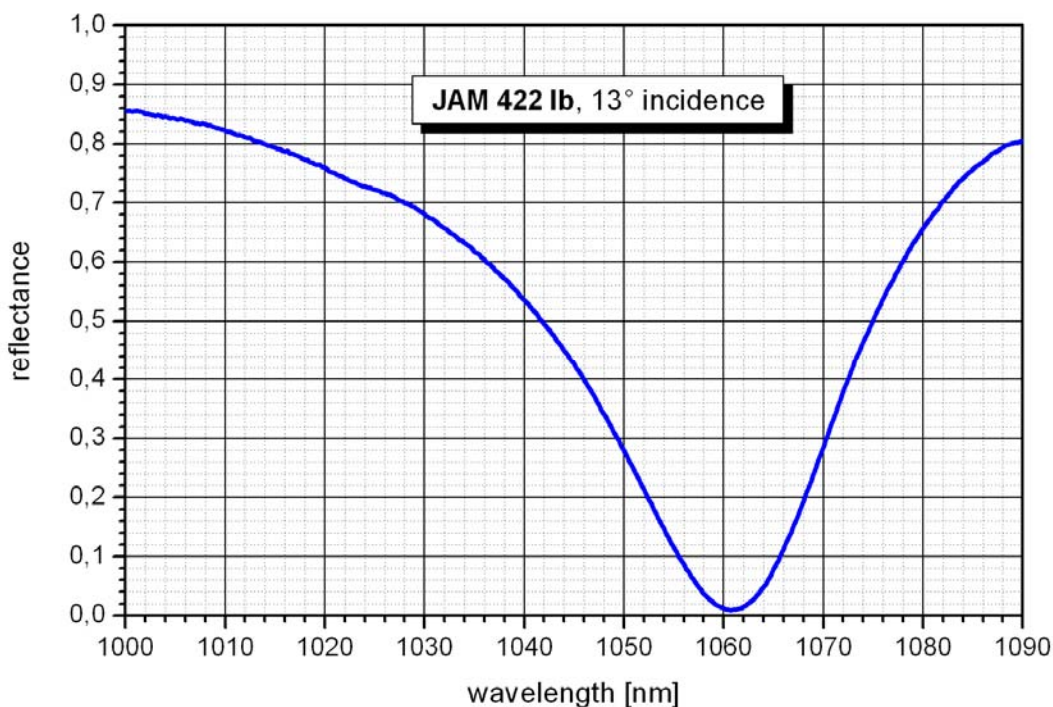


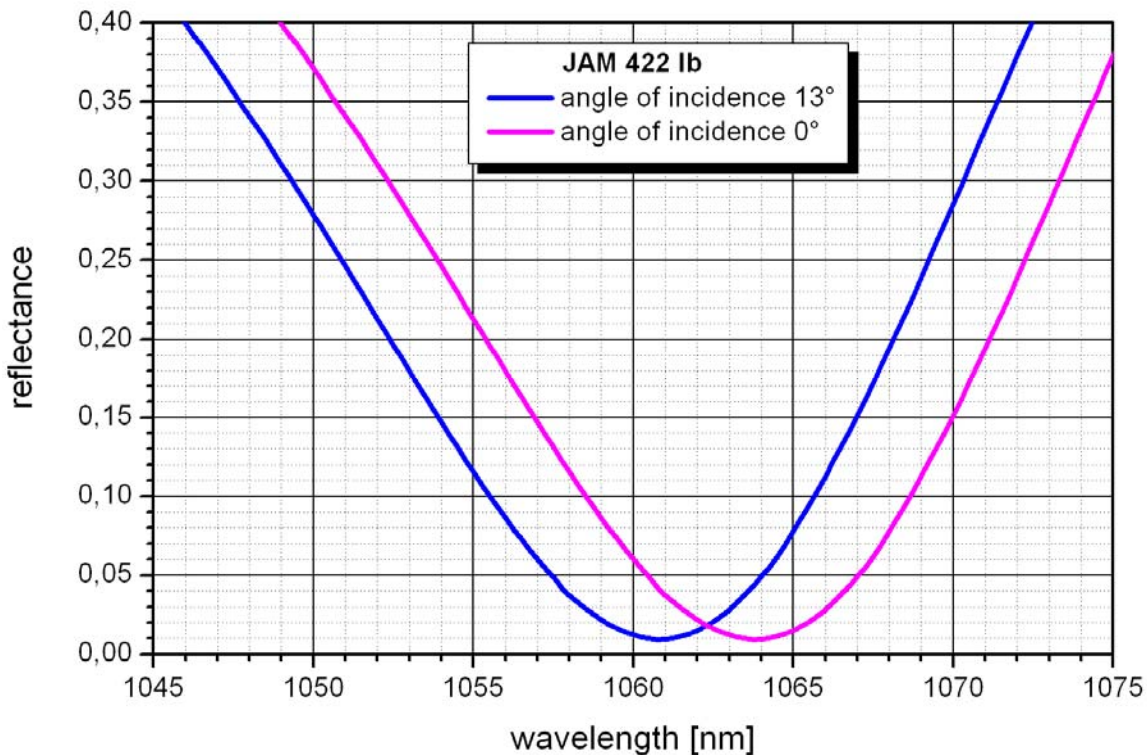
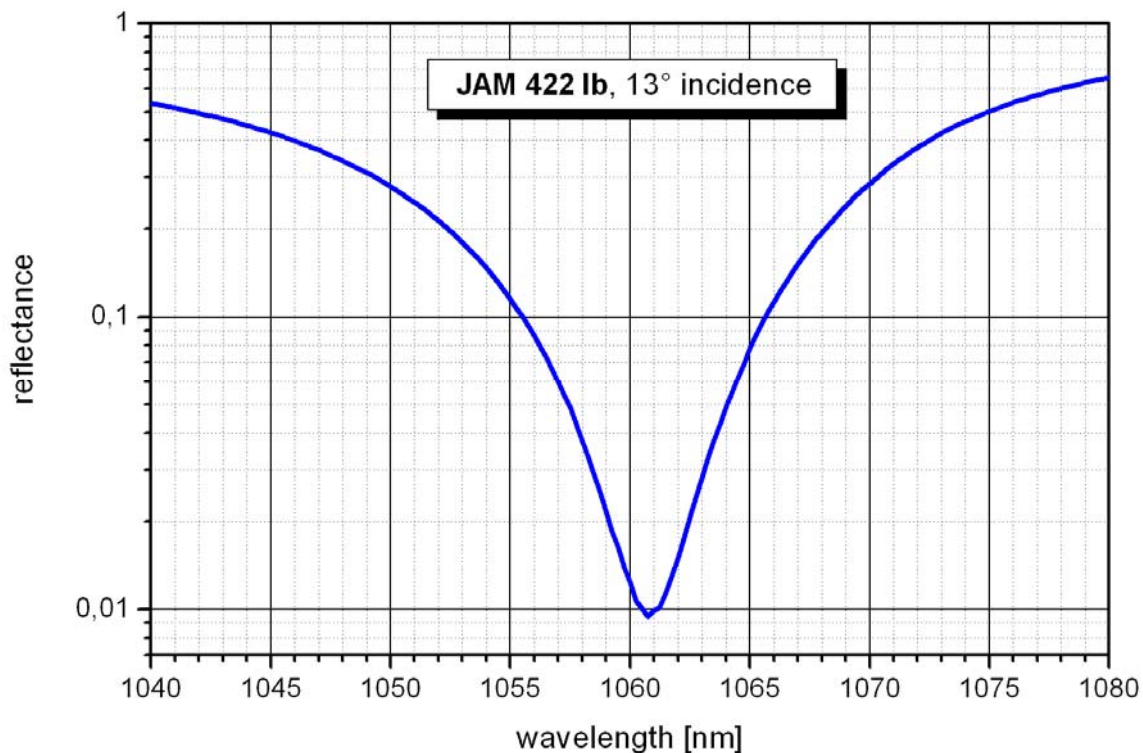
RSAM data sheet RSAM-1064-x, $\lambda = 1064 \text{ nm}$

RSAM - Resonant saturable absorber mirror

Working wavelength	$\lambda = 1050 \dots 1064 \text{ nm}$ (angle and temperature dependent)
Full Width at Half Maximum	FWHM = 25 nm
Low intensity absorptance	$A = 99 \%$
Low intensity reflectance	$R_{\min} \leq 1 \%$
Saturation fluence	$\Phi_{\text{sat}} = 15 \mu\text{J}/\text{cm}^2$
Relaxation time constant	$\tau \sim 9 \text{ ps}$
Non-saturable loss	$A_{\text{ns}} \sim 40 \%$, depending on the pulse duration
Chip area	4mm x 4mm; other dimensions on request
Chip thickness	400 μm
Front side	dielectric cover
Mounting of RSAM-1064-x	denotes the type of mounting as follows:
x = 0	unmounted
x = 12.7 g	glued on a gold plated Cu-cylinder with 12.7 mm \varnothing
x = 25.4 g	glued on a gold plated Cu-cylinder with 25.4 mm \varnothing
x = 12.7 s	soldered on a gold plated Cu-cylinder with 12.7 mm \varnothing
x = 25.4 s	soldered on a gold plated Cu-cylinder with 25.4 mm \varnothing
x = FC	mounted on a 1 m monomode fiber cable with FC/PC connector
x = FC/PC with TEC	mounted on a 1 m monomode fiber cable with FC/PC or other connector type and TEC (thermoelectric cooler) for fine tuning of the resonance wavelength

Unsaturated spectral reflectance, measured at room temperature with 13° angle of incidence





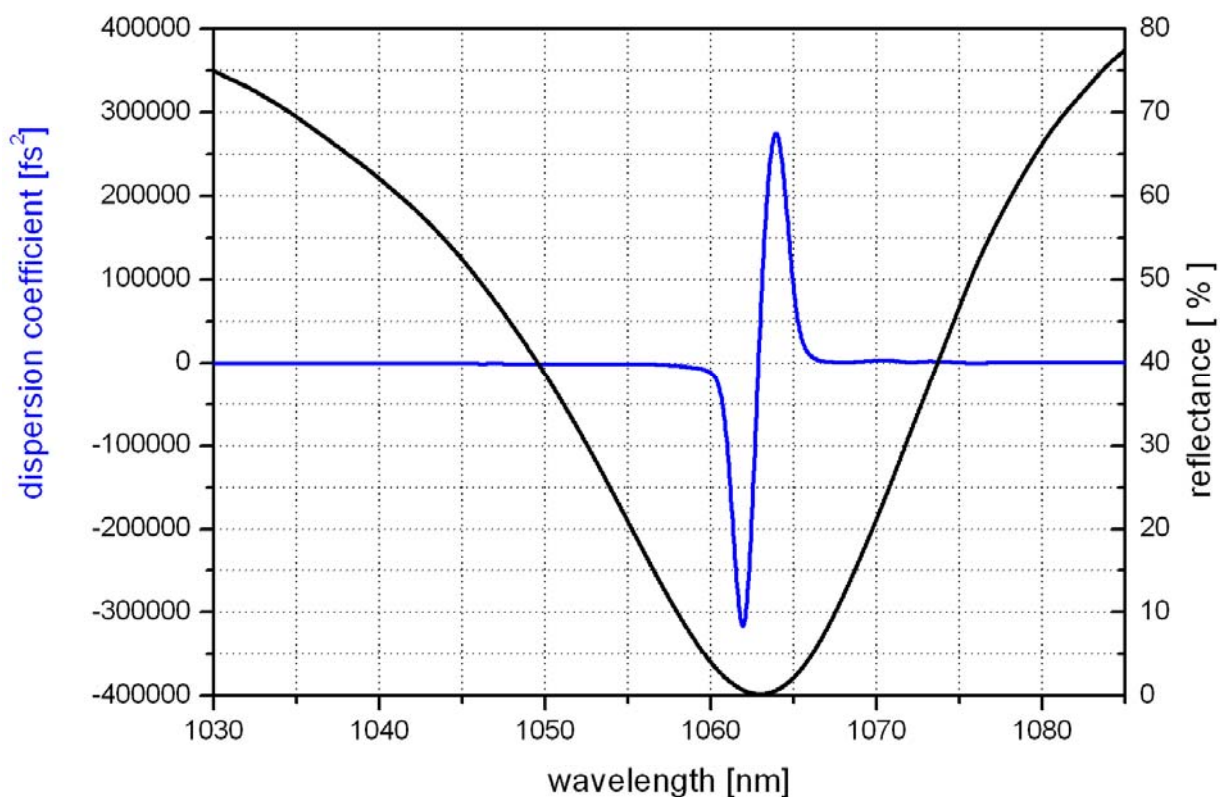
Dispersion:

Group Delay Dispersion (GDD)

Dispersion coefficient $D_2(\omega) = \frac{\partial^2 \varphi}{\partial \omega^2}$ with φ - reflected phase

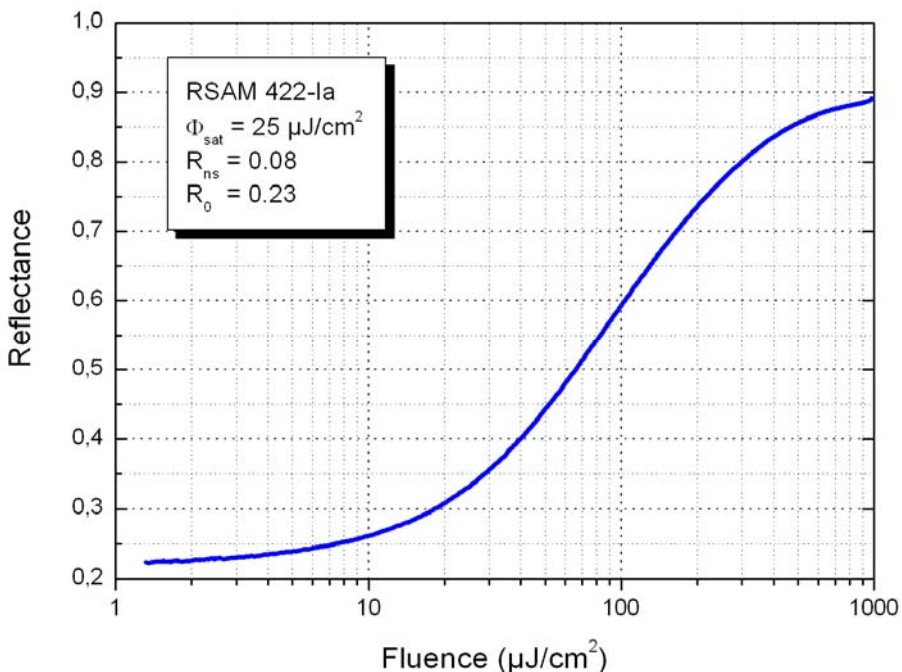
$\omega = 2\pi \frac{c}{\lambda}$ - angular frequency

RSAM 1064

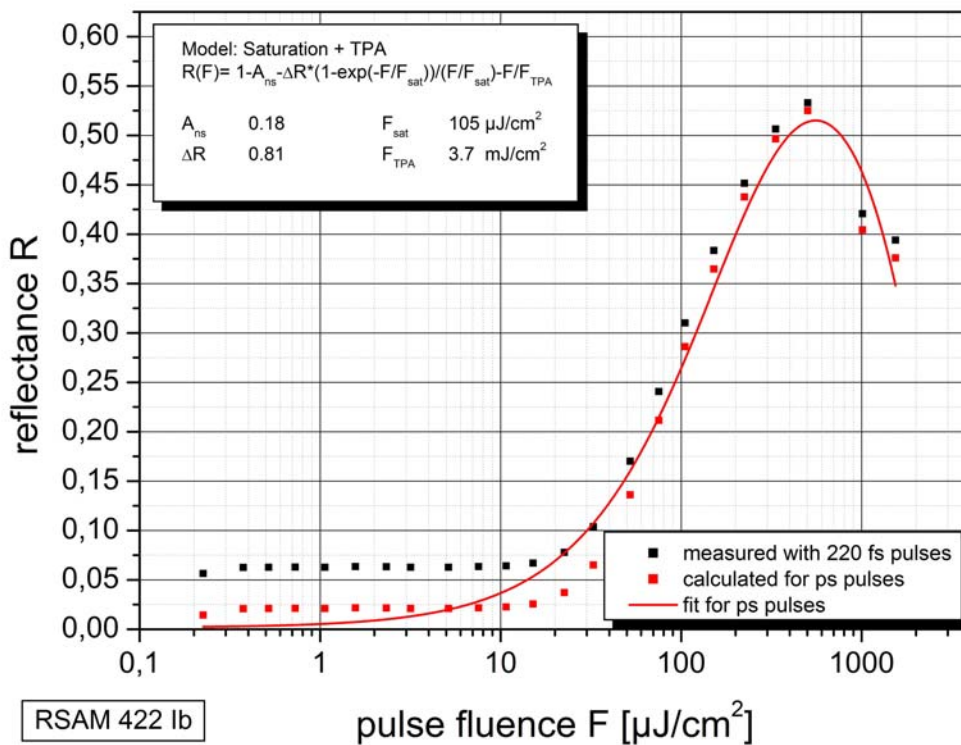


Saturation:

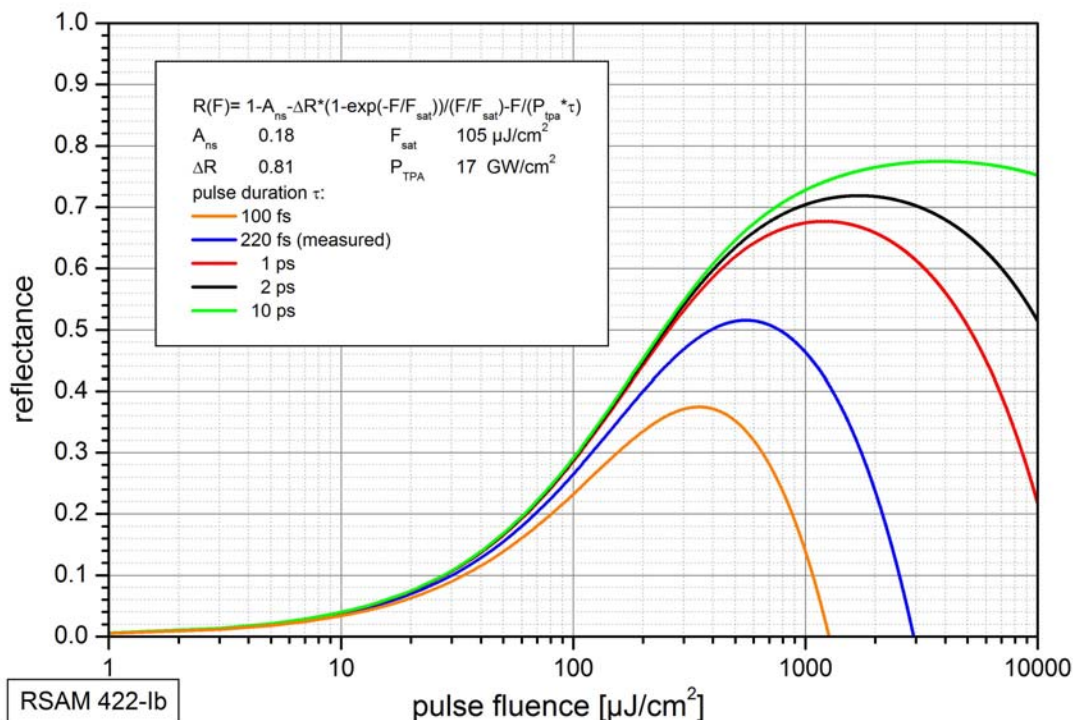
The reflectance depends on the input pulse fluence Φ .



The measurement of the saturation with ps pulses has been carried out by D. Fischer and G. Steinmeyer, Max-Born-Institut Berlin, Germany on a sample with low intensity reflectance R_0 of 23 %.

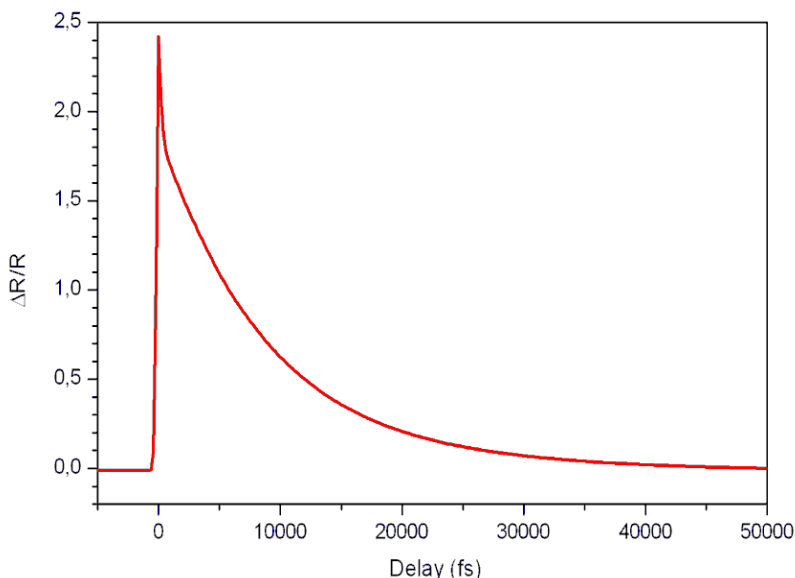


This saturation measurement has been done with 220 fs pulses, where the pulse spectral width of ~ 20 nm is as large as the spectral bandwidth. The red points are re-calculated for ps pulses. Due to the high peak power density of the fs pulses the TPA is significant.

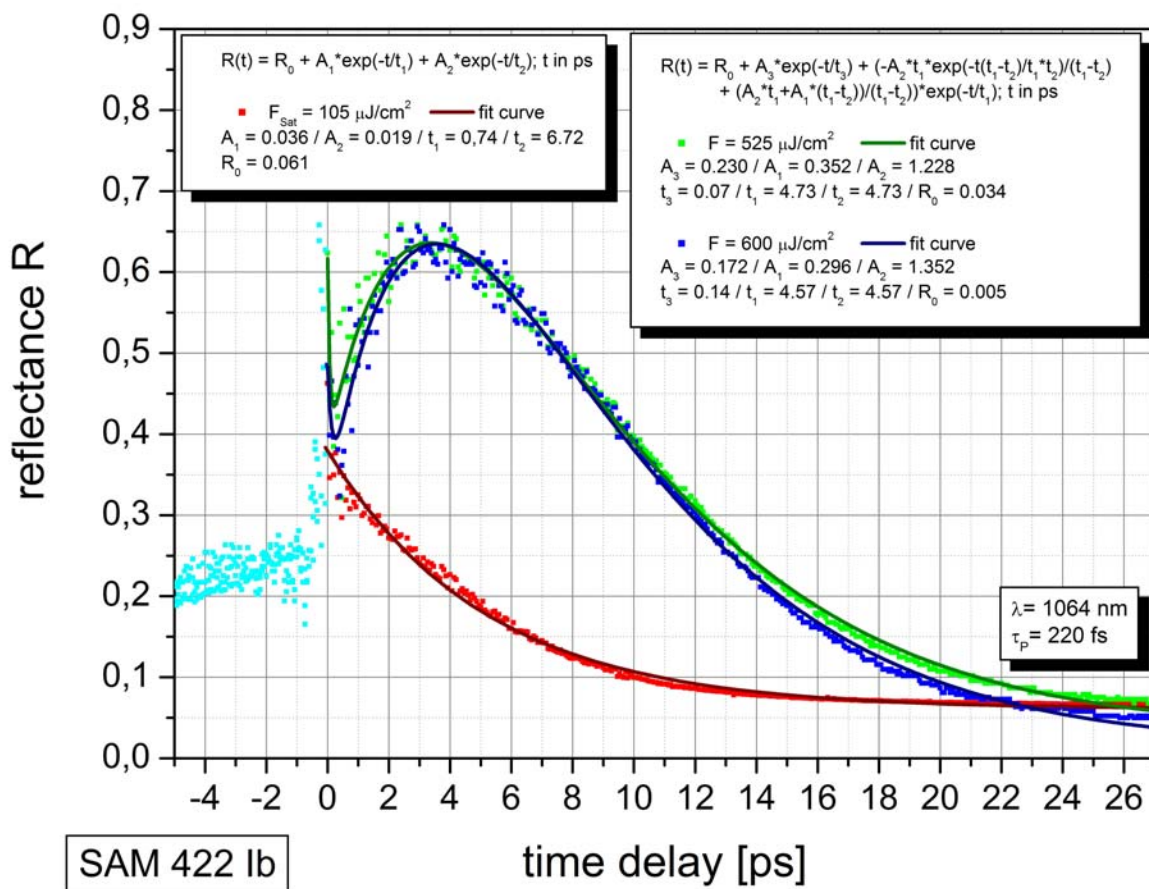


Calculated saturation curves for different pulse duration τ , based on the measured saturation above with a pulse duration of 220 fs. The non-saturable loss increases with decreasing pulse duration.

Relaxation time



Relaxation time, measured in a pump-probe experiment by D. Fischer and G. Steinmeyer, Max-Born-Institut Berlin, Germany



Relaxation time measurement with 220 fs pulses

Resonance wavelength λ

Angle of incidence φ

The resonance wavelength λ of the RSAM depends on the angle of incidence φ as

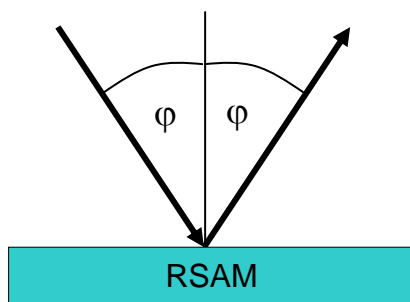
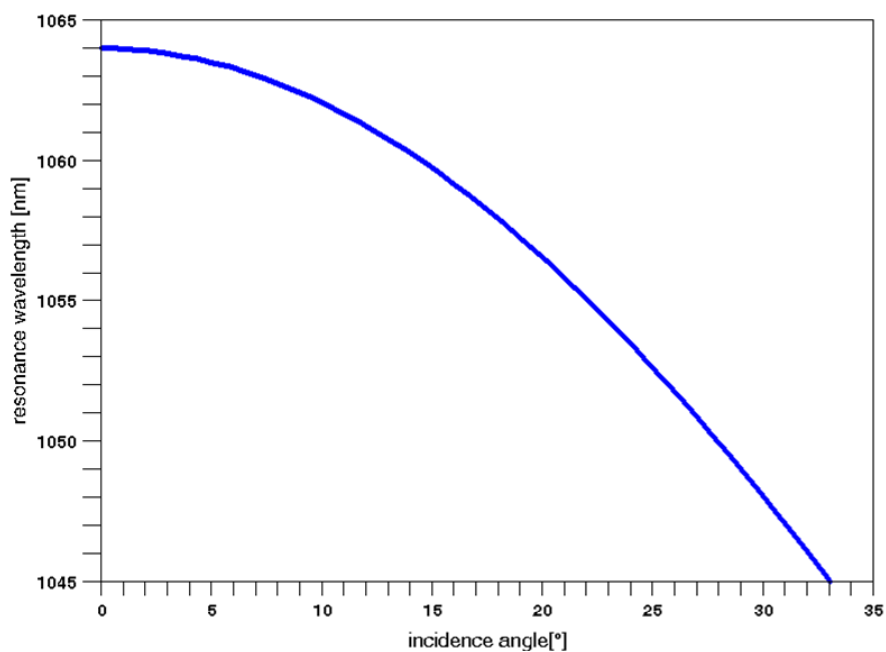
$$\lambda(\varphi) = \lambda_0 \sqrt{1 - \frac{\sin^2 \varphi}{n^2}} \tag{1}$$

The zero resonance wavelength λ_0 is determined by the index of refraction n and the geometrical thickness d of the absorbing spacer layer inside the Gires–Tournois interferometer by

$$\lambda_0 = 2nd. \tag{2}$$

To adjust the working wavelength to the resonance wavelength λ of the RSAM the angle of incidence φ has to be chosen according to equation (1) with $\lambda_0 = 1064 \text{ nm}$ and $n = 2.9$.

Angle of incidence φ	Resonance wavelength λ (nm)
0°	1064.0
5°	1064.0
10°	1063.3
15°	1061.7
20°	1059.2
25°	1055.8
30°	1051.8
35°	1047.1
40°	1041.9
45°	1036.4



Temperature T

The temperature dependency of the optical thickness nd of the absorbing spacer layer, which governs the resonance wavelength λ , is mainly determined by the temperature dependency of the refractive index $n(T)$. The thermal expansion of the spacer layer thickness d is negligible in comparison with the temperature influence on the refractive index.

The resulting temperature dependency of the resonance wavelength λ is given by

$$\lambda(T) = \lambda(T_0) \left[1 + \frac{1}{n} \frac{dn}{dT} (T - T_0) \right] \quad (3)$$

with

$$\text{temperature coefficient } \frac{1}{n} \frac{dn}{dT} \approx 7.5 \cdot 10^{-5} K^{-1}$$

T_0 - reference temperature

T – working temperature.

In case of a fiber coupled RSAM the angle of incidence is fixed to $\varphi = 0^\circ$. To adjust in this case the working wavelength to the resonance wavelength a thermoelectric cooler (TEC) or heater can be used.

