

# Beam Dump Halls

Beam Dump Meeting at SLAC May 3-5 2006

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# Halls for Full Power Beam Dumps

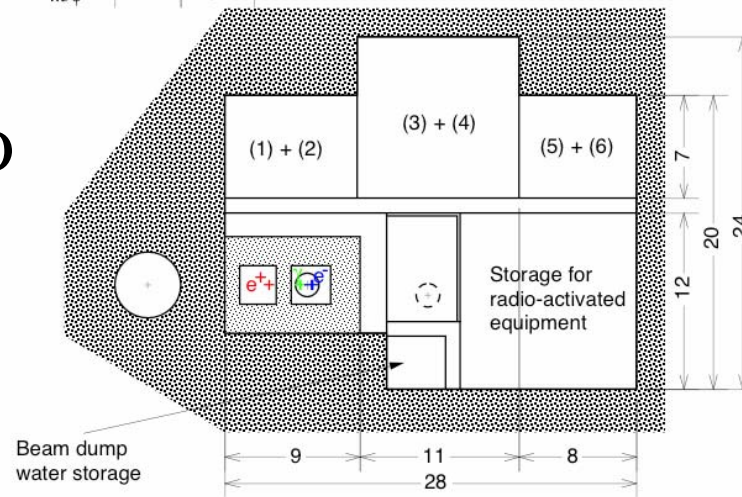
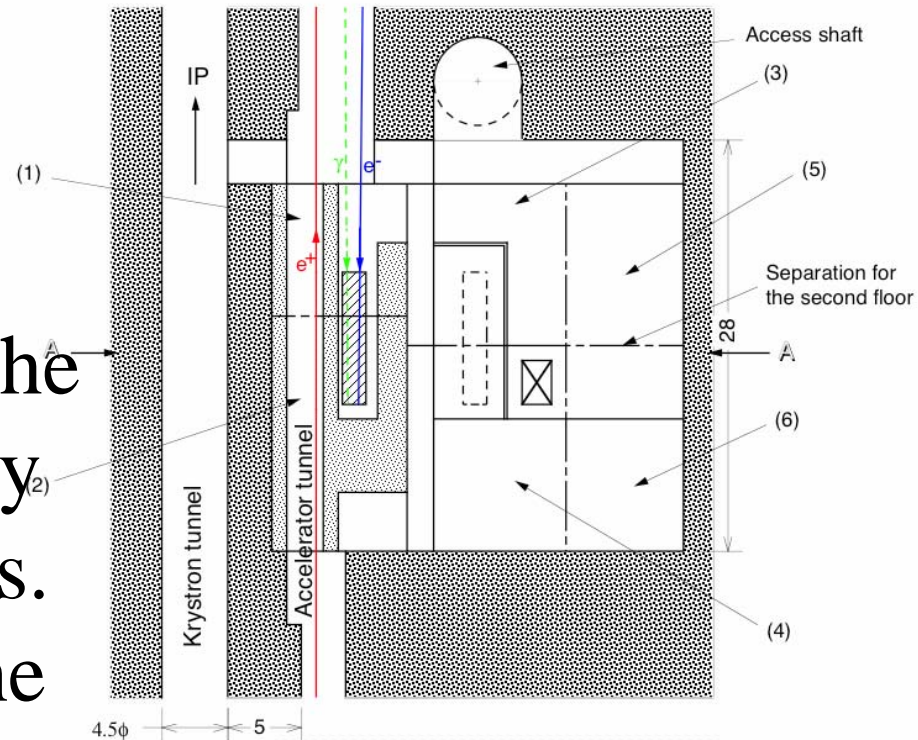
- Beam dump halls are deep underground and it is not easy to construct the facilities
- Based on the SLAC type Water Beam Dumps, beam dump hall design was started

At Snowmass WS

7 mrad one IP.

2.1m separation from the  
beam line, but we only  
have small beam pipes.  
Service Tunnel and the  
vertical shaft.

The dump is shielded to  
reduce soil and air  
activation.



**Cross-section View at A-A**

Rooms on the second floor

- |                                    |                          |                              |
|------------------------------------|--------------------------|------------------------------|
| (1) Operation room                 | (3) Electricity room     | (5) Secondary cooling system |
| (2) H <sub>2</sub> recombiner room | (4) Air conditioner room | (6) Primary cooling system   |

# Activation in soil around the dump hall

Na-22 in the soil is less than IAEA  
Exemption Level, 10 Bq/g

2 – 3 m thick concrete shields are needed  
between the dump and the earth shield.

It depend on the soil component and shielding  
geometry

# Service Tunnels or Vertical Shafts

- Service Tunnels

Easily accessed from IP

If we need temperature stability in the accelerator tunnel, power supplies are placed here.

Non-radioactive storage to repair

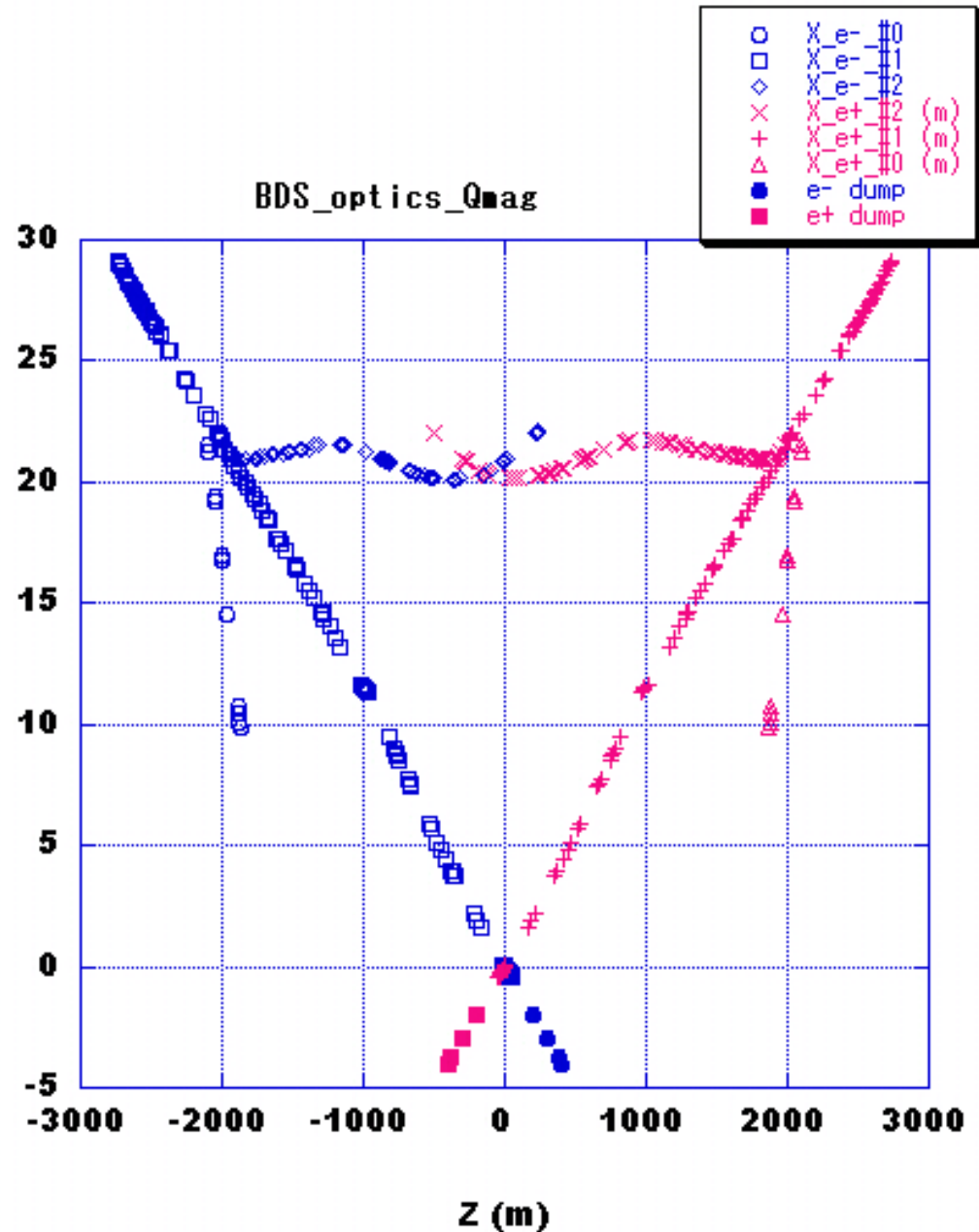
- Vertical Shafts

It becomes easier to construct the dump hall.

In case of fire, exit way without heavy shielding door.

New optics  
 20mrad and  
 2mrad, two  
 IPs.  
 Small Tune-  
 up damps

$X_{e-} \#0$

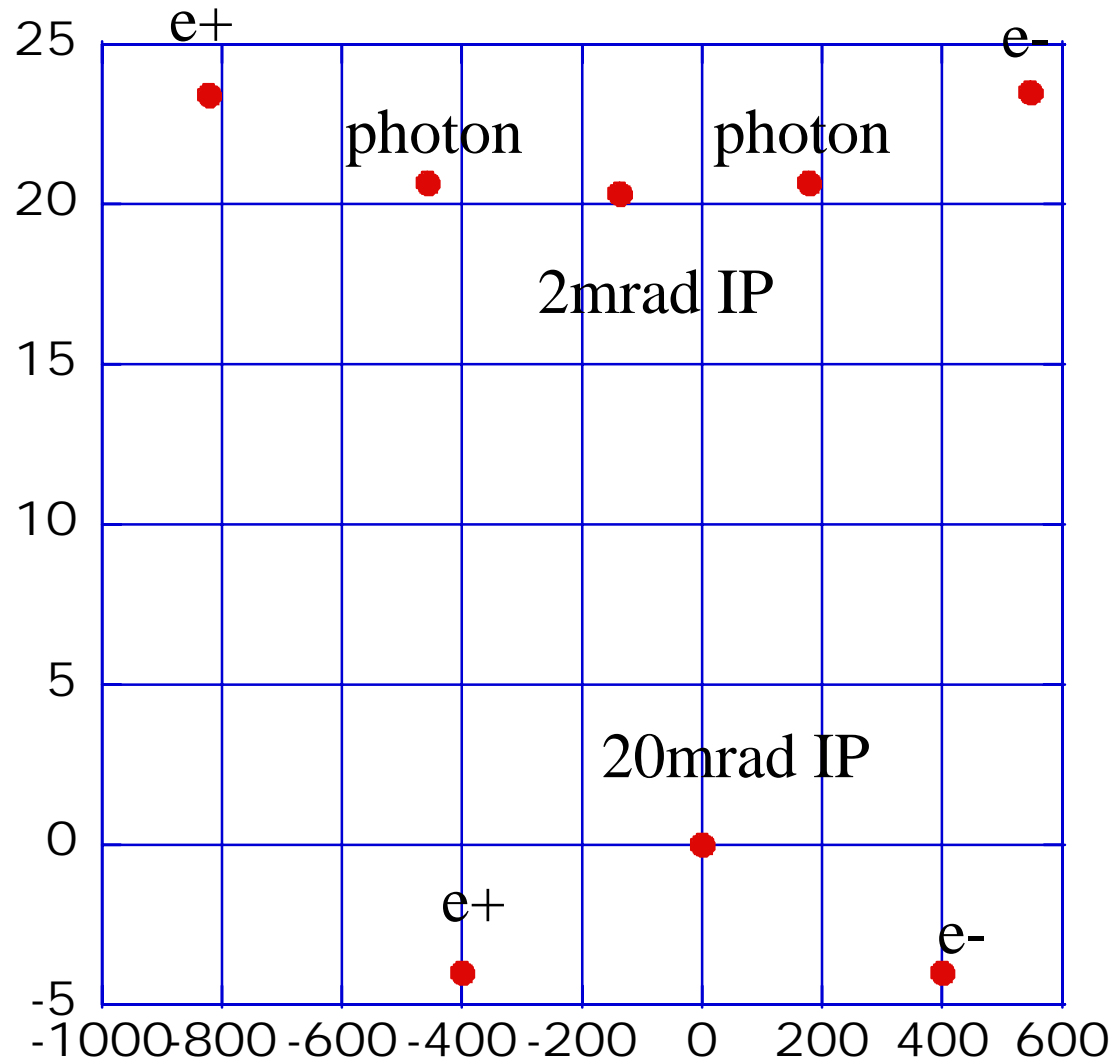


# Coordinates of the dumps

Two vertical shafts at IPs.

Transverse separation from 2mrad beamline is 2.5m.

Both the dump and the beam line are shielded.



# Dose Rate Criteria for Radiation Workers

- $20 \mu\text{ Sv/h}$  (1 mSv per week)
- 20 mSv/year in KEK
- Accidental Loss
- In Japan we don't have the guideline such as  $<250 \text{ mSv/h}$  by DOE. It is our own responsibility to add the shield if we cannot avoid the full power loss that causes 20 mSv exposure.



# Example of Weekly control of the exposure

- near the dump :  $100 \mu \text{ Sv/h}$  1 hour
- in the waste storage :  $100 \mu \text{ Sv/h}$  1 hour
- Service Tunnel :  $10 \mu \text{ Sv/h}$  38 hours
- Totally  $580 \mu \text{ Sv}$  per week  
less than 1 mSv per week

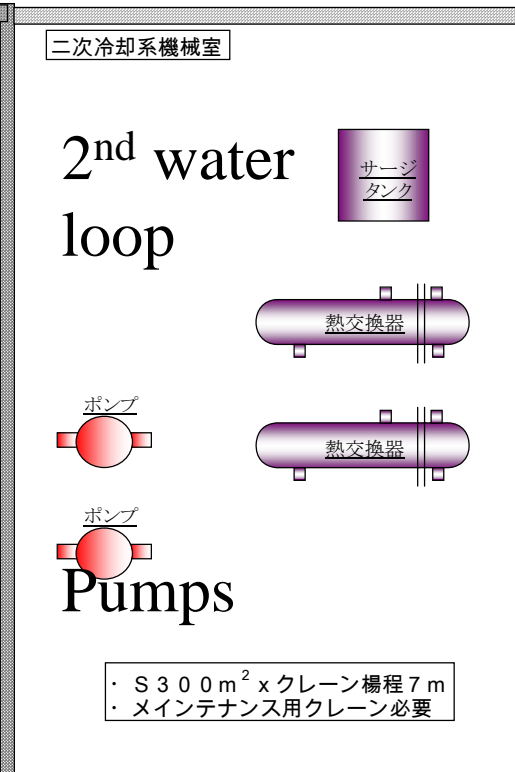
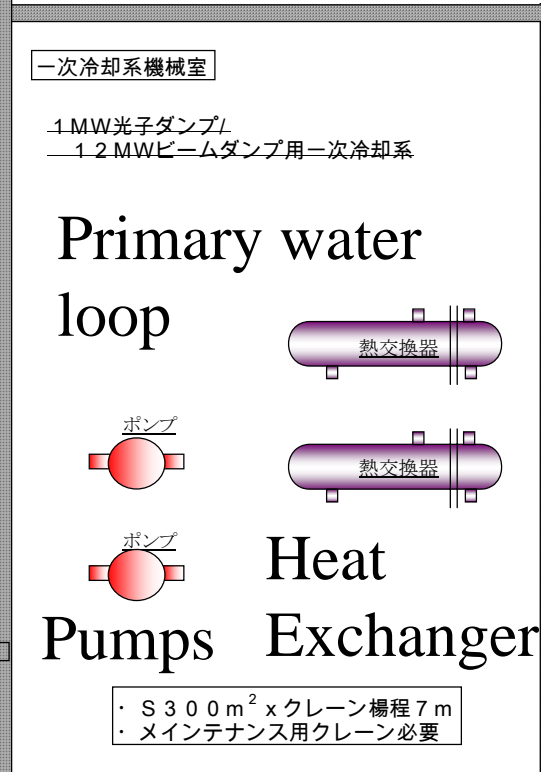
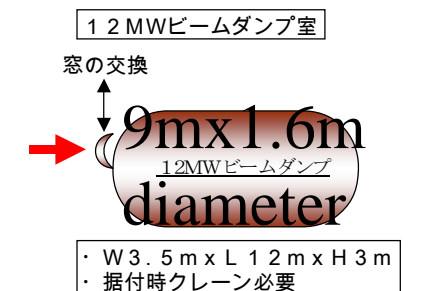
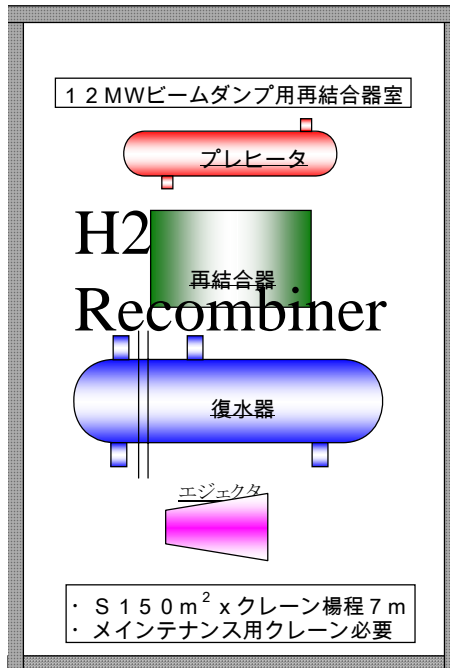
## Estimation of Radioactivity in Ion-exchangers in the primary water loop

Nuclei	Half life	Amount of activity(G Bq)	Dose $\mu$ Sv/h@ 1m	Dose $\mu$ Sv/h@ 1m with 5cm-thick Pb shield
Be-7	53.29Day	60000	428000	86
Co-58	70.86Day	57.6	7550	130
Co-57	271.7Day	14.7	258	0.02
Mn-54	312.1Day	12.9	1430	32
Co-56	77.23Day	4.96	2100	180
Co-60	5.271Year	1.59	485	40
Total			440000 $\mu$ Sv/h	470 $\mu$ Sv/h

# Beam dump halls

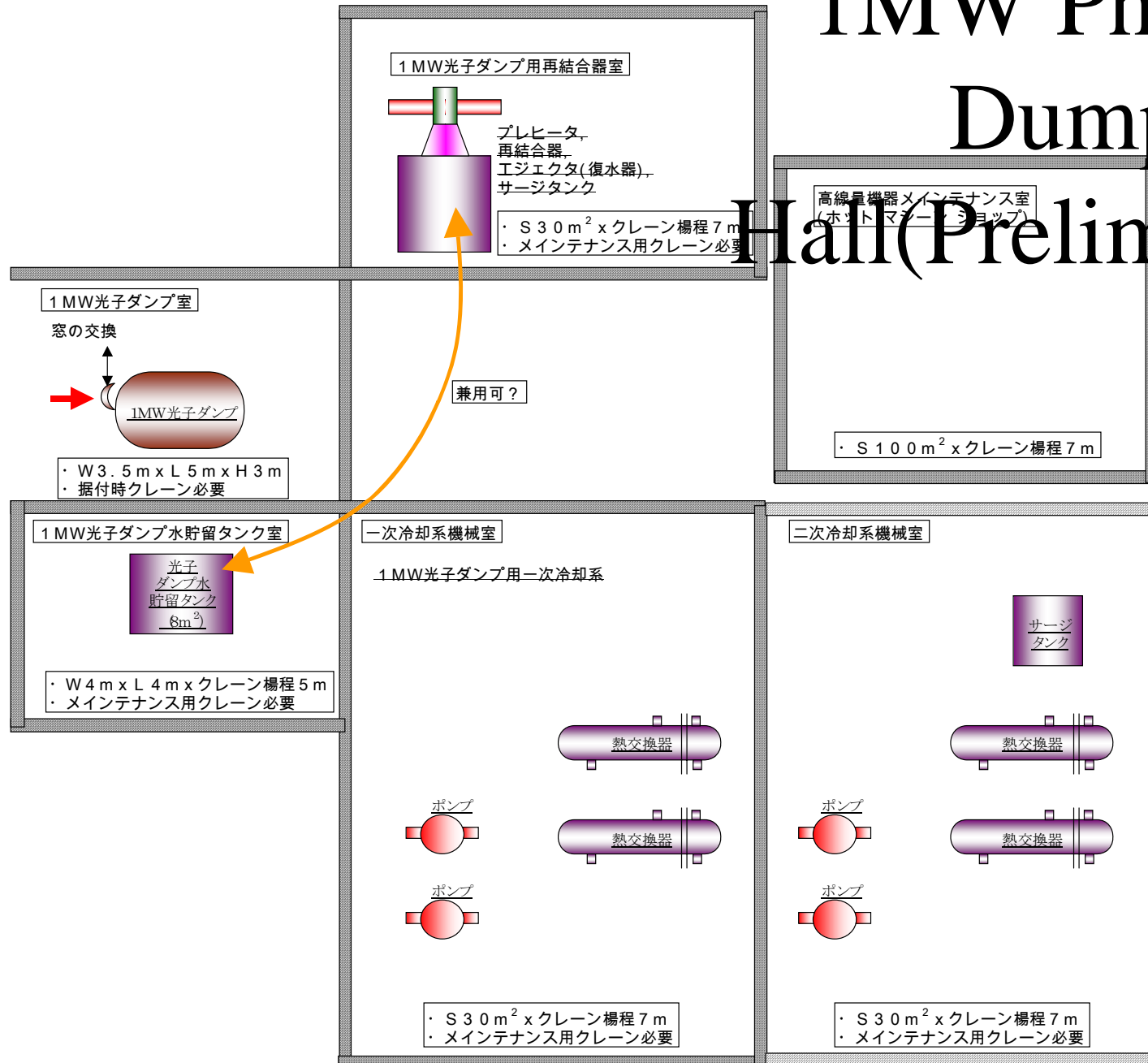
- Without special handling tools, Ion-exchangers need to be surrounded by Pb shield  
People can use a crane and stay there exchanging these devices.
- High-dose area : Beam dump, Purifier of the primary loop, Waste storage
- Keep Purifier and Waste storage area near the dumps.

# 10MW Electron Dump Hall (Preliminary)

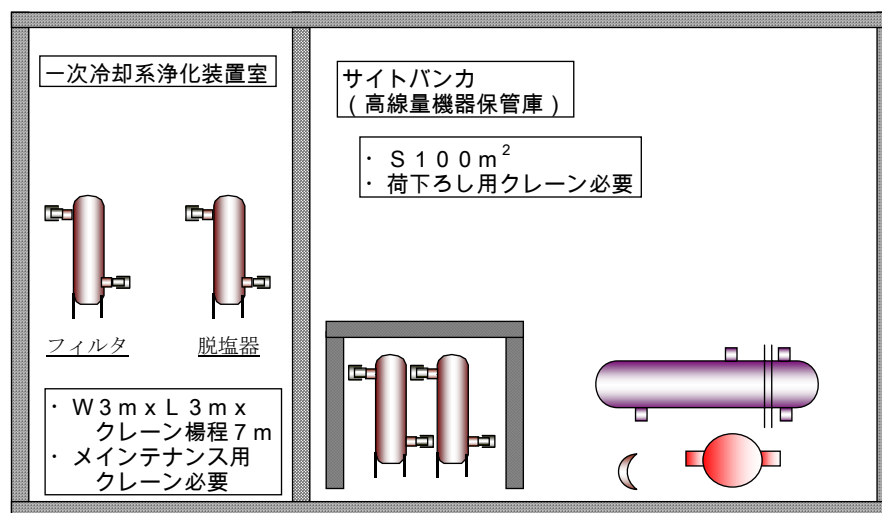


# 1MW Photon Dump

## Hall (Preliminary)

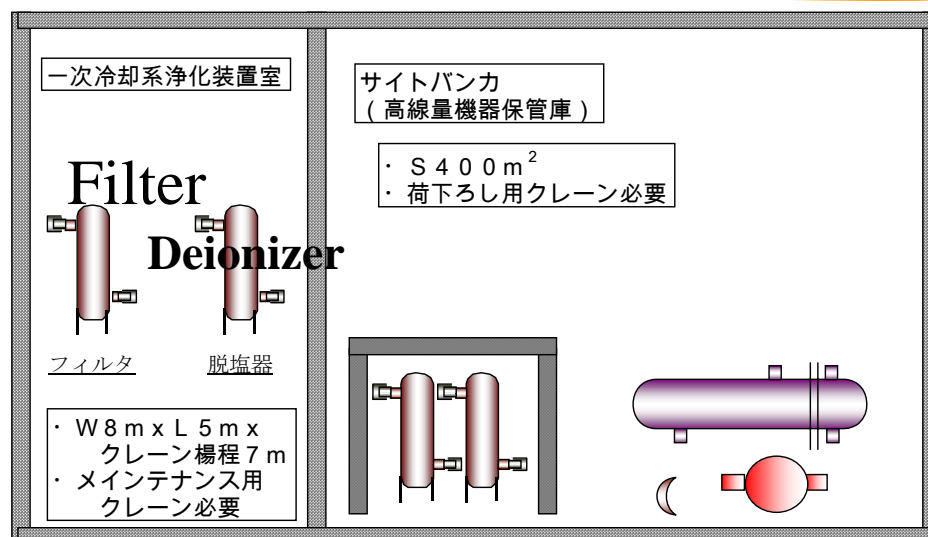


# Purifier and Waste Storage for each dump High Dose Area



Purifier

Waste Storage



Purifier for  
primary cooling  
system

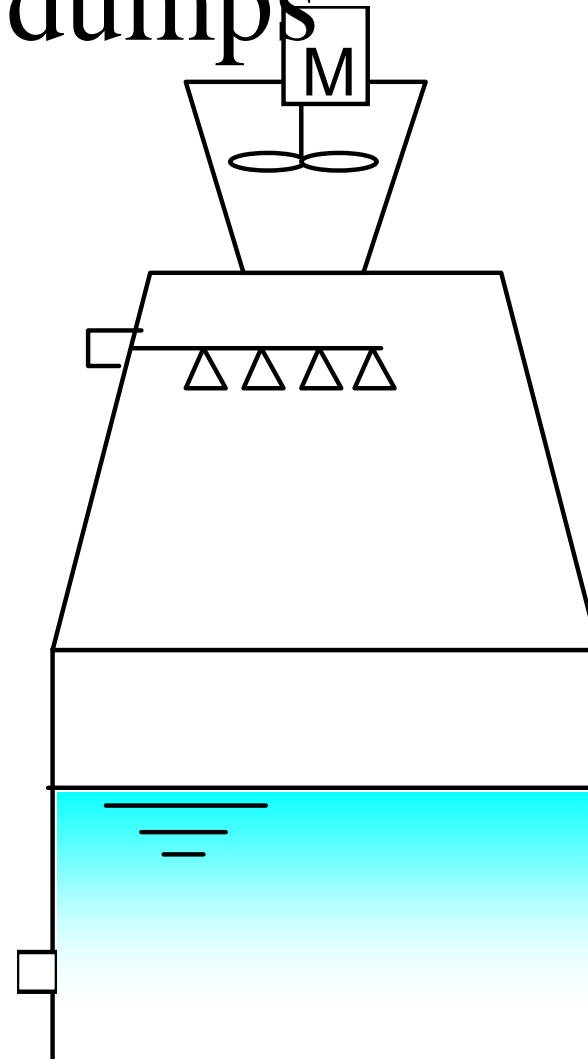
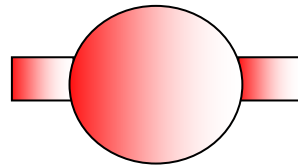
Waste Storage

# 3rd water loop placed on the ground for two dumps

Control Room

Power Supply

Pump



# Discussions

- The photon dumps are very close to the beam lines. Do we need another type of the dumps? such as Al+Water and C+Al+Cu(TESLA TTF type)
- When the water nozzles in the dump have some troubles, it is difficult to repair those.

Do we need the spare dump?

Because the humidity is high in the underground tunnel, we'll use closed air ventilation system during the operation not to exhaust air from this room. Do we need fresh air before people go inside the closed underground tunnel?