



Birgitta Schultze-Bernhardt during a laboratory experiment at the Institute of Experimental Physics at TU Graz.

Measuring Air Pollutants in Real Time: ERC Proof of Concept Grant for TU Graz Physicist

Birgitta Schultze-Bernhardt receives funding from the European Research Council for the development of a portable device that measures several pollutants simultaneously in a fraction of a second.

Philipp Jarke

Volatile air pollutants such as nitrogen dioxide and ozone are only monitored loosely in the EU. Separate devices are used for each individual pollutant, and real-time monitoring is not possible. Birgitta Schultze-Bernhardt from the Institute of Experimental Physics at TU Graz would like to simplify and significantly improve these measurements. In her MULTI TRACE research project, she is developing a portable device that can determine the concentration of several gaseous pollutants in ambient air with the utmost accuracy within fractions of a second. The heart of the system is a laser-based dual-comb spectrometer, which Birgitta Schultze-Bernhardt developed with funding from an ERC Starting Grant in the predecessor project ELFIS. In order to take the technology closer to real-world application, the European Research Council is funding the MULTI TRACE project for 18 months with a Proof of Concept Grant totalling 150,000 euros.

MOLECULES ABSORB FREQUENCIES OF LASER LIGHT

The compact measuring device screens the air to be tested with laser light, which is in turn reflected back by a retroreflector. The molecules in the air absorb parts of the colour spectrum of the laser light. As each gaseous substance absorbs the frequencies of the laser light in a different way, the researchers can recognise which pollutants are present and in what concentration. In the future, the device will automatically analyse the frequency values and display the pollutant concentrations. "Laser technology has

developed very quickly in recent years. Today, we can carry out measurements in almost any environment and in situations relevant to everyday life that were only possible in the laboratory a few years ago," says Birgitta Schultze-Bernhardt. "The technology has also become much more compact. It is therefore realistic that we will be able to produce a portable device within a year and a half and test it in various real-life environments." Tests are planned in urban areas as well as in industrial and forest areas.

THREE POLLUTANTS AT THE SAME TIME

The device developed as part of the MULTI TRACE programme will measure three pollutants simultaneously – these include ozone and nitrogen dioxide. "Basically, our measuring principle can be used to detect any conceivable pollutant, whether gaseous, liquid or solid – provided it is translucent," says Birgitta Schultze-Bernhardt.

The potential fields of application for the technology are diverse. Industrial companies could monitor the air quality in their production facilities, and authorities would have the opportunity to collect data on pollution levels in cities at a high level of temporal resolution. There are also possible applications in medicine. Doctors could collect evidence of possible diseases associated with the concentration of certain molecules in exhaled air.