



Development of a high sensitive radon detector in Kamioka



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1. Abstract:

Radon is one of major background sources in the underground neutrino experiments. Our group has been working to develop a high sensitive radon detector, especially for Super-Kamiokande and XMASS experiments in Kamioka.

Recently, we are trying to make a new vacuum-tight electrostatic-collection radon detector with 80 liter volume. In this poster, we will report the basic performances of the new 80-L radon detector and possible applications to the underground neutrino experiments.

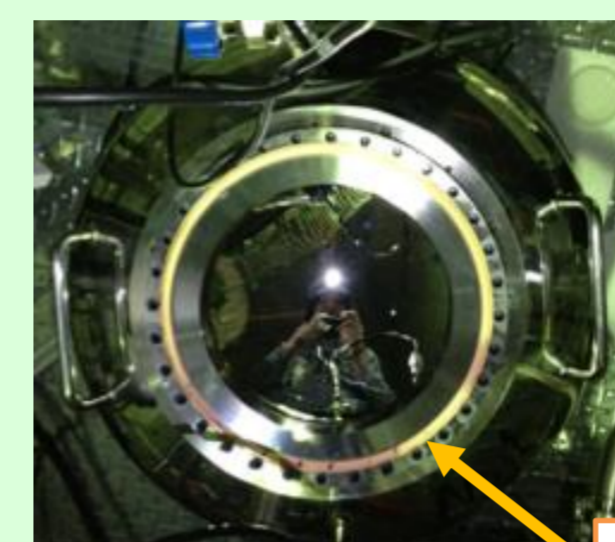


2. 80-L Radon detector:

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Cf. 70-L Rn detector: NIM A421 (1999) 334

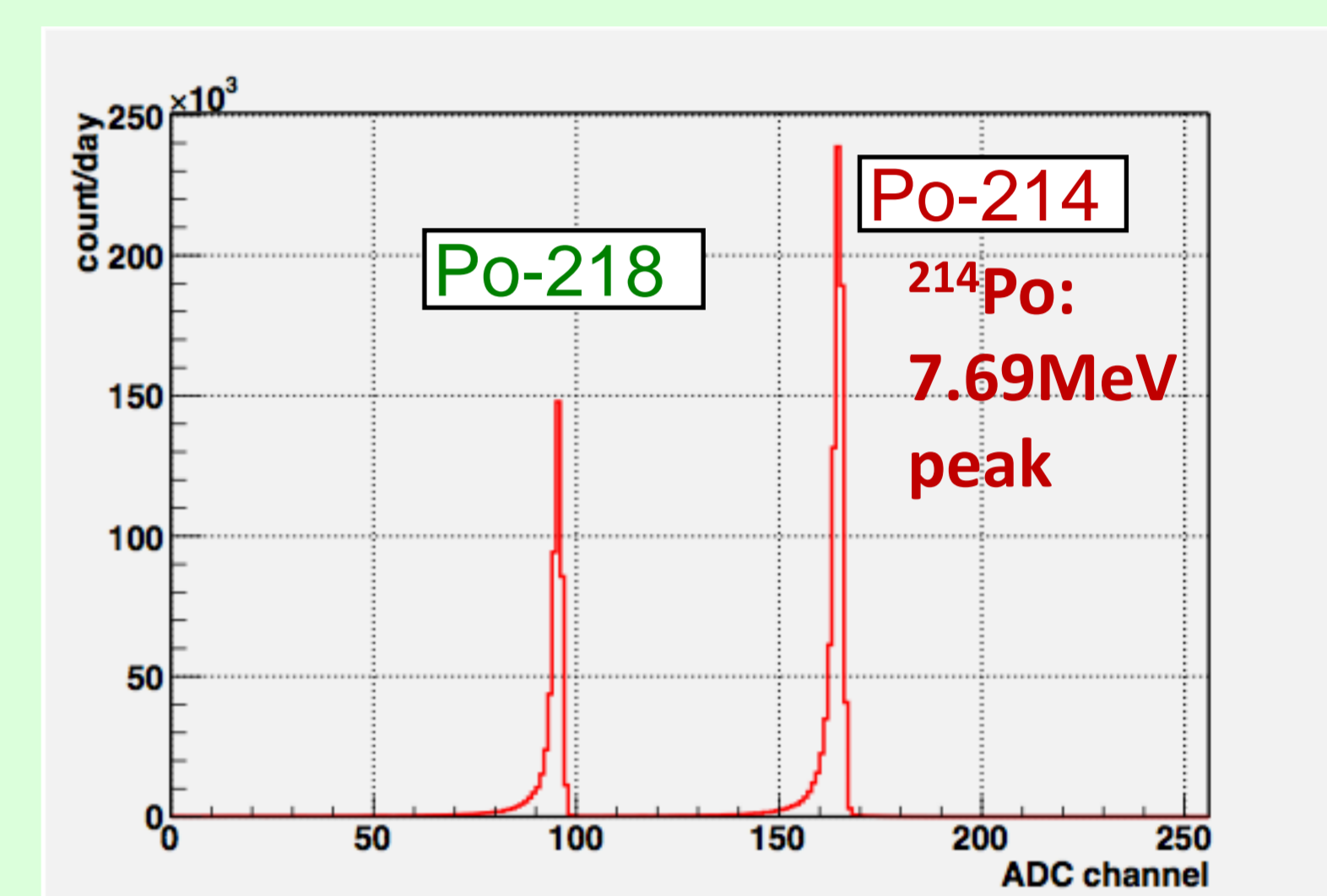
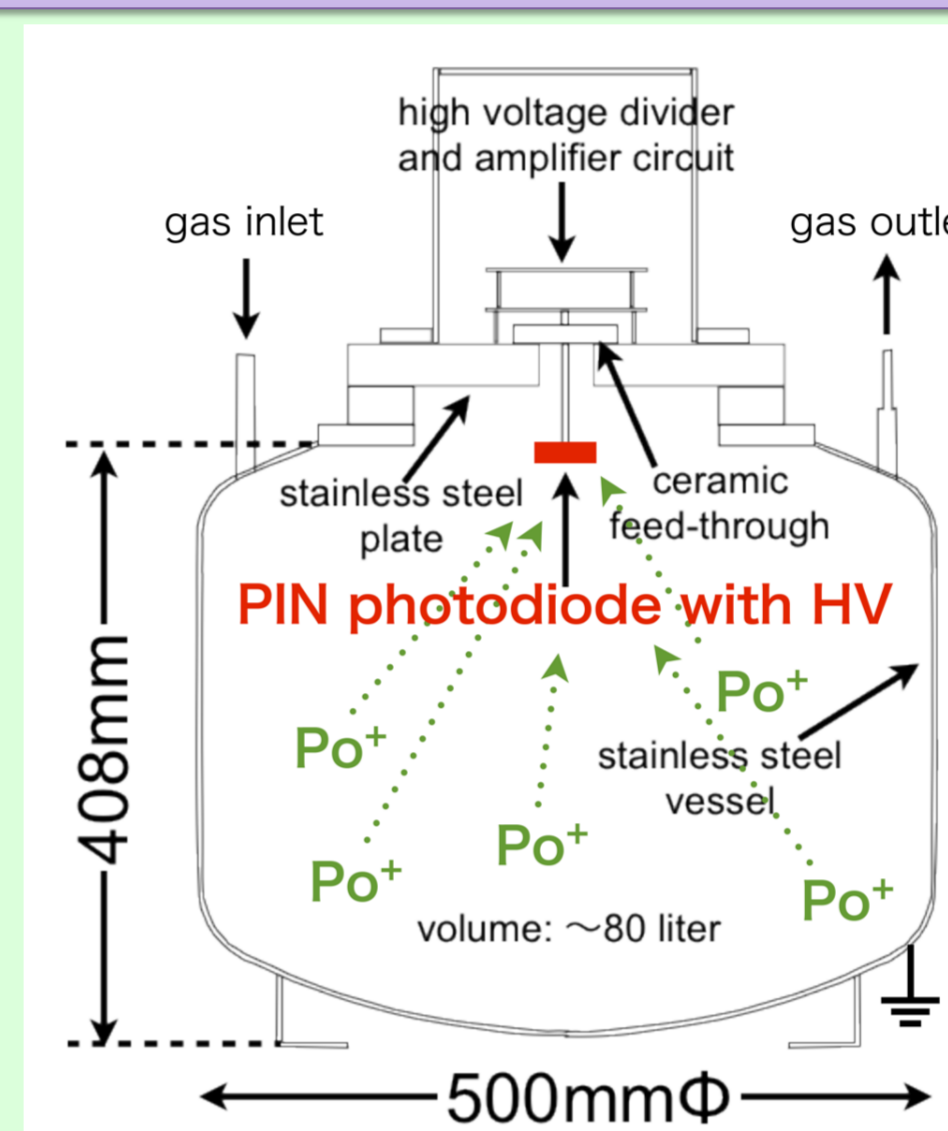
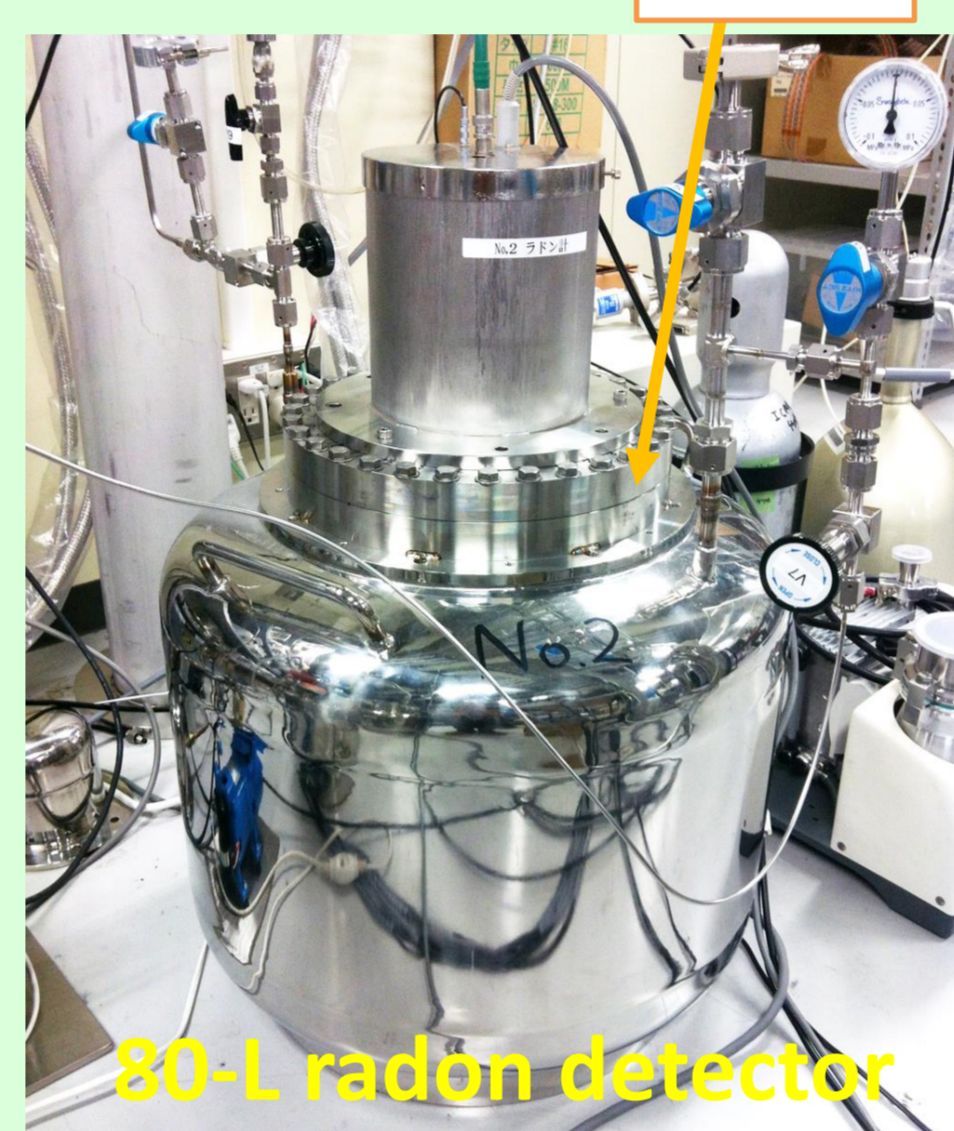
PIN photodiode (18mm x 18mm)



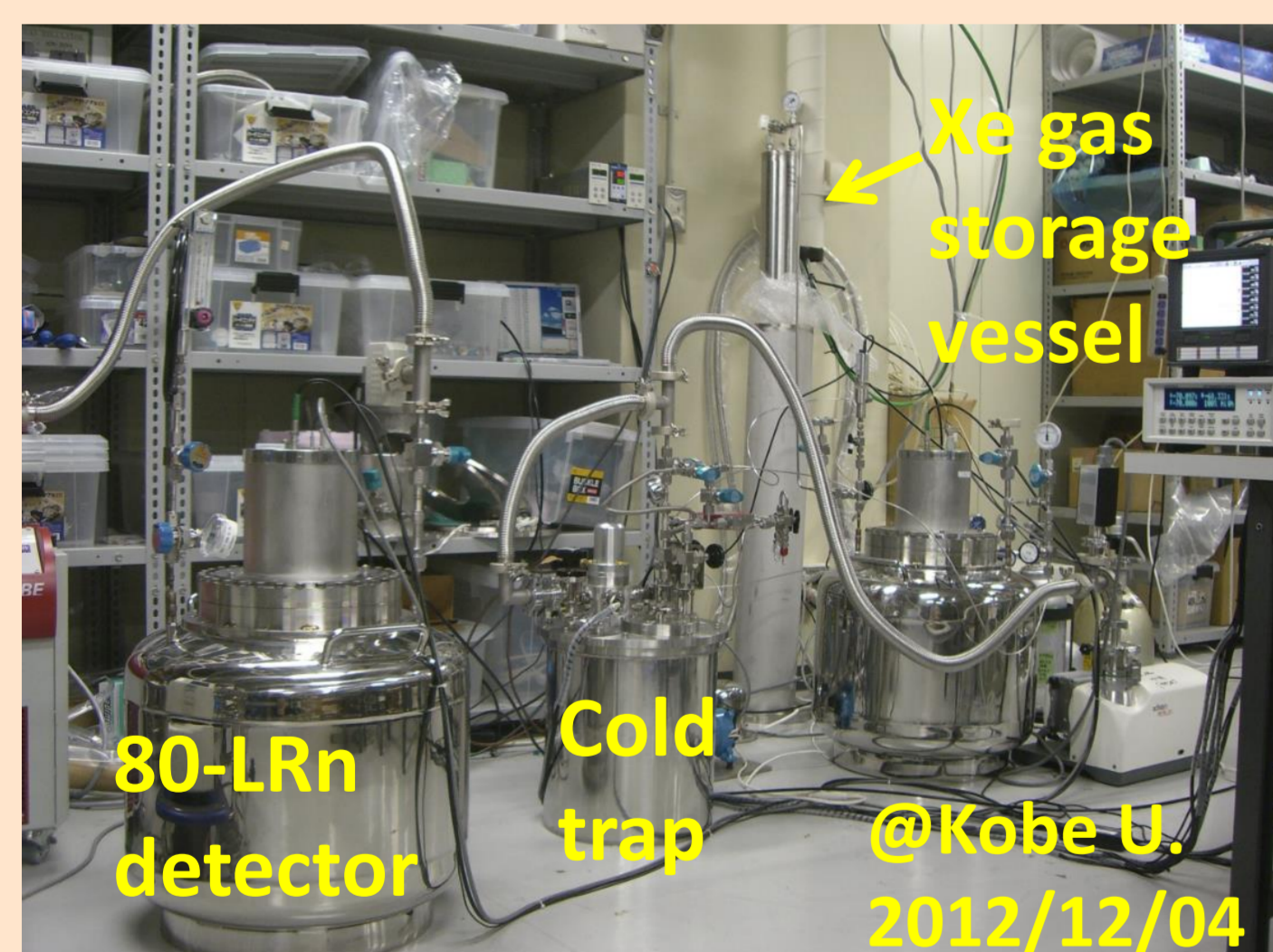
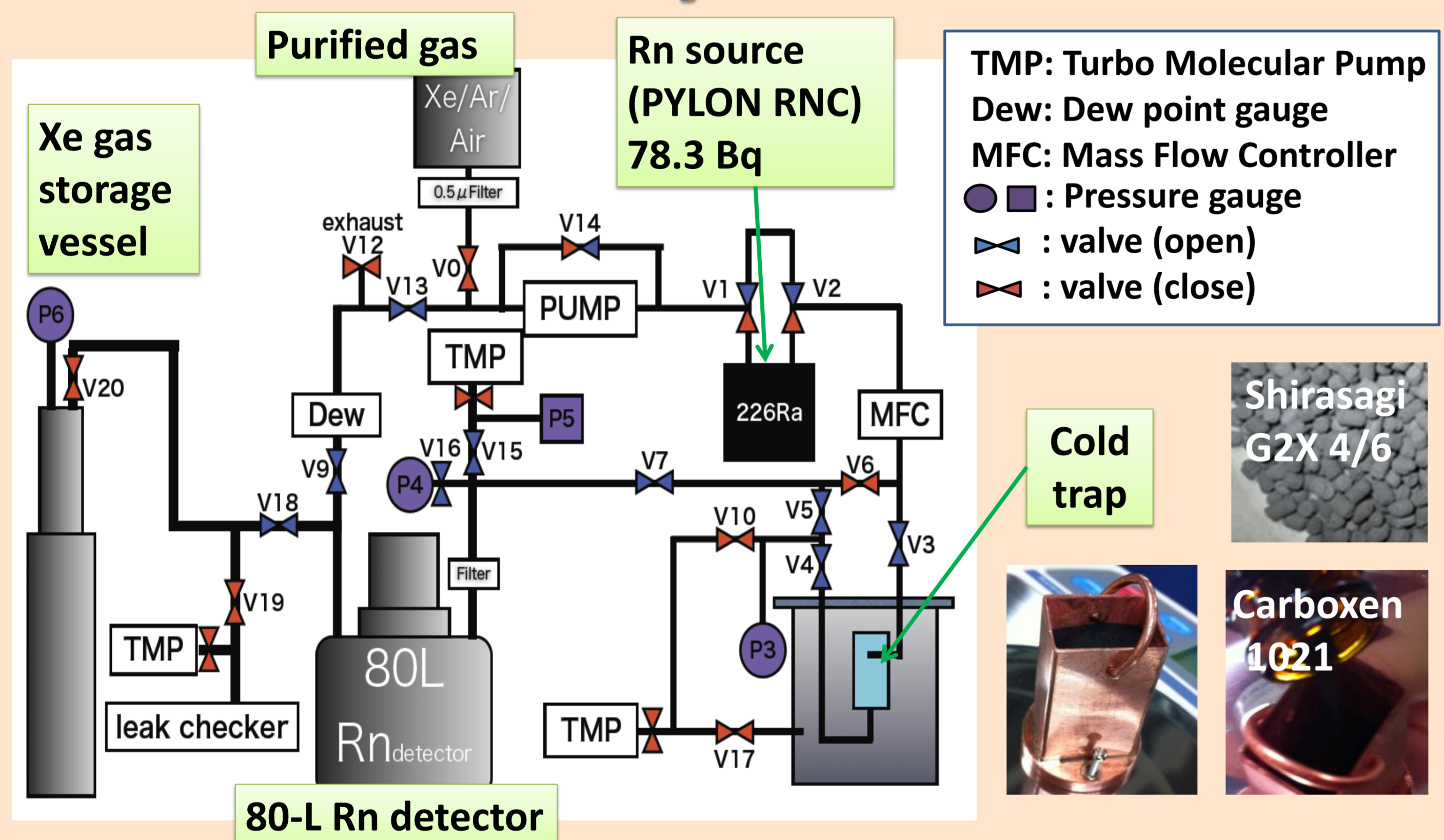
- PIN photo diode + electrostatic collection
- Detector surface: grounded, PIN photodiode: -0.2~-2.0kV
- Developed mainly for Super-K and XMASS experiments.
- Inner volume is about 80-L.
- Viton O-rings and an acrylic plate in the 70-L Rn detector are replaced with ICF flanges in the 80-L Rn detector.
- ^{214}Po count rate is used to estimate ^{222}Rn concentration.

Schematic view of the 80-L Rn detector

ADC distribution of Rn signals



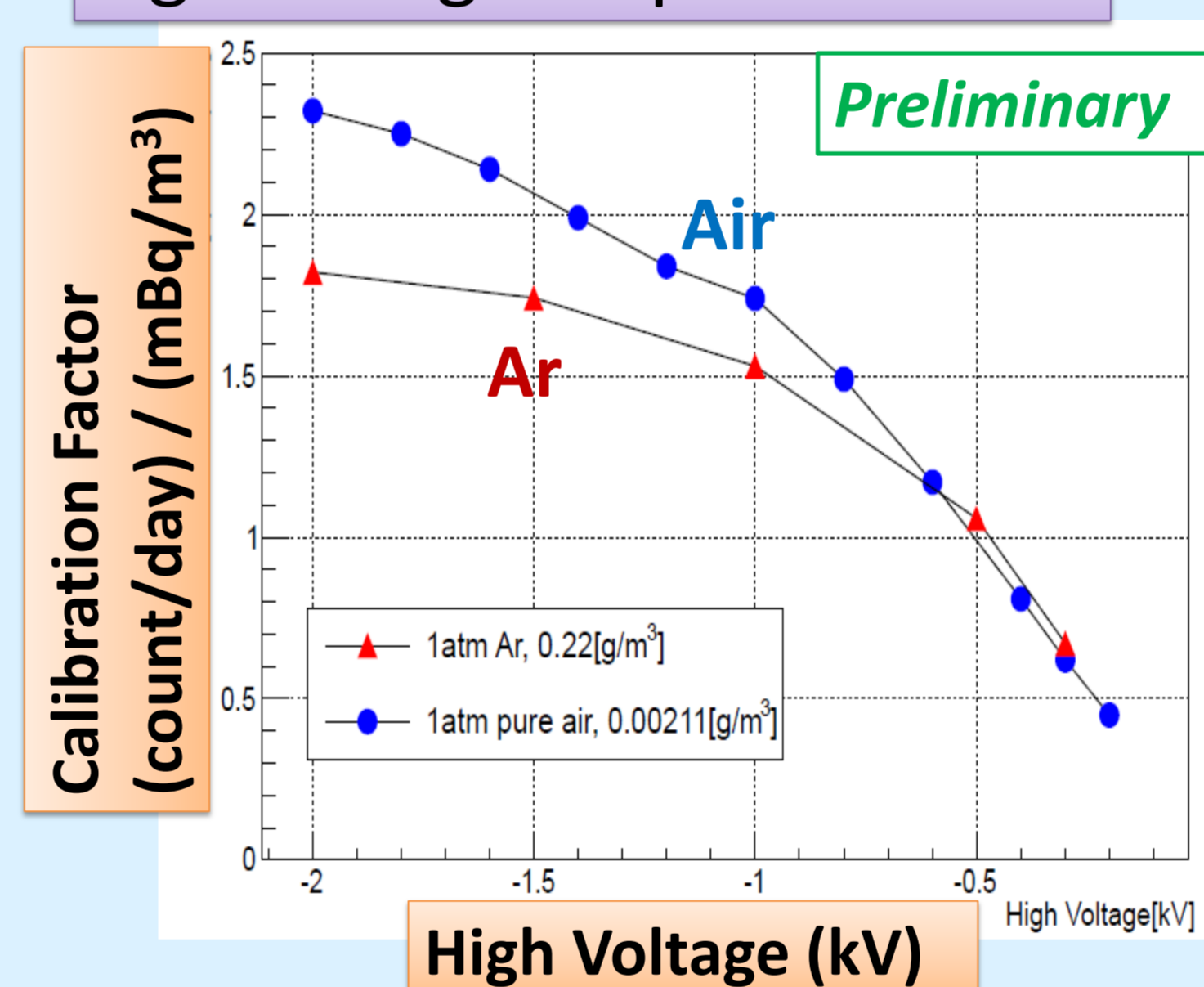
3. Calibration system at Kobe:



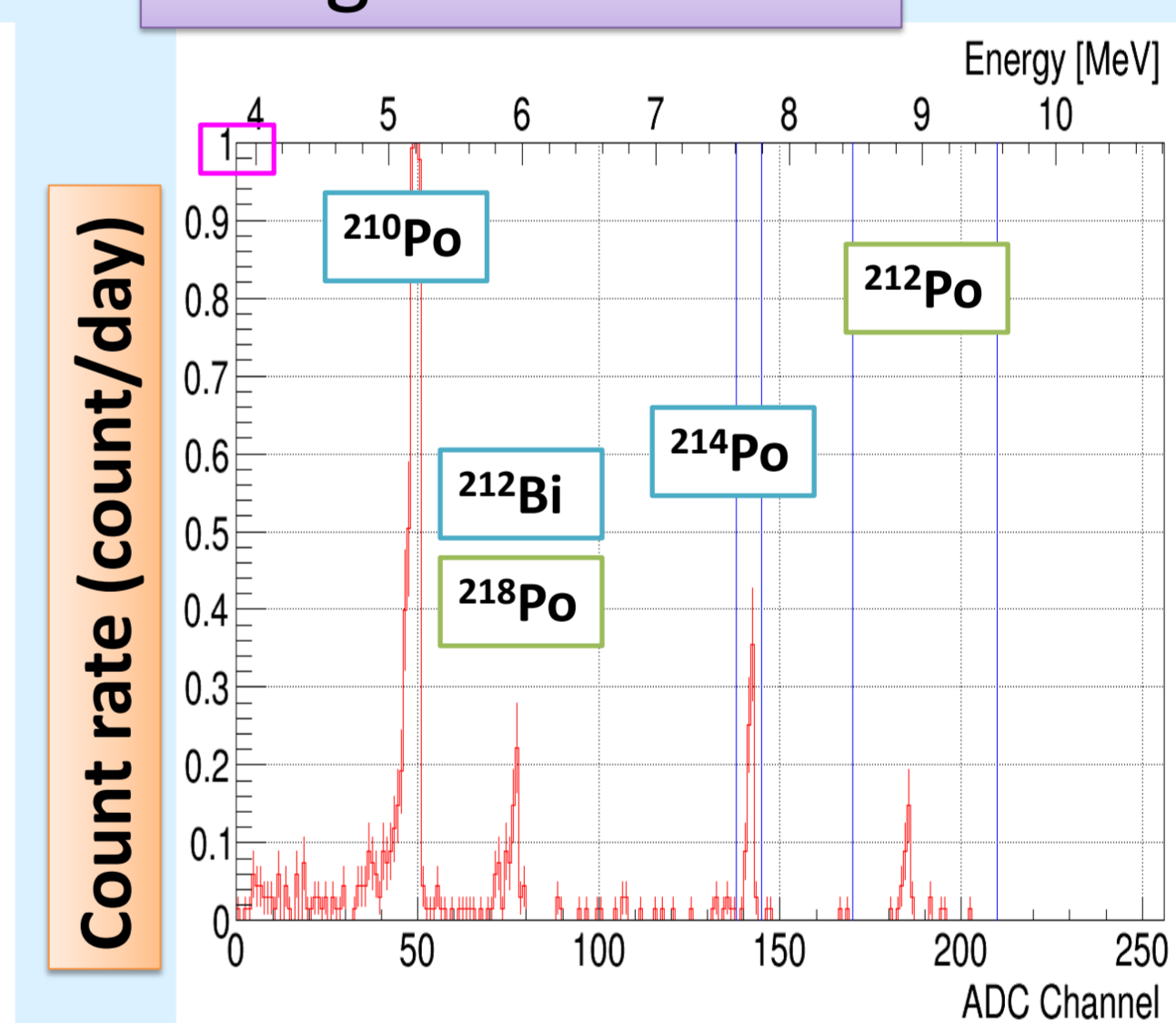
- Radon detector is calibrated with purified carrier gas with known amount of radon.
- Calibration Factor (CF) is obtained from observed ^{214}Po count rate at the Rn detector and calculated Rn concentration in the gas under various conditions.

4. Basic performance:

High Voltage dependence



Background level

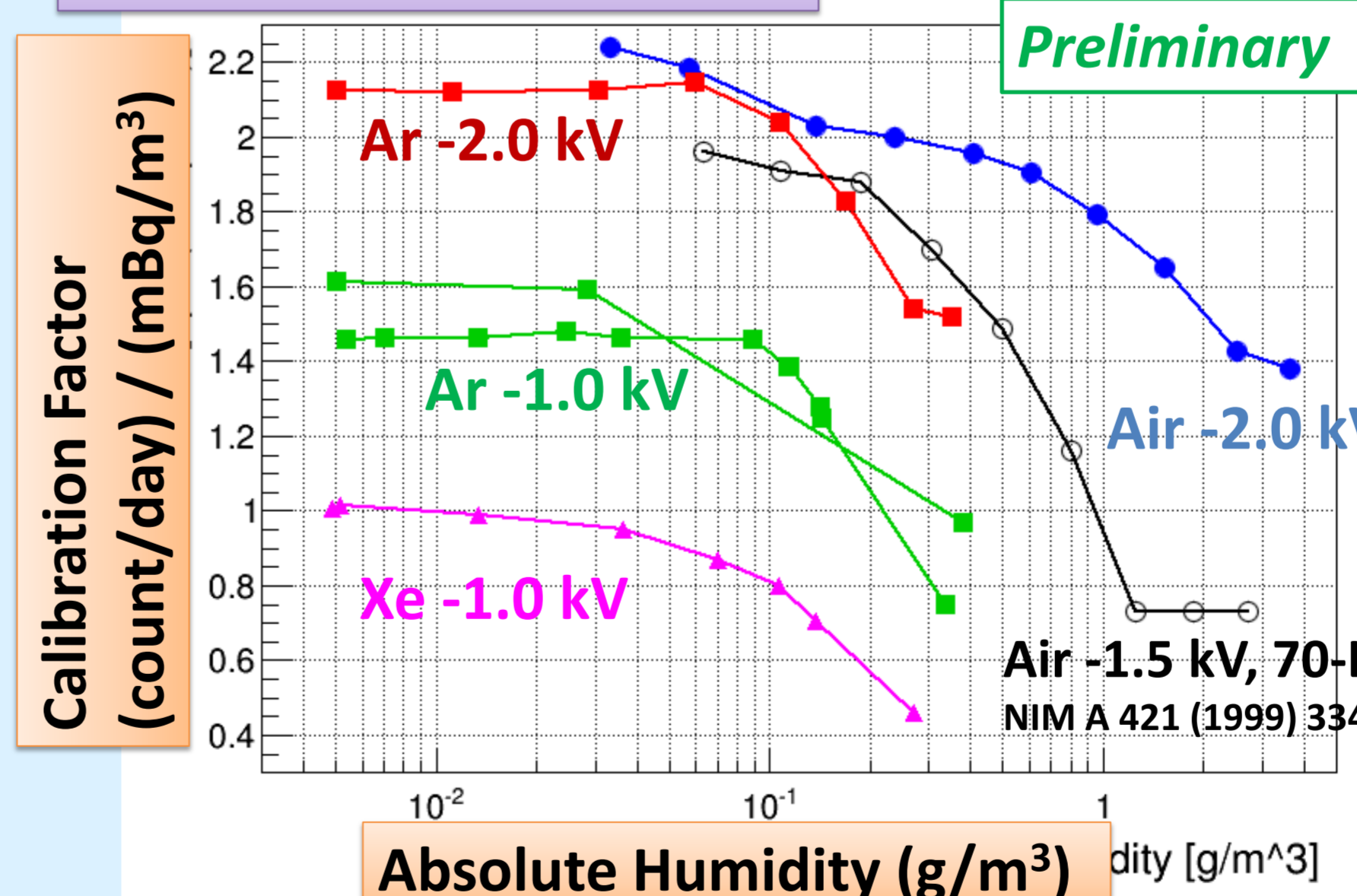


Preliminary

	Count Rate [count/day]
^{210}Po	(5.7 +/- 0.3)
^{224}Ra	<0.15
^{218}Po	0.8 +/- 0.1
^{212}Bi	<0.1
^{220}Rn	<0.1
^{216}Po	<0.1
^{214}Po	0.8 +/- 0.1
^{212}Po	0.4 +/- 0.1

(In Air, -1.0kV)

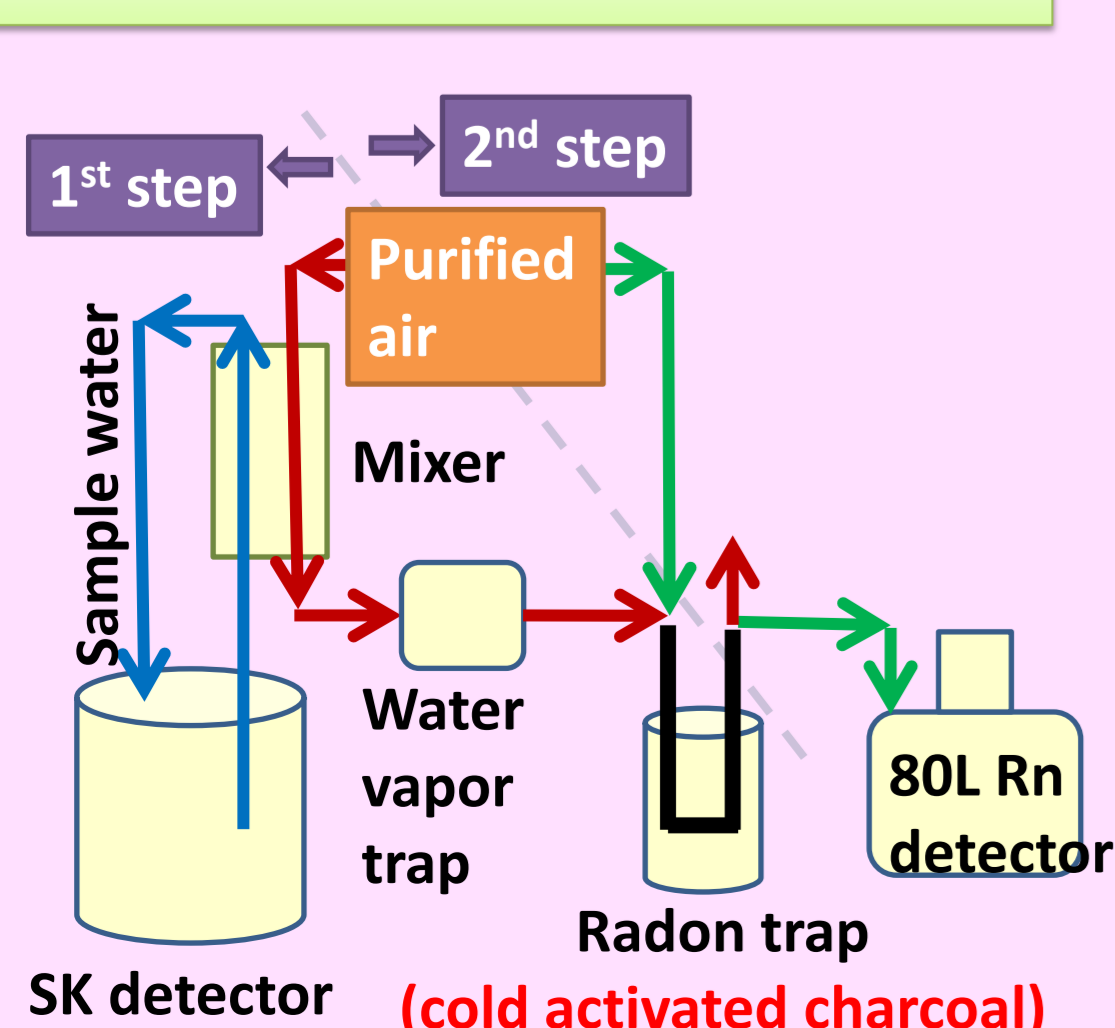
Humidity dependence



- We have measured basic performances of the 80-L Rn detector
- Purified Air, Argon, Xenon gases are used in this measurement.
- BG Rn level: $\sim 0.5\text{mBq/m}^3$
- We are summarizing these results of the performance measurements.

5. Applications:

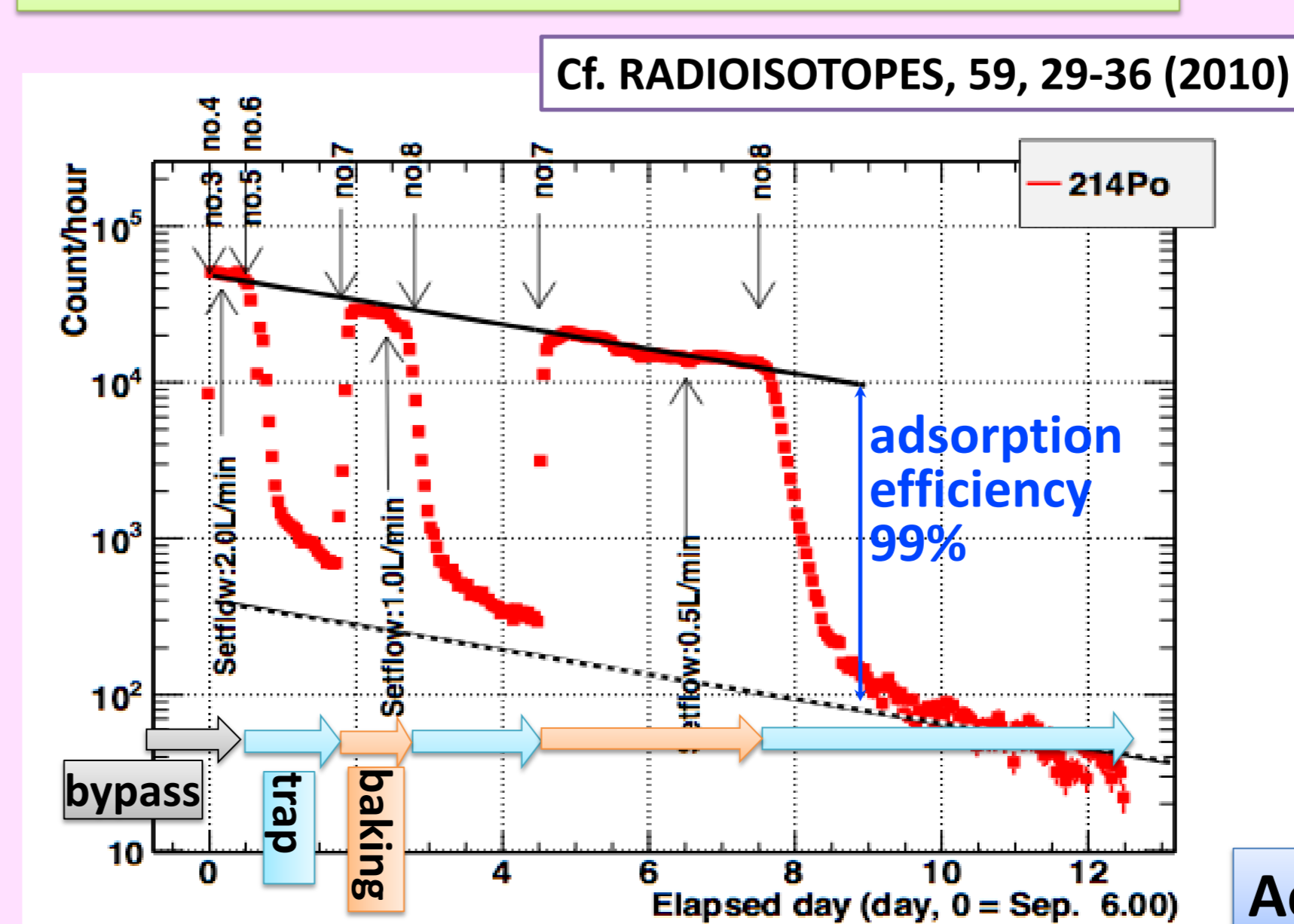
Rn measurement in SK water



1. Radon in sample water is extracted by the Mixer into air. The air go through the cold radon trap. Radon in air will be trapped.
2. Extract radon by baking the radon trap, then the radon will be supplied into 80-L Rn detector by air.

Activated charcoal trap works well for Rn in air

Rn measurement in gas Ar with cold trap



(Using the calibration system at Kobe, in gas Ar, with Shirasagi X2M 4/6, 5g)

1. Evacuate all the system
2. Supply gas Ar (at 0.00 MPaG)
3. Supply Rn for a few minutes, then disconnect the Rn source.
4. Bake the trap at +85 degree C.
5. Cool the trap at -105 degree C.
6. Start flowing through the trap
7. Bake the trap at +85 degree C.
8. Cool the trap at -105 degree C.

Activated charcoal trap works well for Rn in gas Ar