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# Reconstructing JET using LiDAR-vision fusion

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The containment vessel of the Joint European Torus is a huge, complicated assembly with a myriad of components, all of which are important for plasma operation. As a research device, JET has been operated over many years and has been extensively rebuilt. During each maintenance shutdown, inspections and measurements of the Vacuum Vessel are carried out by means of dual-camera Stereo surveys, High-Resolution single camera surveys and precise Gap Gun measurements. This is a precise but labour-intensive process, taking tens of hours to complete a full survey.

Due to rapid advancements in the field, combined visual-LIDAR techniques have evolved to the point where it is possible to carry out on-line, high-resolution measurements of the interior of buildings and scientific installations. Since the radioactivity inside the JET vessel is still low enough to allow consumer-grade electronics to survive unprotected, these advancements can be leveraged.

We present work including the 3D mapping of the inside of the JET Torus using a combined LIDAR-Vision measurement and navigation system. Using one of the remote handling booms, we carry out a scan of the JET vessel. We compare the point cloud model with the CAD models of the JET installation using numerical methods, demonstrating mm and sub-mm accuracy with a dramatically lower survey duration compared to existing techniques. We also compare the estimated path of the scanner through the vessel with the recorded boom joint position data. Conclusions are drawn about the applicability of LIDAR systems to mapping and localisation problems within a Fusion environment as well as assessing the resulting accuracy of the scan.

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