

Druckverlustoptimierung eines 90°-Bogens: Numerische und experimentelle Untersuchung

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Druckverluste in Kanalnetzen

$$\Delta p = \Delta p_R + \Delta p_F = \frac{1}{2} \rho u^2 \left(\lambda \frac{l}{d} + \sum \zeta_i \right)$$

ρ : Dichte

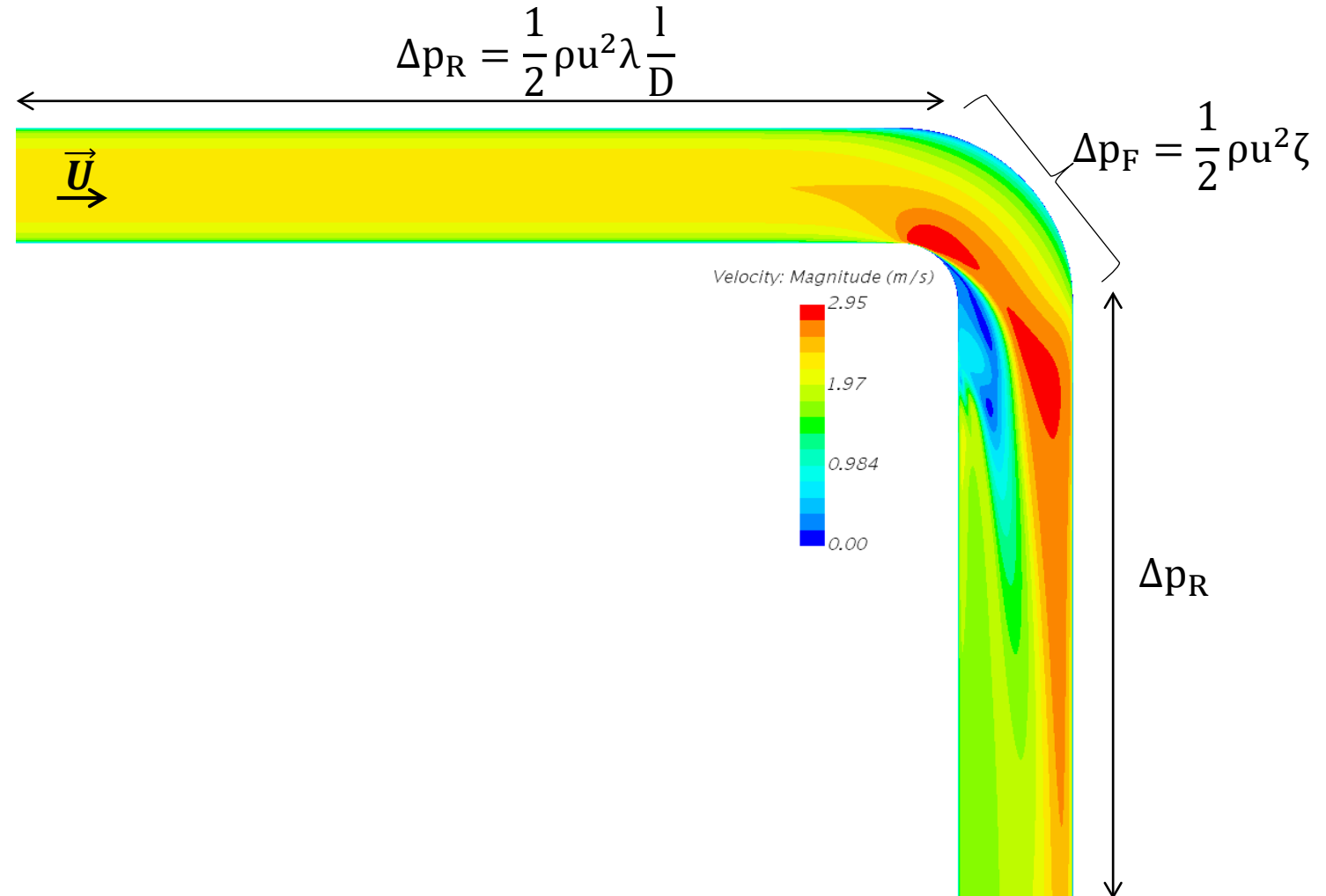
u : Mittlere Strömungsgeschwindigkeit

λ : Rohrreibungszahl

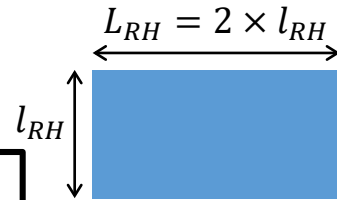
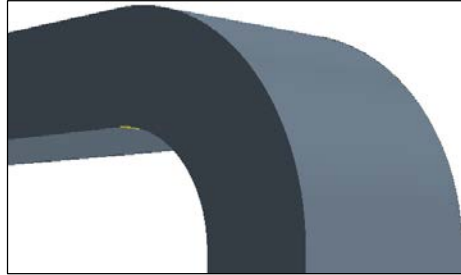
l : Länge der Rohrleitung

D : Innendurchmesser der Rohrleitung

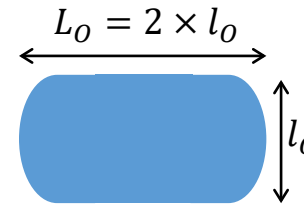
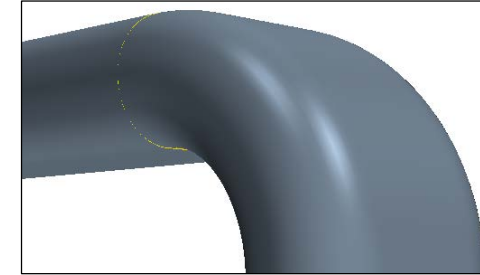
ζ_i : Druckverlustbeiwerte



Rechteckig Horizontal (RH)



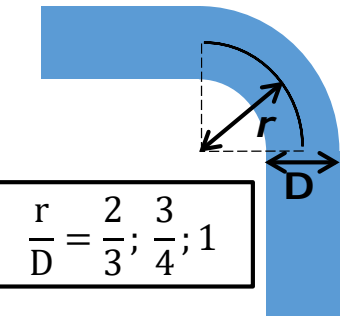
Oval (O)



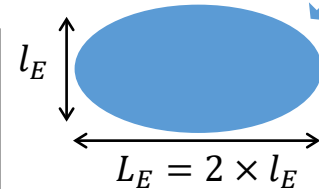
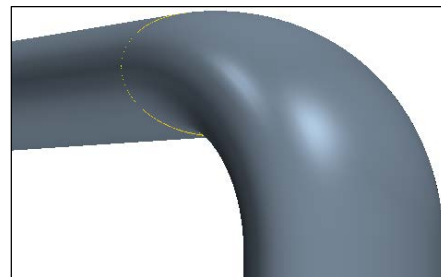
$$d^* = \sqrt[5]{\frac{32}{\pi^2}} \times \sqrt[5]{\frac{A_x^3}{U_x}}$$

= gleichwertiger Durchmesser
 x=O (Oval); E(Ellipse);
 RH (Rechteckig Horizontal);
 RV (Rechteckig Vertikal);
 A=Oberfläche; U=Umfang

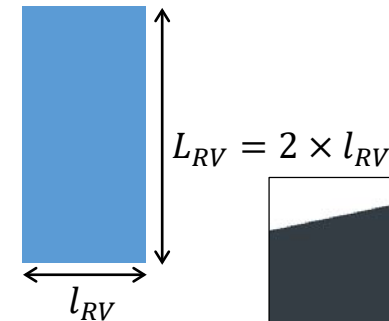
$$D = d^*$$



$$\frac{r}{D} = \frac{2}{3}; \frac{3}{4}; 1$$

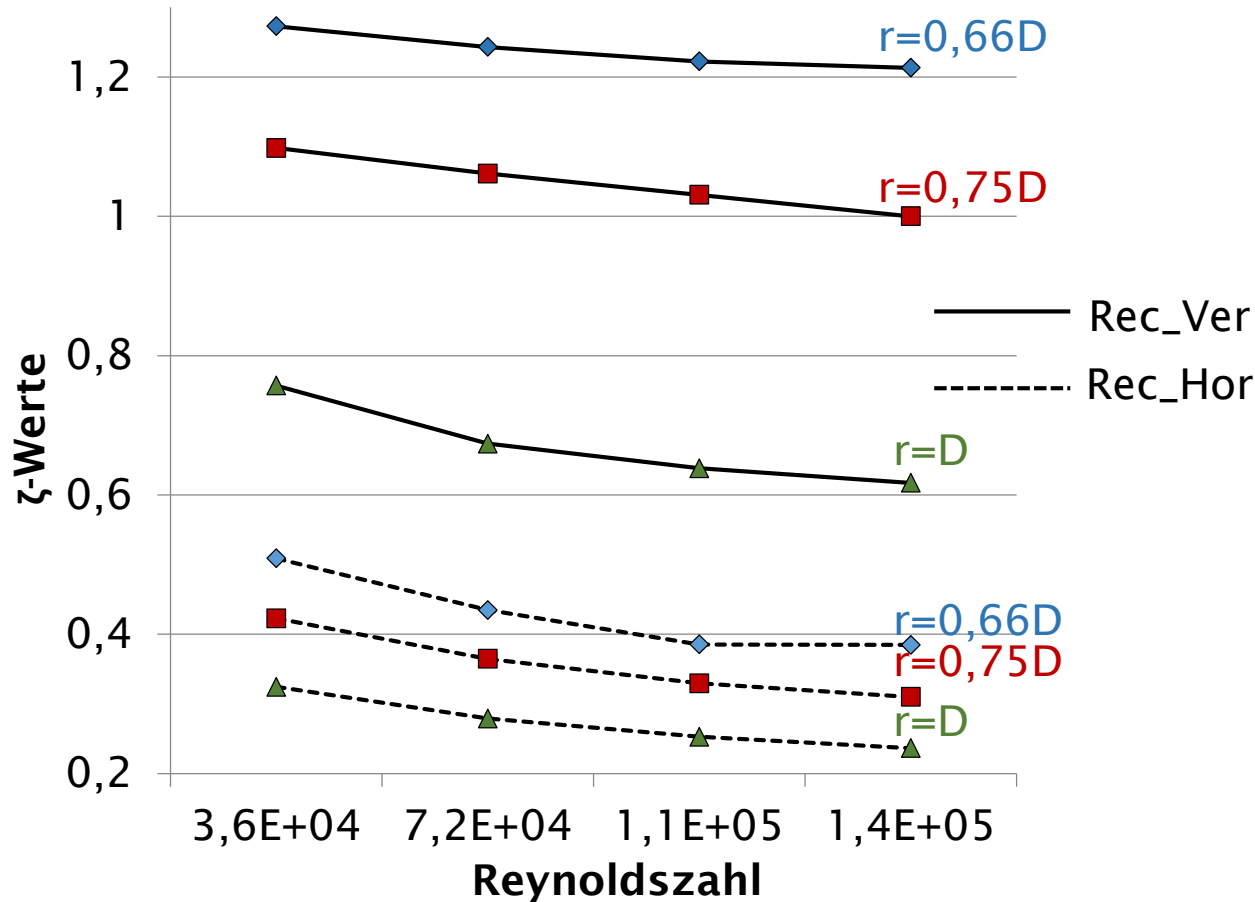


Ellipse (E)

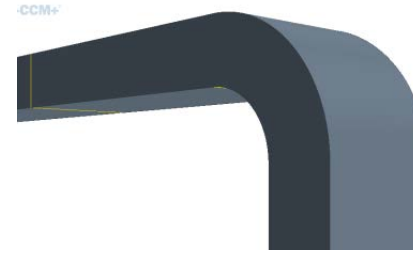


Rechteckig Vertikal (RV)

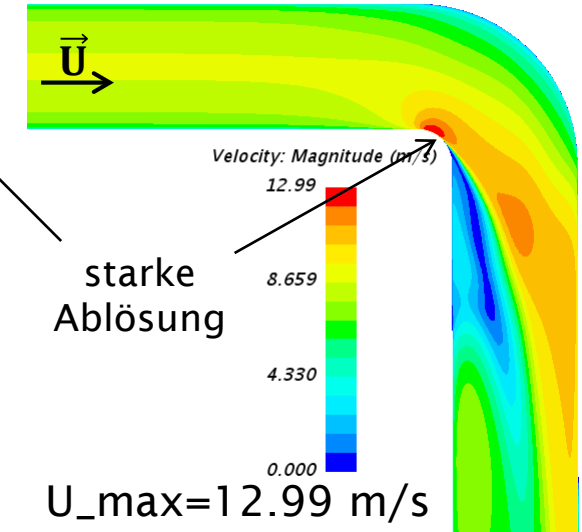
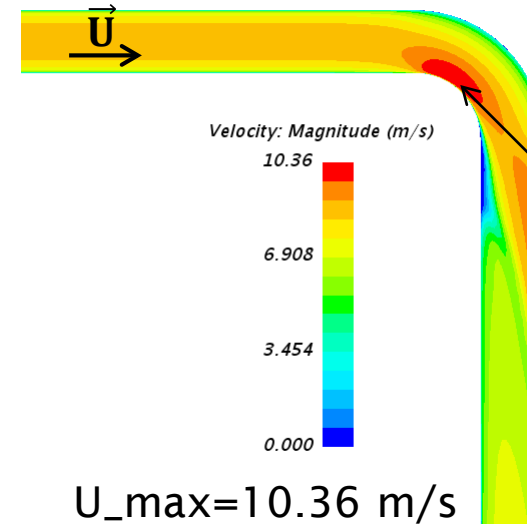
Rechteckig Vertikal VS. Rechteckig Horizontal Querschnitt

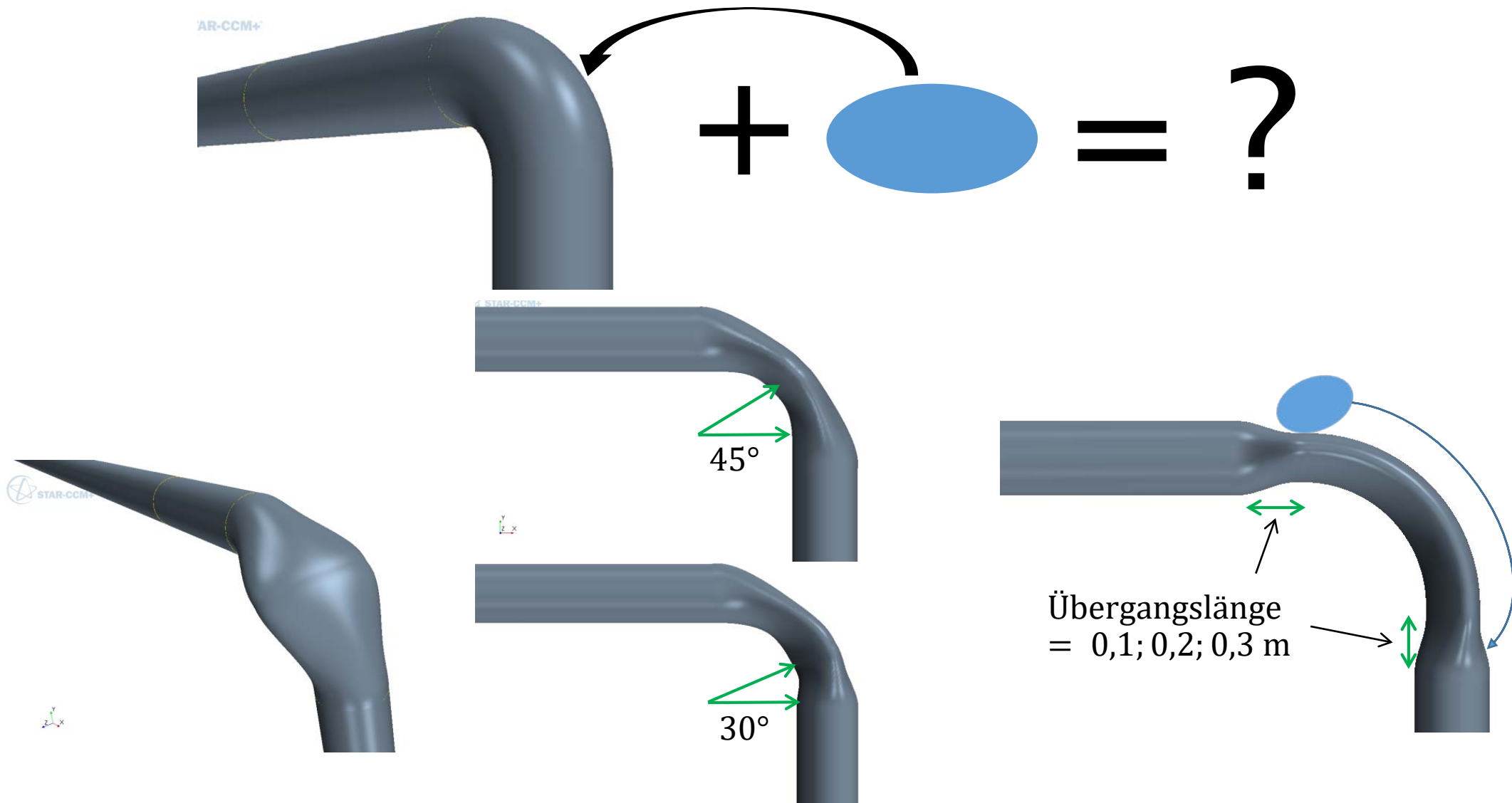


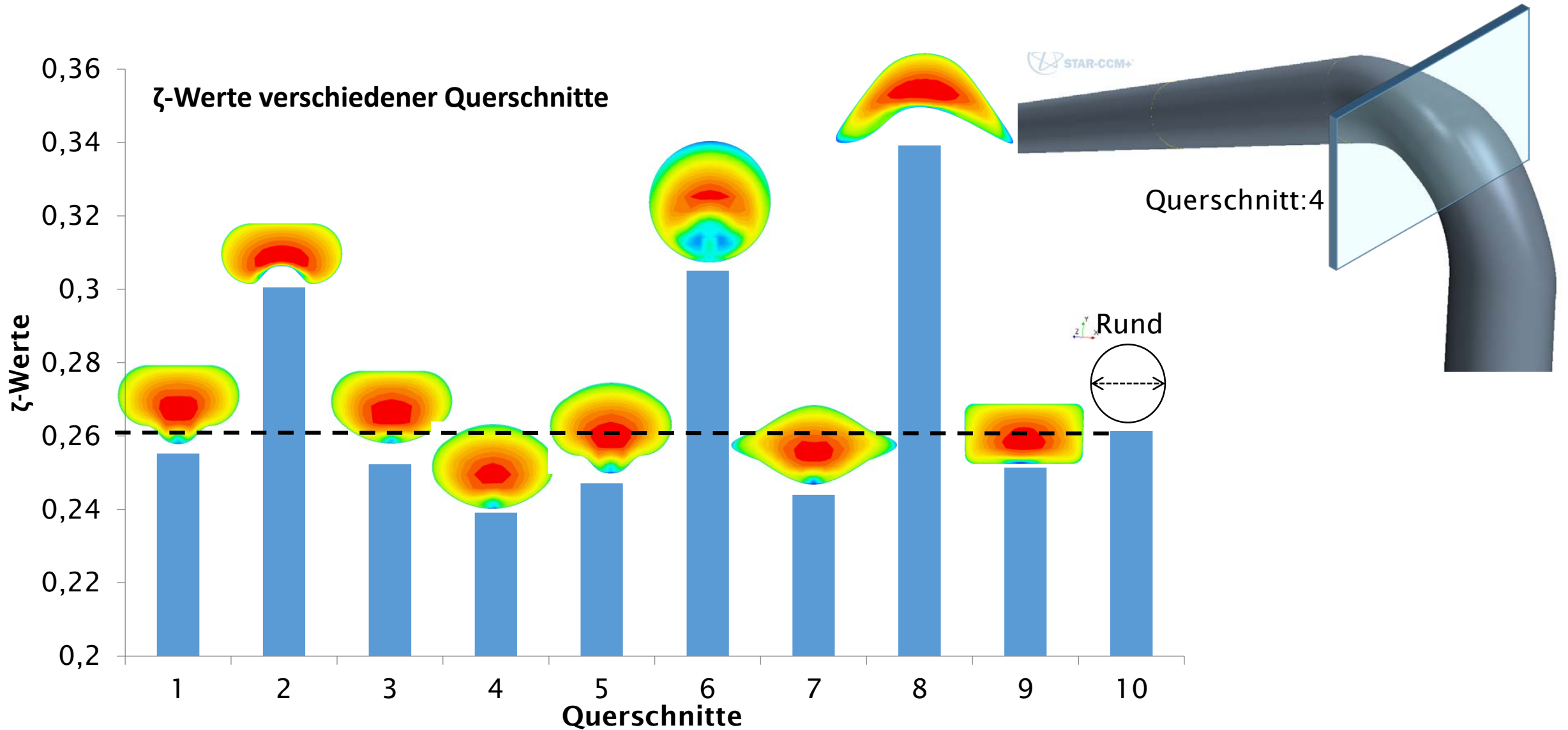
Rechteckig Horizontal



Rechteckig Vertikal

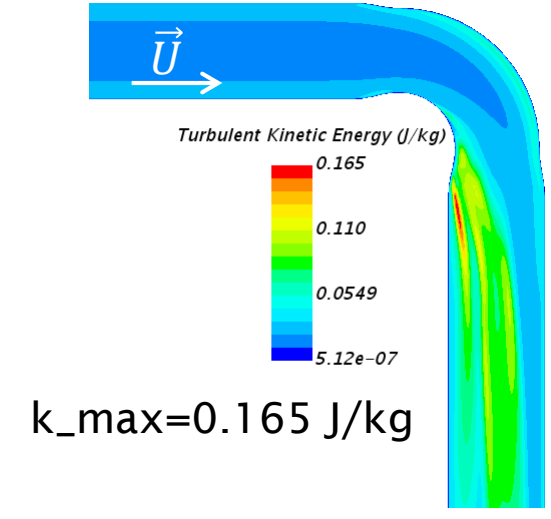
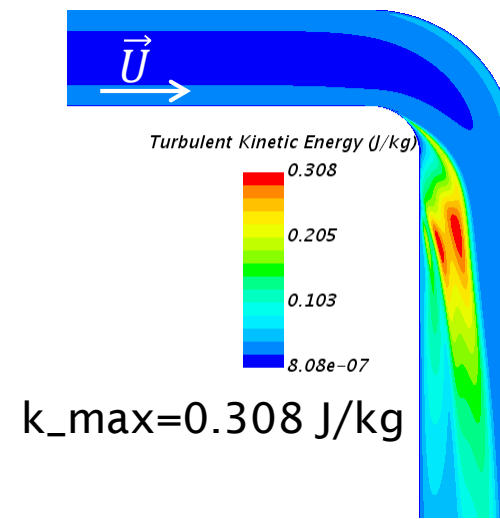
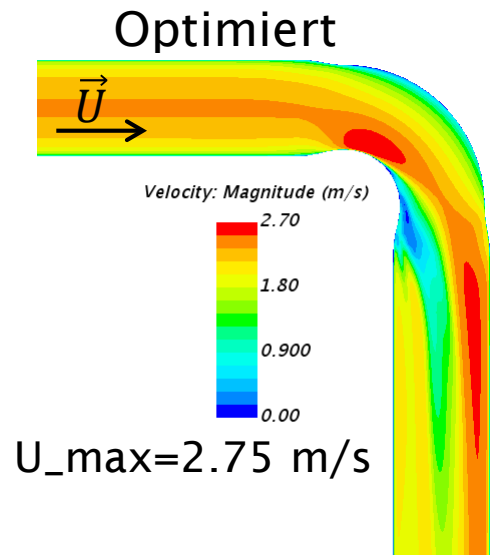
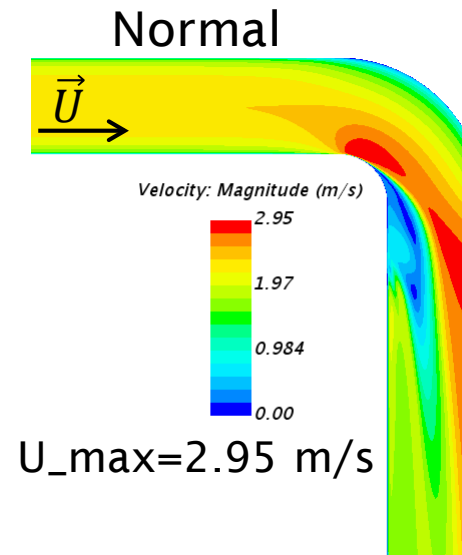
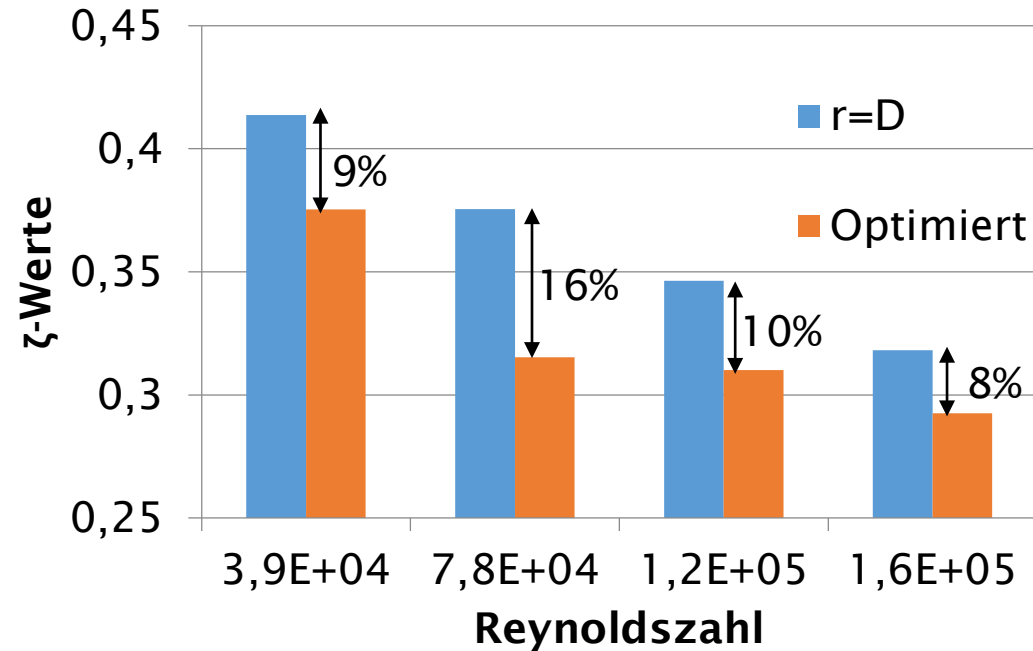






Bis 16% Reduzierung

ζ -Werte optimierter und normaler Bogen



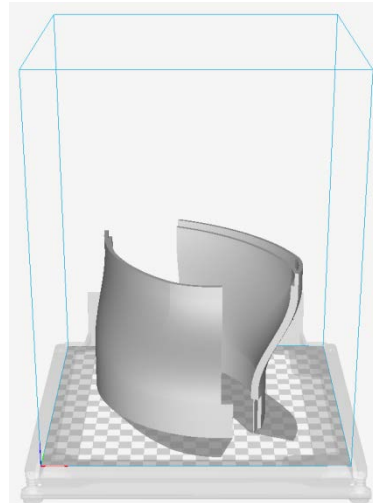
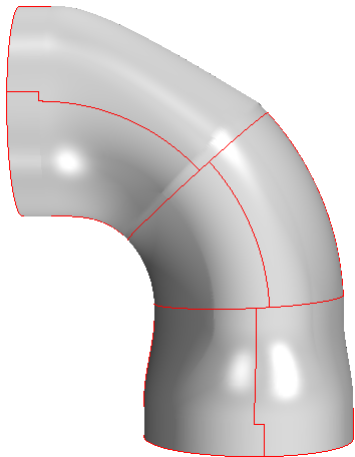
3D Modelle

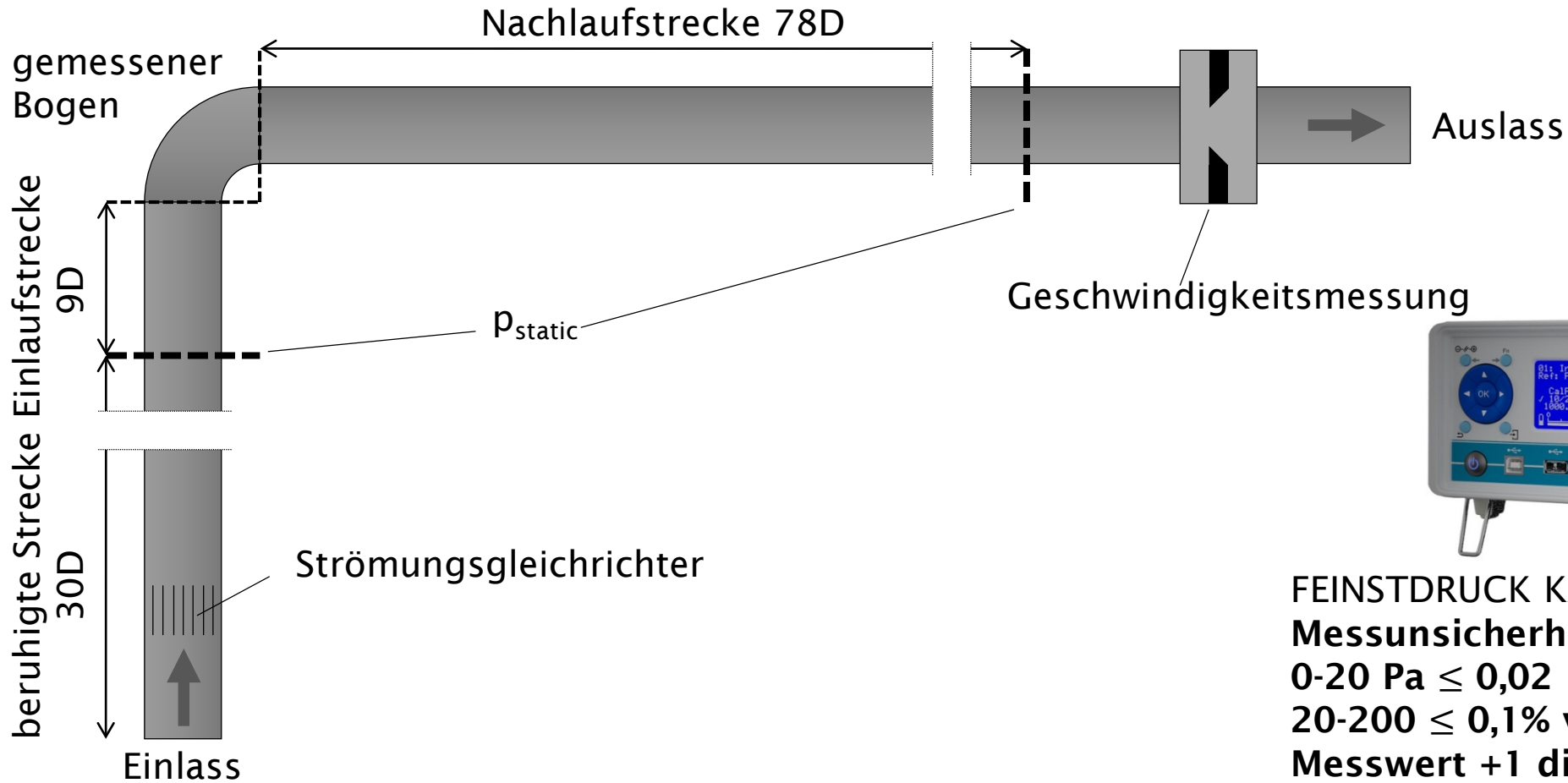
12 Teile

3D Druck

Zusammenbau

Nachbearbeitung





FEINSTDRUCK KALIBRATOR FCO560

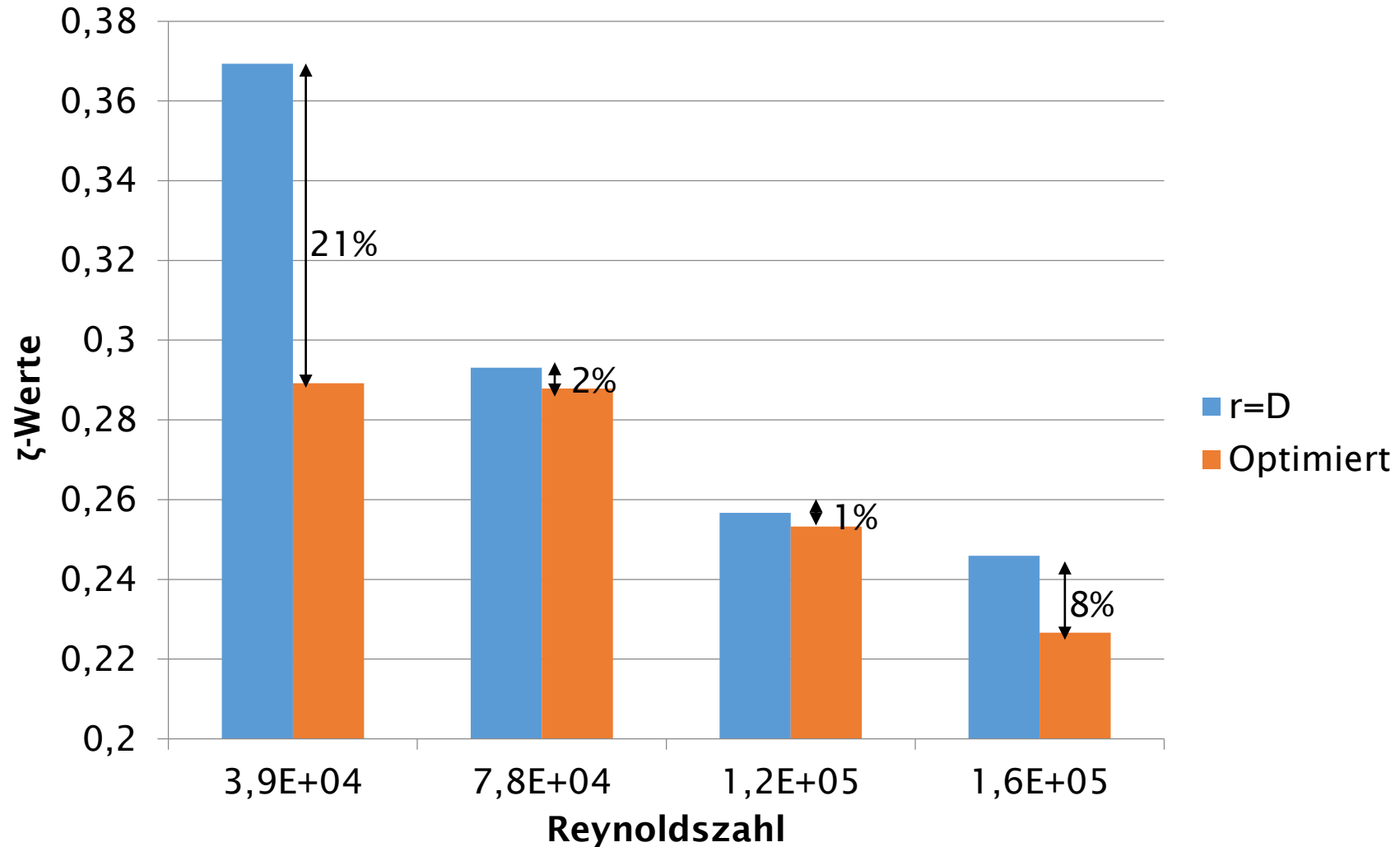
Messunsicherheit:

0-20 Pa \leq 0,02 Pa + 1 digit

20-200 \leq 0,1% v. angezeigte

Messwert +1 digit

bis 21% Reduzierung





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