

Real-Time Radiation Dose Monitor System



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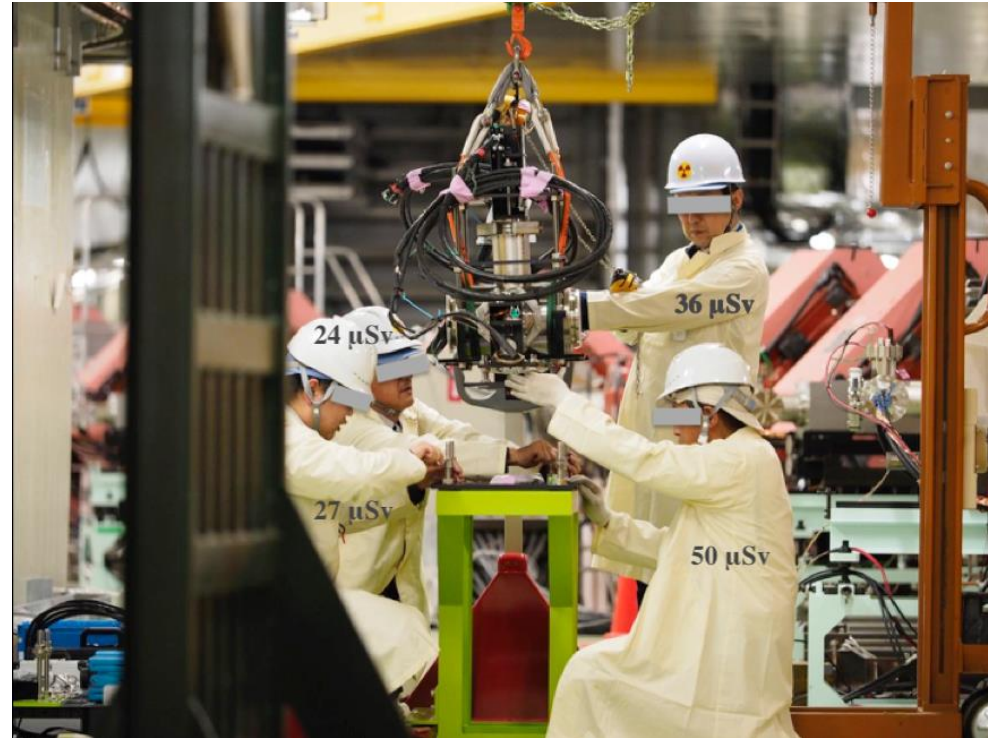
◆ Background

◆ Background

◆ High-radiation environment

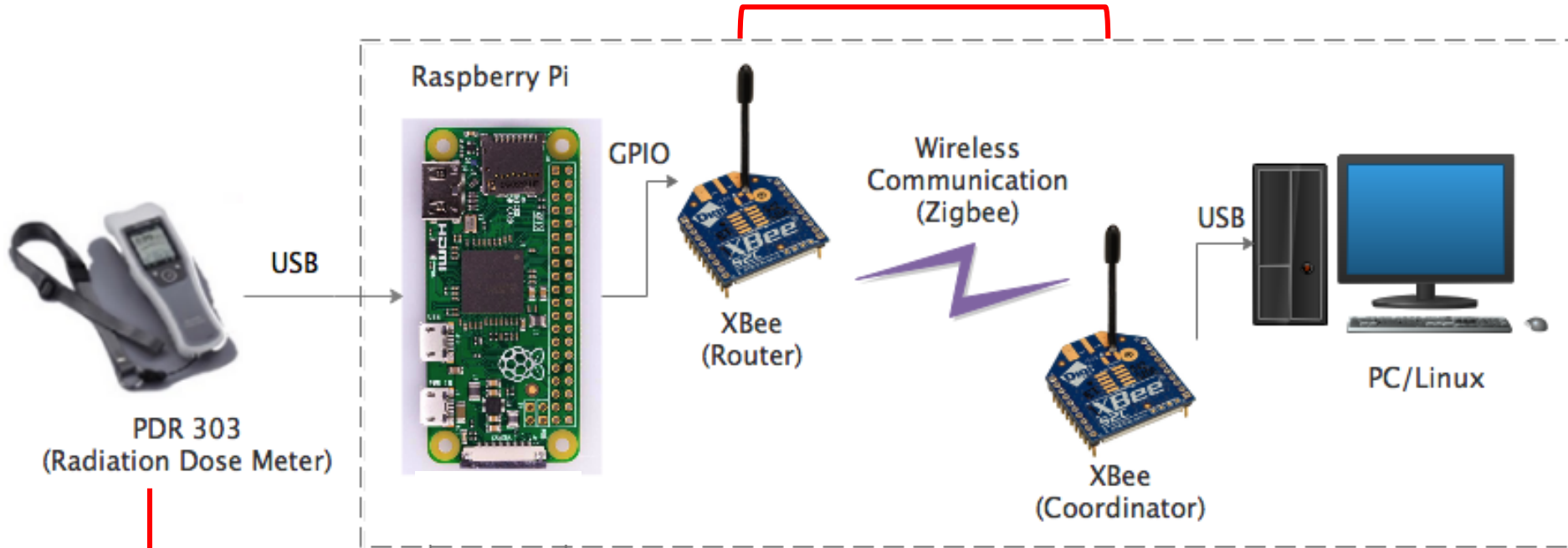
◆ Objective

◆ A system to monitor the real-time radiation dose



◆ Hardware

Wireless communication in short distance



Communication Module

Key technologies { Xbee
Raspberry Pi



Radiation worker

◆ Software

EPICS:
AsynDriver,
StreamDevice,
drvAsynI2C,
procServ,
Sequencer,
devgpio,
re2c



Raspberry Pi
OS: Raspbian: Debian based Linux
for Raspberry Pi

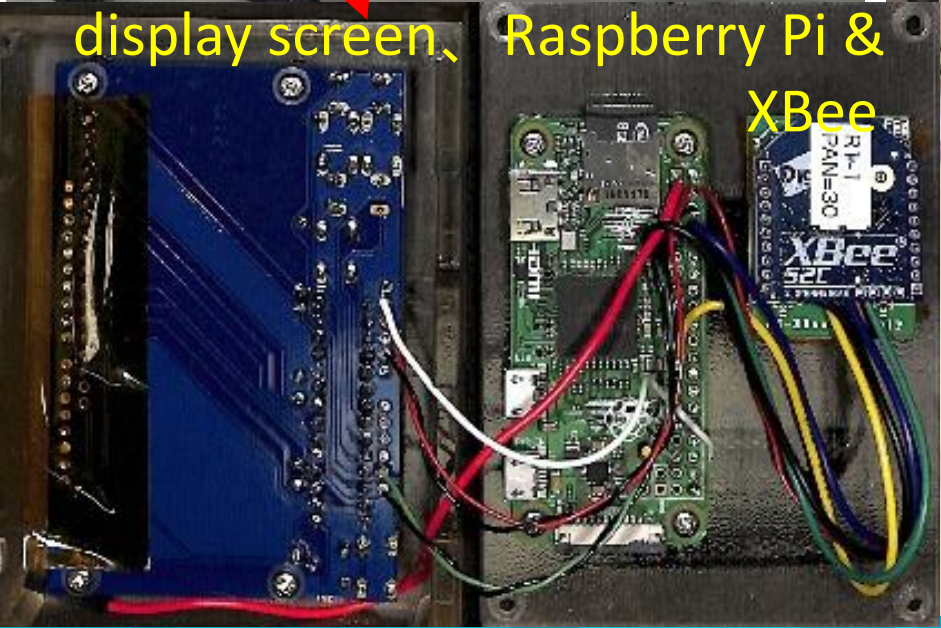
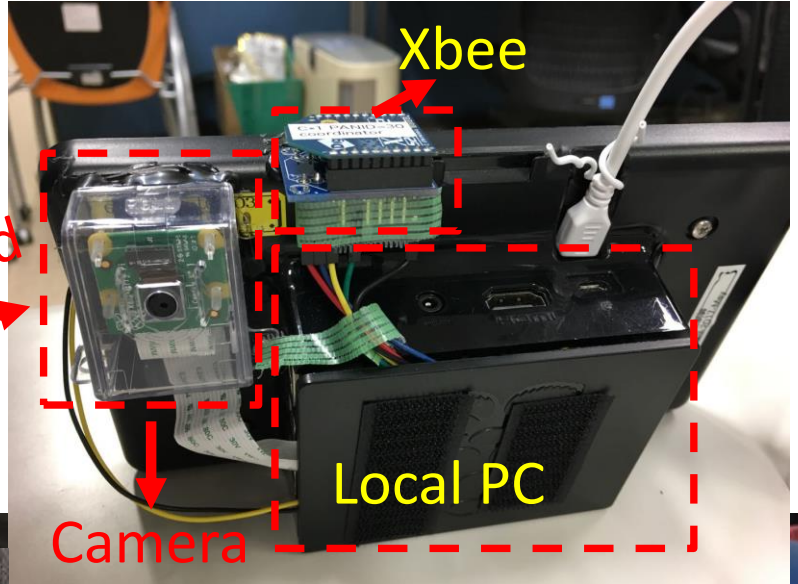
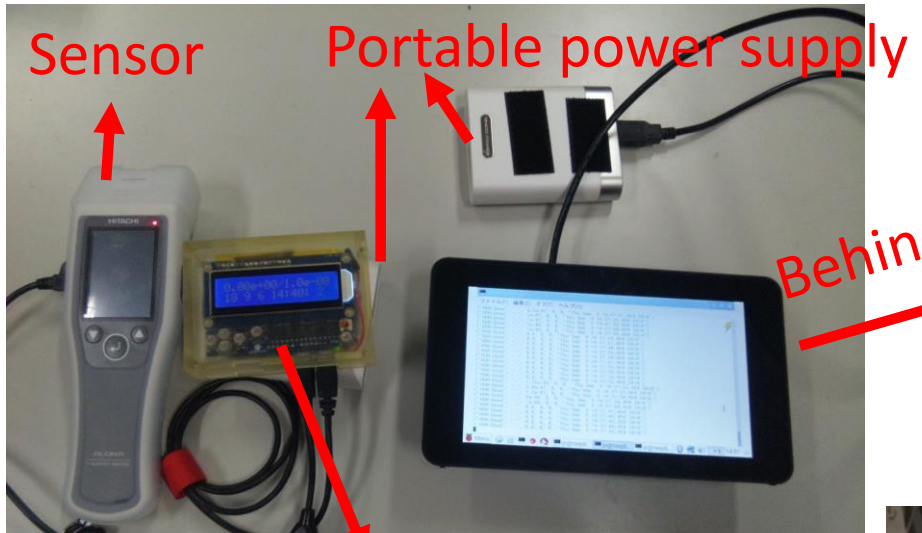


Local PC
OS: Linux

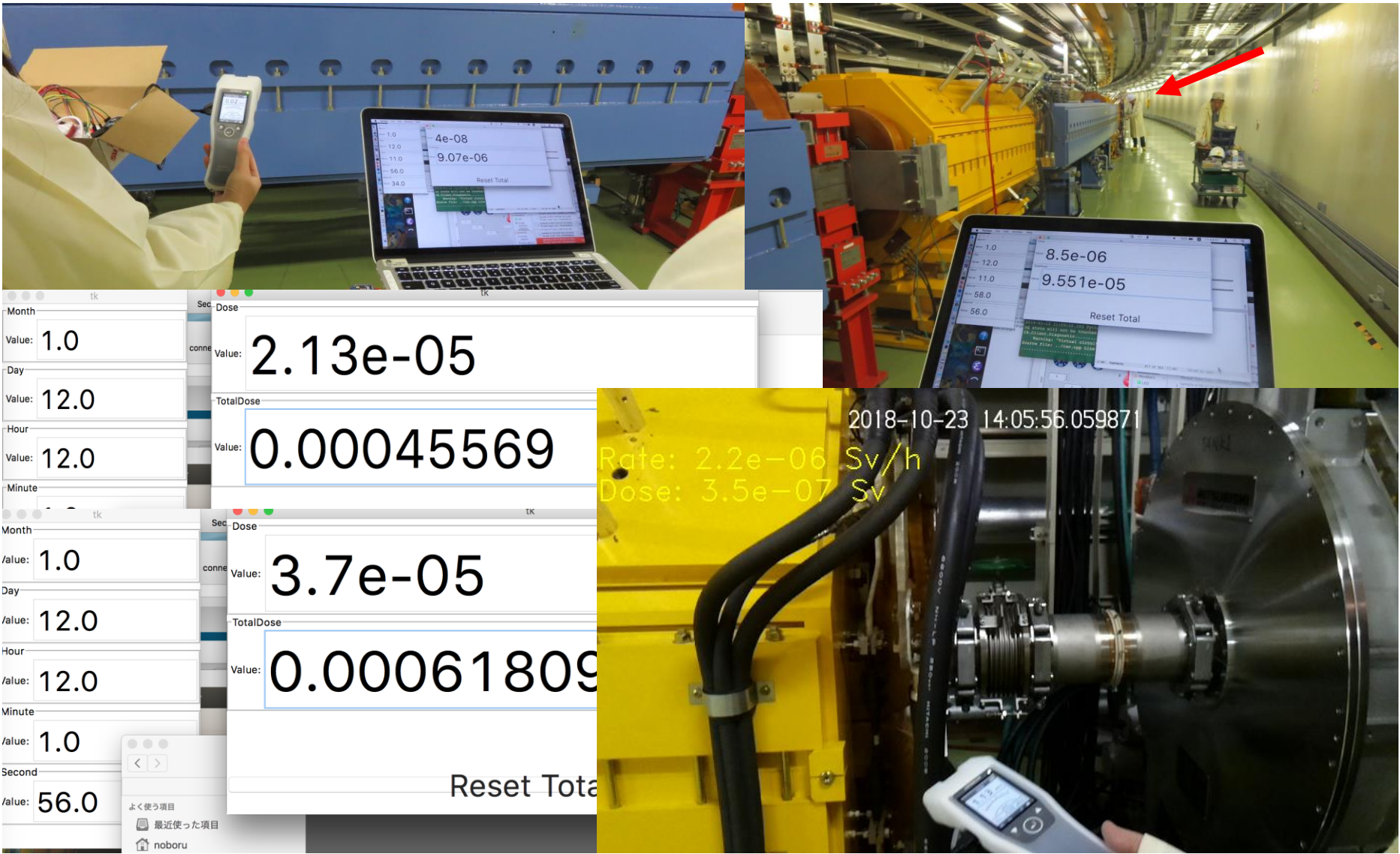
EPICS:
AsynDriver,
StreamDevice
XCTU
CSS

StreamDevice is used for Xbee

◆ Real-Time Radiation Dose Monitor System



◆ Experiment: System Test in Accelerator Tunnel



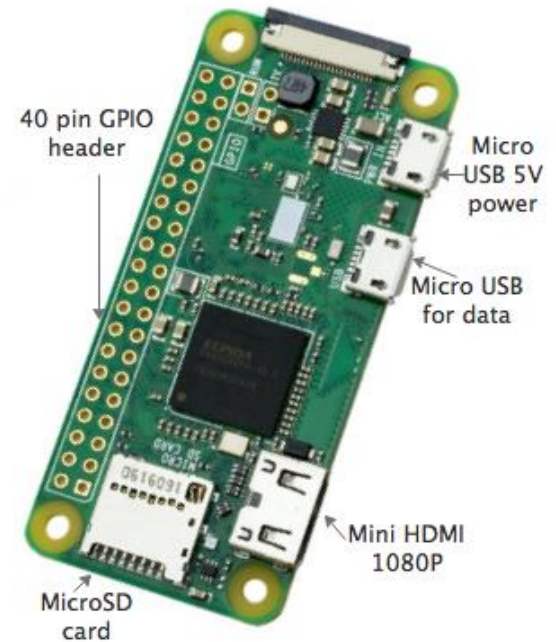
◆ Summary

- ◆ We tested the real-time radiation dose monitor system.
 - ◆ Xbee and Raspberry Pi are used.
 - ◆ StreamDevice is used.
- ◆ Improvement will be made in the future.
 - ◆ Increase more radiation sensors.
 - ◆ Add alarm system.

Appendix: backup

◆ Raspberry Pi

- ◆ The Raspberry Pi is a tiny computer and an ideal rapid prototyping platform.
- ◆ Advantages:
 - ◆ Low power consumption (5-7 watts)
 - ◆ Can be charged with portable power supply
 - ◆ Small form factor
 - ◆ Can be held in our hand
 - ◆ Affordable
 - ◆ Lower price than other computers
 - ◆ Expansion capabilities
 - ◆ Can be connected to other devices by the Raspberry Pi's GPIOs.



◆ Xbee (Zigbee)

◆ Xbee

- ◆ A wireless communication module
- ◆ Built by Digi based on the IEEE 802.15.4/ Zigbee standard
- ◆ The Xbee/ Zigbee module uses the Zigbee protocol
- ◆ Provide reliable wireless sensor networks
- ◆ Delivery of data between remote devices with low cost, low power



◆ Xbee (Zigbee)

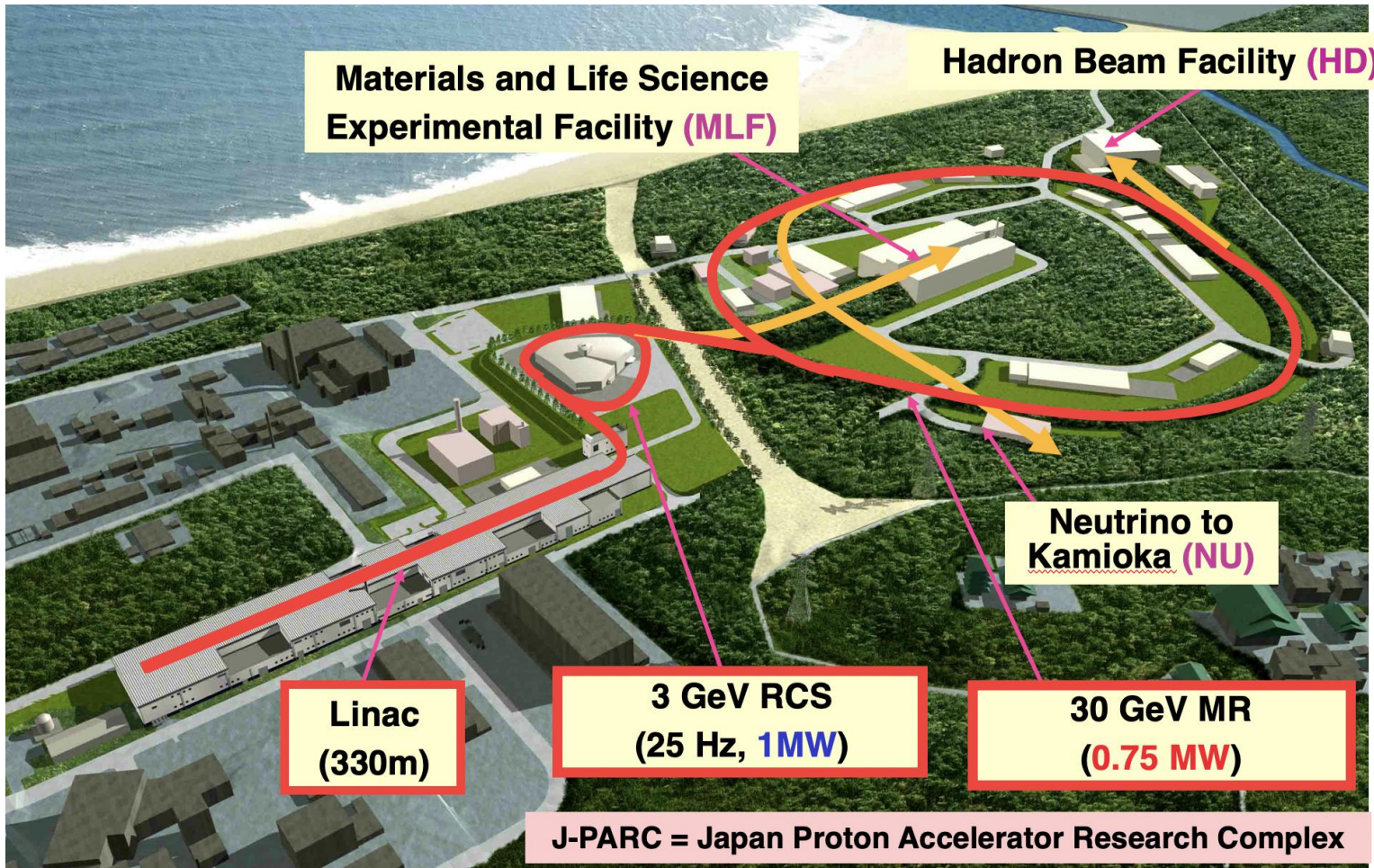
◆ Zigbee

- ◆ Wireless technology
- ◆ A mesh networking protocol built upon the 802.15.4 IEEE standard
- ◆ Less expensive and simpler than Bluetooth and Wi-Fi

Specification	Zigbee	Bluetooth	Wi-Fi
Operating Frequency band(GHz)	2.4	2.4	2.4
Data Rate (Mb/s)	0.25	1-3	2-11
Safety	Medium	Higher	Low
Range (meters)	1-100+	1-100	1-10+
Power Consumption	Ultra Low	Low	Medium
Cost	Very Low	Medium	Higher
Complexity	Simple	Complex	Complex

Appendix: SOKENDAI & J-PARC

- ◆ The Graduate University for Advanced Studies (SOKENDAI)
 - ◆ Established in 1988
 - ◆ A national graduate university of Japan
 - ◆ Only provide doctoral programs
 - ◆ Includes 18 research institute
 - ◆ High Energy Accelerator Research Organization (KEK) is one of the research institute of SOKENDAI.
 - ◆ <https://www.soken.ac.jp/en/>



Joint project of KEK (High Energy Accelerator Research Organization)
and JAEA (Japan Atomic Energy Agency)