Dose measurements with clinical electrometers and Light-Dependent Resistances

Juan Román-Raya – San Cecilio Clinical University Hospital, Granada, Spain

2nd WORKSHOP ELICSIR PROJECT, 9-10.03.2021

Background

- In Radiotherapy, it is necessary to employ **dosimetry systems** in order to check administered doses to patients.

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- Ionization chambers, connected to clinical electrometers, are the most used dosimetry systems → **Expensive**
- The cost of these devices would be reduced if devices not specifically manufactured for dosimetry were used.

Motivation

- Cancer patients → Radiotherapy **(52%)**

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- **In vivo** dosimetry → Detect dosimetric errors

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Is in vivo dosimetry used in all centers?

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- Costly
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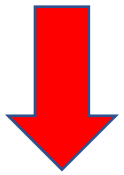

New systems **cheaper** and **easier** to handle

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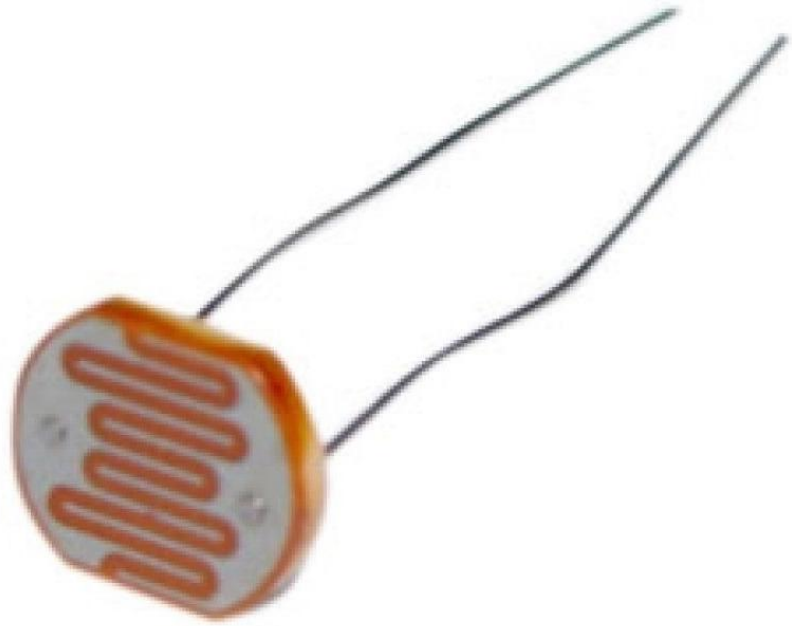
- **Light-Dependent Resistances** (LDRs) → **visible light** detectors → their resistances reduce when increasing light intensity.
- Same behavior under **ionizing radiation?** → **YES**
- Two models of commercial LDRs have been characterized with a **clinical electrometer** as a reader unit for monitoring LDRs radiation response.

Irradiation unit

Light-Dependent Resistances

NSL-19M51

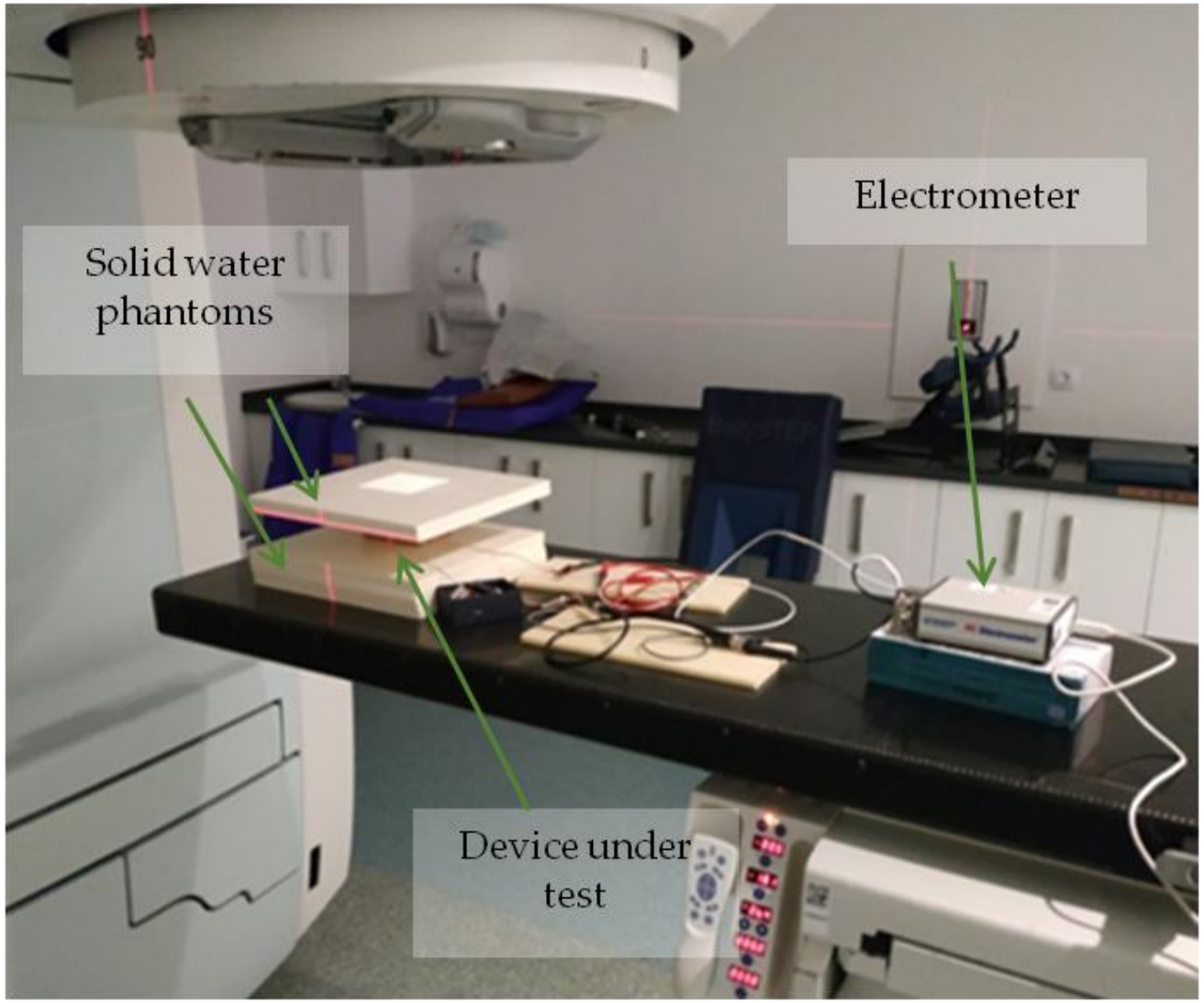


VT43N2

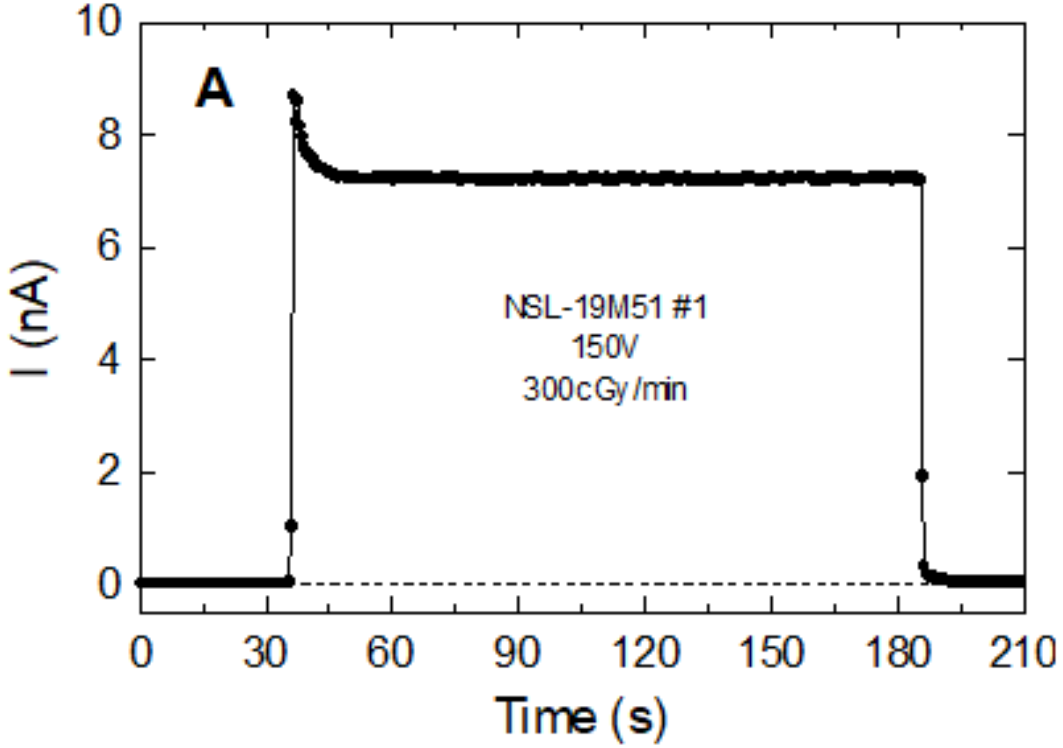
Clinical electrometer

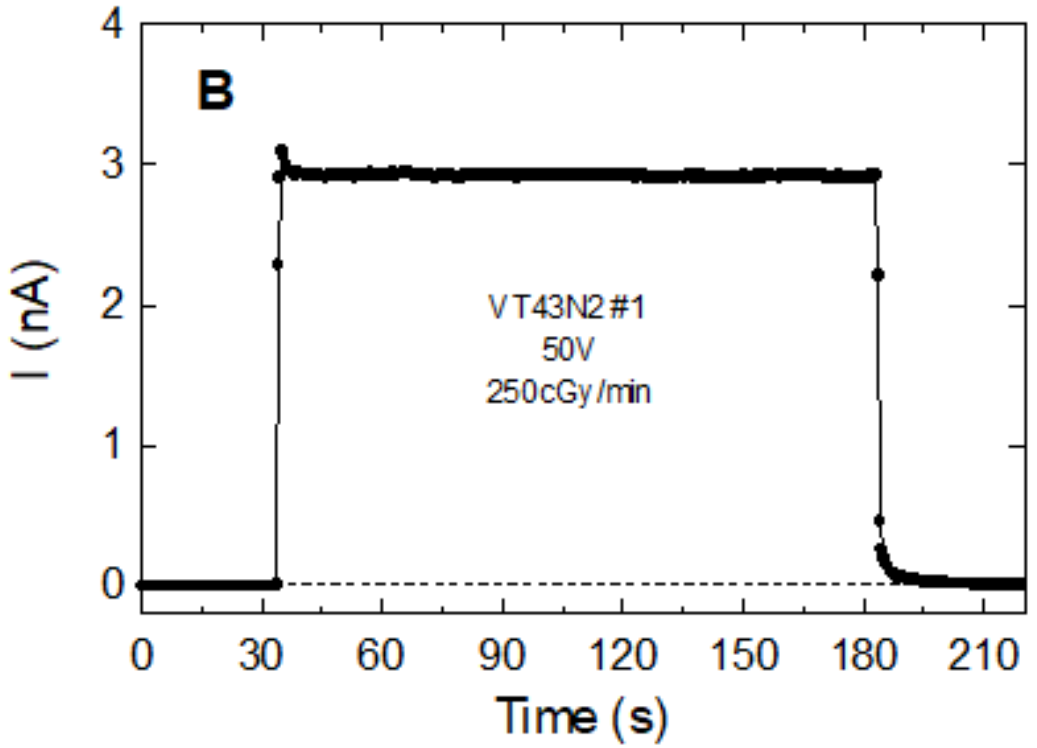
PC Electrometer

Experimental setup



Response of LDRs





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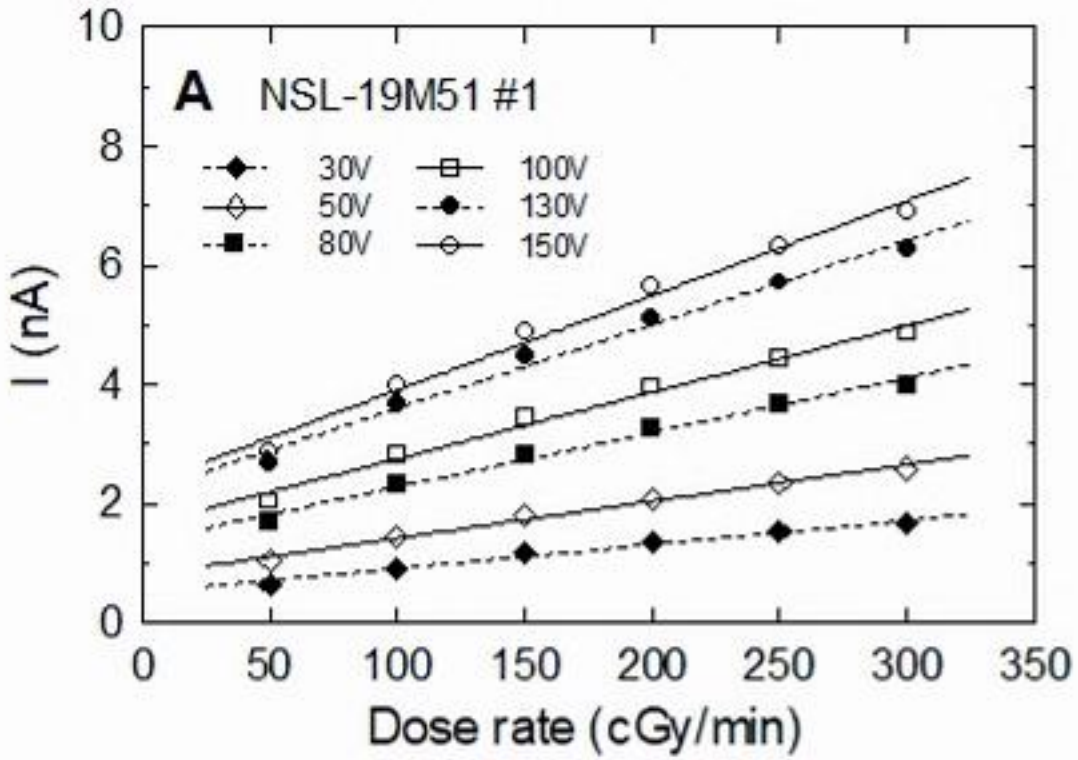

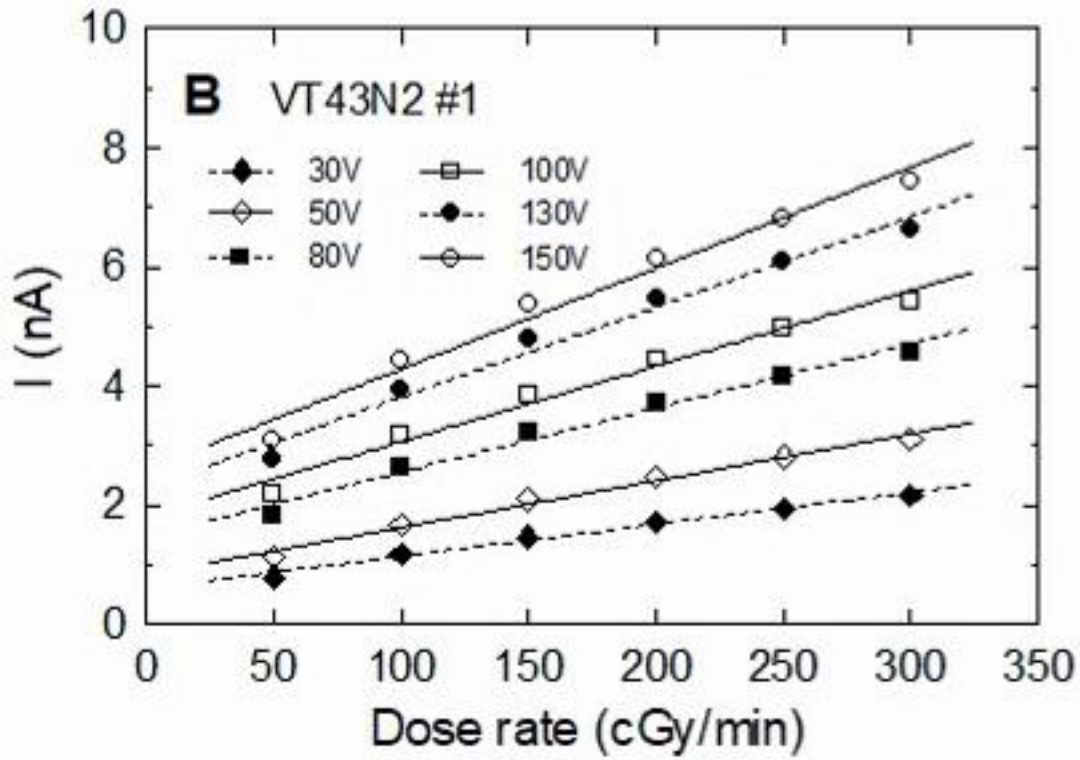

Response of LDRs

NSL-19M51	(1)		(2)		(3)		Mean
I=aR+b	a (nC/cGy)	R^2	a (nC/cGy)	R^2	a (nC/cGy)	R^2	a (nC/cGy)
30 V	0.23±0.02	0.987	0.24±0.03	0.986	0.24±0.02	0.989	0.24±0.02
50 V	0.34±0.03	0.990	0.37±0.04	0.987	0.37±0.04	0.989	0.36±0.03
80 V	0.55±0.05	0.991	0.55±0.06	0.987	0.55±0.06	0.989	0.551±0.004
100 V	0.69±0.07	0.990	0.67±0.08	0.987	0.67±0.07	0.990	0.68±0.02
130 V	0.86±0.09	0.989	0.84±0.10	0.986	0.84±0.08	0.991	0.85±0.03
150 V	0.98±0.10	0.989	0.95±0.11	0.986	0.94±0.09	0.991	0.96±0.04

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Response of LDRs

VT43N2	(1)		(2)		(3)		Mean
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30 V	0.36±0.03	0.994	0.32±0.03	0.992	0.34±0.03	0.993	0.34±0.04
50 V	0.50±0.04	0.993	0.47±0.04	0.991	0.47±0.04	0.991	0.48±0.03
80 V	0.68±0.07	0.989	0.63±0.07	0.988	0.62±0.06	0.990	0.65±0.06
100 V	0.81±0.08	0.989	0.74±0.09	0.986	0.74±0.08	0.988	0.76±0.07
130 V	0.97±0.11	0.986	0.89±0.11	0.985	0.92±0.10	0.988	0.92±0.08
150 V	1.08±0.12	0.987	0.99±0.13	0.984	1.04±0.11	0.987	1.04±0.09

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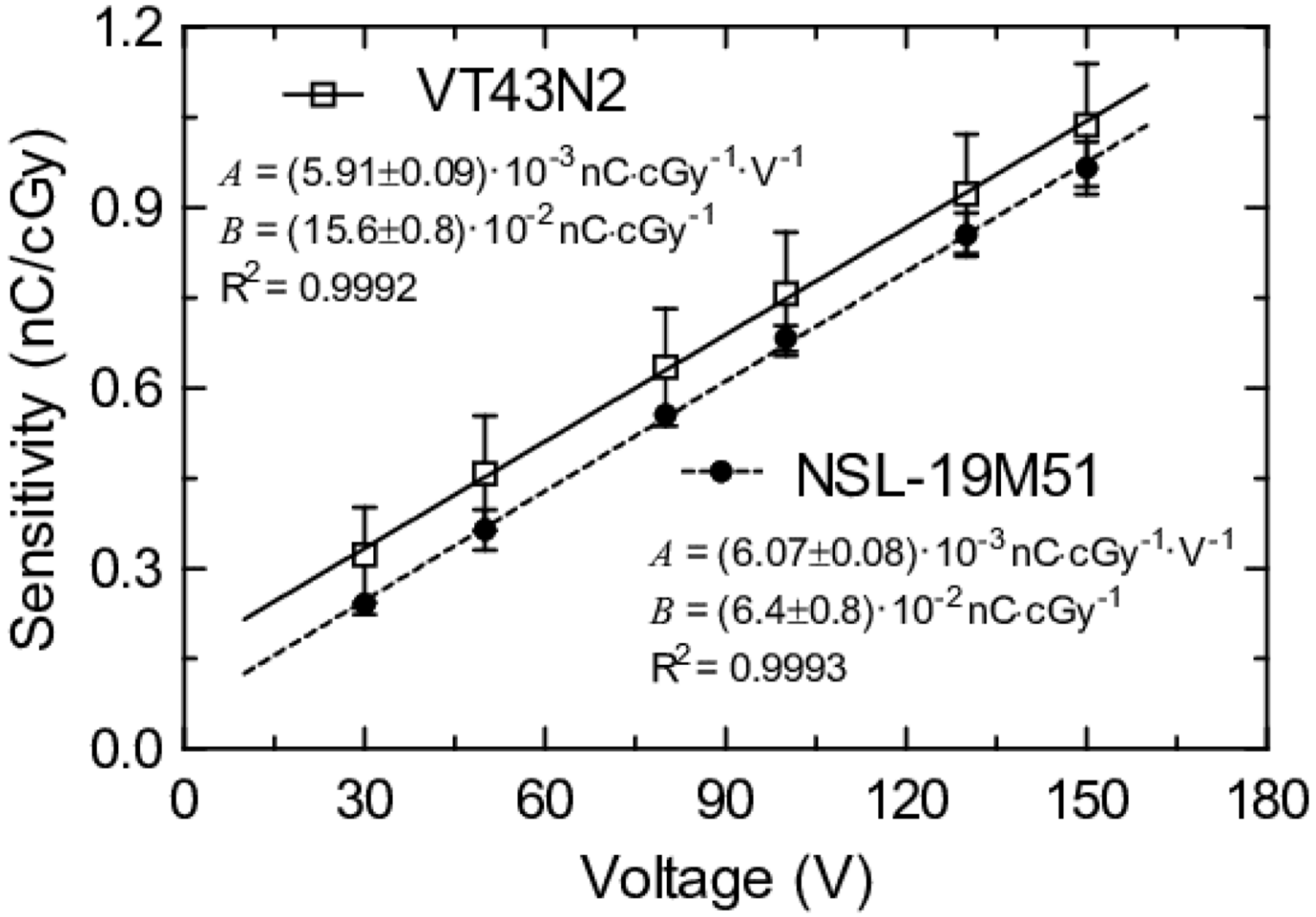

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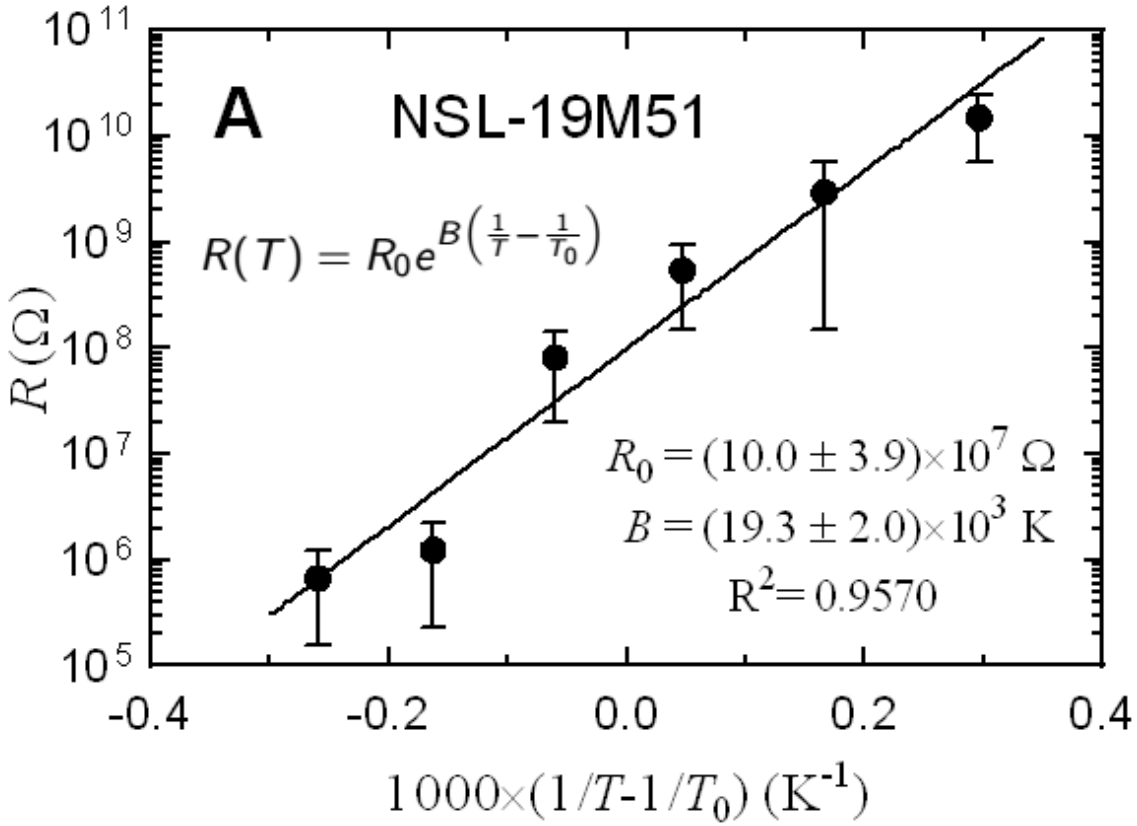

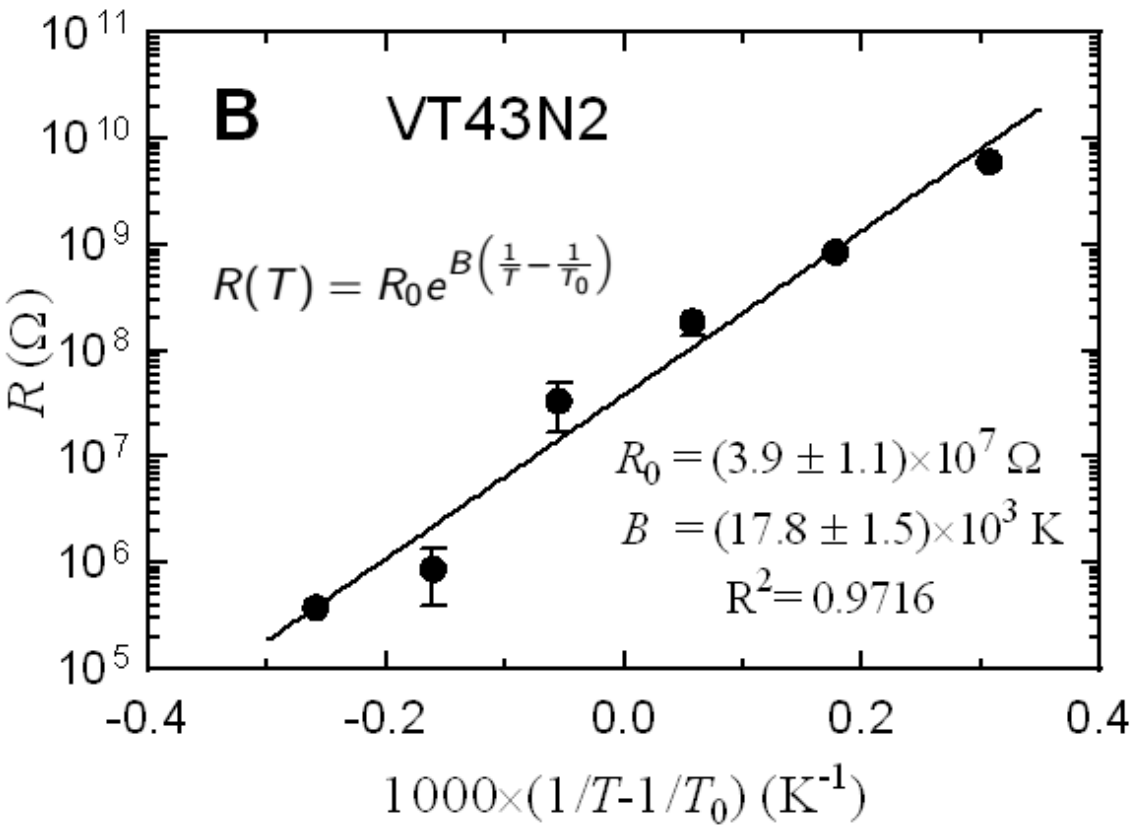

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- Sensitivity of VT43N2: (0.34±0.04) — (1.04±0.09) nC/cGy (30 — 150 V).
- Sensitivity of ionization chamber PTW 30010: 0.2 nC/cGy at 400 V.

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THANK YOU FOR YOUR ATTENTION- QUESTIONS?