# Patient neutron dosimetry with TNRD

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# Radiotherapy

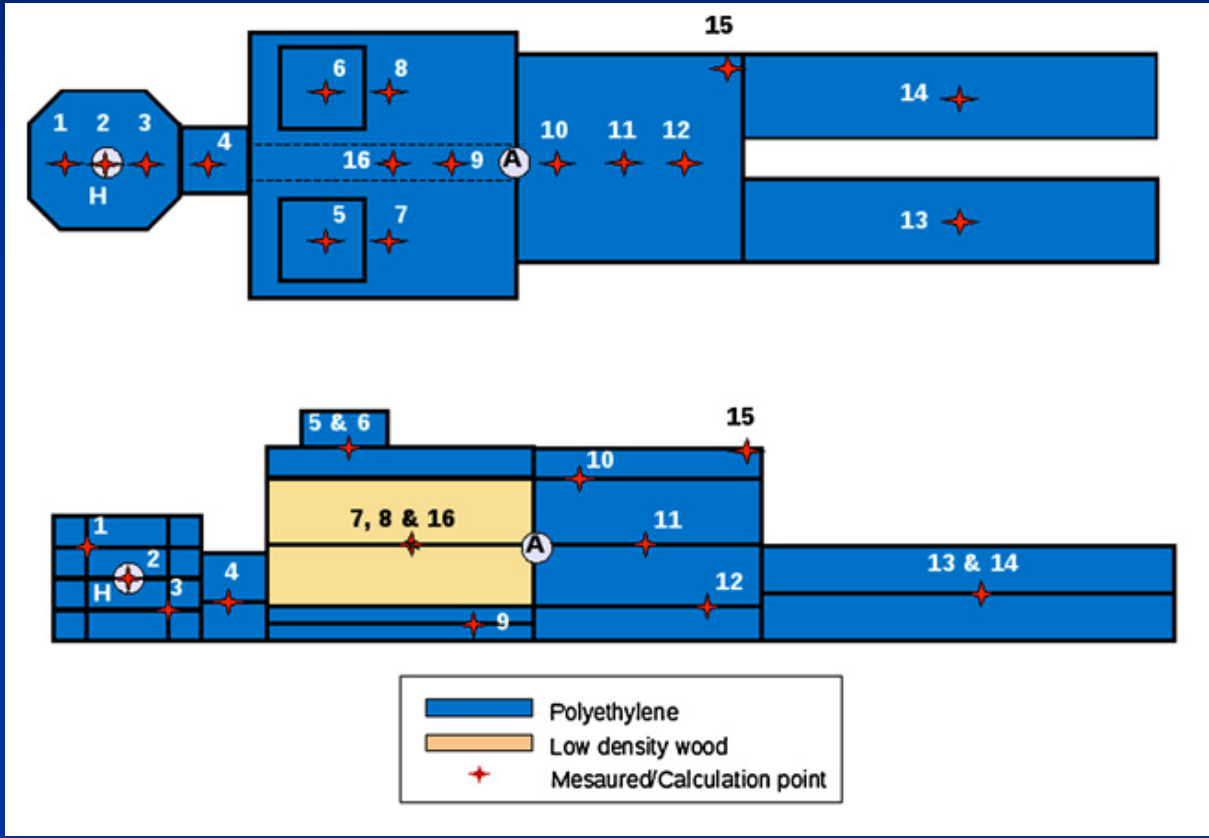
- Destroying tumors through ionizing radiation.
- Safeguarding the viability of organs at risk: therapy as a potential source of new neoplastic processes.

→ Patient neutron dosimetry study

# Sánchez-Doblado et Al.

- Development of a methodology in order to correlate the neutron fluence inside the treatment room and the neutron dose in patients.
- SRAM (Static Random Access Memory) based detector for room neutron fluence.
- TLD dosimeters for in-phantom passive measurements.

# NORMA phantom

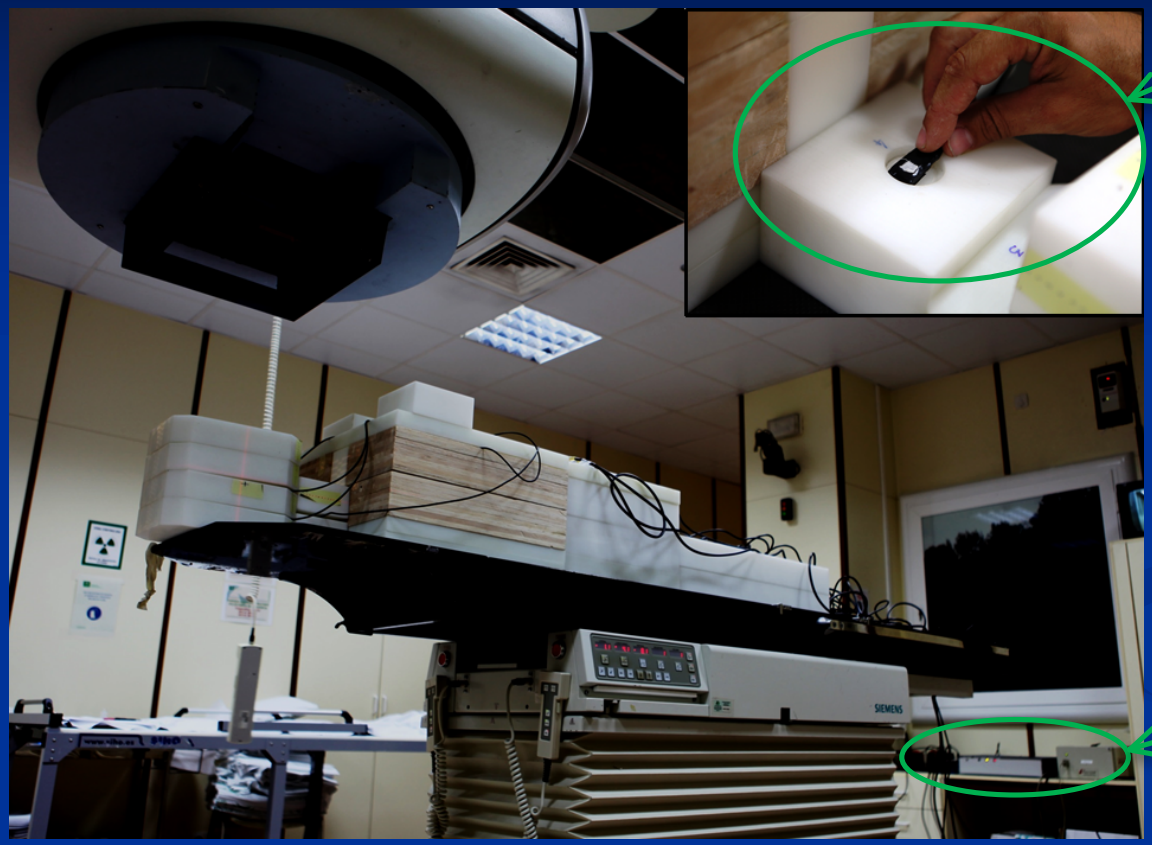



| Organs and tissues | NORMA points |
|---|---|
| Thyroid | 4 |
| Oesophagus | 4, 9, 16 |
| Lung | 7, 8 |
| Breast | 5, 6, 15 |
| Stomach | 9, 11, 16 |
| Liver | 9, 10, 11, 16 |
| Colon | 11, 12 |
| Urinary bladder | 10 |
| Ovary | 11, 12 |
| Skin | 15 |
| Bone | 1, 3, 9, 12, 13, 14, 15 |
| Bone marrow | 9, 12, 15 |
| Remainder | All except 7, 8, 15 |

# TNRD

- Compact detector.
- Possibility of both room fluence and in-phantom applications.
- Direct online measurements of fluence and its time evolution.

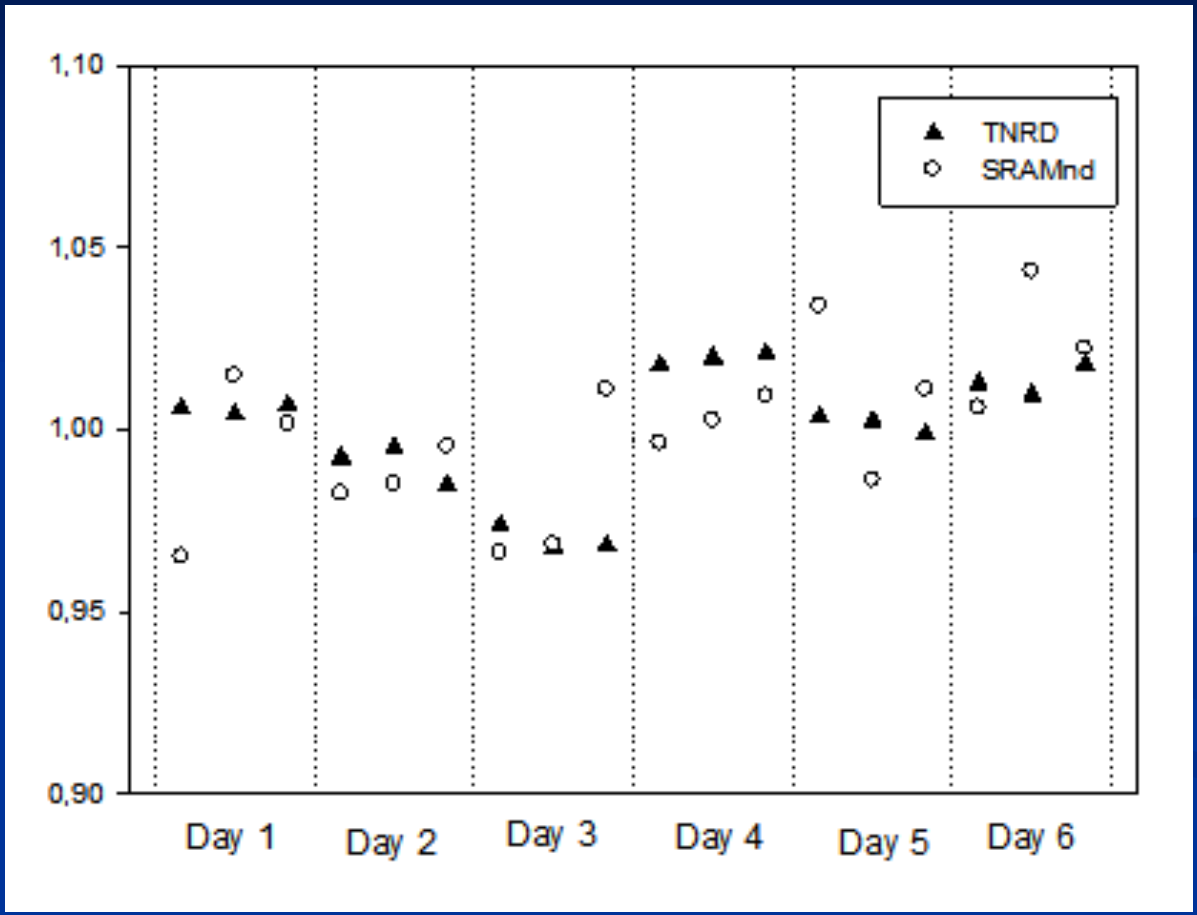
# Room setup



In-phantom placing of a TNRD probe

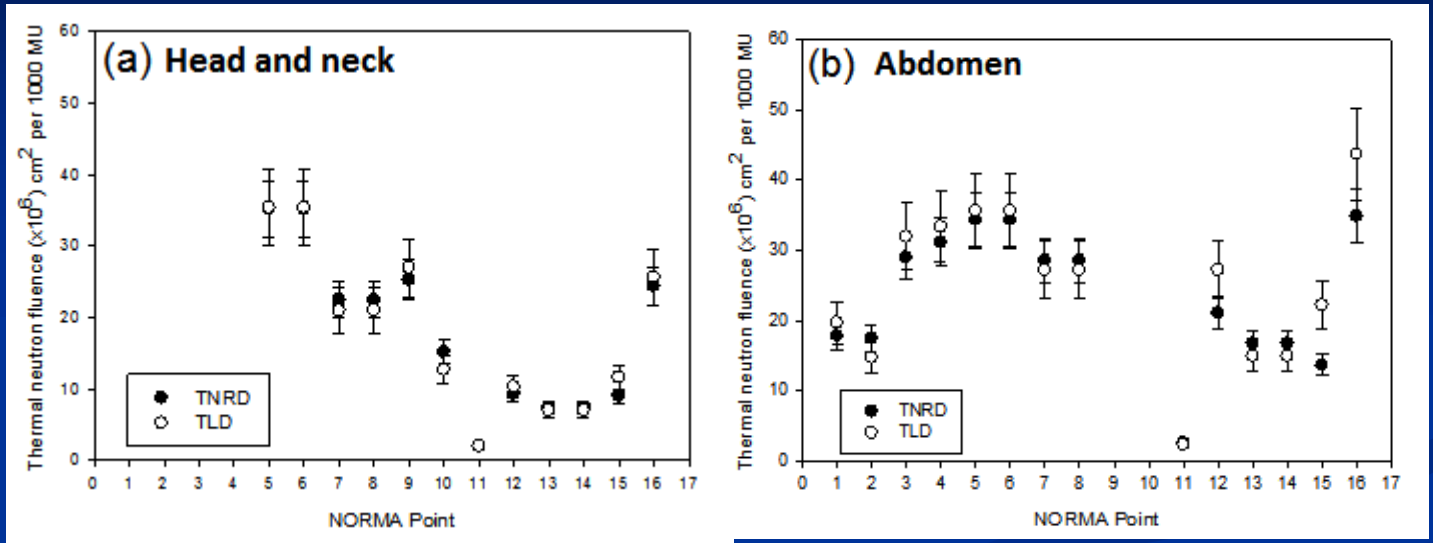
Room measurements: TNRD probe (up) and SRAM neutron detector (down)

# Reproducibility tests




Multiple measurements with 1000 MU (Monitor Unit) performed with TNRD and SRAMnd; TNRD presents a standard deviation of 1.70%, better than the 2.21% of the SRAMnd.

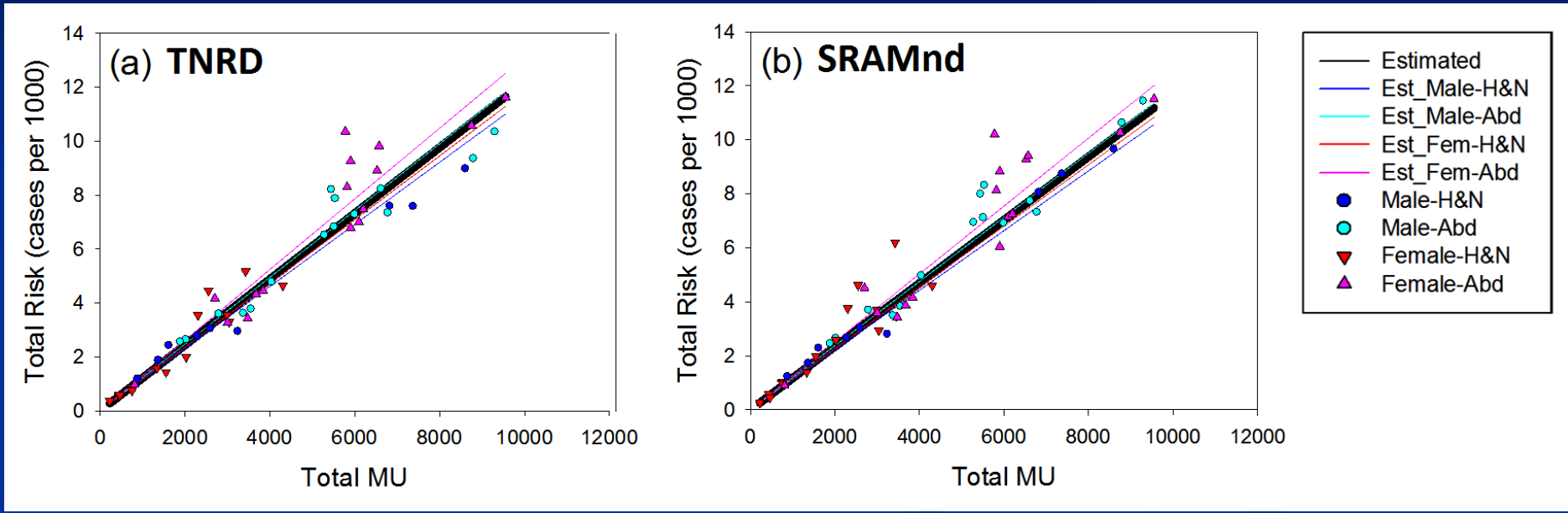
# Methodology confirmation: in-phantom measurements




Comparison between in-phantom neutron fluence measurements with TLDs and with TNRD at the same conditions: the agreement is satisfactory.

Missing points have been excluded as placed inside the treatment fields.

# Patients risk assessment




Comparison of experimental and estimated Total Risk (TR), cases per 1000, for radiotherapy patients: good agreement between the two detector results and the values expected from the facility characterization.

# Conclusions

- TNRD has accomplished the requirements of SRAMnd, with even better reproducibility and sensitivity.
- This enables TNRD use with the existing methodology for direct estimation of equivalent dose in organ, as confirmed by the comparison of the patients risk assessment.
- In addition, TNRD opens the possibility of active in-phantom measurements, i.e. estimation of neutron peripheral dose in radiotherapy, allowing to improve the existing general models and to generate new specific ones.

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