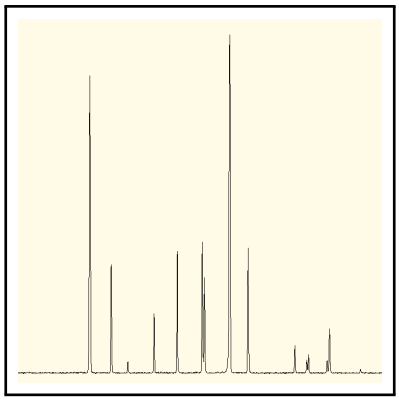
Eureca Line Scan Cameras
Application example spectroscopy

Czerny-Turner Spectrometer

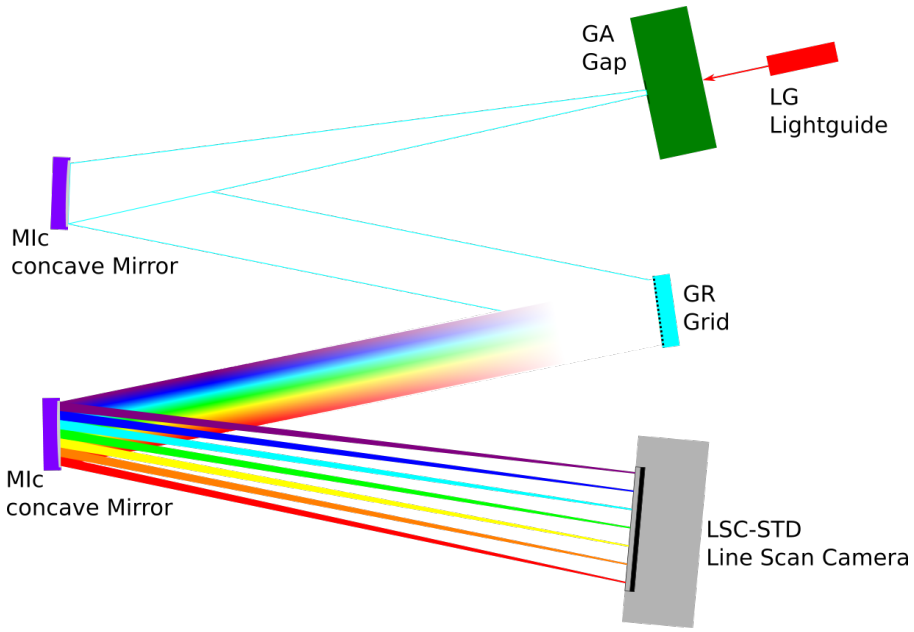


The Eureca line scan camera e9u-LSMD-TCD1304-STD allows for demanding measurements with high spectral resolution at a relatively low price. This makes it ideal for use in schools or internships. Shown here is the Czerny-Turner spectroscope as an applicational example. Detailed instructions are available per request.
The line scan camera is based on Toshiba's TCD1304DG linear sensor and offers 3648 pixels of 8 µm × 200 µm each. Due to the relatively large pixel height, this detector is ideally suited for use in low-light applications, such as in spectroscopy.

1 Physical basics

Czerny-Turner spectrometers utilize two concave mirrors to widen or focus the beam path. The light to be analyzed is coupled in via a light guide and hits the gap GA. The first concave mirror MIc is at the distance of its focal length from the gap and thus parallelizes the light emerging from the gap. The parallel light beam strikes the grating GR and is split spectrally. The second concave mirror MIc then directs the light to the line scan camera LSC-STD as a detector, which is at the focal length distance from the second MIc.

principle sketch



Advantages: beam path easy to comprehend, therefore well suited for didactic purposes. The coupling of the light via a light guide makes the setup very flexible and easy to use for a wide variety of measurements.

Disadvantages: relatively many optical elements that have to be adjusted to each other. A reduction in the number of optical elements can be achieved by using a self-focusing grating.

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2 Experimental Setup

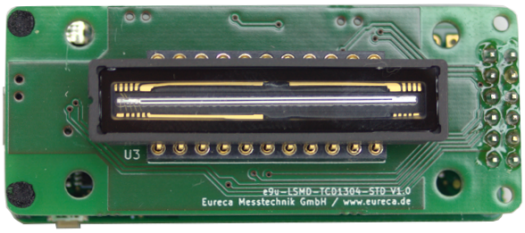
One way to assemble a Czerny-Turner spectrometer is to fabricate a base from aluminum profiles and slide the optical components into 3D-printed holders. The price for the entire setup with high-quality optical components is around 800 €.

List of core components

Designation	Type	Sum
LG	light guide Ø 600 µm fiber	90 €
GA	adjustable gap	250 €
GR	grating 300 line pairs	110 €
MIc	2 concave mirrors, 200 mm focal length	160 €
LSC-STD	line scan camera	150 €
material set	Flat rate 3D printing, aluminum base	40 €

Photo of the Czerny-Turner spectrometer

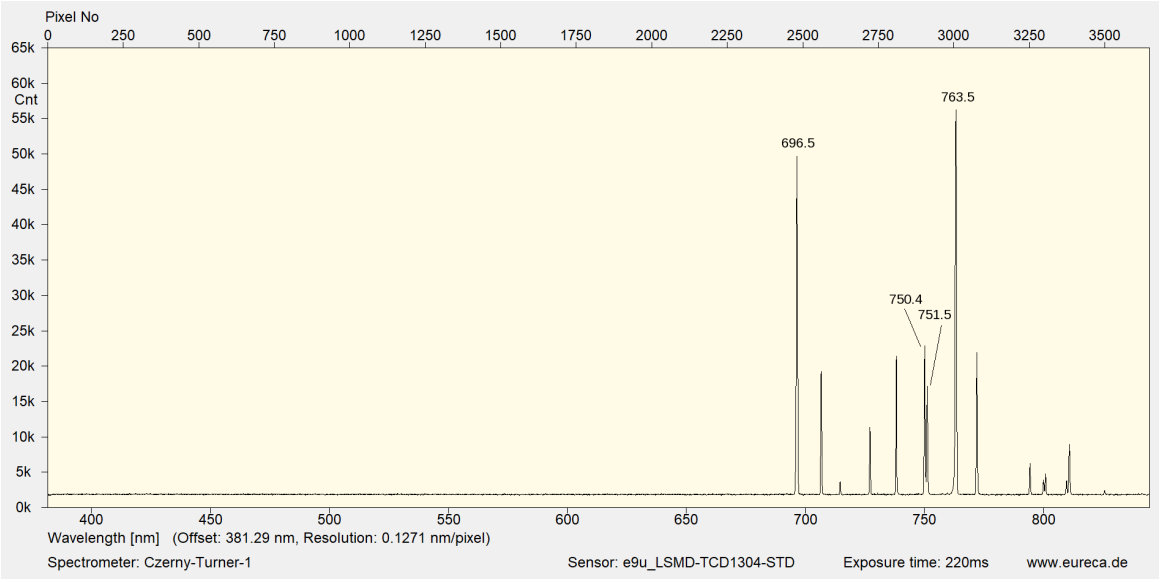
Line Scan Camera e9u-LSMD-TCD1304-STD with Toshiba sensor TCD1304DG



3 Spectrum

Example of a spectrum of a Pen-Ray LSP030 argon spectral lamp from Quantum Design GmbH recorded with the test setup described. There are two closely related peaks in the spectrum at 750.4 nm and 751.5 nm. The spectrometer easily separates these peaks from each other.

Sample spectrum of an argon light source



More on our website: https://www.eureca.de/LSC/.

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