

Figure S1. Implemented pulse sequences for PFG-STE dispersion analysis of flowing methane in the honeycomb monolith (not to scale).



Figure S2. The obtained flow rate within ROI(1) in printed monolith from CFD simulation and MRV measurement. The gray band shows the ± 5 % range of CFD data.



Figure S3. a. The obtained pressure field from CFD simulation along the printed monolith. b. Pressure drop curve obtained along ROI(1) of 3D-printed honeycomb in CFD simulations along the length of the sample, including the entrance and exit regions represented on *x*-axis. c. Magnified section of the box in graph b which illustrates pressure gradient in front of inlet.



Figure **S4**. Direct comparison of the simulated and measured radial velocity profiles of Figure 11.

	Repetition #1	Repetition #2	Repetition #3
SNR	14	14	14
VNR_{calc}	13.6	13.6	13.6
VNR _{meas}	13.5	14.7	13.6
$v_{x^{(\text{sample})}}(\text{mm}\cdot\text{s}^{-1})$	-1.63 ± 1.19	-0.07 ± 1.86	-0.87 ± 2.25
$Vx^{(wall)}(mm \cdot S^{-1})$	-1.94 ± 2.47	-0.02 ± 3.14	-0.51 ± 3.64
$v_{y}^{(\text{sample})}$ (mm·s ⁻¹)	-3.62 ± 0.77	-0.23 ± 1.12	-0.94 ± 0.73
$V_{y}^{(wall)}(mm \cdot S^{-1})$	-3.53 ± 2.37	-0.43 ± 2.48	-2.12 ± 2.75
MRV vz velocity (mm·s-1)	68.31	65.30	67.10
STD of MRV (mm·s ⁻¹)	5.06	4.43	4.93

Table S1. Reproducibility of the MRV measurement for a defined measurement.