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Unmanned Radiation Measurements

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Introduction

Due to criminal or other activities, radioactive materials may be out of regulatory control. Radioactivity can be used maliciously against the society or individuals. A release of radioactive materials can cause large economical and political consequences even in cases where the impact on public health is small. The importance of radiation detection is emphasized at the EU level (CBRN Action Plan 2009) and at the national level (Yhteiskunnan turvallisuus-strategia 2010). Localizing the source is, however, an extremely difficult task requiring spectrometric data and advanced data analysis. For the authorities it is of utmost importance to detect, identify and localize these materials.

FDRA Airborne Radiation Measurements

FDRA have used for manned aerial radiation measurements twenty six years UniSampo measurements program with online extension to control measurements, combine GPS coordinates with radiation data to produce radiation map layer to be presented on geographical map.

Measurement features

- UniSampo program can control several different type gamma spectrometry analyzer (Ortec, Canberra, Kromek etc…)
- Make energy, shape, *efficiency calibrations* and corrections
- Make analysis based on special library
- send peak table to expert system for more accurate analysis

Measurement features (cont.)

- For aerial measurements UniSampo offer online window for immediate detection and determination of radioactive substances
- Position from GPS receiver
- Ground level modelling (GMLINT) is used to present each detected nuclides on geographical map

Platforms

Manned platforms

- LJ jet plane
- NH90 helicopter
- Pilatus coming

Unmanned platforms

- Orbiter
- Mini helicopter KX-4 LE
- XUAV (2025)

Detectors

Manned platforms

- HPGe 70 – 100 %
- NaI 2 – 4 litres
- LaBr3 1.5 x 1.5 inch (43 cm^3)

Unmanned platforms

- CZT 1 cm^3
- LaBr3 1.5 x 1.5 inch (43 cm^3)

Detector and Computer

- The system is based on Kromek GR1 gamma-ray spectrometer, Intel 32/64 architecture computer and small unmanned helicopter
- The measurement and analysis programs run on the same Linux platform what we do use in manned radiation measurement (Ubuntu 14.04 LTS)
- Kromek spectrometer and computer weight approximately 700 grams
- With LaBr3 detector the weight is 2000 grams

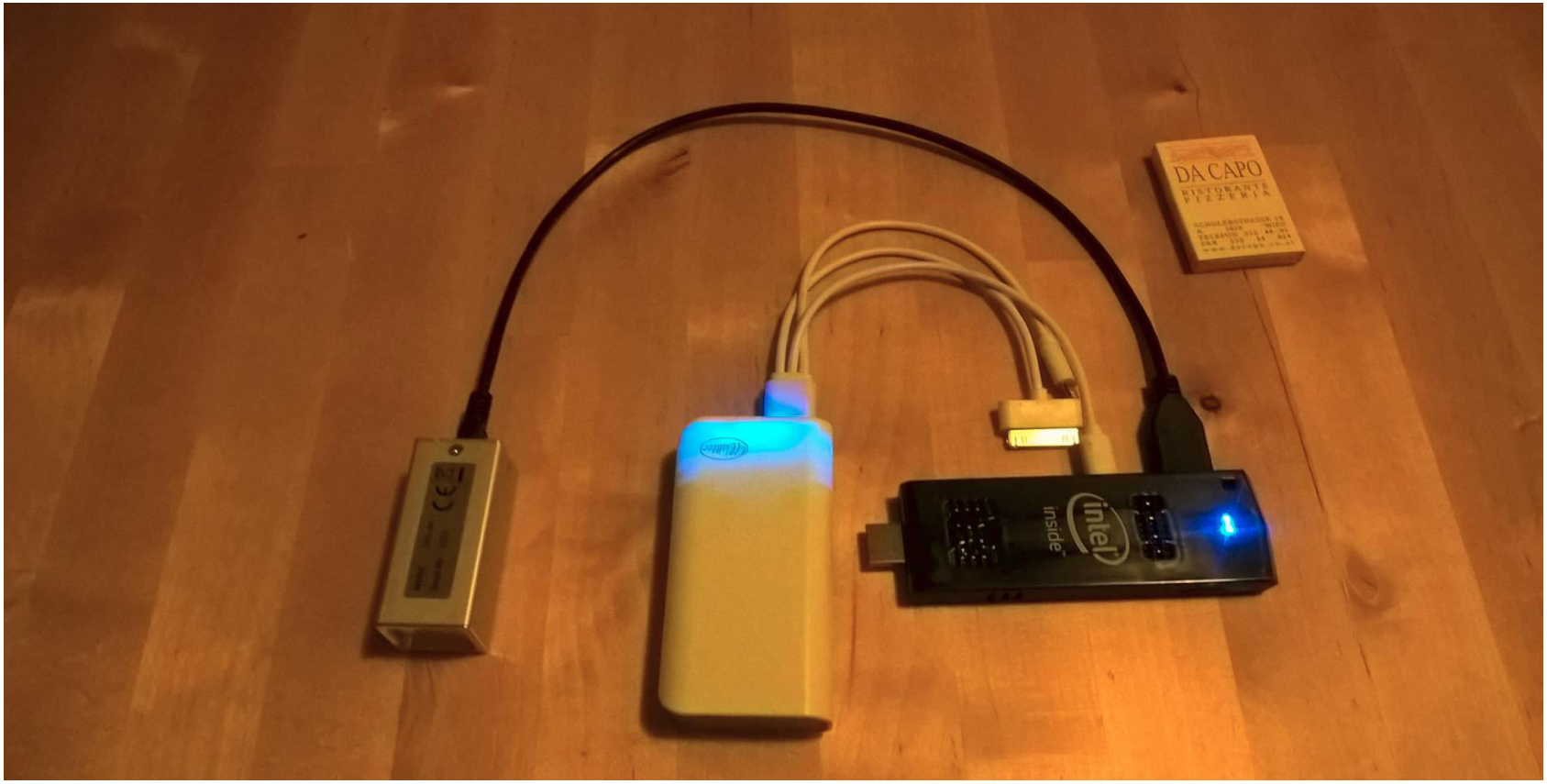
Hardware 1: Spectrometer

1 cm^3 CZT detector and analyzer
CZT = Cadmium Zink Tellurium

- FWHM 2% @662 keV
- Power consumption 250 mW
- Weight 60 g
- Tough structure

Hardware 2: Computer

Unisampo – Shaman - Linssi on Intel 64/32 Architecture Computer



On left spectrometer, middle battery pack and right computer. Matchbox as scaler

KX-4 LE mini Helicopter

- Payload up to 6 kg
- Endurance 40 – 60 minutes
- Good camera installation
- modularity

Unmanned Platforms

The UAS radiation measurement platform is used to:

- **Measure heavily contaminated areas**
- **Find lost radiation sources**
- **Identify nuclear power plant release**
- **Mapping of radioactive cloud (dimension, nuclides)**
- **Estimate concentration of radioactive substances in air**
- **Dose rate measurements**

The system can be implemented meteorological sounding balloon or jet motor powered UAV (XUAV) to get information from radiation levels of upper air where military and commercial aero planes fly

NKS NORDUM Exercise 2016 Oslo Norway

AREA S1 Am-241

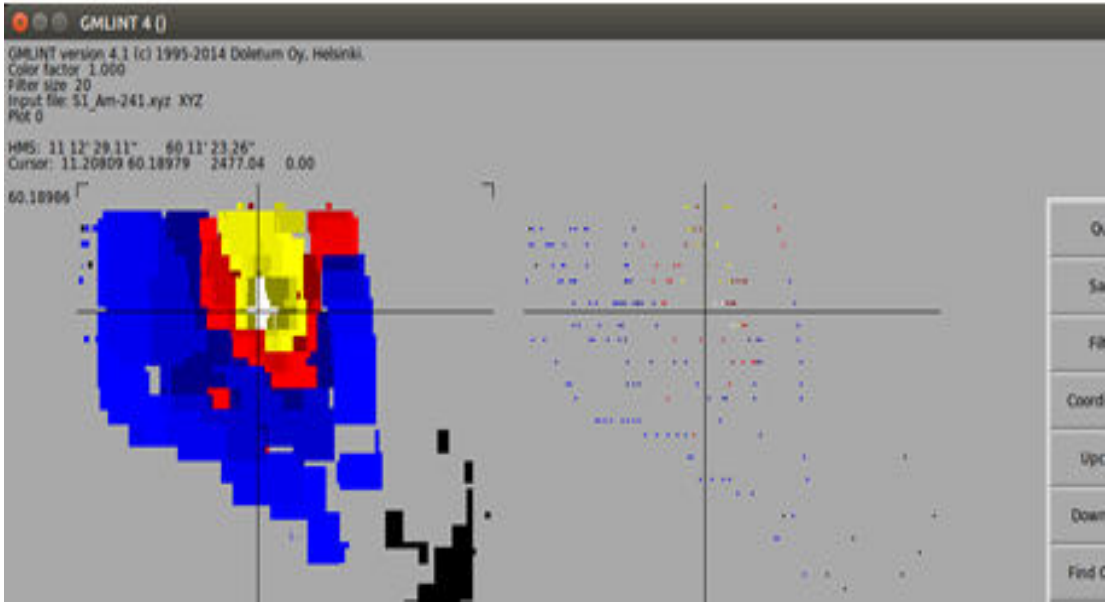


Figure A : Area S1. Modeled radiation surface (Am-241) produced by GMLINT program. Measurement points are presented on right side. Cursor shows most active point and related co-ordinates and activity value is also shown (2477).

NKS NORDUM (cont.)

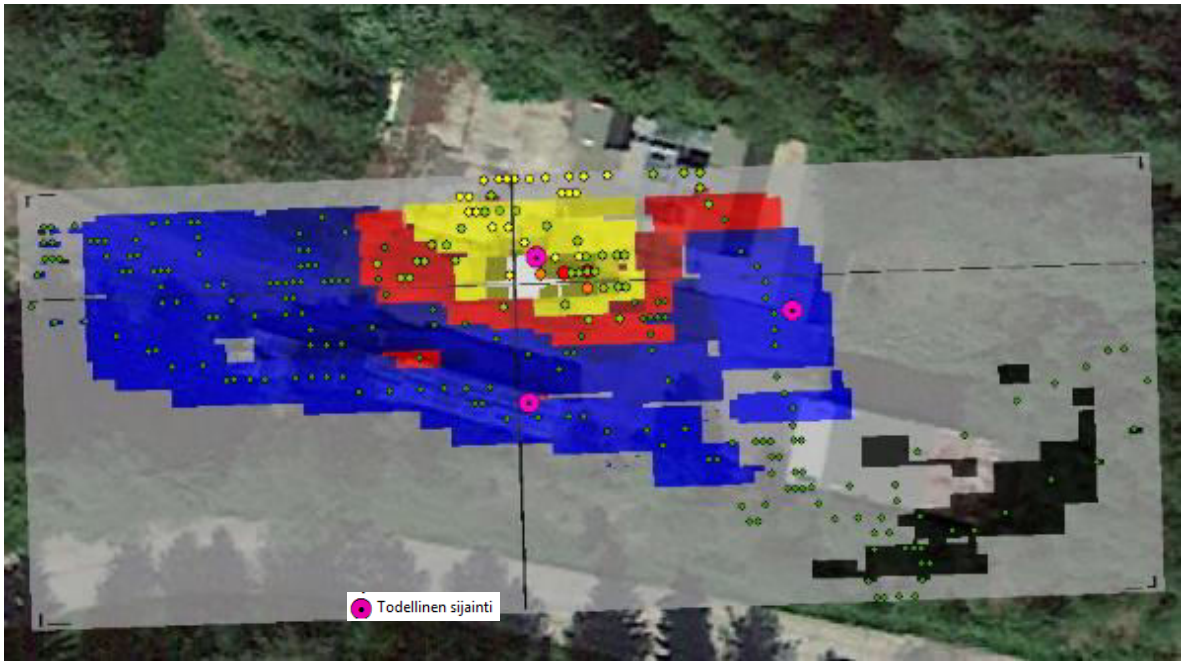


Figure 5-19: Area S1. In this figure is presented measurement points, modeled radiation surface (Am-241) and Google Maps map. The reported location of radiation source is shown by cursor.
Real source is presented by purple circle. Distance difference from modeled source to actual source is 3 meters.

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