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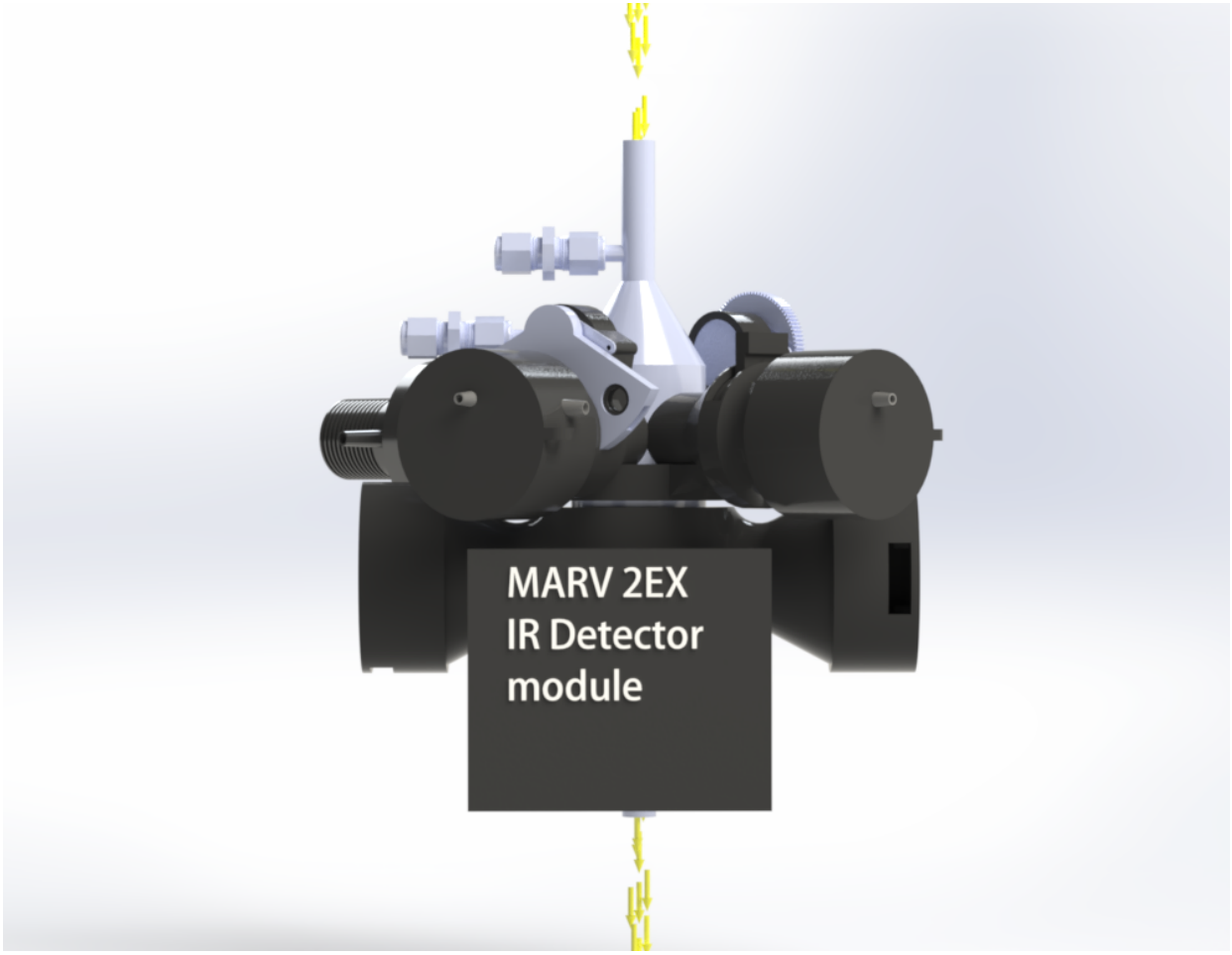
MARV gas analyzer
All-in-one analyzer for gas, dust and moisture measurement



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WE CAN MEASURE YOUR PROCESS

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Description of the MARV gas analyzer

MARV 2EX = All-in-one analyzer for gas, dust and moisture measurement

Flow and Temperature controlled continuous measurement for wet/dry processes in explosive and non-explosive atmospheres

Gas analyzer MARV is designed to continuously measure concentration of the dust particles, moisture and gas composition. It is an ideal solution for gas process concentration monitoring in dry/wet conditions.

MARV analyzer is the only one, which can measure dust particles, moisture and gas composition in applications with explosive atmosphere according to ATEX requirements (Zone 1/2).

At the heart of the Marvilon system is a 3rd generation uniquely designed **five-zone optical measurement cell**, consisting of coaxial stainless-steel tubes forming a hermetically sealed cuvette. This structure is divided into five distinct sections along the optical path:

- A **central measuring zone** houses undiluted sample gas.
- Surrounded by **purge protection zones**, which continuously receive a flow of dry purge gas (air/N2).

This innovative architecture establishes a **buffering purge barrier** that isolates the optical windows from dust, moisture, and corrosive condensates. By maintaining a high purge/sample flow ratio (≥ 1:20), the device **prevents fouling and window contamination** that traditionally plague optical analyzers in harsh environments, while ensuring that the **sample gas is undiluted** for accurate analysis.

Stainless steel is used in cell for high temperature **(up to 200 °C) and pressure (up to 10 bar)** operation, the cell is assembled with welded or metal-sealed joints ensuring mechanical integrity and leak tightness. The optical windows are crafted from **durable infrared- and visible-transparent materials** such as sapphire or ZnSe/CaF_2, providing chemical resistance and thermal stability. The short purge sections adjacent to windows (~3 mm) minimize dead volume, preserving optical path length precision.

The **sample zone's optical path length (10–50 mm)** balances sensitivity and dynamic range, enabling measurement of both trace and high-concentration gases (e.g., CO up to 60% vol and dust at mg/m3 level).

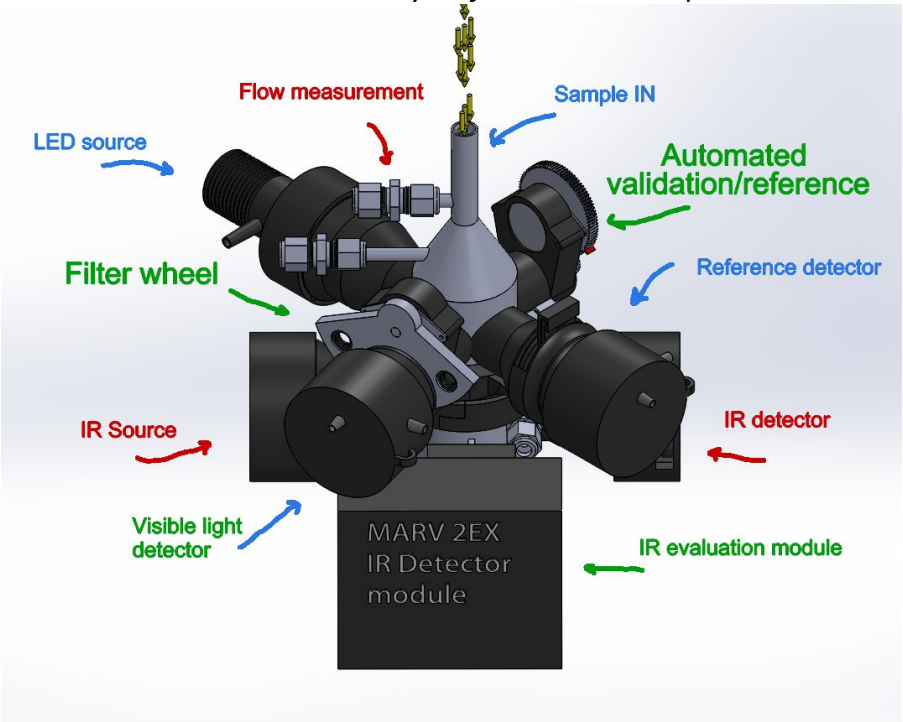
Dual-Path Optics: Infrared Absorption and Visible Light Scattering

The Marvilon 3rd generation of optical cell incorporates **two simultaneous optical measurement paths** within the same sample volume:

- An **infrared (IR) beam path** aligned diametrically opposite for gas/moisture analysis via absorption spectroscopy.
- A **visible-light beam path** arranged at an off-axis angle (~120°), optimized for detecting particulate matter (dust) through forward light scattering. Second sensor is placed opposite, to compensate for temperature fluctuations.

This dual-path design allows **concurrent measurement of dust concentration and gas composition without interference**. Unlike conventional systems where sample conditioning (filtration) prevents dust measurement on gas analyzers, **Marvilon's cell measures dust and gas components directly in the undiluted gas stream before any filtration.** The influence of dust on IR absorption is accounted based on baseline slope and compensated algorithmically, enabling accurate multi-component gas/moisture quantification alongside particulate monitoring.

Picture 1. MARV analyzer functional description



The visible scattering channel uses **LED or laser illumination** and a fast photodiode detector with focusing optics, providing a **linear dust detection range from 0.1 to 300 mg/m³**.

Advanced IR Methodologies and Modular Detector Design

The 3rd generation of Marvilon optical cell is designed with a **modular approach** to optical modules, allowing flexible integration of different spectroscopic techniques depending on the application needs:

- **NDIR (Non-Dispersive Infrared) spectroscopy**, ideal for multi-gas detection with bandpass filters.
- **TDLA (Tunable Diode Laser Absorption)**, providing high sensitivity for specific gas components at low concentrations.
- **FTIR (Fourier Transform Infrared) spectroscopy**, enabling wide spectral range analysis (not yet tested but compatible).

The IR sources and detectors are mounted as **independent, quick-release modules**, enabling easy field upgrades or configuration changes without redesigning the entire system. The system supports diverse IR detectors such as photodiodes, thermopiles, and photoconductive detectors (e.g., InGaAs, InAsSb), and radiation sources including LEDs and lasers (fixed or tunable wavelength). This modular design supports measurement over a wide dynamic range, for example, direct measurement of **CO up to 60% vol** in steel mill Basic Oxygen Furnace (BOF) off-gas and ppm level at emission monitoring in agglomeration or graphite production, a capability unmatched by many commercial analyzers that require dilution for high CO concentrations.

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Specification

General information:	
Product name:	MARV analyzer
Measured objects:	Total suspended particles (TSP), moisture, CO/CO2/CH4/etc.
Measurement principle:	Optical forward scattering and Infrared absorption
Measurement range:	Dust - up to 300 mg/m3 Moisture – up to 40% CO – up to 70% CO2 – up to 30% CH4 – up to 10% Other gases - on request
Power:	± 12 V DC – Visible source ± 15 V DC – Visible detector + 5 V DC – IR module

Outputs:	
Signals:	USB digital output – gas and moisture concentrations 0 - 10 V DC output - dust concentration
Pneumatic:	dP outputs - gas volume measurement - 6mm, Swagelok
Temperature:	K-type temperature sensor, -150 … 350 °C

Physical properties:	
Wetted materials:	Stainless steel (316L), Saphire, Borosilicate.

Sample gas conditions:	
Max. temperature:	200 °C
Gas volume measurement:	5 ... 40 l/min
Pressure:	Up to 10 Bar

Automated validation (optional):	
According to requirements of EN 15267:	Scheduled automated validation: - Validation based on NIST-traceable optical filters and - reference measurement

Ambient conditions	
Ambient temperature:	+15 … +40 °C

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