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#6-283 A computer-vision aided Compton-imaging system for radioactive waste characterization and decommissioning of nuclear power plants

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Electricity production primarily based on uranium fission is considered a viable alternative to reduce greenhouse gas emissions. However, the generation and subsequent storage of radioactive waste remain significant challenges associated with this technology. Given the cost, duration and limited space for radioactive waste storage, effective management is essential to minimize the amount of material classified, which necessitates dedicated storage centers. In this work, we address this challenge by evaluating the applicability and performance of a high-efficiency, cost-effective and portable Compton camera for detecting and visualizing low- and medium-level radioactive waste generated during both the decommissioning and regular operation of nuclear power plants. Results will be presented to demonstrate the good performance of Compton imaging for this type of application, both in terms of efficiency or measuring time and image resolution. A technical readiness level of TRL7 has been thus achieved with this system prototype, as demonstrated with dedicated field measurements carried out at the radioactive-waste storage plant of El Cabril (Spain) utilizing drums with residues from decommissioned power plants and different amounts of radioactivity contents. The system's performance has been enhanced by means of computer-vision techniques in combination with advanced Compton-image reconstruction algorithms based on Maximum-Likelihood Expectation Maximization. The feasibility of 3D tomographic reconstruction from a series of relatively short measurements around the objects of interest will be also shown. Finally, next steps and upgrades of this system will be summarized.

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