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Current status and developments of post irradiation examination techniques in JMTR Hot laboratory

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Introduction

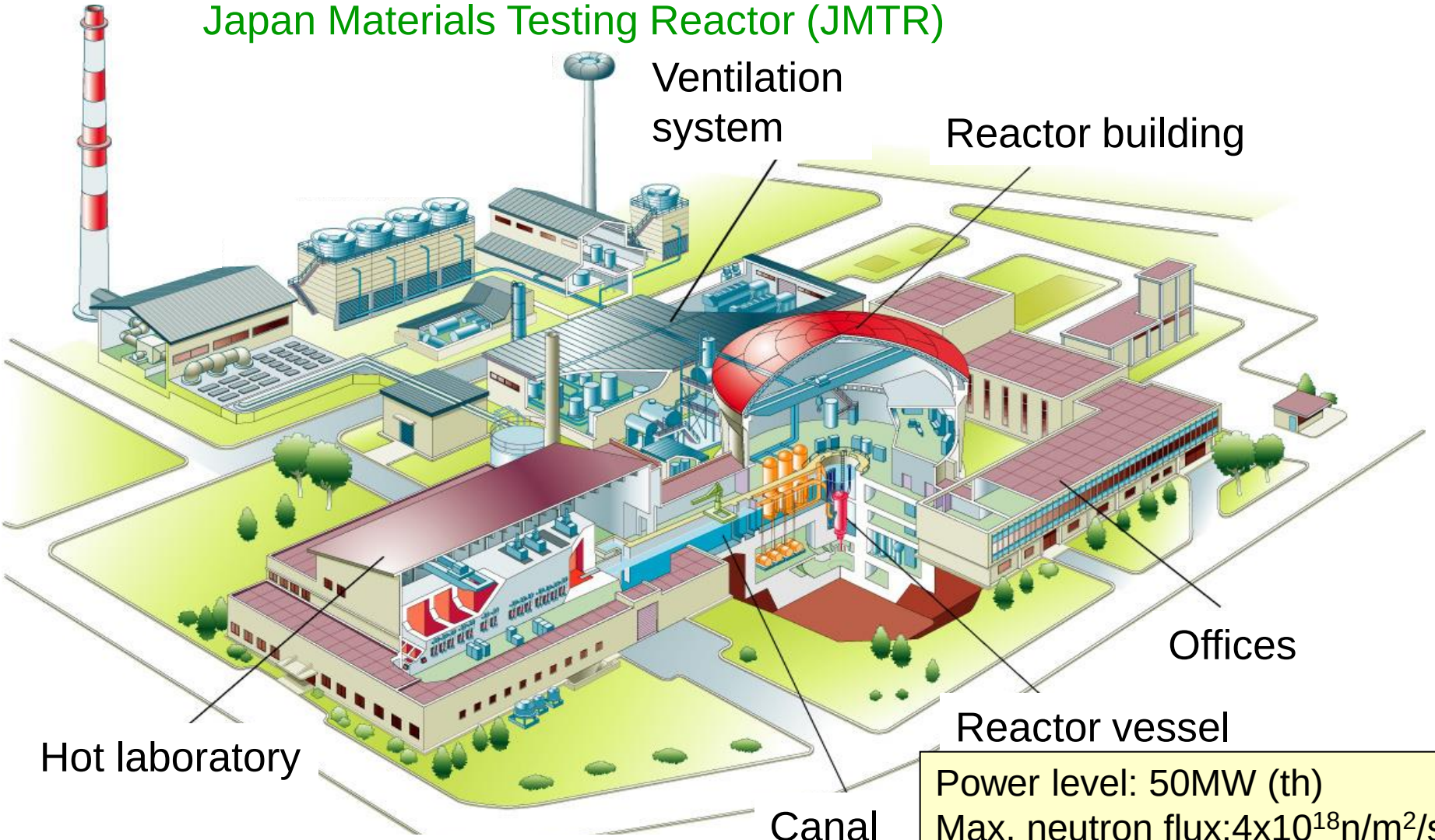
The Japan Materials Testing Reactor (JMTR) is the largest scale materials testing reactor in Japan and the JMTR Hot laboratory was put into service in 1971 to perform Post Irradiation Examinations.

The JMTR stopped its operation in 2006 for the refurbishment. The reactor facilities have been refurbished from 2007.

Modifications of facilities and installations of new experimental apparatuses were performed for restart of JMTR.

Outline of the JMTR

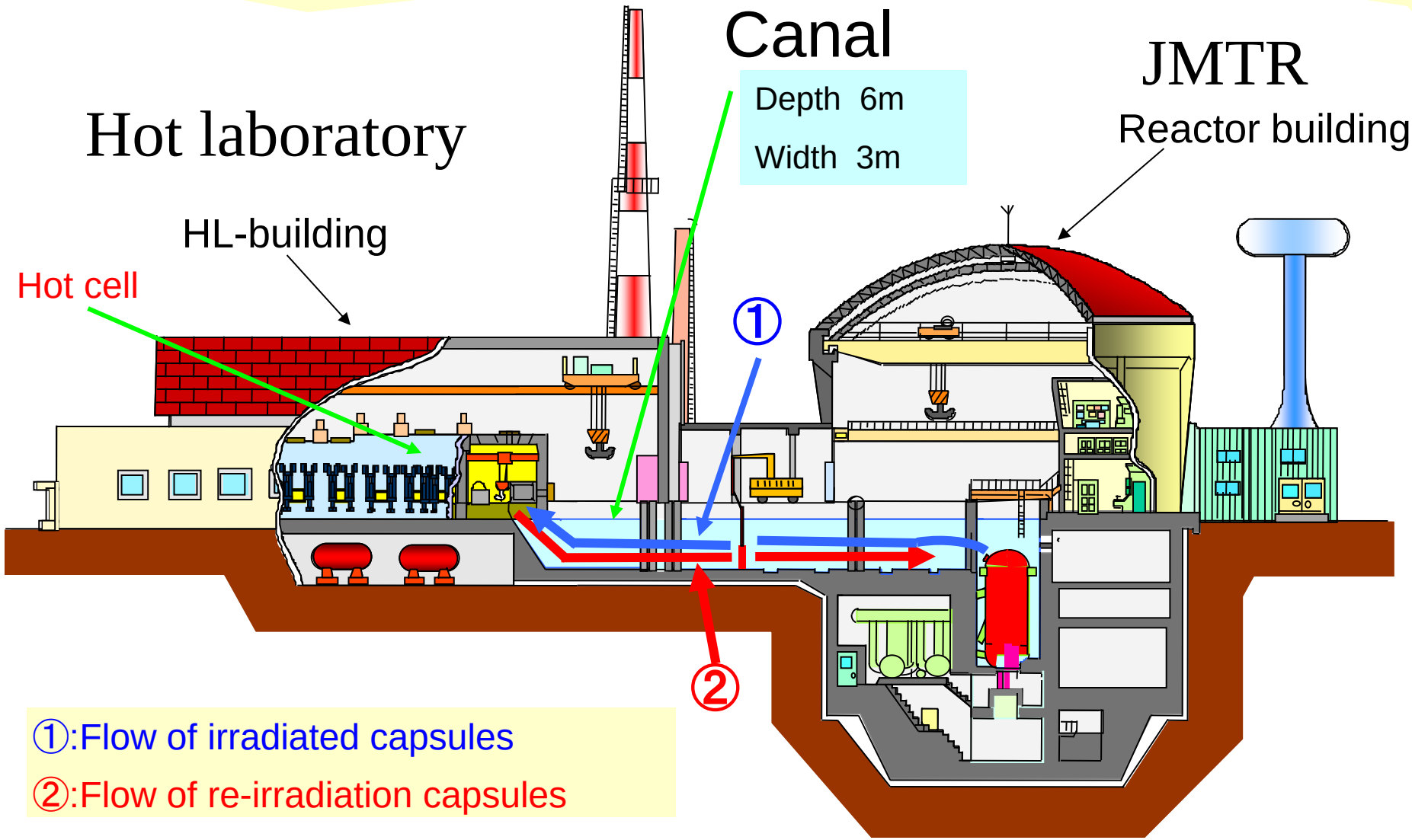
Japan Materials Testing Reactor (JMTR)



Largest scale materials testing reactor.
Irradiation test of materials and fuels.

Power level: 50MW (th)
Max. neutron flux:$4x10^{18}n/m^2/s(f)$
$4x10^{18}n/m^2/s(t)$
Operating temp.: 50℃

Outline of JMTR and Hot laboratory

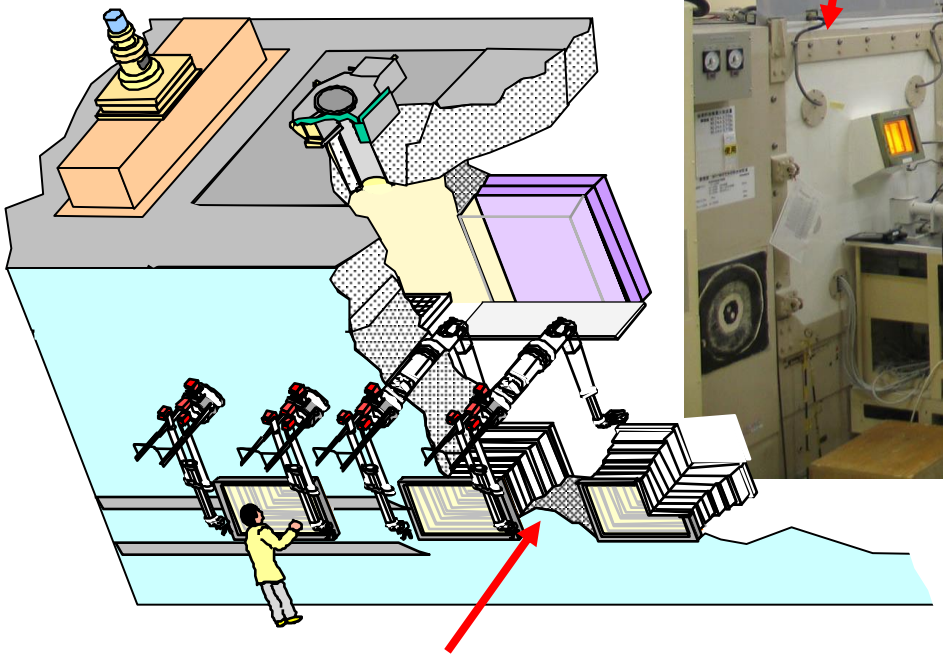


Cross-sectional view of JMTR and Hot Laboratory buildings

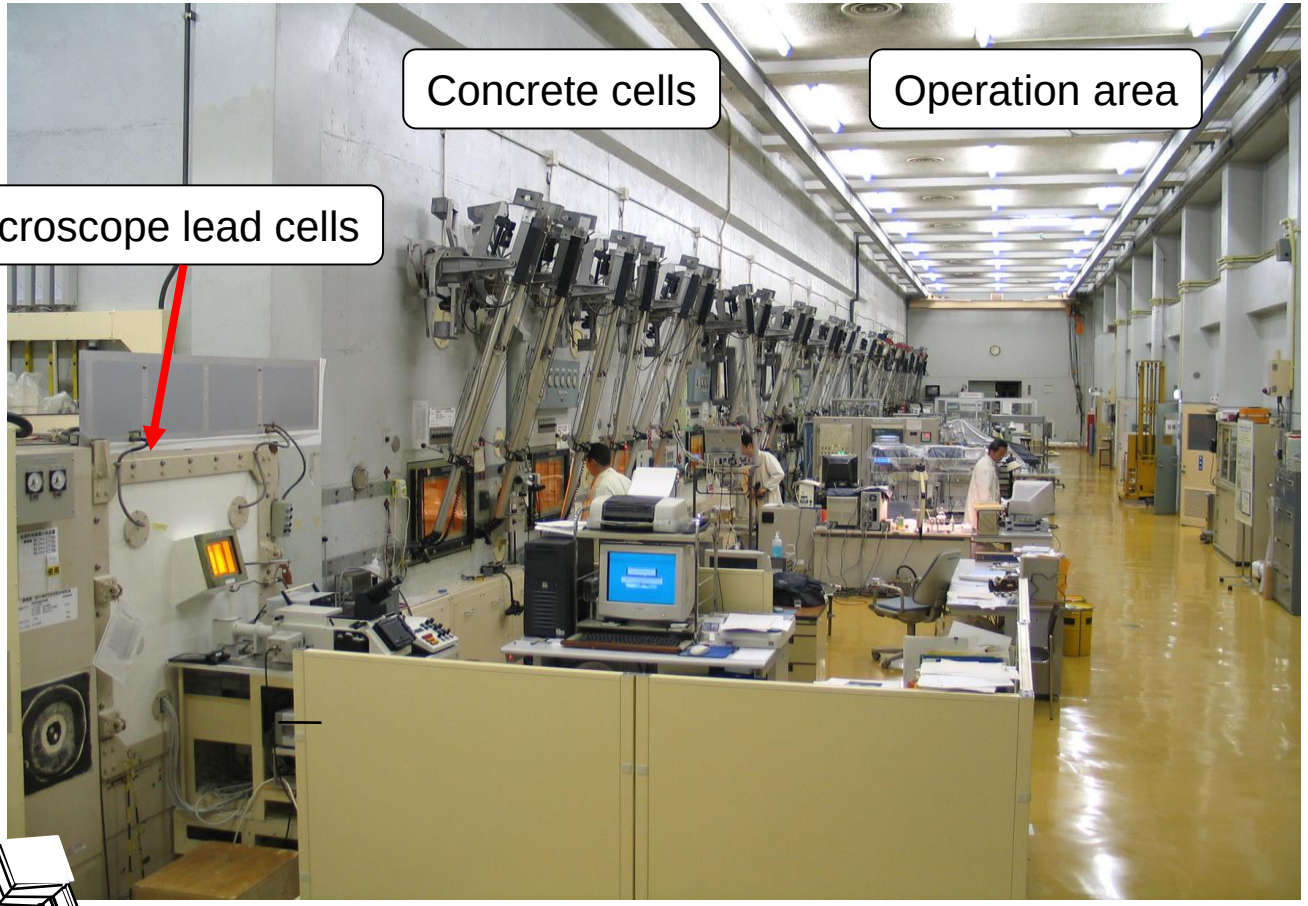
Concrete Cells

PIE Terms

- Capsule dismantling
- X-ray radiography
- Gamma scanning
- Eddy current test
- Dimensional measurement



Heavy concrete (1.1m~1m in thickness)



The concrete cell line consists of eight concrete cells, and is mainly used for dismantling of irradiated capsules and examination of fuels.

Steel and Lead Cells

Steel cells

5 cells
Steel wale thickness
35cm

PIE Terms

- Fatigue test
- Specimen storage
- Tensile test
- Fracture toughness test
- Heat treatment
- SSRT/SCC test

Lead cells

7 cells
Lead wale thickness
15cm

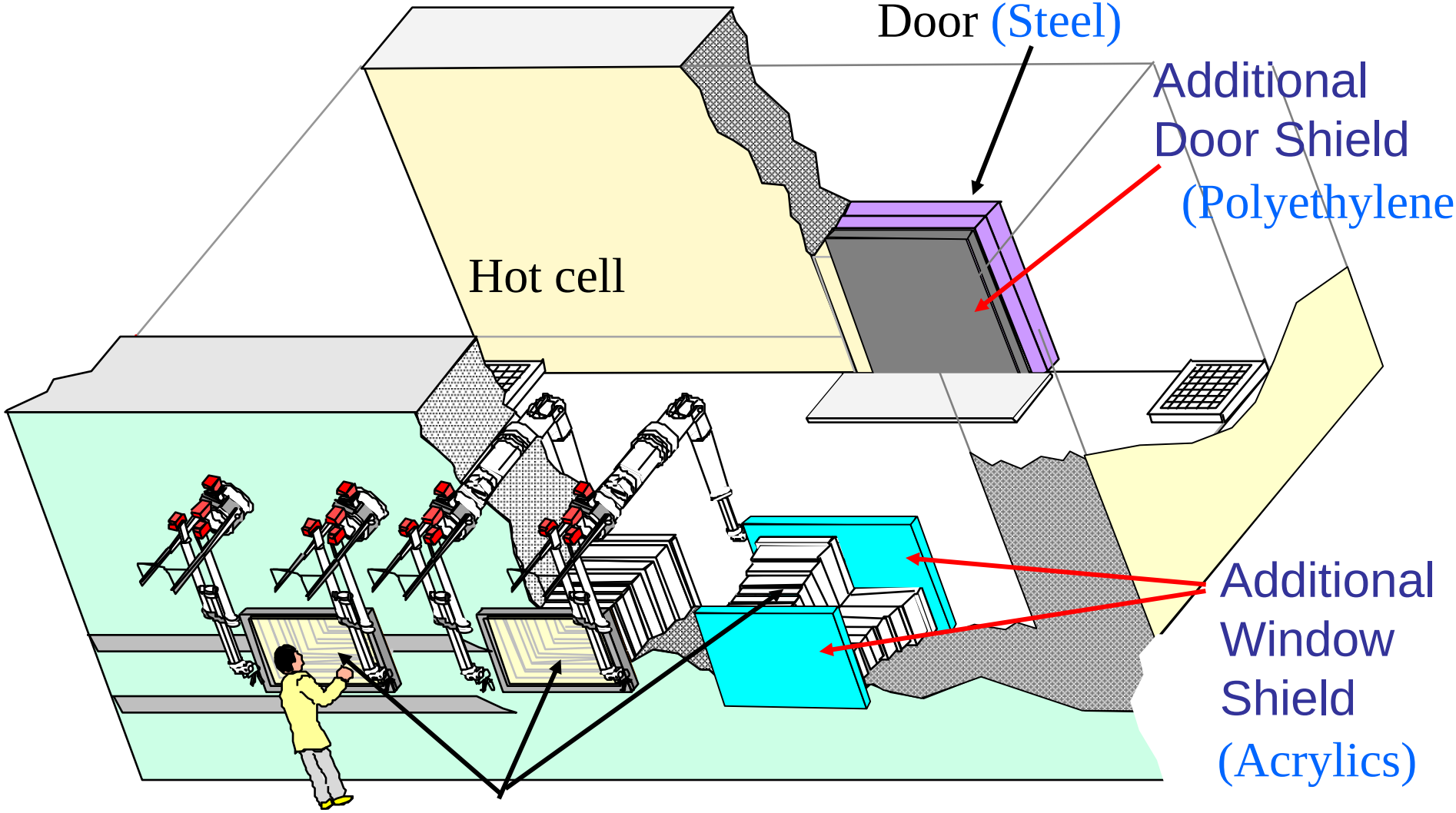
PIE Terms

- $^{99}Mo/^{99m}Tc$ Production
- Tensile test
- Charpy impact test
- SEM observation

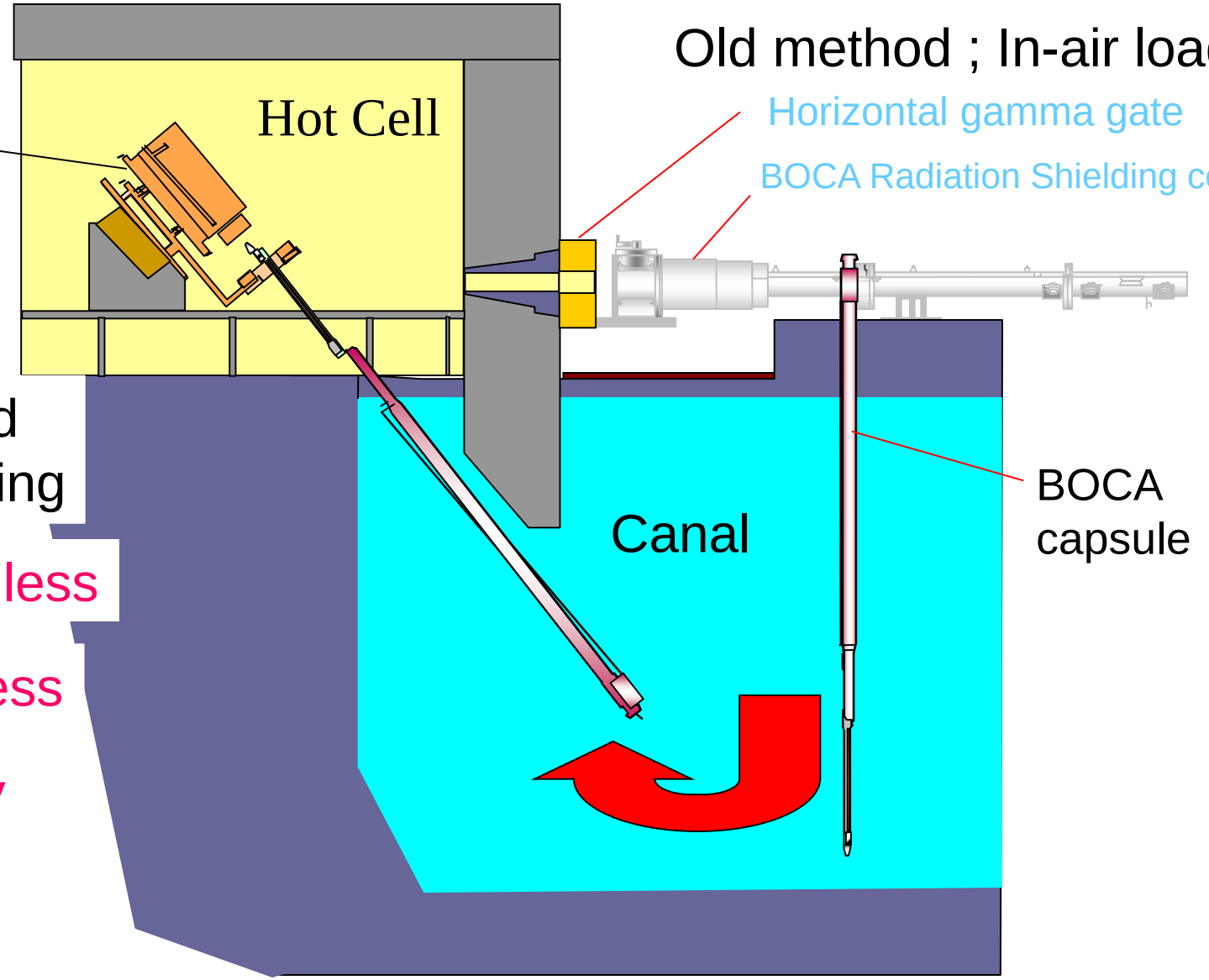
The steel cell line consists of five steel cells ,the lead cell line consists of seven lead cells, and they are used to perform mechanical property test of irradiated materials.

Modification of facilities

Reinforcement of shielding capacity of hot cell



Renewal of the BOCA assembling apparatus

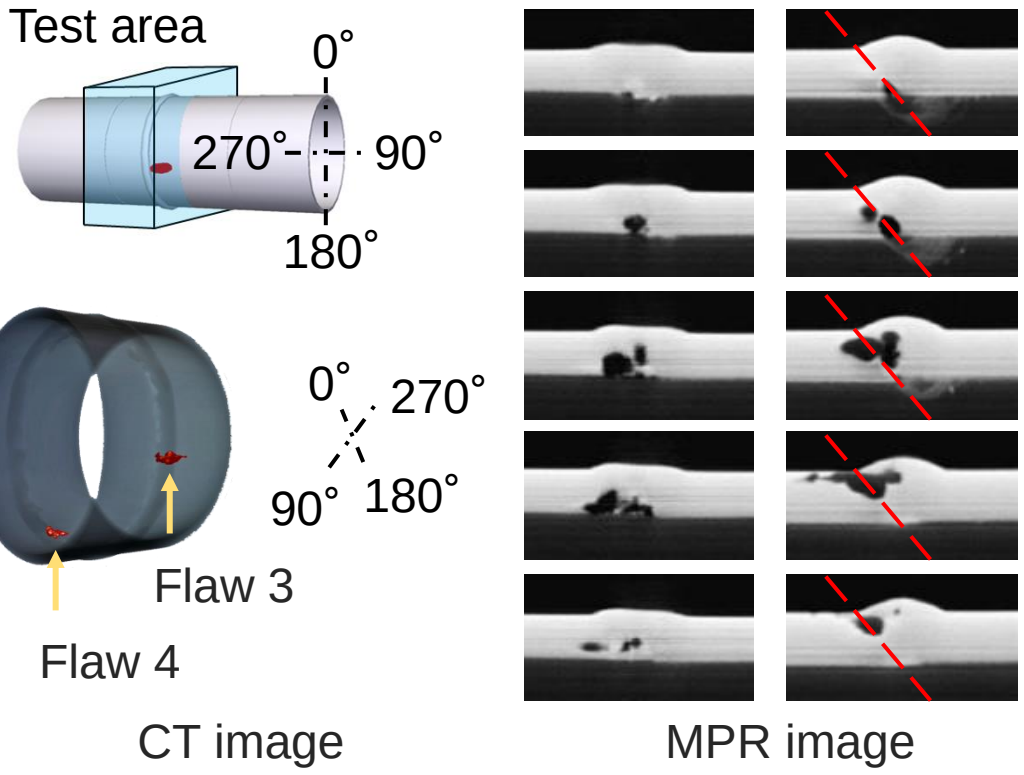


- Man power less
- work time less
- More safety

Installation of new experimental apparatrus

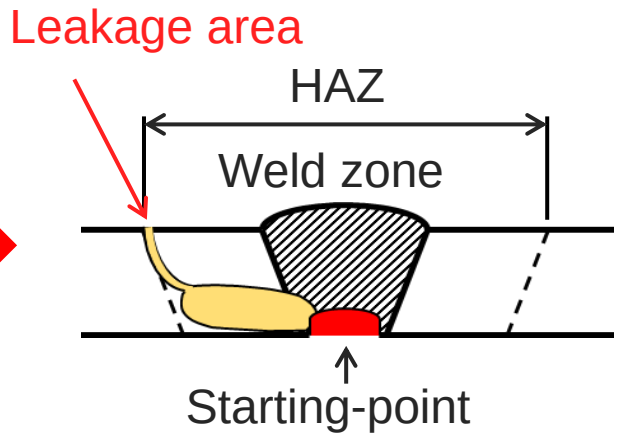
Three dimensional X-ray computed tomography

X-ray CT results



X-ray RT results

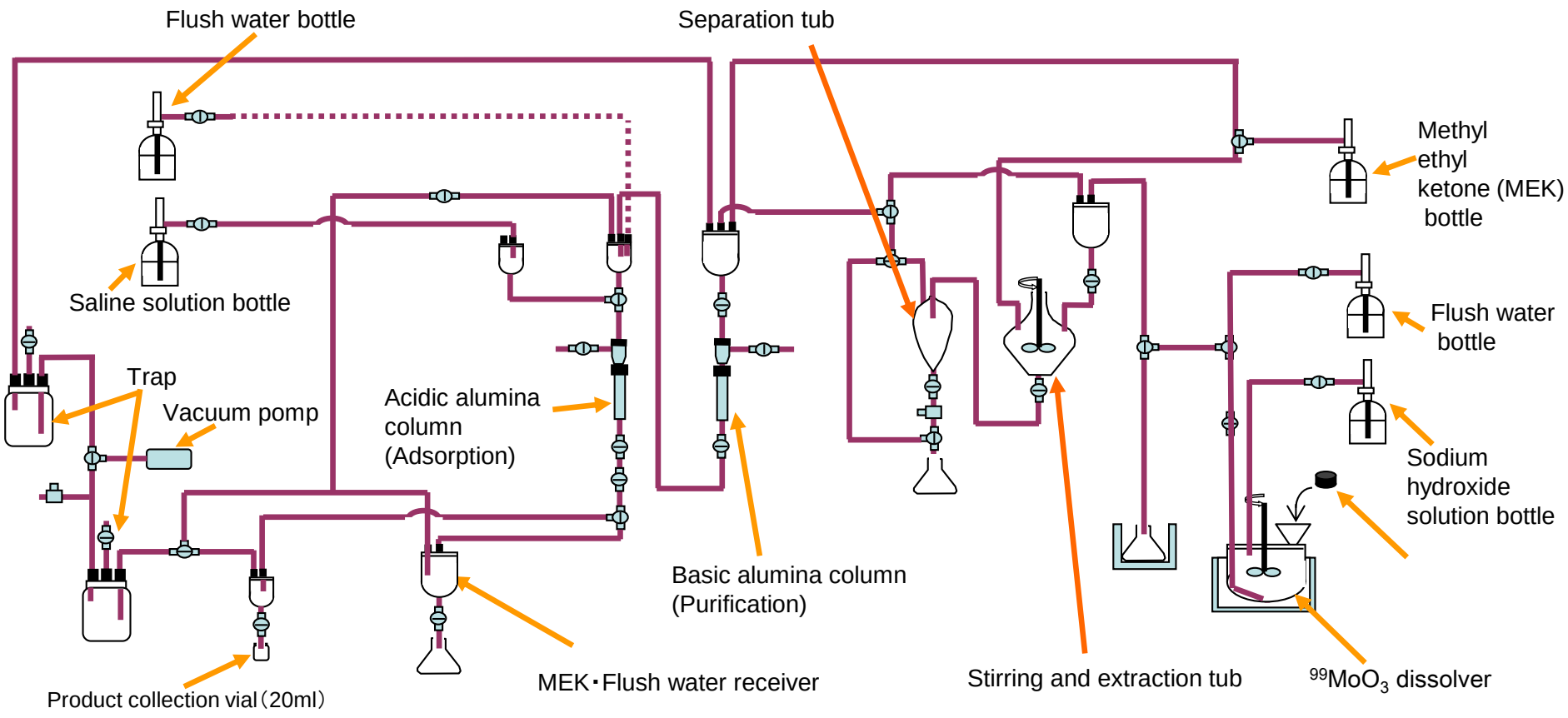
Flaw morphology of the Flaw 3



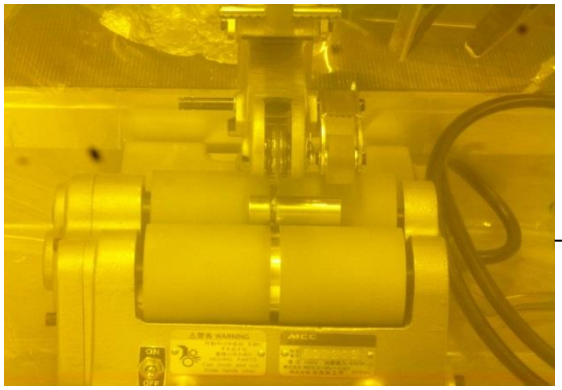
3D-flaw-morphology is difficult to evaluate exactly by the X-ray RT.

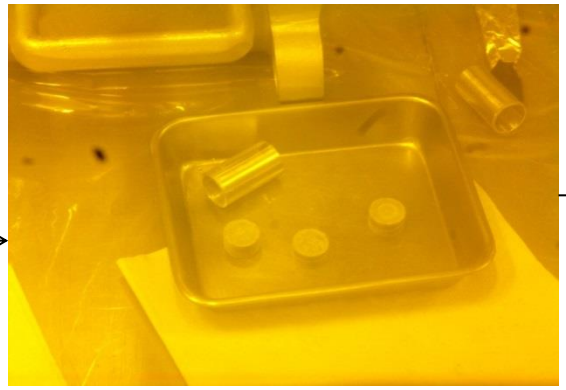
- - Possible to distinguish different contrast of the flaw.
- - Difficult to evaluate 3D-flaw-morphology exactly at once.

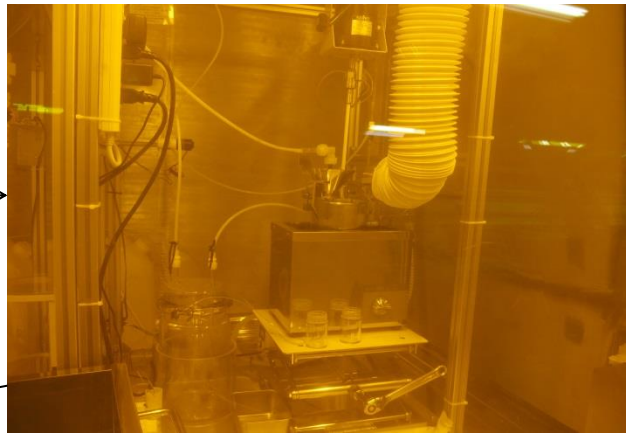
Experimental apparatus for $^{99}Mo/^{99m}Tc$ production.

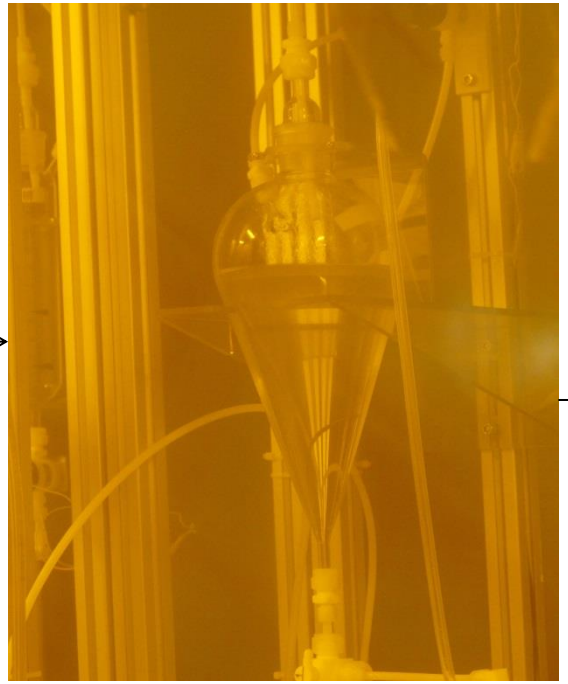


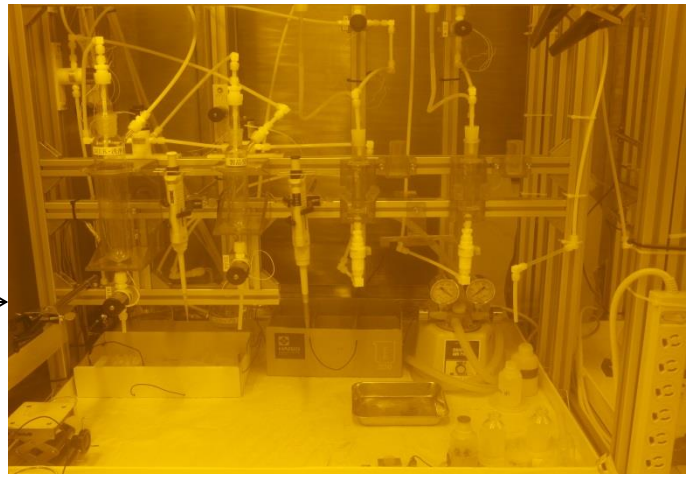
$^{99}Mo/^{99m}Tc$ production



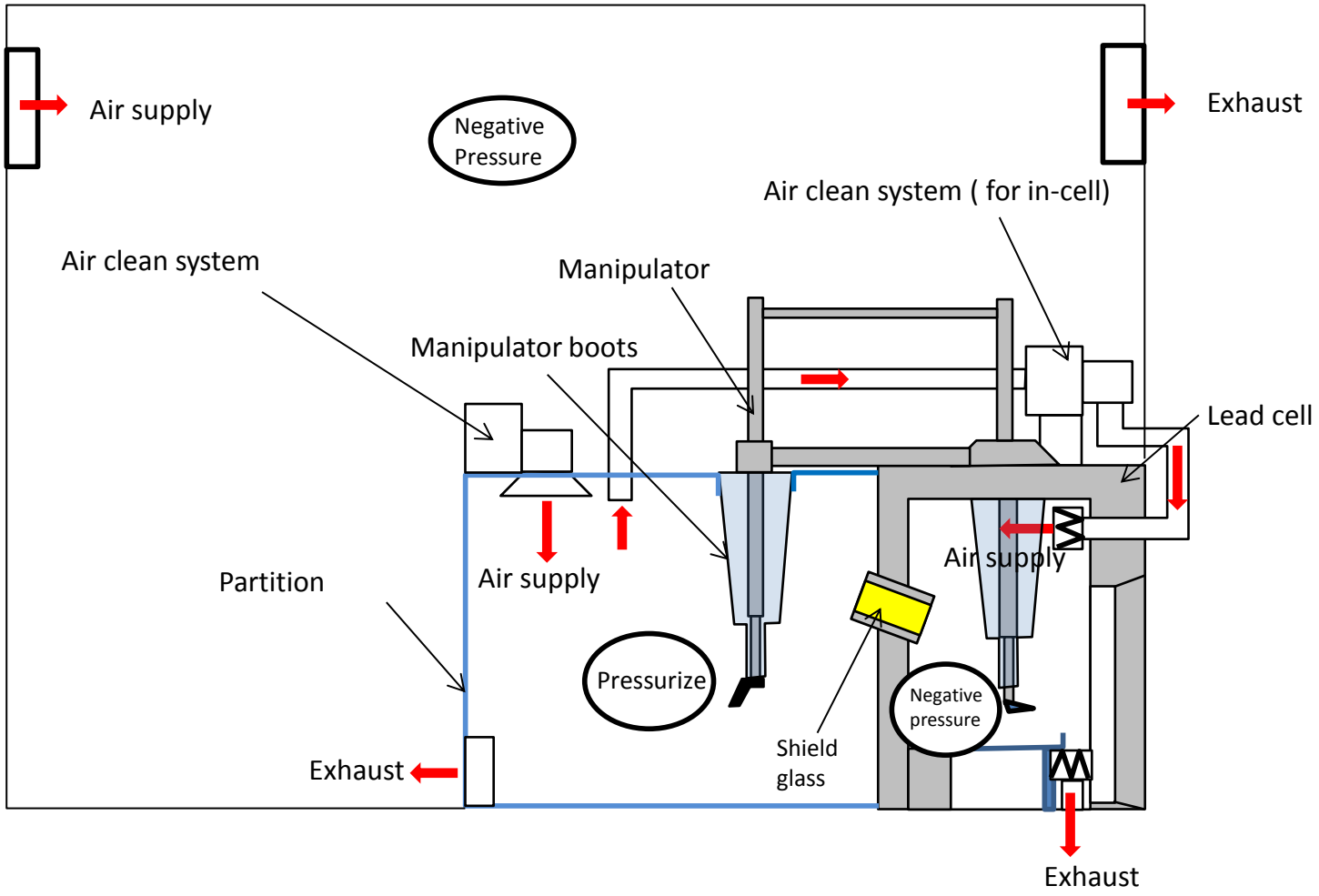






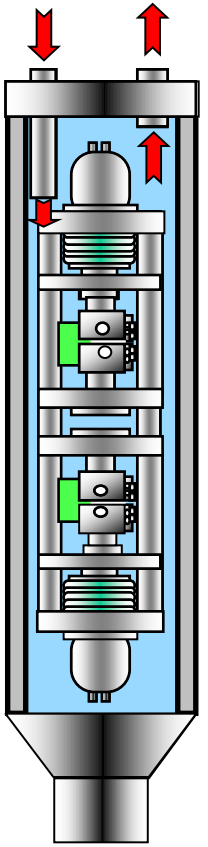


Clean room for ^{99m}Tc production



Assembling apparatus for In-pile IASCC test capsule

In-pile IASCC test capsule



This new welding apparatus will be installed in concrete cell No.1

For In-cell welding of inner and outer tubes of the capsule

Installation of nano-indenter.

To evaluate mechanical properties of irradiated material, hardness measurements using nano-indenter with spherical indenter tip will be performed

For the purpose to perform this experiments, a nano-indenter with 5 μm radius spherical indenter will be installed in concrete cell No.7.

Conclusions

The JMTR Hot laboratory will perform various post irradiation examinations with those advanced techniques to contribute research of irradiated materials and fuels after restart of JMTR.

Thank you for your attention!