



PHYSICS

The MARKerless lung target Tracking CHallenge (MATCH)

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What was your motivation for initiating this study?

Markerless lung target tracking (MLTT) provides real-time respiratory motion management for lung stereotactic ablative body radiotherapy (SABR) without the need for surgically implanted markers. Several specialised treatment systems that utilise X-ray-based MLTT have been introduced to our clinics, and the first MLTT-guided patient treatment on a standard linear accelerator was reported in 2021. As illustrated in Figure 1, we anticipate that MLTT is at the tipping point to evolve from a state-of-the-art approach to a widely accessible implementation, bringing MLTT one step closer to becoming standard-of-care in the future. To accelerate this transition, the purpose of the markerless lung target tracking challenge (MATCH) was to benchmark the lung target tracking accuracy of existing and future MLTT approaches.

Journey of Markerless Lung Target Tracking

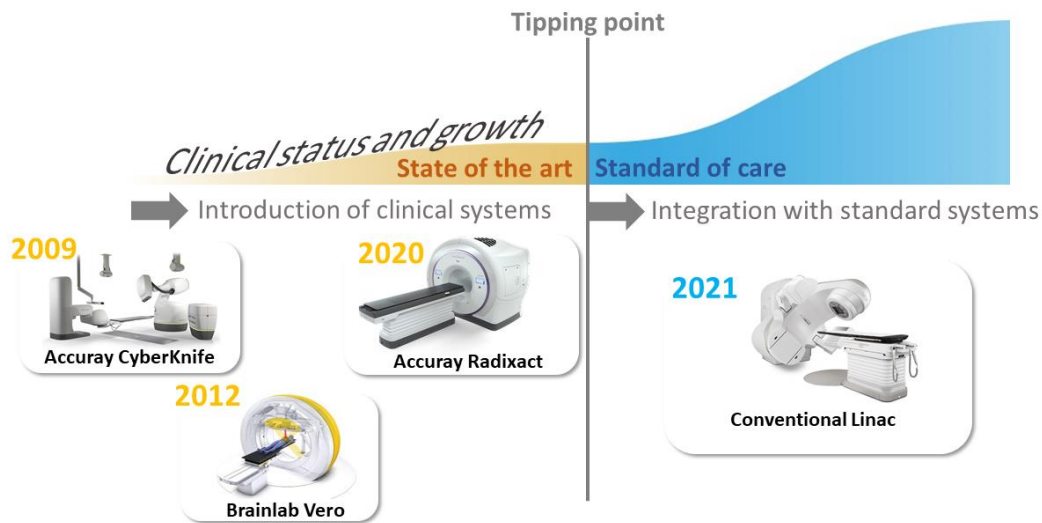


Figure 1: Clinical status and development of X-ray-based markerless lung target tracking with approximate first clinical dates based on publication dates

What is the most important finding of your study?

MATCH successfully benchmarked the geometric tracking accuracy of six preclinical and five clinically available commercial MLTT approaches in one in-silico and one experimental study. Several MLTT approaches were used to track the moving lung target inside an anthropomorphic 3D-printed thorax phantom with sub-millimetre accuracy and precision.

What are the implications of this research?

The MATCH outcome paves the way for a broader clinical implementation of MLTT. The developed benchmarking framework will support the development of clinical implementation guidelines for MLTT hardware and software, commissioning and quality assurance recommendations, and future research objectives. MATCH is live to support future research, with datasets and analysis software publicly available online at <https://www.aapm.org/GrandChallenge/MATCH/>.



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