

An accuracy assessment of motion tracking systems in radiotherapy suite

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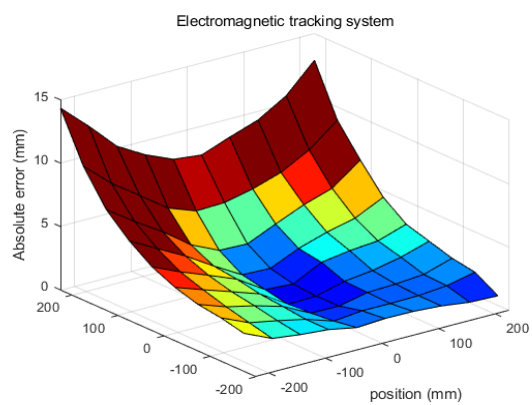
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Purpose: This study aimed to evaluate performances of optical- and electromagnetic (EM)-based tracking systems in radiotherapy suite using a precise positioning phantom.

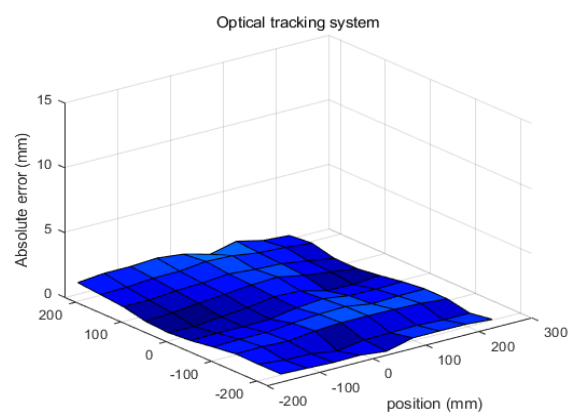
Methods: We assess the performances of the optical tracking system (Polaris Spectra, Northern Digital Inc., Waterloo, On, Canada) and the EM tracking system (Aurora, Northern Digital Inc., Waterloo, On, Canada) in the radiation treatment room. The EM-based systems consist of three basic components, the field generator, a system control unit, and tracked sensor coils. The optical tracking system contains CCD cameras with infrared LEDs and reflective markers with known geometry. The phantom for assessment of the performance of motion tracking systems was designed to mount both EM sensors and reflective markers. We measured relative position errors which are determined by comparing Euclidean distance between the measurements with the known physical distance of the phantom.

Results: The tracking performance varied significantly depending on the type of systems. For the EM-based system, the error tends to increase as the sensors were positioned outside of the electromagnetic field generator. The absolute error was increased up to 14.3 mm. For the optical tracking system, the measurement error varied from 0.06 to 1.18 mm depending on the marker positions.

Conclusion: This study was conducted to assess the accuracy of the two types of tracking systems in radiation therapy suite. The performances of the tracking systems should be determined using the precise positioning phantom in the clinical environment disturbing to the measurements. The choice among the systems may vary depending on the clinical application within the acceptable margin of position errors.



(a)



(b)

Figure 1. Relative position error vs grid position of electromagnetic (a) and optical (b) tracking systems on the measurement phantom.