

# Longitudinal Diagnostics with THz Radiation

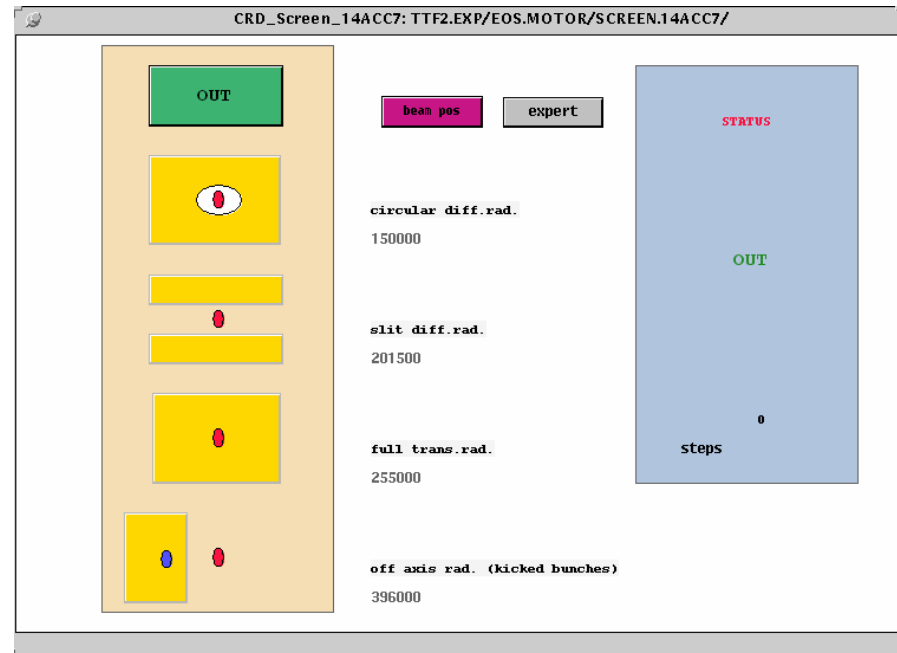
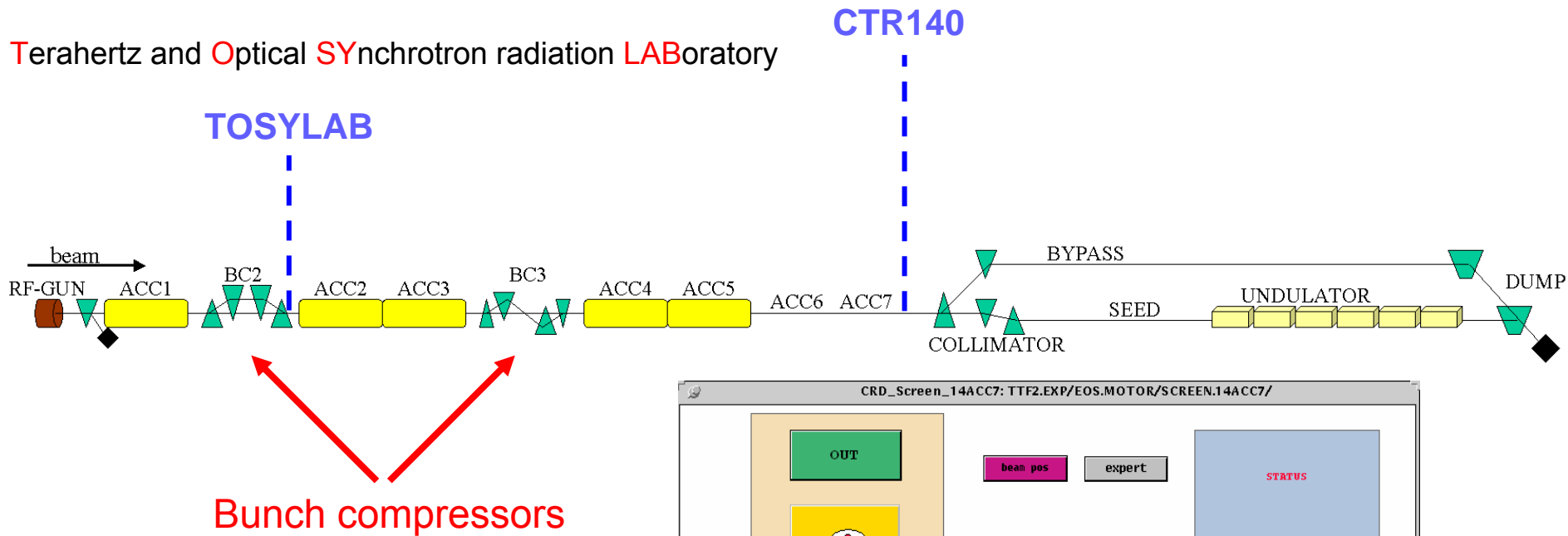
May 16<sup>th</sup> 2006

H. Delsim-Hashemi

O. Grimm, B. Schmidt, P. Schmueser

# FLASH layout and infrared radiation beam-lines

Terahertz and Optical SYNchrotron radiation LABoratory



*spectral energy density*

$$\frac{dU}{d\omega} = C N^2 |F_{long}(\omega)|^2 T(\omega, \gamma, r_b, \theta, source)$$

$$F_{long}(\omega) = \int_{-\infty}^{\infty} \tilde{\rho}(t) \exp(-i\omega t) dt$$

normalized charge density

- integral intensity



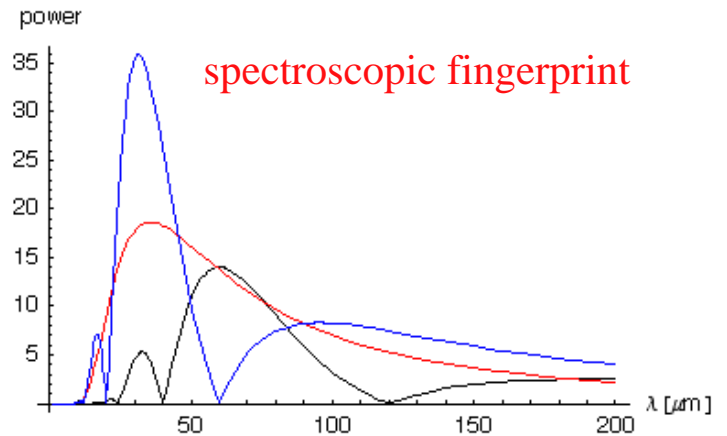
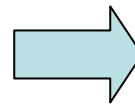
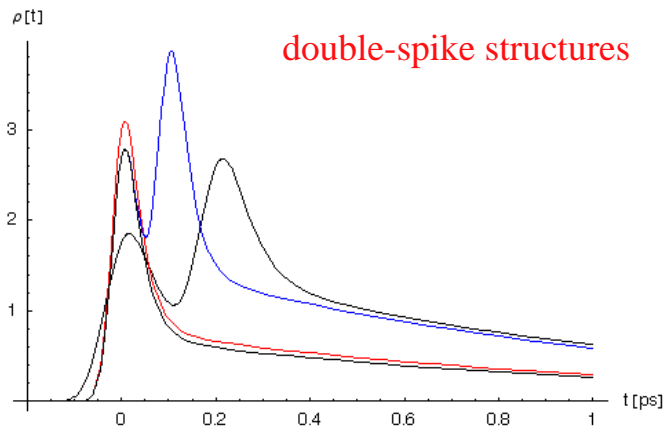
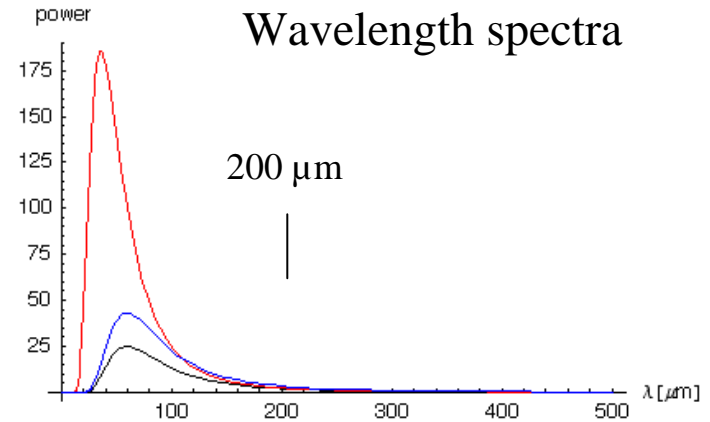
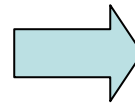
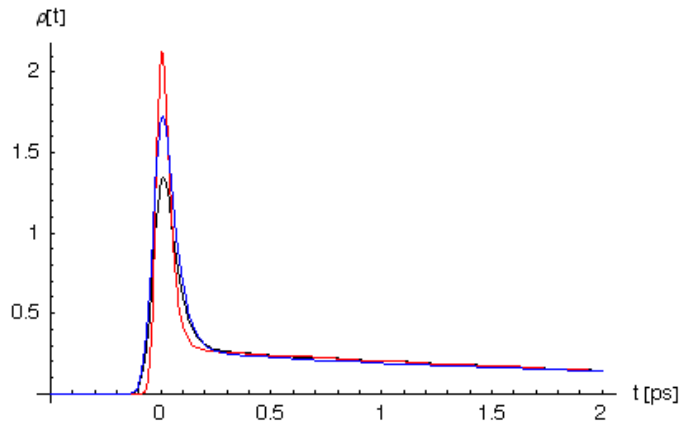
'compression factor', effective bunch length

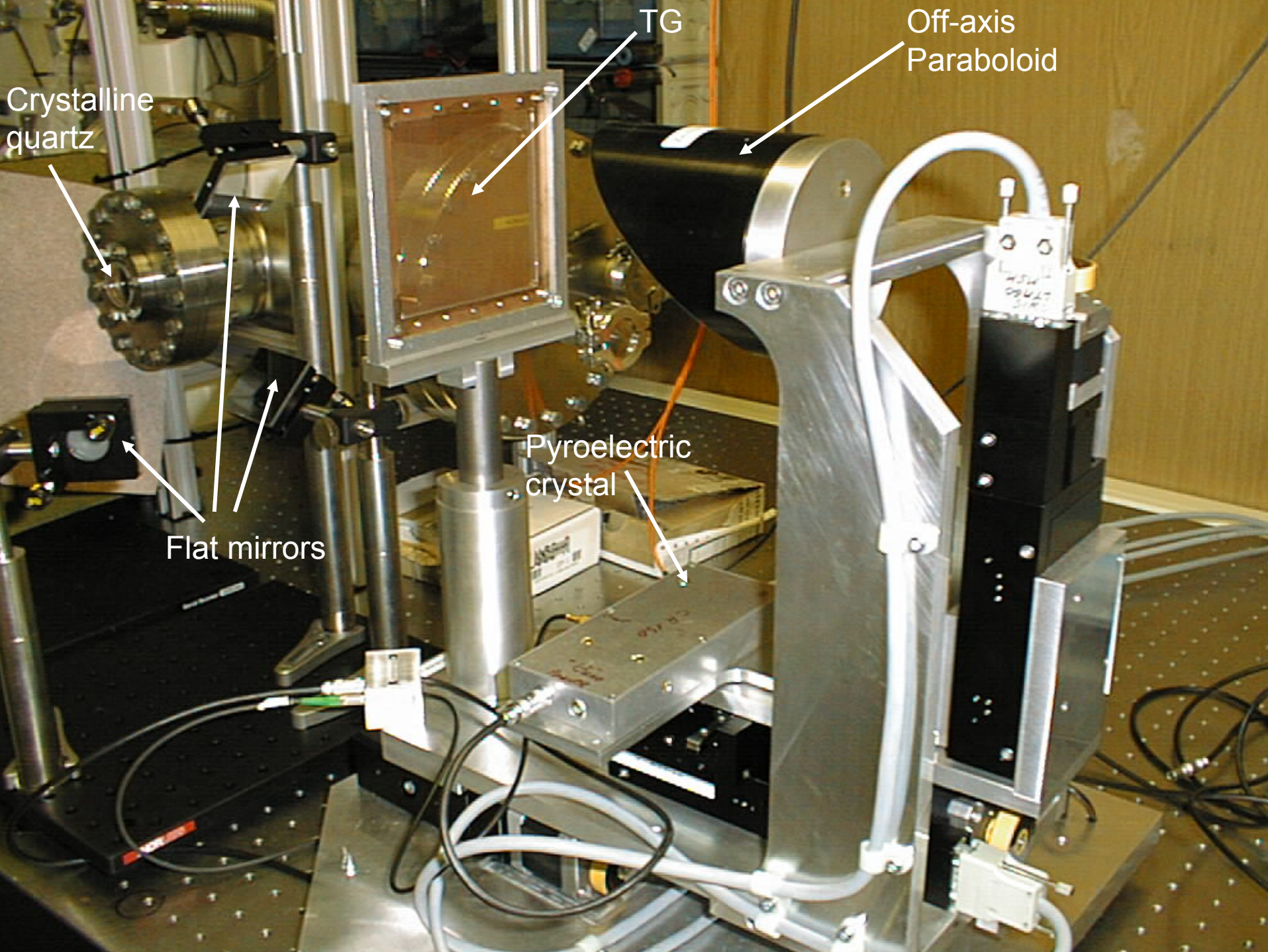
- spectral resolved intensity



+ bunch structure, 'longitudinal fingerprint'

# Wavelength range of relevance





Crystalline quartz

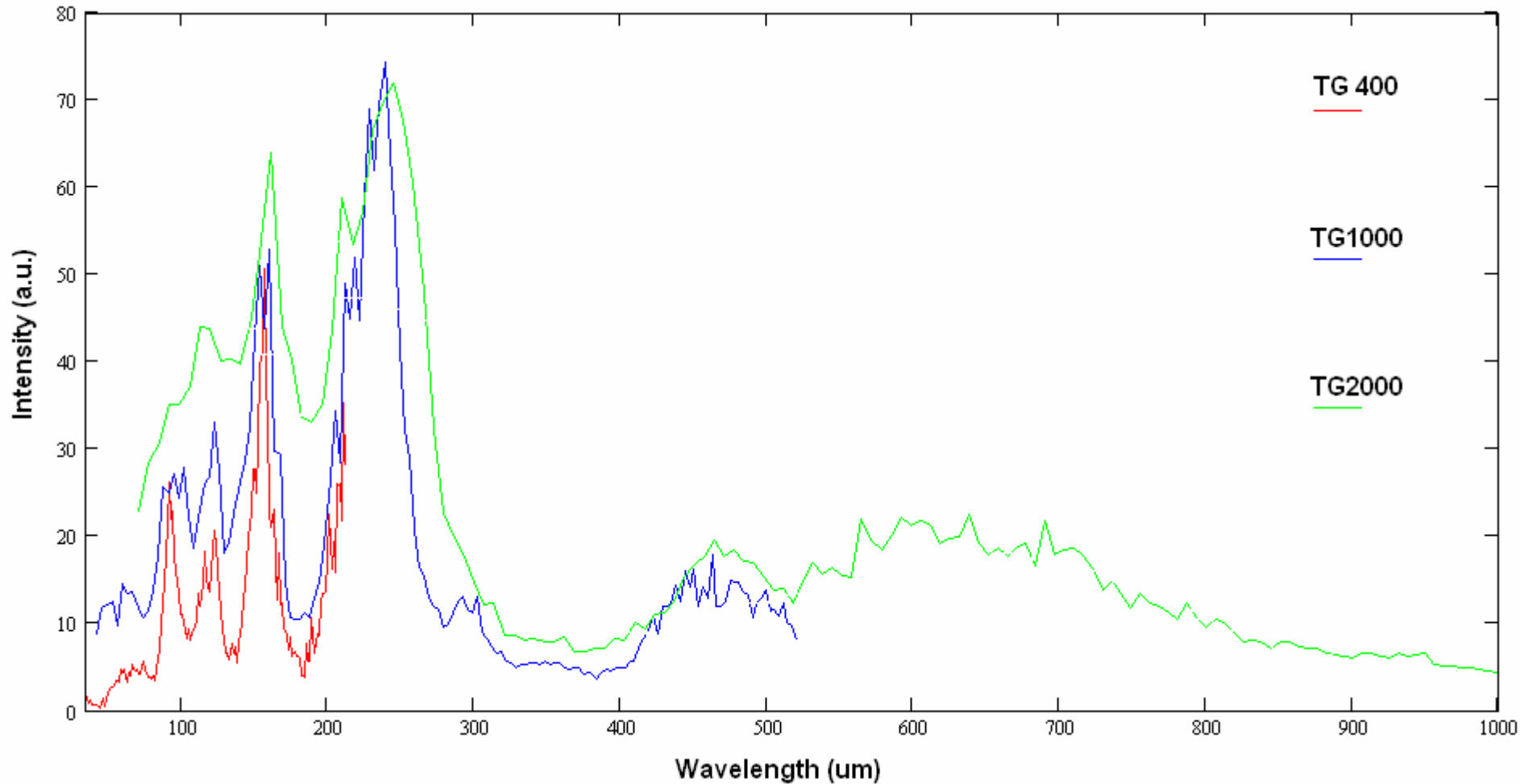
TG

Off-axis Paraboloid

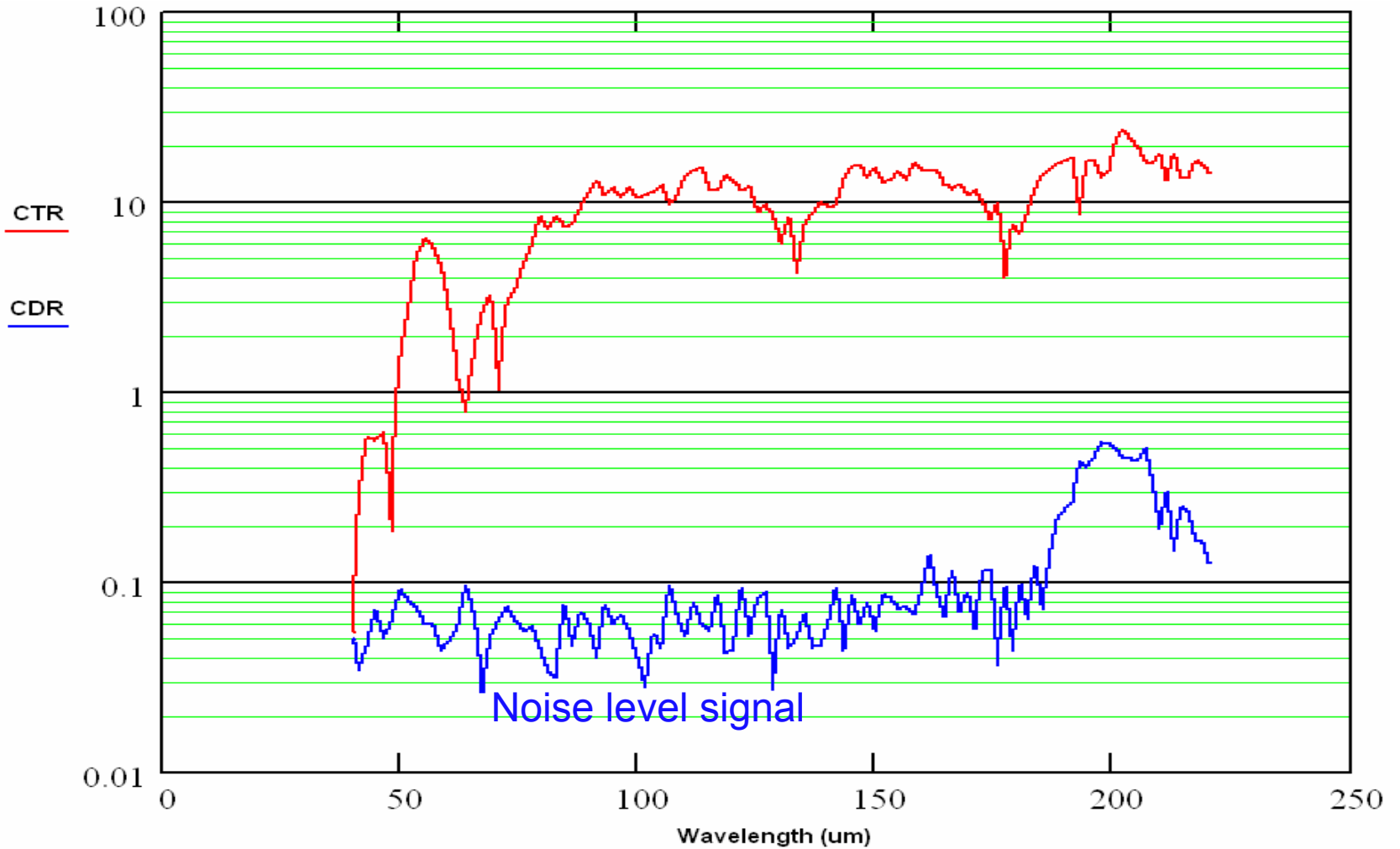
Pyroelectric crystal

Flat mirrors

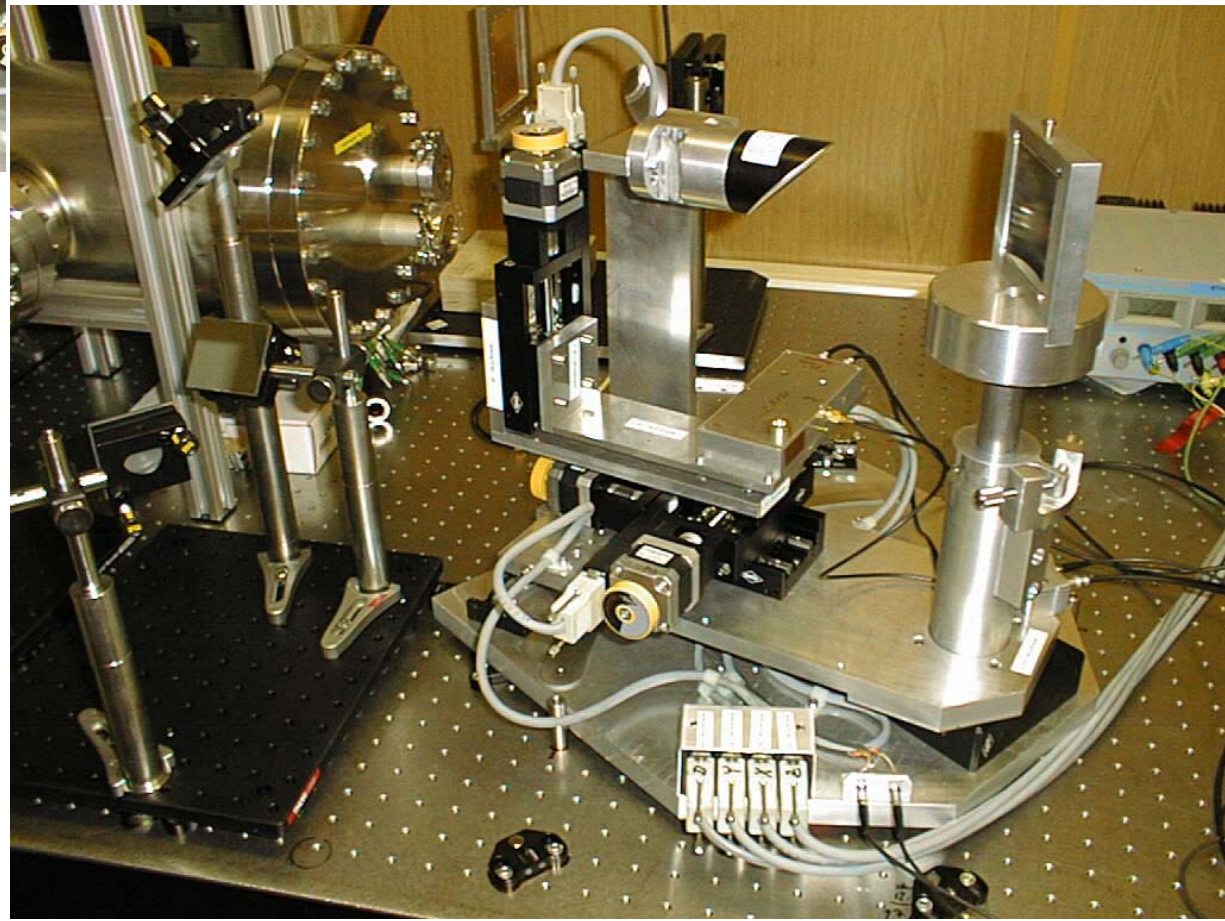
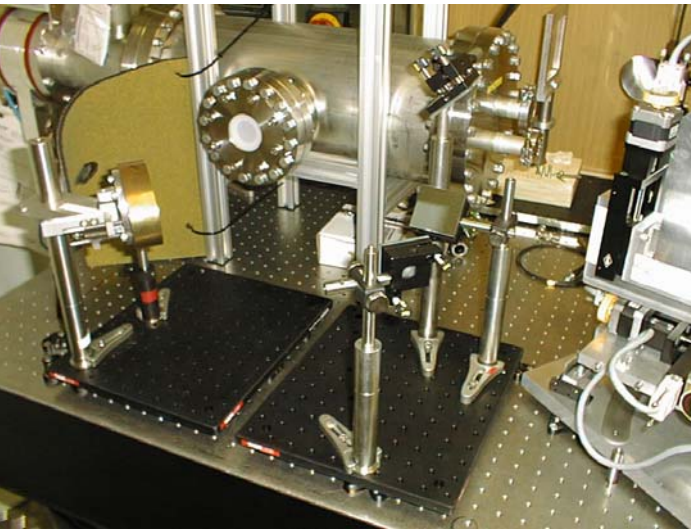
30 bunches, slit diffraction radiator, standard pyroelectric detectors



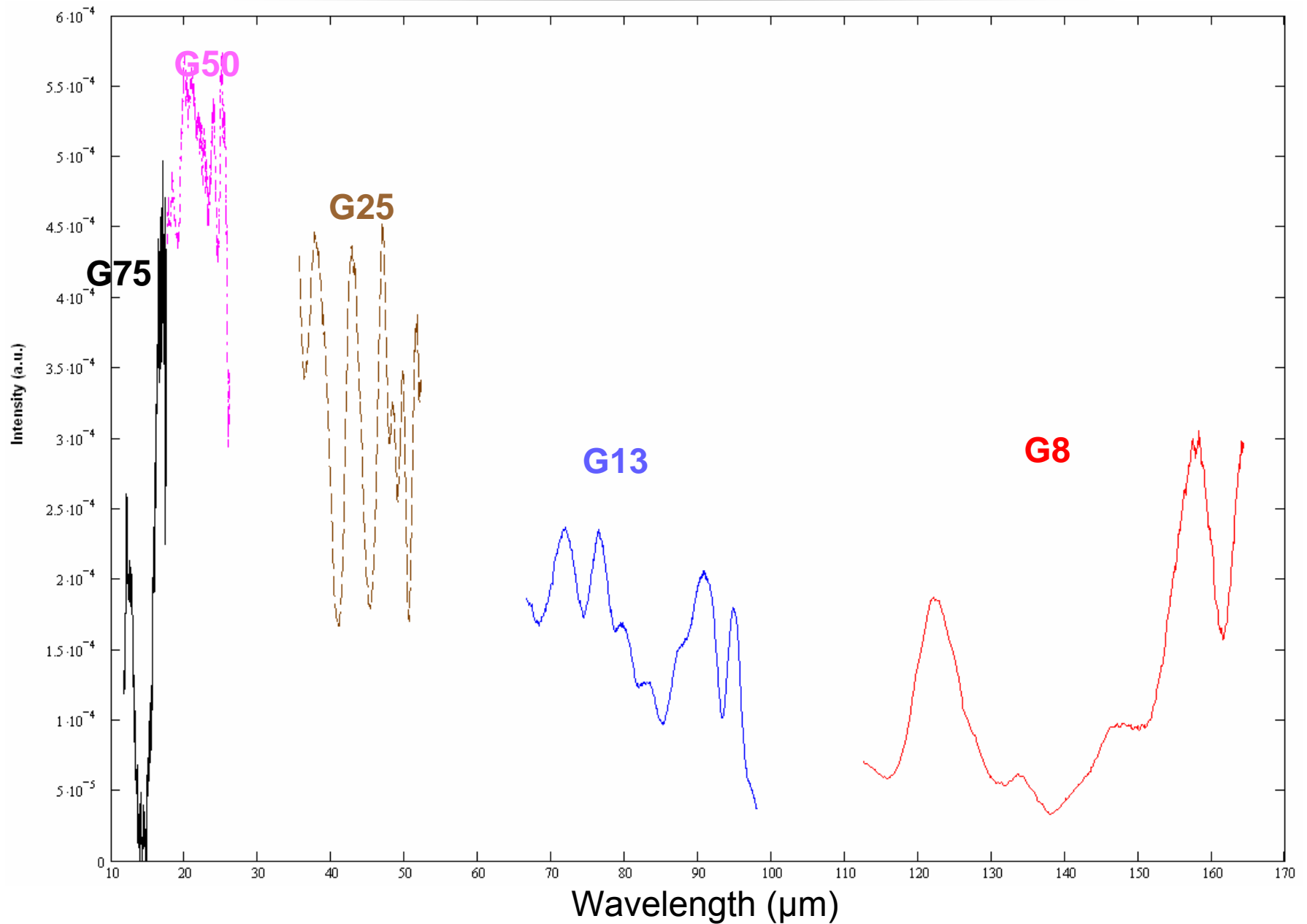
Using flat response Golay-cell detectors, it is shown that in order to study short wavelengths part of the spectra CTR has to be used.

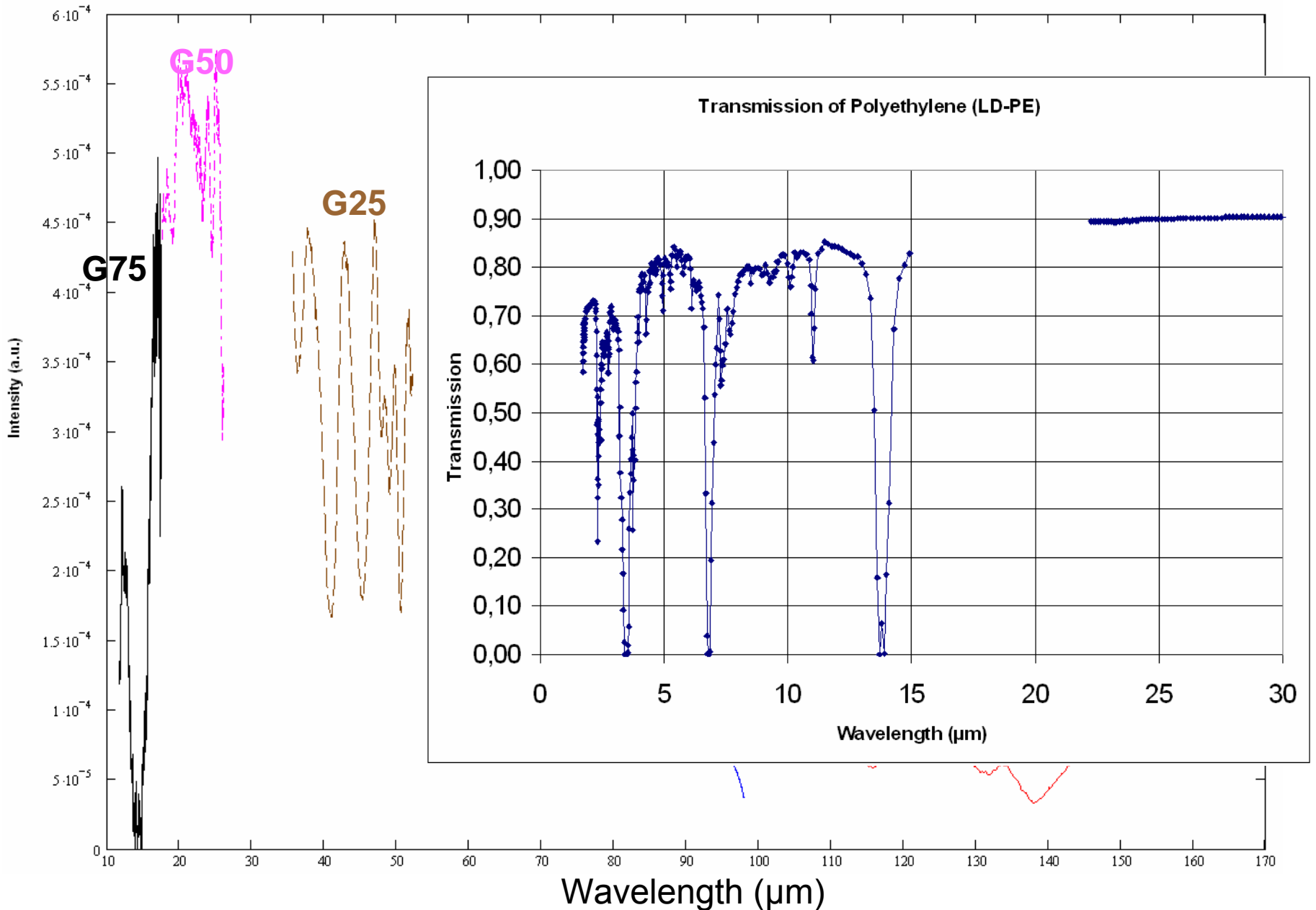


# Rotating mirror spectrometer-reflectance grating

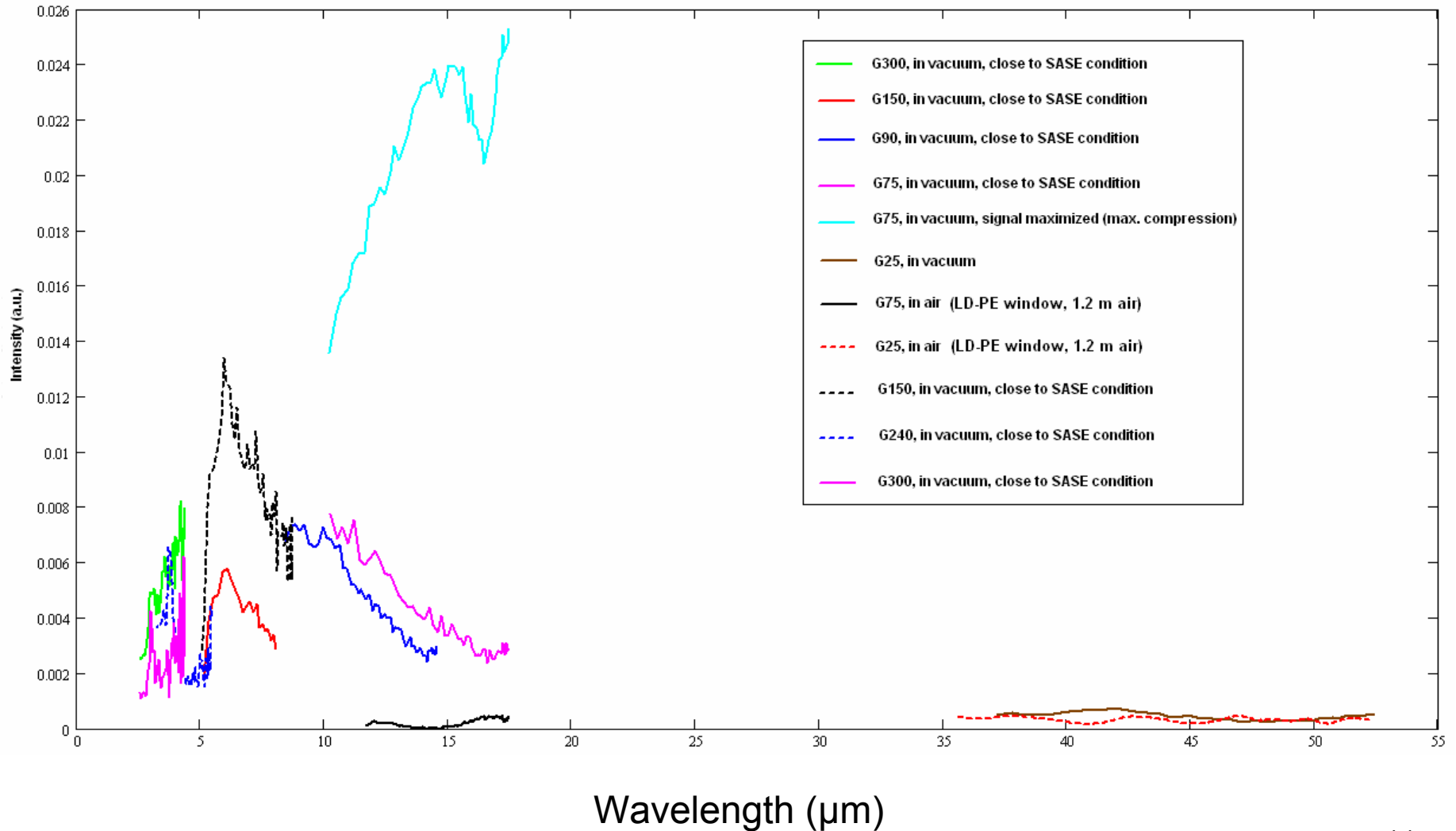




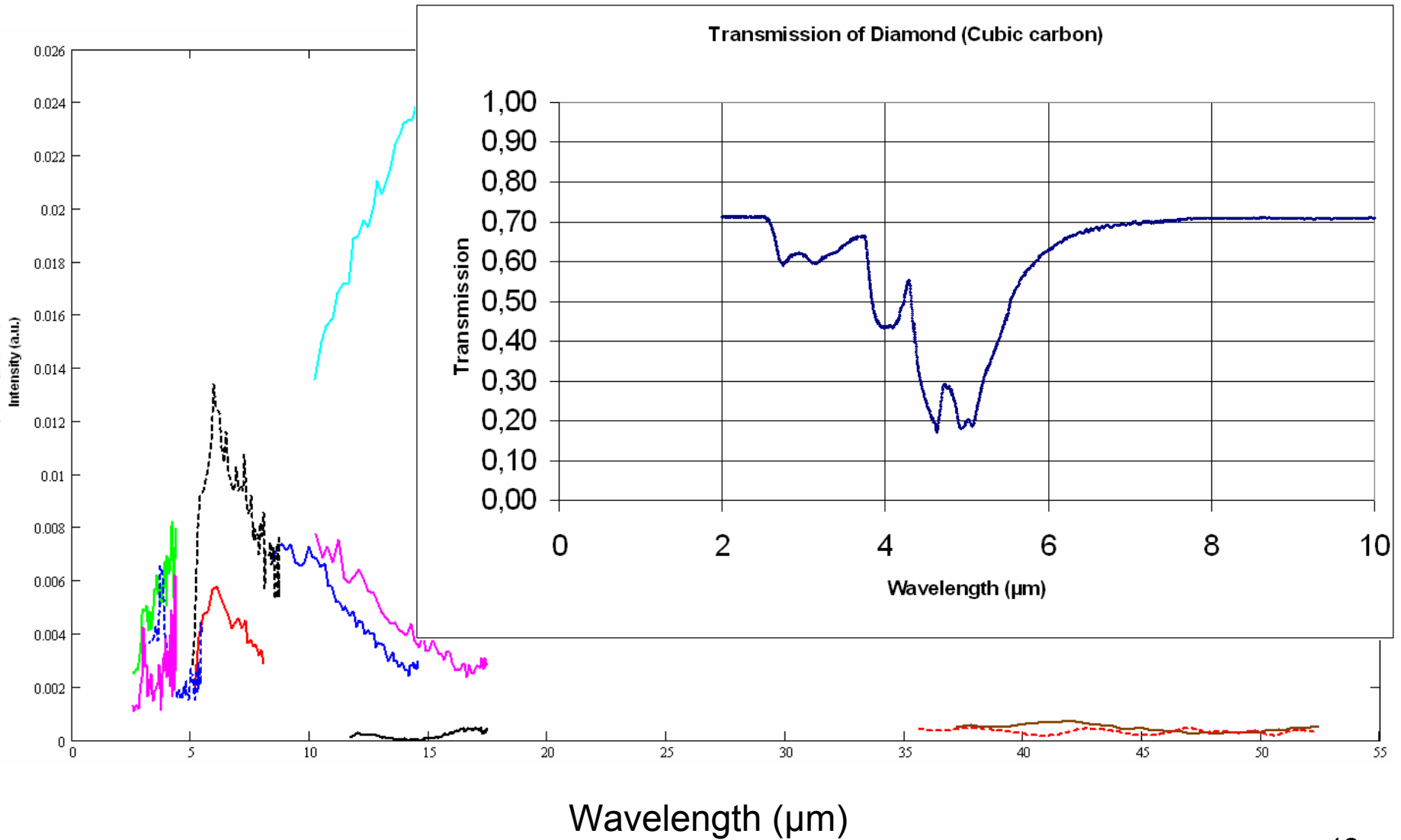




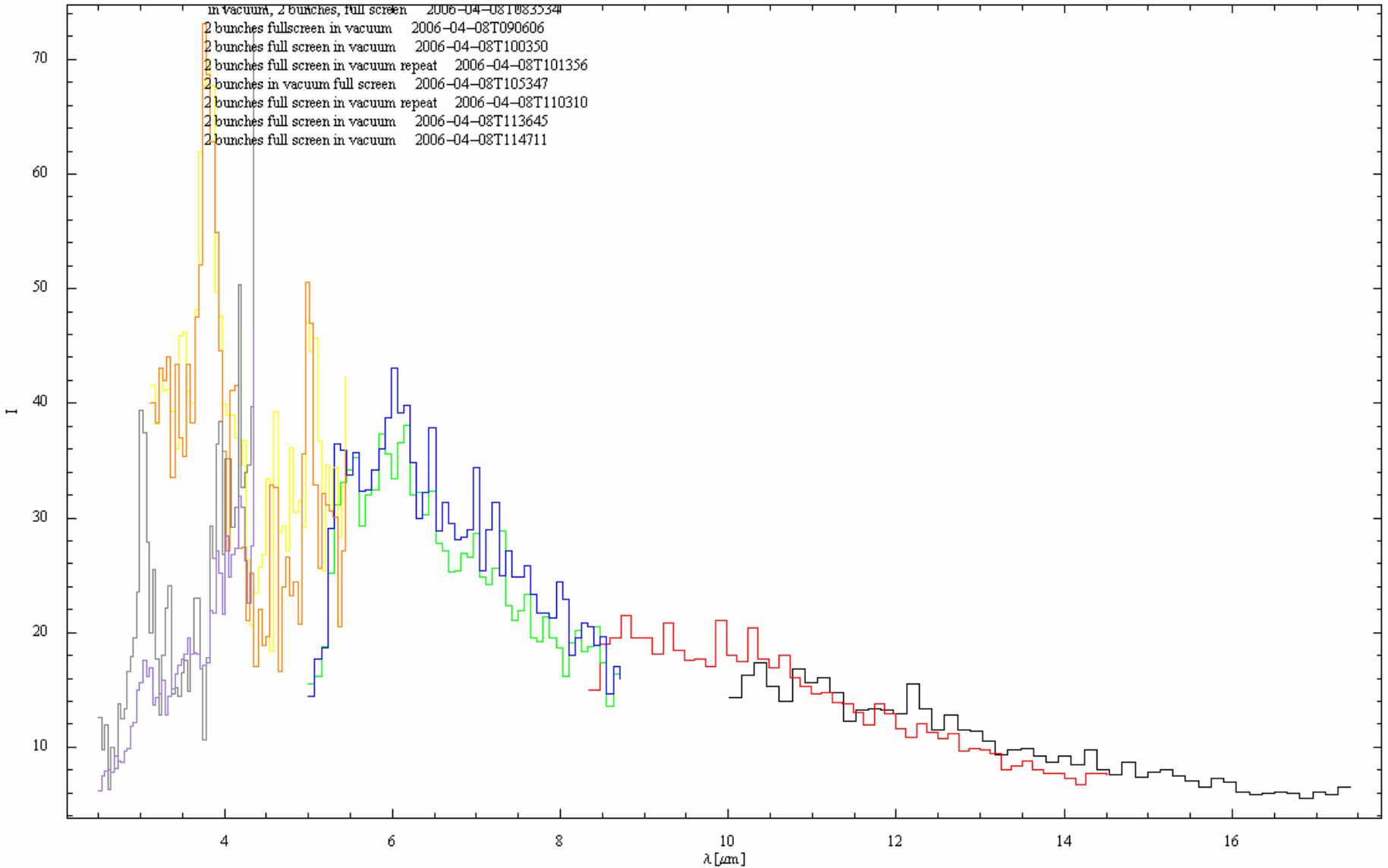
# Rotating mirror spectrometer-reflectance grating (short wavelengths in vacuum )



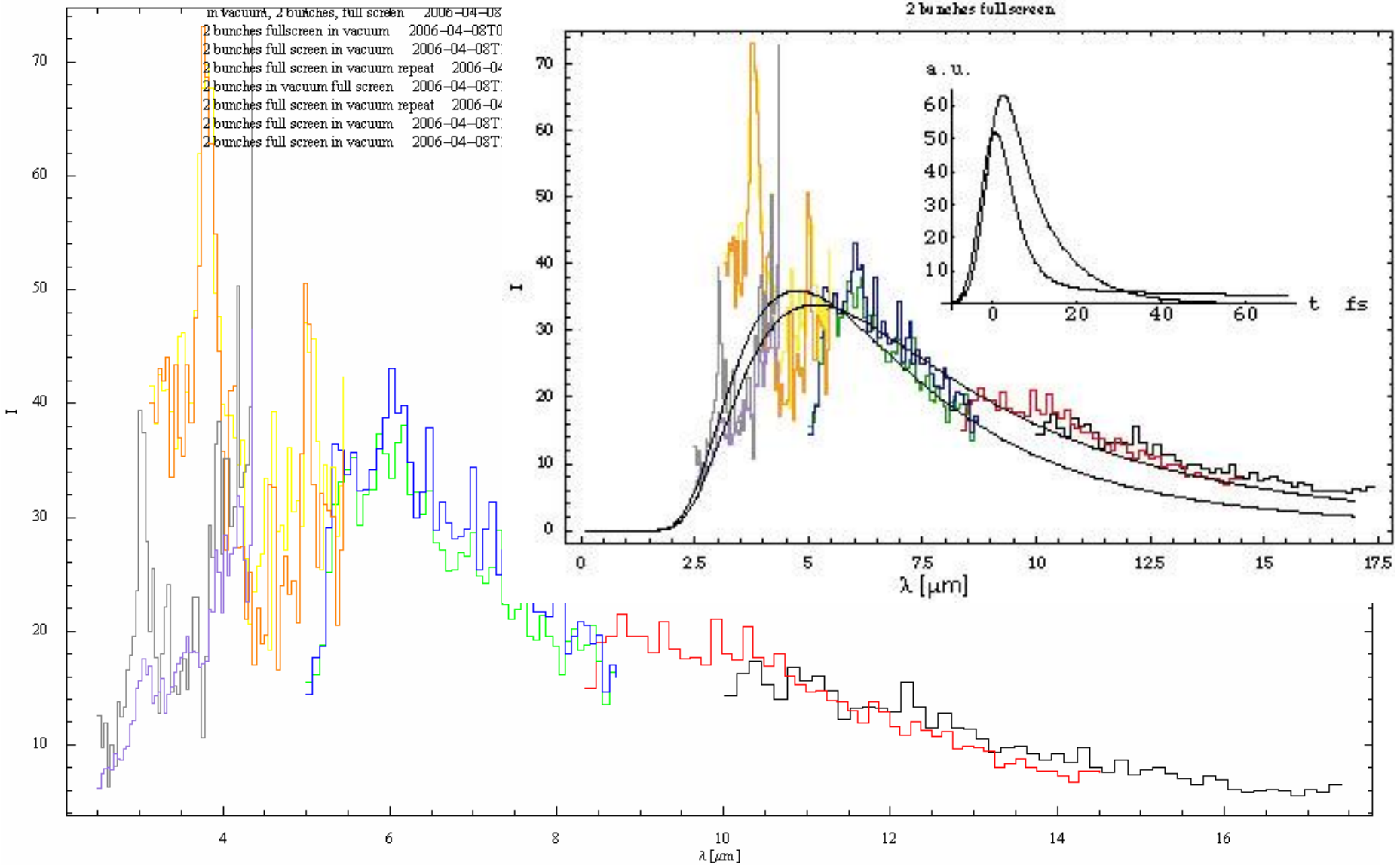
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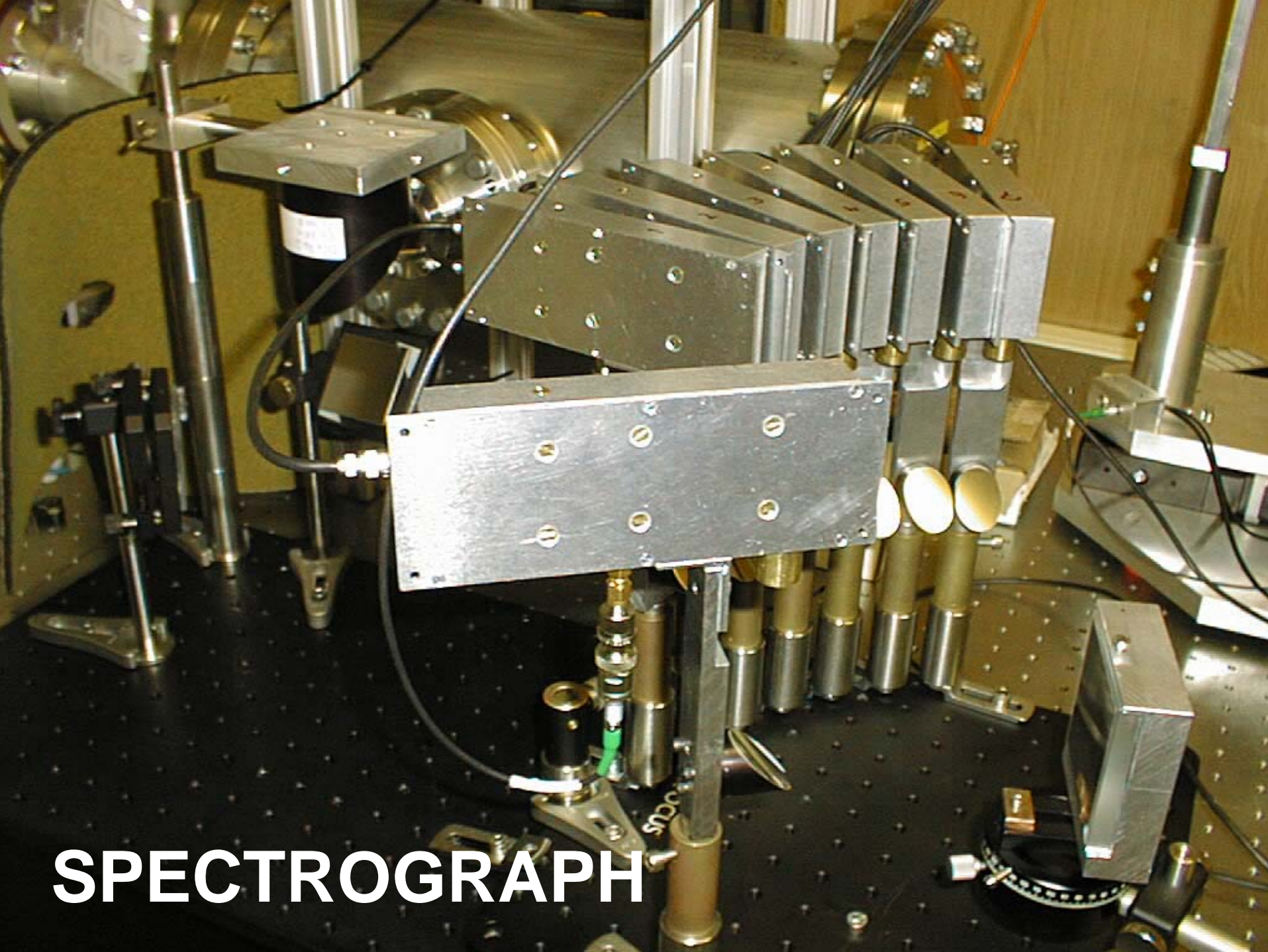


# Rotating mirror spectrometer-reflectance grating (short wavelengths in vacuum)



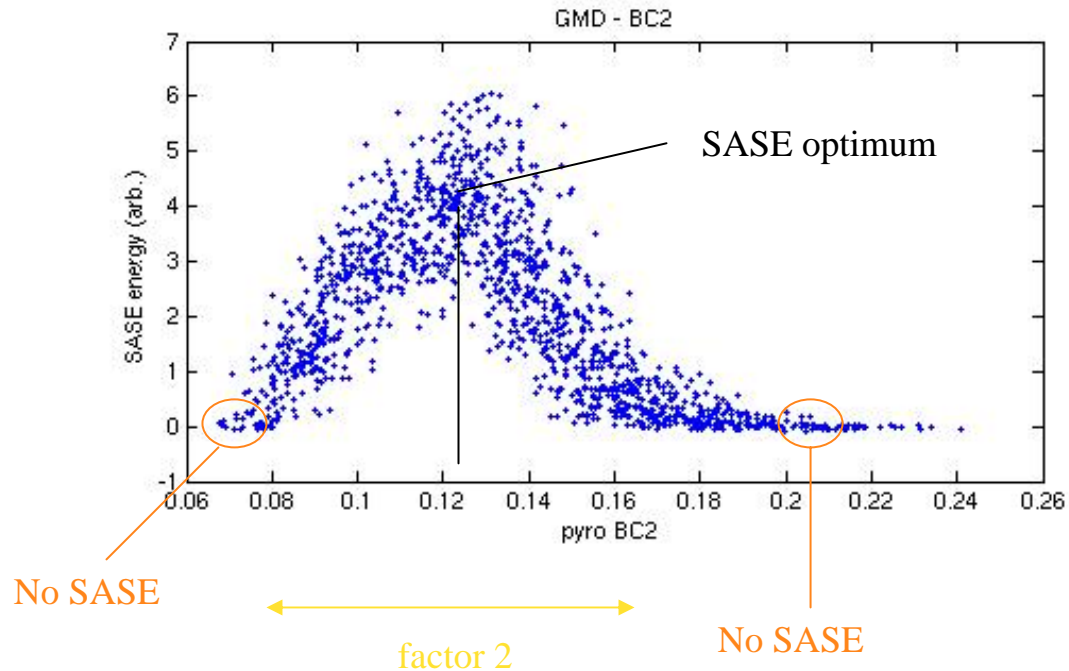
# Rotating mirror spectrometer-reflectance grating (short wavelengths in vacuum)





**SPECTROGRAPH**

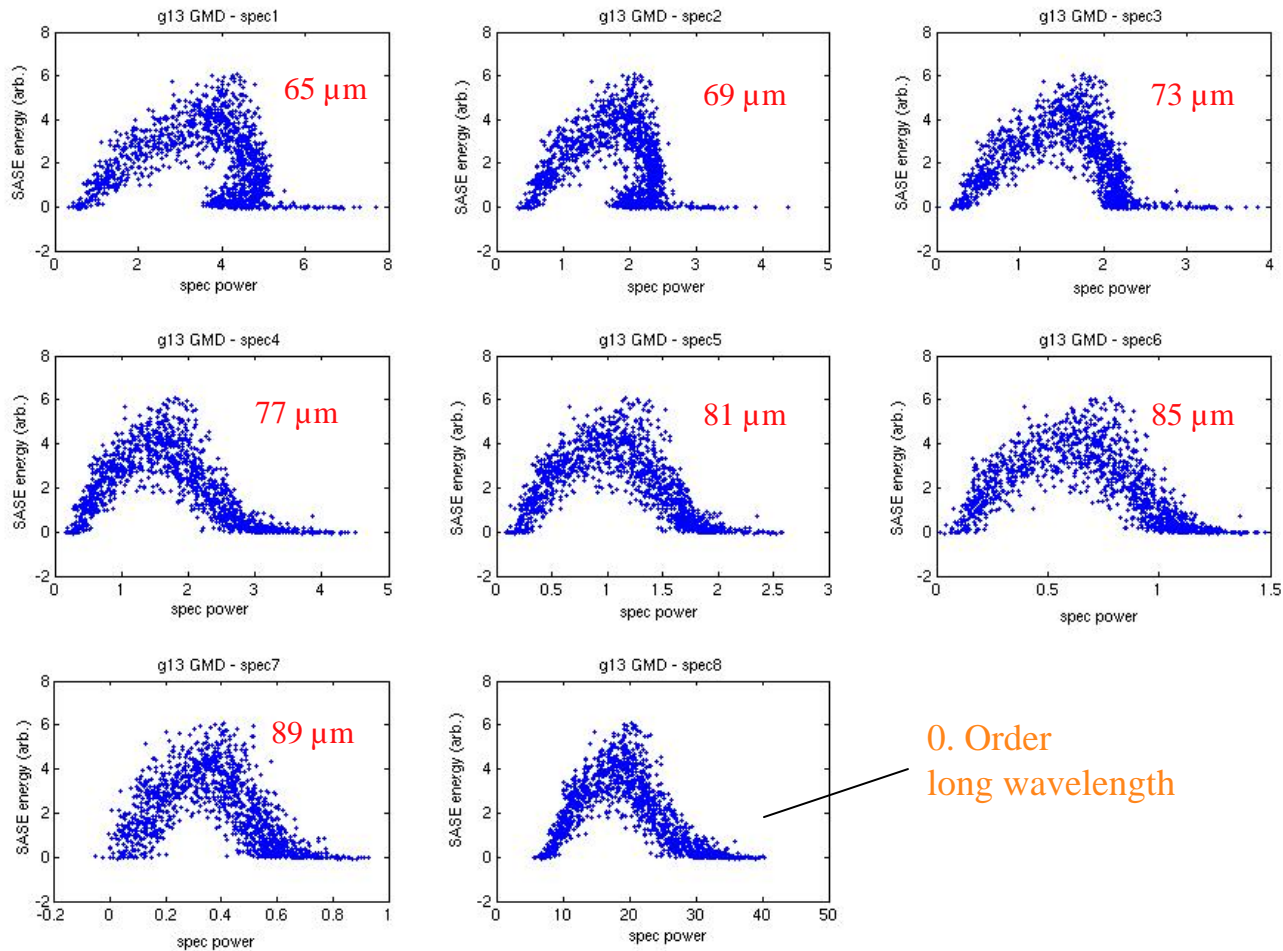
## BC2 compression monitor

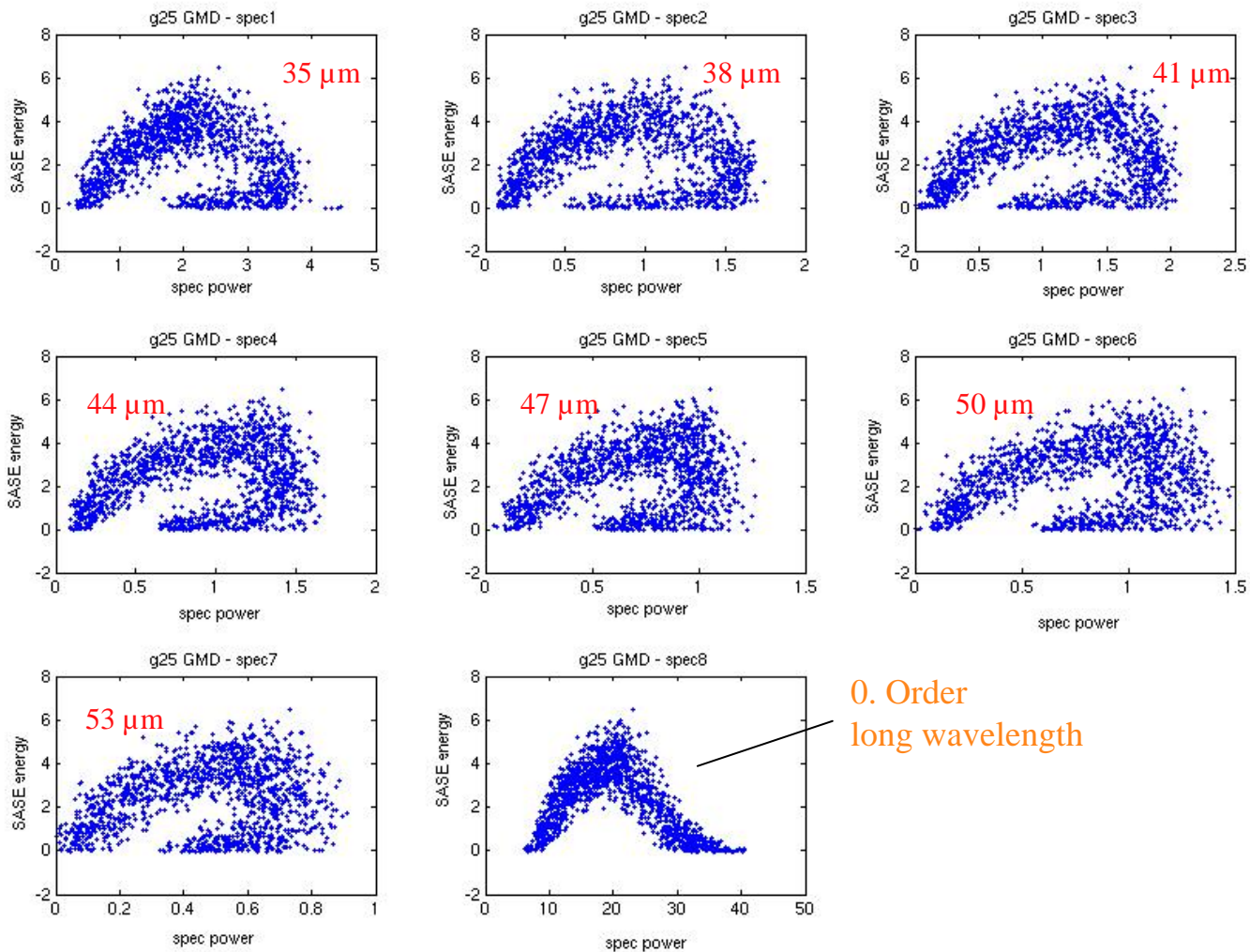


- compression (BC2) fluctuates from 'under' to 'over' compressed



# Correlations SASE - short wavelengths - I





SASE correlation to shortest wavelengths that more correspond to the spike

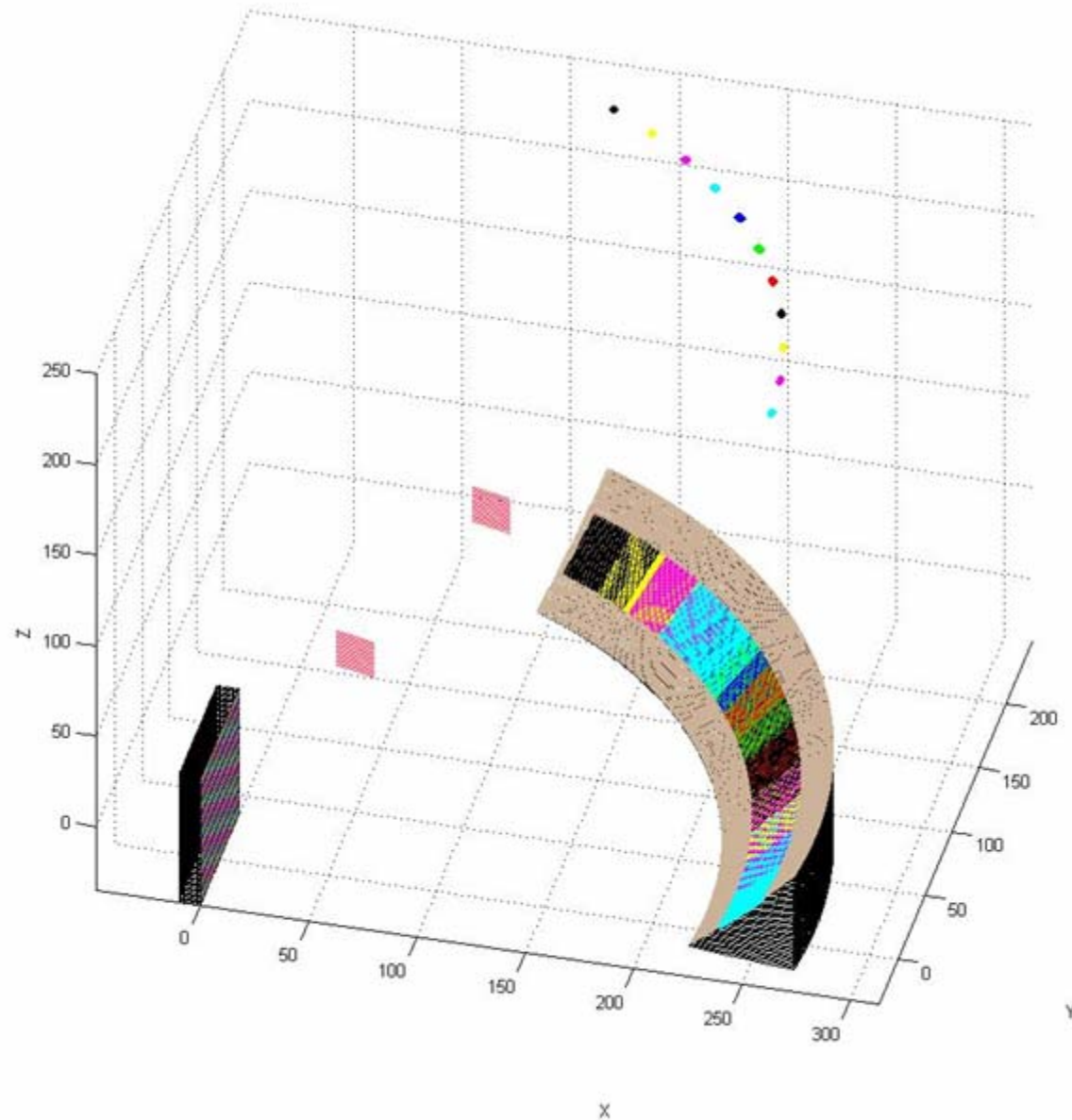
The circuit which makes it possible to readout from 30 pyro-detectors and has amplifiers all in one unit

Set-up the spectrograph stages based on the new designed mirror and readout

SASE correlation to shortes

The circuit which makes it p  
has amplifiers all in one unit

Set-up the spectrograph sta



The wavelength calibration of the spectrometers is checked with THz filters. The effects of crystalline-quartz, LD-PE and diamond window transmission are clearly observed.

The suppression of short wavelengths with diffraction radiator is clearly seen, for most interesting part of the spectra, short wavelengths, transition radiation should be used.

Pyro-electric detectors could be used as detectors.

Already first measurements in vacuum show very short structures in the FLASH electron bunch.