

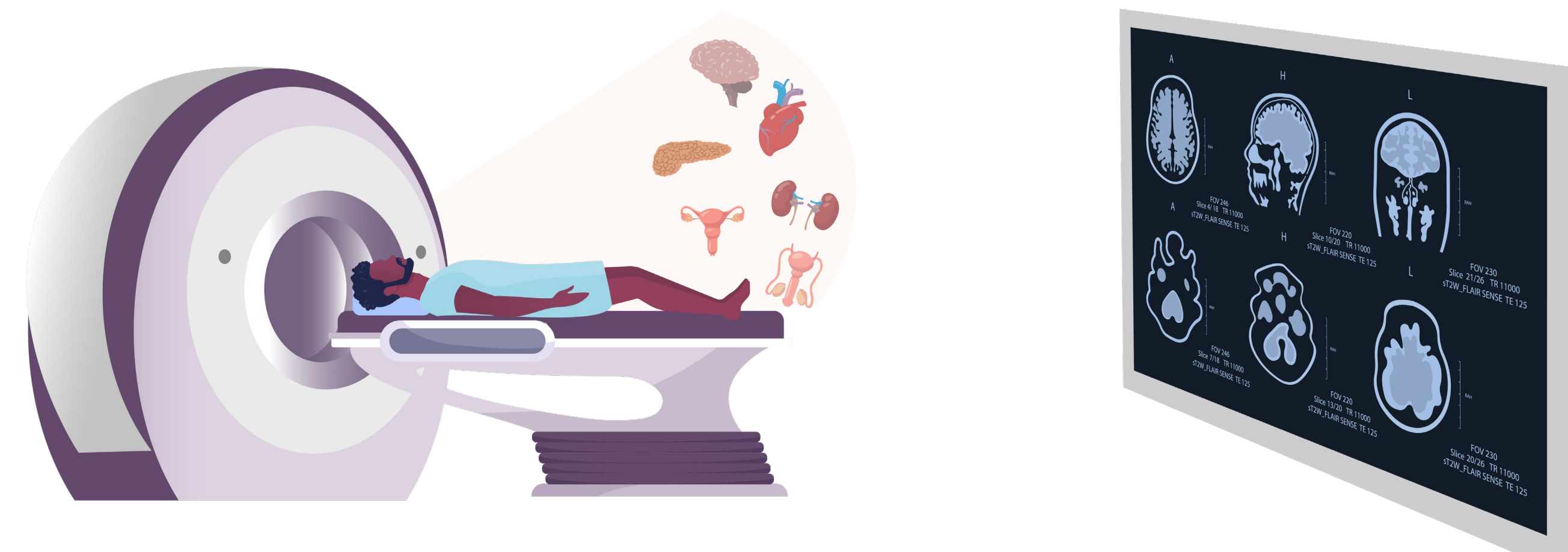
# Evolution of X ray dosimetry for medical applications and challenges in developing the dosimetry standards

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## INTRODUCTION

- The discovery of X rays has been of benefit to humankind contributing to their health, as they are broadly used for diagnostic and therapeutic purposes;
- The 2020/2021 UNSCEAR report indicate that about 4.2 billion medical radiological examinations are performed yearly, and this number is expected to grow [1].



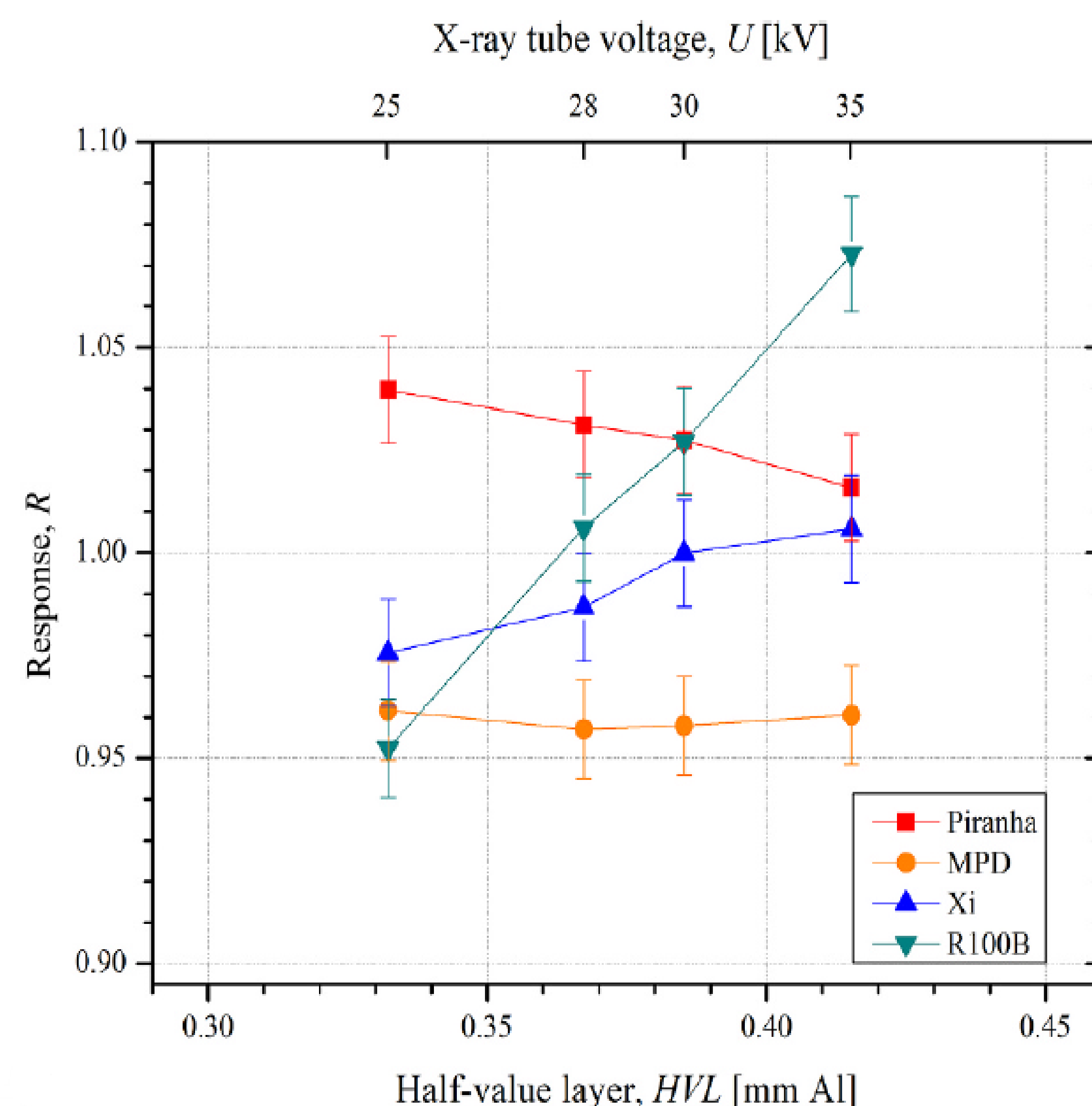
## CURRENT CHALLENGES

The rapid development of detector technology, measuring instruments and their wide availability for use in dosimetry, comes with challenges for the secondary standards dosimetry laboratories (SSDLs):

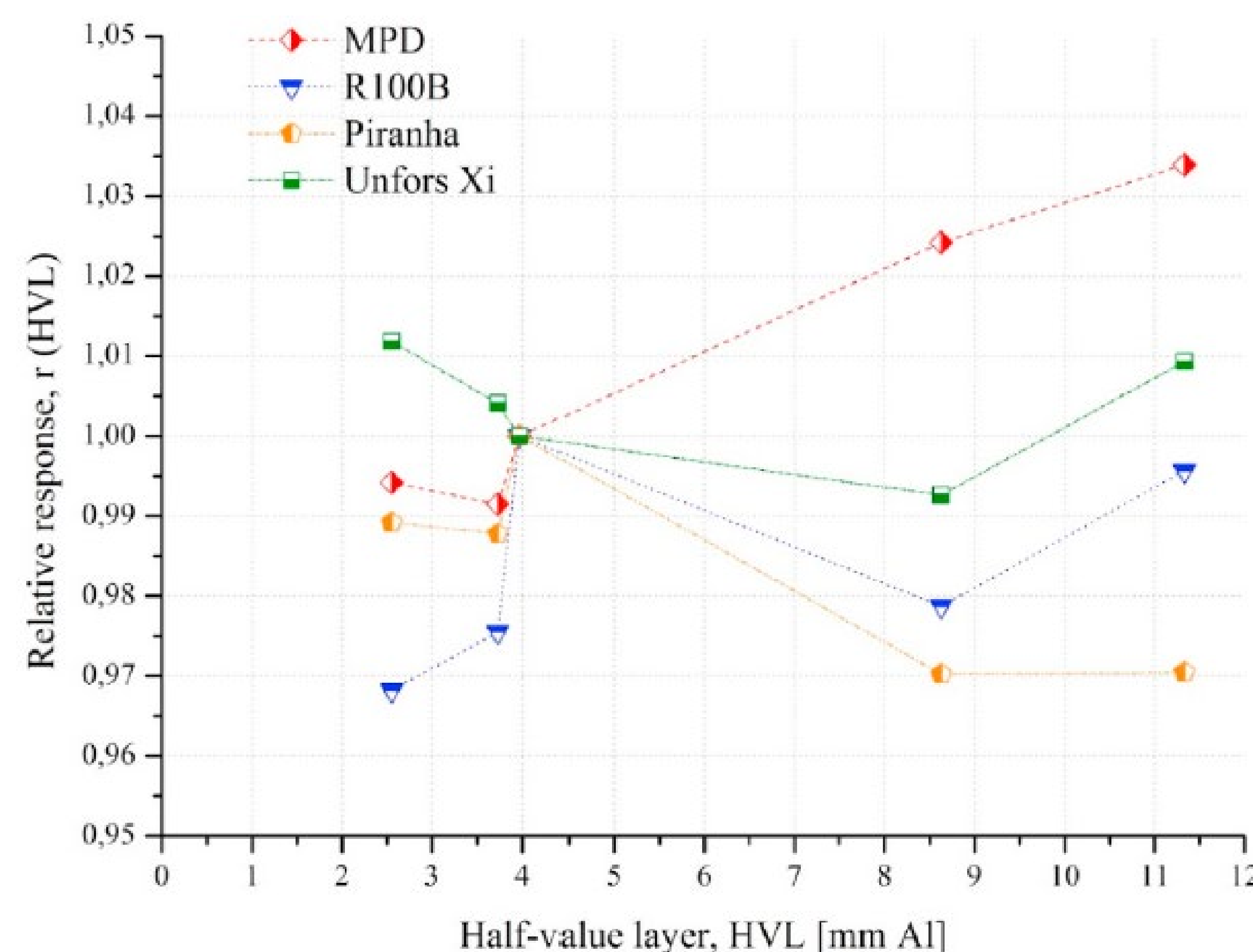
- To calibrate wide range of instruments in conditions very close to the clinical ones, in terms of irradiation geometry and radiation qualities used;
- The traceability received by the SSDL's from the primary standards laboratories does not necessarily resemble those at the end user, e.g. use of pulsed beams in hospitals and constant beams in calibration laboratories, different geometries that might affect the response of some equipment, etc;
- There are various vendors supplying clinical X ray machines and the machine characteristics vary from vendor to vendor including the beam qualities;
- It is impossible for calibration laboratories to establish all the radiation beam qualities and calibration methods as close as possible to those used in clinical conditions, even just considering only the national needs.

## ROLE OF THE IAEA

- The IAEA has a role in harmonizing dosimetry practice globally;
- Ongoing Coordinated Research project to evaluate the Dosimetry Needs and Practices for the Update of the Code of Practice for Dosimetry in Diagnostic Radiology (TRS-457) [2], team consists of primary and secondary standards laboratories, members of the IAEA/WHO SSDL Network, together with medical physicists;
- Testing of the detectors is being performed at laboratories and clinical beams.



Relative response of the solid-state detectors used in the field when compared in a clinical mammography machine with a molybdenum anode and a molybdenum filter. Some detectors read consistently lower than expected and another showing an increase with the tube voltage [3].



Relative response of the solid-state detectors used in the field for data measured in a standard radiation quality established in a lab in line with IAEA TRS 457 (normalisation point) and four other radiation qualities established in a lab to those resembling clinical conditions [4].

## CONCLUSIONS

- Data show that there are opportunities of improvement for dosimetry in diagnostic radiology taking into consideration the equipment now being used by the end users including the regulators who may make decisions on licensing based on these measurements.
- The questions are whether there is a need for dosimetry calibration laboratories:
  - To reconsider the calibration capabilities in support of diagnostic radiology;
  - Are the beam qualities established at primary standards labs and used for the comparison sufficient to provide confidence for the measurements performed by the users in diagnostic and imaging departments?
  - To consider developing methods that may be used by the users taking into consideration the equipment in the market and the measurement uncertainties needed in the clinic.
- Are the detector manufacturers needing to further develop their equipment so that they are less sensitive to the variation in beam qualities?
- There is a need for dosimetry labs to work closely with the manufacturers of detectors.



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