

Fractional self-calibration of silicon photodiodes

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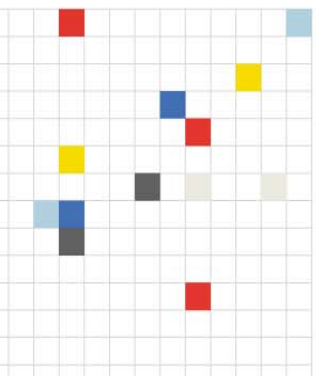
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Outline

- Background and Principle
- Detector characterisation
 - Responsivity change with bias
 - Reflectance measurements
 - Uniformity
 - Doping profile and level
 - Stability
 - Calibration and comparison
- Improved design of the detectors
- Conclusions and future work

Background and principle



Responsivity:
$$R(\lambda) = \frac{e\lambda}{hc} \cdot (1 - \rho(\lambda)) \cdot (1 - \delta(\lambda))$$

- Responsivity and mechanical
- The two **deficiencies**
- Only re
- The ori

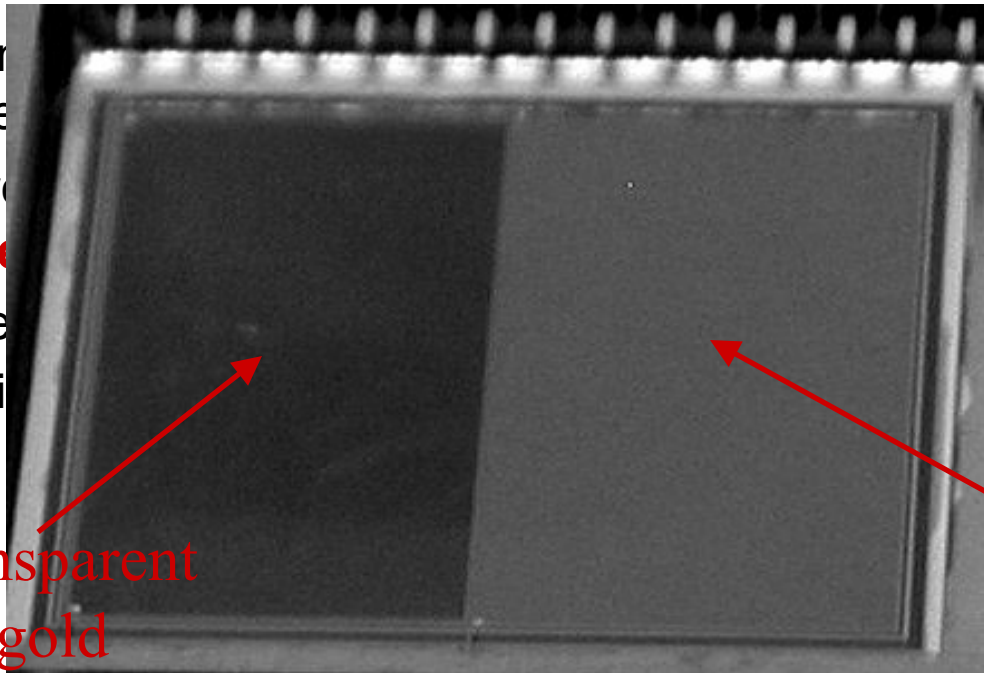
fundamental constants

photon quantum

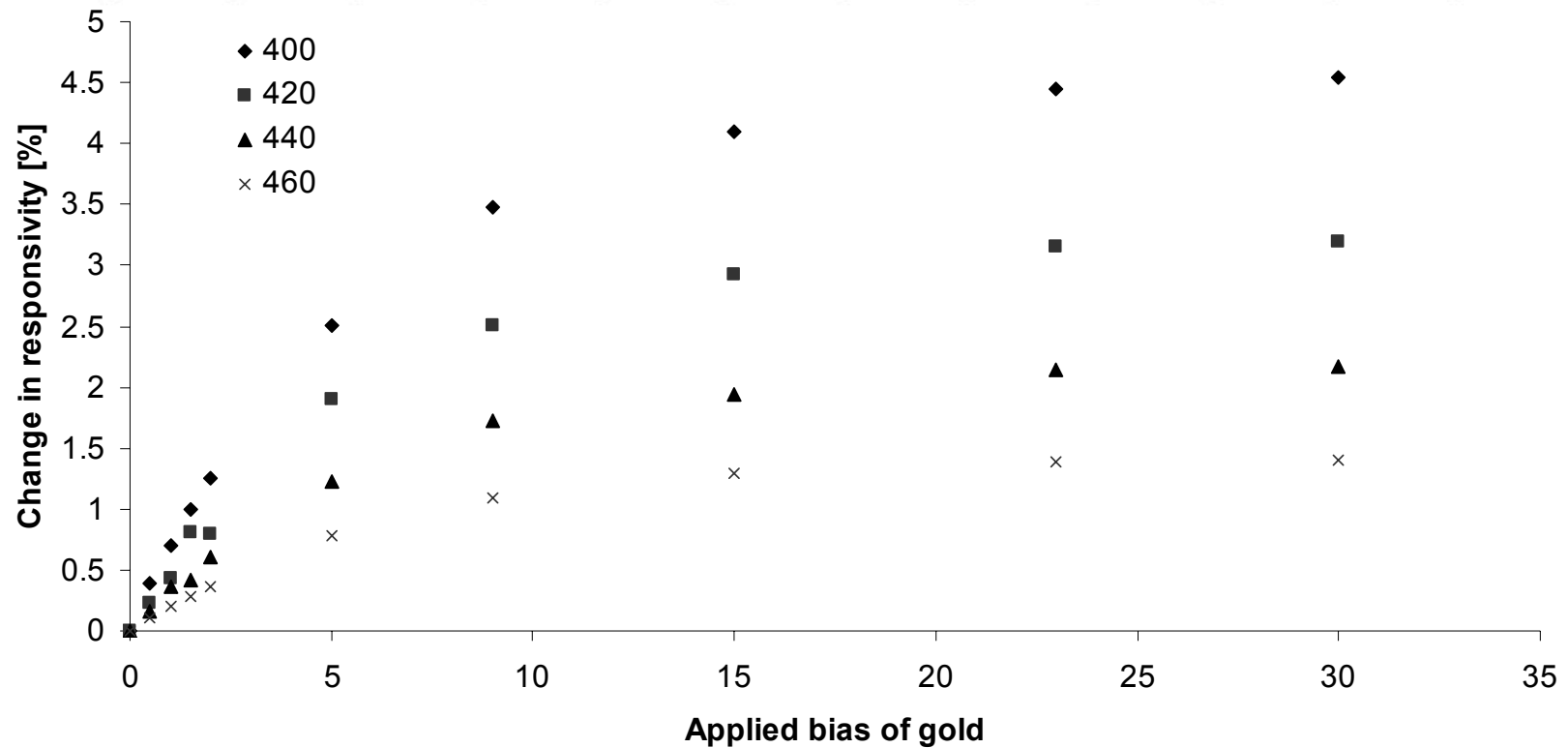
to be eliminated

Semitransparent layer of gold

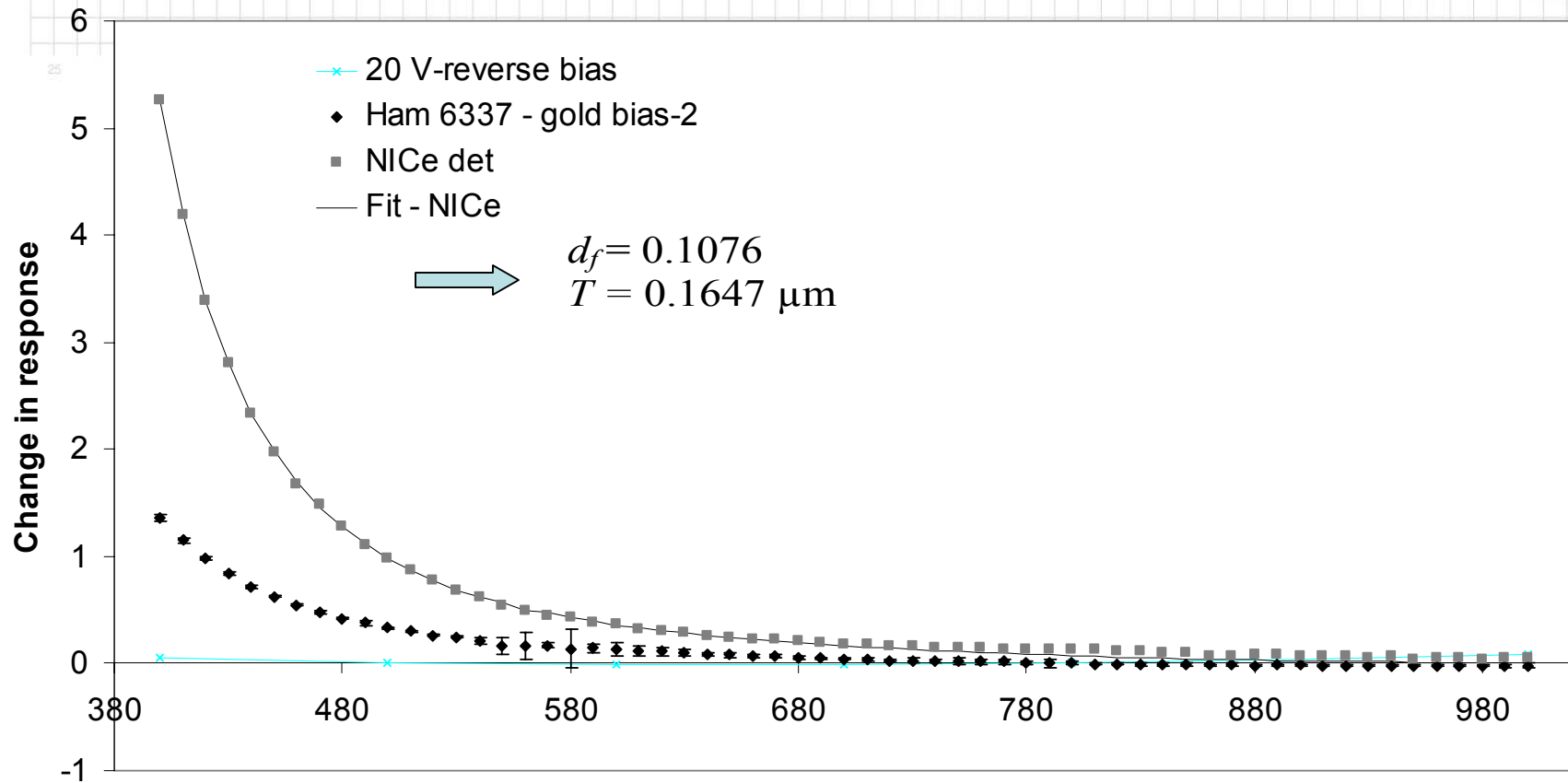
Uncoated area



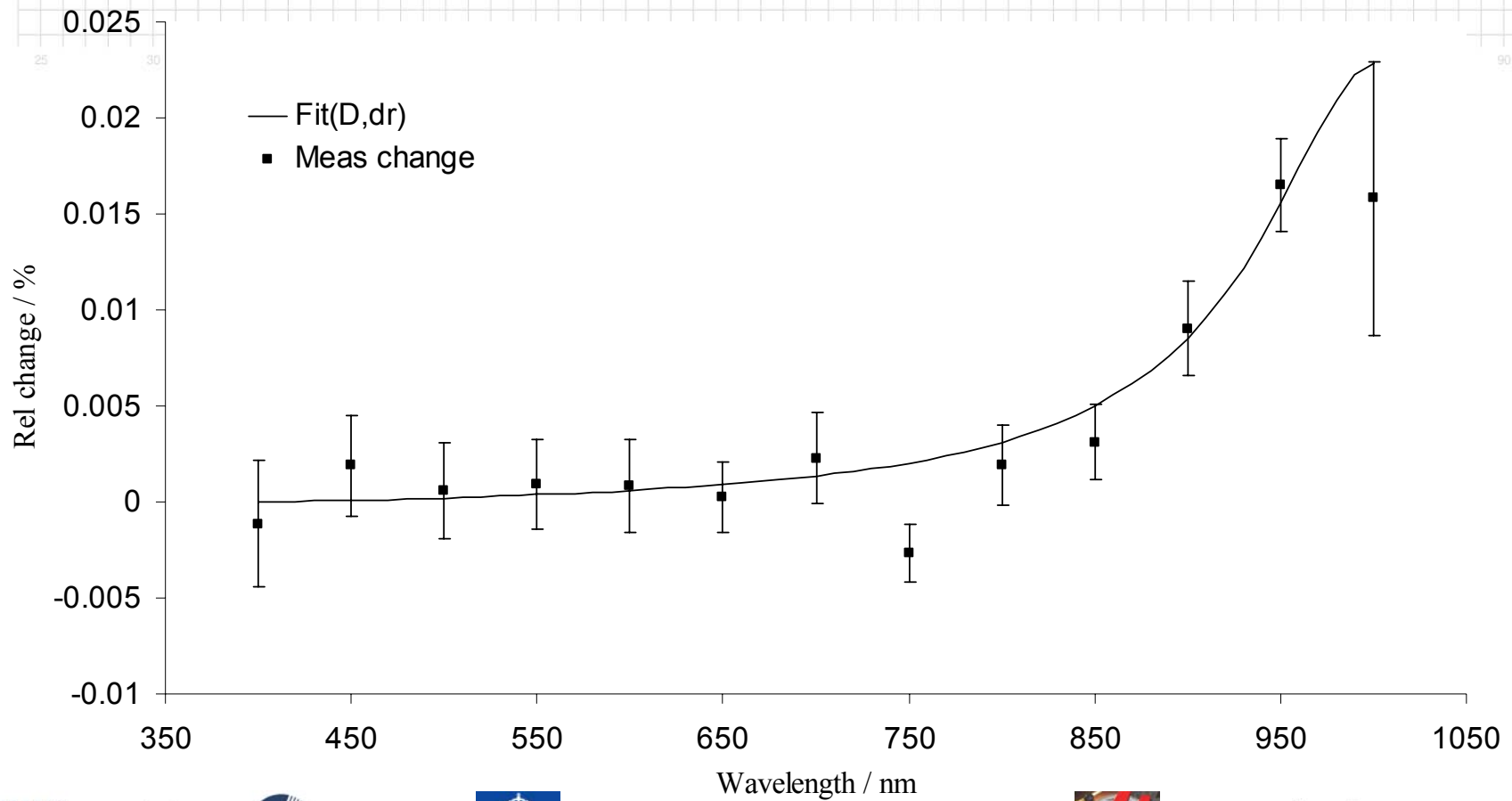
Responsivity change with bias



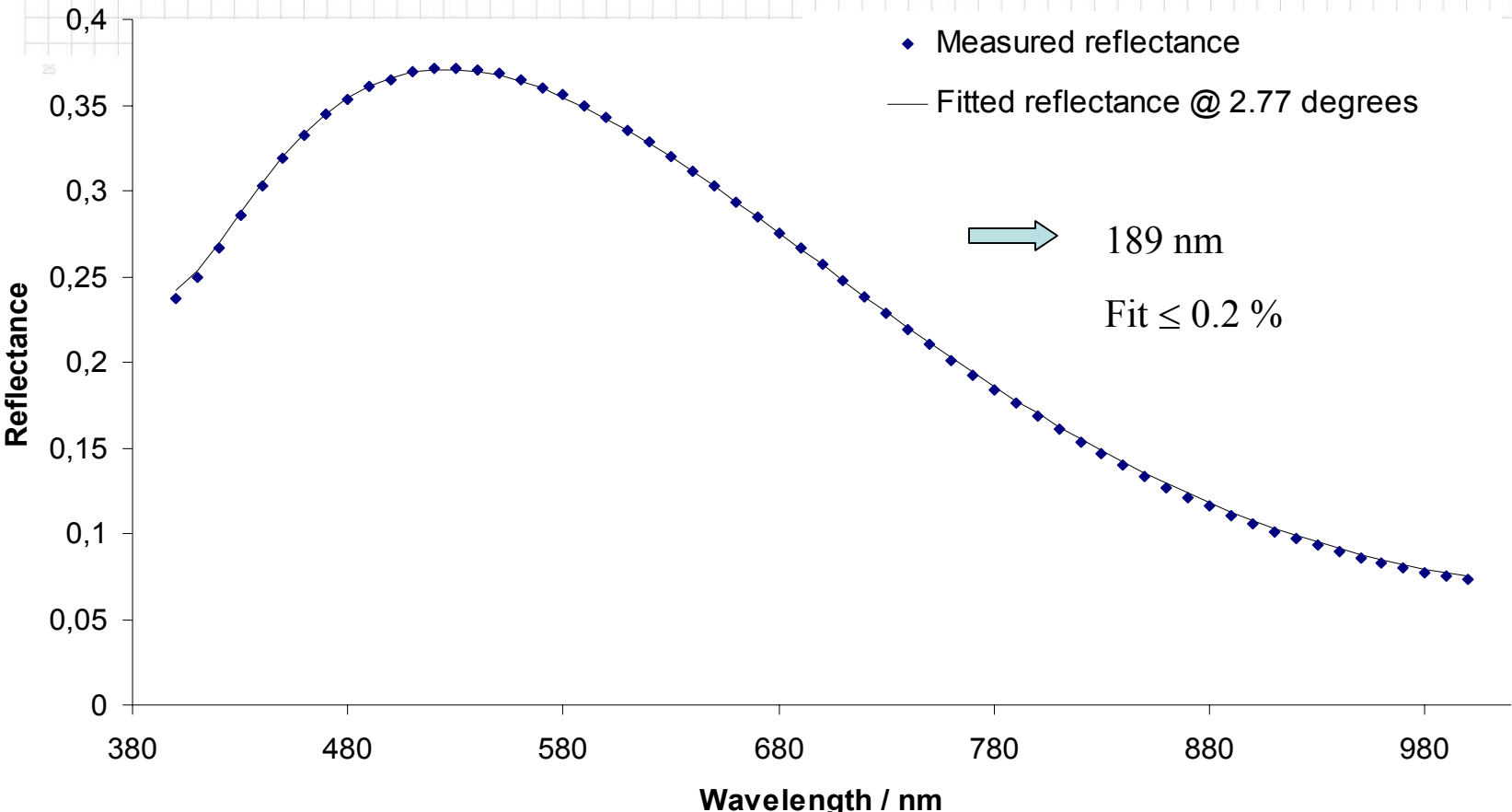
Spectral response change



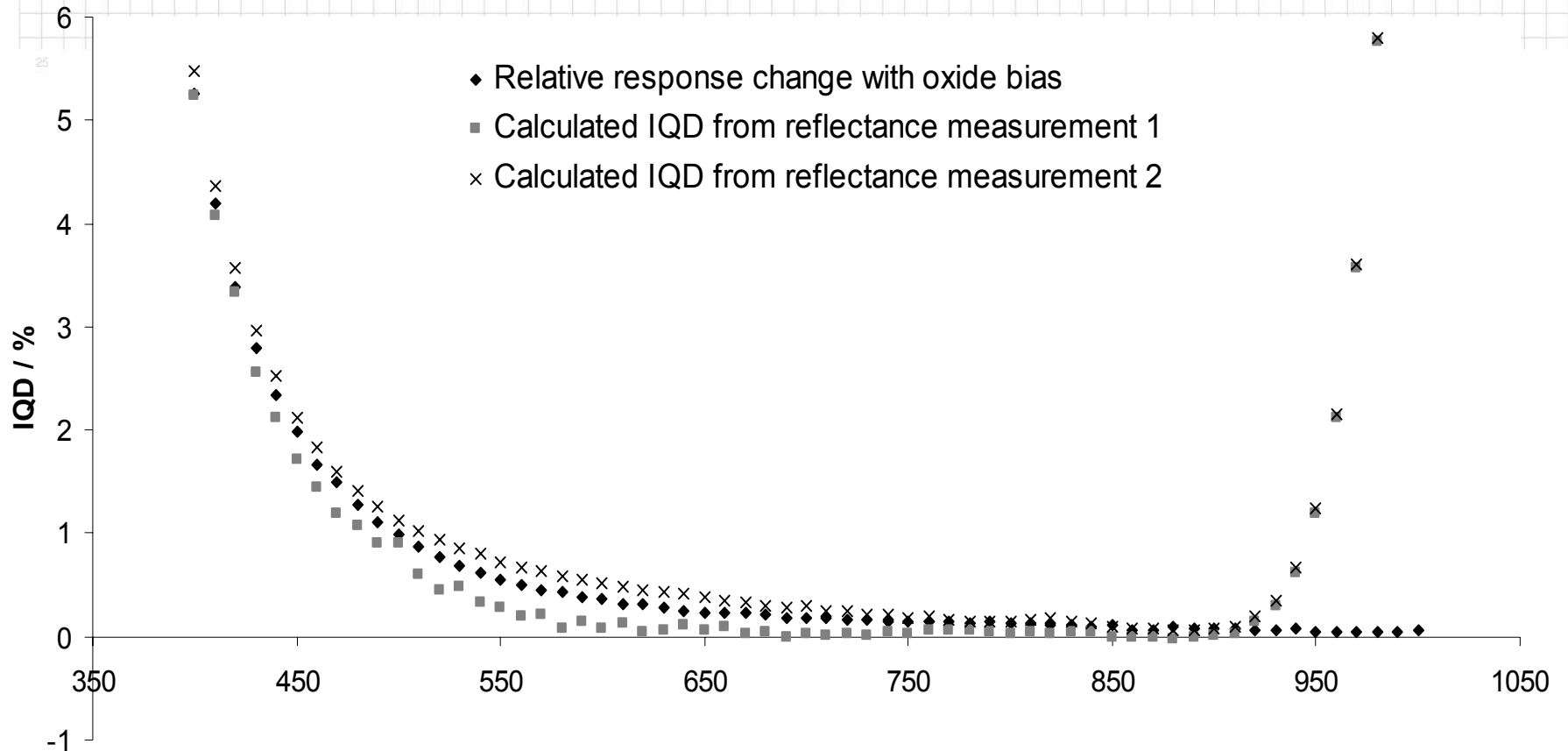
Reverse bias



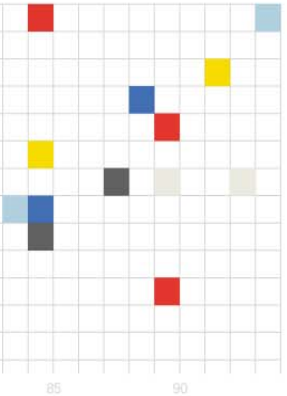
Reflectance



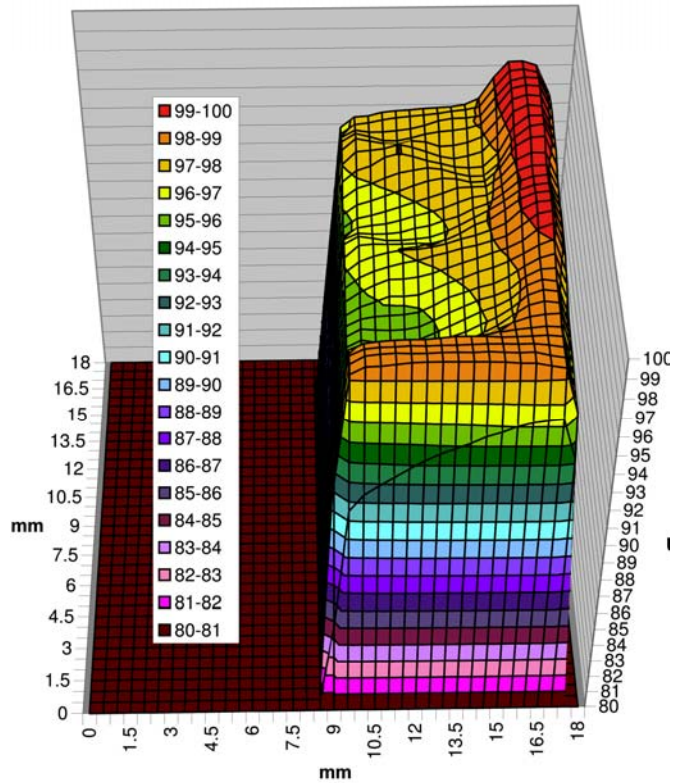
Internal quantum deficiency (IQD)



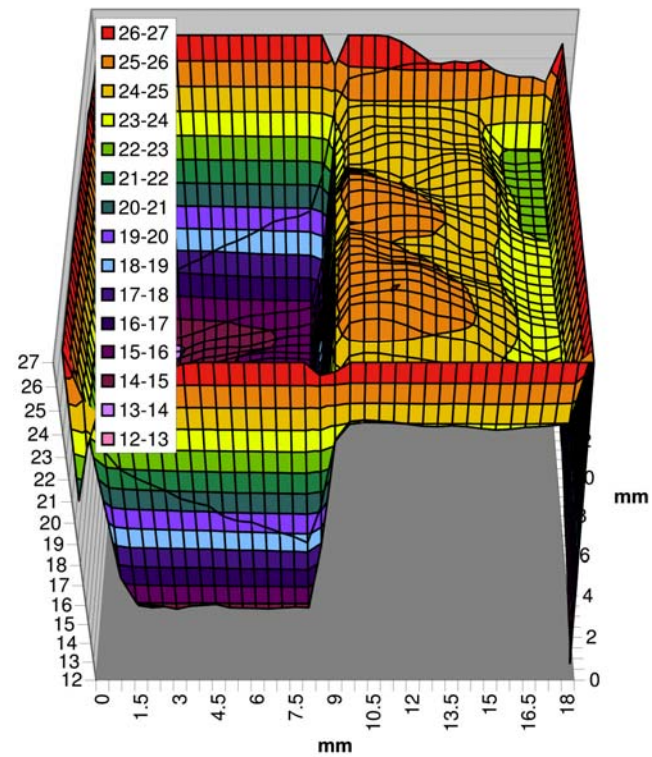
Uniformity @ 405 nm



Responsivity

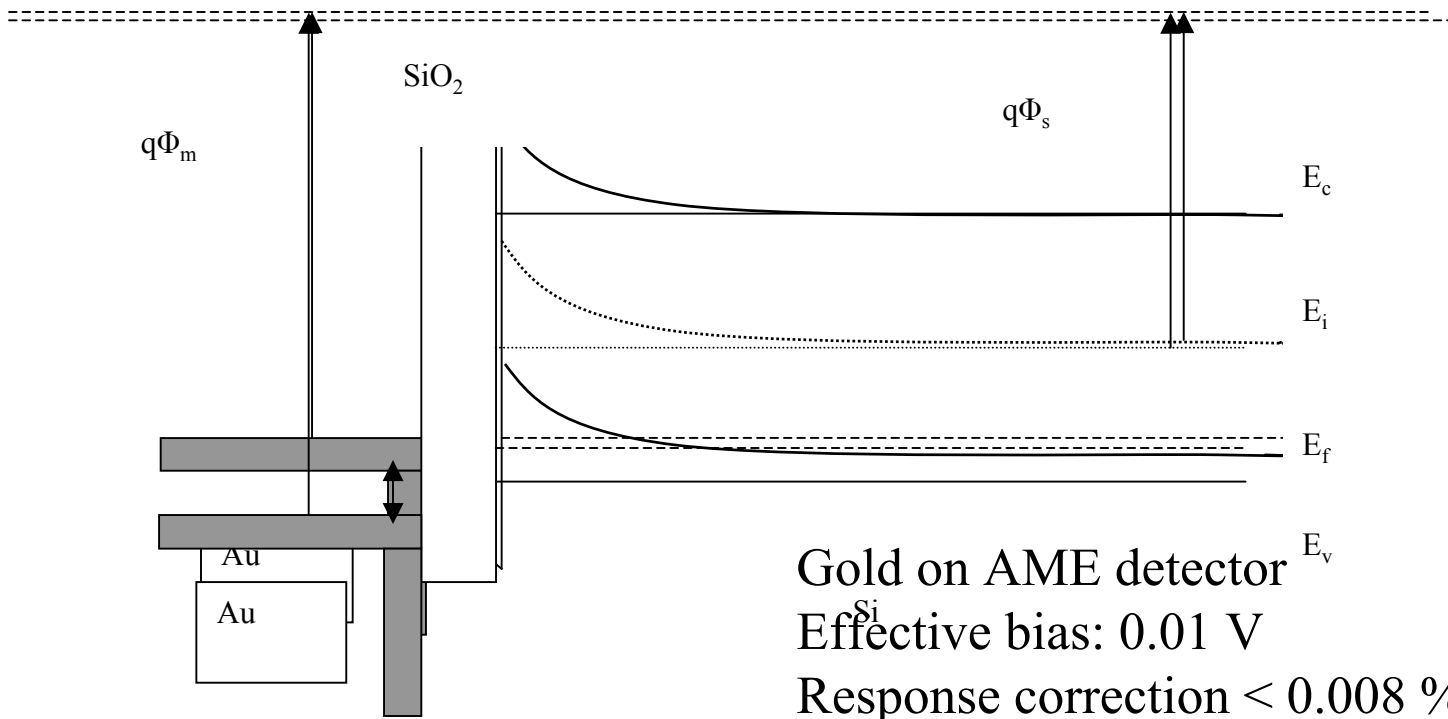


Reflectance

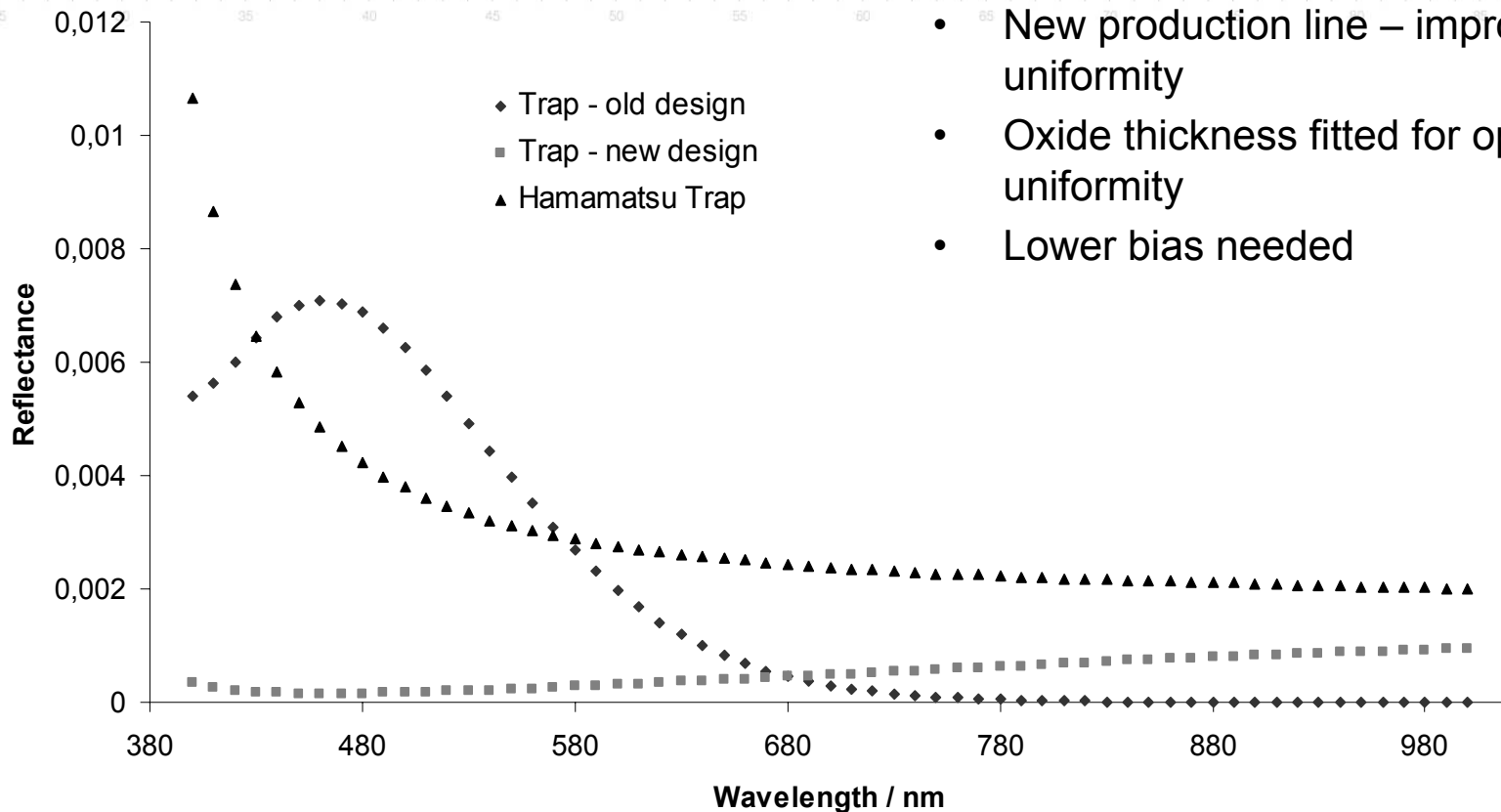
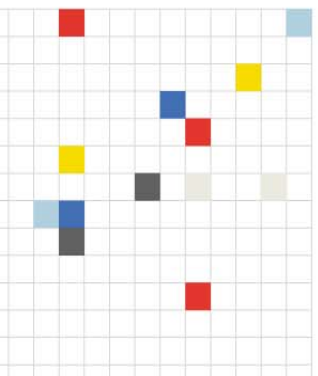


Workfunction bias

Metal deposition will effectively bias the detector



Improving the detector design



- New production line – improved uniformity
- Oxide thickness fitted for optimum uniformity
- Lower bias needed

Conclusions and future work

- Promising results so far
- Responsivity change with oxide bias and reverse bias as expected
- Nonuniformity limits the accuracy
- Construction of trap detector
- Calibration and comparison to cryogenic radiometer
- Develop a measurement procedure
- The project will close in desember 2006
- The principle is applicabile with cryogenic silicon detectors