Nextef
Status of high gradient experiment

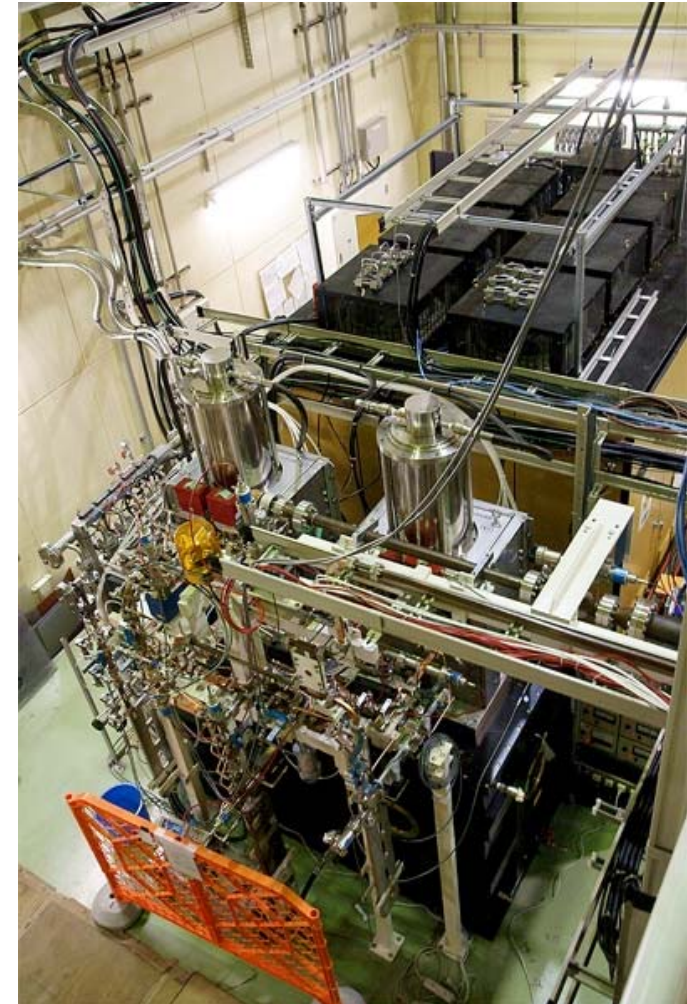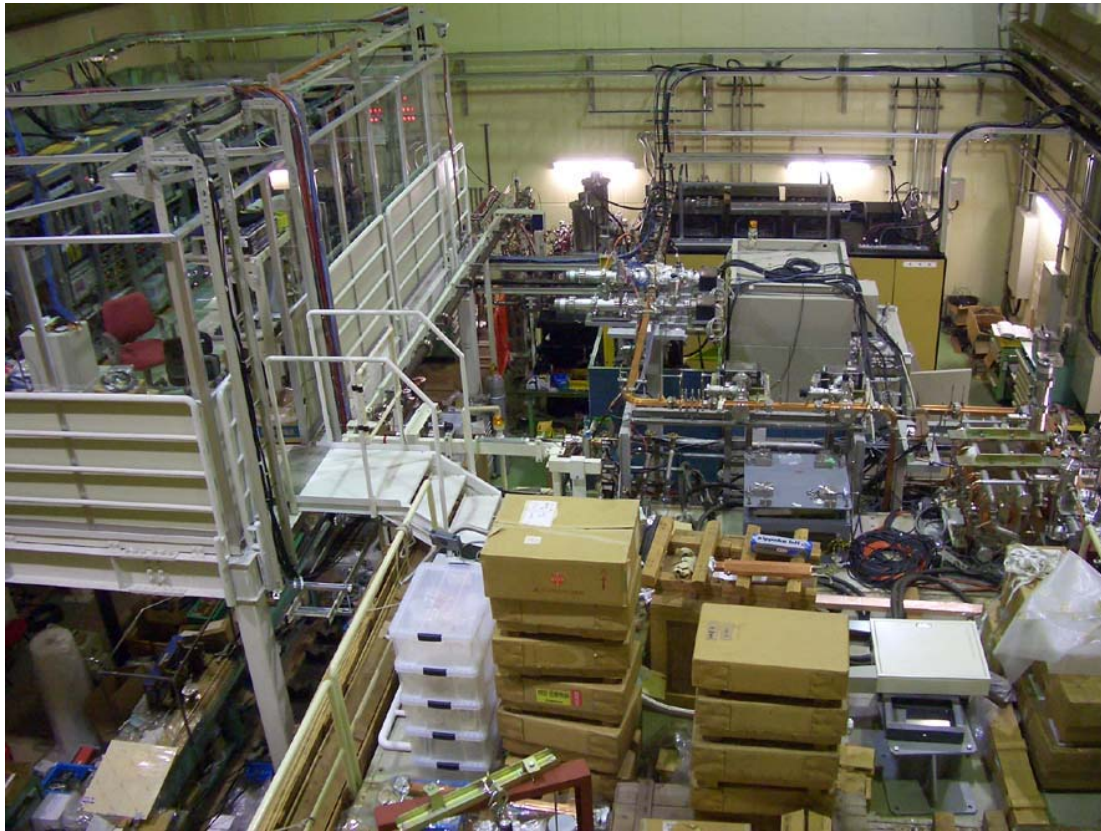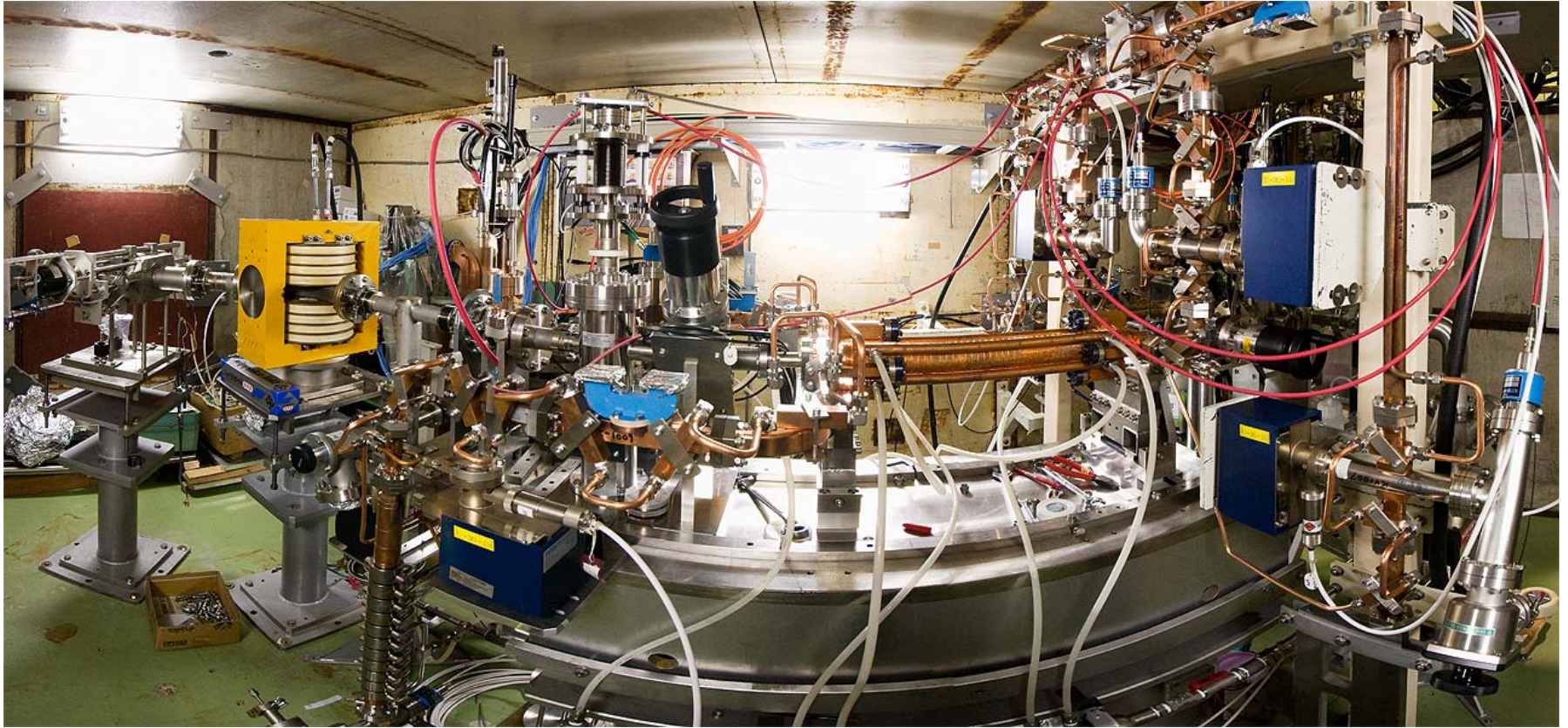# Nextef progress
Establishing power generation and transport in 2007

Nextef inside shield room
most basic components are now in line.

Nextef planning

2008
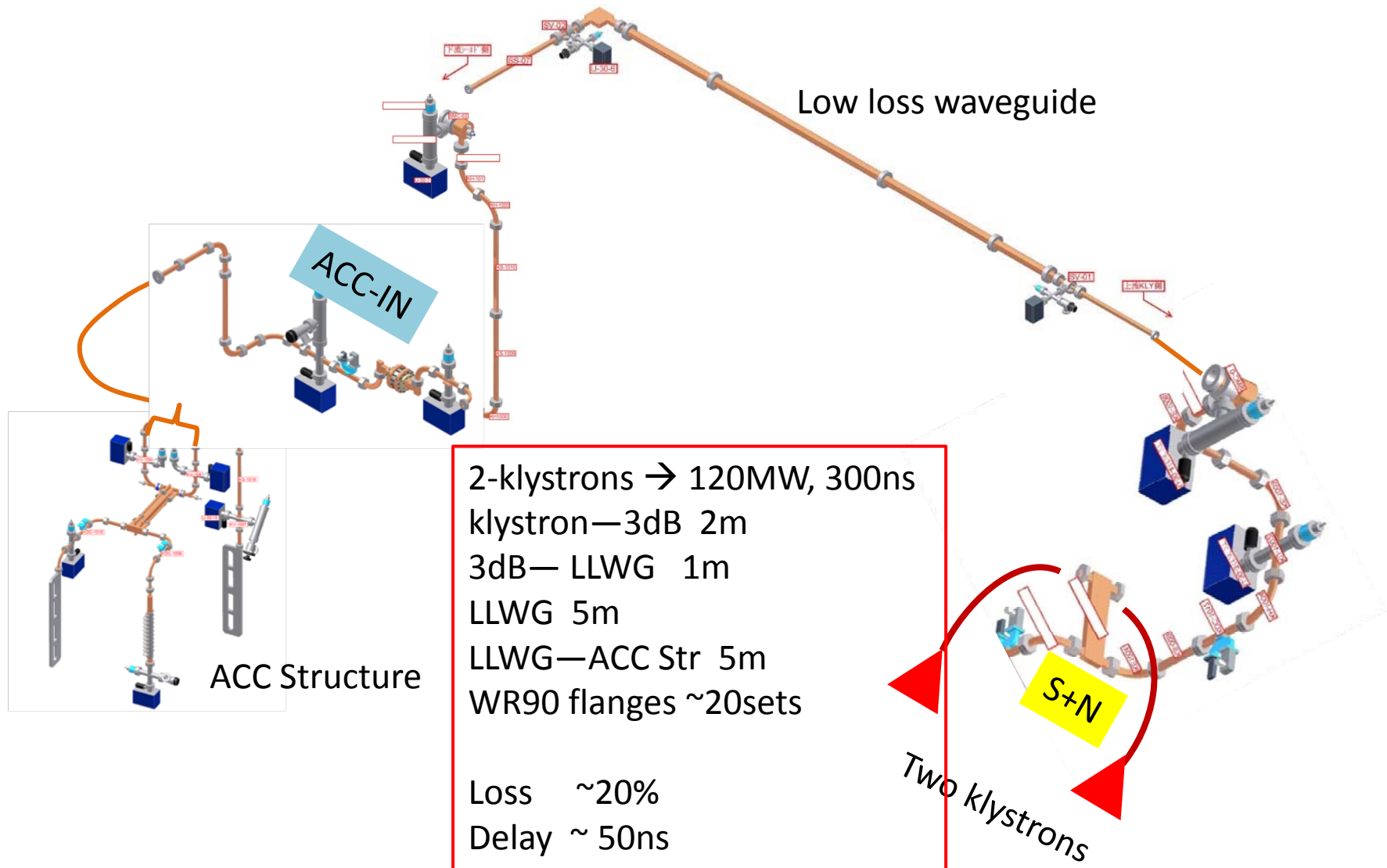
2009

| 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |

Establish system with KX03

T18_VG2.4_Disk #2

TD18_VG2.4_Quad

TD18_VG2.4_Disk

T18_VG2.4_Disk #3

T18_VG2.4_Disk #4

?????

C-band test at same place
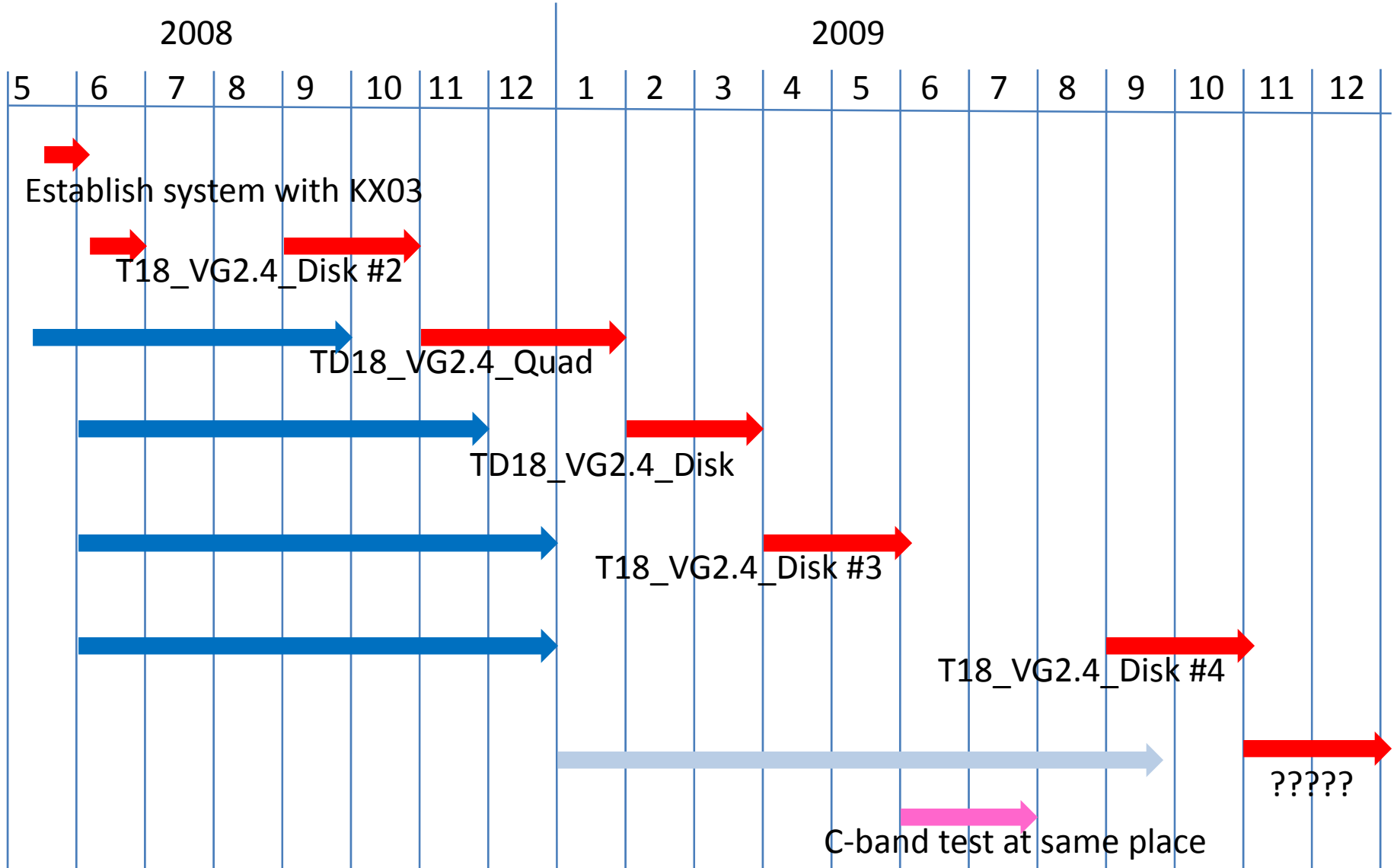
What are needed for Nextef

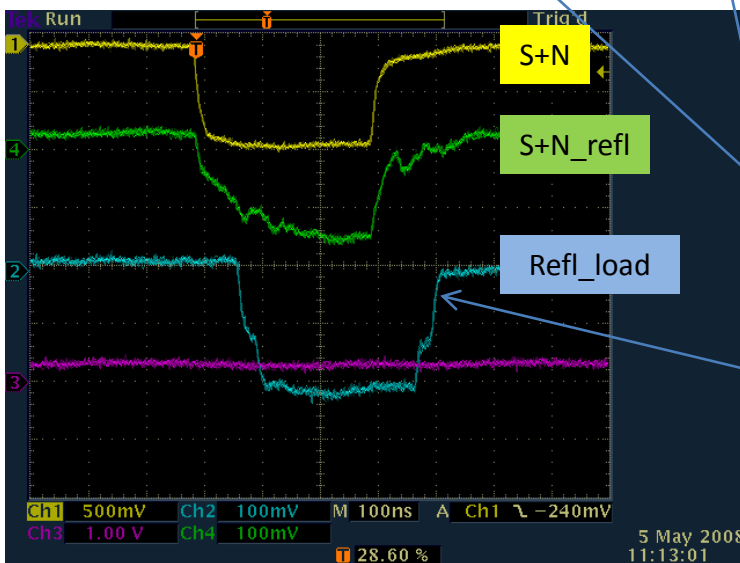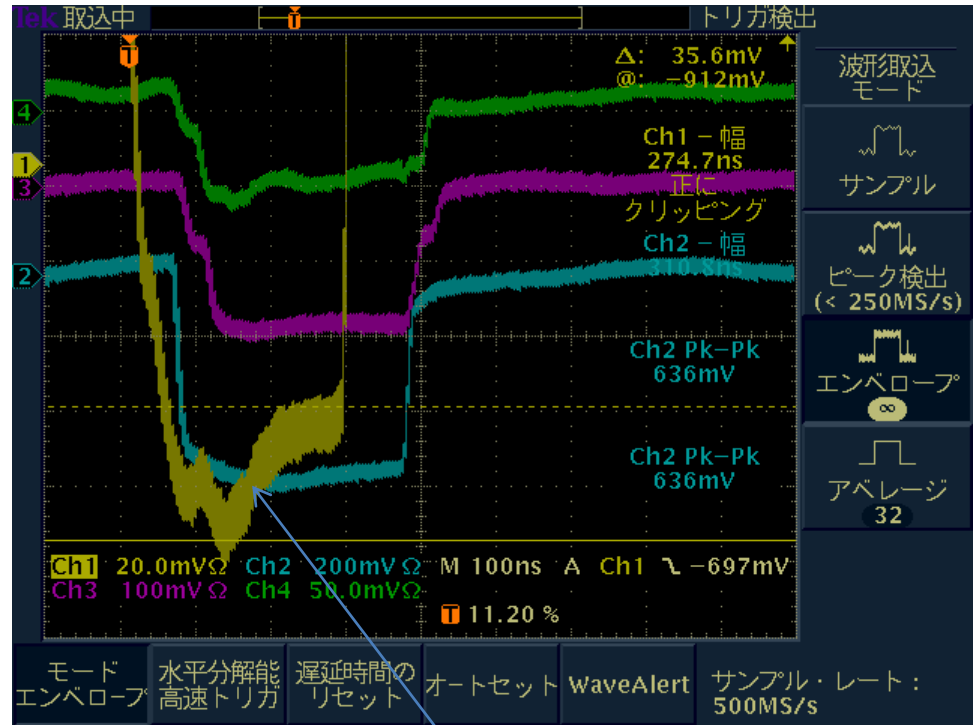- Enough power, 55MW, 300ns at accelerator structure, CLIC_VG1, for 100MV/m
- Square RF pulse with variable width
- Operation and each RF pulse analysis at 50Hz
- Stable operation with BRD < 1BD/hr at most
- Proper control program based on the well-defined processing protocol
- Identification of breakdowns, distinguishing either at structure or outside

Nextef Nominal RF power line

Low loss waveguide

ACC-IN

ACC Structure

2-klystrons → 120MW, 300ns
klystron—3dB 2m
3dB— LLWG   1m
LLWG 5m
LLWG—ACC Str 5m
WR90 flanges ~20sets

Loss   ~20%
Delay ~ 50ns

S+N

Two klystrons

Nextef operation without structure
RF shape at 50MW, 300ns, 50Hz
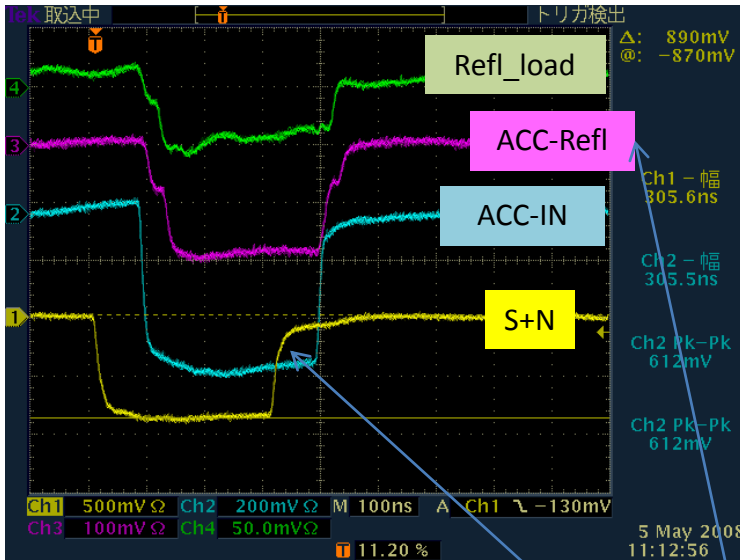
Shape rise and
fall and flat top

Refl. From load

2mV / 89mV
= ±0.4mW / 11mW
= ±4%

Base line jitter or actual?

Nextef recent typical operation

Blue ~ ACC-IN[MW], Pink = Load Vacuum, Green = Combiner vacuum
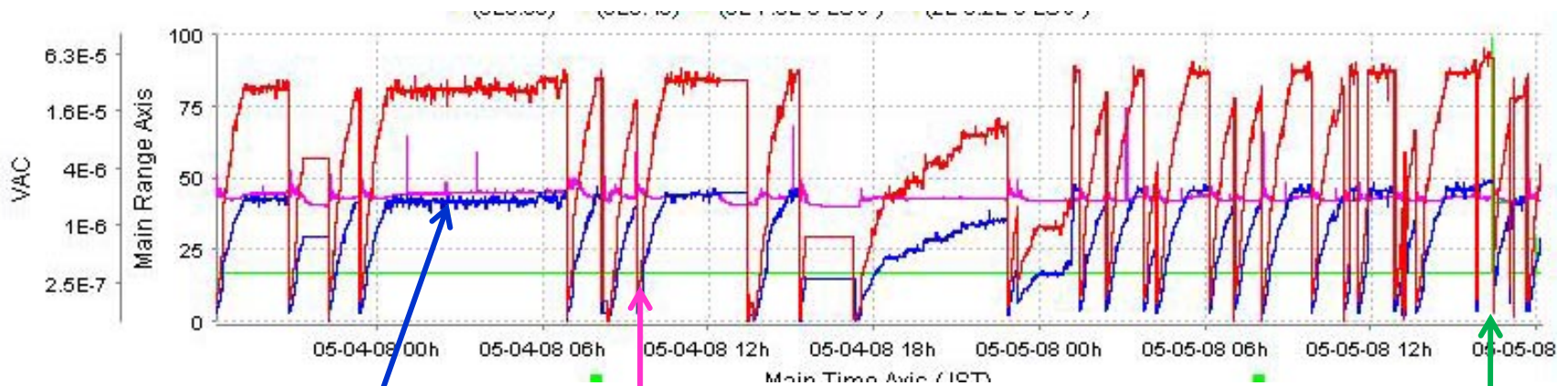
Stable operation at 50MW level

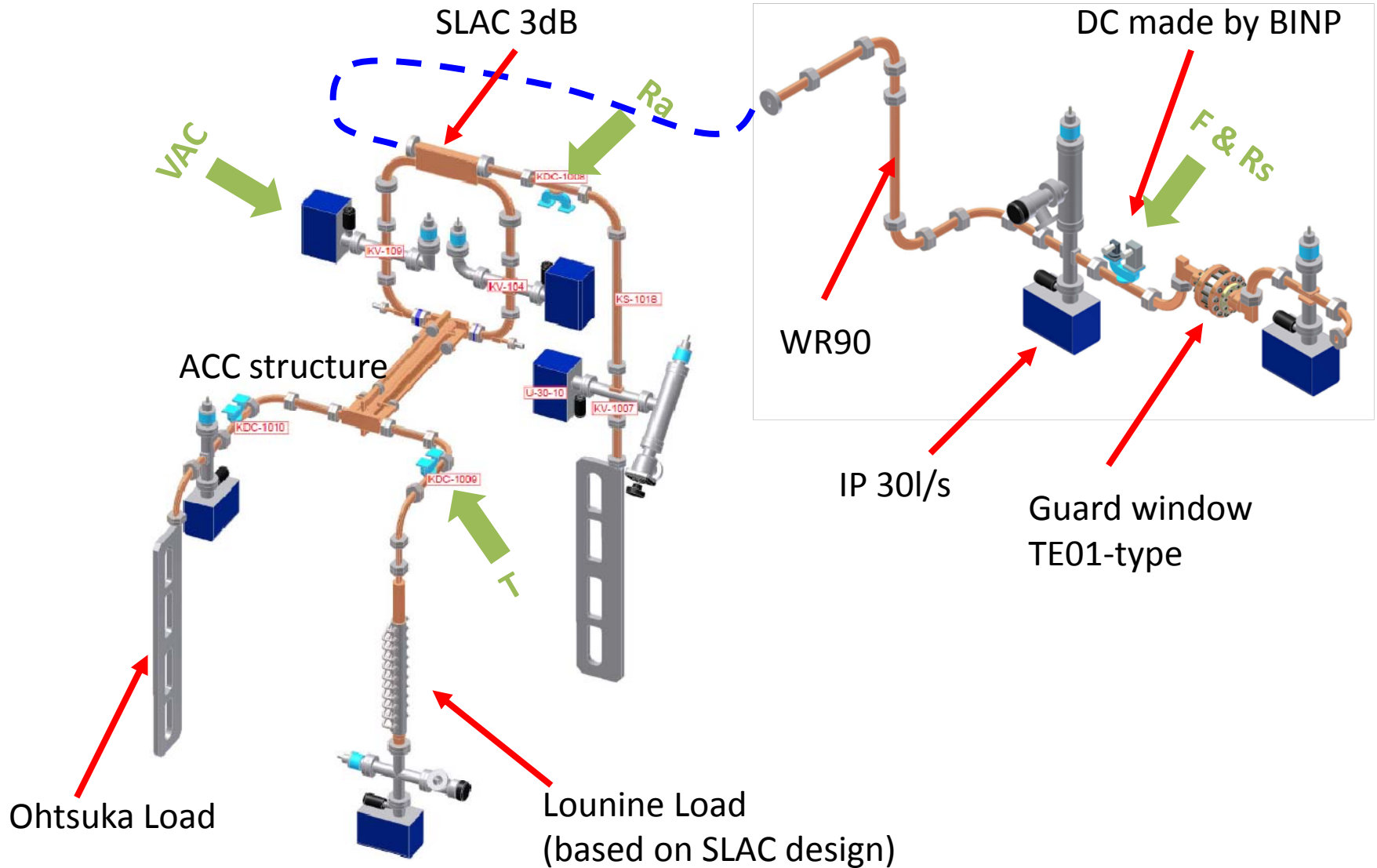Load vacuum jump with reflection from load

Rarely but sometimes vacuum jump near combiner 3dB, with big reflection to klystrons

Readiness of components

- Nextef: Refer to Matsumoto's talk

- Klystrons are tested at 60MW for 300nsec pulse, which makes the combined power of 120MW.

- 3dB hybrid or WR90 waveguide components are sometimes arcing at 50MW level now. This needs to be conditioned out or identified to distinguish from the events due to accelerator structure.

- Loads are subject to damage due to high pulse energy operation. Proper loads are to be used for the loads downstream of accelerator structure.

Nextef: Nominal observables along waveguide

SLAC 3dB

DC made by BINP

Ra

VAC

WR90

IP 30l/s

Guard window
TE01-type

F & Rs

ACC structure

T
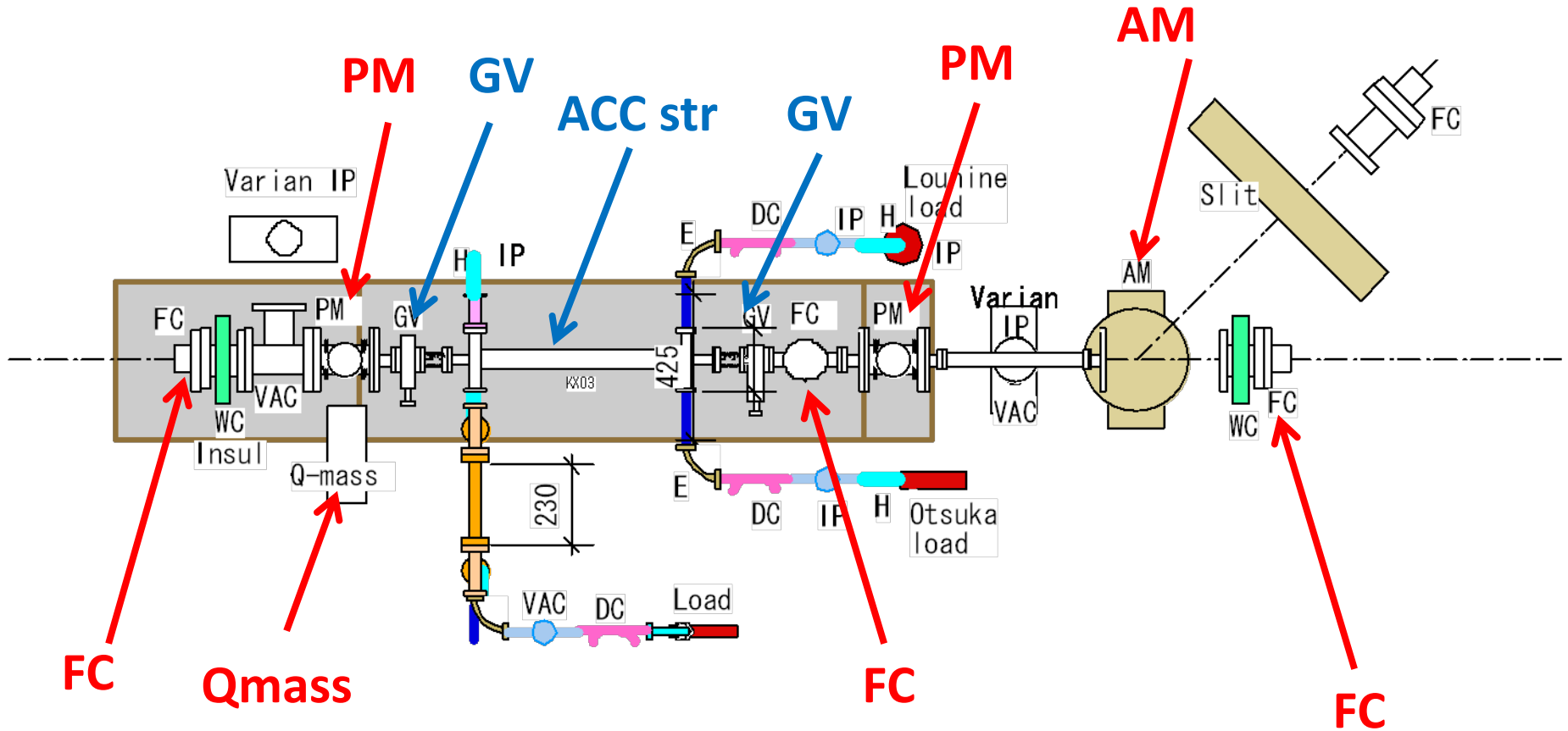
Ohtsuka Load

Lounine Load
(based on SLAC design)

Beam-line setup
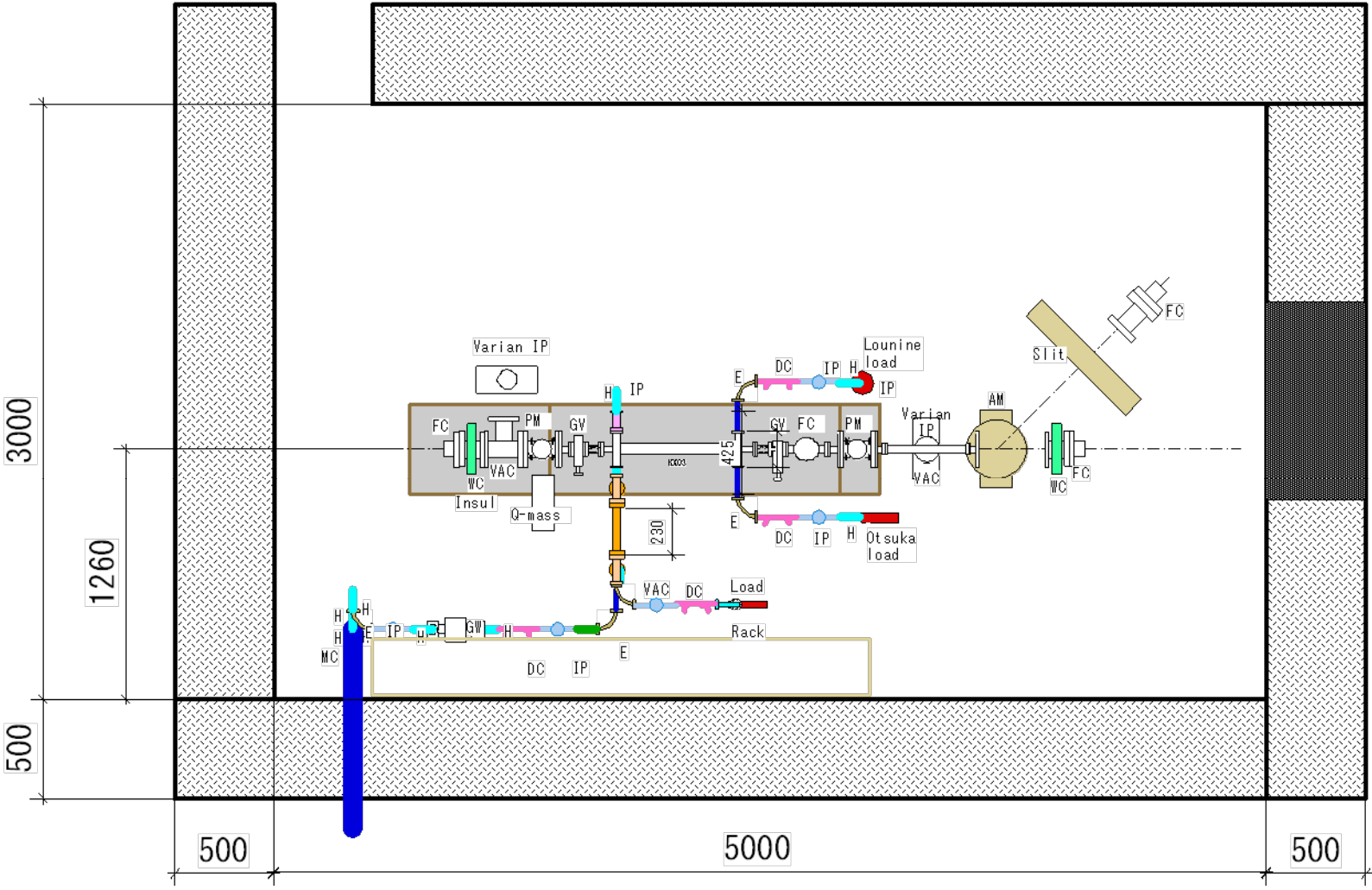
Nextef Beam line and waveguide configuration

Nextef: observables along beam axis

Preparation status of sensors

- **RF pulse: crystals**
  - Combined, ACC-input are being monitored as feed RF power.
  - F, Rs, Ra and T will be detected with crystals. Each pulse will be analyzed with 7000 series Tektro oscillo. Oscilloscope data taking is under development at KT-1.
- **VAC : cold cathord gauges**
  - CCG monitors are working at various places of WR90 and two points of beam line
- **Dark currents: Faraday cups, analyzer magnet and profile monitors**
  - DC current measurement wit FC is our typical.
  - Transient response of FC is yet to be confirmed.
  - AM should work without problem.
  - The response of profile monitor is not checked after many years idling.
- **Acoustic sensors**
  - Sensors are those from SLAC and used at XTF.
  - VME modules are under preparation for operation.
- **Photomultiplier and scintillator**
  - A few lead-shielded sets are prepared.
- **Q-mass**
  - Operation should be checked.

Various detection tools are to be integrated into Nextef control system
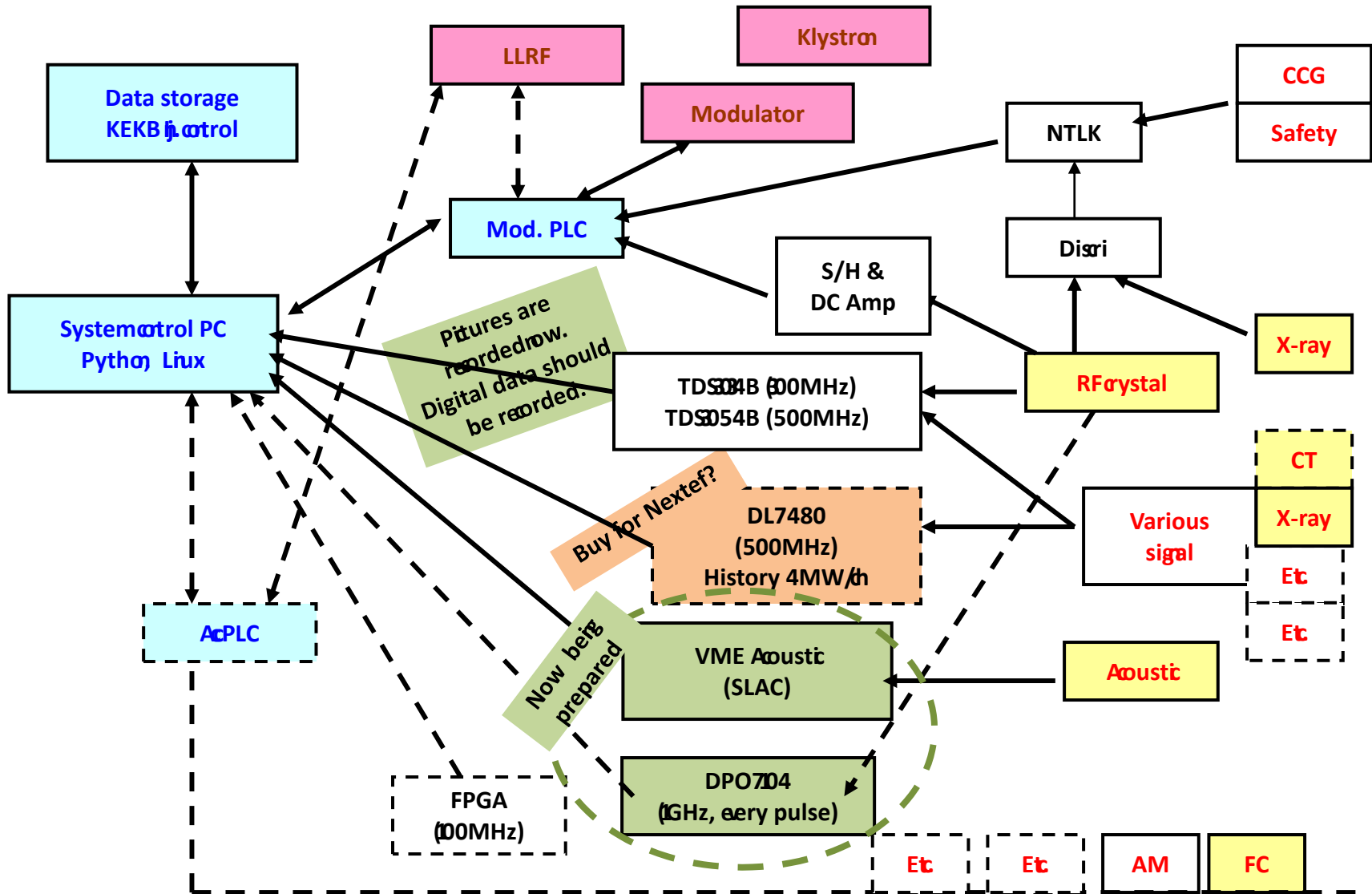
Nextef to be done for breakdown detection system

- Tektro 7104 pulse-to-pulse analysis
  - Take experience at KT-1
  - Establish the threshold and other parameters
- RF pulse at all points
  - Identify the breakdown position in Nextef system
  - Digital data taking and analysis as needed.
- VME modules
  - Restart operation program similar to XTF
  - Use as positioning of arc in the system or in the structure.
- FC, AM, PM, PMT, Q-mass operations
  - Basic performance should be confirmed. With actual signal or with other source?

- Red-marked items should be from the beginning of CLIC_VG1 test.

Conclusion

- Nextef power rating is now ~50MW, 300ns, 50Hz level with less than 1BD/hr.

- We need to establish the detection system in May with KX03.
  - In breakdown detection and analysis at the input power level of 50MW or more.

- We want to start CLIC_VG1 before summer shutdown of KEKB.
  - Some incompleteness of the system should be tolerated, as long as essential features, such as power evaluation, processing protocol and identification of breakdown, are confirmed.

- We try to operate the Nextef as effectively as possible within the KEK regulation.
  - Hopefully run during shutdown but we admit it not easily be realized.