
Advanced Features of InfraTec Pyroelectric Detectors

3. Beamsplitter Detectors - even for the narrowest signal beams

The principle of the multi-color detector with integrated beamsplitter is shown in the following picture. The IR radiation entering through the aperture stop is divided by a beamsplitter in two or four parts (4 channel pictured). Each of the partial beams goes through an IR filter and then hits a pyroelectric detector chip. This design works well with single narrow-beam sources, or in situations where contamination (dust, insects) in the light path could be an issue.

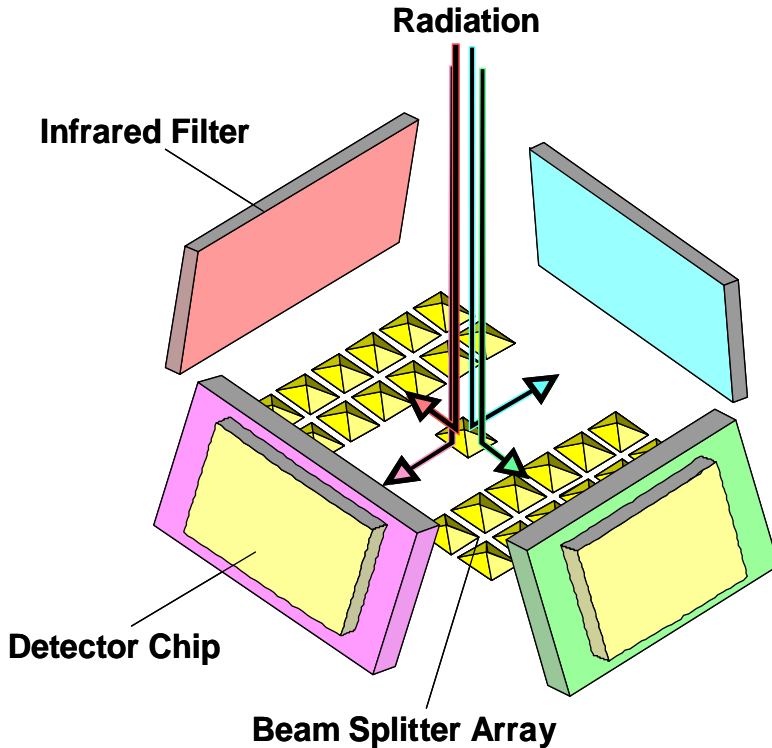


Fig. 1: Principle of reflective beamsplittering

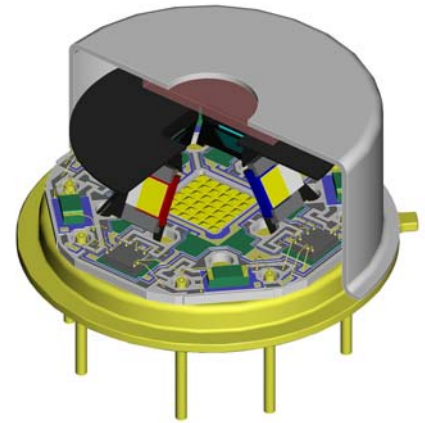


Fig. 2: 3-D Design LIM-054

3.1. General design

The beamsplitters are made of gold plated microstructures for the two and four channel devices to achieve a homogeneous distribution of the radiance. The filters are mounted at a certain angle to obtain a normal incidence of the radiation. This configuration avoids drifts in the filter transmission curves to shorter wavelengths and the influence of the opposite filter (reflections).

In addition to four channel beamsplitter detectors using four-sided micro pyramids, InfraTec has also developed two channel detectors based on micro V-grooves. In the following figure SEM images of two and four channel beamsplitters are shown. The V-grooves pitch is 100 μm and the pyramids are 50 μm , with the tilt angle of the filters and detectors set at 30°.

Advanced Features of InfraTec Pyroelectric Detectors

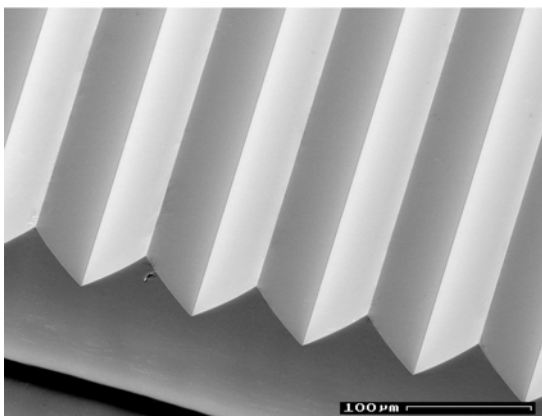


Fig. 3: Micro groove (2-channel)

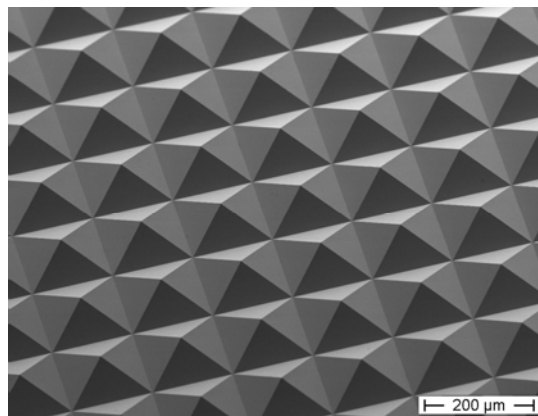


Fig. 4: Micro pyramids (4-channel)

3.2. Comparison to other multi channel detectors

The beamsplitter detector has a single aperture stop compared to other multi channel detectors. It is possible to use a gas cell with a smaller diameter reducing the gas volume. A smaller gas volume reduces the size of the sensor module and accelerates the gas exchange. Also, the signal ratio of all channels is independent from aging, mechanical shift or pollution processes among one another.

The **multi-color** detectors should be used for the analysis of gas mixtures with few known gases. Typical examples for a successful application are anesthetic gas monitors and the pulmonary function testing. **Variable color** detectors allow a more flexible operation of the analyzer enabling the detection of adjoining or overlapping absorption bands. So far the measurement of single gases like ethanol and carbon dioxide as well as gas mixtures of methane, propane and anesthetic gases have been tested. In the following table characteristics of the multi- and variable color detectors are summarized.

Detector Specification	Multi-color	Multi-color	Variable color
Principal	Individual Windows	Beamsplitter	Tunable Fabry-Perot Filter
Filtering	Parallel	Parallel	Serial
Area to be illuminated	Ø 9.5mm	Ø 2.5mm	Ø 1.9mm
Spectral Range	(2...25) µm	(2...25) µm	(3.0...4.1) µm and (3.9...4.8) µm
Current Mode	Yes	Yes	Yes
Voltage Mode	Yes	Yes	No
Thermal Compensation	Yes	No	Yes