

## Small probe, big effect – Micro Laser Sintering makes tailor-made flow measurement technology possible

*Accuracy is mandatory in the field of fluid dynamic measurement technology. Flow probes help to determine fluid flows simply and accurately. By means of Micro Laser Sintering, the components are developed flexibly for the respective application and manufactured on demand. Size and shape are adapted according to the different application areas.*

### ***That's what it's all about***

In order to increase the efficiency of flowed-on products - such as aircraft engines, compressors or vehicles - the flow parameters of fluids (e.g. air, liquids) such as speed, pressure and angle of attack are measured with the aid of measuring probes. After evaluating the measurement data, geometries can be optimized or controlled in operation.

### ***This is how the flow probe works***

The probes can be easily adapted in shape (diameter from 1 mm) to the needs of the customer. Based on the Bernoulli Effect, it is possible to define simply and accurately pressure, velocity and angle of inflow of fluid flows by Vectoflow measuring probes. For this the pressure distribution at the probe tip is considered, which finally allows the flow parameters to be determined. The following applies: The more holes at the tip of the probe, the higher the achievable accuracy and the better the measurable angular range. The same advantages apply to high-frequency and high temperature probes. The integration into complete devices enables the use on systems such as UAVs and wind turbines.

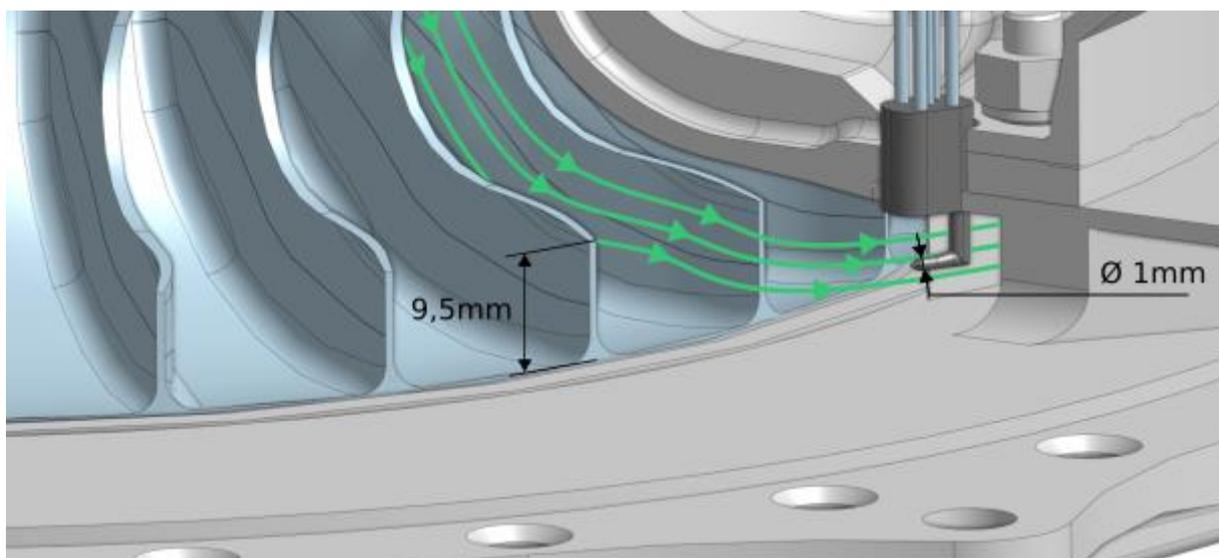


Abbildung 1 – CAD-Anordnung einer Strömungsmesssonde In einem Radialkompressor. Lauftrad (blau), Diffusor (grau, aufgeschnitten)

### ***Conventionally manufactured measuring probes***

The production of measuring probes is conventionally carried out with various manufacturing technologies. The smaller their dimensioning, the more assembling the measuring probes becomes more complicated. Furthermore, the miniaturization limits the stability of the measuring probes, which limits the service life. Considering currently available solutions, there is a lack of robustness, user friendliness and geometric flexibility.

### ***Additive thinking***

The company Vectoflow is specialized in the development and construction of complex flow measuring probes. Since the very beginning, Vectoflow has recognized and exploited the possibilities of additive manufacturing. Consequently, ideal designs according to the fields of application are developed and quickly produced from one component, without the need for subsequent assembly. Depending on the size of the probe and the given requirements, different additive manufacturing technologies for additive manufacturing are available. For use on the smallest building space with maximum load-bearing capacity Vectoflow sets on the additive "Micro Laser Sintering" manufacturing technology from 3D MicroPrint GmbH. Compared to other available systems the advantages are the significantly higher detail resolution for filigree structures as well as the high significantly lower roughness after the manufacturing process. The latter reduces the reworking costs extraordinary. This is achieved by the use of finest powder particles around the 5 µm size as well as a slim focus diameter of 30 µm.

### ***New design of the probe ensures additive producibility***

The design of a component must always take into account the possibilities and limitations of the respective manufacturing technologies. After the initial consultation between 3D MicroPrint and Vectoflow, it was clear that the original model was unsuitable and a redesign would lead to the desired result. Great emphasis was placed on the channel geometries inside the probe, the probe neck and the support structure. In several iterations of design optimization, additive manufacturing and testing, the removal of powder from the channels and the structural safety of the filigree internal structures were significantly improved.

### ***Flow probes from Vectoflow, manufactured at 3D MicroPrint***

The measuring probes were manufactured with Micro Laser Sintering DMP50GP system from 3D MicroPrint and then separated from the construction platform by wire cut. The surfaces of the probes were optimized by selected post-processing steps in order to minimize roughness-induced flow changes.

Micro Laser Sintering with 3D printing systems from 3D MicroPrint opens up new design possibilities in component design. This technology enables innovative applications in the field of microfluidics, optimized flow properties and function integration and thus completely new possibilities for our customers. By using Micro Laser Sintering technology, excellent mechanical properties and a high level of detail accuracy are achieved on the filigree flow measurement probes. Due to the production from only one part, assembly times are eliminated and the product is robust and durable even in harsh operating conditions.



Abbildung 2 – Additively manufactured flow measurement probe from 3D MicroPrint

### The technology

Micro Laser Sintering (MLS) is a powder-based additive manufacturing process for micro parts and components with micro characteristics. On the basis of digital CAD data, a DMP machine from 3D MicroPrint builds up the workpiece layer by layer without recognizing this on the finished product. Product designers' benefit from newly gained design freedom (Cavity, inner structures) as additive manufacturing eliminates shape constraints in many areas. Complex structures such as intertwined or interwoven individual parts can thus be manufactured to the highest quality. This tool-free processes enable cost-effective production of single pieces up to individualized series products.

### About 3D MicroPrint GmbH

3D MicroPrint manufactures high-precision metal micro components using Micro Laser Sintering technology. Based on many years of experience in additive manufacturing, this process has been developed in an industrial environment since 2006. 3D MicroPrint offers an integrated service. From the exchange of knowledge and functional integration, process-oriented design to the production of series parts. Furthermore 3D MicroPrint offers material developments for exclusive technologies on demand.

### About Vectoflow GmbH

Vectoflow designs and manufactures the industry's most powerful systems for fluid dynamic measurements. These are based on proprietary modeling and additive manufacturing technologies.

Companies such as Siemens, GE and Safran as well as research institutes such as DLR, Onera and UTC use Vectoflow systems worldwide to determine velocities, flow angles, pressure and temperature in their applications (e.g. in turbomachinery and aviation).