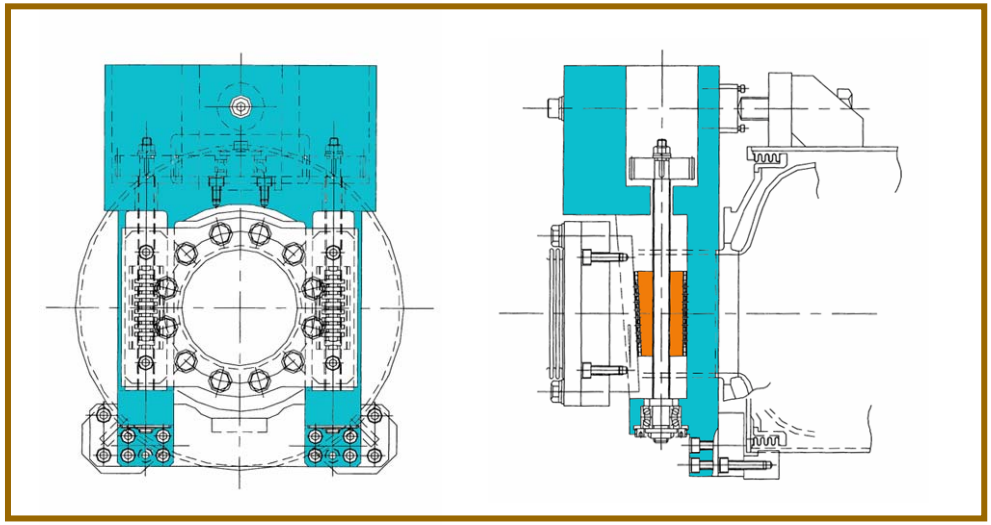
2. **cavity and He jacket rigidity improvement for small Lorentz detuning**



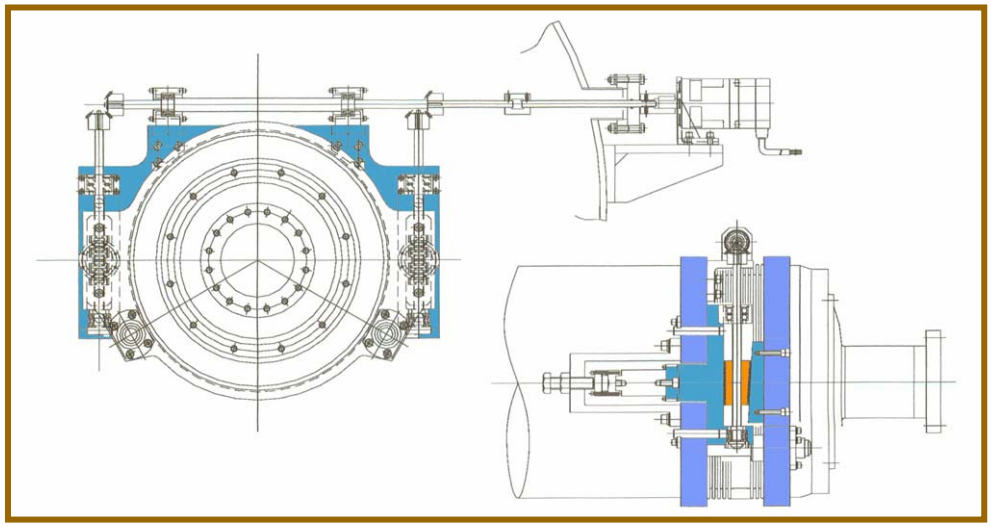
Base-Line Cavity Design status cont.

3. Simplification of Tuner mechanism, exchangeability of Piezo Element, Pulse Motor outside, etc

Type 1:
tuner on beam pipe flange
(interfere with HOM?)

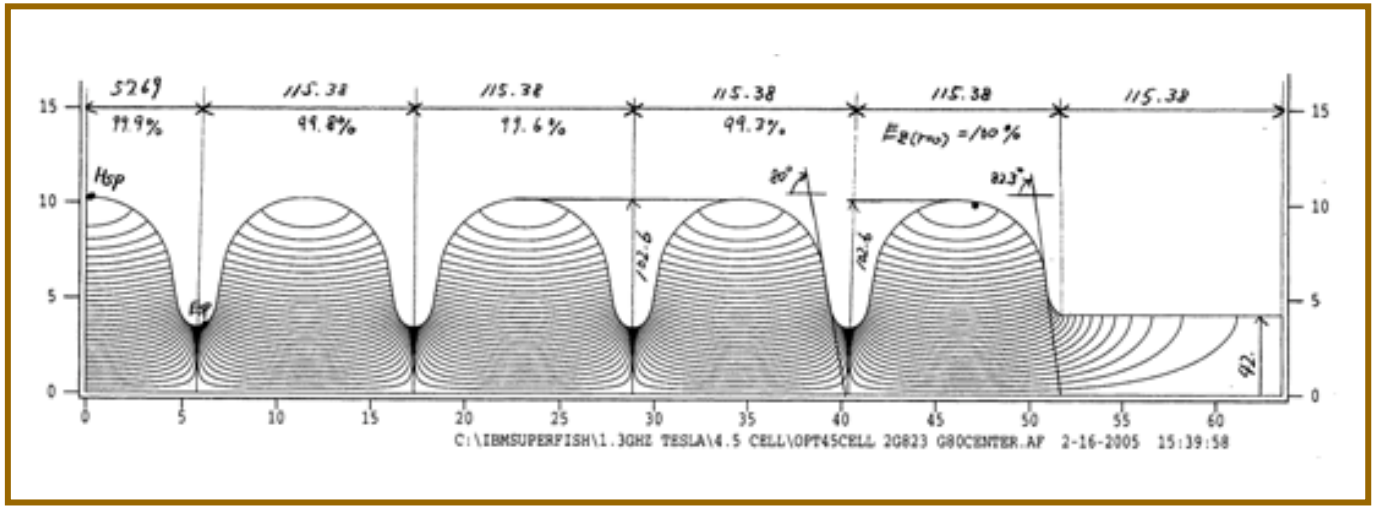


Type 2:
tuner on He jacket
With motor outside



Base-Line Cavity Design status cont.

4. Cavity Shape optimization



High gradient (LL) Cavity status

1. **Single cell High gradient cavity Test**
   (re-startup of surface process,
   vertical test stand)

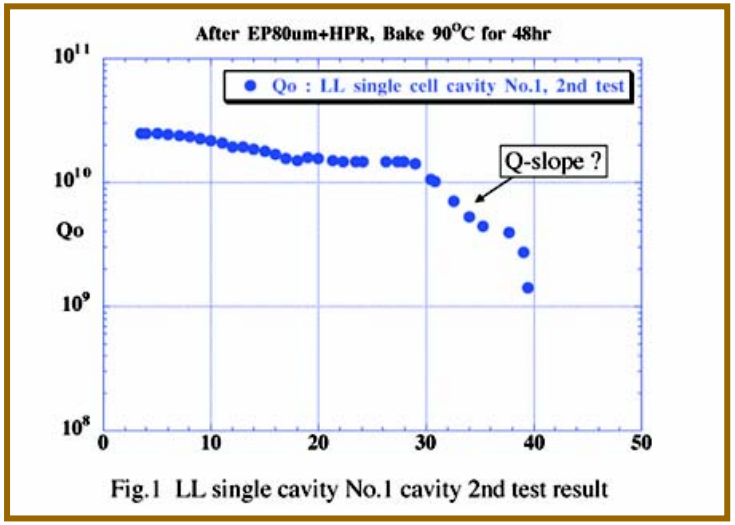
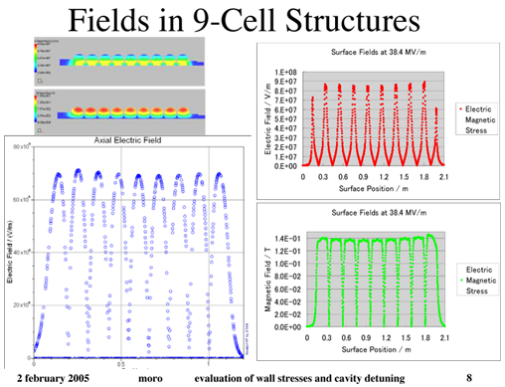
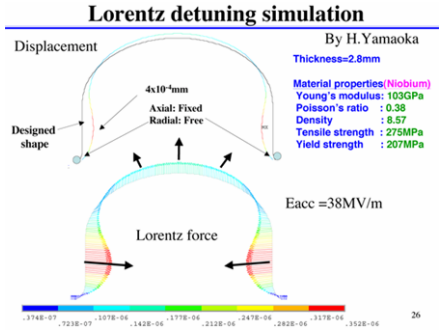
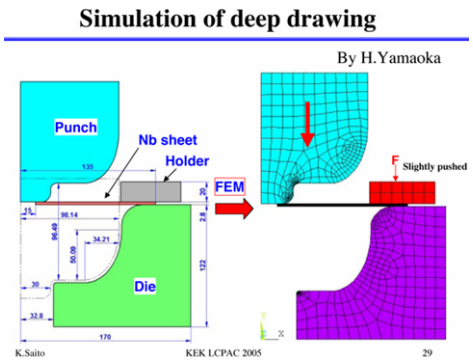


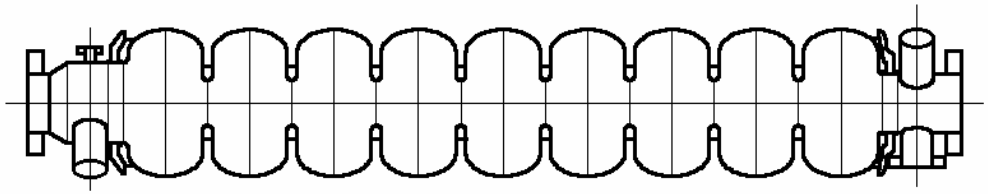
Fig.1 LL single cavity No.1 cavity 2nd test result

2. **9-cell LL cavity design was completed.**



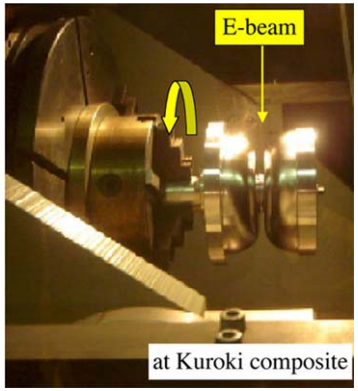






High gradient (LL) Cavity status cont.

3. Fabrication of 9-cell LL cavity (deep drawing, EBW, Burring)



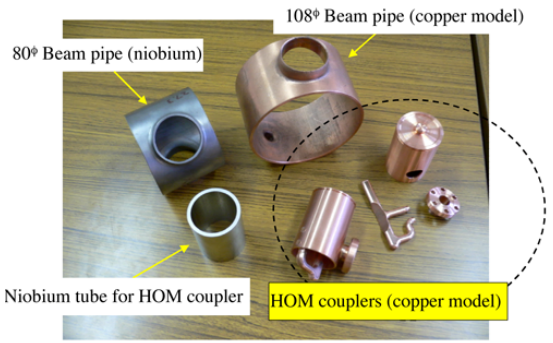
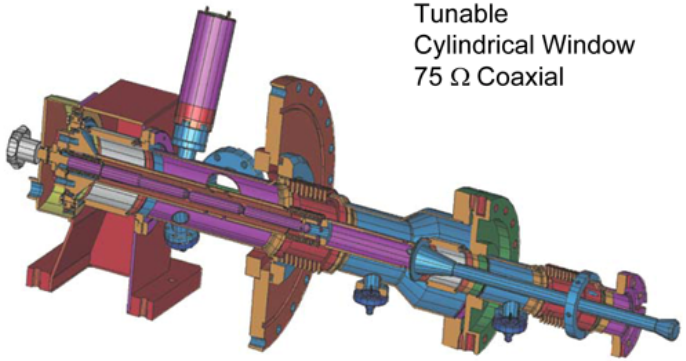
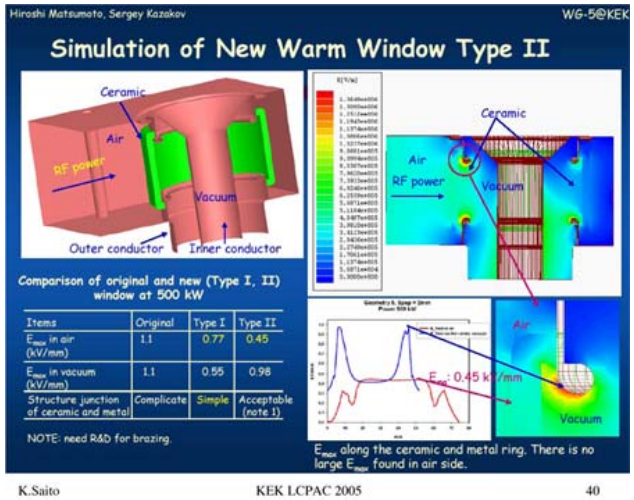
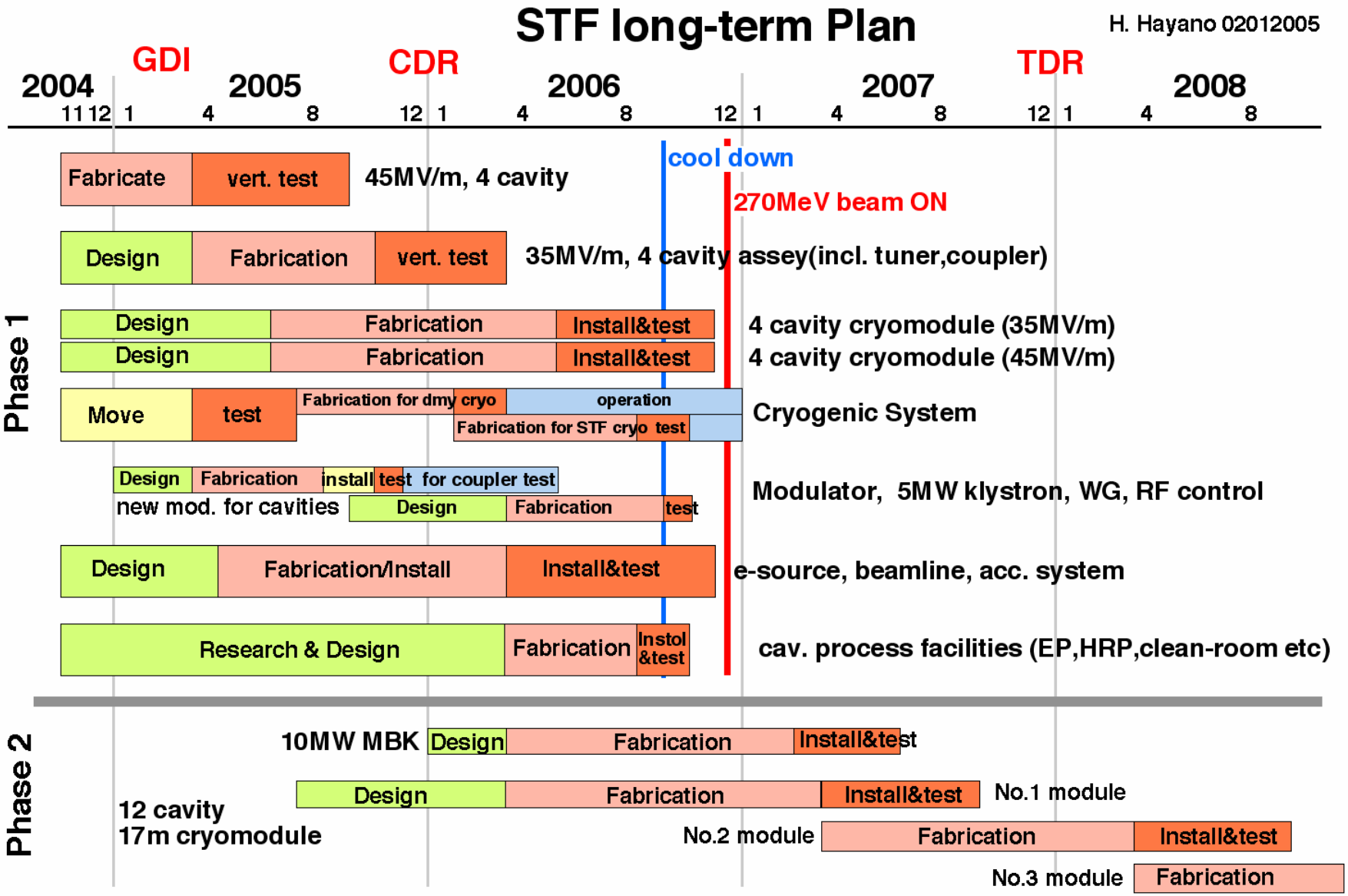


Fig.2 HOM copper model(Suzuno Giken) and successfully burring test on Nb and Cu tubes (Eishyo)

4. Input coupler design modification (low field on ceramic edge)






STF long-term Plan
H. Hayano 02012005
GDI
CDR
TDR
2004
2005
2006
2007
2008
11 12 1 4 8 12 1 4 8 12 1 4 8 12 1 4 8
cool down
270MeV beam ON
Phase 1
Fabricate
vert. test
45MV/m, 4 cavity
Design
Fabrication
vert. test
35MV/m, 4 cavity assey(incl. tuner,coupler)
Design
Fabrication
Install&test
4 cavity cryomodule (35MV/m)
Design
Fabrication
Install&test
4 cavity cryomodule (45MV/m)
Move
test
Fabrication for dmy cryo
operation
Fabrication for STF cryo
test
Cryogenic System
Design
Fabrication
install
test
for coupler test
new mod. for cavities
Design
Fabrication
test
Modulator, 5MW klystron, WG, RF control
Design
Fabrication/Install
Install&test
e-source, beamline, acc. system
Research & Design
Fabrication
Instol &test
cav. process facilities (EP,HRP,clean-room etc)
Phase 2
10MW MBK
Design
Fabrication
Install&test
Design
Fabrication
Install&test
No.1 module
12 cavity
17m cryomodule
No.2 module
Fabrication
Install&test
No.3 module
Fabrication

STF phase 1 start-up status

JFY 2004 budget reallocated to

Cryogenic plant movement: will be done by April 2005
45MV/m cavity fabrication: will be done by April 2005

JFY 2005 budget

2005 plan is almost fixed.

Construction

responsible person has fixed.
detail scheduling has started (making Excel sheet).
interaction with collaborators has started.
interaction with Industry has started.
Detail design has started.

end