KEK test area plans

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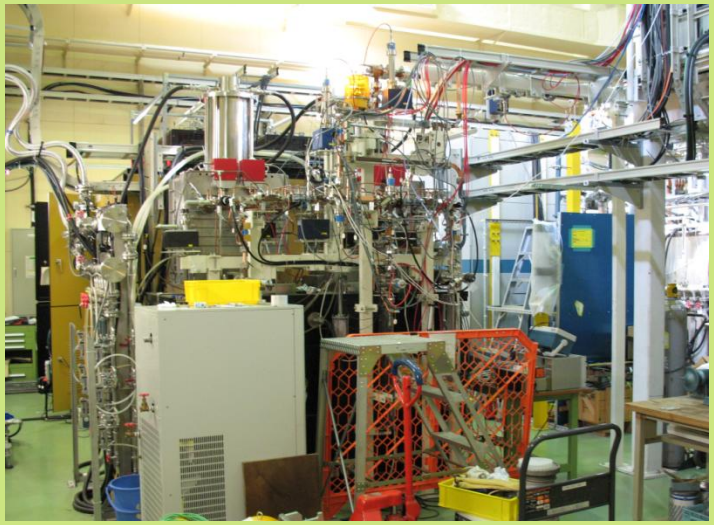
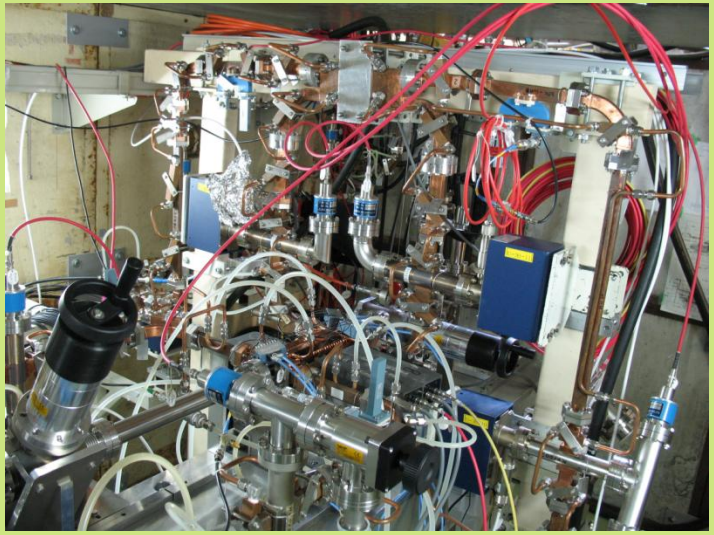
Two X-band high power stations in KEK

Nextef (100MW)

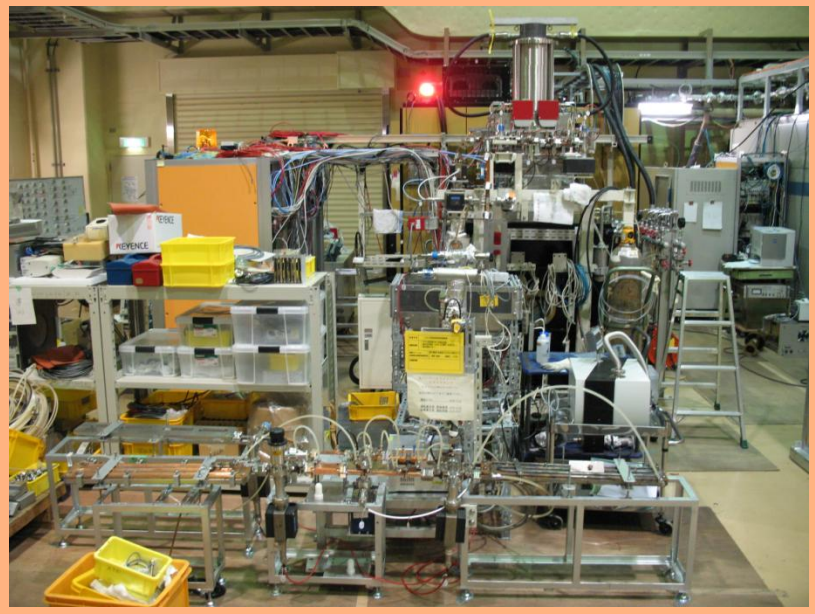


Modulator and twin klystrons



Test area in Shield-A

KT-1 (50MW)

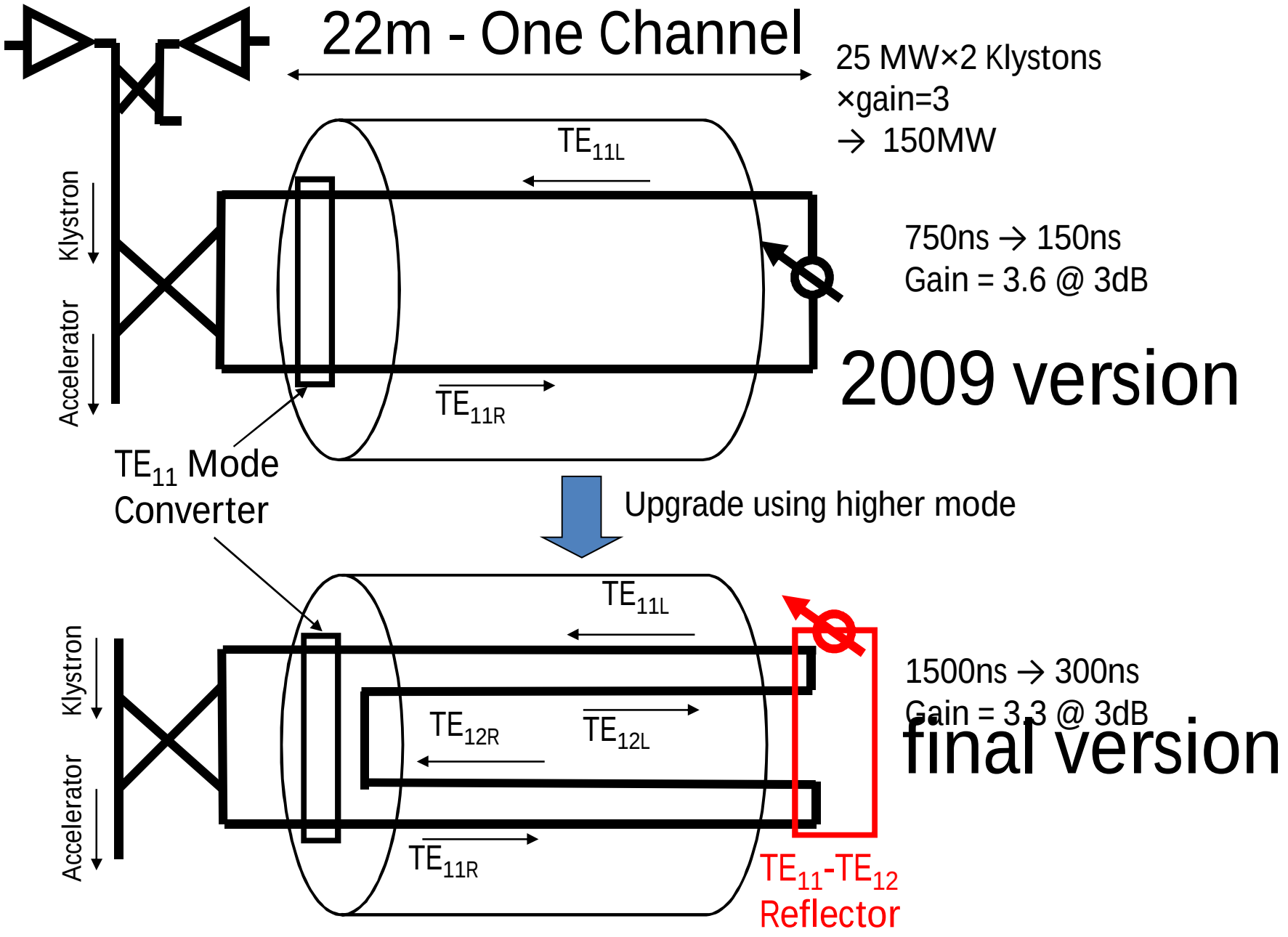


Klystron Test,
Small experiments (in Lead shield box)

What to be pursued by KEK X-band

- Practical structure evaluation and develop high power system
  - Aiming at CLIC design
    - Minimum required power and pulse width are ~ 75MW and ~ 240ns.
    - Nextef is our only choice to conduct this work. These parameters are just we are operating. Introducing power compression system is needed beyond these.
- Basic research on high gradient
  - Study with: Single-cell, Narrow waveguide, C10, CD10, …
    - Required the power as low as10MW to very high >>100MW with pulse width ~500ns.
    - KT-1 is suitable for these works . We may use Shield-B with Nextef klystrons.
- Development of components and devices
  - load, directional coupler, …, Klystron, …

Pulse Compressor (circular TE11 / TE21) proposed by M. Yoshida.



Gycom High-Q Cavity PC

Our colleague, Sergey Kuzikov from GYCOM, Nizny-Novgorod, Russia have proposed extremely interesting design of the cavity pulse compressor. The main features:

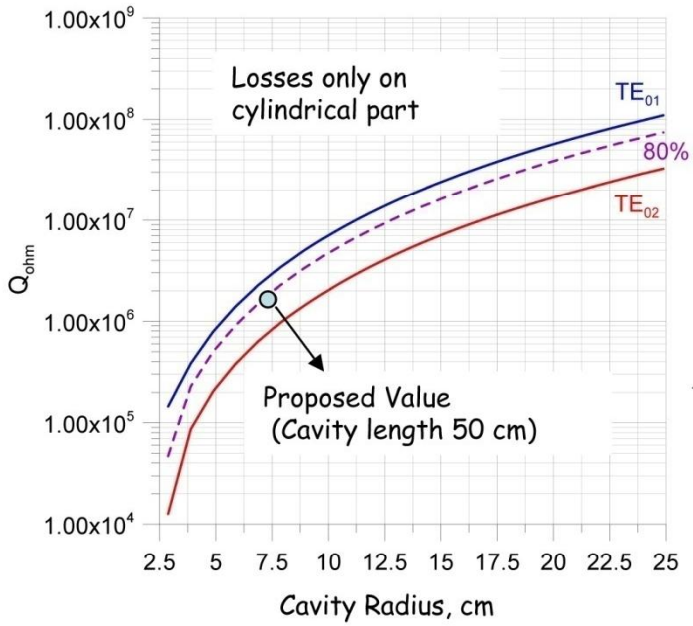
Big cavity volume with mixed-modes oscillation will provide enough Q-factor (~ 2x105).

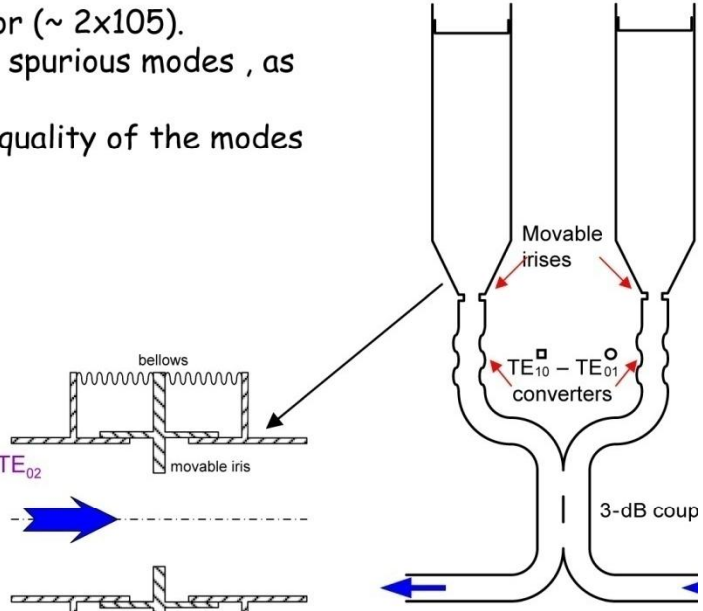
#The nature of the mixed-modes field pattern allows for the damping of the spurious modes , as well as for installation of the sufficient pumping of the cavity volume.

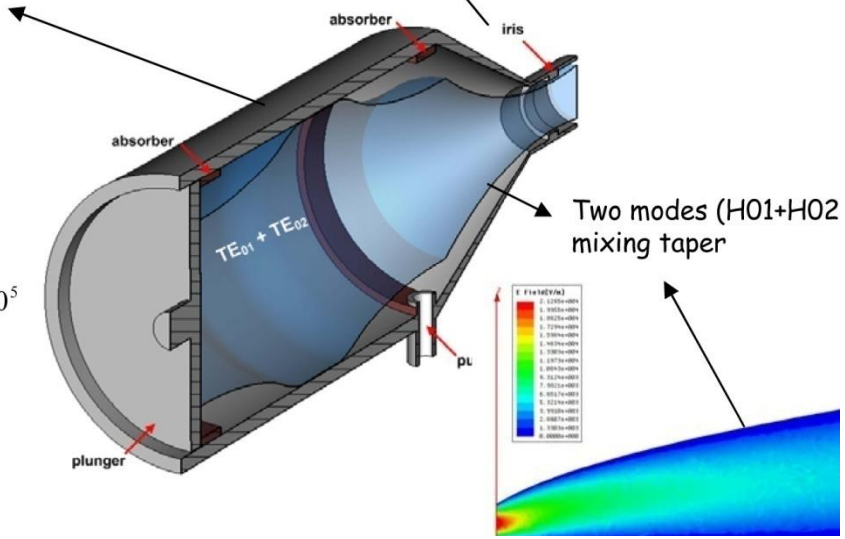
#The clever idea – to use the iris position as a frequency tuner will keep the quality of the modes mixing unperturbed during tuning procedures.

#The overall design looks very simple and inexpensive.

#He confirmed that they are interested in building the device for us.





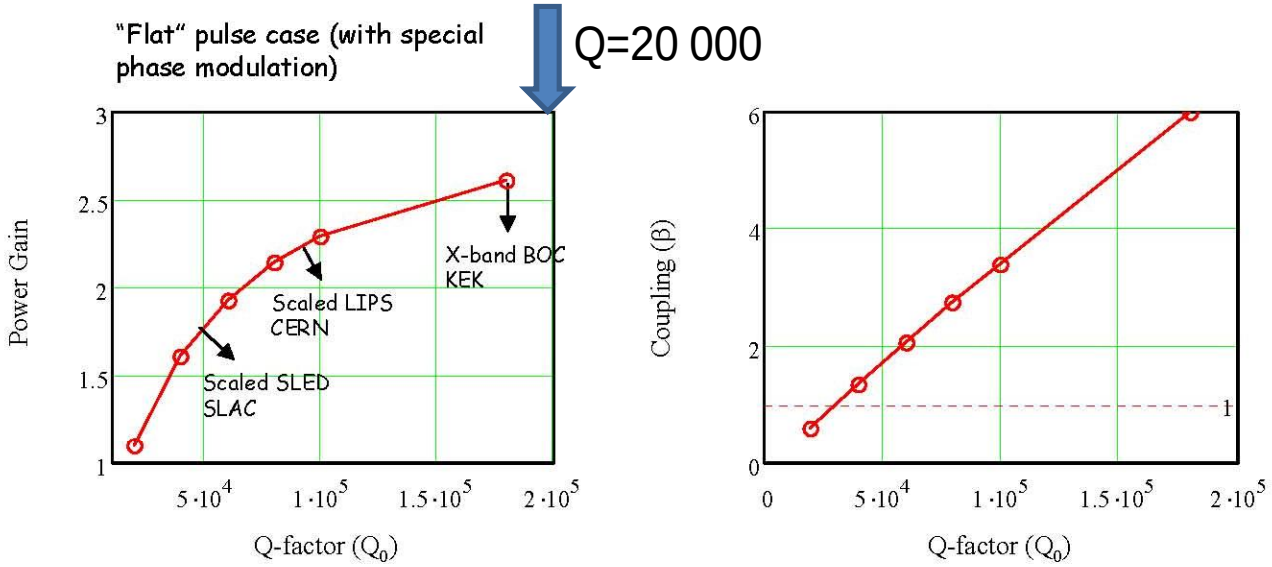


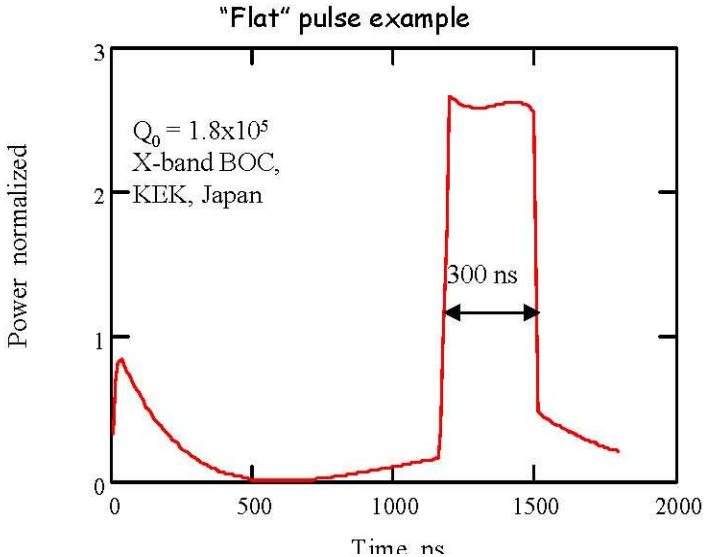
$$Q_{ohm} = \frac{2kl}{2P_w + 2P_{con} + P_{iris} + P_{plunger}} = \frac{365}{2\cdot 4.2\cdot 10^{-5} + 2\cdot 1.5\cdot 10^{-4} + 1.5\cdot 10^{-4} + 3\cdot 10^{-4}} = 4.4\cdot 10^5$$

$$Q_{diffr} = \frac{365}{1\cdot 10^{-3}} = 3.7\cdot 10^5$$

$$Q_0 = \frac{Q_{ohm}\cdot Q_{diffr}}{Q_{ohm} + Q_{diffr}} = 2\cdot 10^5$$

12 GHz, cavity-based pulse compressor (SLED or BOC); compression: 1500 ns -> 300 ns





Discussion:
The cavity with Q-factor above 80 000 will be sufficient to provid
100 MW flat pulses from 50 MW klystron.

- The SLED cavities (cylindrical H_{0NM}) are at their performance lir
the Q > 100 000 is very challenging.
Another challenge is a rather small coupling factor (~3) and as a
consequence – the small diameter coupling holes in 100 MW device.
Still possible!?
-The BOC cavity (moderate version) can easily provide 150 000 (18
000 was demonstrated in high power BOC version in KEK). + Distrib
coupling (many (~40-100) holes)

Proposal
Pulse compression systems

Construct Yoshida PC of “final version” (double-mode version). The compressed power goes to Shield-A for the structure test.

Test of High-Q Cavity PC at Nextef. The (maximum) power of 50MW with 1.5us will be available for the test.

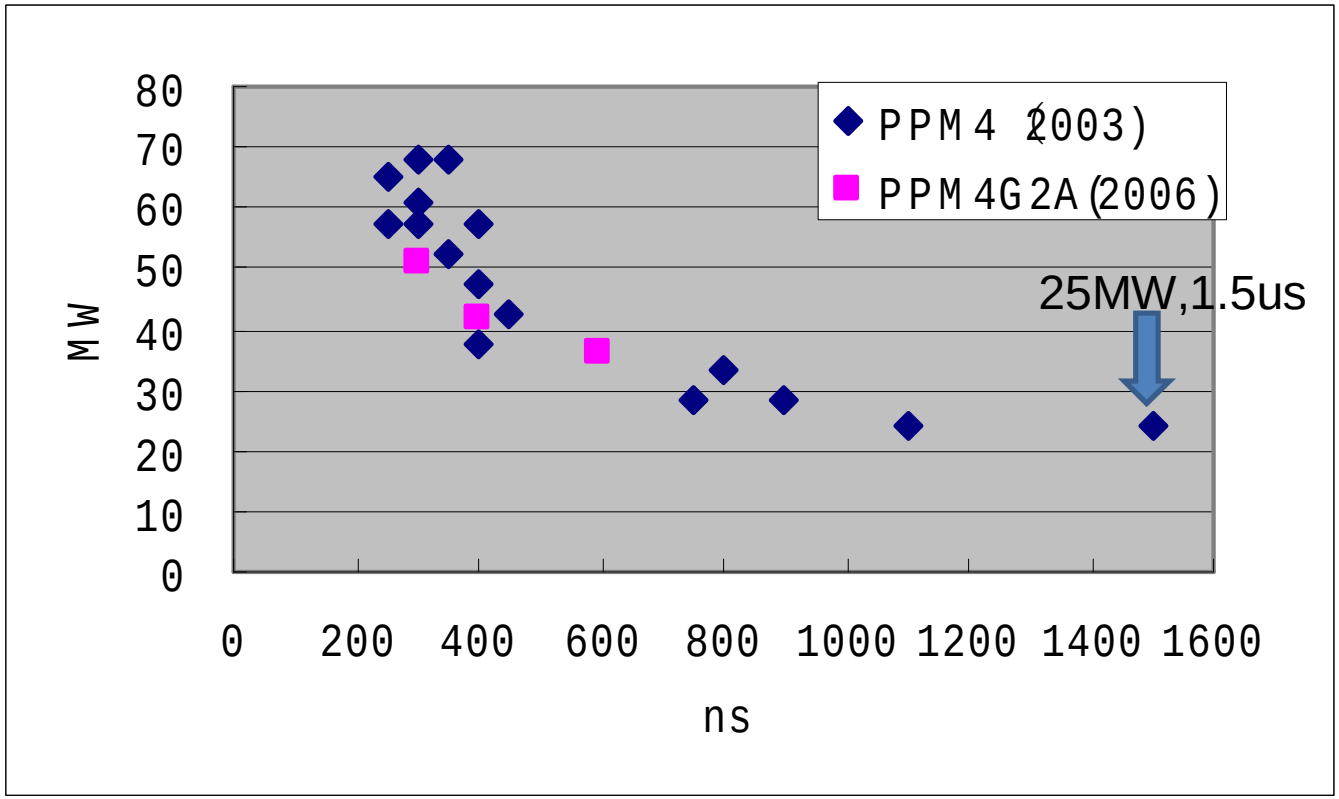
High-Q Cavity PC may be installed at KT-1.

Pulse compressors

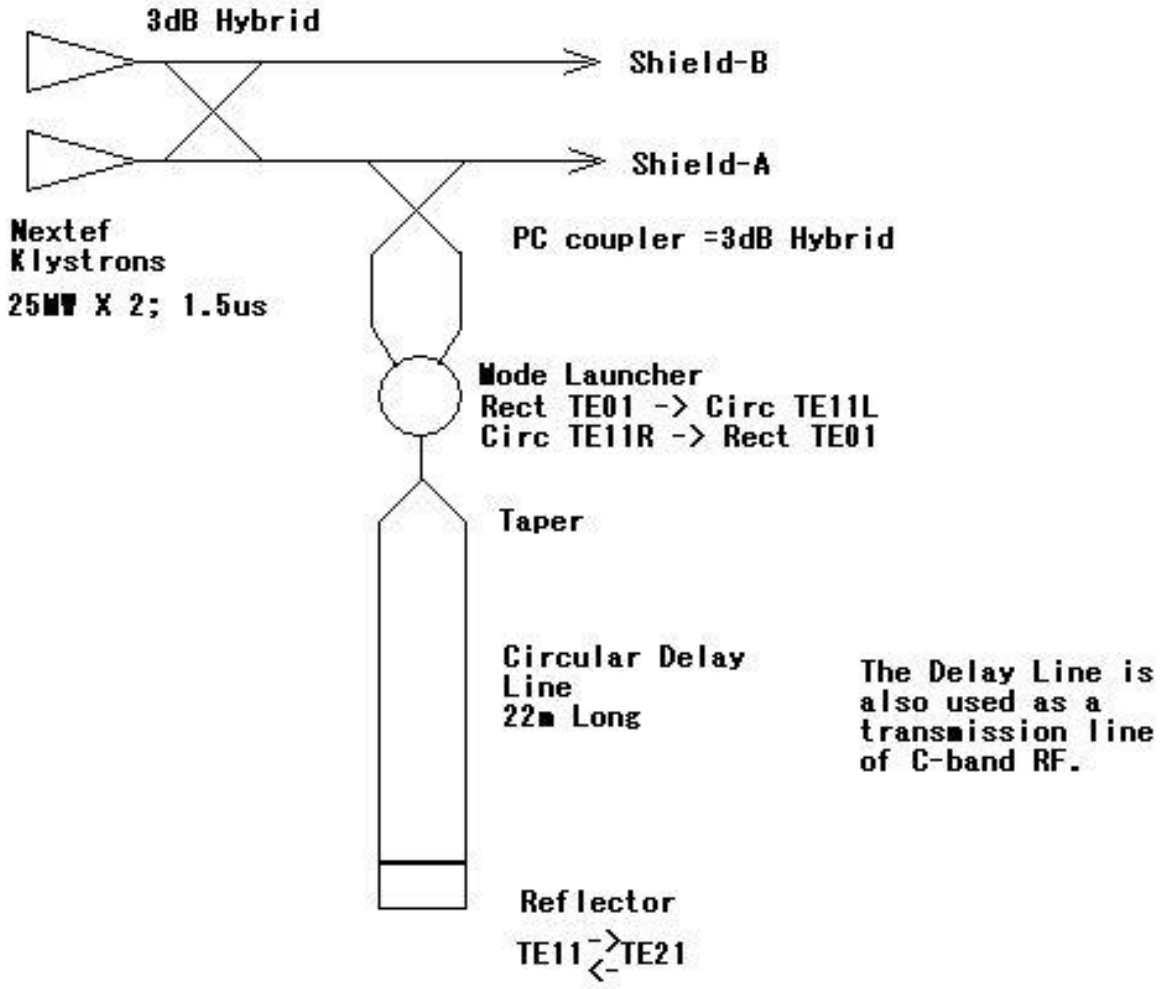
Nextef		KT-1	
Source RF	Compressed (Gain=3)	Source RF	Compressed (Gain=2.5)
1500ns	300ns	1500ns	300ns
25MW X 2	150MW	25MW	60MW
	Yoshida Delay Line PC with Double Modes		Gycom High-Q cavity PC

Comment : Practical operation limit of PPM Klystron

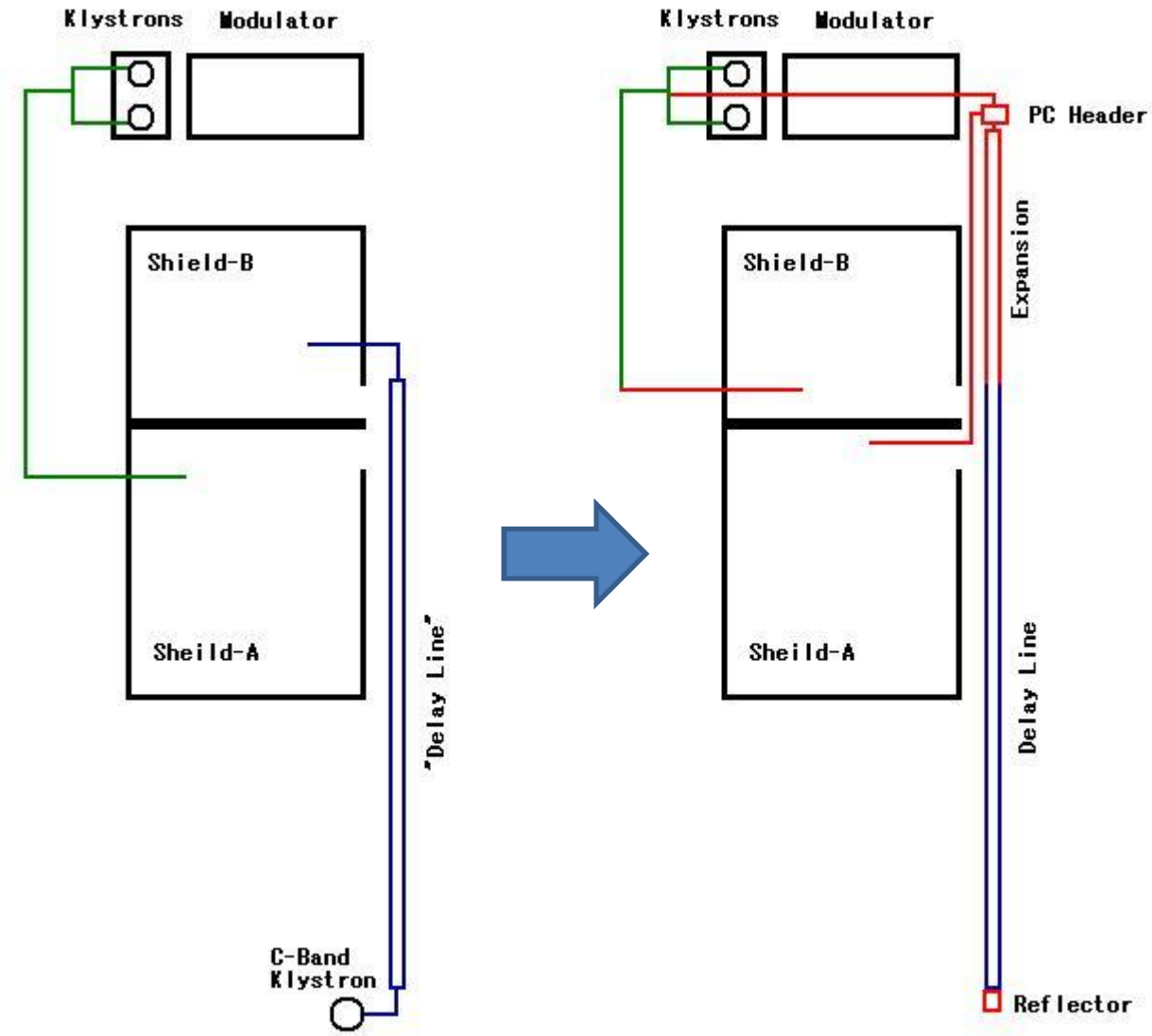
Plots of Pulse Shortening Events on Power / Width plane.



TE11/TE21 PC Configuration



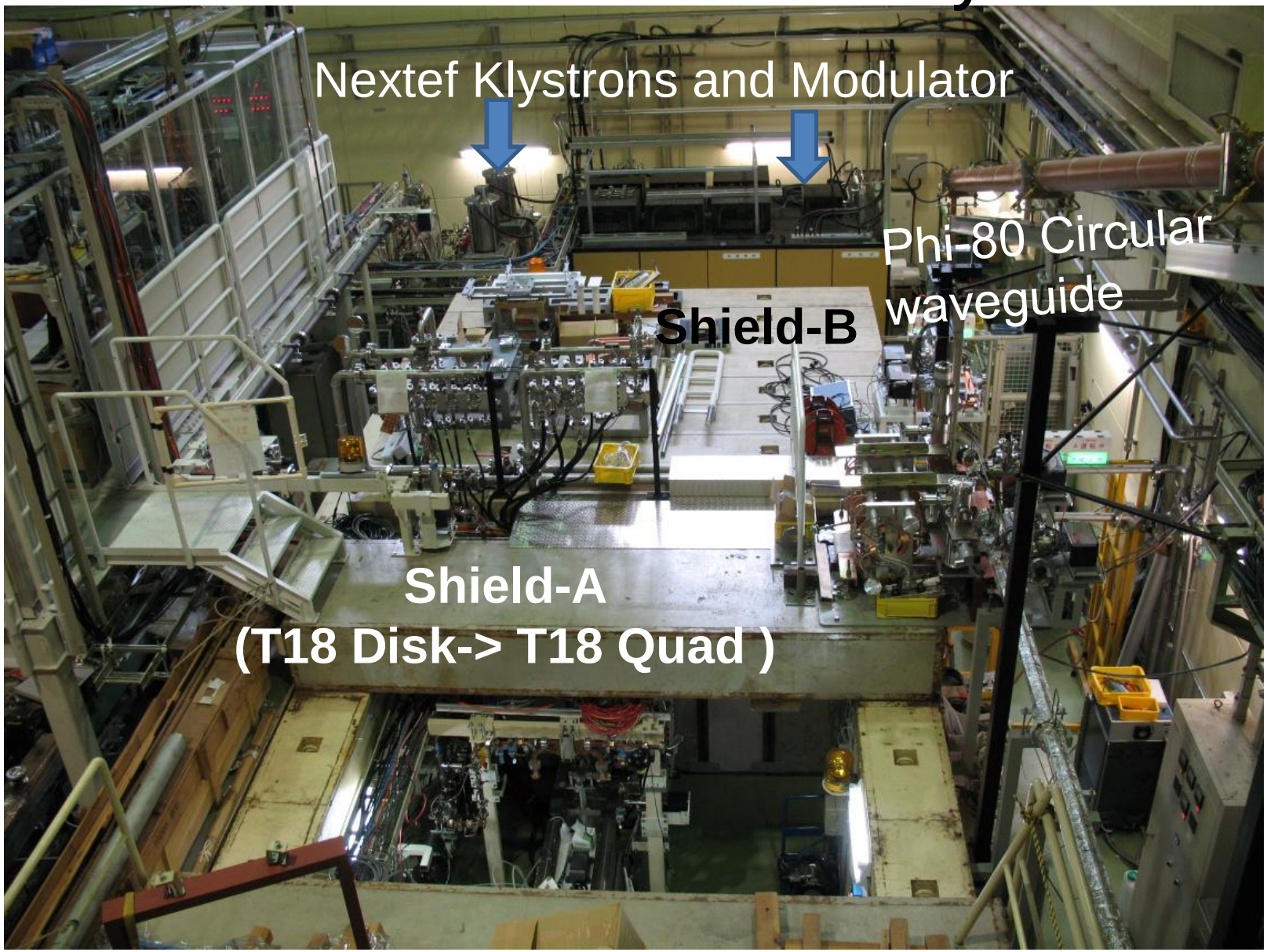
Reconfiguration of transmission lines



Current configuration

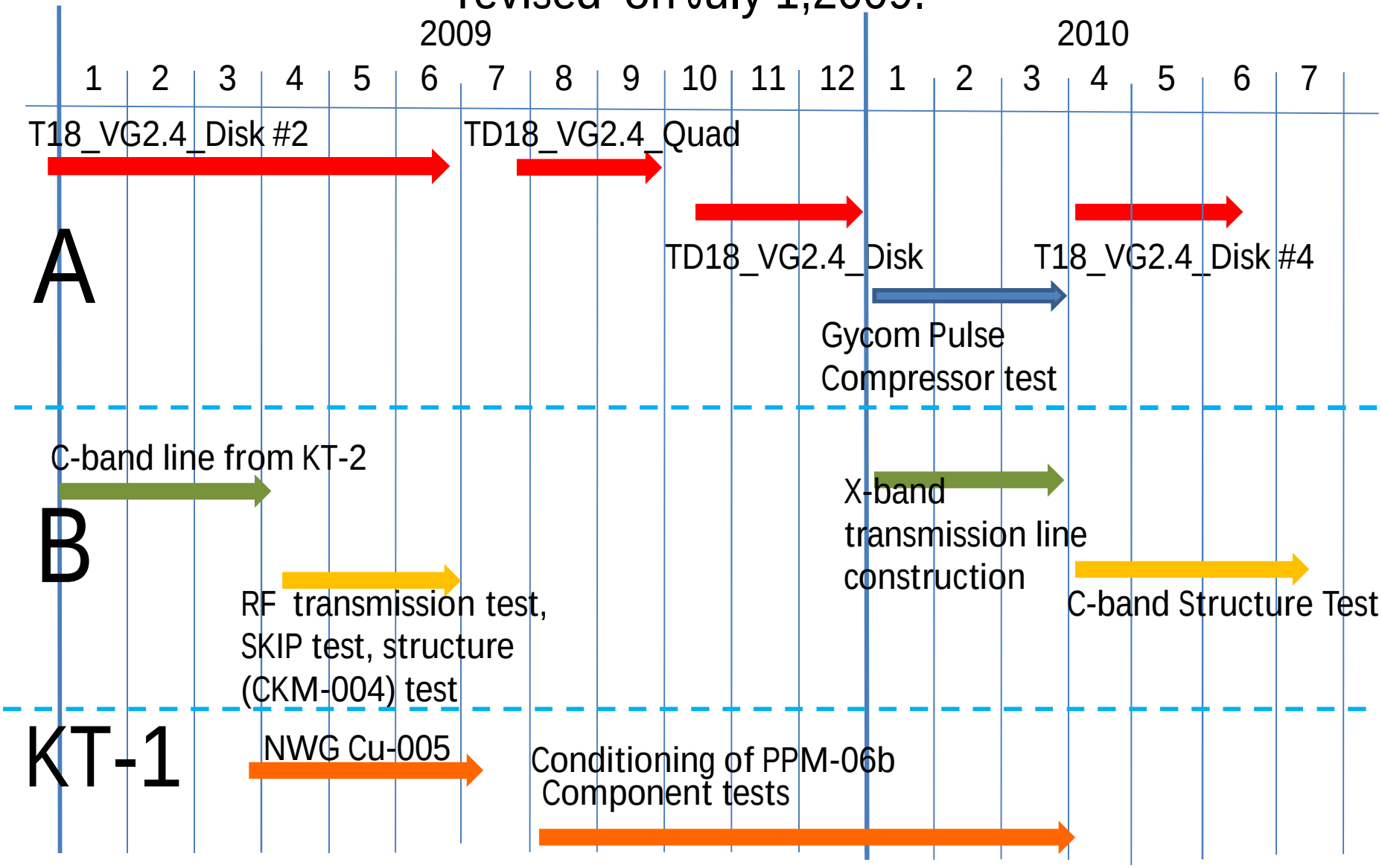
Proposed configuration

Nextef Area as of July 3.

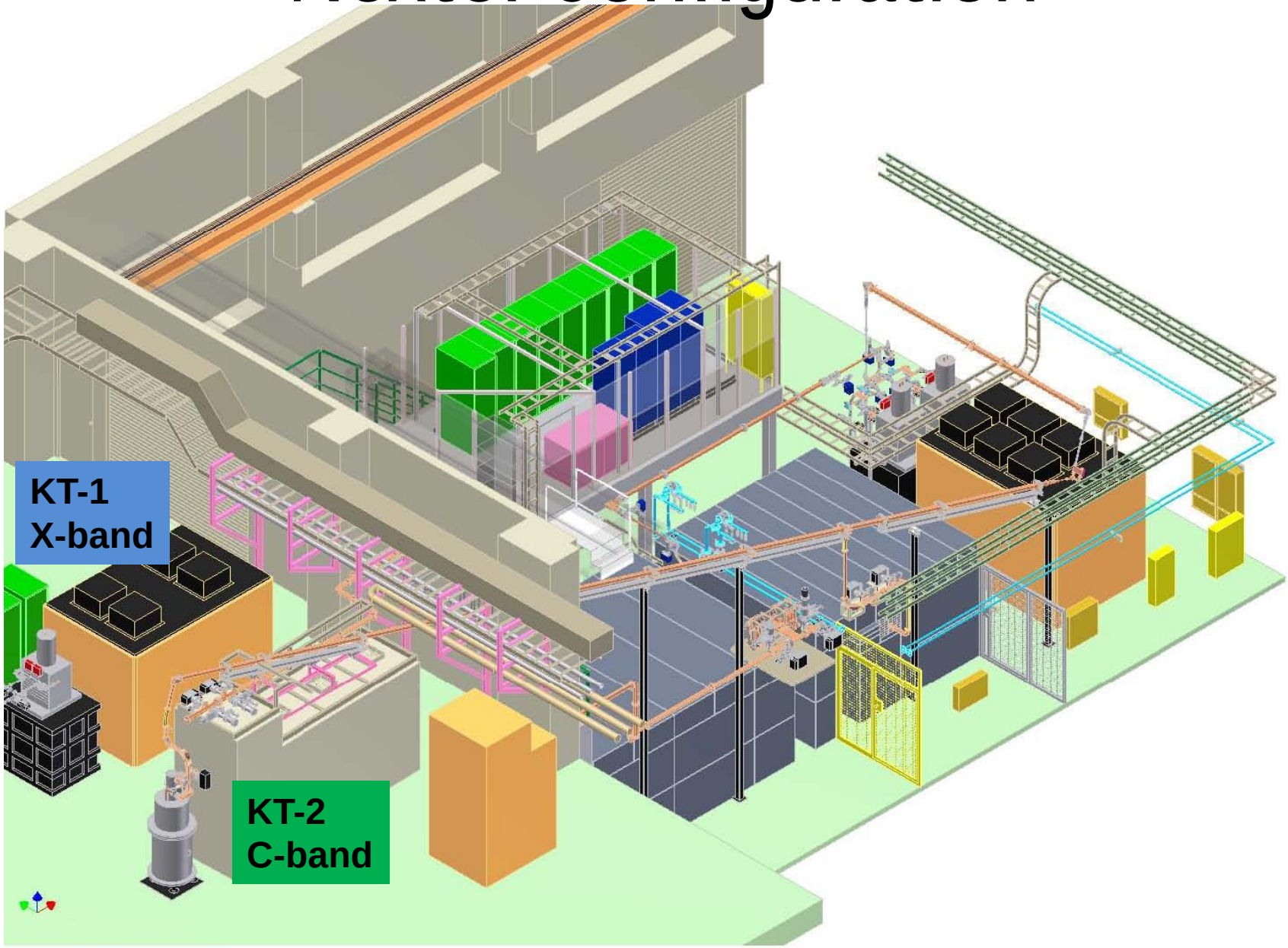


Nextef Planning

revised on July 1,2009.



Nextef Configuration



Conclusion

Nextef

Sheild-A:

•We continue X-band structure tests.
•Delay Line Pulse Compression system will be installed in FY 2009. 150MW 300ns pulse is expected.
• DLPC starts operation in early summer 2010 after a 2m-long C-band structure test. (The test starts in April 2010. Note the test occupies the delay line.)

Sheild-B:
•X-band power line will be established from Nextef klystrons.

KT-1
•Continues tests of RF loads as well as klystron test.
•Install Gycom Cavity PC after its test(proposal).

Nextef planning (longer period)