SAS at FIR / sub-mm: (MF - RAL/SSTD, 01/06/04)

Starting with central wavelength $\lambda_0 = 200\,\mu m$
(i.e. $\sigma_0 = 50\ cm^{-1}$)

→ Resolving power: $R = 4W\sigma \sin\theta = \dfrac{\sigma}{\delta\sigma}$

Grating equation gives, for Littrow mount at λ_0,
$\sigma_0 \cdot 2d\sin\theta = m$

$\Leftrightarrow \quad 2d\sin\theta = m\lambda_0$

At central λ_0: $R_0 = \dfrac{\sigma_0}{\delta\sigma} = 4W\sigma_0 \sin\theta$

W = width of grating $= \underset{\text{nb of period}}{n} \cdot \underset{\text{grating period}}{d}$

$R_0 = 4nd\sigma_0\sin\theta = 2n \cdot \underbrace{(2d\sigma_0\sin\theta)}_{=\underset{\text{grating order}}{m}}$

so that spectral resolution is:
$\delta\sigma = \dfrac{\sigma_0}{2nm} \quad \Leftrightarrow \quad R_0 = 2.n.m$

If we want $R_0 \simeq 1000 \Leftrightarrow n.m \simeq 500$

Lets assume that for a compact system, W is at max $\simeq 75\,mm$ which gives:

if $m = 10 \rightarrow n = 50 \rightarrow d = 1{,}5\ mm\ (= 7{,}5\,\lambda_0)$
if $m = 1 \rightarrow n = 500 \rightarrow d = 0{,}15\ mm\ (= 0{,}75\,\lambda_0)$