## > Background & introduction

Magnetic sensors offer potential for contactless detection techniques. These magnetic sensing technologies are recurrently exploited by CEDRAT TECHNOLOGIES (CTEC) to provide innovative solutions, either as components or as complete systems:

- Its Eddy Current Sensors products are used for high precision motion control on distance up to 3mm. They are used in its actuators or for making customised force & torque sensors.
- Its Inductive Sensors are used for distance measurements up to 100mm, and find applications for example as tyre wear sensors.
- Longer range electromagnetic detection systems, from 0.1m to 0.5m, have been shown feasible for localisation and for identification of objects via SURGIMAG and MUSIC projects.

Using this background, and in the frame of ROXTAR project, CTEC has developed an accurate Magnetic 6 DoF Alignment Localisation & Tracking (MALT) device with a detection range larger than 1meter.

MAGNETIC FIELD EMITTER

PC WITH GUI

PLATE INCLUDING SENSORS
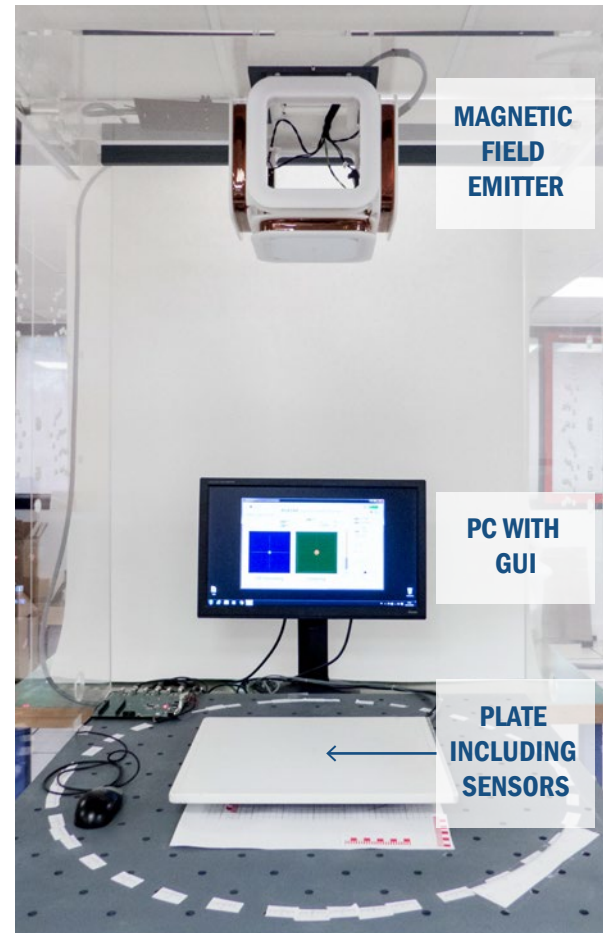
1meter range MALT for ROXTAR

> ROXTAR objectives

ROXTAR is a MINALOGIC R&D collaborative project dedicated to the next generation of XRay sensors for medical application. The project leader is TRIXELL, and partners are CTEC, CEA Grenoble, Isorg and the Hubert Curien Laboratory (Saint Etienne University).

In this context, TRIXELL partner has spotted the interest for a contactless alignment between the XRay imager and XRay emitter.

The alignment function should allow for a better positioning of the imager relatively to emitter in order to:

- Improve the quality of pictures
- Reduce the XRay dose exposure for any patient by avoiding multi shots to obtain one picture

In this application, an optical alignment is not feasible because the human body is placed between the XRay imager and XRay emitter. Therefore a magnetic detection solution was deemed the only approach.

To meet this need, CTEC has designed and developed the MALT system.
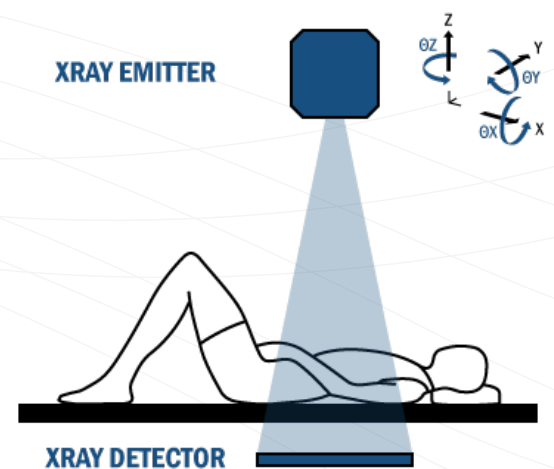
ROXTAR alignment application

> MALT system application for ROXTAR

The MALT system is based on 3 sub-systems, which can be used for ROXTAR as well as other applications in the same way.

- a **magnetic fields emitter** and placed on the X Ray emitter
- a **sensor systems** placed in the X Ray detector plate
- a **PC** with **electronics** and a Graphical User Interface (**GUI**)

The MALT system offers:

- **Alignment** assistance to the operator, to guide him for putting the detector to the right position, via a Graphical User Interface (GUI),
- **Localisation** information in form of dx, dy, dz distances of XRay detector to the centered position, as well as the angles θ of the XRay detector with the vertical and horizontal axis.
- **Tracking** feature in the sense the motion can be observed in real time via the GUI (**watch our video on YouTube**: https://youtu.be/z1c6Ply-k1Y).

MALT GUI for ROXTAR
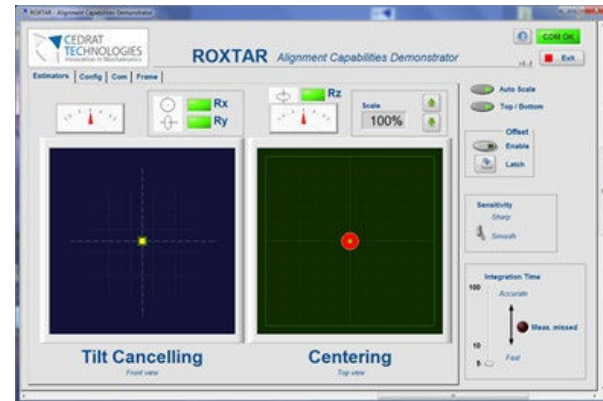
> MALT system performance

Performances of the MALT Systêm have been established in terms of 6 DoF position resolution in various conditions. Typical cases are given in the next table.

Other performances are feasible playing with the field intensity, the latency, etc. For example, if a detection with a twice lower resolution is enough, a faster detection with a twice lower latency can be realised.
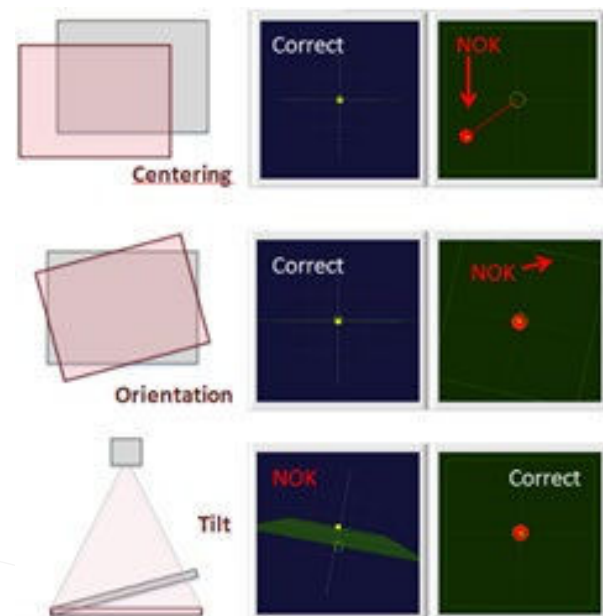

MALT GUI showing misalignment

CASE	CASE 1	CASE 2	UNIT
Distance dz emitter to sensors	1.1	1.5	m
Emission			
Magnetic fields @ 0.7m	3	3	µT
Detection speed			
Latency	300	300	ms
Detection resolution			
Distance dx, dy	0.2	0.5	mm
Distance dz	2	5	mm
Angle θx, θy	0.05	0.1	°
Angle θz	0.05	0.1	°

> Keywords

Contactless, magnetic, sensor, detection, position, alignment, localisation, tracking
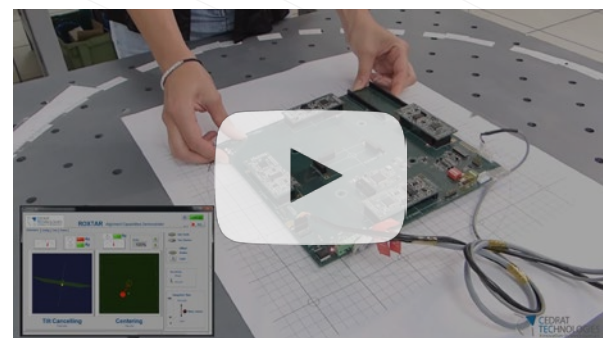
Extract of the video showing tracking feature

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