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The KOMAC Accelerator Facility

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Outline

KOrea Multi-Purpose Accelerator Complex

- PEFP
- Facility Introduction
- 100MeV Linac Commissioning
- Applications
- Conclusion

PEFP: 1st phase of KOMAC

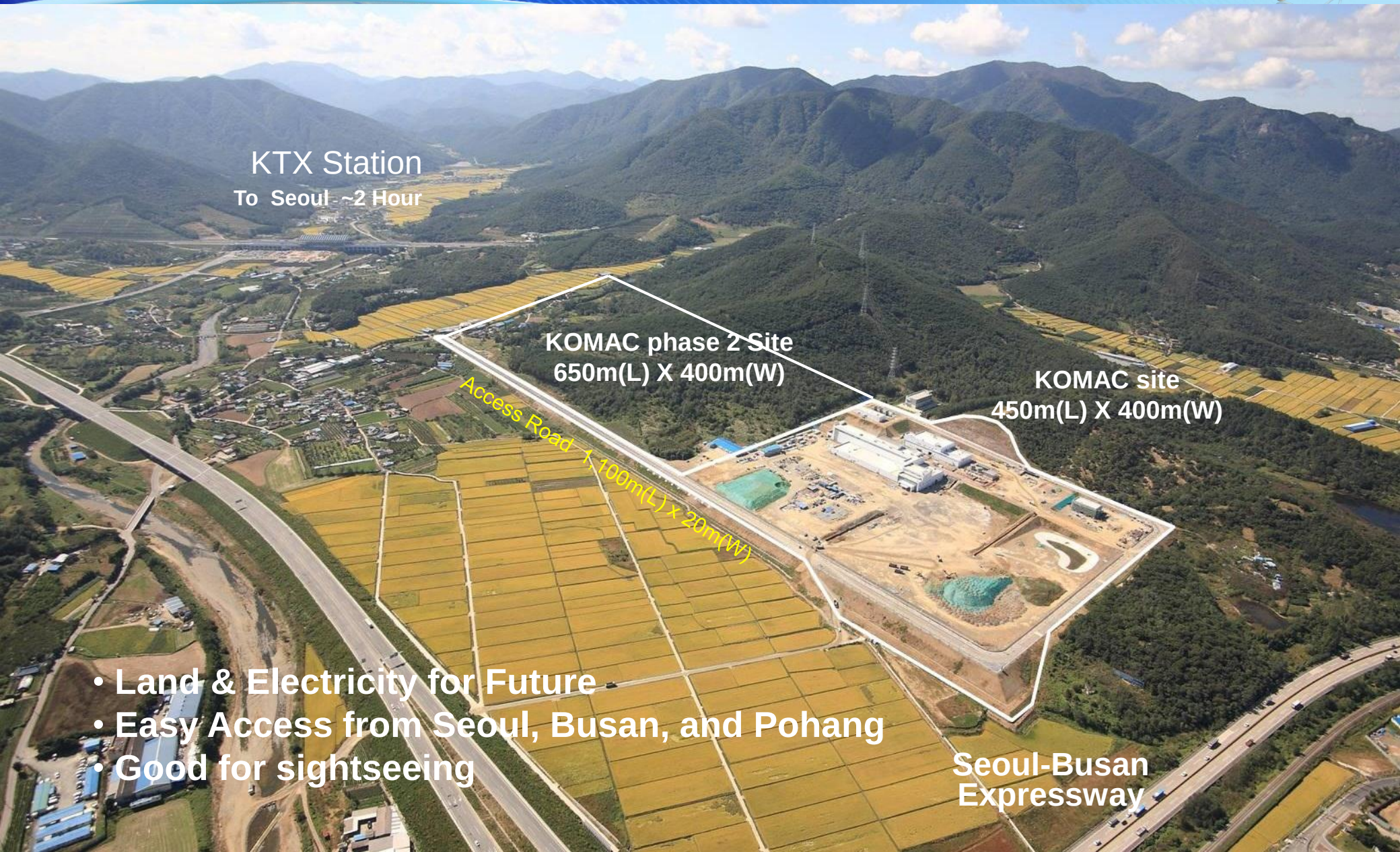
❖ Proton Engineering Frontier Project

- Period: 2002.7 ~ 2012.12 (10.5 Year)
- Total Budget: 314.3 B Won (1USD ~ 1.1 kWon)
  ※ Gov: 183.6 B, Gyeongju: 118.2 B, Industry: 12.5 B
- Gyeongju city provides land for KOMAC.

❖ Project Goals

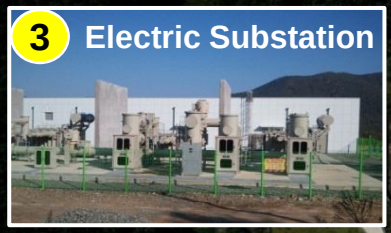
1. Development of 100 MeV Proton Linac
2. Development of Beam Utilization Tech.
3. Development of Tech. for Industrial Application

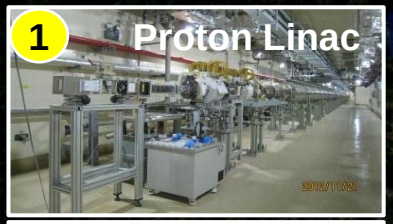
KOMAC site



- Land & Electricity for Future
- Easy Access from Seoul, Busan, and Pohang
- Good for sightseeing

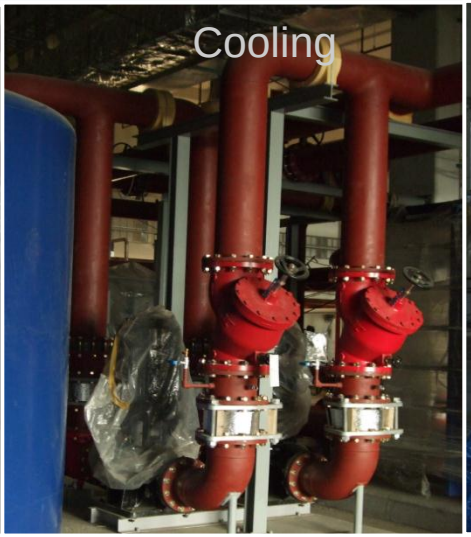
Main Facilities

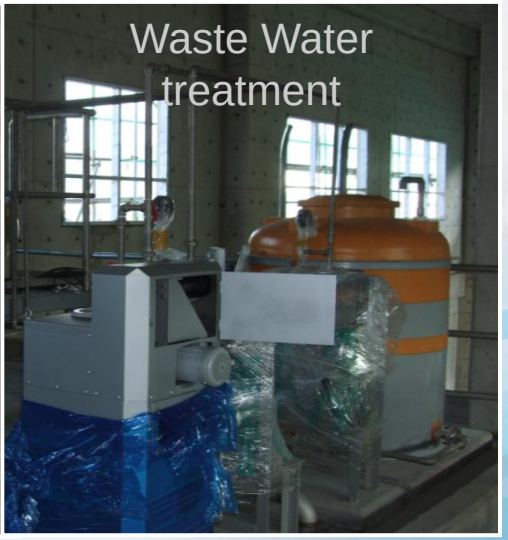




- Site: 180,000 m^2
- Building: 39,843 m^2
  (Accelerator and beam line 14,426 m^2)
- Electricity : 154kV, 20MVA

Buildings and Utilities



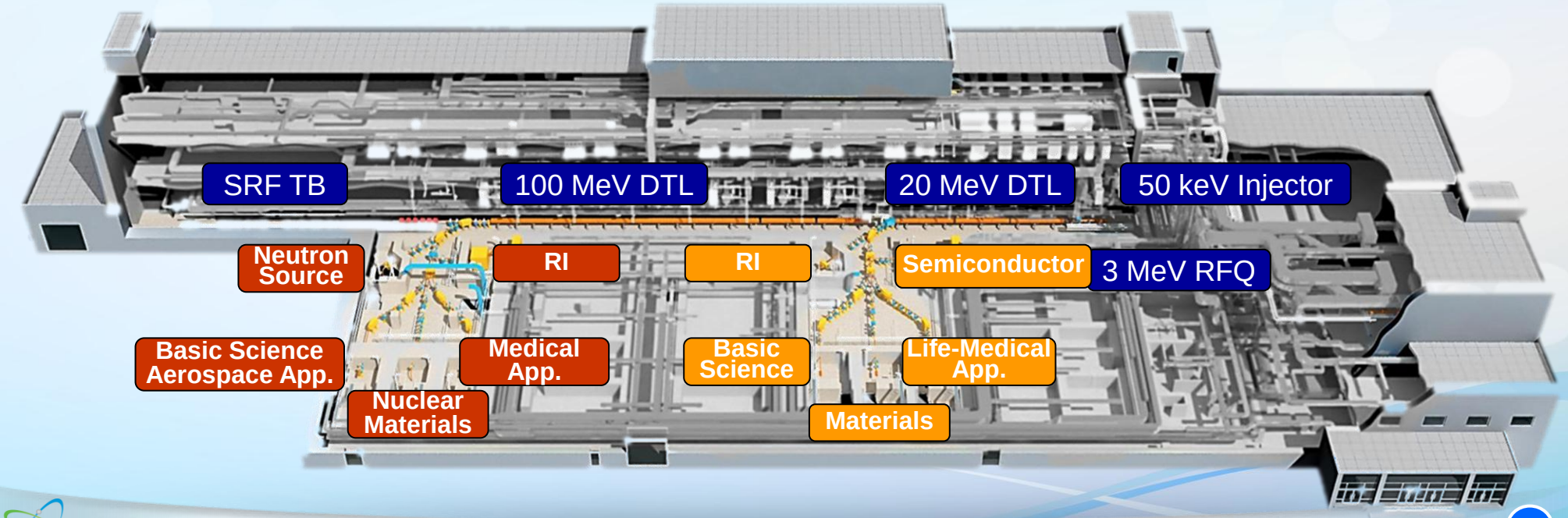


Linac and Beam Lines

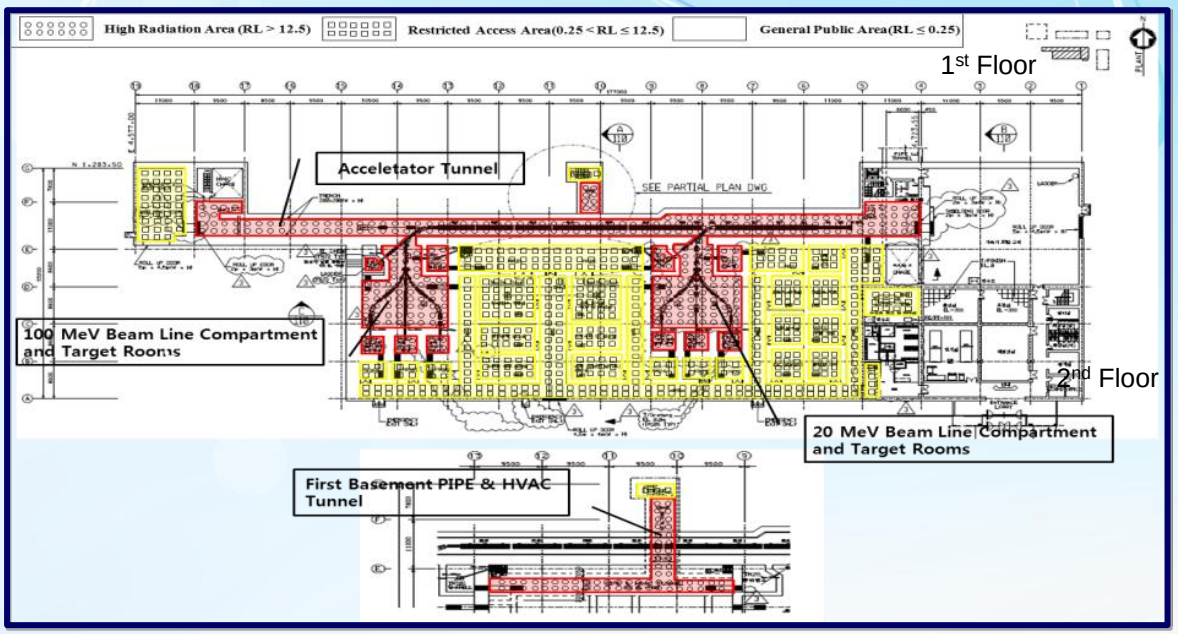
Features of KOMAC 100MeV linac

- 50 keV Injector (Ion source + LEBT)
- 3 MeV RFQ (4-vane type)
- 20 & 100 MeV DTL
- RF Frequency : 350 MHz
- Beam Extractions at 20 or 100 MeV
- 5 Beamlines for 20 MeV & 100 MeV

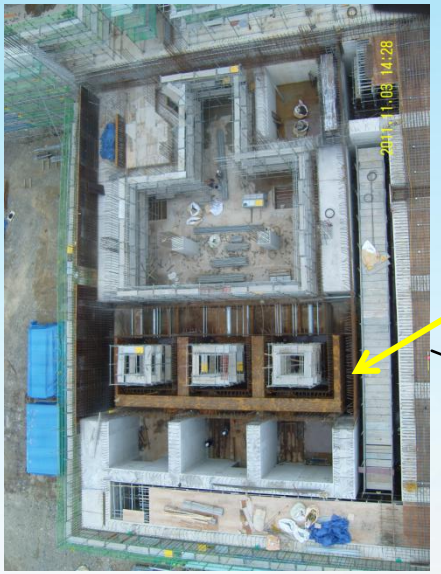
Output Energy (MeV)	20	100
Max. Peak Beam Current (mA)	1 ~ 20	1 ~ 20
Max. Beam Duty (%)	24	8
Avg. Beam Current (mA)	0.1 ~ 4.8	0.1 ~ 1.6
Pulse Length (ms)	0.1 ~ 2	0.1 ~ 1.33
Max. Repetition Rate (Hz)	120	60
Max. Avg. Beam Power (kW)	96	160



Radiation Shielding & Radiation License



Area	μSV/hr	Facilities
High level Radiation Area	DL > 12.5	-Accelerator Tunnel -Beam Line Room
Radiation Worker Area	0.25 < DL ≤ 12.5	- Klystron Gallery (Klystron, AHU, CCW HX room) - Beam Utilization Facility (Beam Experimental Hall, Test Prep., ACU room)
General Public Area	DL ≤ 0.25	- Office & General Laboratory



Target Room Shielding
- **Iron: 0.9m**
- **Concrete: 2.4m**

License for Operation of Radiation Generating Facility
- issued by NSSC (Jan.2012)

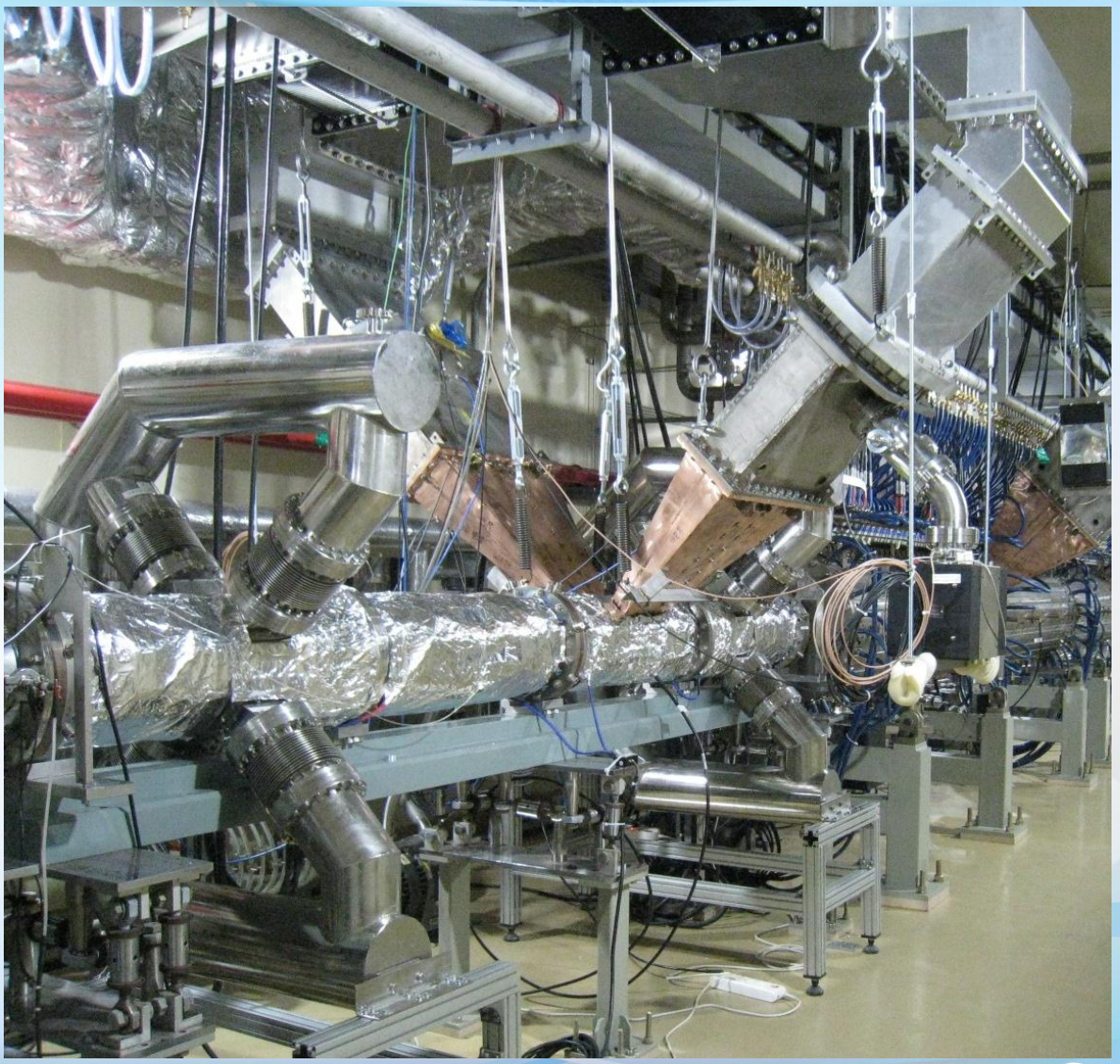
Injector

- 2.45GHz Microwave ion source:
  - Extraction energy: 50 keV
  - Peak beam current: 30 mA
  - Compact with one solenoid
  - Operation modes:
    DC or Pulsed
    with IGBT switch

- LEBT :
  - 2 solenoids
  - 2 steering magnets

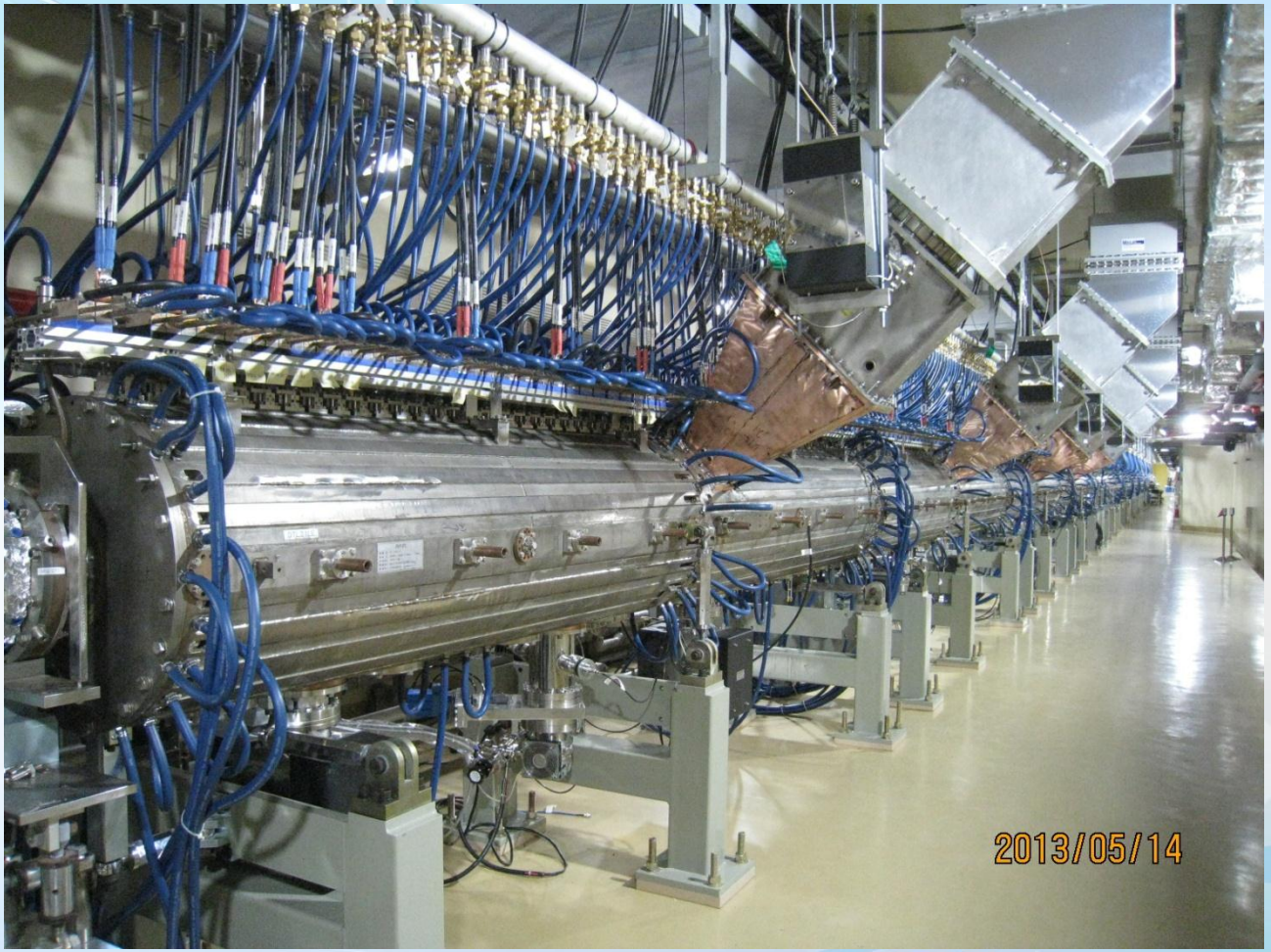
RFQ

- Specifications
  - frequency : 350MHz
  - energy : 3MeV
  - peak current : 20mA
  - 4 vane type
  - dipole stabilizer rods
  - iris coupling
  - length : 3.2 m
  - duty : 24%



20-MeV DTL

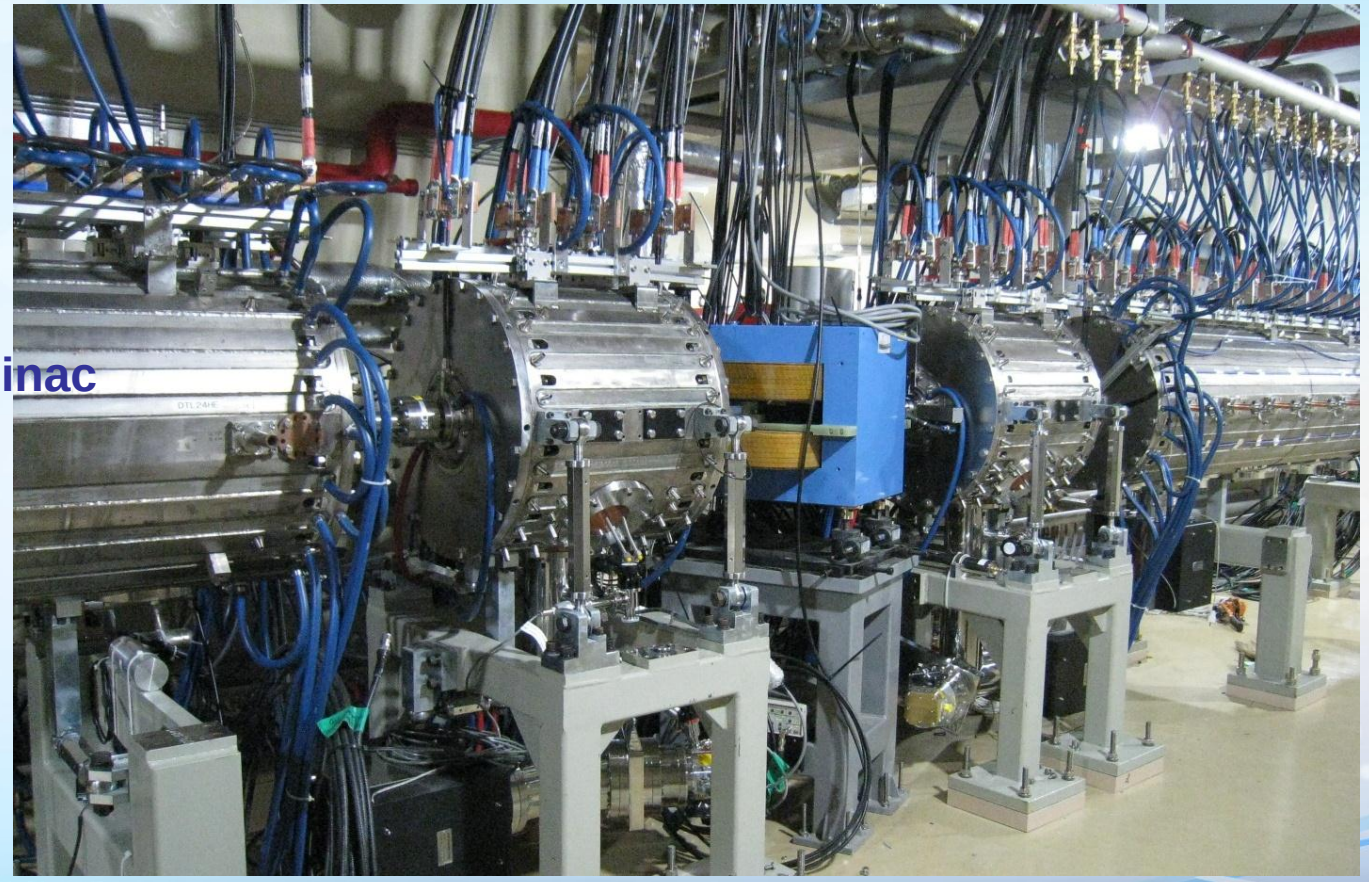
- Specifications
  - frequency : 350MHz
  - energy : 3~20 MeV
  - peak current : 20 mA
  - electromagnetic Q
  - FFDD
  - 4 tanks
  - driven by
    a 1-MW klystron
  - duty : 24%



MEBT

- **Specifications**
  - a bending magnet at 20MeV to extract beam to 20MeV target rooms
  - matching section with two cavities

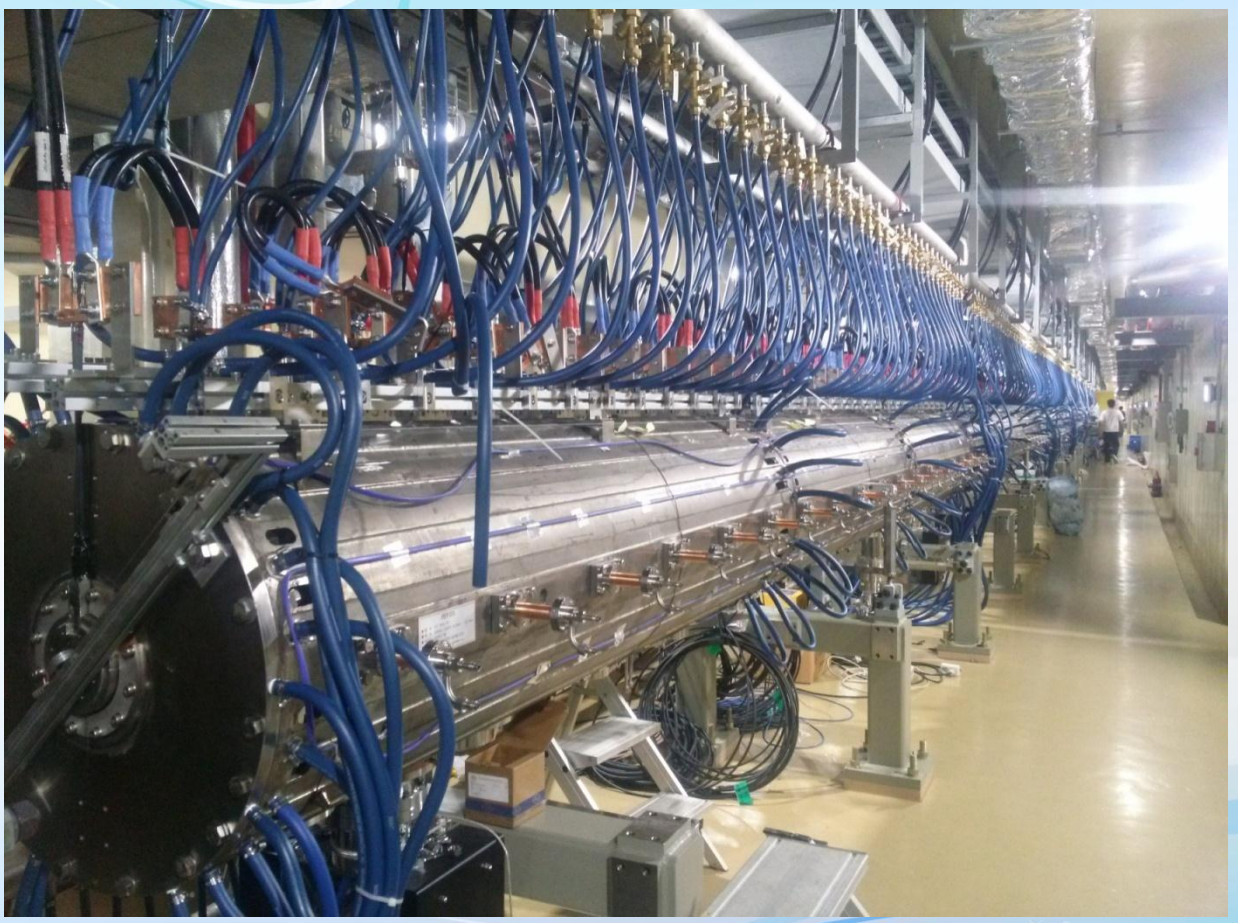
20MeV Linac



100MeV Linac

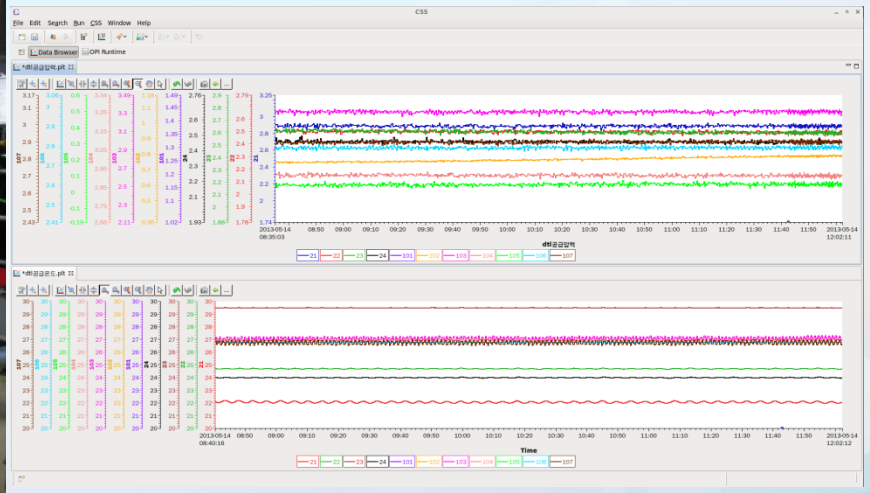
100-MeV DTL

- Specifications
  - frequency : 350MHz
  - energy : 20 ~ 100 MeV
  - peak current : 20 mA
  - electromagnetic Q
  - FFDD
  - 7 tanks
  - driven by
    a 1.6-MW klystron
    per each tank
  - duty : 8%



RCCS

- RCCS (Resonant Control Cooling System) for temperature control of DT.
- Operation Range 21~33 °C, Temperature Control < ±0.1°C
- 11 sets for 11 DTL tanks



HPRF system

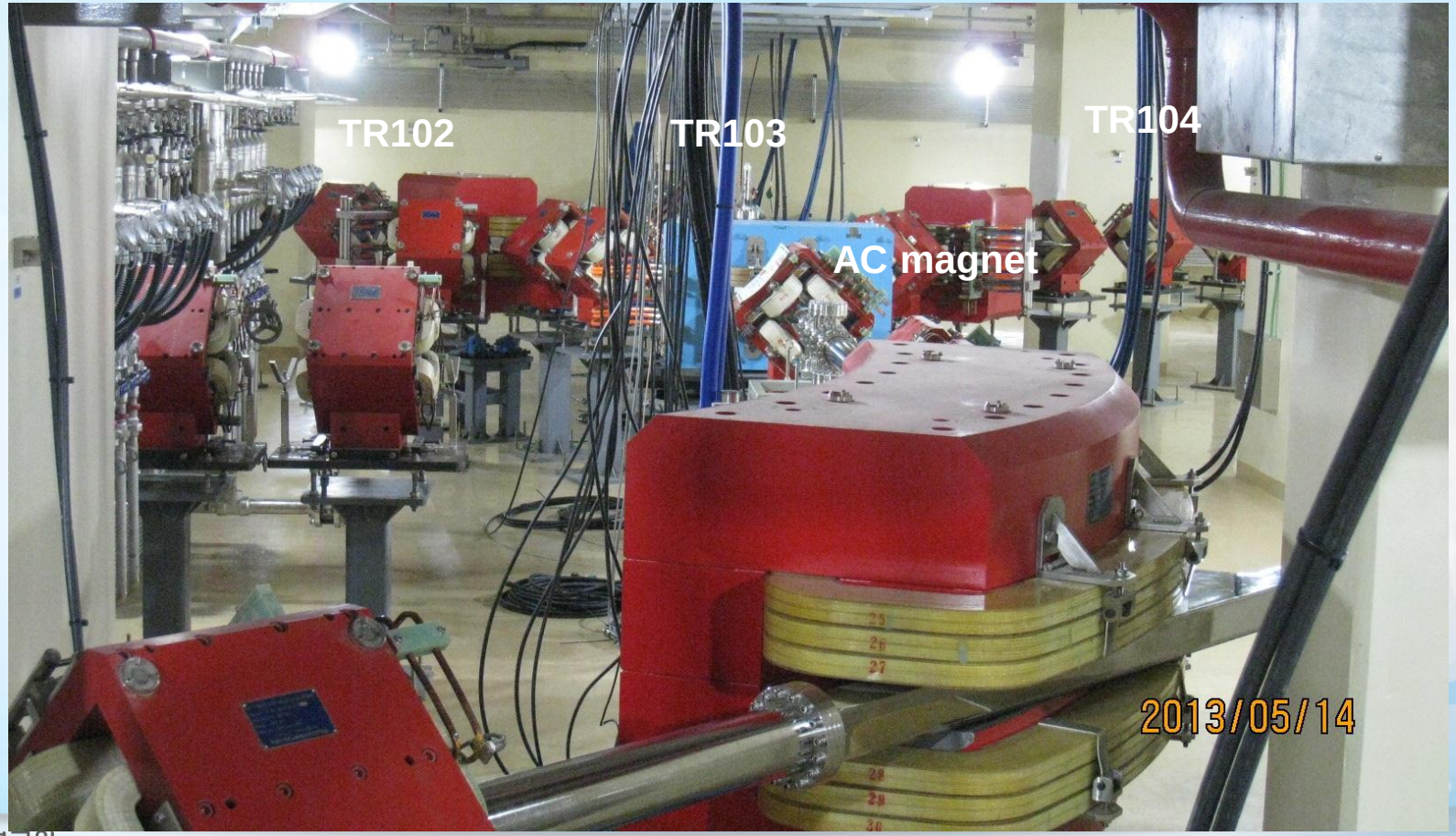
- 9 Klystrons : 1 for RFQ, 1 for 20-MeV DTL, 7 for 100-MeV DTL
- Penetration wave guides were installed in building construction.

Modulator

- 4 Modulators (Each modulator drives 2 or 3 klystrons)
- Output peak power 5.8 MW, duty 9%, pulse width 1.5 ms, repetition 60Hz

Beam Lines

- Initial operation : 1 beam line for 20 MeV and 1 beam line for 100 MeV
- Beam lines will be prepared according to the beam needs from users.



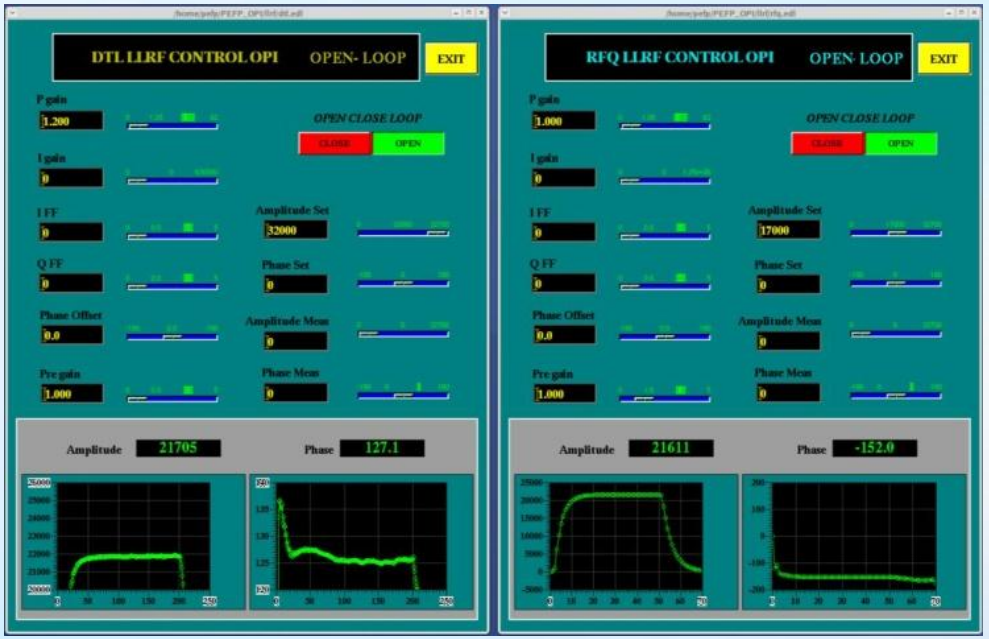
Target Rooms

- Specifications
  - 5 rooms for 20 & 5 rooms for 100 MeV
    : 1 room for 20 & 1 room for 100MeV will be available on June.
  - In air irradiation
  - beam widow : 0.5mmt 300mmΦ AlBeMat

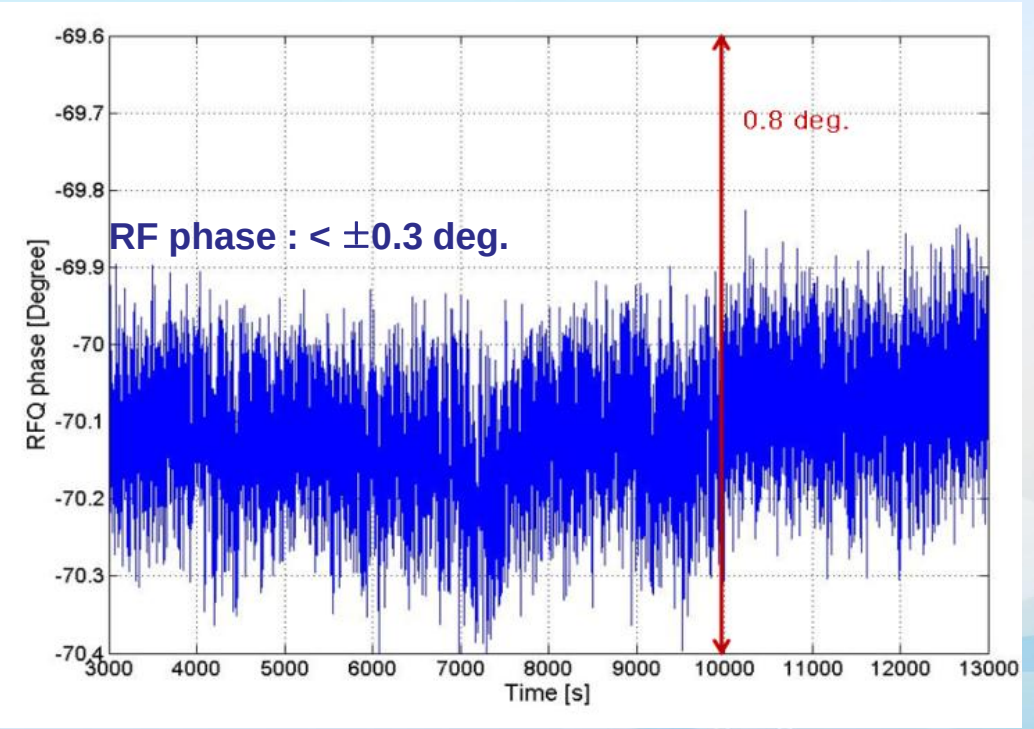
Proton beam

Digital LLRF system

- Goal : 1% in amplitude, 1 degree in phase
- hardware : Commercially available FPGA board
- software : PI implemented in FPGA and EPICS OPI



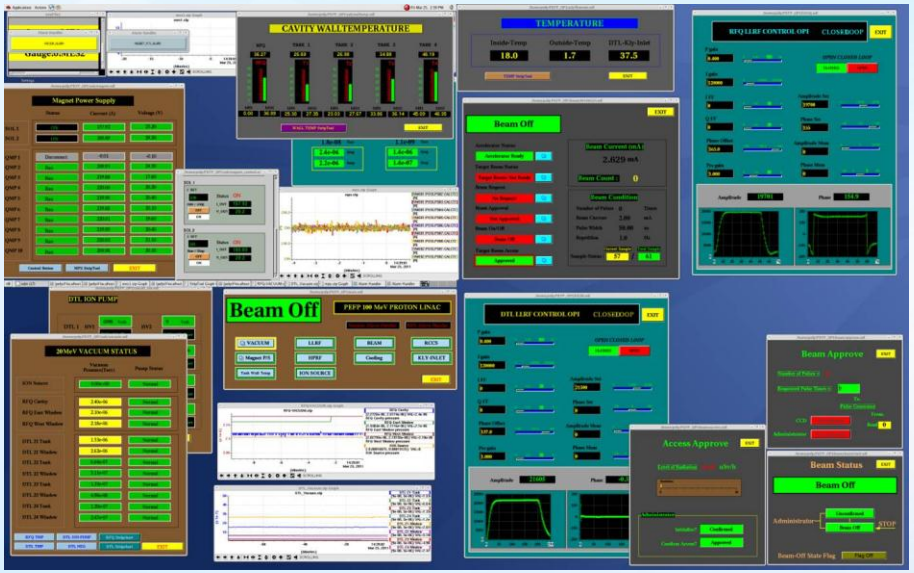
LLRF OPI based on EPICS



Phase variation during HPRF operation

Control System

- EPICS based system was developed for linac and beam lines.
- Radiation monitoring system & personal safety interlock system are prepared.



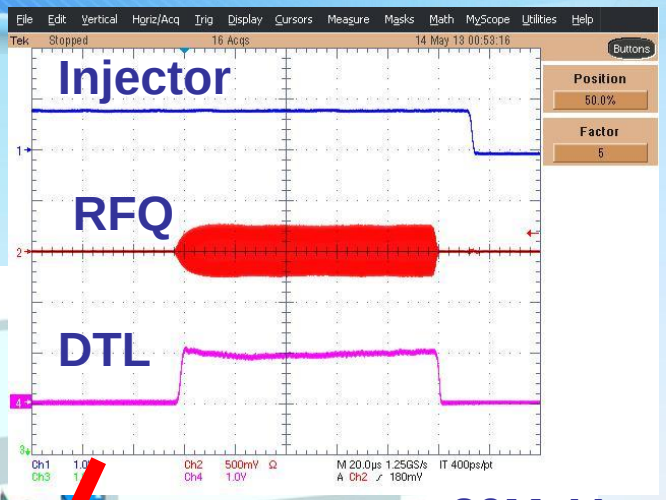
EPICS based OPI

Main Control Room

Status of Commissioning

Up to now

- Initial goal : 100 MeV 1kW in June



20MeV
~1mA peak

Applications near future

- Basic science studies
  - Bio- and medical
  - Space, detectors etc
- Radio isotope production
- Nuclear fission and fusion material damage test
- ISOL target test

Conclusion

- KOMAC has the 1st phase facility through the PEFP.
  - Land, buildings, utilities and 100-MeV linac
  - The linac is under commissioning
  - Beam service in 2 target rooms will start from July.

- For the plan,
  - Preparation of all target rooms for many applications
  - GeV extension for pulsed neutron source
  - And many accelerators for many purposes


KOMAC will be
谢谢!
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