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# Assessment of the impact on an OSL dosimetry system of the new operational dose quantities proposed in the ICRU 95

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## ► To cite this version:

jean-marc bordy, Marc Million, Marc Moreno, Johann Plagnard. Assessment of the impact on an OSL dosimetry system of the new operational dose quantities proposed in the ICRU 95. IM2022 - International Conference on Individual Monitoring of Ionising Radiation (IM2022) and Neutron and Ion Dosimetry Symposium (NEUDOS-14), Apr 2022, Cracovie, Poland. cea-04152300

**HAL Id: cea-04152300**

**<https://cea.hal.science/cea-04152300v1>**

Submitted on 5 Jul 2023

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# ASSESSMENT OF THE IMPACT ON AN OSL DOSIMETRY SYSTEM OF THE NEW OPERATIONAL DOSE QUANTITIES PROPOSED IN THE ICRU 95

Presented by: M Million<sup>1</sup>

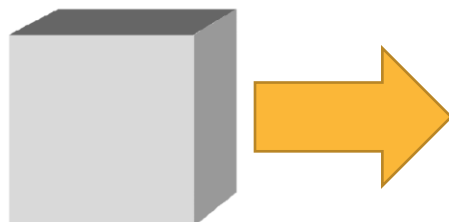
Co-authors: B Moreno<sup>1</sup>, J-M Bordy<sup>2</sup>, J PLAGNARD<sup>2</sup>

<sup>1</sup>Landauer, Vélizy-Villacoublay, (France), e-mail: [mmillion@landauer-fr.com](mailto:mmillion@landauer-fr.com)

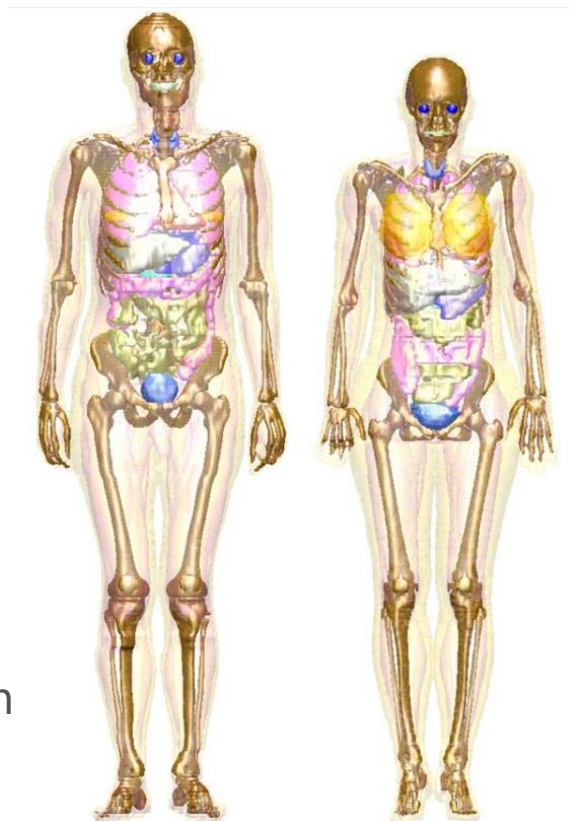
<sup>2</sup>Laboratoire National Henri Becquerel (LNE-LNHB), CEA LIST(France)

# Standard ICRU95

Current phantom and future phantom for operational quantities references (for Hp(α))



30 cm × 30 cm × 15 cm  
ICRU-tissue phantoms

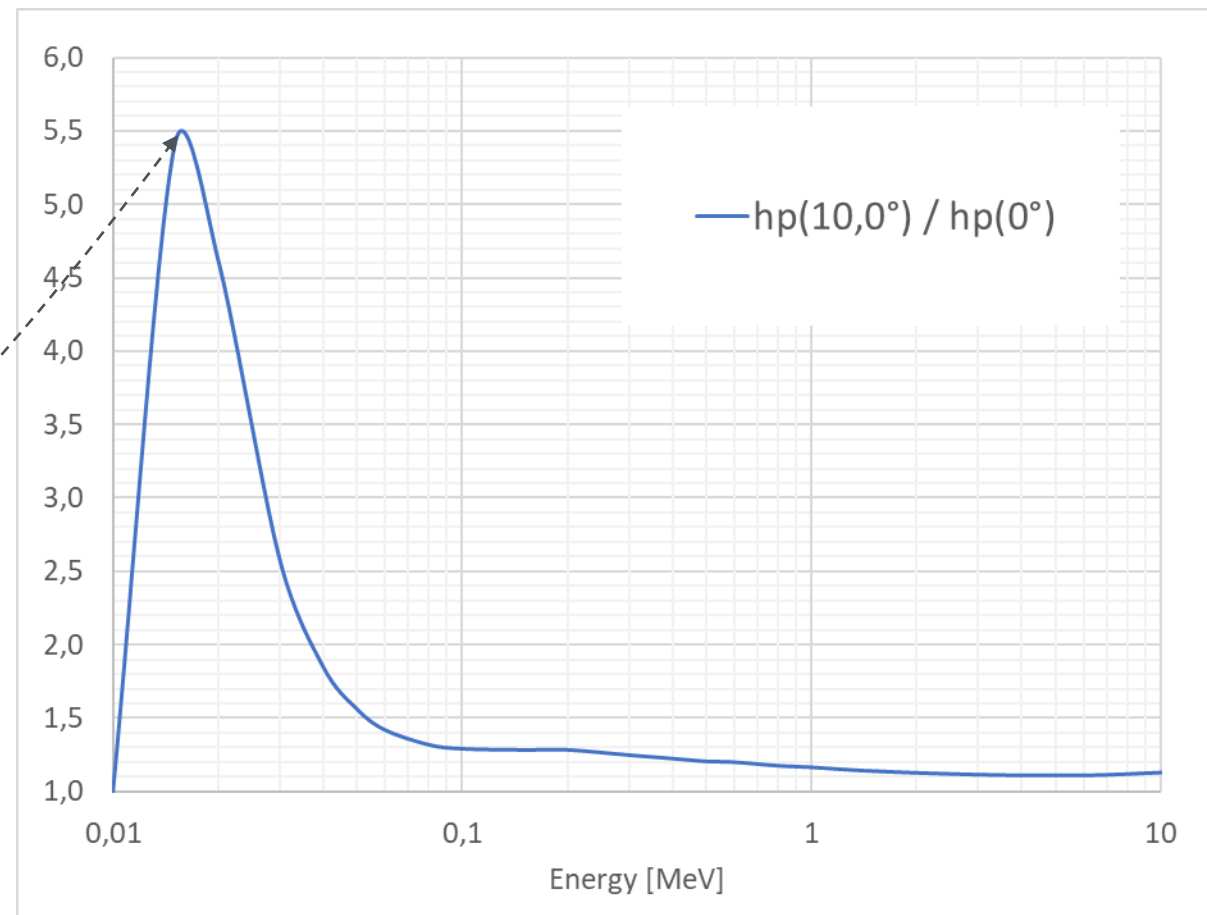
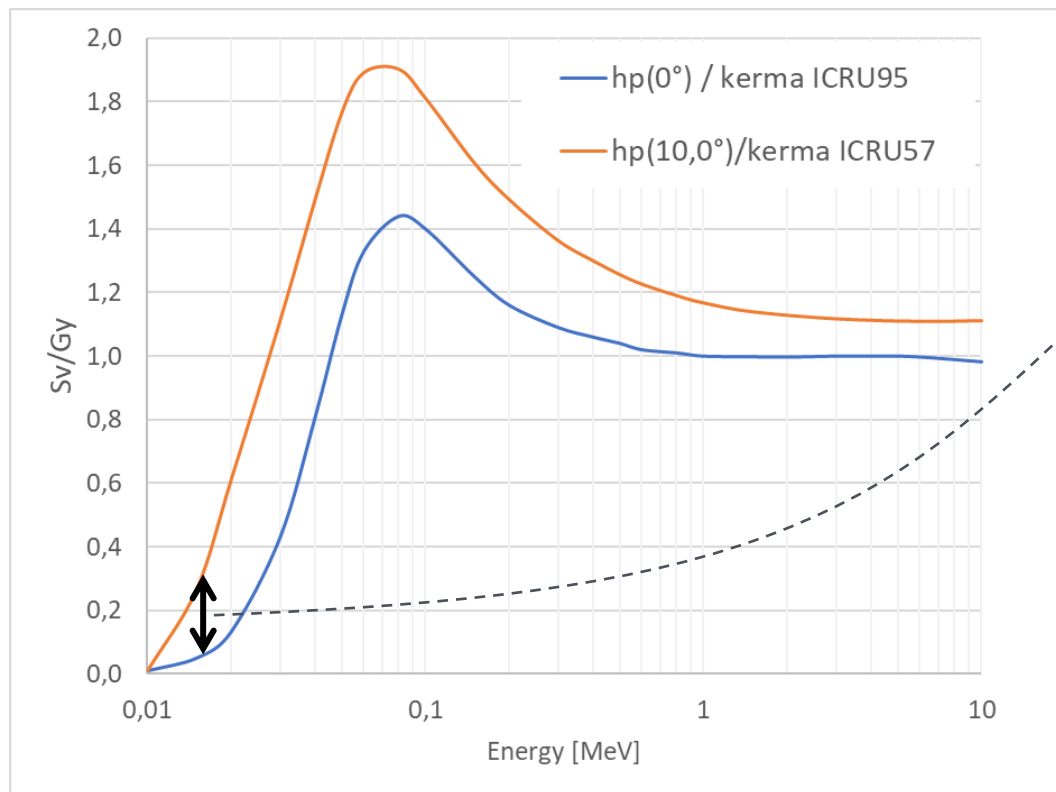


- ICRP Publication 89 (2002)
- Male – 1.95 million tissue voxels
  - slice thickness of 8.0 mm and lateral dimensions of 2.137 mm
  - 1.76 m
  - 73 kg
- Female -3.89 million tissue voxels
  - Slice thickness of 4.84 mm
  - Lateral dimensions of 1.775 mm.
  - 1.63 m
  - 60 kg
- 140 Organ identification numbers

# Summary

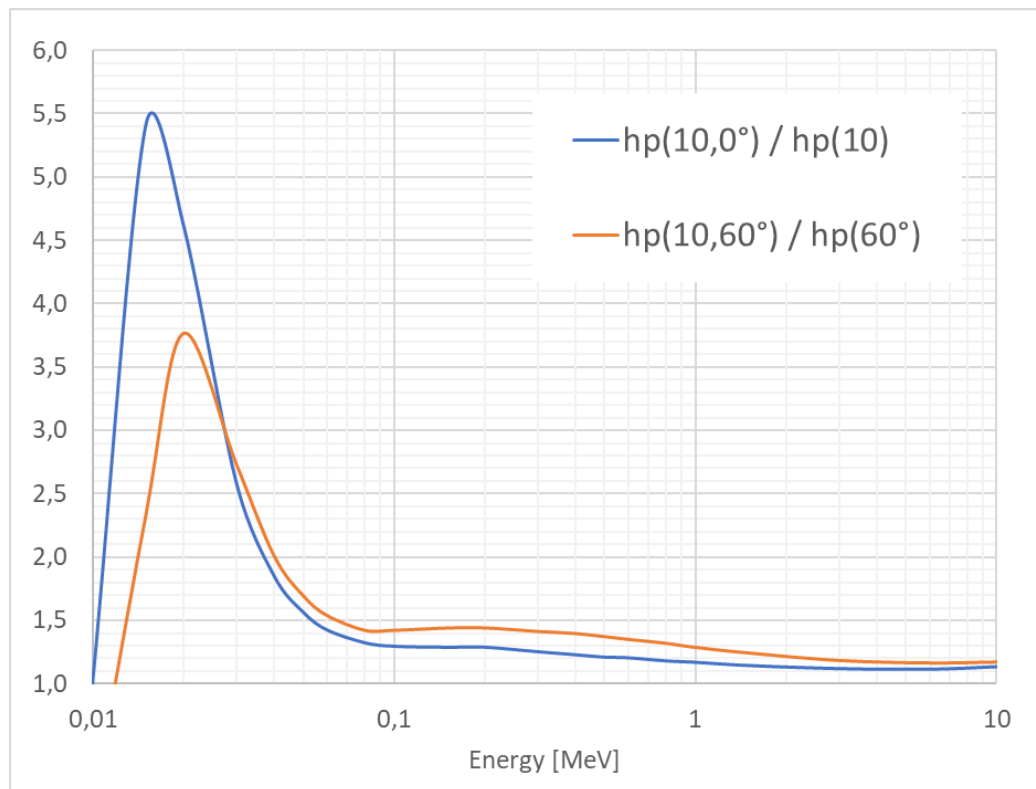
- ICRU95 vs ICRU57 and its consequences for the individual monitoring quantities
- Impact on the individual monitoring dosimeter design
- Implementation of the ICRU95 in OSL dosimetry system
- Consequence on the personal equivalent dose reported
- Conclusion

## ICRU95 vs ICRU57 and its consequences



The new operational quantities may decrease the dose assessment by a factor up to 5.5

## ICRU95 vs ICRU57 and its consequence



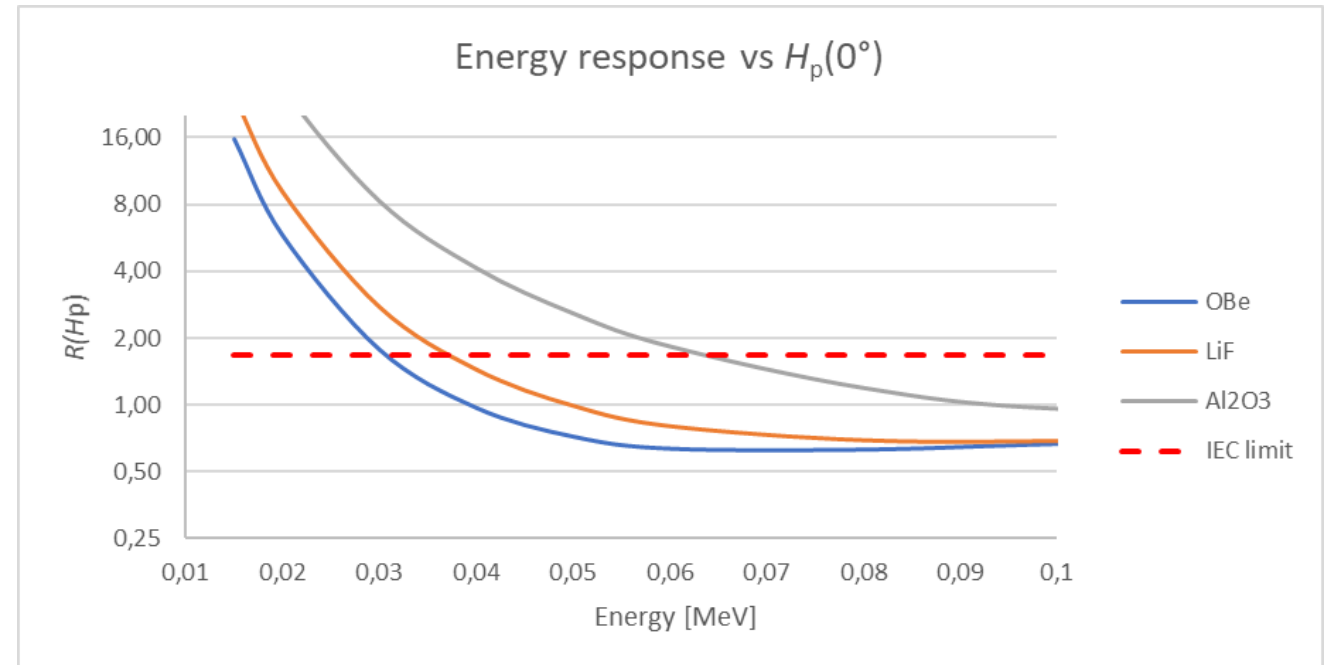
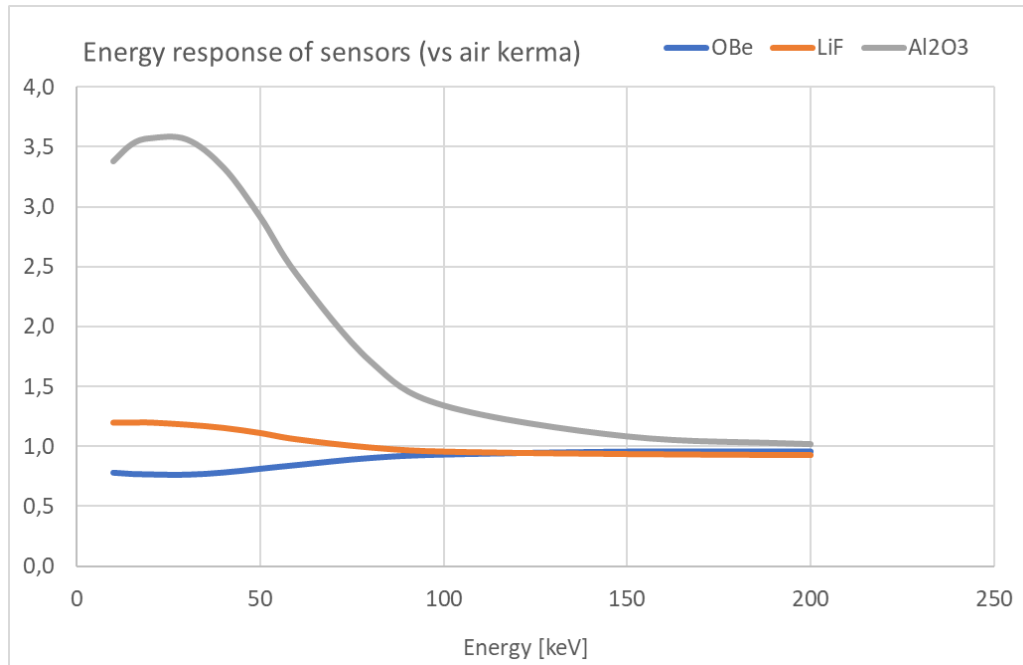
Angular response of the dosimeter is also impacted

$\frac{h_p(0^\circ)_{ICRU95}}{h_p(10,0^\circ)_{ICRU57}}$	0°	15°	30°	45°	60°	75°
10 keV	1.03	1.13	1.65	3.55	-	2.6 (15 keV)
20-50 keV	0.20-0.65				0.25-0.60	0.40-0.70
60 keV - 10 MeV	0.82	0.83	0.84	0.93	0.74	0.75

Cs-137	0°	60°
ICRU 95 conversion coefficients	1,016	0,88
ICRU 57 conversion coefficients	1,21	1,19

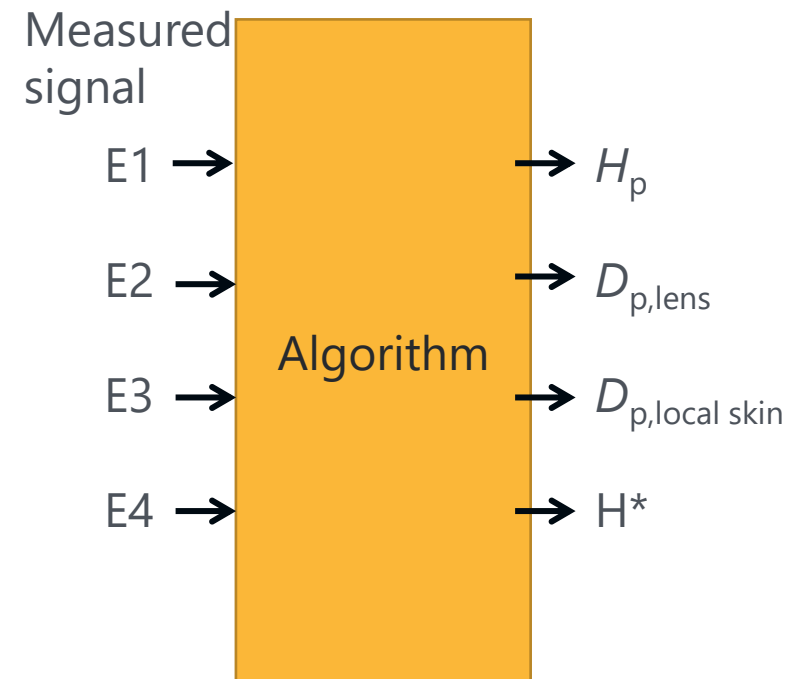
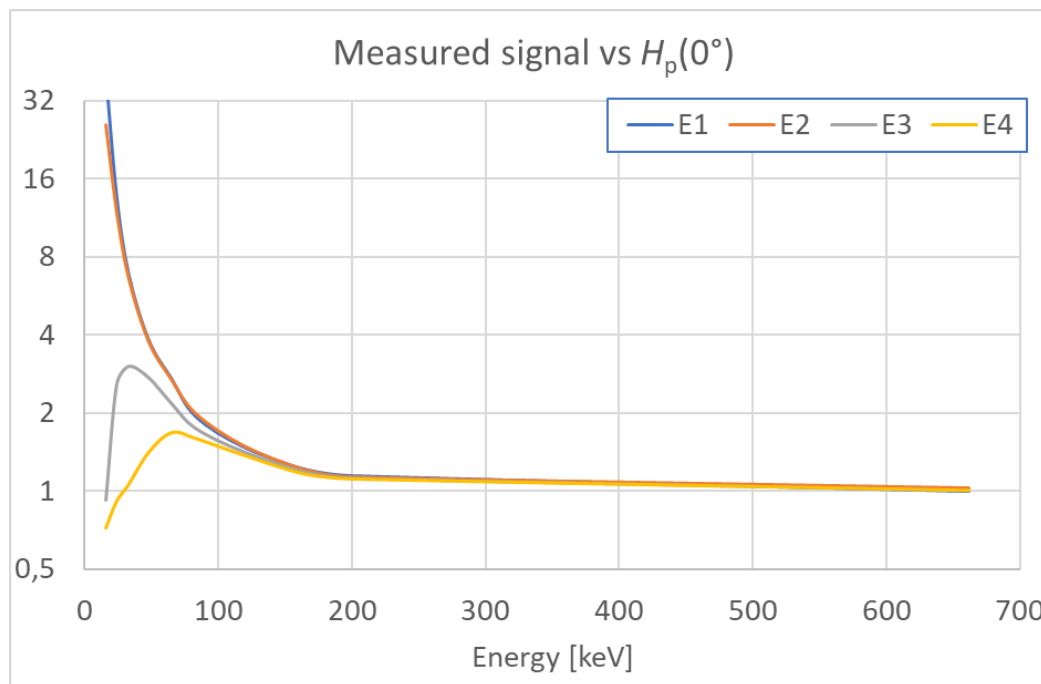
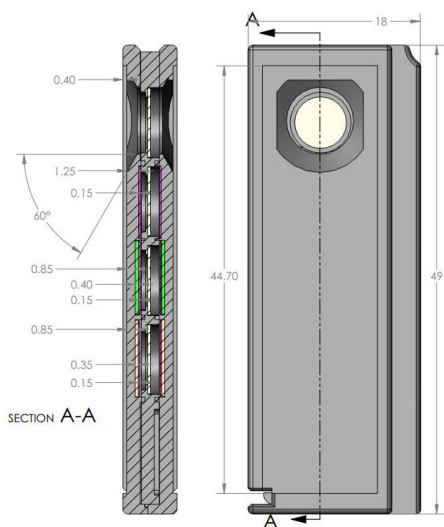
The angular response may be impacted and at high energy it may be difficult to handle

## Impact on the individual monitoring dosimeter design



Any chemical composition of a sensitive material will not have an energy response able to assess personal dose  $H_p$  with a raw sensor within IEC 62387:2020 limits

## Implementation of the ICRU95 in OSL dosimetry system

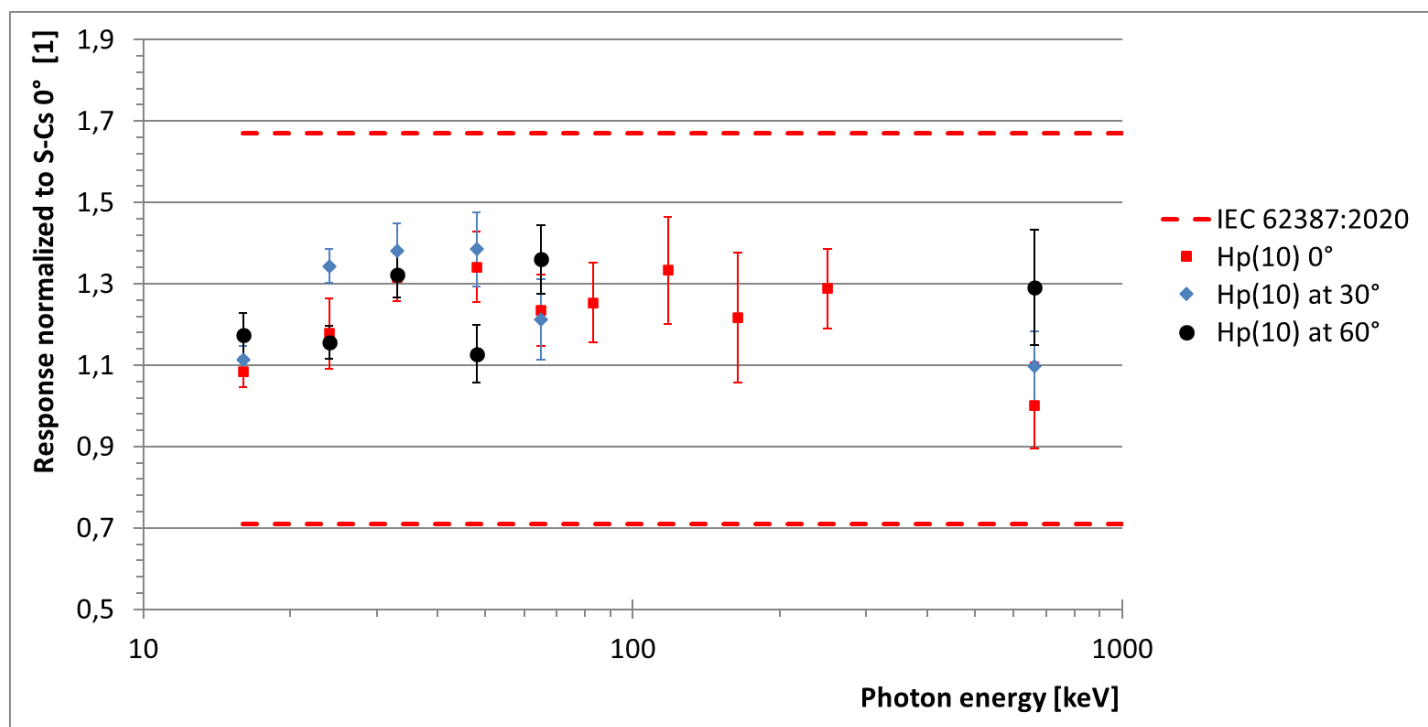


A new parameterization of the algorithm has been design considering the ICRU95 dose response of the dosimeter

Marc Million, Brahim Moreno, Development of a Multi-Sensitive Element Passive Dosimeter Based on OSL Technology, *Radiation Protection Dosimetry*, Volume 174, Issue 3, April 2017, Pages 377–381, <https://doi.org/10.1093/rpd/ncw217>



## Implementation of the ICRU95 in OSL dosimetry system

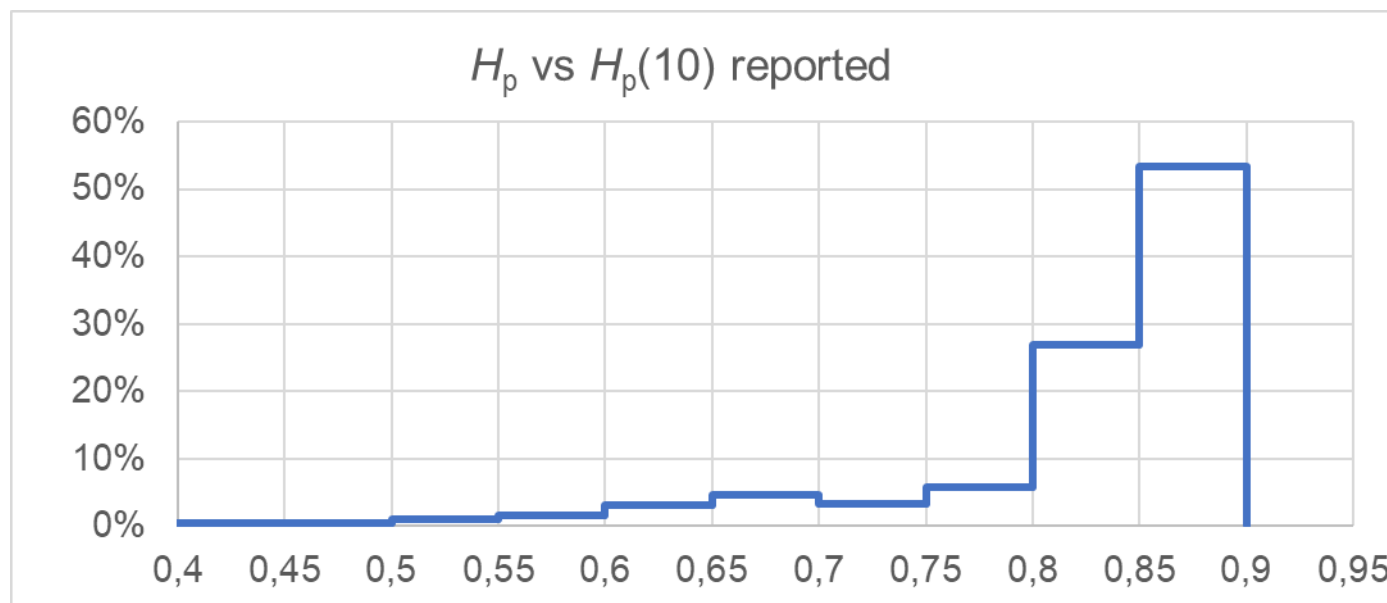


Energy response of the Al<sub>2</sub>O<sub>3</sub> IPLUS Landauer dosimeter with an adapted algorithm for the ICRU95

## Consequence on the equivalent dose reported

A re-assessment of the dose has been done for 6500 values above 0,1 mSv

- In average  $H_p = 0,80 H_p(10)$ , total dose of the 6500 values  $H_p = 0,80 H_p(10)$

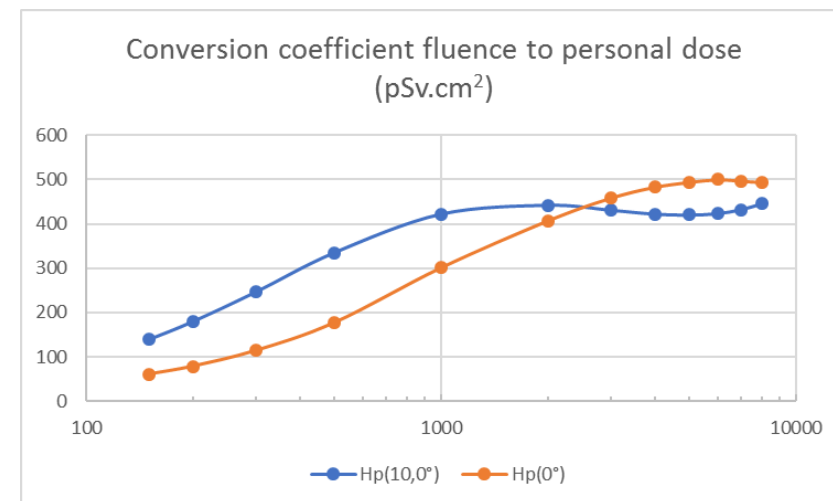
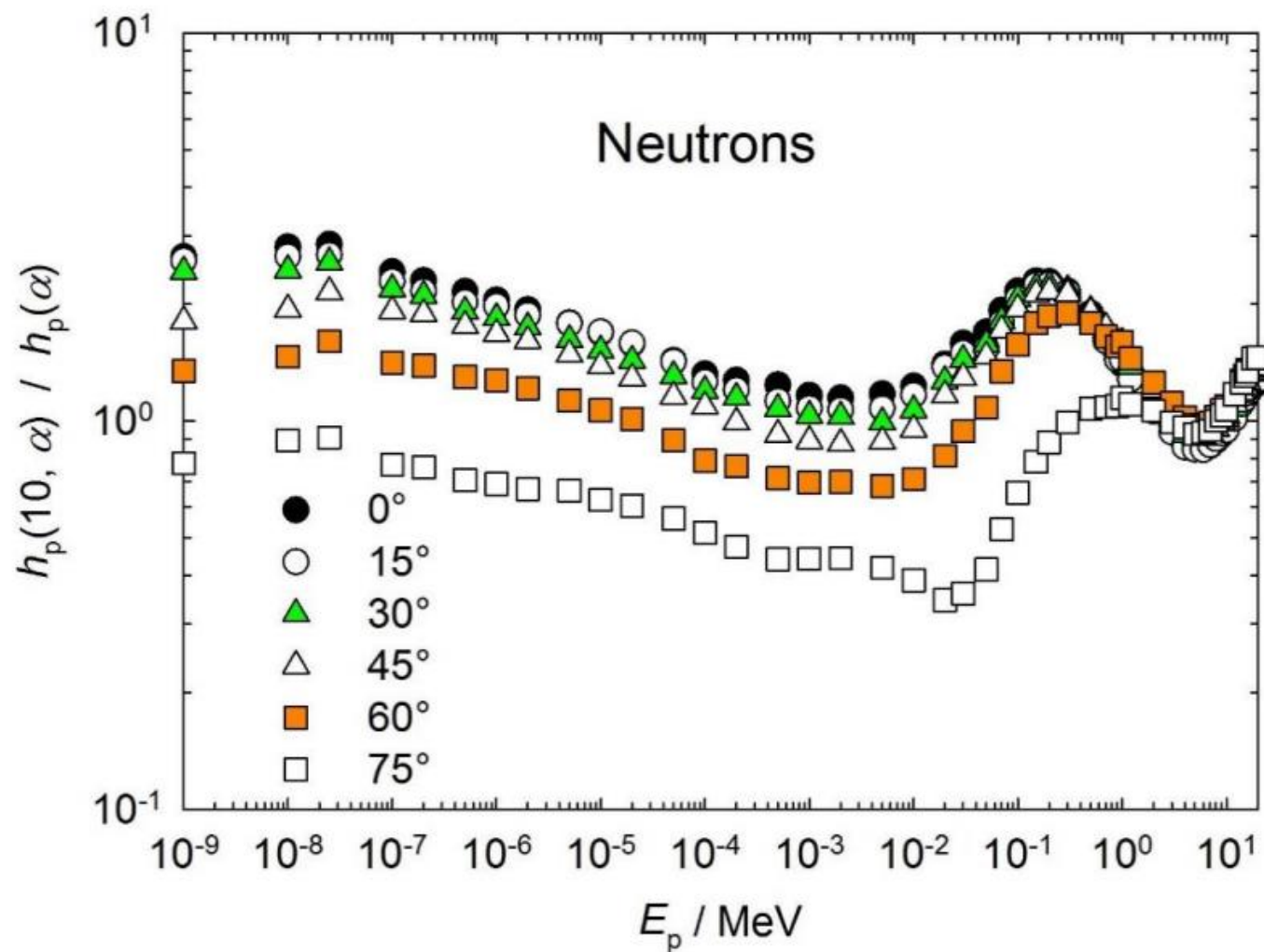


The reported dose with the ICRU95 should be 20% below the ICRU57

# Conclusion

- By modifying the algorithm, first investigation showed that it is possible to fit the IPLUS OSL dosimeter response within the IEC criteria for energy and angular response – further work needed to assess compliance against IEC 62387:2020
- With ICRU95, the variation of the energy-angle response of the IPLUS dosimeter will be probably higher than that with ICRU57 but more inline with the protection quantity
- The estimated reported dose of the worker is about 20% below

# Standard ICRU95



The current unit overestimate the irradiation risk (energy < 2.5 MeV)