# Rn-reduced air systems on KamLAND

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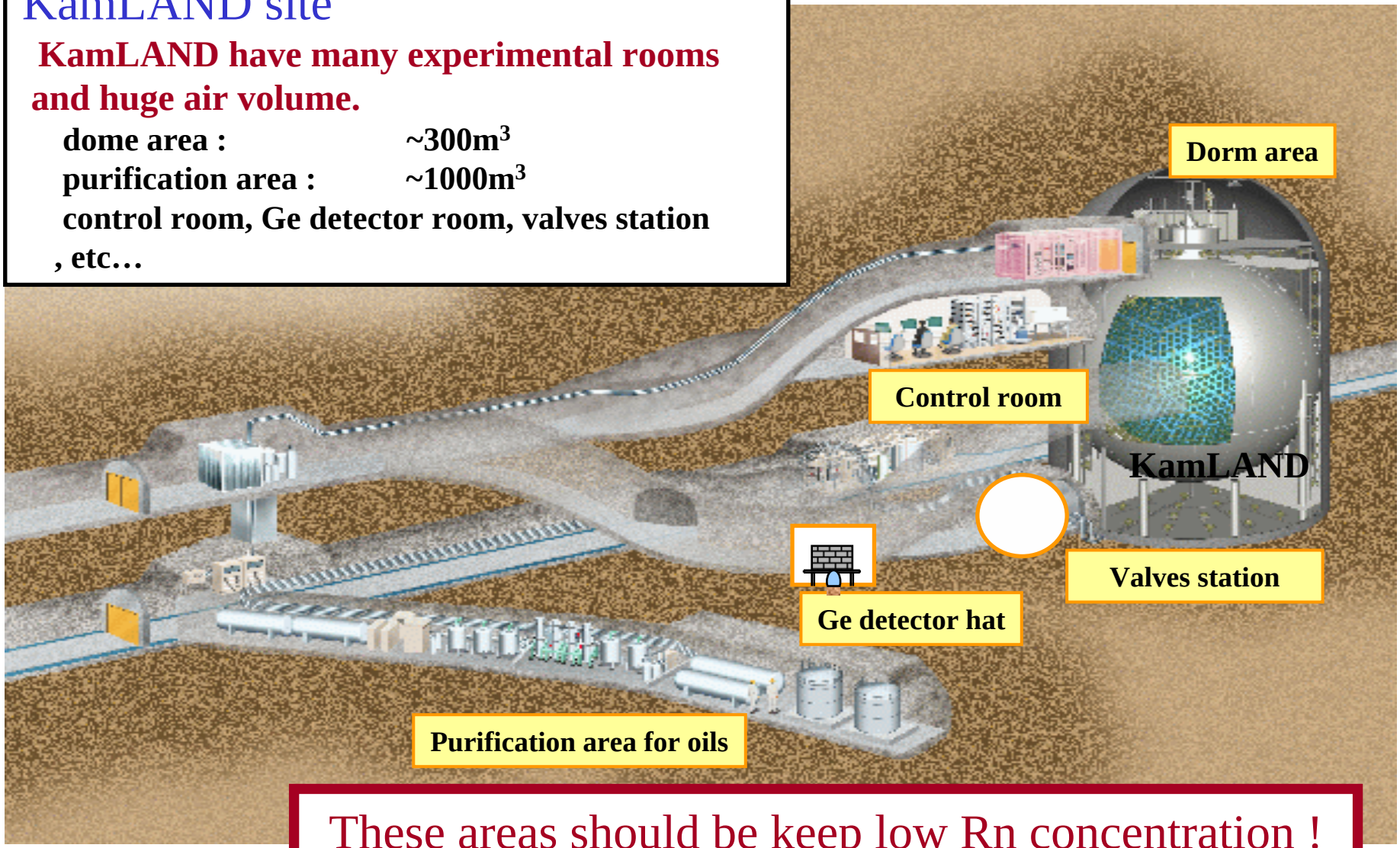
# KamLAND site

**KamLAND have many experimental rooms and huge air volume.**

**dome area : ~300m$^3$**

**purification area : ~1000m$^3$**

**control room, Ge detector room, valves station , etc…**

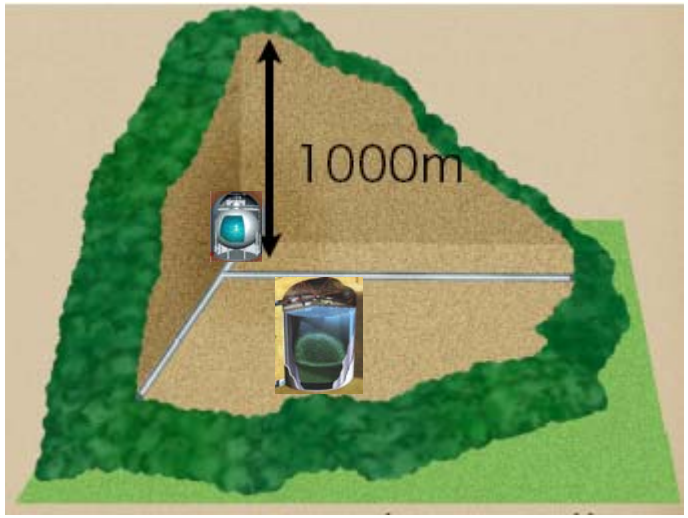


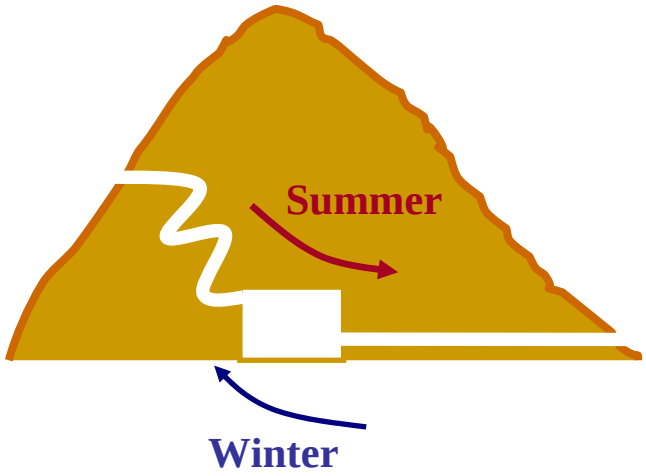

These areas should be keep low Rn concentration !

# What kind of the Rn-reduced air system is better for large and sensitive detector?

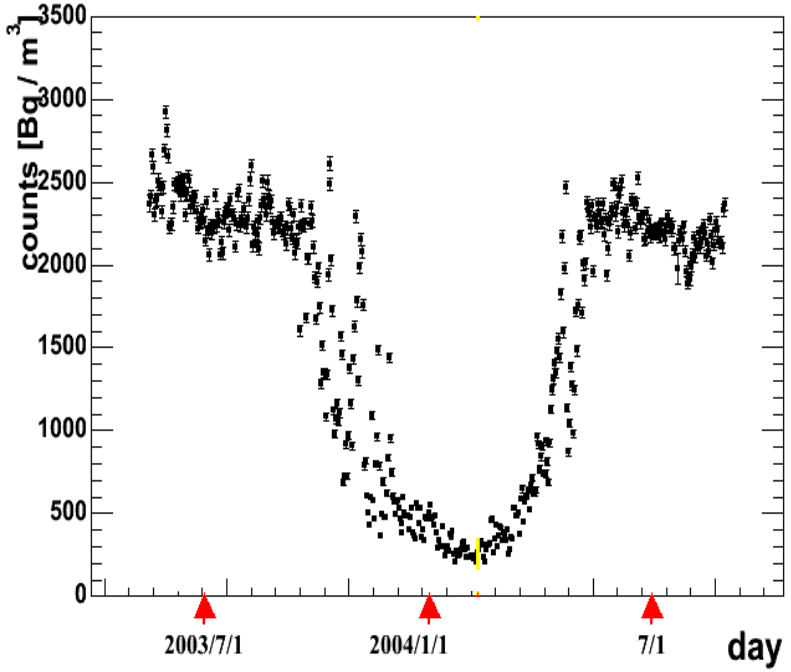
- Rn concentration in the mine air is too high
- Spaces are limited in the mine
- We need large volume Rn-reduced air supply system .
- Access points to the detector should be very low Rn concentration (ex. chimney area on KamLAND)
- Purge gas for inside of detector should be used noble gas (we use $N_2$ gas)
- Each rooms should be coated by the mine gard (a kind of polyurethane resin)
- low cost ! => We cannot choice special method

# Environment Rn concentration in the kamioka mine




**Seasonal variation of Rn concentration in the mine**

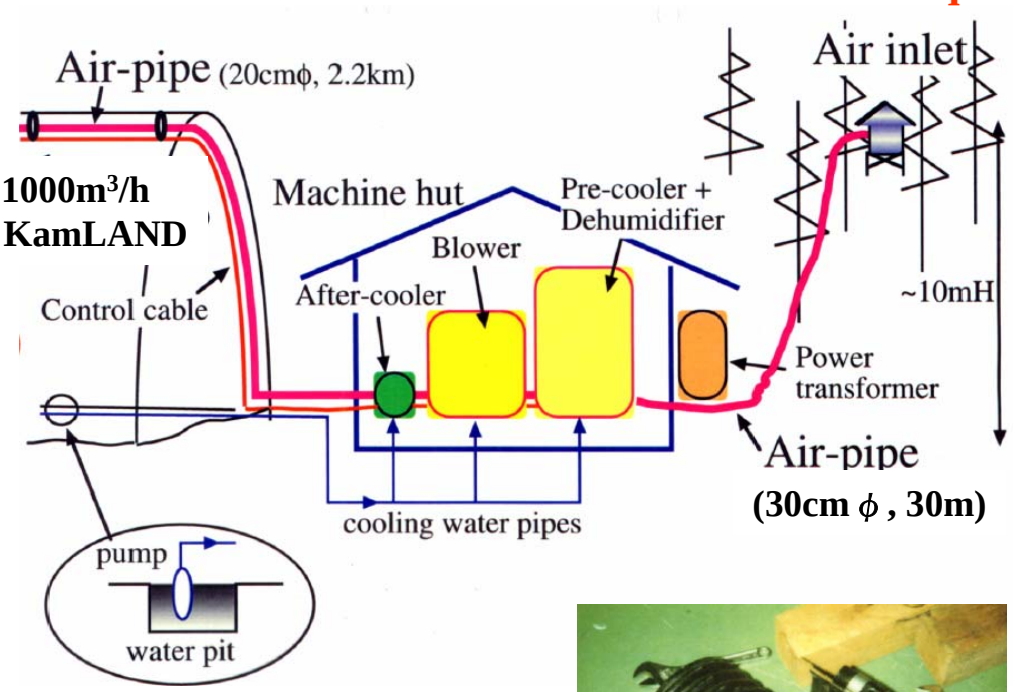



**Summer : 2500 – 3500Bq/m$^3$**
**Winter : 200 – 300Bq/m$^3$**

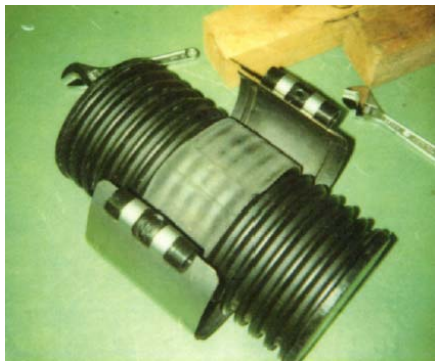
**@KamLAND site**

# Rn-reduced air supply system ①
## Flesh air supply from outside of the mine

**20-30Bq/m$^3$**



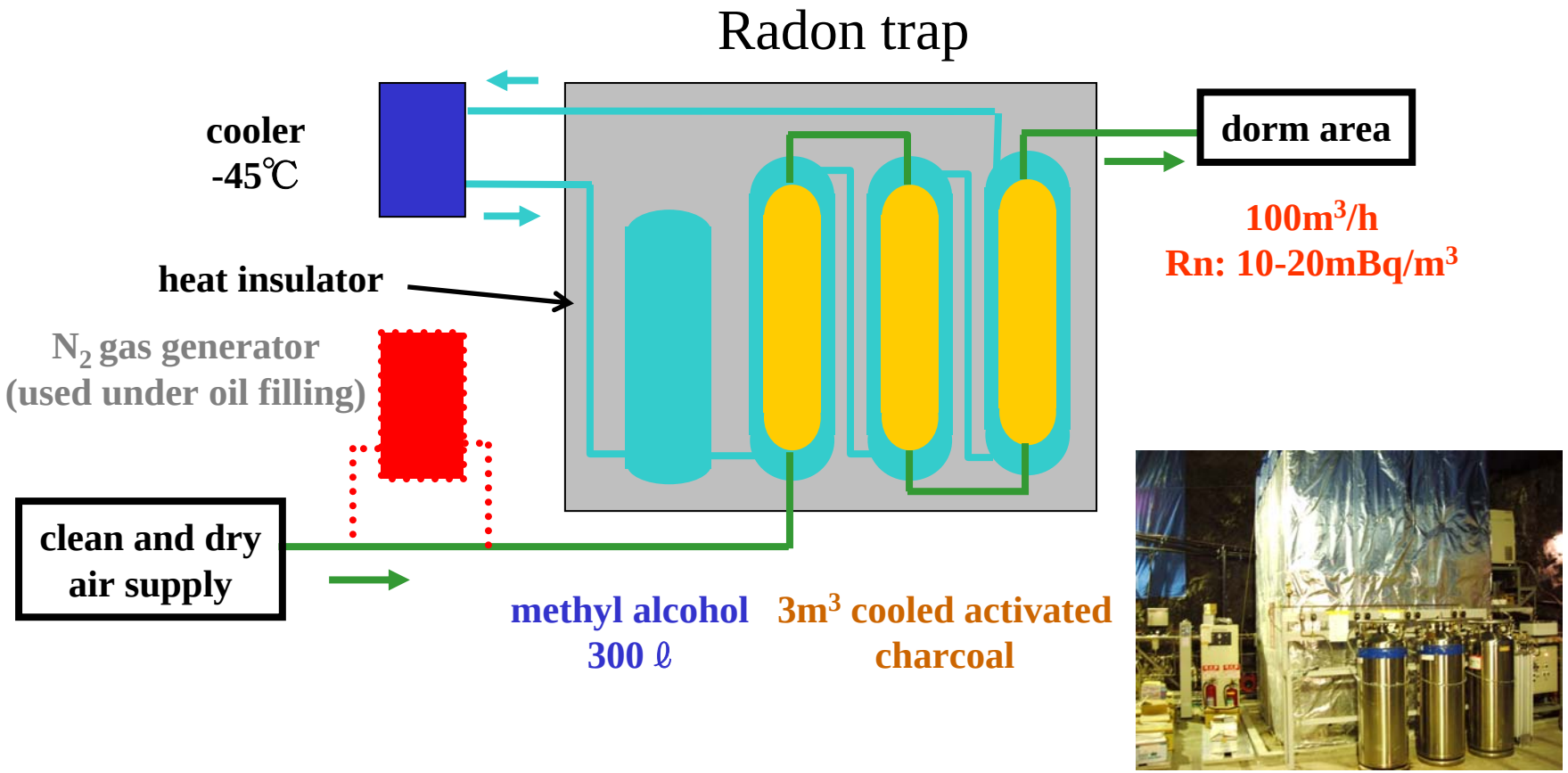

**expected Rn concentration**
**<50Bq/m$^3$**



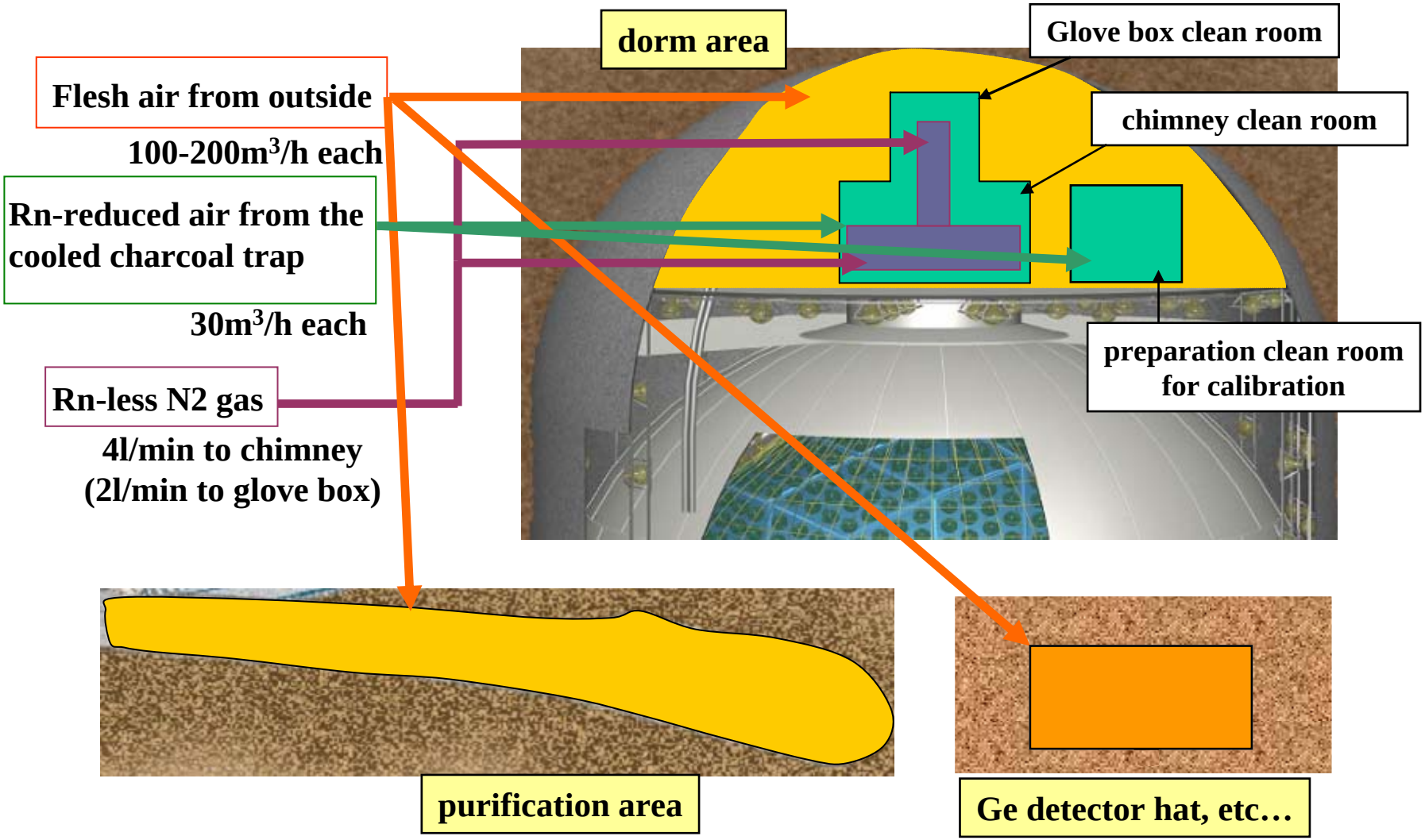
**20cm ϕ polyethylene pipe**

# Rn-reduced air supply system ②

## Rn-reduced air using a cooled activated charcoal Rn trap



# KamLAND Rn-reduced air and $N_2$ gas systems



# Achieved Rn concentration

| | original Rn level | place | achieved value | Comment (future plan) |
|---|---|---|---|---|
| **Fresh air from outside**<br>**1000 $m^3$/h total**<br>**350k US$**<br>**(2.2km piping cost was 1/2)** | **Same as outside**<br>**20-40 $Bq/m^3$** | **•dorm area**<br>**•purification room**<br>**•Ge detector hat** | **20-30 $Bq/m^3$**<br>**30-40 $Bq/m^3$**<br>**200-300 $Bq/m^3$** | **do air tight sealing more** |
| **Rn-reduced air from cold Charcoal trap**<br>**100 $m^3$/h total**<br>**300k US$** | **~ 10 $mBq/m^3$** | **•Chimney clean room**<br>**•glove box clean room**<br>**•preparation room** | **1-2 $Bq/m^3$** | **cover by acrylic plate** |
| **Rn-less N2 gas**<br>**4l/min (+2l/min for grove box and cal. material purge)**<br>**1k US$/month** | **<10 $mBq/m^3$** | **•Inside of chimney** | **cannot measure now** | **keep clean!**<br>**don't carry any activity!**<br>**more low?** |

# summary

- We prepared 2 type Rn-reduced air systems
- Achieved Rn concentration

  dorm area, purification area : **20-30 Bq/m$^3$**

  clean room for chimney, glove box: **1-2 Bq/m$^3$**
- We need more progress against $^7$Be neutrino detection

*Thanks for Super-Kamiokande group
**We borrowed sensitive Rn detectors**