Combined lidar Compton camera system for visualization and localization of hotspots

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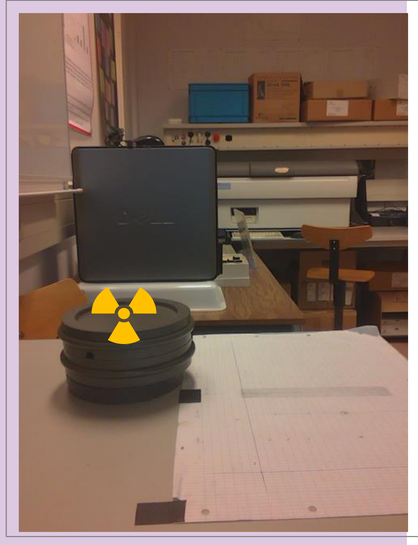
Introduction

To reduce the dose uptake of workers in a nuclear environment, robots or gamma cameras are often used to **localise hotspots and sources**. A semi-autonomous robotic platform was developed during a previous research project called ARCHER. This robot limits the need for human intervention. But still uses the time-consuming way of measuring point by point.

Gamma cameras can measure from relatively **far away** and therefore **reduce the chance of contamination.** This study **combined** a **single layer Compton Camera** with a **3D camera** to better **visualise** the source and estimate the **source-to-detector distance**. Preliminary tests were performed with a ^{137}Cs source.



Experimental setup

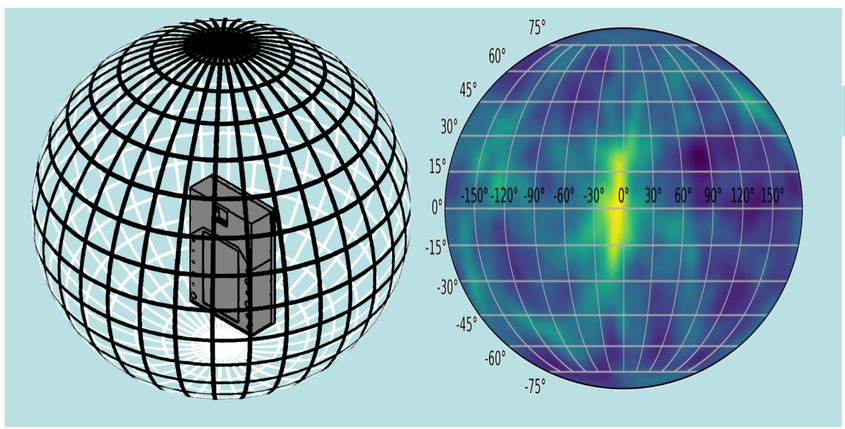
- Advapix TPX3 1mm CdTe
- Intel Realsense L515
- ^{137}Cs source (±230 kBq)
- Source placed at 50 cm

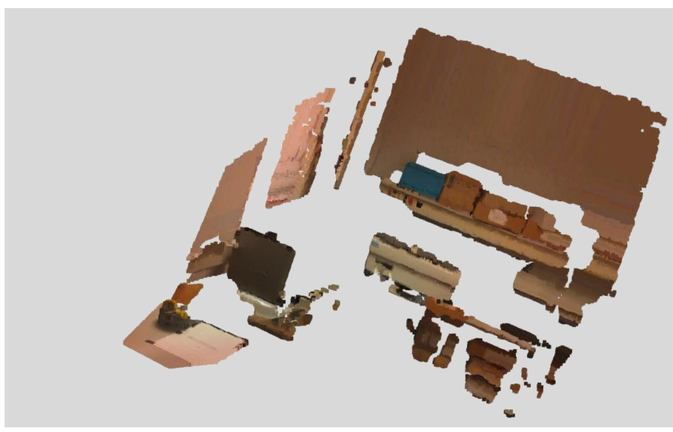
Methods

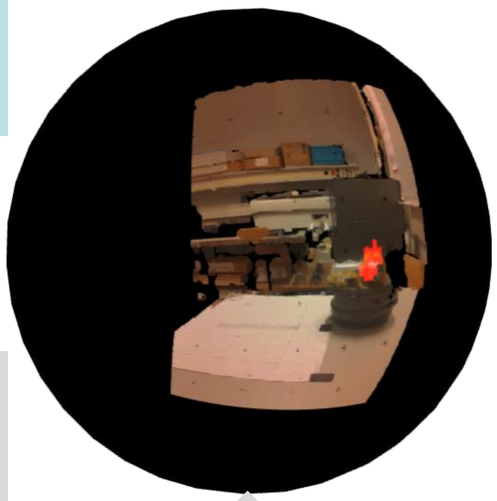
- **Measurement Compton camera:** 3D reconstruction applied on the advapix detector => a single layer Compton camera.
- **Back-projection:** Direct back-projection algorithm in spherical coordinates. Values lower than 99% of the maximum are hidden.
- **Transformation of point cloud:** A point cloud from the 3D camera was corrected for the offset between the two sensors.
- **Superimposition of hotspot with point cloud:** The angular information (coming from the Compton camera) was superimposed with the corrected point cloud

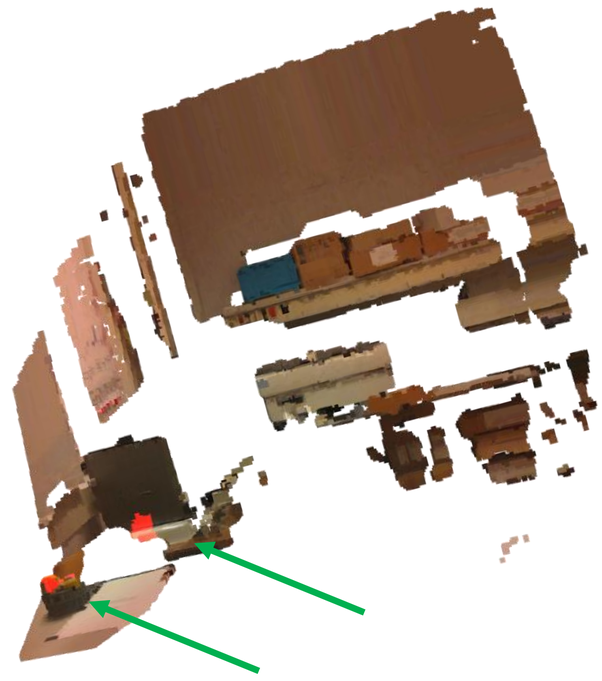
Advapix
Compton camera

Realsense L515
3D camera









Conclusions

- ^{137}Cs source found near 0 degrees elevation and 5 degrees azimuthal angle.
- Combined with 3D camera data => accurate depth and location estimation
- False hotspot found behind real source => eliminate with second measurement from side

Future works will focus on eliminating the false-positive estimation of a source and increasing the field of view by rotating the setup and optimising the efficiency of the Compton camera.

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Radiological mapping and localisation via lightweight Compton imaging system supported by thin shielding and collimation Materials

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Acknowledgements

This work was supported by the Fund for Scientific Research Flanders (FWO) scholarship nr 1SA2621N hosted by the University of Hasselt.

The ARCHER project is carried out by UHasselt and KU Leuven in collaboration with Equans (Engie) and Magics instruments. This project is funded by the energy transition fund of the FOD economy (federal government of Belgium).