

## Motivation

For the automatic surveillance and inspection of high-risk emergency scenarios using security robots there is a need of:

- accurate ranging
- good estimation of temperature and detection of hot spots
- localisation of possible hazardous materials

## UWB Radar

Ultrawideband Microwave Radar shows advantages for the challenge:

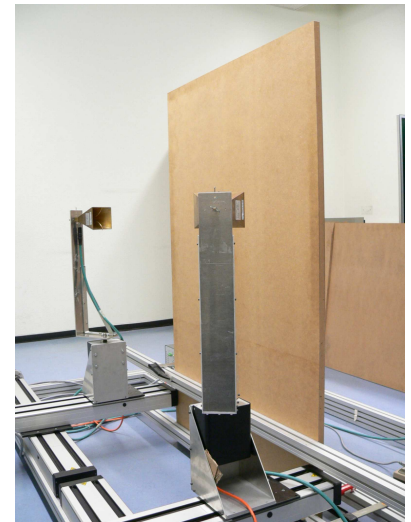
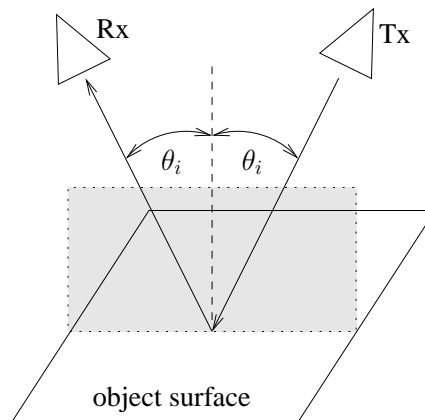
- wide frequency range for high spatial resolution
- negligible influence due to smoke/dust
- "view through thin walls"
- detection of hidden hot spots

## Microwave Ellipsometry

The information needed for temperature estimation and material characterisation (e.g. permittivity and emissivity) can be estimated by the ellipsometry, which is based on the Fresnel-formulas.

$$\epsilon_r = \left( \frac{\sin^2 \theta_i \left( \frac{E_{\perp}}{E_{\parallel}} - 1 \right)}{\cos \theta_i \left( \frac{E_{\perp}}{E_{\parallel}} + 1 \right)} \right)^2 + \sin^2 \theta_i$$

$$e = 1 - \left| \frac{1 - \sqrt{\epsilon_r}}{1 + \sqrt{\epsilon_r}} \right|^2$$



## Measurements

(1 m<sup>2</sup> MDF-Board,  $\epsilon_r \approx 2.65$ )

