Challenge to an occupational dose reduction in the medical field based on the dose mapping obtained by a small type OSL dosimeter

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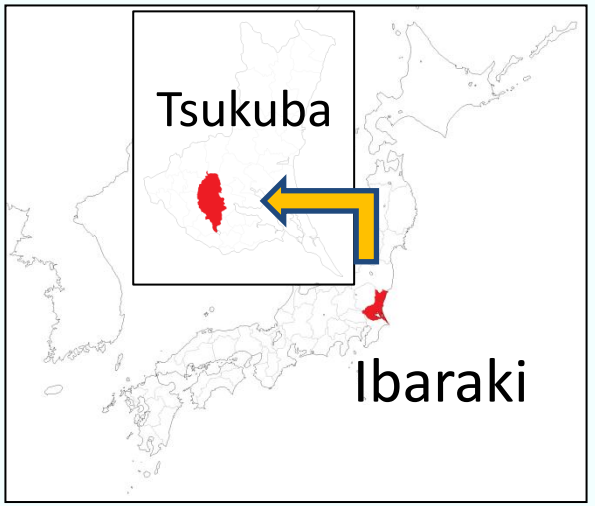
Introduction of our company

Personal dosimetry service

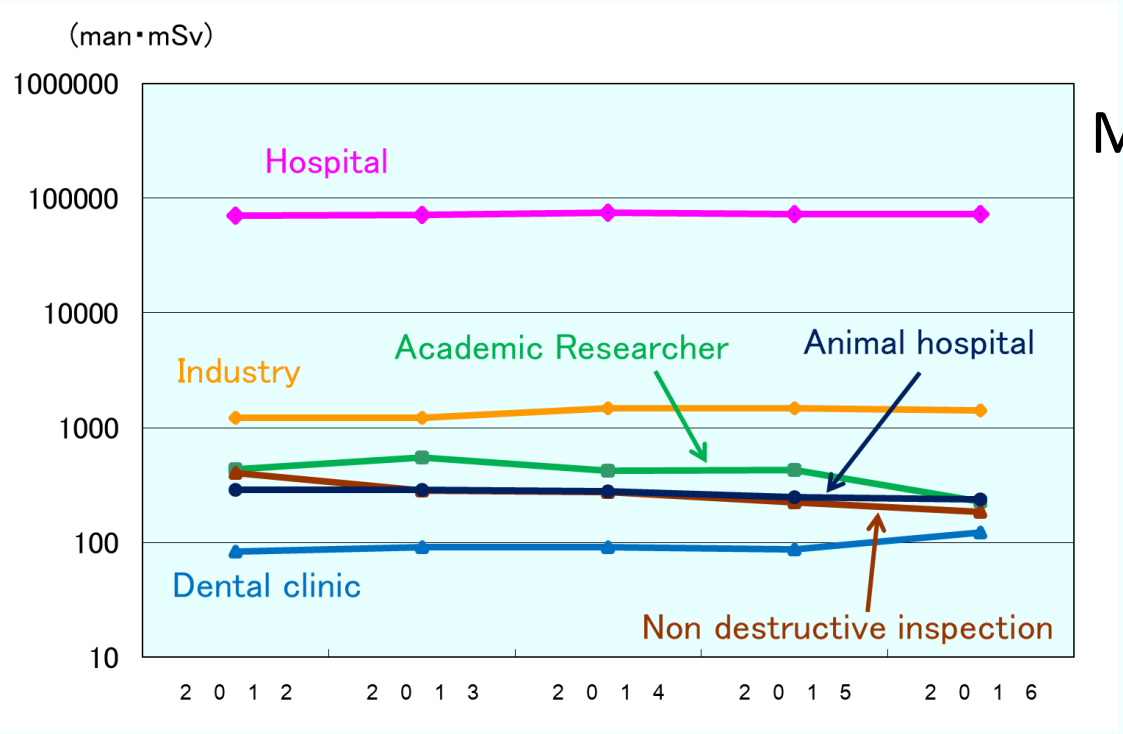
Provider of OSL dosimetry system

Nagase-Landauer, Tsukuba



CraftMAP; http://www.craftmap.box-i.net/

Occupational dose of our customers



Collective effective dose of our customers in 2012 - 2016

Mission of our company is …

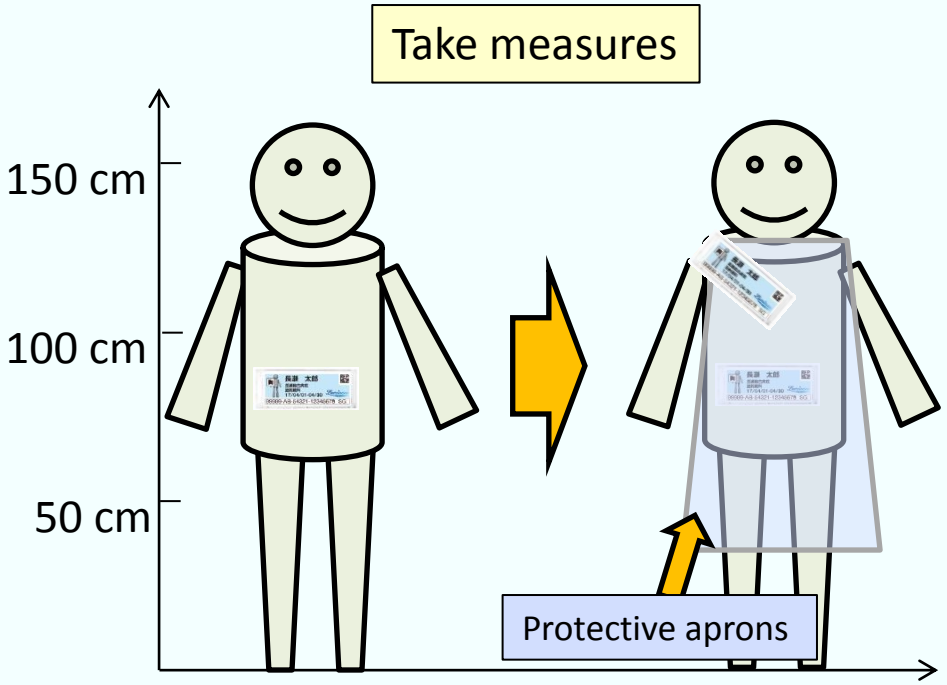
- Report occupational dose of radiation workers.
- Reduce radiation exposure according to ALARA principle.

We start the challenge to reduce the occupational dose in hospital.

We focus on the staff of interventional Radiology (IR).

Exposure during IR procedures

Image of Interventional radiology (IR).



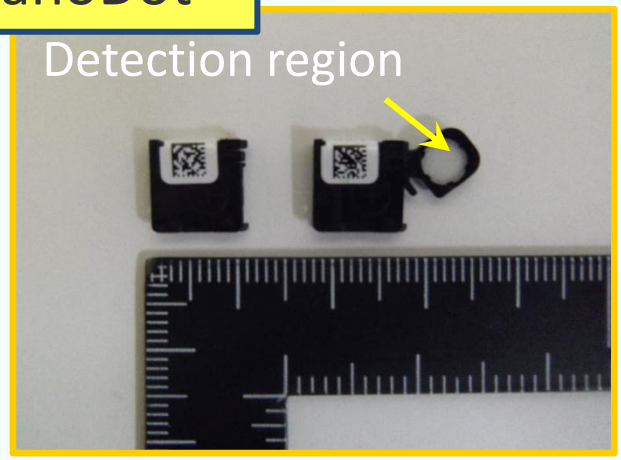
To reduce the radiation exposure, we focus on how to evaluate

- The position of radiation source and the dose distribution.
- The effect of the procedure improvement when we take some measures.

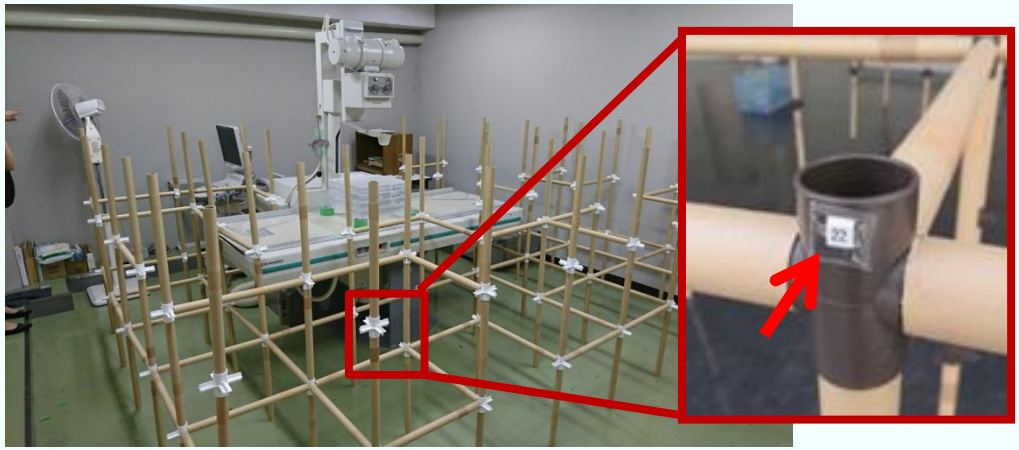
Jungle gym method (JG Method)

- Assemble jungle gym by paper pipes and plastic joints that don't disturb the dose distribution.
- To evaluate the dose distribution, put dosimeters on the jungle gym at equal intervals.
- We used a small type OSL dosimeter; nanoDot for dose mapping.

nanoDot



nanoDot; 10×10×2 mm

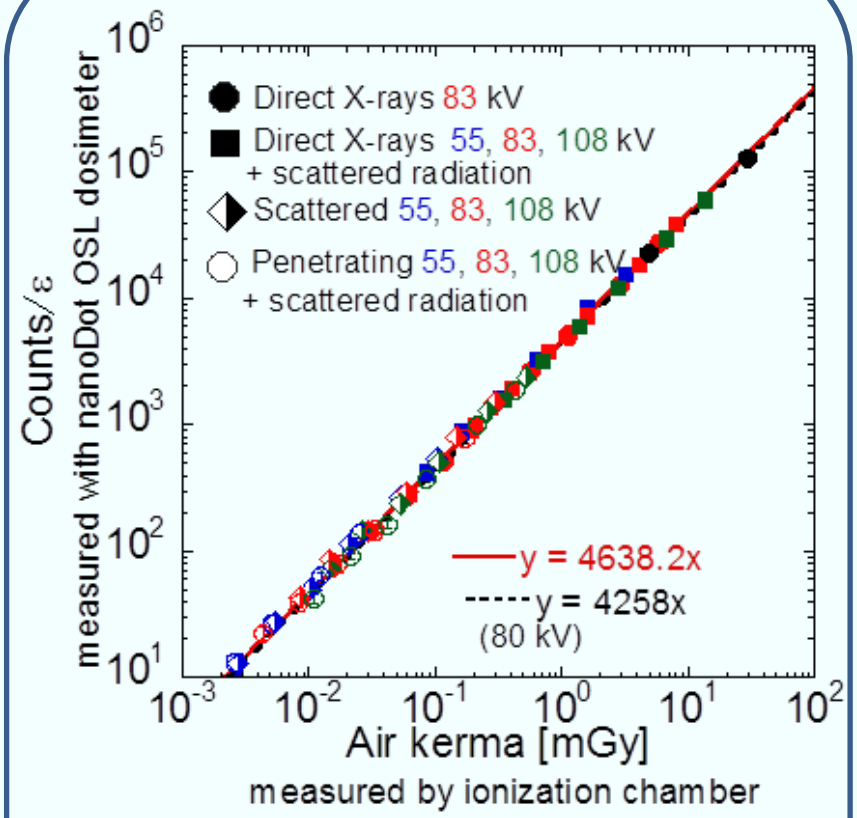


Doses of 50, 100, 150 cm height are mapped.

Invisible dosimeters in medical image don't disturb dose distribution in the field.

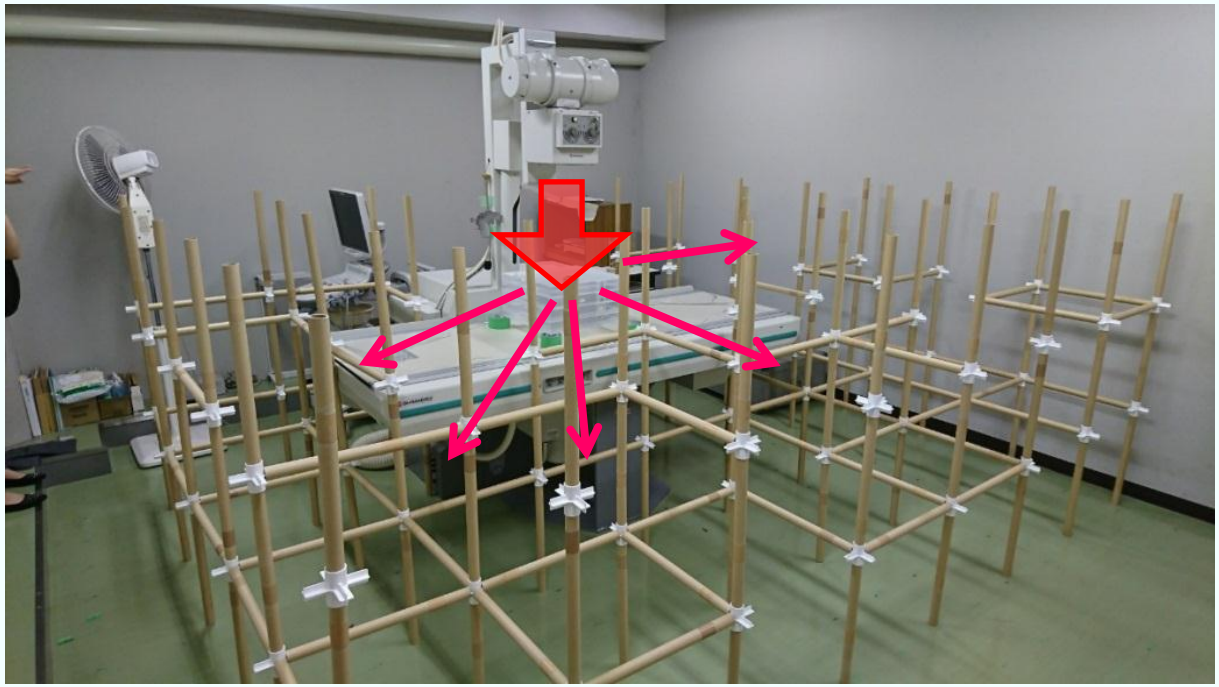
Measurement of nanoDot

- Measuring nanoDot takes less than 10 s by portable OSL reader (microStar).
- microStar can work only with commercial AC power supply.
- nanoDot has good linearity in less than 10 µGy.



T. Okazaki et al., Applicability of Practical Calibration of a Small-type OSL dosimeter for Measuring the Exposure Doses Effected by Scattered and Penetrating X-rays, Progress in Nuclear Science and Technology (In press)

Experiment of X-ray exposure

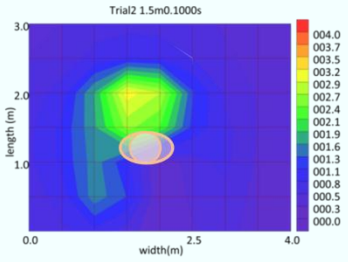
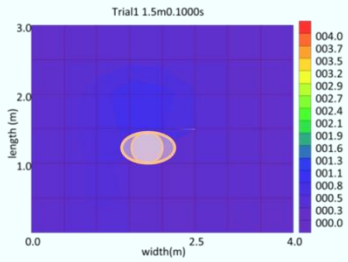
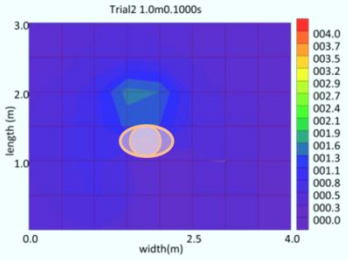
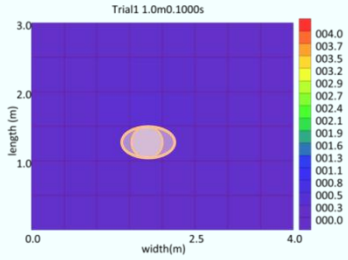
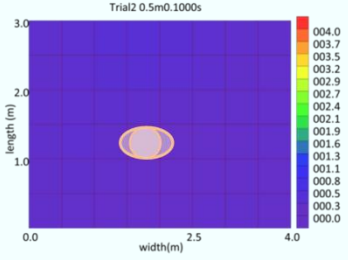
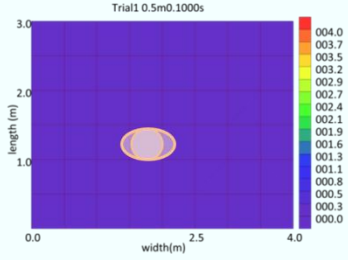


Exposure conditions
Tube voltage: 115 kV
Tube current: 2.5 mA
Exposure time: 10 min.

X-rays were exposed to acrylic phantom from above the couch.

Dose distribution of the position of medical staff during IR procedures was evaluated in different 2 conditions.
The irradiated field size is Exp._1: 40 × 40 cm^2
Exp._2: 20 × 20 cm^2

Dose map around the irradiated field

Field size / Height	40 cm × 40 cm	20 cm × 20 cm
150 cm		
100 cm		
50 cm		

The X-rays exposed from over the patient are mainly scattered to above the patient.

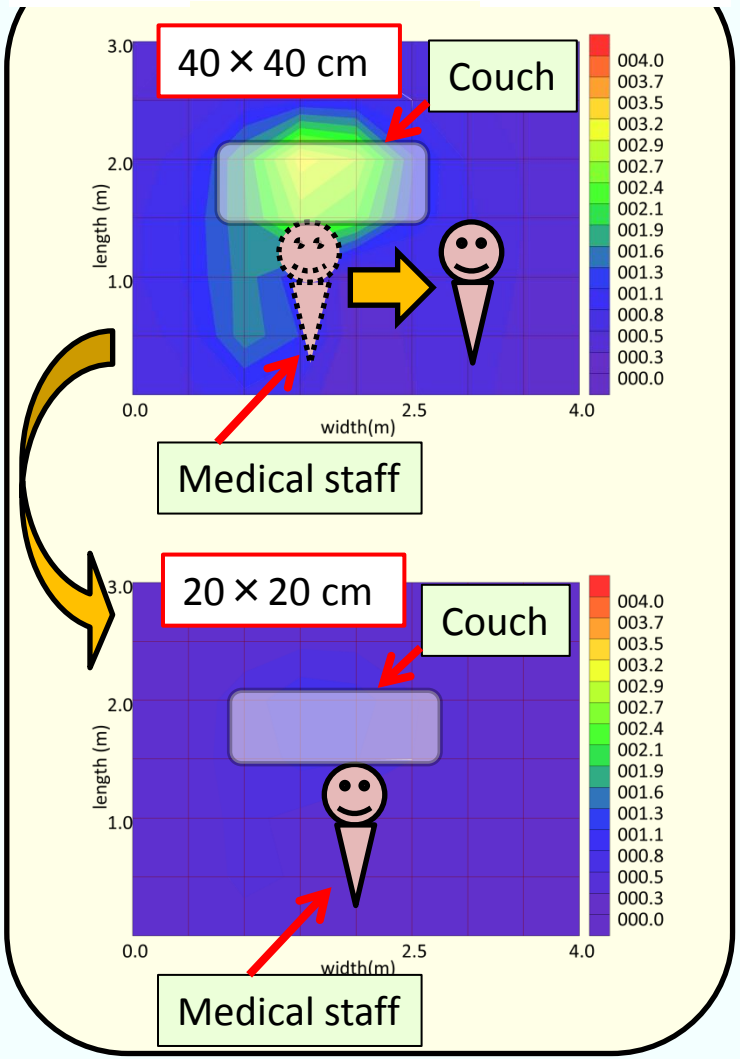
Collimating the irradiation field ¼, the dose reduced to ¼ in all area.

→ The collimator didn't make scattered X-rays.

Typical position of doctor

How to reduce the occupational dose?

Dose distribution in 150 cm Height



The dose map clearly shows

- The high / low dose position.
- The impact of work procedure change on dose distribution.

The dose map is a useful tool to have a discussion toward the dose reduction.

- Where is better position?
- Whether or not the measures are useful?

Conclusions

- The Jungle Gym (JG) method can evaluate the dose distribution around the irradiation field.
- The JG method using nanoDot makes it easy to evaluate the dose distribution on site.
- JG method is useful tool to evaluate the dose distribution toward the reduction of occupational dose.