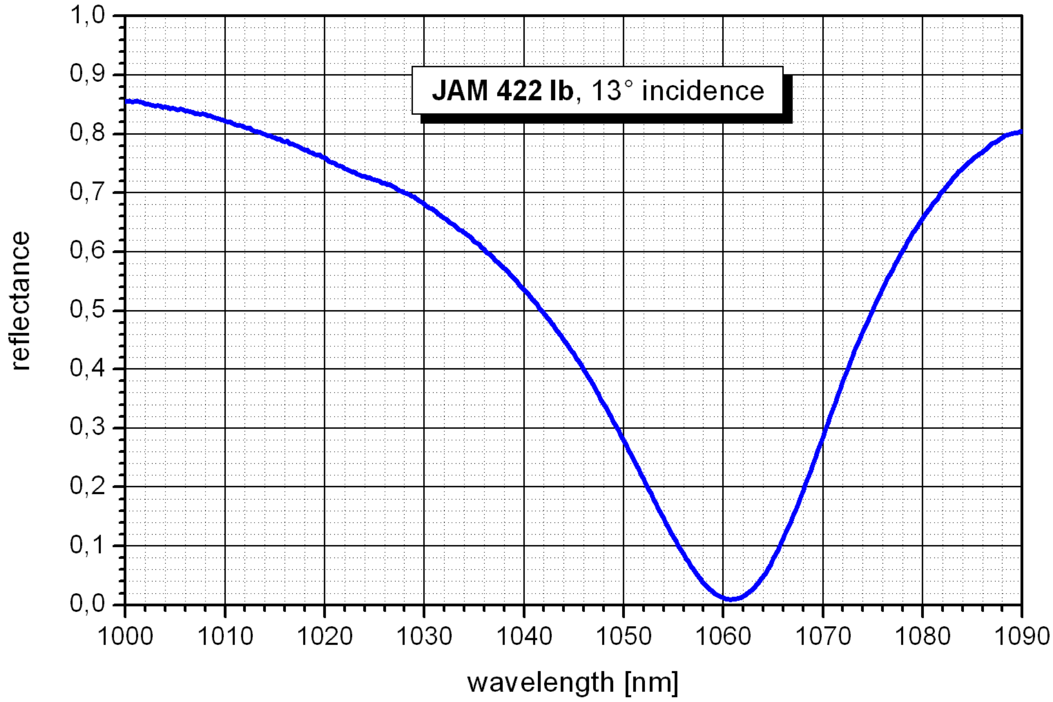
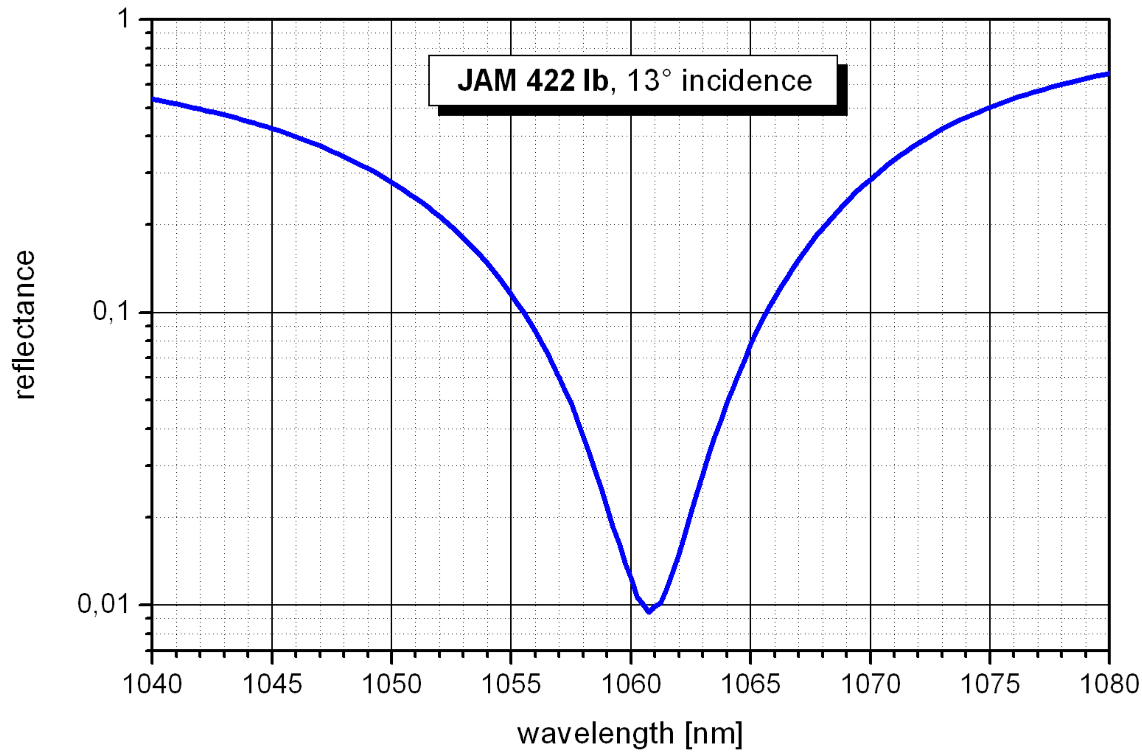
RSAM data sheet RSAM-1064-x, λ = 1064 nm

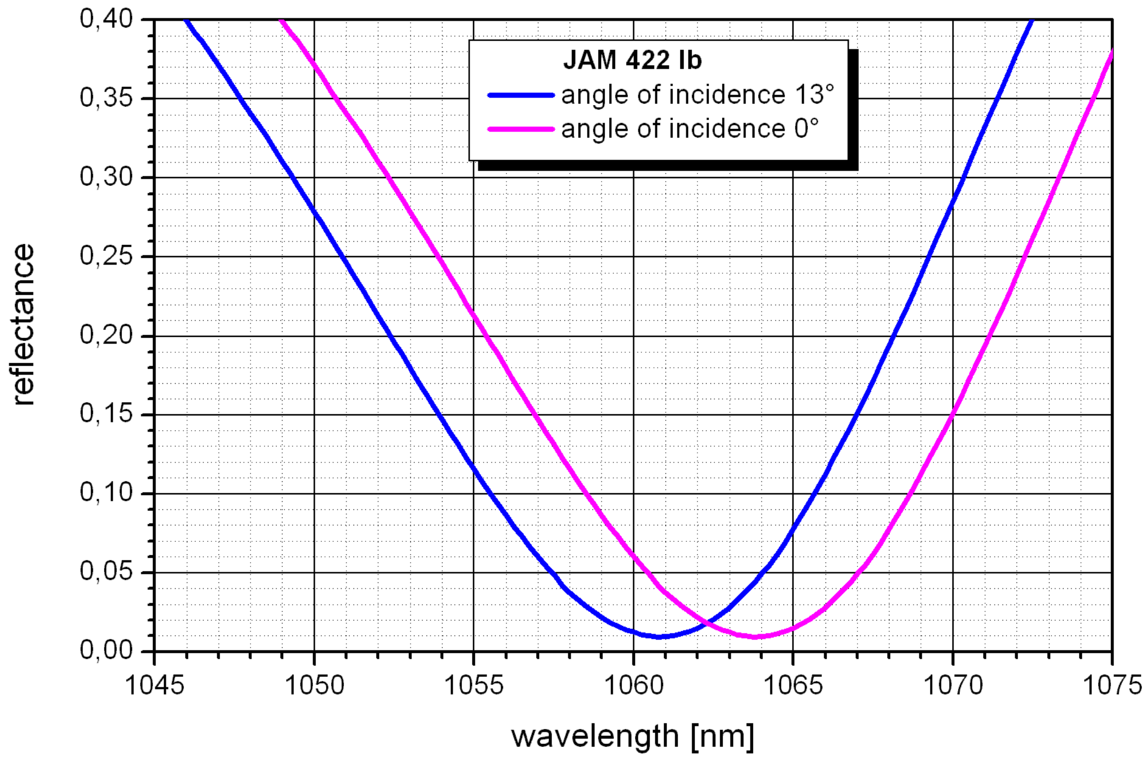
RSAM - Resonant saturable absorber mirror

Working wavelength	λ = 1050…1064 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	Φ_{sat} = 15 µJ/cm^2
Relaxation time constant	τ ~ 9 ps
Non-saturable loss	A_{ns} ~ 40 %, depending on the pulse duration
Chip area	4.0 mm x 4.0 mm; other dimensions on request
Chip thickness	450 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 ∅
x = 25.4 g	glued on a gold plated Cu-cylinder with 25.4 mm ∅
x = 12.7 s	soldered on a gold plated Cu-cylinder with 12.7 mm ∅
x = 25.4 s	soldered on a gold plated Cu-cylinder with 25.4 mm ∅
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




JAM 422 lb, 13° incidence
1
0,1
0,01
reflectance
1040
1045
1050
1055
1060
1065
1070
1075
1080
wavelength [nm]

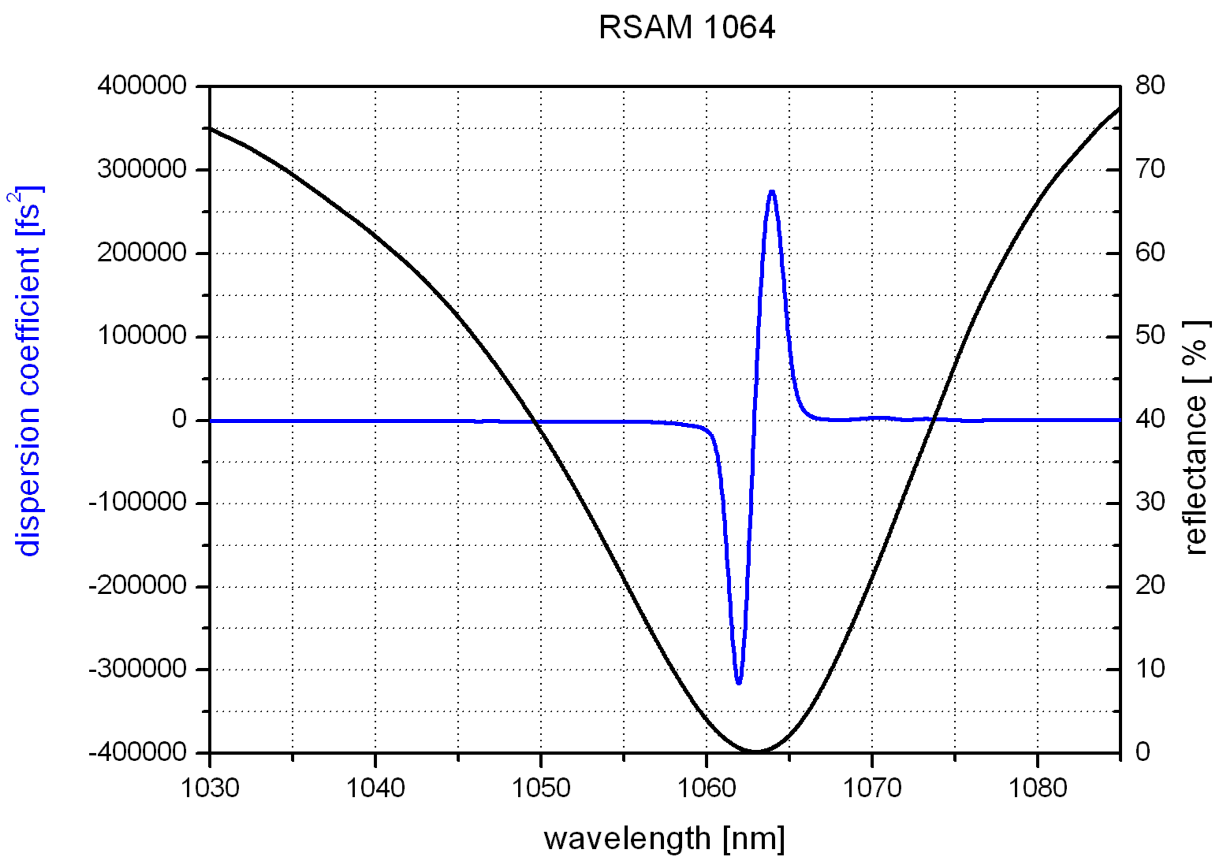

JAM 422 lb
angle of incidence 13°
angle of incidence 0°
0,40
0,35
0,30
0,25
0,20
0,15
0,10
0,05
0,00
reflectance
1045
1050
1055
1060
1065
1070
1075
wavelength [nm]

Dispersion:

Group Delay Dispersion (GDD)

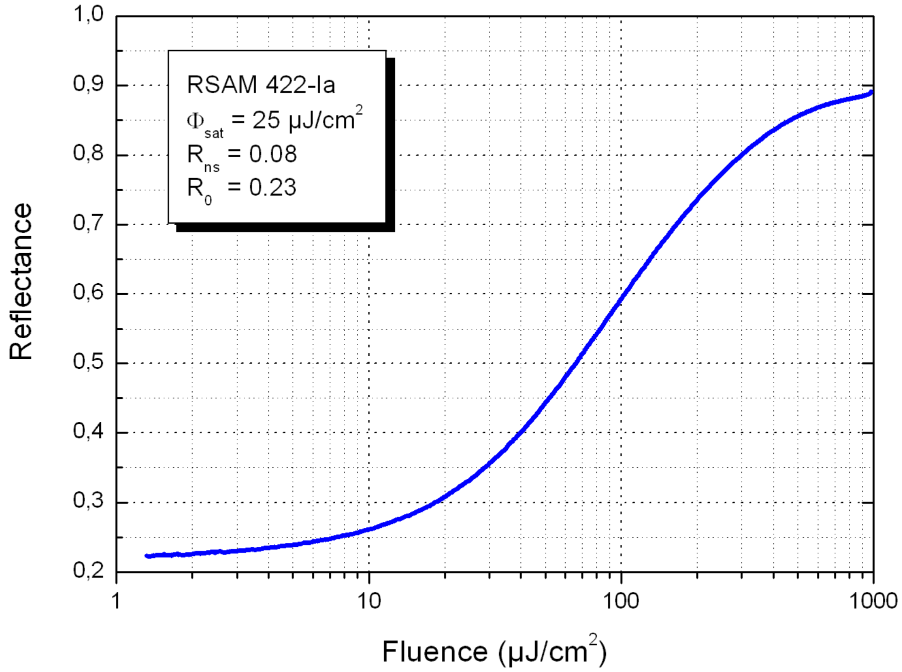
Dispersion coefficient $D_2(\omega) = \frac{\partial^2 \varphi}{\partial \omega^2}$ with φ - reflected phase

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

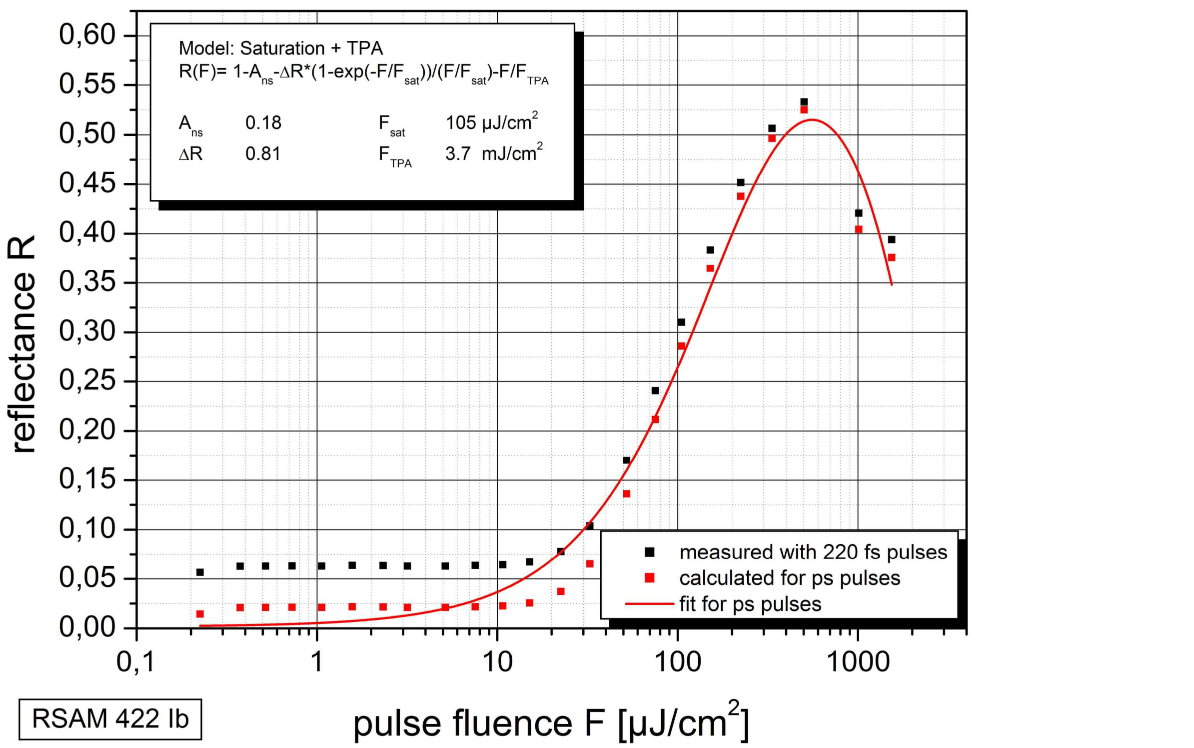


Saturation:

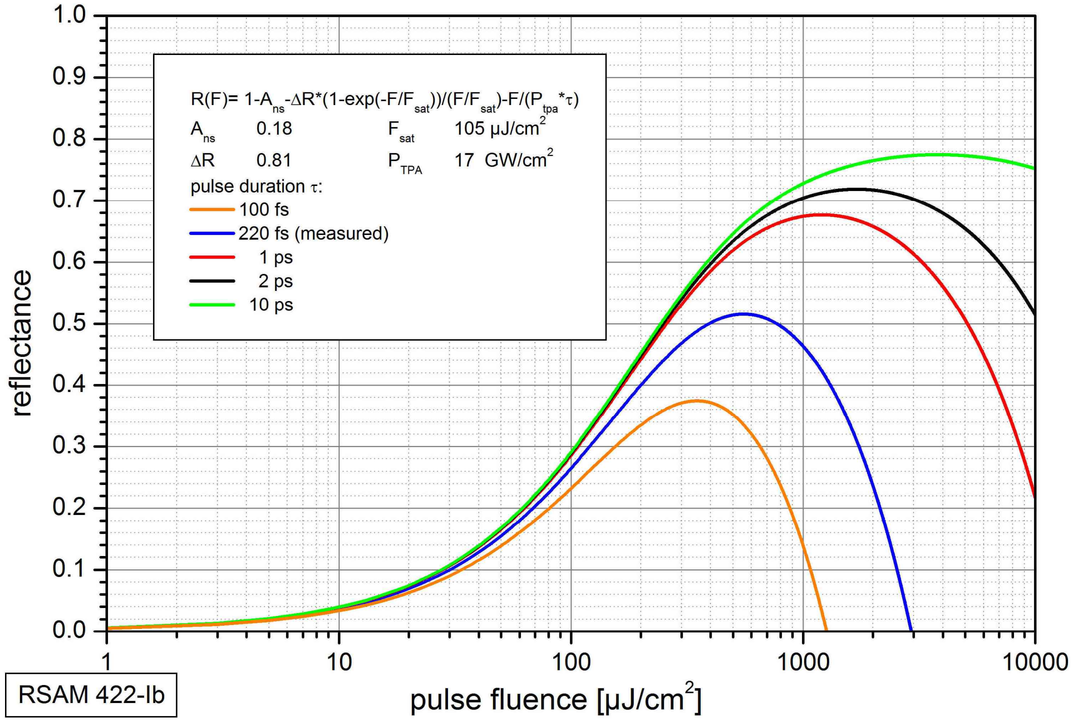
The reflectance depends on the input pulse fluence Φ.



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 %.

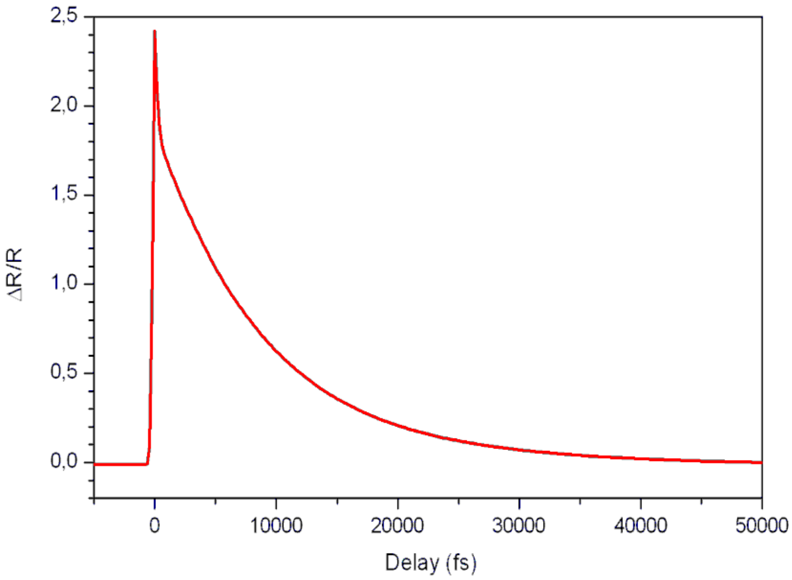


This saturation measurement has been done with 220 fs pulses, where the pulse spectral width of ~ 20 nm is as large as the spectral bandwidth. The red points are re-calculated for ps pulses. Due to the high peak power density of the fs pulses the TPA is significant.

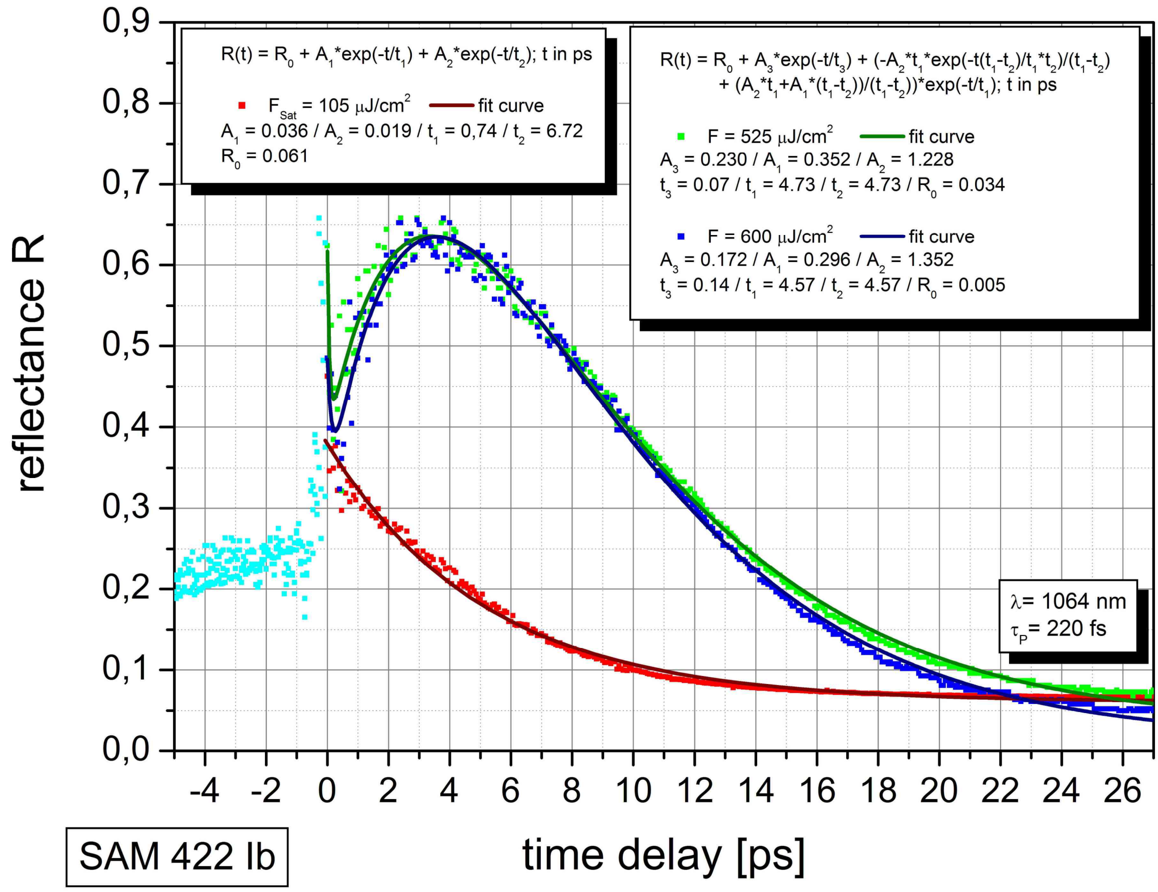


Calculated saturation curves for different pulse duration τ, based on the measured saturation above with a pulse duration of 220 fs. The non-saturable loss increases with decreasing pulse duration.

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

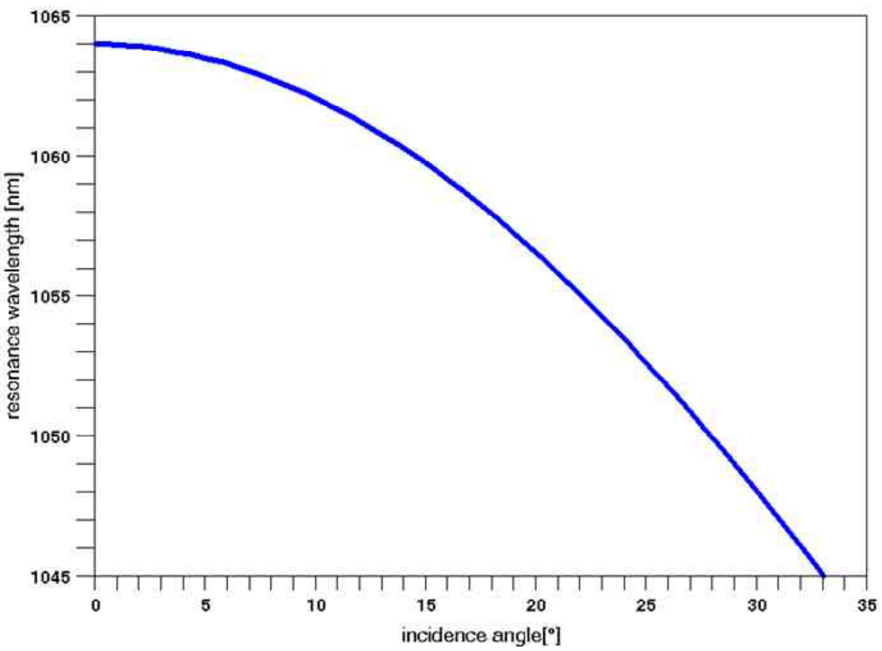
$$\lambda(\varphi) = \lambda_0 \sqrt{1 - \frac{\sin^2 \varphi}{n^2}} \qquad (1)$$

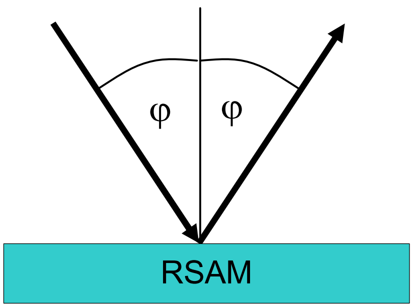
The zero resonance wavelength λ_0 is determined by the index of refraction n and the geometrical thickness d of the absorbing spacer layer inside the Gires–Tournois interferometer by

$$\lambda_0 = 2nd. \qquad (2)$$

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 λ_0 = 1064 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

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

with

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 φ = 0°. To adjust in this case the working wavelength to the resonance wavelength a thermoelectric cooler (TEC) or heater can be used.