

Heat you can measure: Verification and standards for clinical hyperthermia

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Hyperthermia therapy (39–44°C for ~60 min) has repeatedly demonstrated clinically meaningful radiosensitization, yet it remains a niche adjunct in routine oncology. This plenary will argue that a key limiter is not biology or clinical intent, but metrology: hyperthermia still lacks the radiation-therapy equivalent of a standardized prescription, verification, and reporting framework. Without that, outcomes remain challenging to compare, reproduce, and optimize across centers. This framing aligns with CIRMS's mission to identify radiation measurement needs and accelerate practical standards that make results reproducible across devices, sites, and experimental/clinical studies.

This presentation will review the practical dosimetry chain for radiofrequency hyperthermia (electric field → specific absorption rate, SAR → temperature → thermal dose) and how the field is moving toward more verifiable, patient-specific delivery. Invasive temperature probes will be discussed as the current clinical gold standard and a reliable foundation for safety monitoring and control, while also highlighting their intrinsic limitation: sparse sampling of heterogeneous temperature distributions. The talk will then focus on the main pathway to richer dosimetry: noninvasive 3D thermometry. MR thermometry will be presented as the most mature approach, with growing deployment in new clinical centers. Ultrasound thermometry will also be described as an emerging option that could improve access and workflow while reducing cost. Finally, 3D patient-specific treatment planning will be positioned as the most immediately actionable lever to improve consistency and documentation of delivered heating, especially when combined with in-treatment measurements to manage uncertainty from tissue properties, positioning, and thermoregulation.

This talk will propose a CIRMS-relevant roadmap to close the dosimetry gap and enable scaling of hyperthermia: (1) consensus minimum reporting for thermal delivery (time–temperature distribution metrics, (2) traceable calibration and measurement uncertainty analysis for probes and imaging thermometry, (3) standardized phantom-based quality assurance to quantify steering/focusing and validate SAR/temperature models, (4) inter-center intercomparisons and acceptance criteria for device performance, and (5) integration of thermal mapping with adaptive control, analogous to RT treatment planning and IGRT.

This roadmap will be presented as a practical path to reproducible evidence, clearer dose–response, safer escalation, and broader clinical adoption of a powerful radiation adjuvant—targeted, measurable heat.