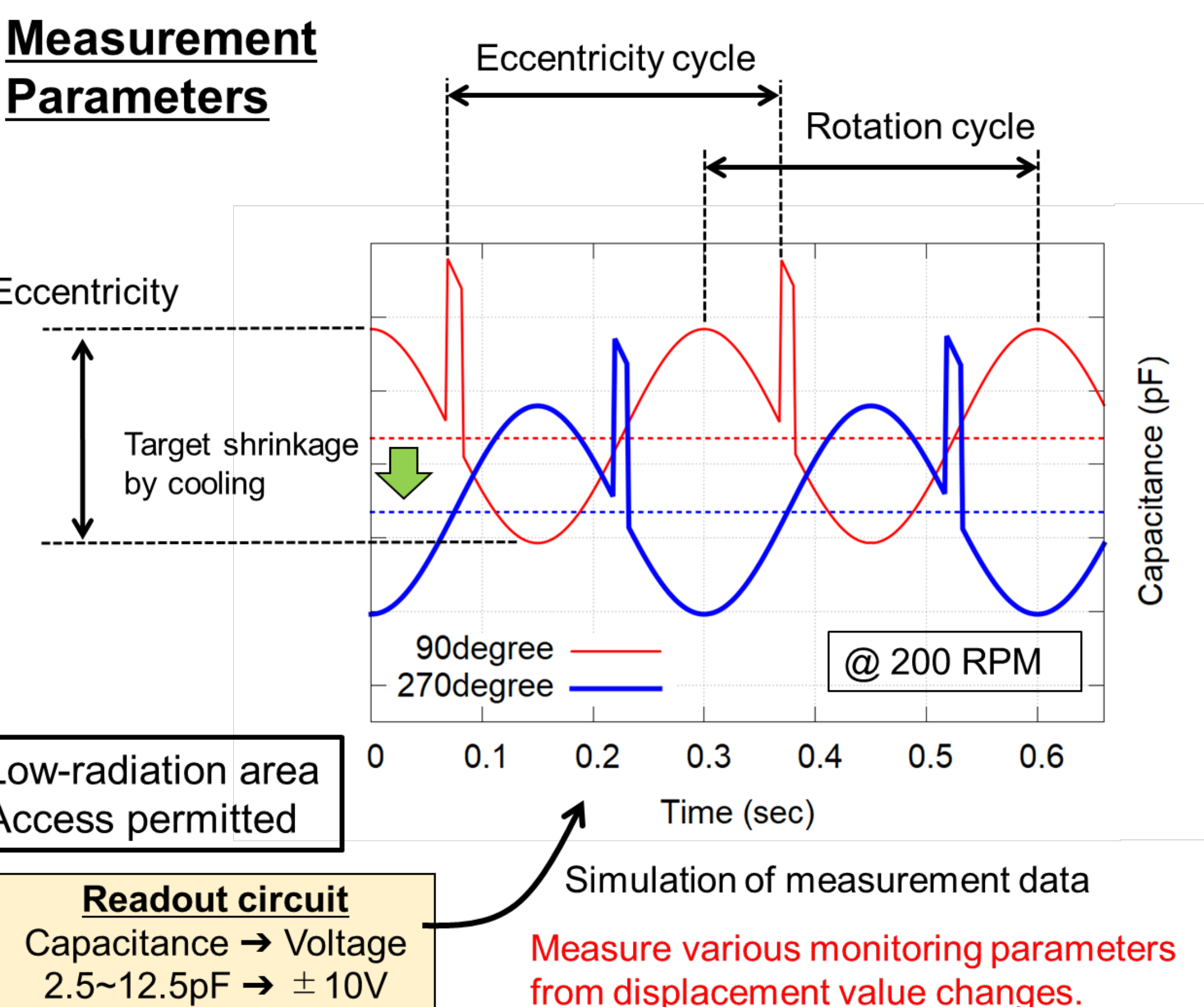
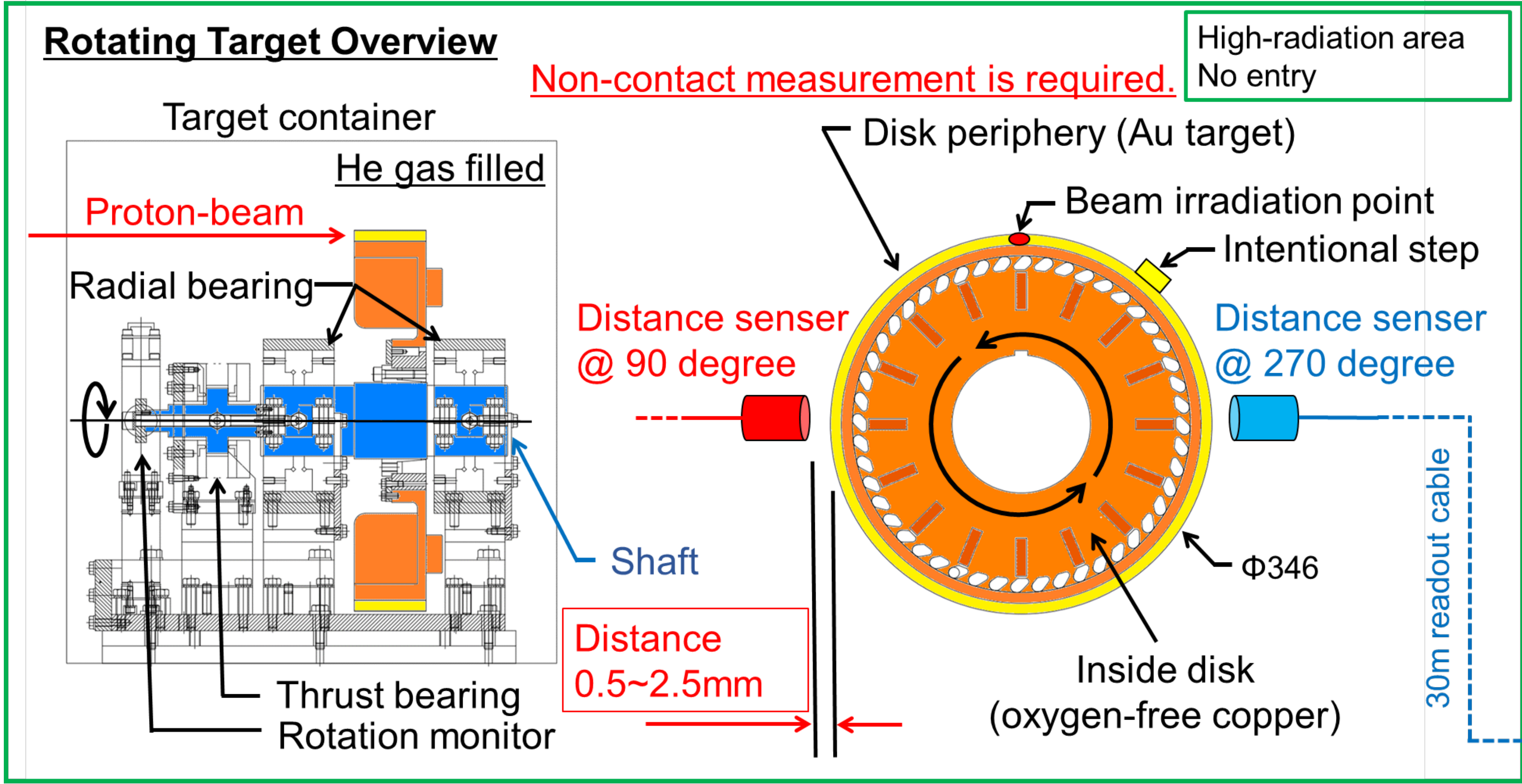


Rotation and temperature test of radiation-resistant distance-sensor for rotating-disk-type target at J-PARC Hadron Experimental Facility.

Fumimasa MUTO for Hadron Beam Line Group (KEK / IPNS)

1. Monitoring concept of rotating-target condition.

At J-PARC Hadron Experimental Facility, a new rotating-disk target is being developed to achieve the beam power of 150 kW. The rotating target is advantageous in terms of dispersions of heat load and radiation damage compared to current fixed target. However, target-condition monitoring is not an easy task. → A radiation-resistant distance-sensor for target monitoring is now under development.



Operating environment

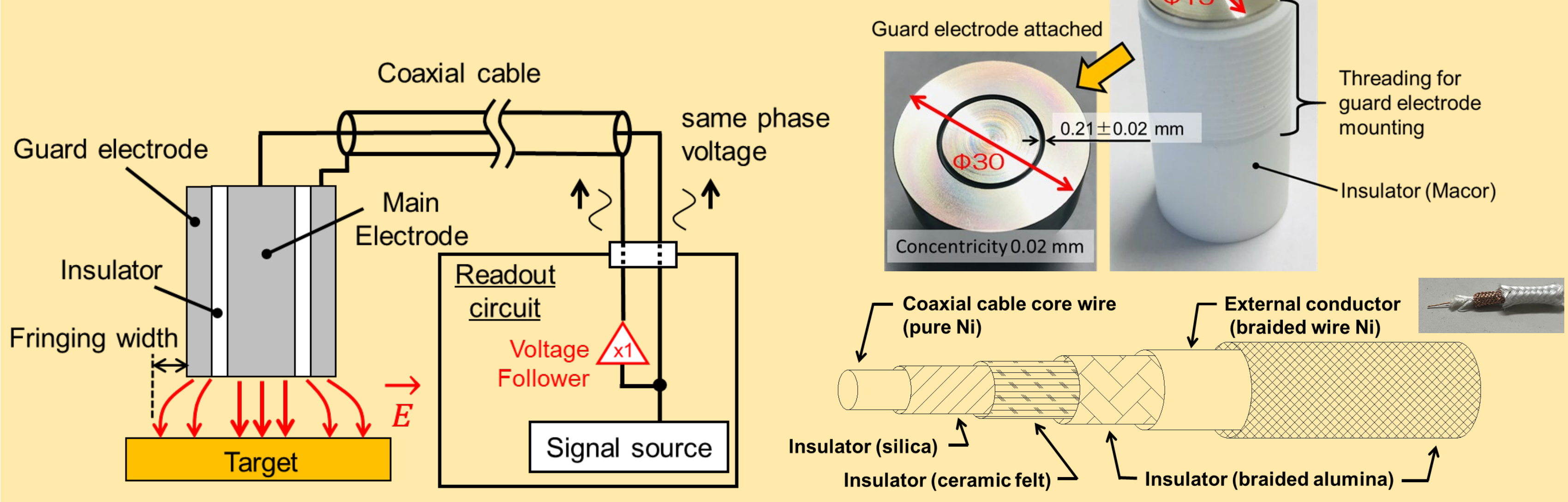
- **High radiation from proton beam :**
At the sensor position, the cumulative dose of 200 MGy or more is expected by 150 kW × 10,000 hours beam operation.
→ Even epoxy resin can not be used. → adopting ceramic.
- **Long distance signal transmission to low-radiation areas :** ~30 m
- **Radiant heat from the target :** ~100°C (Unverified)

Monitoring parameters

- ① **Rotation speed** → Relating cooling capability.
(e.g. 200 RPM is necessary for 150 kW beam.)
- ② **Eccentricity** → To check rotation stability.
(c.f. designed clearance betw. shaft and gas-bearing is 20 μm)
- ③ **Thermal expansion** → Showing thermal load on target disk, and useful to estimate thermal stress and fatigue.

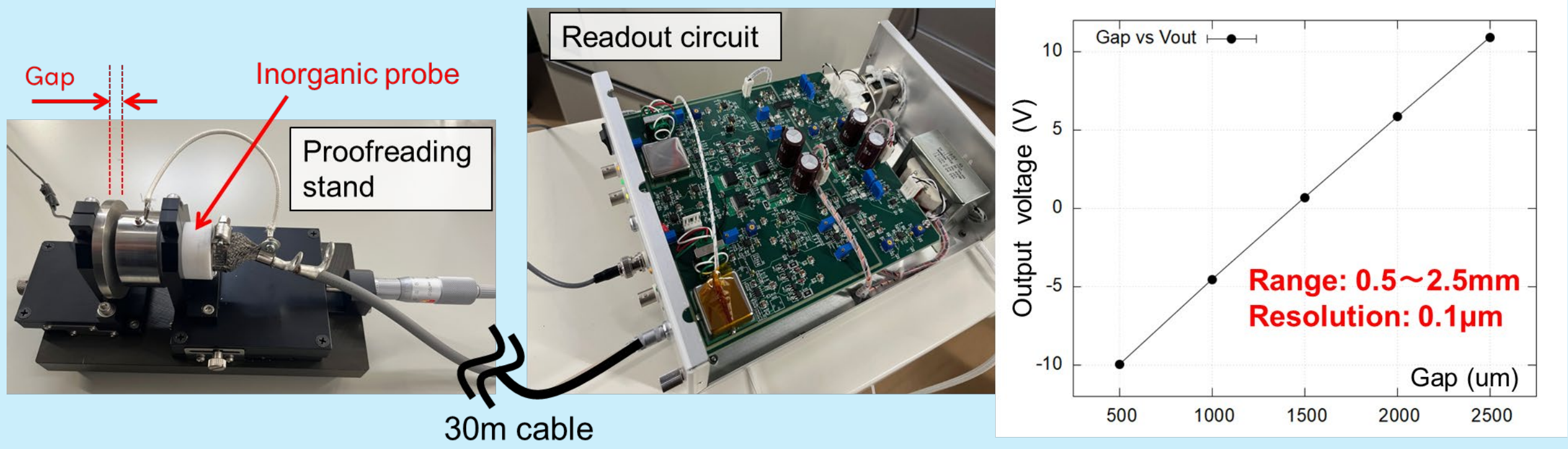
2. Development items for distance sensor.

Fully inorganic probe & cable



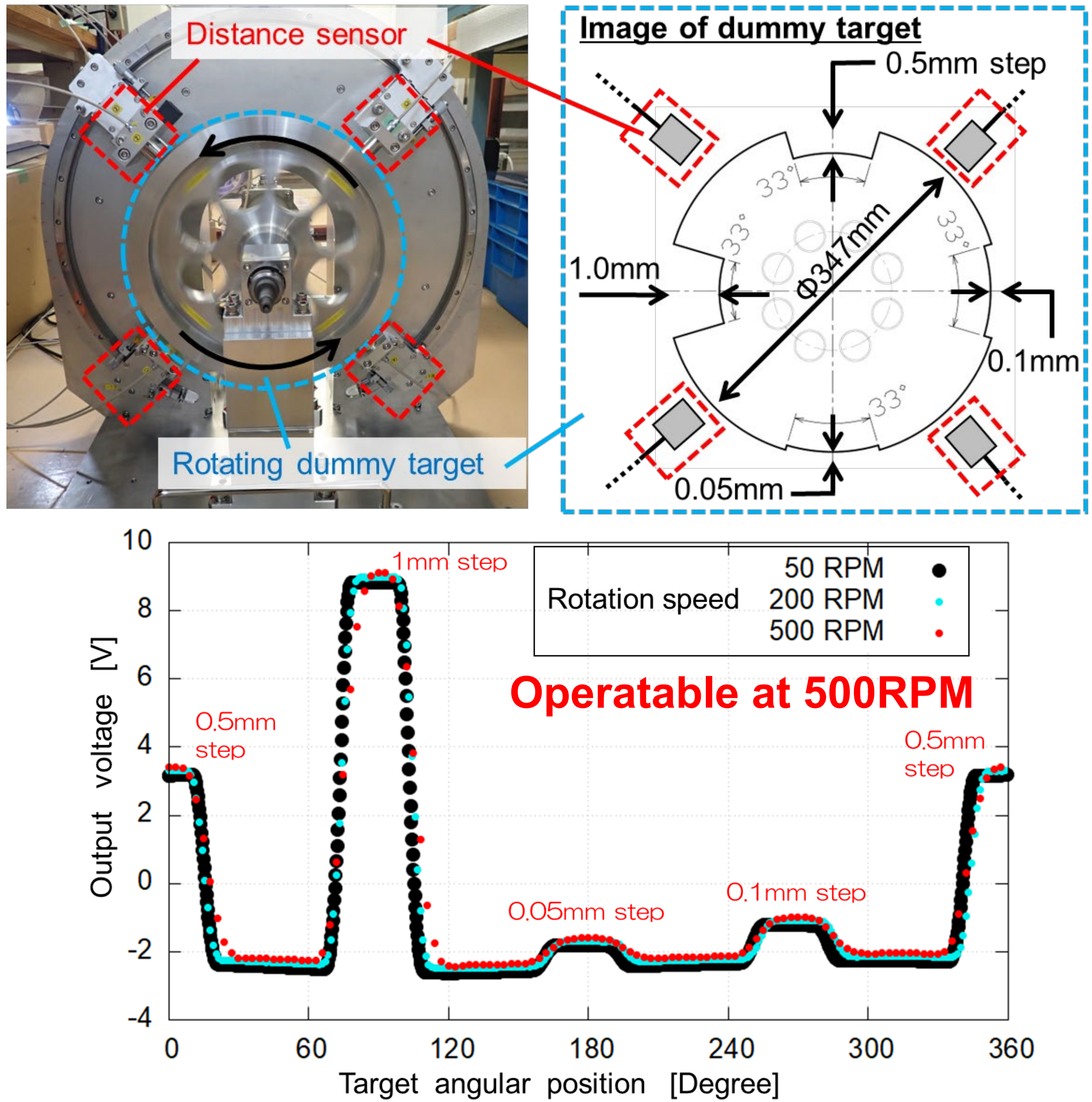
Readout circuit for long distance signal transmission

- Long cable carry significant parasitic capacitance.
The following measures were taken:
- ① Increasing the probe's capacitance.
 - ② Reinforcing the shielding.
 - ③ Adjusting the circuit parts parameter.
- **Linear voltage output achieved even with a 30m cable.**



3. Rotation test

We fabricated a dummy target modeled after the actual target. The dummy target featured various depth steps that can be used for response verification of distance sensors.



4. Temperature dependency test

The temperature dependence of the probe, cable, and readout circuit comprising the distance sensor was confirmed. Among these components, temperature dependence was confirmed only for the probe.

