



**6th Workshop on
ULTRAVIOLET RADIATION MEASUREMENTS**

GaAsP trap detector for UV measurement

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Purpose of the work :

- ✓ **High accuracy in spectral responsivity measurement with cryogenic radiometer**
- ✓ **Good transfer standard in the near UV, the visible and the near IR with silicon trap detector**
- ✓ **Try of achieving good measurement also in the full UV spectral range (200 nm - 400 nm)**

Selection of photodiodes

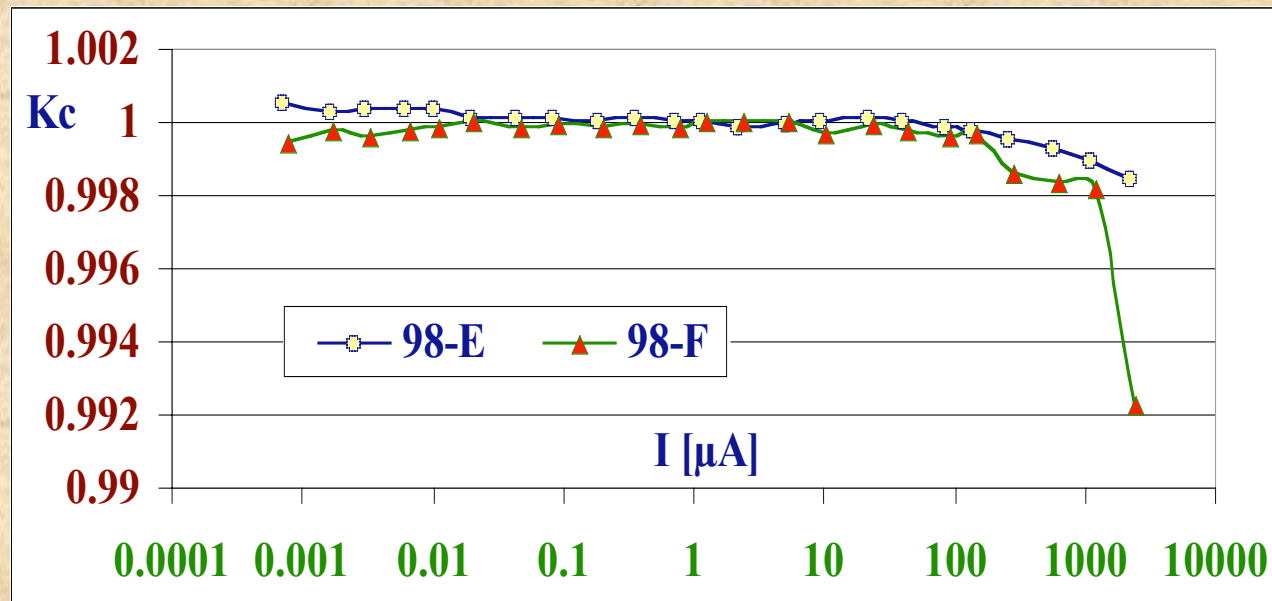
Photodiode	Type	Active area [mm ²]	Spectral range [nm]	λ_{\max} [nm]
98 - B	GaAsP	4,6x4,6	190 – 680	610
98 – C				
98 – D				
98 – E	GaAsP	10x10	190 – 680	610
98 – F				
98 – G	GaP	4,6x4,6	190 – 550	440
98 – H				
98 – I				

Possible UV Photodiodes (Schottky type, manufactured by Hamamatsu)

- ✓ Characterisation done : linearity, shunt resistance, noise, local responsivity and stability under ultraviolet irradiation.

Characterisation of GaAsP photodiodes

✓ Linearity :



Linearity correction factor against the photo-current for two GaAsP photodiodes (G2119) : 10x10 mm²

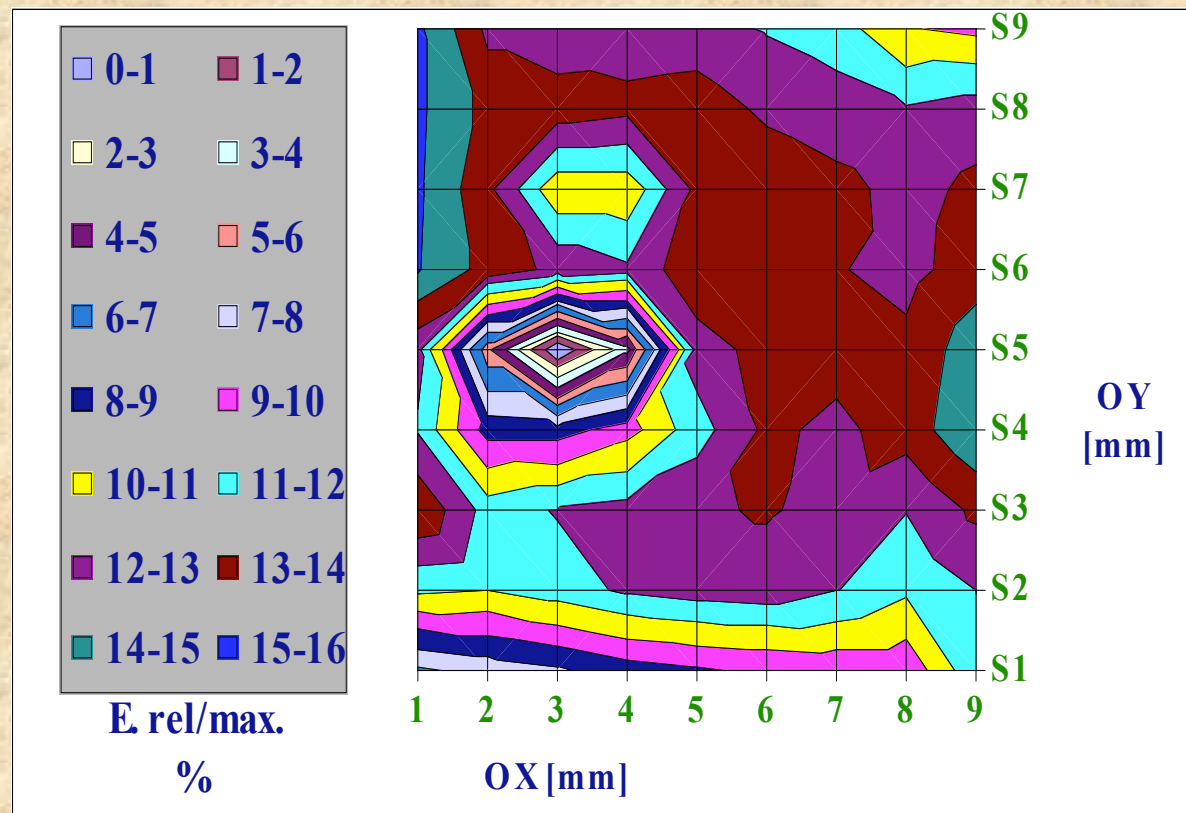
✓ Shunt resistance : in the range of GΩ.

✓ Noise : in the range of pA.

Characterisation of GaAsP photodiodes

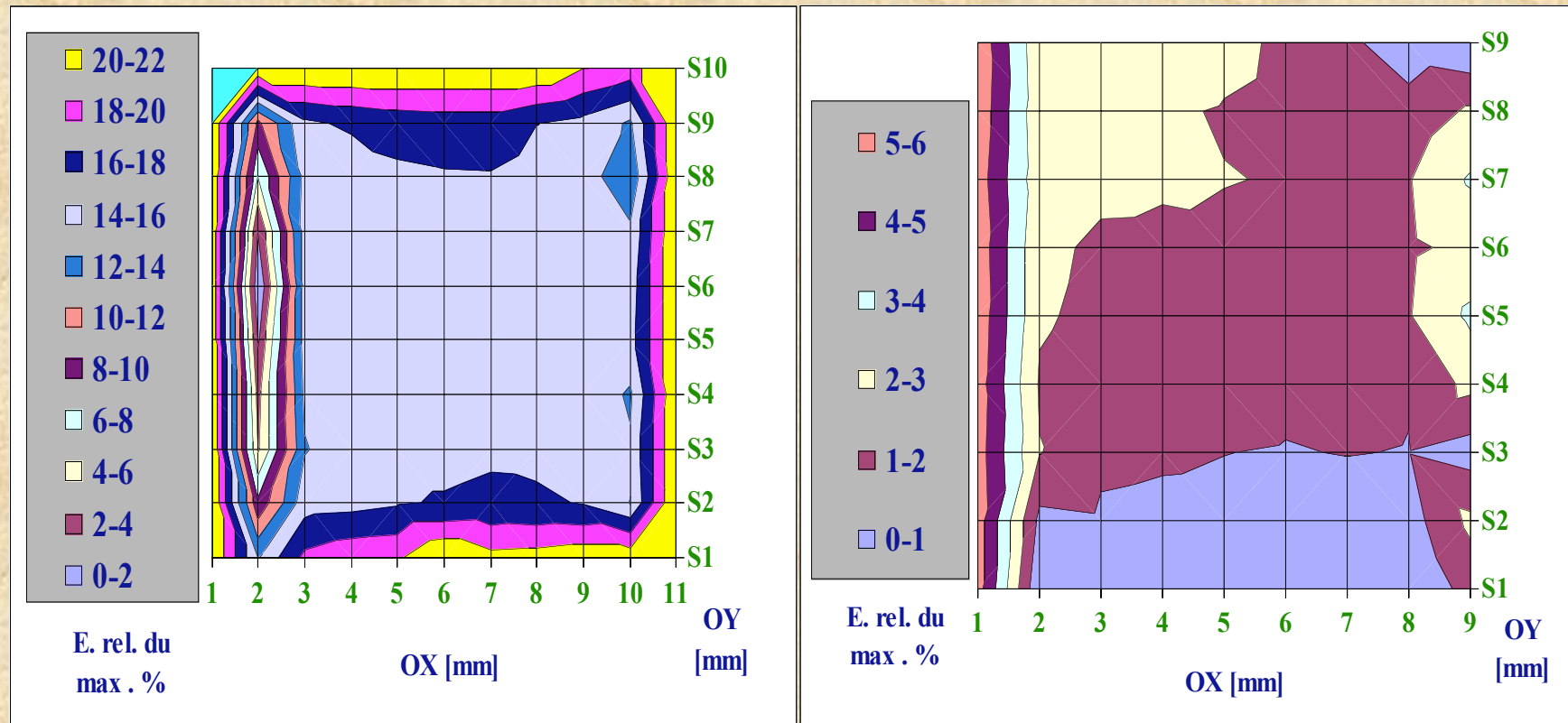
✓ Local responsivity of a GaAsP photodiode (10x10 mm²)

- ✓ Wavelength 300 nm
- ✓ Spot size 1 mm
- ✓ Step size 1 mm



Characterisation of GaAsP photodiodes

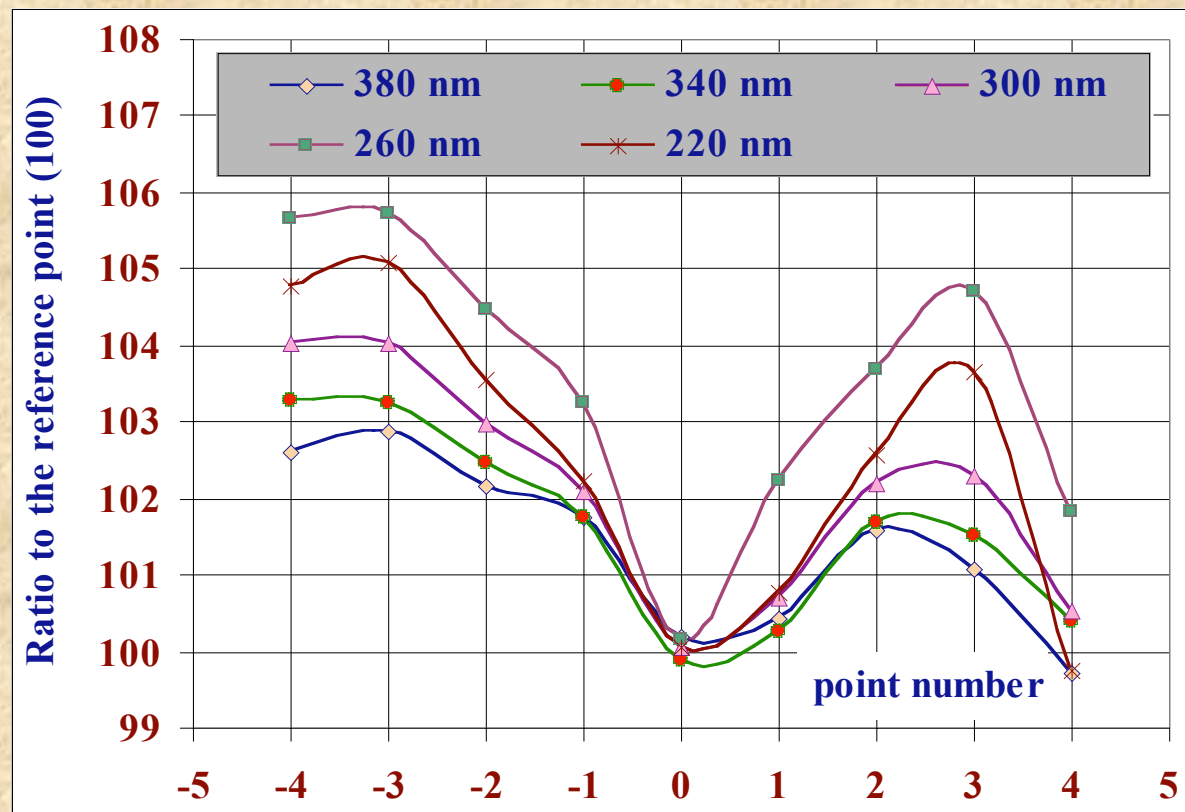
✓ Local responsivity of a GaAsP photodiode (10x10 mm²)



Characterisation of GaAsP photodiodes

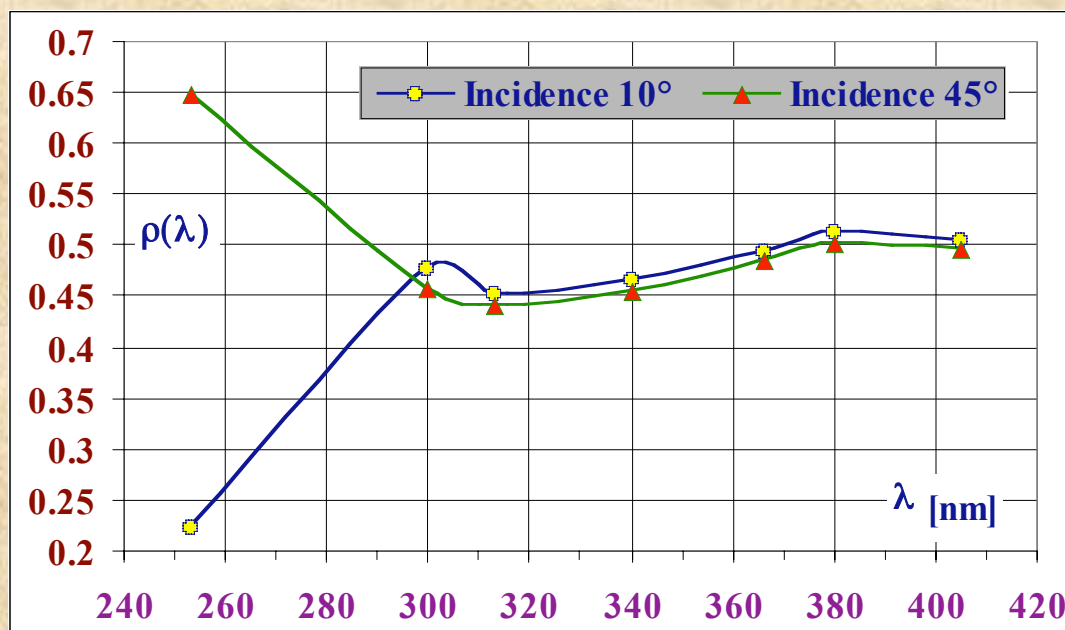
✓ Local responsivity of a GaAsP photodiode (10x10 mm²)

- ✓ Central line
- ✓ Spot size 1 mm
- ✓ Step size 1 mm



Characterisation of GaAsP photodiodes

✓ Reflectance factor of a GaAsP photodiode (10x10 mm²)

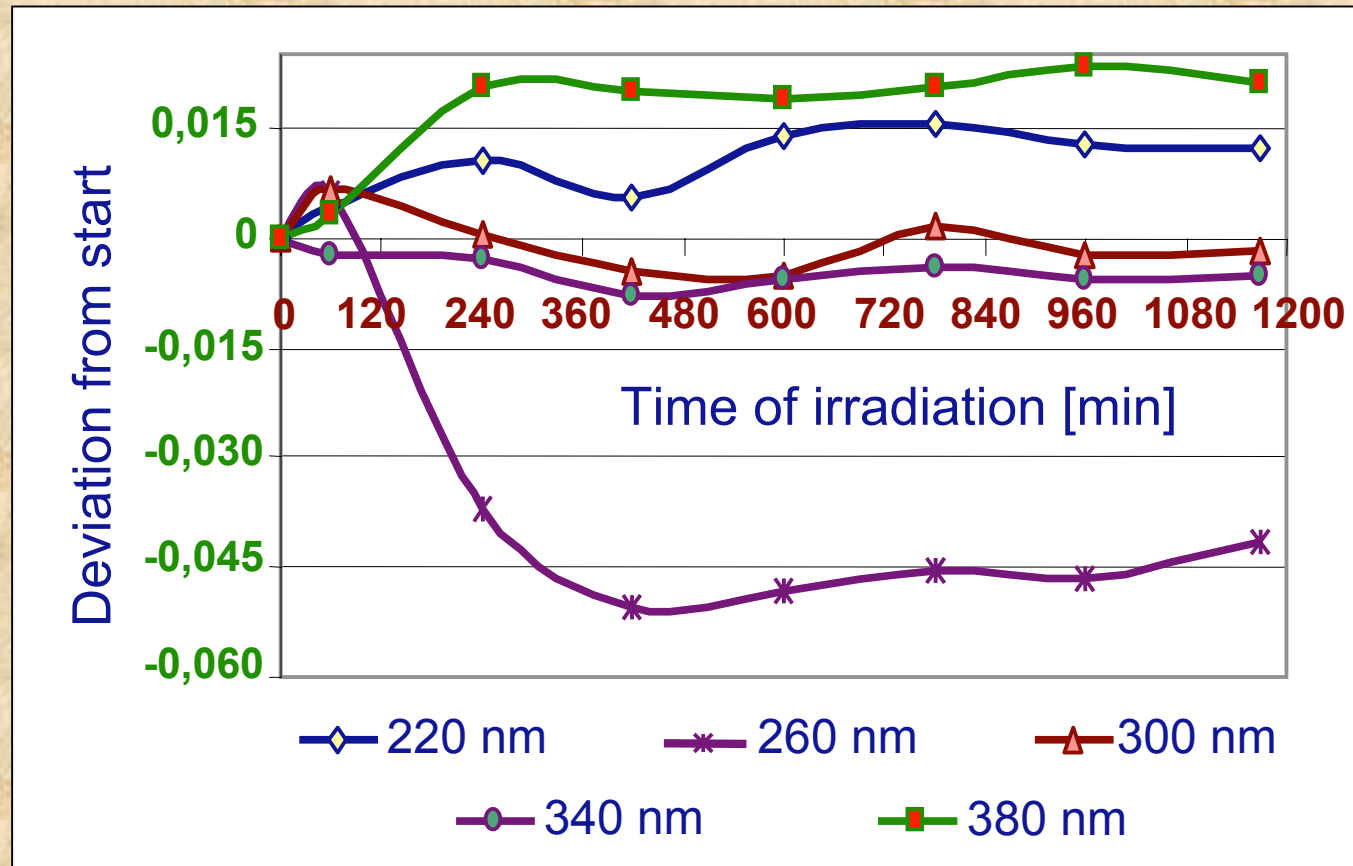


Reflectance factor of the surface of a GaAsP photodiode (10x10 mm²) versus wavelength for two incidence angles

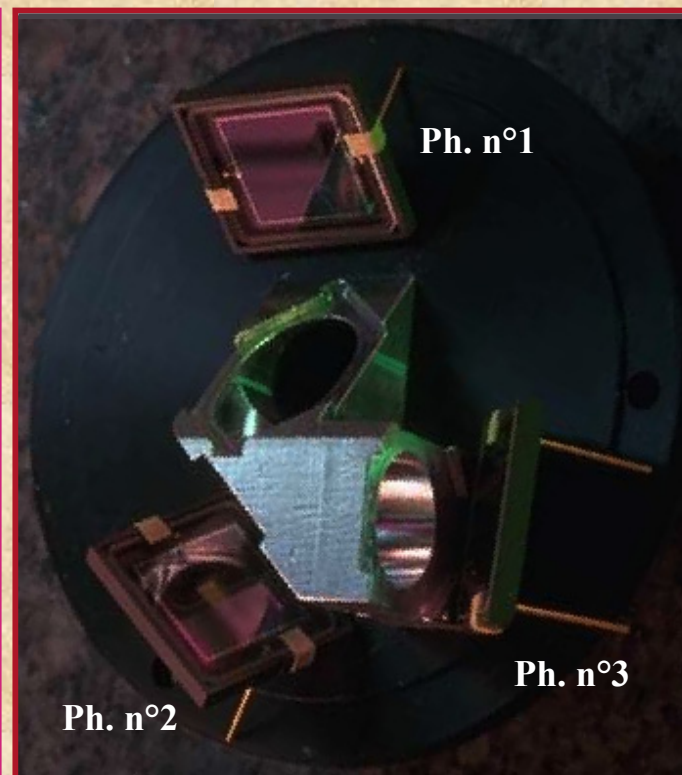
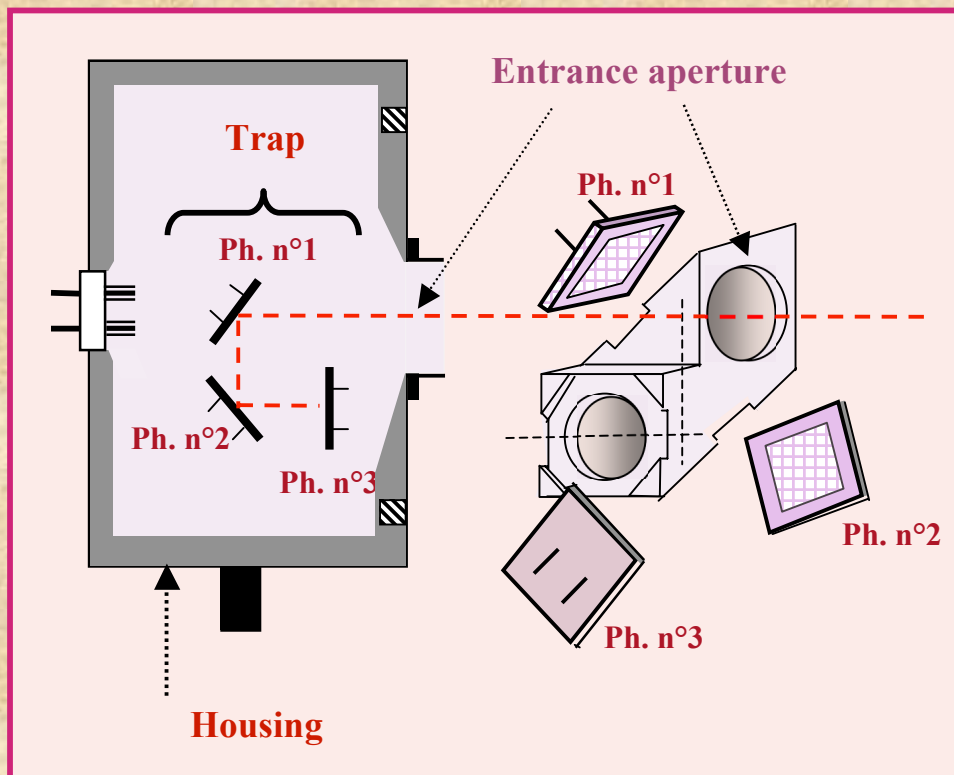
Characterisation of GaAsP photodiodes

✓ Ageing under UV irradiation :

- ✓ 5 to 7 periods of 2h of irradiation.
- ✓ Source : D₂ lamp .
- ✓ E_e = 130 mW/m².
- ✓ Reference : PtSi-n-Si (10x10 mm²).

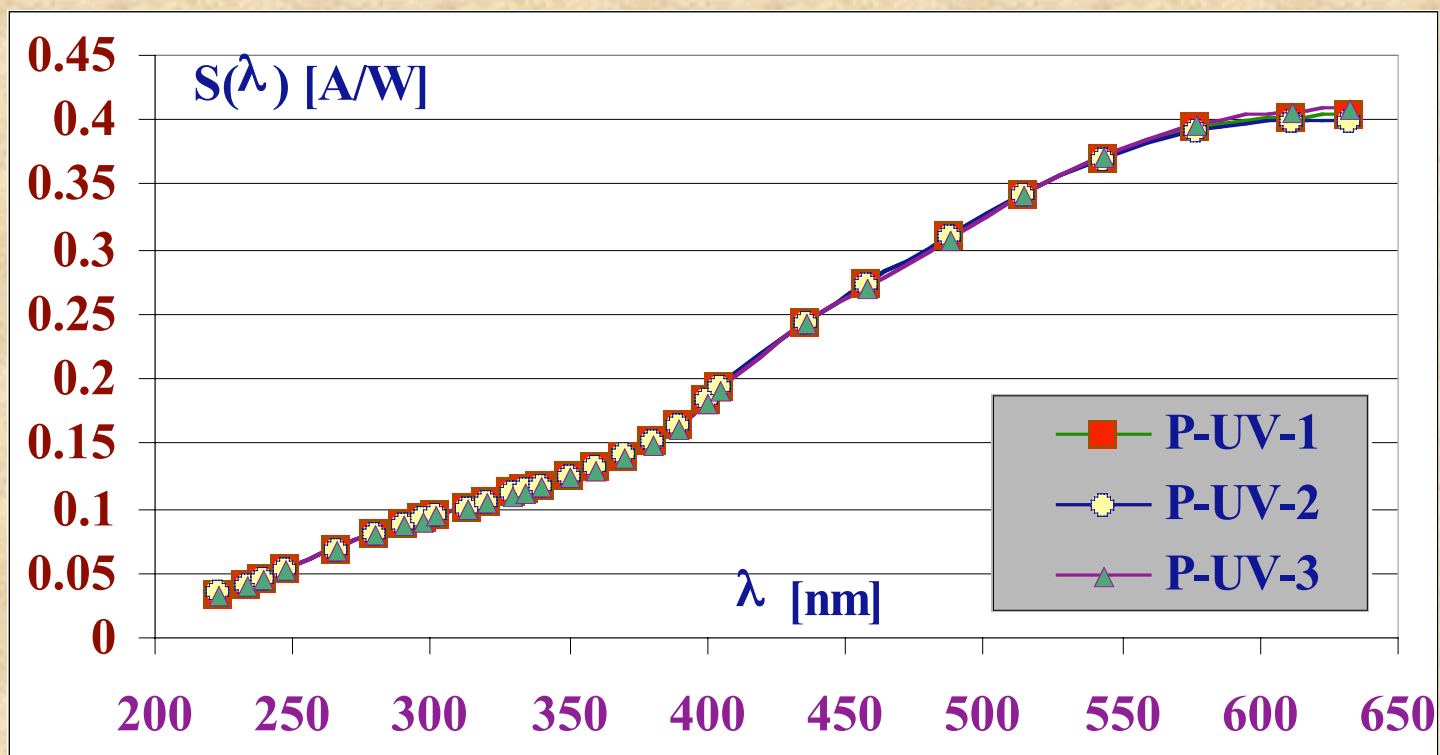


Reflection trap detector



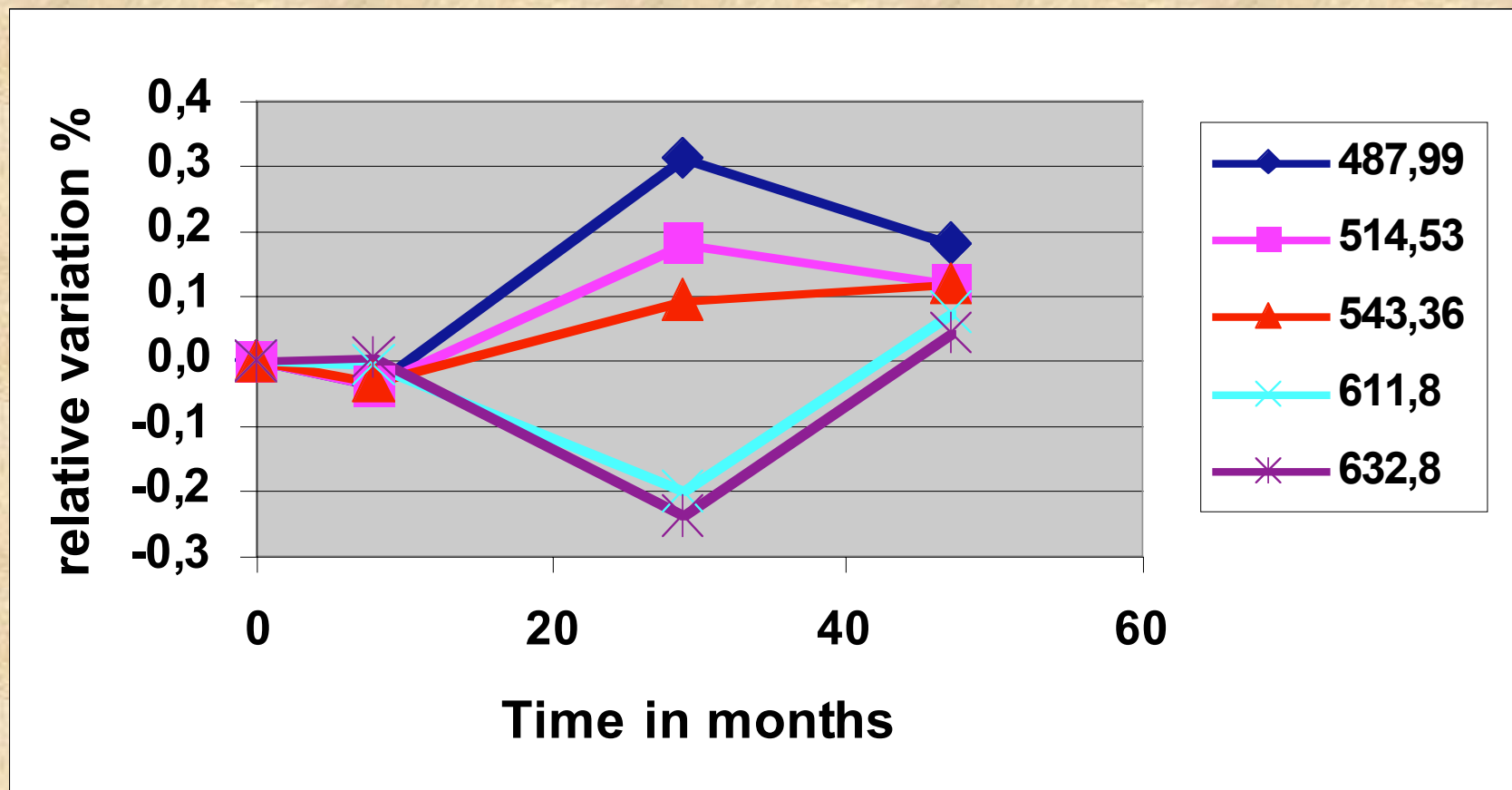
Trap detector using GaAsP : 10x10 mm² photodiodes

Trap detector spectral responsivity



Absolute spectral responsivity curve of 3 GaAsP trap detectors

Trap detector stability of absolute spectral responsivity



Trap detector absolute spectral responsivity

✓ Checks done for the calibration with laser beam :

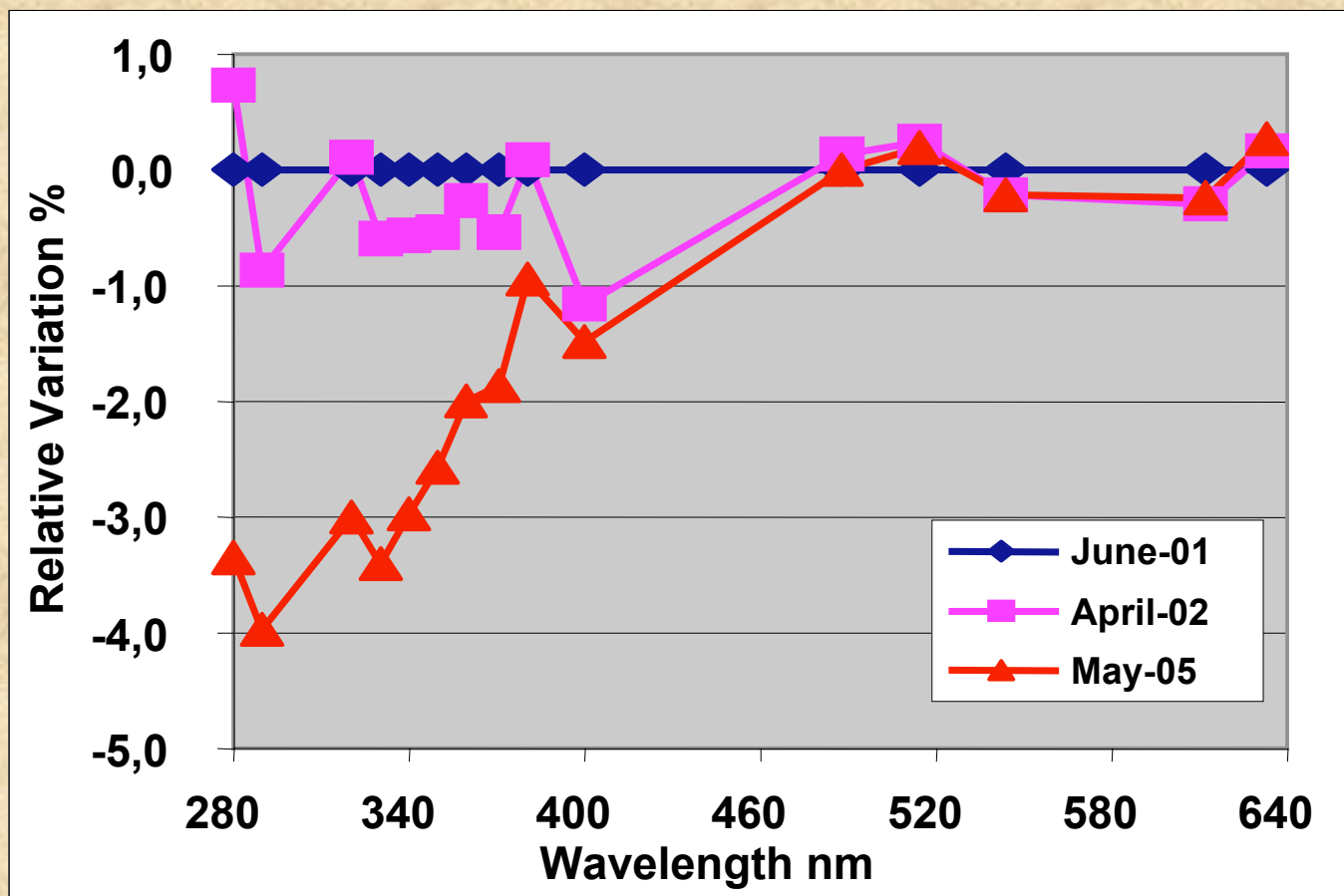
☑ Local responsivity

Checked along diameters with a laser beam
with a diameter less than 1mm over 6 mm
with 1 mm step at 543 nm
Maximum deviation $5.2 \cdot 10^{-4}$

☑ Linearity

Checked by calibration at two different
levels, 50 μW and 100 μW at 488 nm
Results well within the uncertainties

Trap detector relative spectral responsivity



Conclusion :

- ✓ **For routine calibration in the UV spectral range GaAsP trap detectors can be used, but after ageing**
- ✓ **Long term stability is not good enough for high quality Transfer standard**
- ✓ **Work is continuing with new silicon photodiodes Si-8552 (10x10 mm²) and Si-8553 (18x18 mm²) from Hamamatsu specially design for UV measurements**