

# Comparing Accuracies of a RFID-based and an Optical Tracking System for Medical Navigation Purposes

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## Introduction

The essential part of a medical navigation system is the tracking device, which can be characterized by its accuracy, precision, spatial resolution, update rate and its measurement volume. Most medical navigation systems use optical tracking devices, which require a free line of sight. A newly developed RFID-based tracking device could overcome this drawback. We performed an experimental study to compare the accuracies of both systems.

## Methods

To compare the accuracy and precision of the optical tracking device Polaris (NDI) and the prototype of the RFID-based tracking device PRPS (amedo), we developed a system, which synchronously records positions and aligns the different coordinate systems. Several series of measurements (in total 2500 positions for accuracy and 3600 positions for precision evaluation) were recorded and the resulting position sets were aligned by an optimized transformation. A CNC device was used as reference system.

## Results

We were able to record and visualize positions from all three devices synchronously, to align the datasets and to perform a statistical evaluation afterwards. A first test resulted in a mean localization error of 0.39 ( $\pm 0.19$ ) mm for the Polaris and 3.81 ( $\pm 1.48$ ) mm for the PRPS-prototype. Regarding the precision, the Polaris showed a mean error of 0.35 ( $\pm 0.19$ ) mm, while the PRPS-prototype achieved one of 0.73 ( $\pm 0.48$ ) mm.

## Conclusion

We developed a system that allows for a direct comparison of two tracking devices of different types. The obtained values of accuracy and precision of the Polaris concurred with the manufacturer information. RFID originates from logistics, usually demanding accuracies on meter scale, and the PRPS-prototype was still under development. Therefore, the accuracy at the time of these measurements was not sufficient for intraoperative use in critical applications (like brain surgery). However, since optimization of the prototype focuses strongly on accuracy, continuous evaluation is needed, which is offered by our system, now.