The Joint ESS -J-PARC & SAKURA Workshop
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# Plan for Accelerator Development at J-PARC

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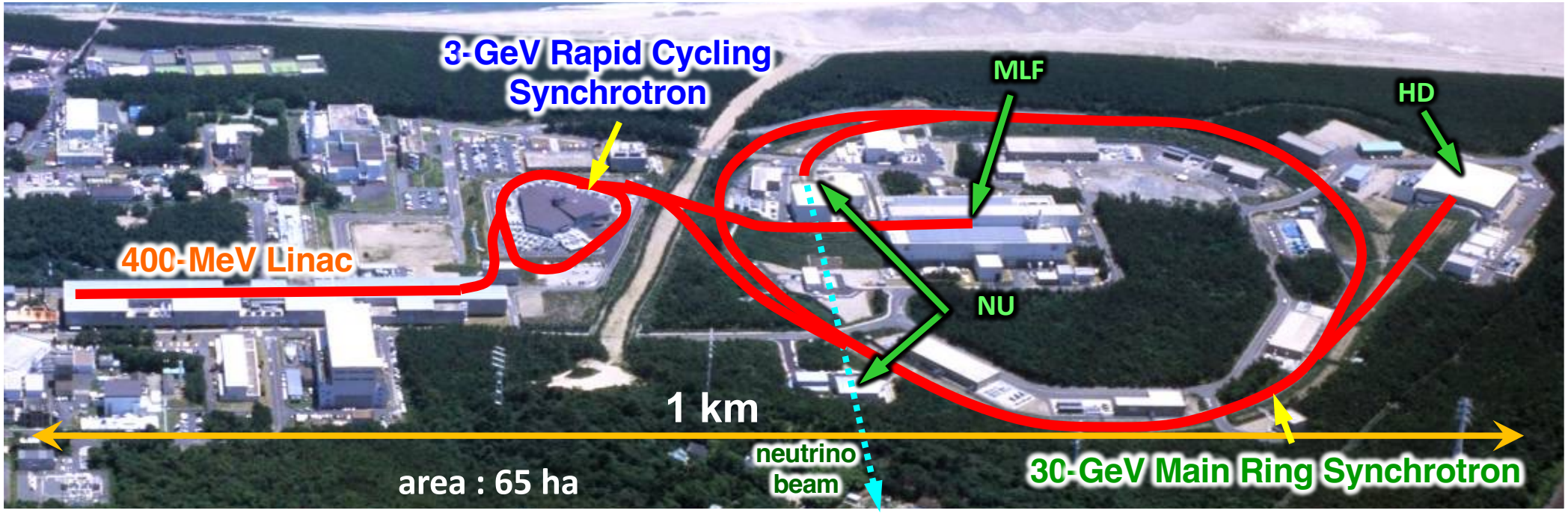
# J-PARC Accelerators




## ●Linac

- **$H^-$ beam** acceleration
- Beam energy : **400 MeV**
- Beam current:
  **50 mA** for user operation
  **60 mA** for beam study
  (peak current at linac exit)
- Pulse length : < 0.5 ms
- Repetition: 25 Hz

## ●Rapid Cycling Synchrotron(RCS)

- Charge-exchange injection **$H^-$-> $H^+$**
- Beam energy :**3 GeV**
- Injection into MR
- Delivery to MLF
- Beam supply to MLF with the beam power of **~1 MW** (in 2024)

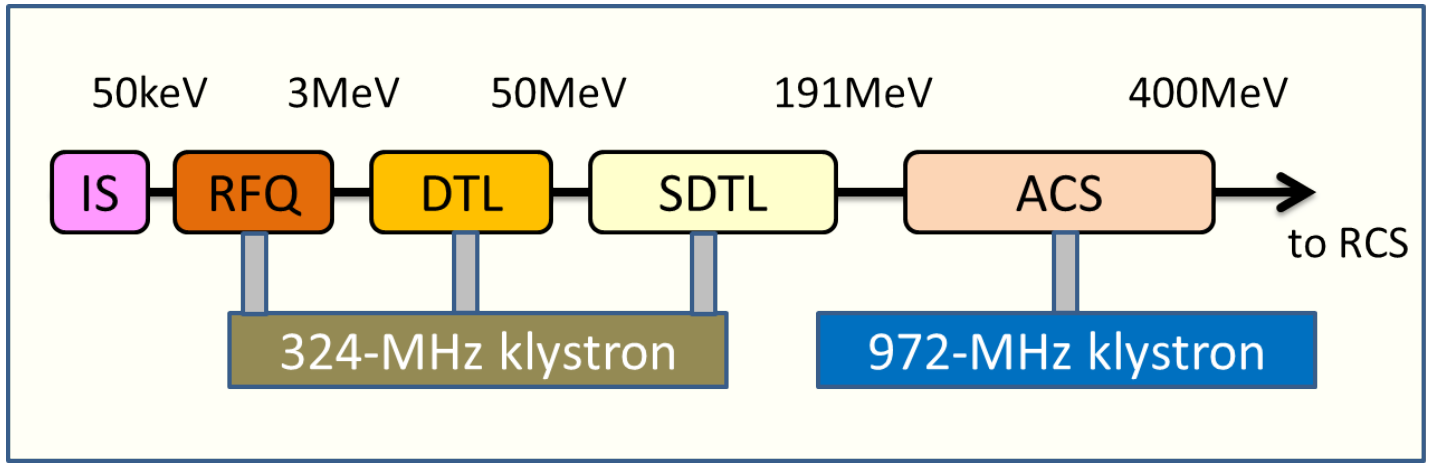
## ●Main Ring Synchrotron(MR)

- Beam energy :**30 GeV**
- Beam power:
  **760 kW** (in 2023) to NU
  **80 kW** (in 2024) to HD

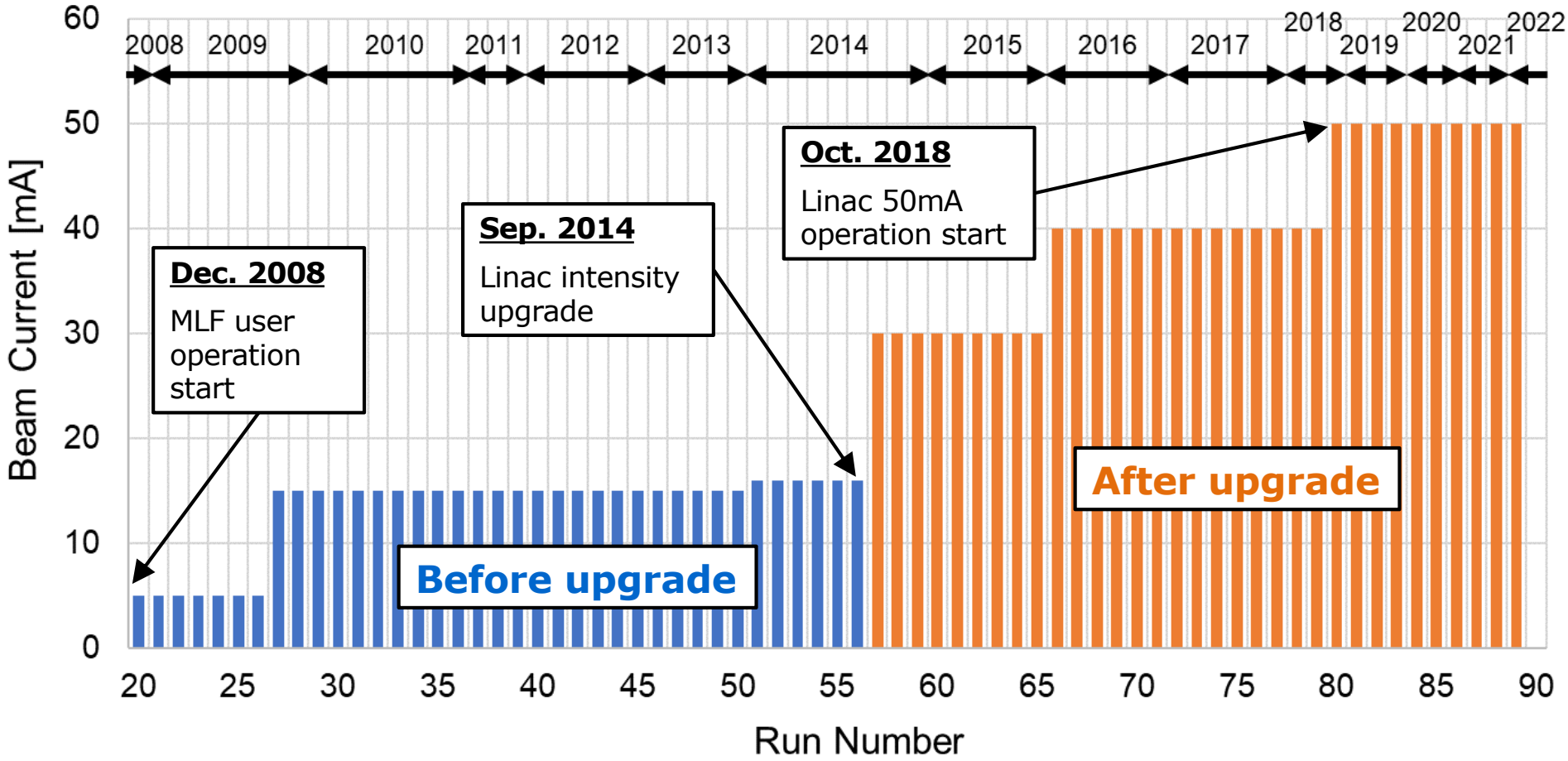
# Layout of linac components

- The J-PARC linac consists of an ion source and four types of accelerating cavities (RFQ, DTL, SDTL and ACS), and is installed in an accelerator tunnel approximately 13 meters underground.

- The RFQ, DTL and SDTL are driven by 324-MHz klystrons, and the ACS is driven by 972-MHz klystrons. These klystrons are installed in a 330-m-long room called the klystron gallery at ground level.



# Linac beam intensity




**Operation history of the linac beam intensity**

- In 2008, MLF user operation started with linac beam current of 5mA.
- In 2009, beam current was increased to 15mA and operated for about next five year.
- In 2014, after linac upgrade was completed, 30mA operation started.
- In 2018, **50mA (nominal)** operation was started.

# Plan for Accelerator Devel. (MR)

## ■ for Neutrino experiment:

**Beam power increase to 1.3 MW**
(Present max. power: 760 kW)

- RF system upgrade
- Reinforcement of capacitor bank for main electromagnet power supply
- Improvement (capacity increasing) of beam dump to facilitate beam tuning
- Beam diagnostics development and upgrade

## ■ for Hadron experiment:

**Beam power 100 kW early achieved**
(Present max. power: 80 kW)

- Slow extraction system upgrade to realize low residual radiation
- Replacing extraction devices (extraction septum magnets, Q-magnets) with having large aperture ones (for COMET experiment).

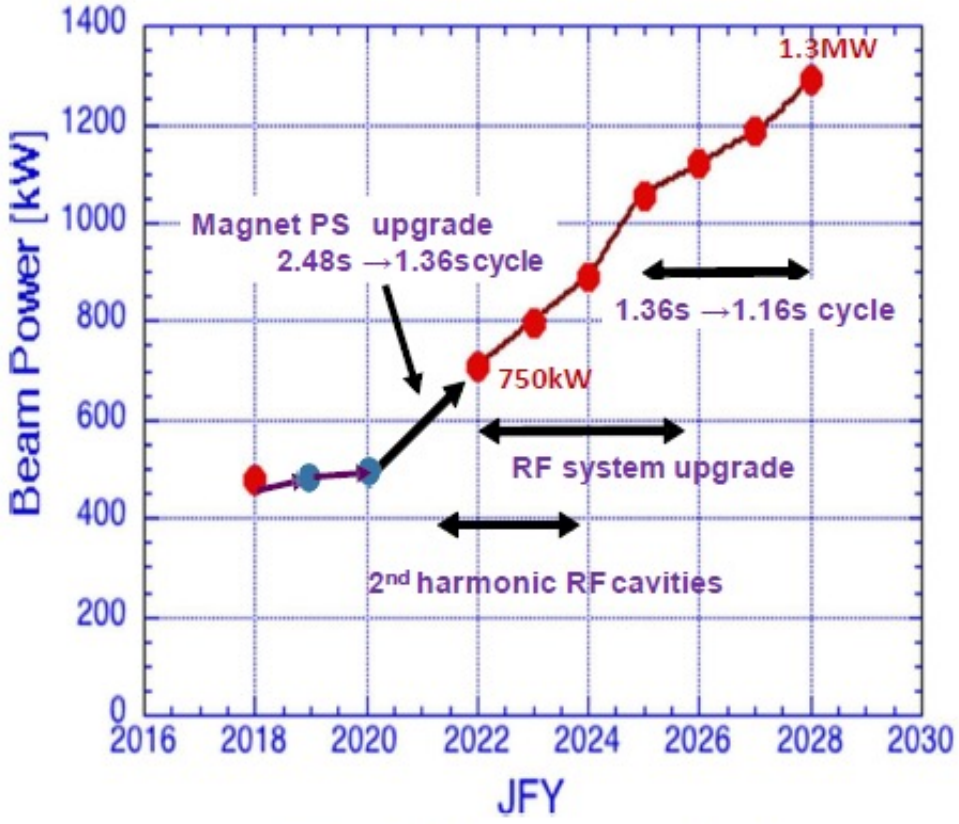



Fig.: MR beam upgrade plan

# Plan for Accelerator Devel. (LI/RCS/3NBT)

## ■ for MLF-TS2 (1.5 MW from RCS):

**Linac:**

- Increasing the beam intensity of the front-end part
- High power klystron and klystron power supply system to keep high availability

**RCS:**

- Long lifetime exchange stripper foil
- High performance semiconductor amplifiers for RF system

**3NBT:**

- Design of beam transport line from RCS to MLF-TS2

## ■ for Irradiation facility (250 kW from linac):

**Linac 50 Hz operation**

- System commissioning of 50 Hz operation will be conducted this summer.
- High power klystron and klystron power supply system.
- Beam dividing system.
- Beam monitor upgrade.
- Cooling water system upgrade.