Results and experience from the area dosimeter intercomparison NDS2025area: Performance assessment of passive H*(10) dosemeters at the Vinča Institute of Nuclear Sciences

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INTRODUCTION

The accurate measurement of ambient dose equivalent, H*(10), is essential for ensuring the safe workplace and the environment. H*(10) provides a foundation for graded approach, triggering different protective actions; providing the data necessary to estimate population exposure; and ensuring that workers remain within safe dose limits. This paper presents the results of Vinča Institute of Nuclear Sciences (VINS) in the regional NDS2025area Intercomparison for passive area dosimeters. The intercomparison, organized by the Laboratory for Dosimetry Standards of Jožef Stefan Institute (NDS), provided a unique opportunity to benchmark dosimeter performance across different radiation qualities and dose ranges, fostering international harmonization and quality assurance. Five organizations from three countries, with in total eight dosimetry systems, took part in the exercise between May and August 2025.

METHODS AND MATERIALS

Dosemeters: Vinča Institute of Nuclear Sciences participated with TLDCARD-27P, TLD-700H two-element dosimeters (Thermo Fisher Scientific, USA) housed in holder type 8857 for environmental monitoring. Dosimeters contain ^{7}LiF:Mg,Cu,P crystals.

Calibration: Calibrated in a ^{137}Cs reference field (662 keV) according to ISO 4037-3:2019 standard at secondary standard dosimetry laboratory at VINS.

Irradiation: During irradiation, dosimeters were positioned with reference points at the geometric center or along the axis of rotation for rotational irradiations. Irradiations followed NDS-DN-04 and NDS-DN-05 procedures, with reference standards traceable to national and international standards. NDS estimated the measurement uncertainties of the reference values obtaining a 95% confidence interval.

Reader: Readouts of 22 dosemeters were conducted with a Harshaw 6600 Plus automated TL reader (Thermo Fisher Scientific, USA).

RESULTS and DISCUSSION

The results obtained by the Vinča Institute of Nuclear Sciences demonstrated highly precise results on all radiation qualities and incident angles and remarkable agreement for ^{137}Cs irradiations, with measured-to-reference ratios of 1.00-1.06 across tested dose levels, ranging from 0.2 to 20 mSv (Fig.1). For X-ray qualities: N-30 (24.6 keV) and N-60 (47.9 keV) the underresponse was recorded of 0.77-0.97, while mid-energy N-120 (100 keV) and N-300 (248 keV) qualities, yielded 0.56-0.61 and 0.80-0.82, respectively (Fig. 2). These responses are in line with the previous results of the type test of various passive dosimetry systems used in environmental radiation monitoring done in 2021 during EMPIR 16ENV04 Preparedness project [1]. Additionally, dosimeters that were subjected to constant rotation around vertical axis, while being in N-30 field gave excellent result of 0.96 in average.

CONCLUSION

The VINS participation in regional intercomparison highlights the capabilities of passive dosimetry system, based upon TLD-700H dosimeters, in routine environmental H*(10) monitoring and its reliability across a range of radiation qualities. Beyond confirming technical performance, this intercomparison underscores the value of international collaborative exercises in enhancing regional capabilities and confidence in measurement results, while advancing in radiation protection monitoring harmonization.

REFERENCES

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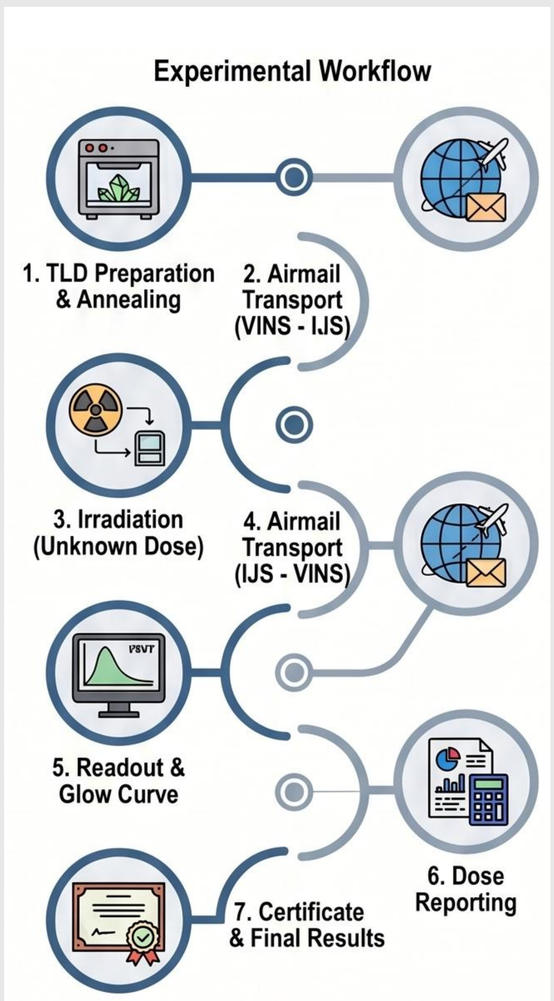

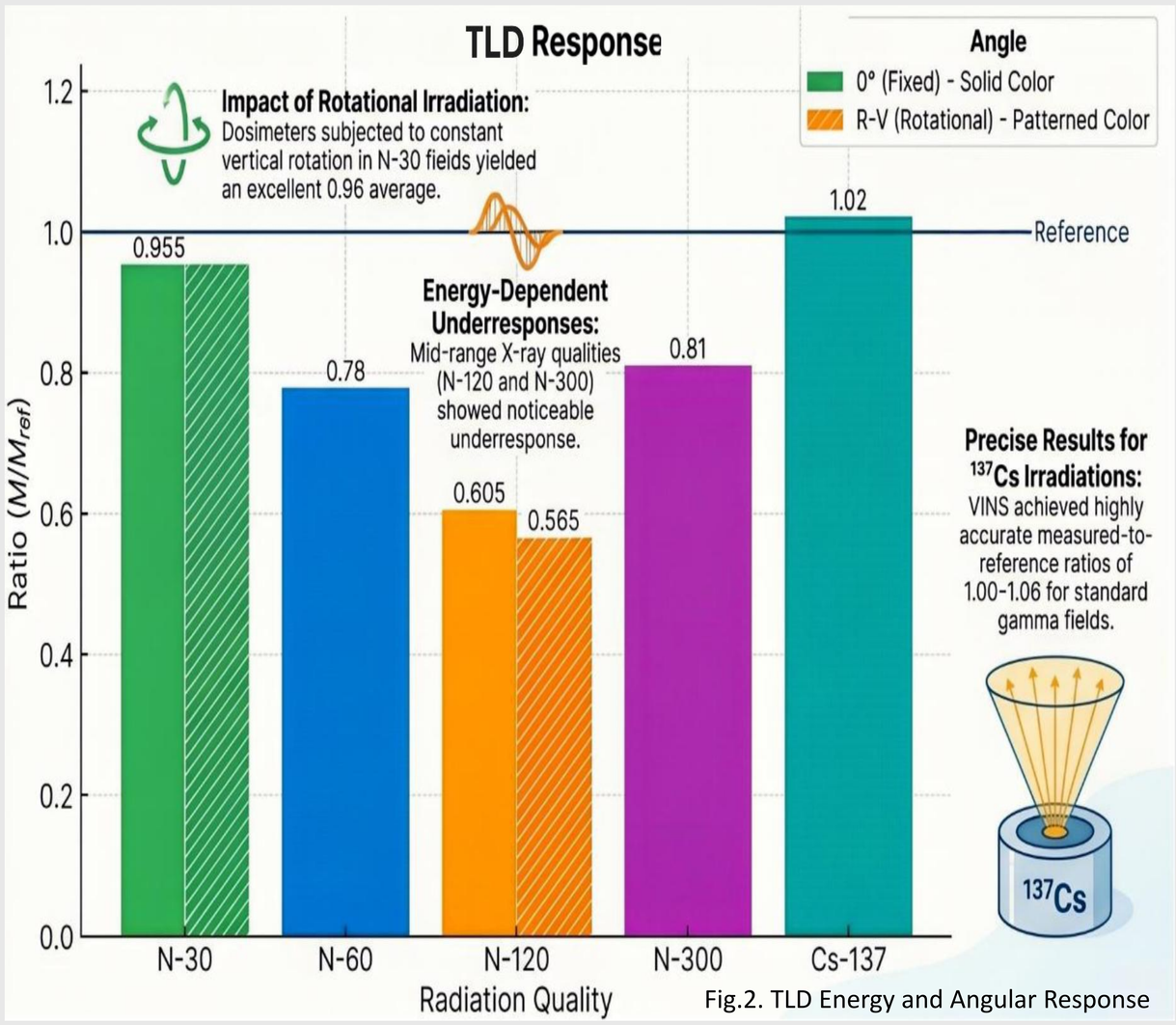

Fig.2. TLD Energy and Angular Response

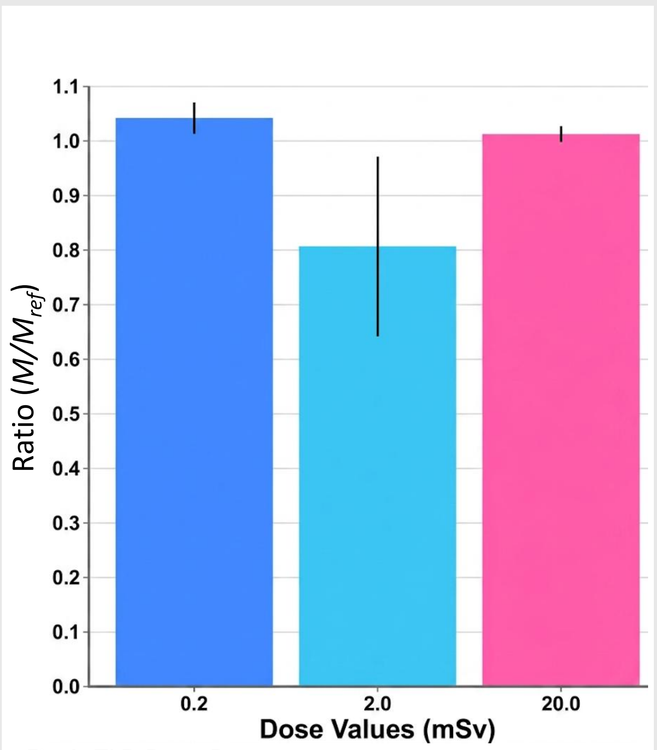

Fig.1. TLD Dose Response

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