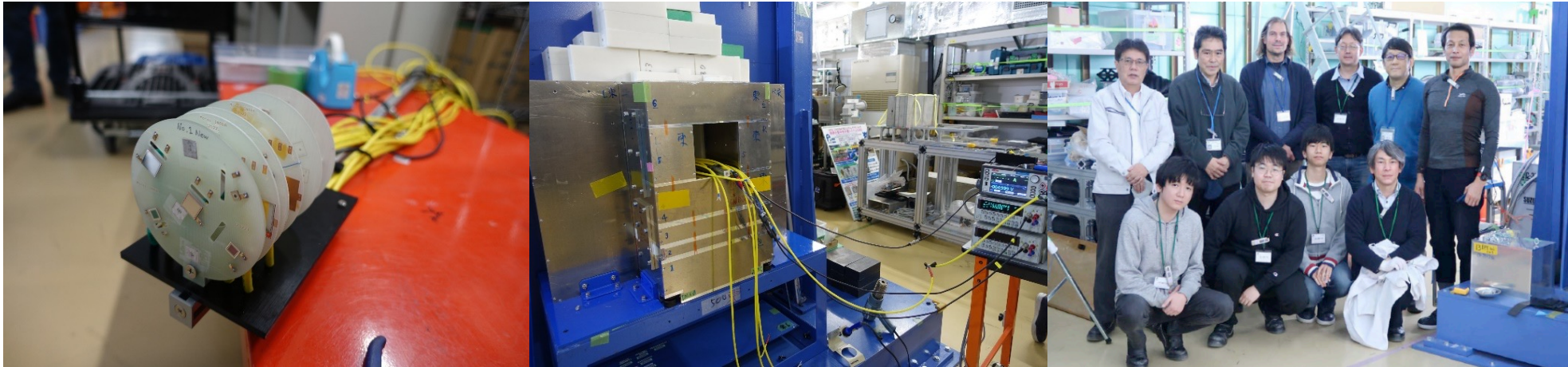


# Roman pots, OMD, and B0 tracker/EMCAL

- Neutron fluences up to  $\sim 1e13$  MEQ n/cm<sup>2</sup> (especially for the B0 tracker) need to be tested.
  - 10 years of running with operational year 6 months @ > 60% machine efficiency.
  - Less stringent “normal” operational requirement for RP/OMD, but need to understand damage thresholds in a beam loss event which potentially directly hits sensors.
- Open question about loss in spatial/timing resolution performance for AC-LGADs with radiation damage – especially important for B0 tracker performance.
- Ionizing doses need to be tested up to  $\sim 100$ krad for a similar time period for frontend ASICs (ready  $\sim 2025$ ) and support materials (e.g. PCB and cabling; late 2024).
- B0 EMCAL can potentially share testing needs with ZDC, but doses are similar to other subsystems (100krad, and  $1e12 - 1e13$  MEQ n/cm<sup>2</sup> over 10 years).

# RANS Neutron Irradiation Test

- RIKEN RANS
  - 7MeV proton beam,  $100\mu\text{A}$ ,  $6 \times 10^{13}$  proton/s
    - Maximum current stable produced about  $40\mu\text{A}$
  - Neutron 5MeV max,  $10^{12}$  neutron/s from the Be target
  - 2cm from the target:  $10^8$  neutron/cm<sup>2</sup>/s
- 2022.3.3-4 first irradiation test
- 2023.3.7-8 second irradiation test
  - Tested FoCal-E Pad p-type/n-type baby-chip/MPD, APD/SiPM for readout of crystal calorimeter
  - Monitored by MPD from Kyushu Univ., Indium foil, and thermistor
- 2023.7.6-7 third irradiation test

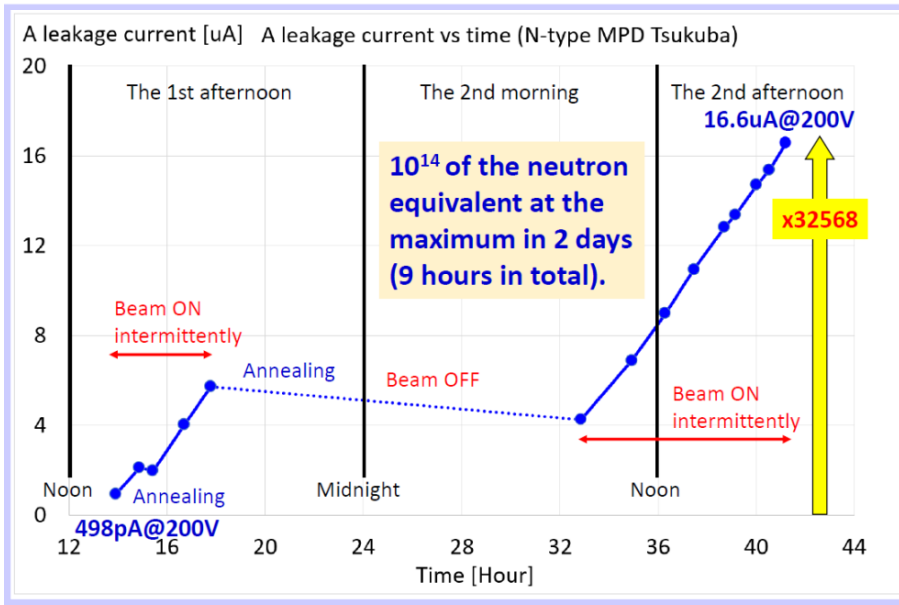


# RANS neutron irradiation test

- $10^{14}$  neutron/cm<sup>2</sup> at the maximum in 2 days, 9 hours in total
- Recorded online a leakage current of the n-type MPD (monitor photo-diode)
- Comparison of the C-V characteristics of the n-type MPD before and after the irradiation
  - Full-depletion voltage: 35V→85V

Inaba-san's slides

### The n-substrate monitor PD



### The C-V characteristics of n-substrate MPDs

