Calibration Source Deployment System

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Motivation of Automated Calibration Source Deployment System

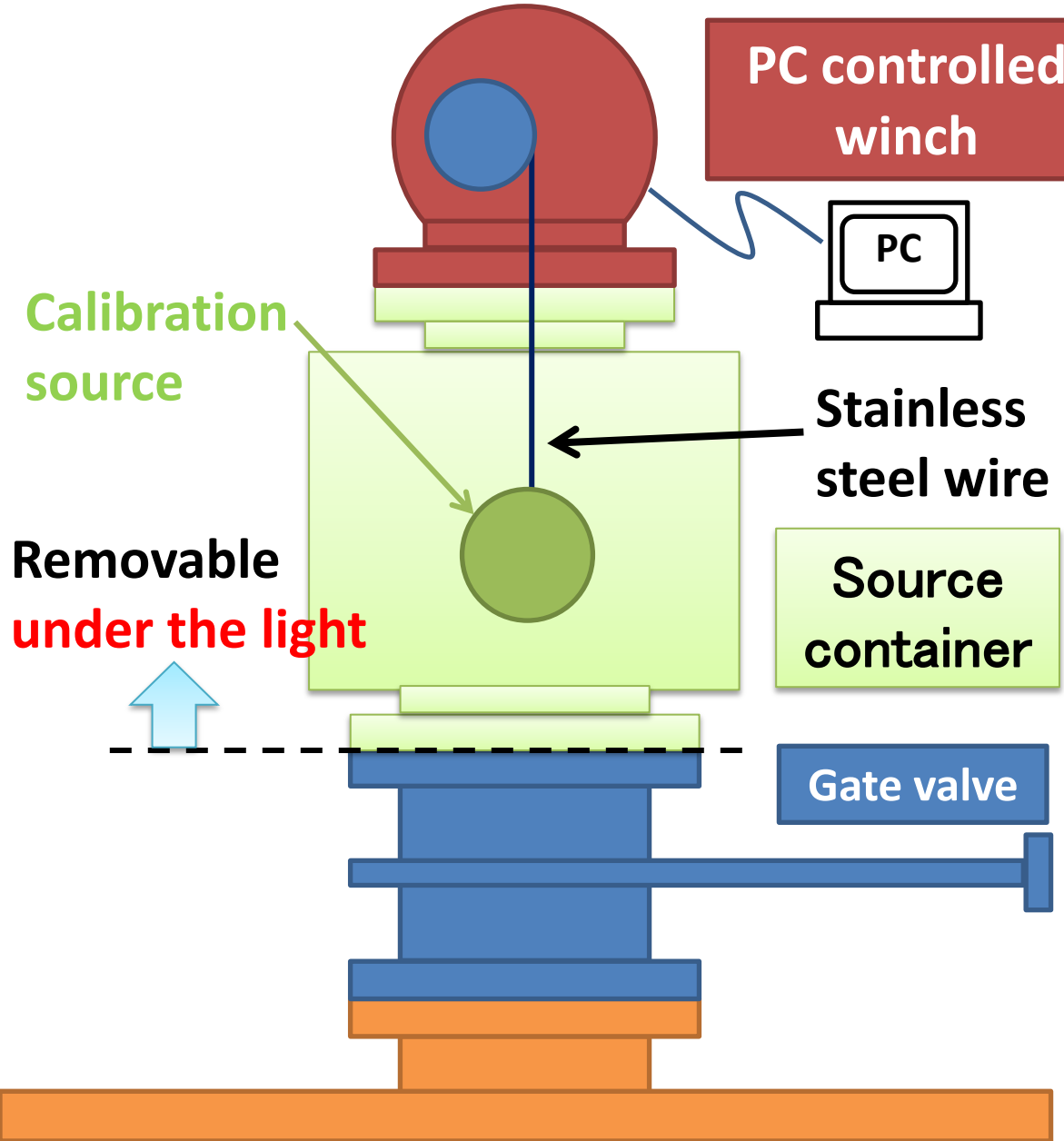
- In current SK calibration, we need much manpower and working time.
- We have to automate these works in HK, which is 20 times larger than SK.
- An approach to this problem is presented here. It is illustrated for one of the several calibration systems needed.
  - computer controlled (remote controlled)
  - compact and light-shielded (easy to use)

Test items

- **It works.**
- **It is reliable and stable.**
- **It is safe.**
  - **avoiding falling things (especially calibration sources) into the detector**
  - **no light leak**

After guaranteeing these items by several tests, we plan to test the system in SK. These results will be applied for HK calibration program.

Rough Design of Semi-automated System for Calibration



Design requirements

- Safe for SK detector.
- Movable in Z (vertical) direction.
- Position precision < ±5mm.
- Monitor the wire tension

Most of SK calibration sources are deployed hanging by a wire

Calibration Source	Weight & size	Cable
Ni/Cf (once a month) Absolute gain calibration	~ 10kg ~ ϕ 20 cm sphere	Stainless wire
DT(～twice a year) To create ^{16}N via the (n,p) reaction on ^{16}O in the water Absolute Energy calibration	~ 50kg ~1.5m high	Stainless wire + Power cable
Rayleigh Device (occasionally) Laser To measure Rayleigh scattering	~ 30kg ~1 m high	Stainless wire + Power cable + Optical fiber
Diffuser Ball (LED) / Scintillation Ball (Xe) Timing/relative gain calibrations	~ 200g ~ϕ 5 cm sphere	Stainless wire + Optical fiber

← First Target

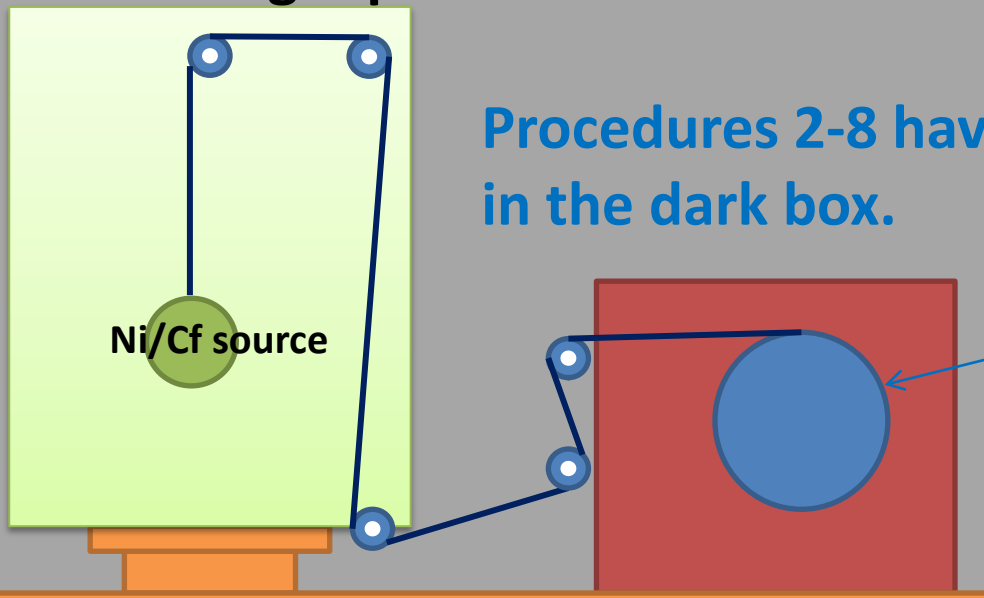
***All sources are deployed through the calibration hole (~ϕ 20 cm).**

Ni/Cf source is the first target. Although the weight and size are different, we can apply the same technique for the other sources.

Current Ni Calibration

Dark box
～2.5 m × ～2.5 m × ～2.5 m

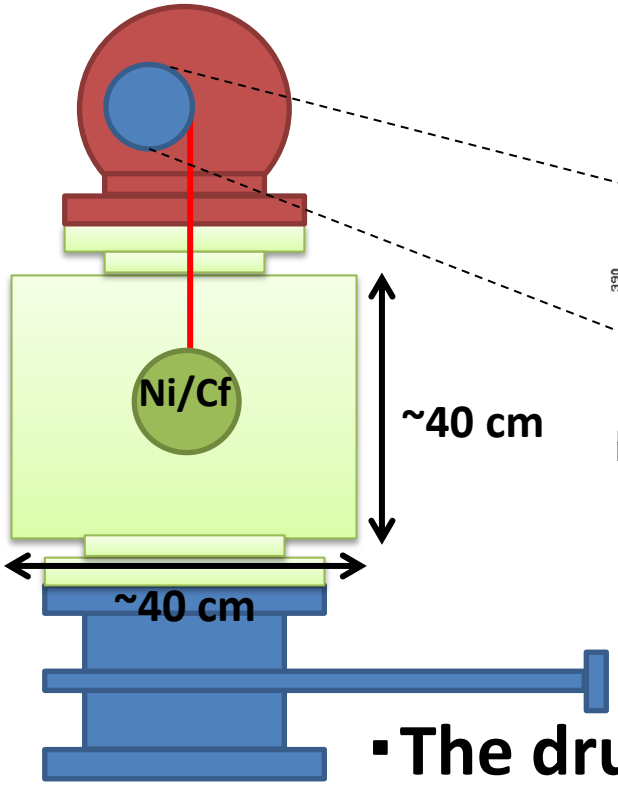
1. Set the dark box (We need 4 people.)
2. Confirm light shielding
3. Open the flange
4. Set source box & winch
5. Set the Ni source to the wire
6. Take down the source about 1-2 m below manually
7. Till 5m slowly by motor
8. To the target position at the normal speed

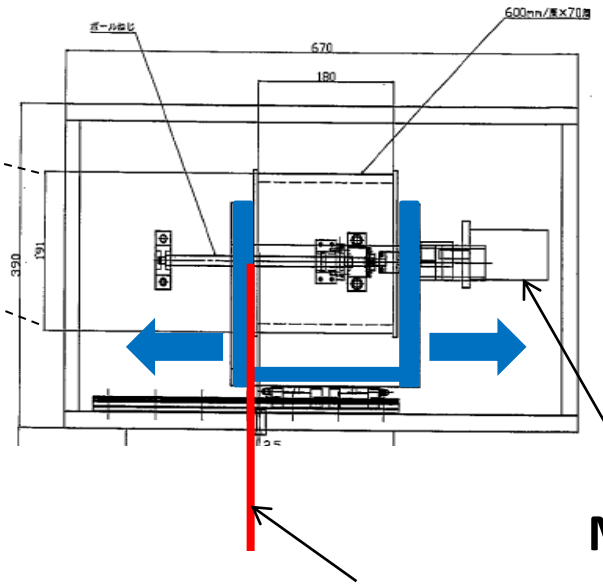


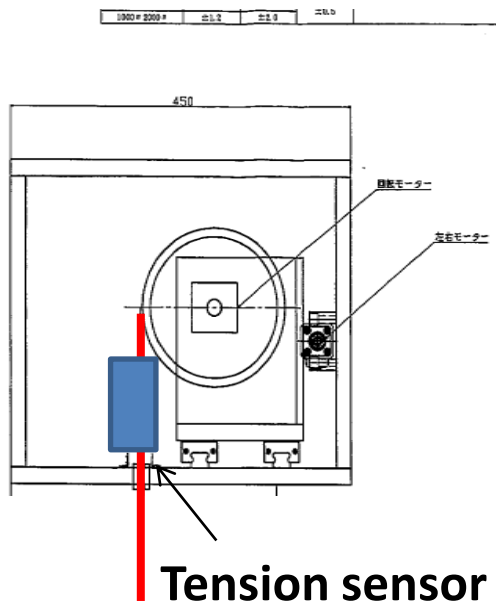
Procedures 2-8 have to be done in the dark box.

Automate this work!

Current Design Status

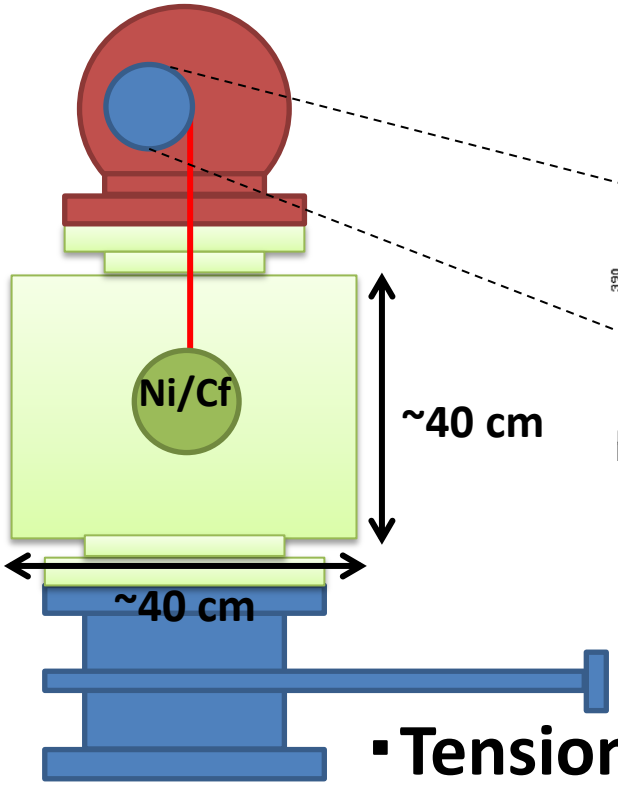


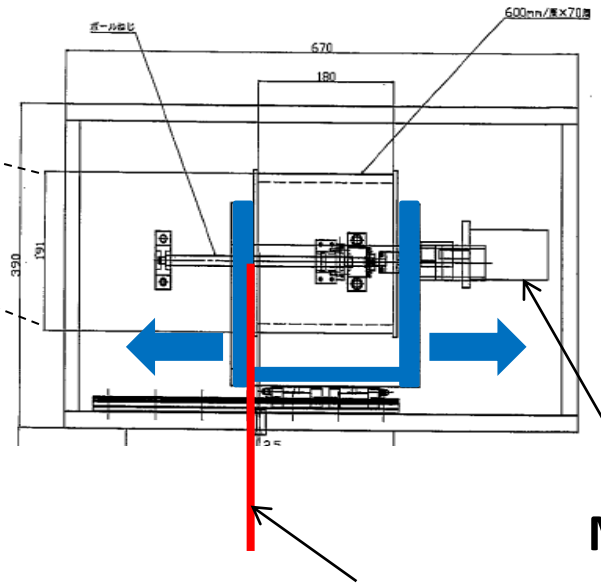


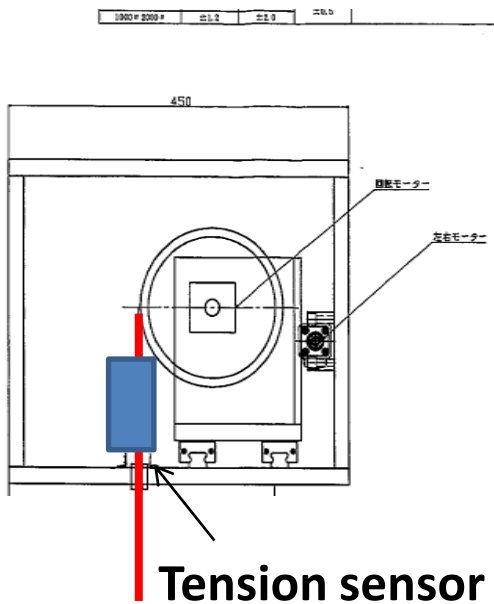


- The drum is moved in right and left by a motor to keep the wire position while paying out or winding it (detail is under discussion).
- The wire is strong enough.

Current Design Status

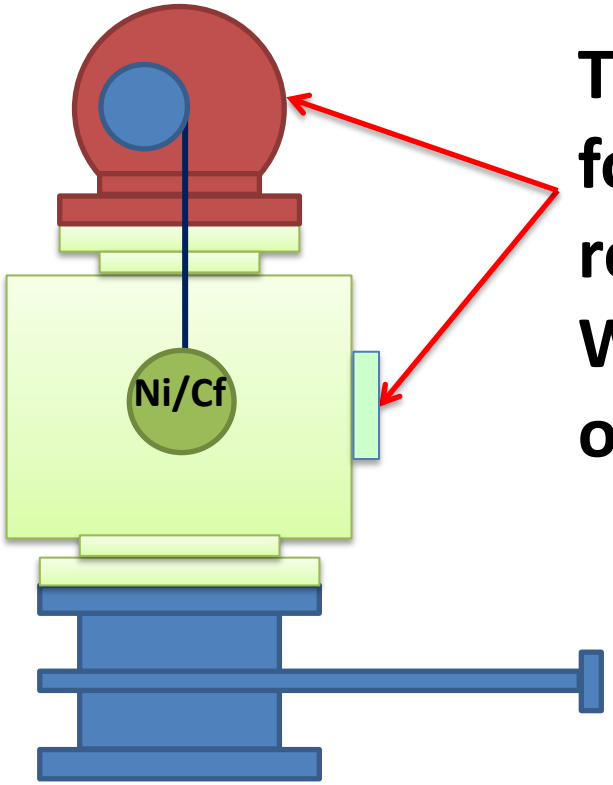






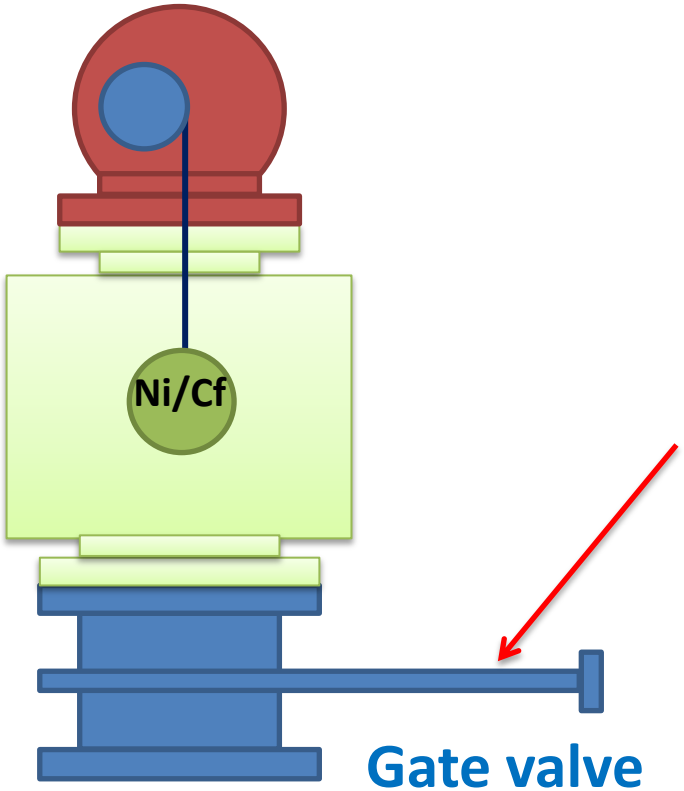
- **Tension monitor will be installed.**
  Max. Meas. :200 N(~20kg), Sensitivity : 2 N

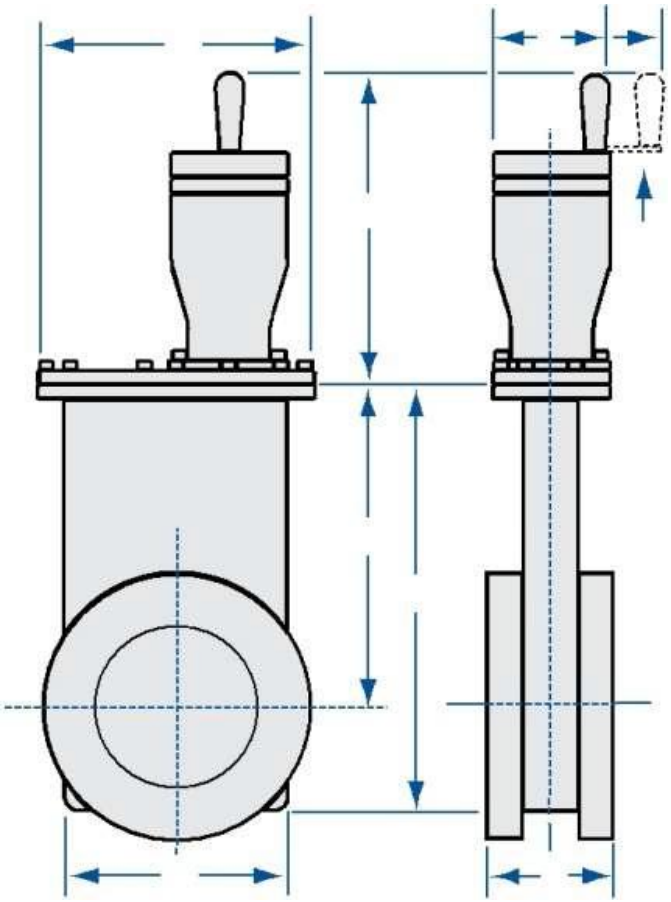
Current Design Status (cont'd)



There are opening and closing windows for maintenance and source attachment, respectively.
We are thinking of setting locks not to open them while operation.

Current Design Status (cont'd)





Gate valve

can shield the light (We should confirm it ourselves).

This product is a candidate.

Automatic gate valve is also considered.

Schedule

First design was proposed. Further design is under discussion among SK calibration group, taking into account the detector safety well.

FY2014

July-Sep. : Finalizing the design (safety first !)

Sep.-Dec. : Manufacturing

Dec.-Mar. : Test & study in the air

- **basic operation, position precision, wire tension, etc in a short range (a few meters vertically)**

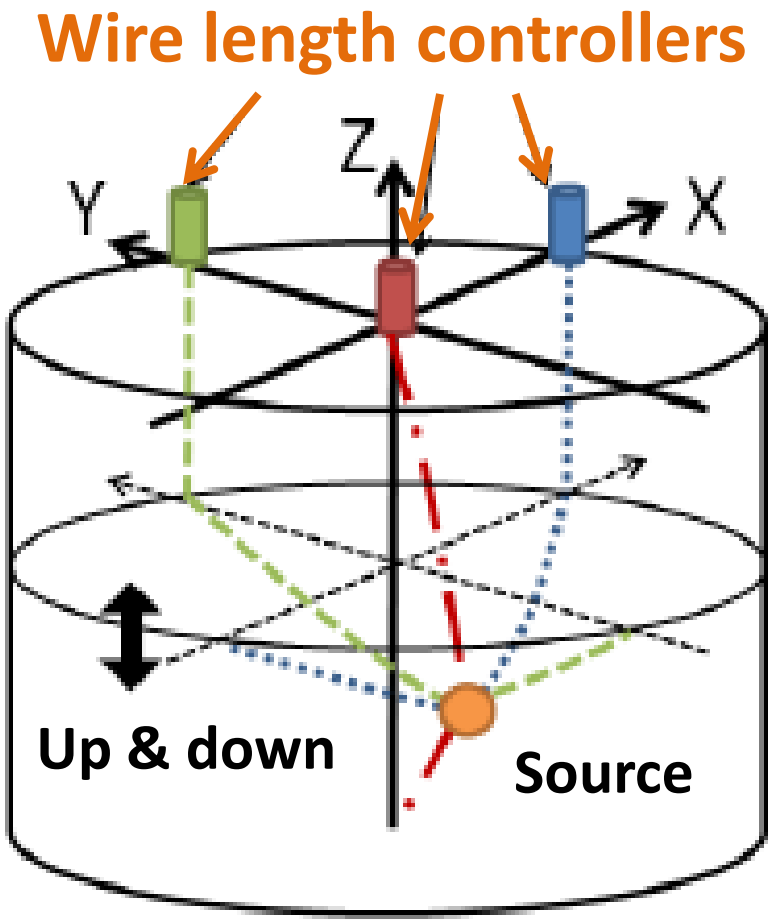
Schedule (cont'd)

FY2015

1st half : Control software optimization & test in the water (small pool & water tank)

Fy2015 2nd half - FY2016

- **Test in SK (if possible)**
- **Full operation in SK**
- **Start R&D in the HK prototype (3D ?)**



Summary

- A calibration source deployment system is planned.

–For the time being only Ni calibration source is considered; controlled by PC, source operation in z direction, easy to deal under the lights.

- The system will be manufactured in FY2014.
- The tests in the air/water will be done in FY2015
- The tests in SK and full operation in SK is planned in FY2015 -FY2016.
- After guaranteeing the detector safety, reliability, stability, and good operability, we will apply the system at HK calibration.