



*Accelerator Laboratory*

# DRFS R&D Plan

S. Fukuda/KEK

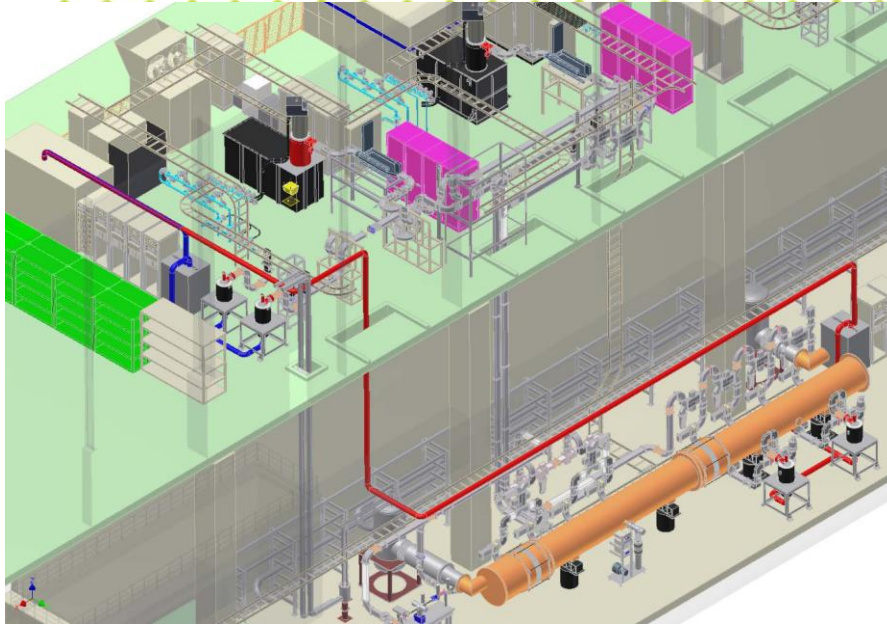
# Current program

- 2 units DRFS for S1 global project(2010)
  - RF source of DRFS comprises of a prototype DC power supply, a modulating-anode (MA) modulator and 2 proto-type MA klystrons.
  - Power distribution system (PDS) employs the circulator-less system to show the feasibility of proposed DRFS PDS.
  - Power supply system has a simple crowbar circuit using a gap switch, available HV relays, but does not include the bouncer circuit.
  - LLRF feedback is also introduced to test the DRFS LLRF system.
- Prototype DRFS klystron outputting medium power of 750kW was designed and manufactured in 2009 and completed in 2010.  
Second tube is manufactured in 2010.  
Various evaluations will be performed after the S1-Global HLRF test.
- PDS performance using high isolation magic-tee without a circulator is investigated for 2-cavity system under the LLRF feedback.  
Crosstalk and diagnoses of cavity parameters at the pulsed tail are studied in S1-Global test.



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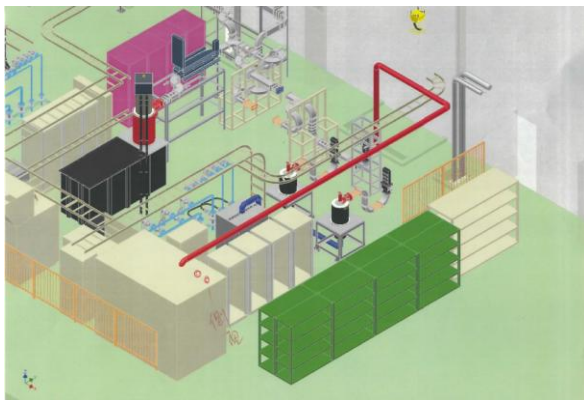
# DRFS Demo in S1-Global



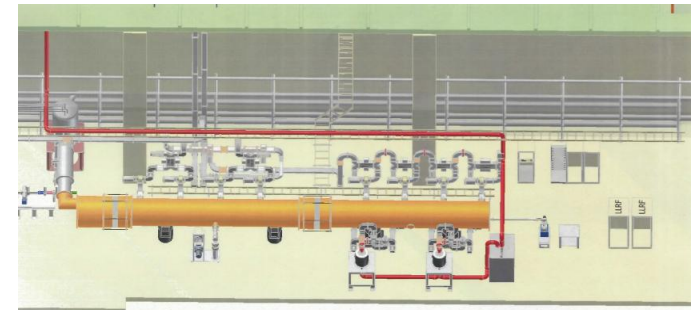
DRFS demonstration will be Prepared in the end of S1-global: December of 2010.

2 units DRFS

← Birds eye view of STF site



First evaluation test is done in klystron gallery



Then 2 DRFS units are connected to the four cavities in the cryomodule.



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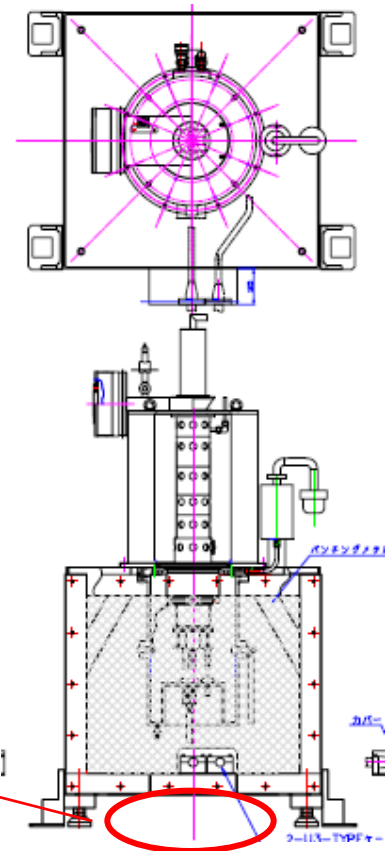
## System description and progressing R&D (1)

- MA Modulator : based on the J-Parc MA modulator (120kV) and simplified.
- Proto-type switching regulators are ordered.
- DC Power supply without Bouncer circuit are being manufactured.
- HV relay R&D
- Reliable Gap Switch as a Crowbar circuits are planned.
- Klystron and klystron socket are manufactured. One is soon arriving and No. 2 will be delivered in October.

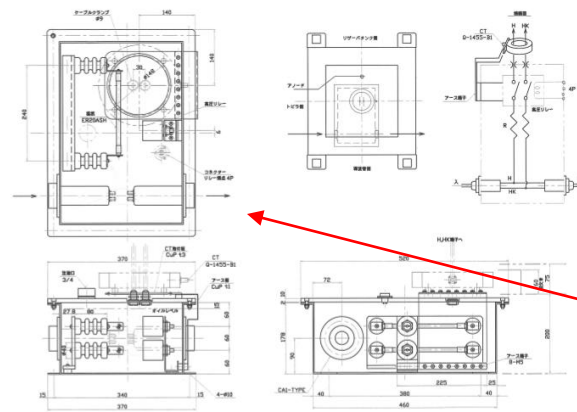
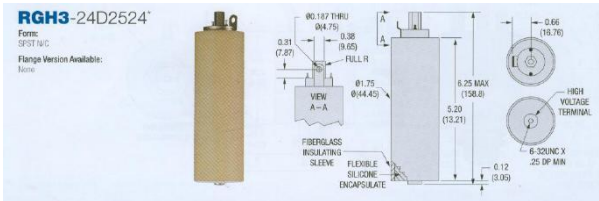
# System description and progressing R&D (2)

- Klystron and klystron socket are manufactured.

HV relay R&D  
With Jennings Corp.



High Voltage Connection Box  
At the tentative demonstration



SCRF 100728  
(S. Fukuda)



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## Follow-up plans (toward the “Quantum beam project” and STF-II)

- In KEK, successive test plans are follows up:
  - the “quantum beam project” in 2012 and STF-II plan in 2013.
  - RF system of the DRFS will be adopted in these successive test plans to demonstrate the basic function of DRFS.
  - In the “quantum beam project”, one klystron of DRFS is used and LLRF feedback is performed with the beam.
  - In the first stage of the STF-II, 5 klystrons driven by a DC-power supply and a modulator feed powers to 10 cavities in an ILC-type cryomodule and in a “quantum beam” cryomodule with the beam operation.
  - LLRF digital feedback technology is conducted under the beam operation.
  - The FPGA board based on the micro-TCA will be installed and the vector sum control of two cavities in DRFS will be evaluated.



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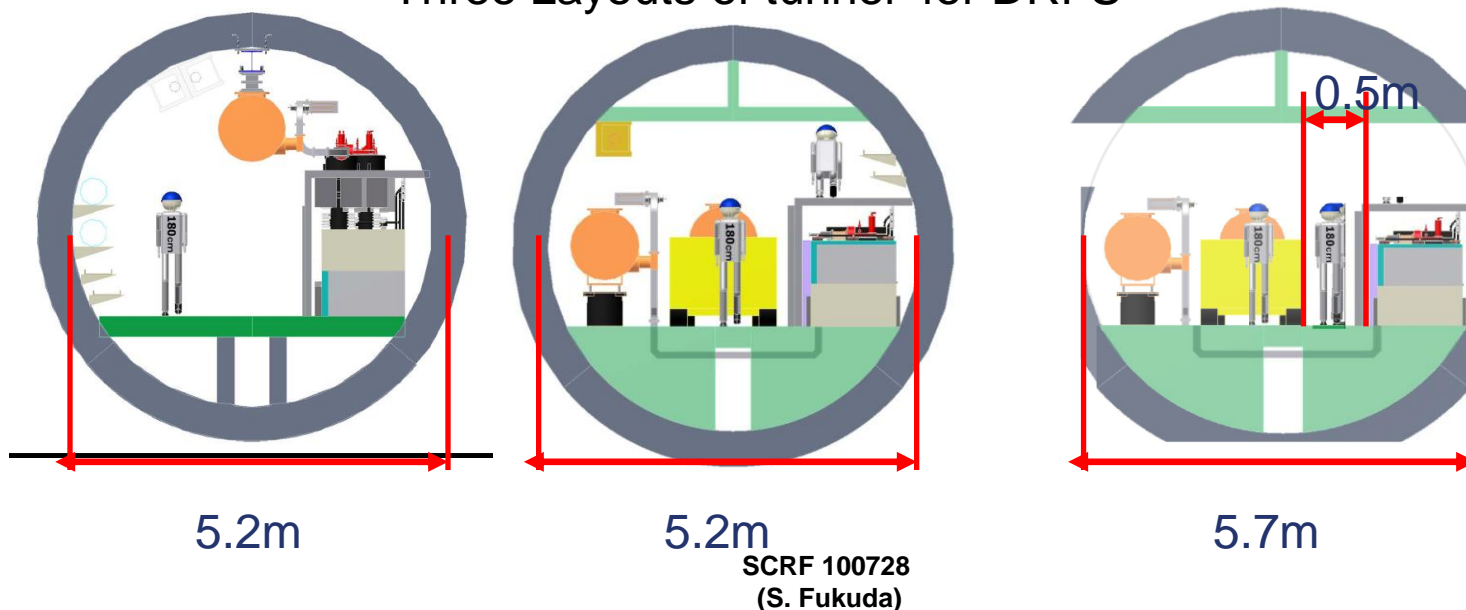
# PS / NA Modulator R&D

- In the power supply and the MA modulator, important R&D items are, :
  - (1) development of reliable and cheap HV relay,
  - (2) the reliable and cheap gap switch for the crowbar circuit
  - (3) cheap large diameter current transformer or optically sensed current monitor.
- Though enough budgets for these R&D items are approved, it is necessary to have an effort to develop these R&D.
- We try to perform those minimum R&D through the plan of STF-II in three years.

# Tunnel Layout

- Layout of the DRFS that the cryomodule is on the floor is studied in tunnel diameter of 5.2m and 5.7(5)m are developed. Especially DRFS in 5.7(5)m tunnel diameter has a 0.5m emergency egress during the maintenance and we **want to propose this scheme as the standard configuration**. Value engineering of this scheme is intensively developed.

Three Layouts of tunnel for DRFS





# Radiation Issue

- Radiation damage for the installed system requires the serious test and evaluation.
- LLRF system requires the serious evaluation for radiation damage for both the DRFS and the KCS as the common problems.
- We need to watch the X-FEL results in DESY.
- At the same time, we should make an experiment plan of the radiation shield collaborating with the KEK radiation division.

# Other Issues

- Detail scenario of installation into single tunnel will be studied in FY2011.
- Maintenance and upgrade-work ability will be studied in FY2011, including the low energy scheme with 10 Hz operation. This design work is performed by not only the simulation using 3D CAD but also fabricating **the real size tunnel model** manufactured by wood or cheap material. The end station in the underground of STF building is a candidate to make such a mock-up.
- Detailed MTBF evaluation is studied more. For klystron, the data of KEKB injector linac and newly manufactured DRFS klystron are evaluated. For other equipment, we study the individual component life utilizing the available data.