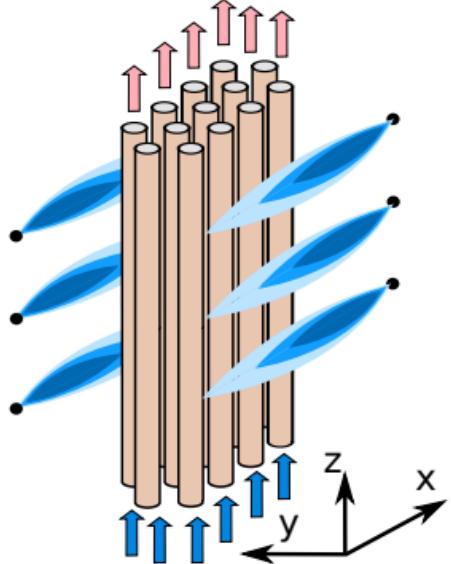
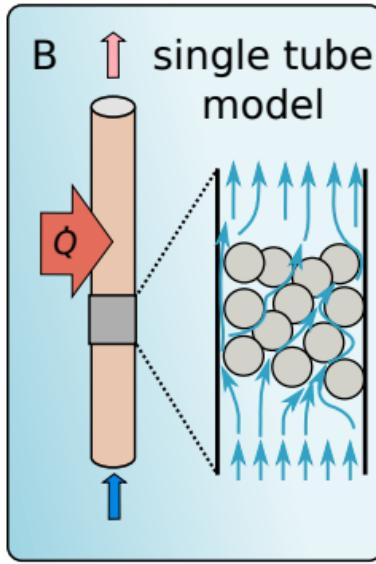


A

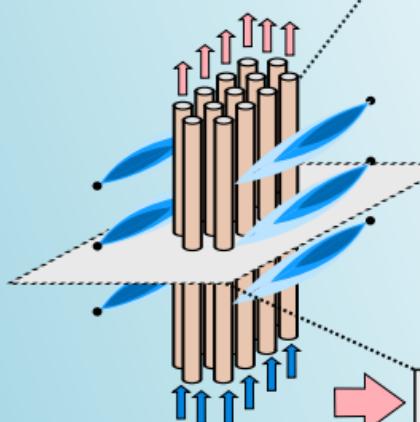


B single tube model

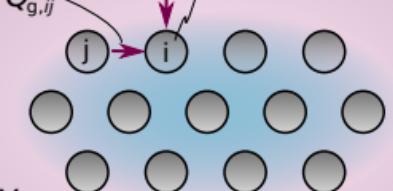


C

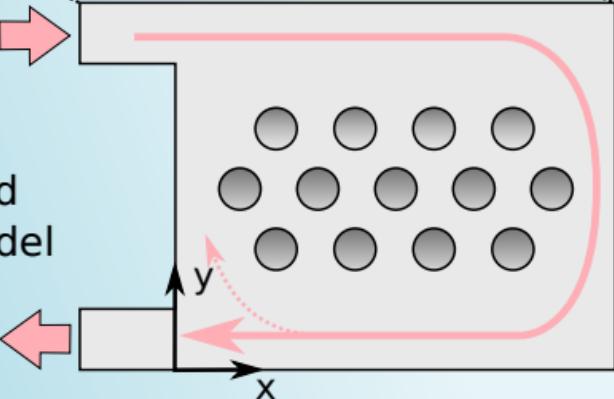
radiation-based furnace model



$$\dot{Q}_{g,iw}^{(r)} \quad Q_i = V_i \sum_{\alpha \in \mathcal{N}_c} h_\alpha \sigma_{\alpha,i}$$



CFD-based furnace model



D

length = 12.5m



constant temperature wall T_{wall}

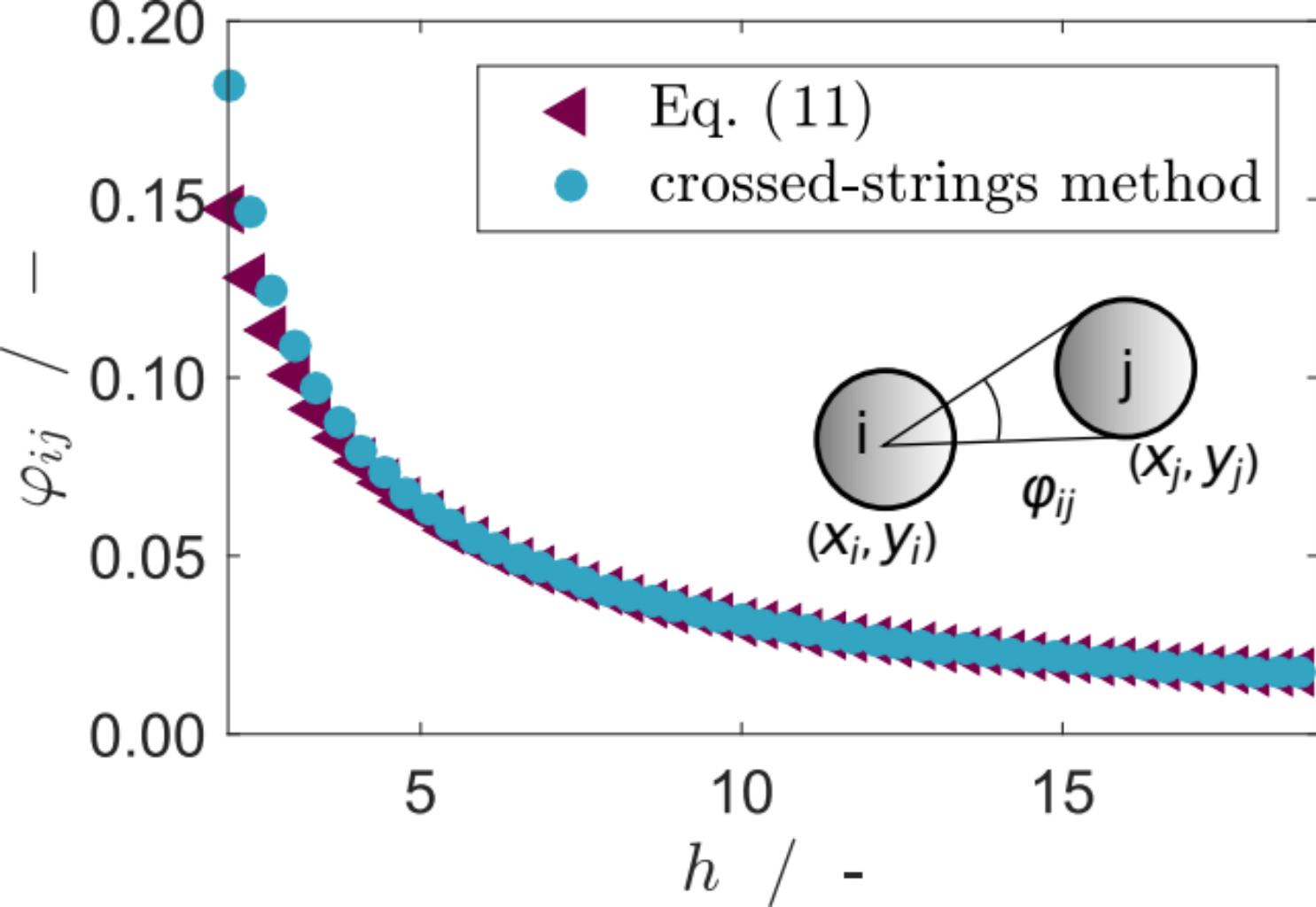
r

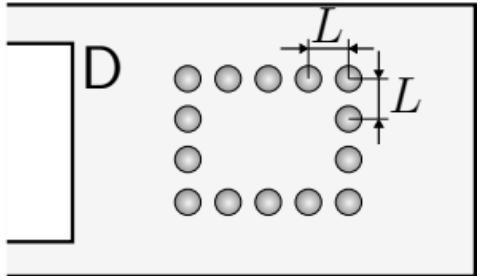
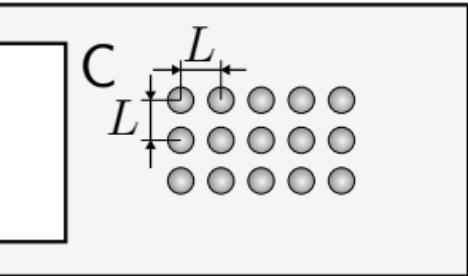
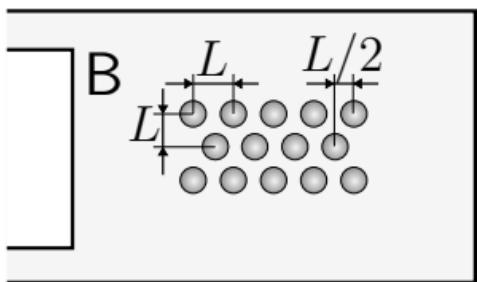
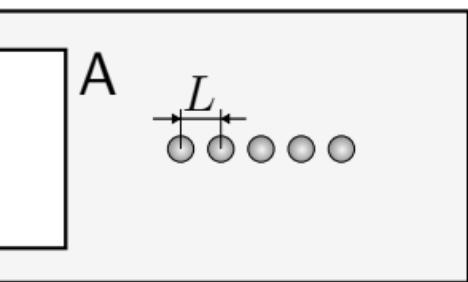
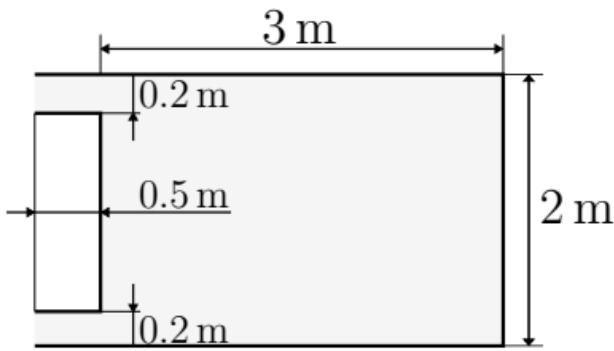
parabolic
cst. mass flow

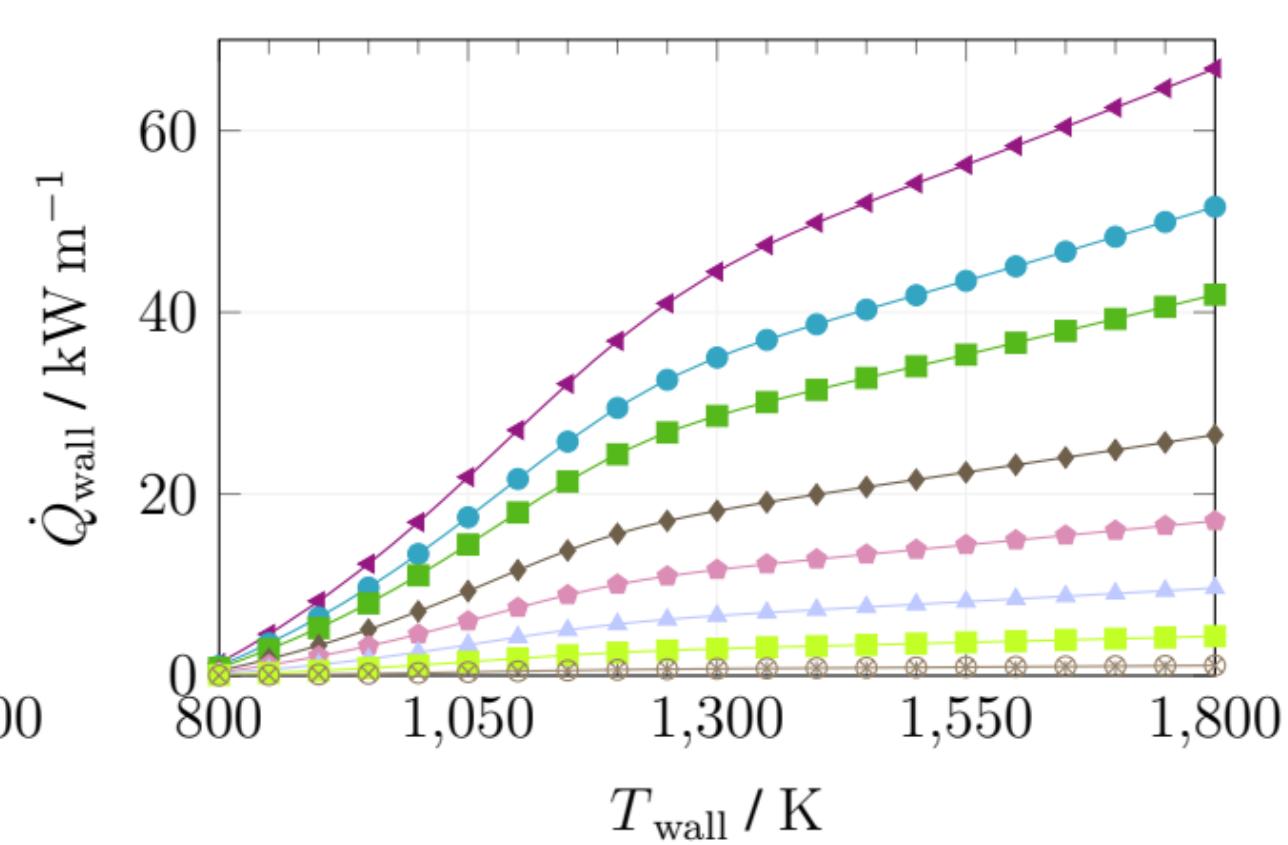
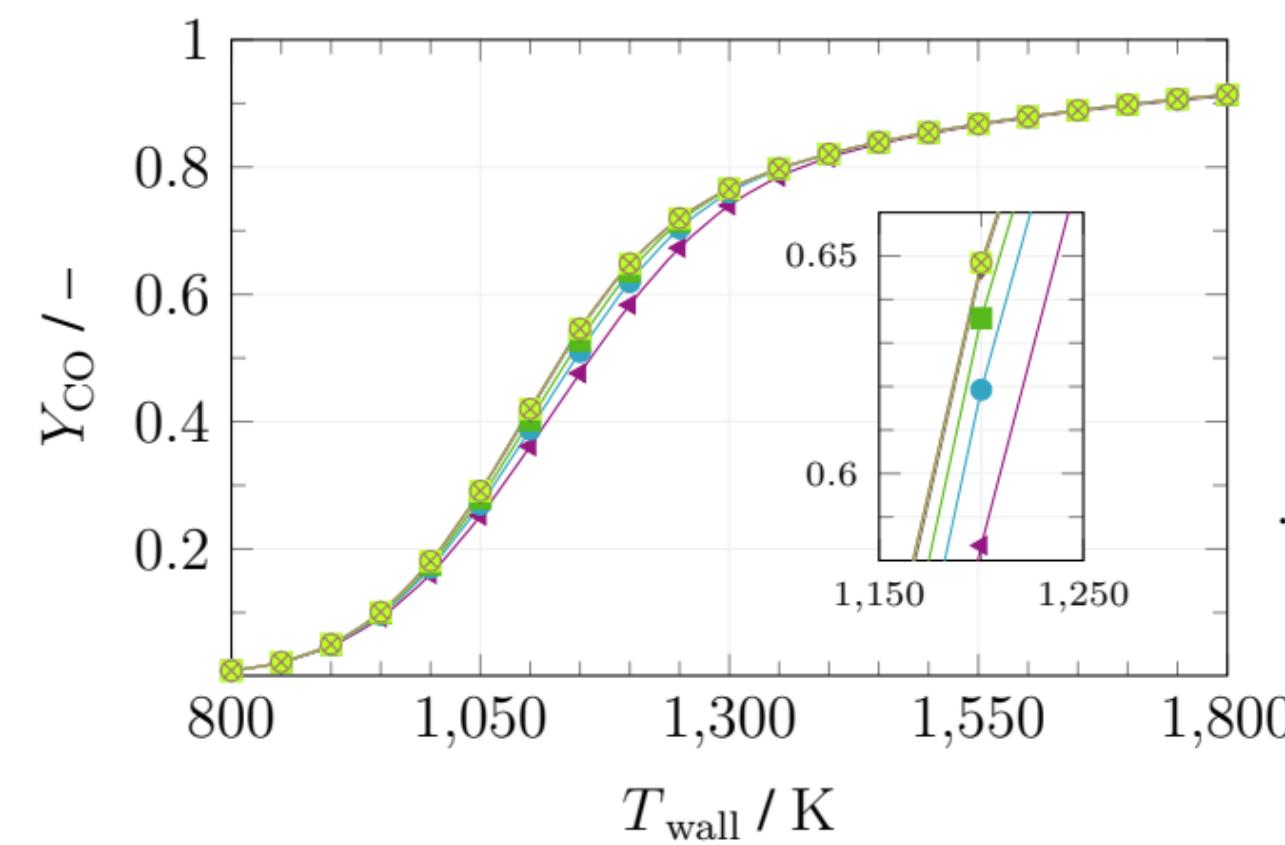
porous media

2d-axisymmetric

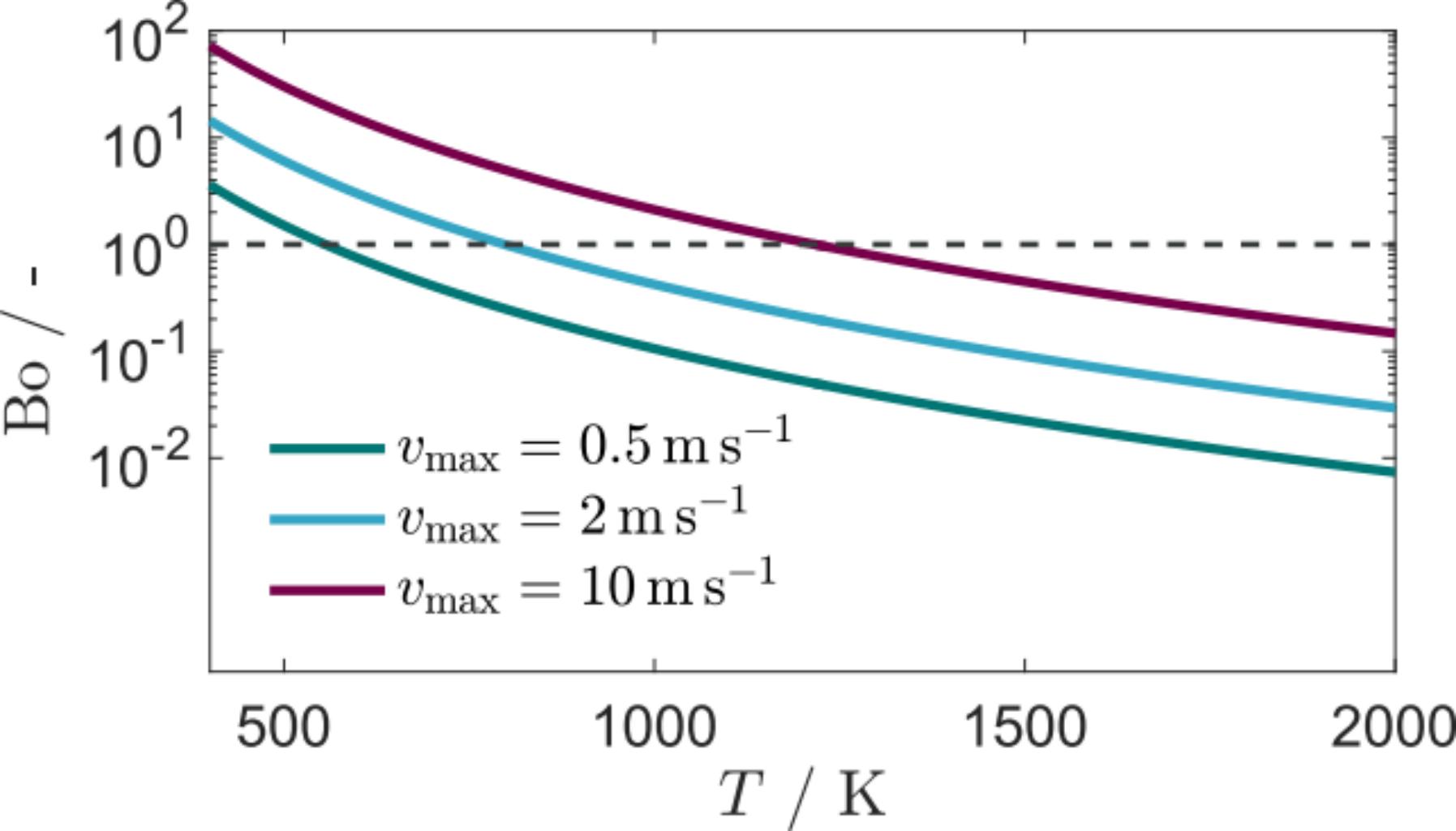
pressure outlet

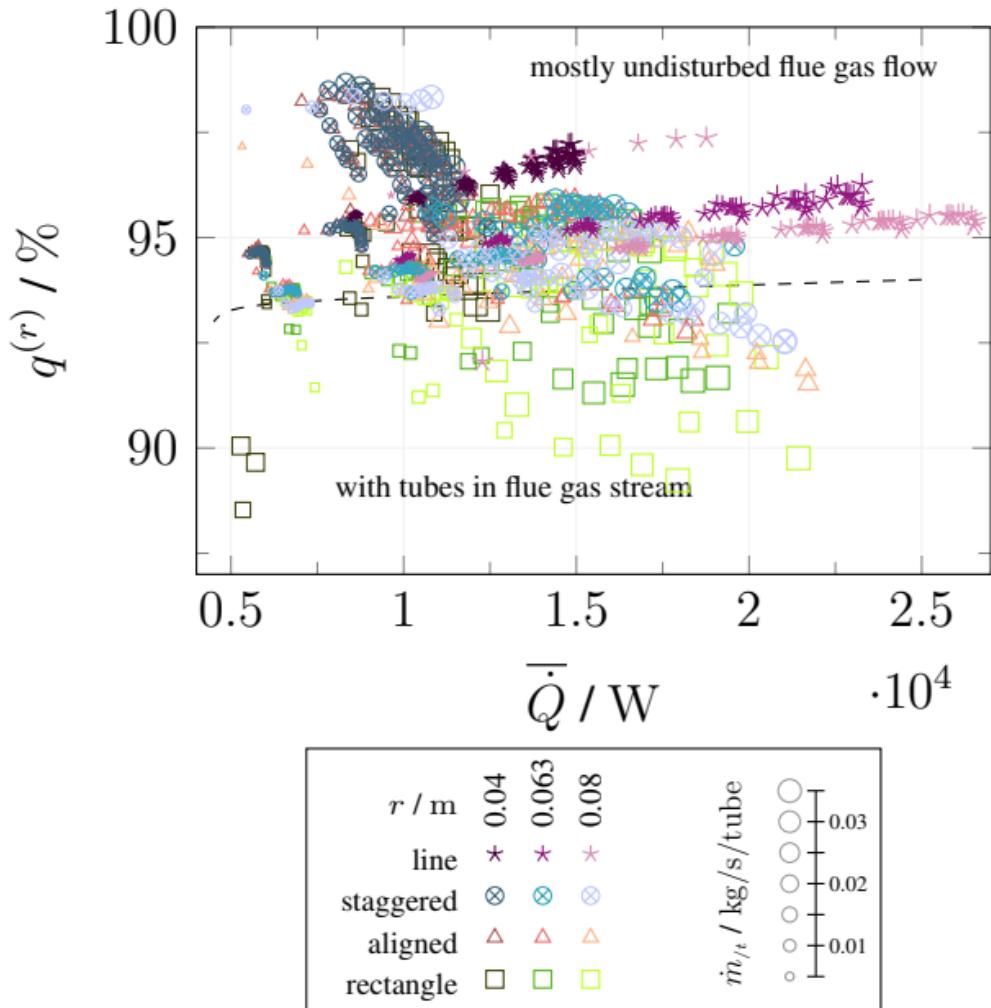


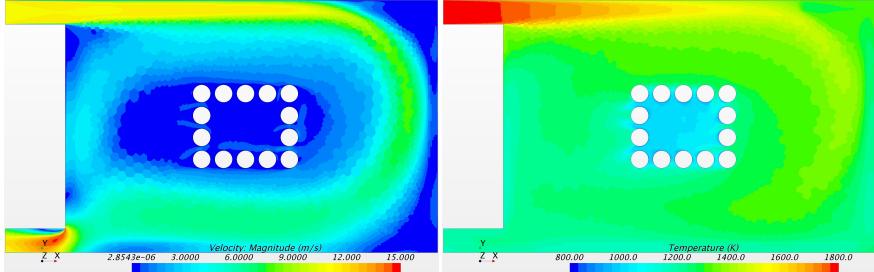




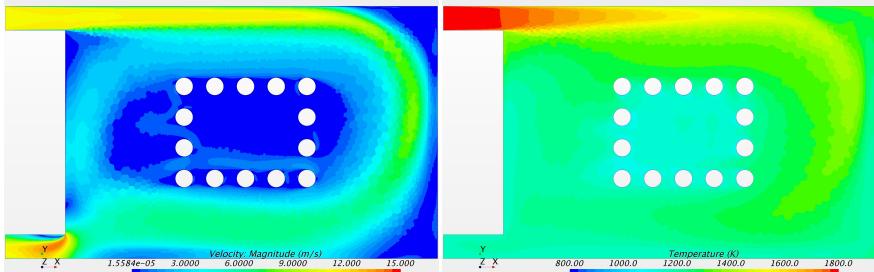
r/m	0.01	0.02	0.03	0.04	0.05	0.063	0.07	0.08
\bullet	\circ	\blacksquare	\triangle	\bullet	\blacklozenge	\blacktriangledown	\blacklozenge	\blacktriangledown



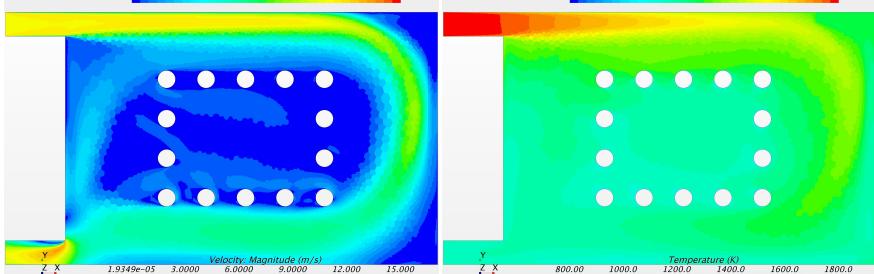




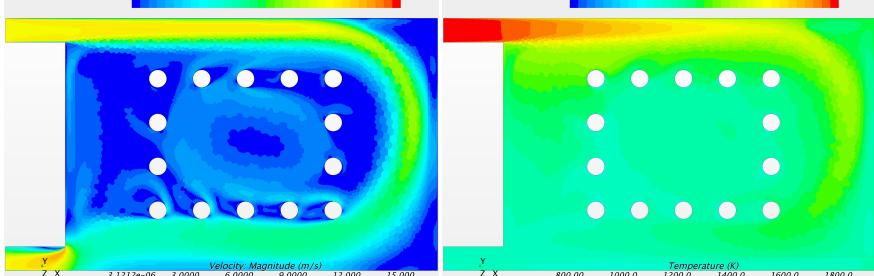
$$\begin{aligned} h &= 1.25 \\ \underline{q}^{(r)} &= 95.24\% \\ \dot{\underline{Q}} &= 11870\text{W} \\ \bar{\varphi} &= 0.52 \end{aligned}$$



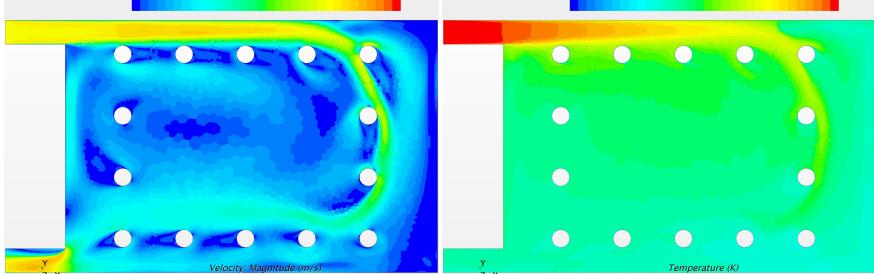
$$\begin{aligned} h &= 1.75 \\ \underline{q}^{(r)} &= 95.78\% \\ \dot{\underline{Q}} &= 14166\text{W} \\ \bar{\varphi} &= 0.41 \end{aligned}$$



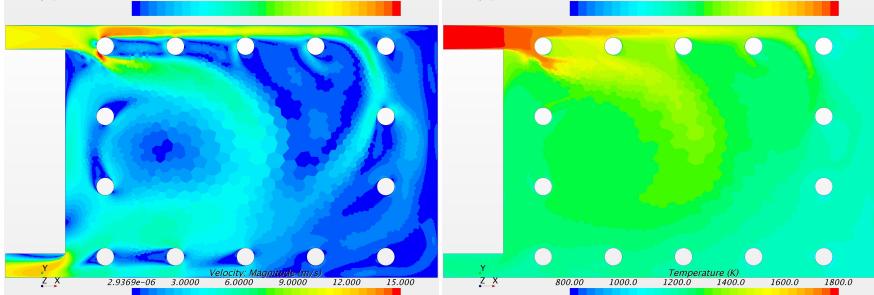
$$\begin{aligned} h &= 2.25 \\ \underline{q}^{(r)} &= 95.47\% \\ \dot{\underline{Q}} &= 15711\text{W} \\ \bar{\varphi} &= 0.33 \end{aligned}$$



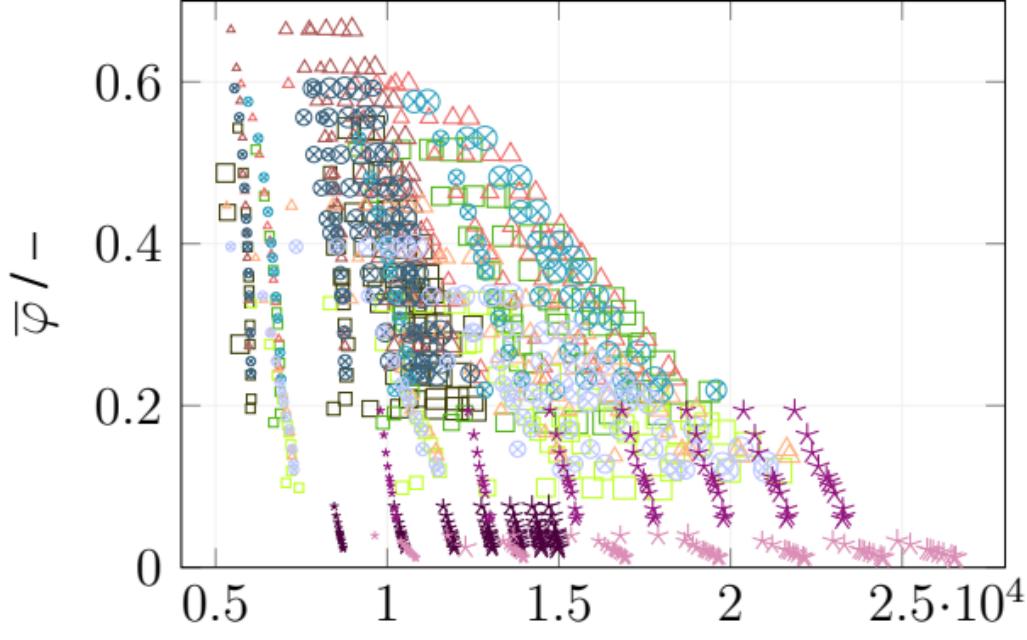
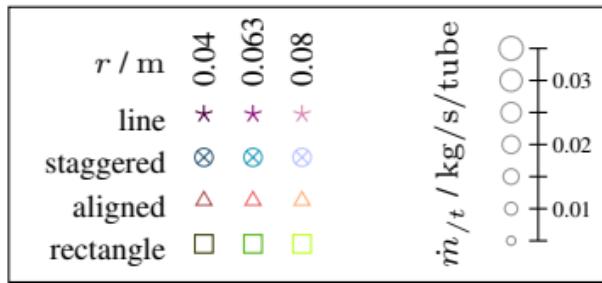
$$\begin{aligned} h &= 2.50 \\ \underline{q}^{(r)} &= 94.69\% \\ \dot{\underline{Q}} &= 16200\text{W} \\ \bar{\varphi} &= 0.30 \end{aligned}$$

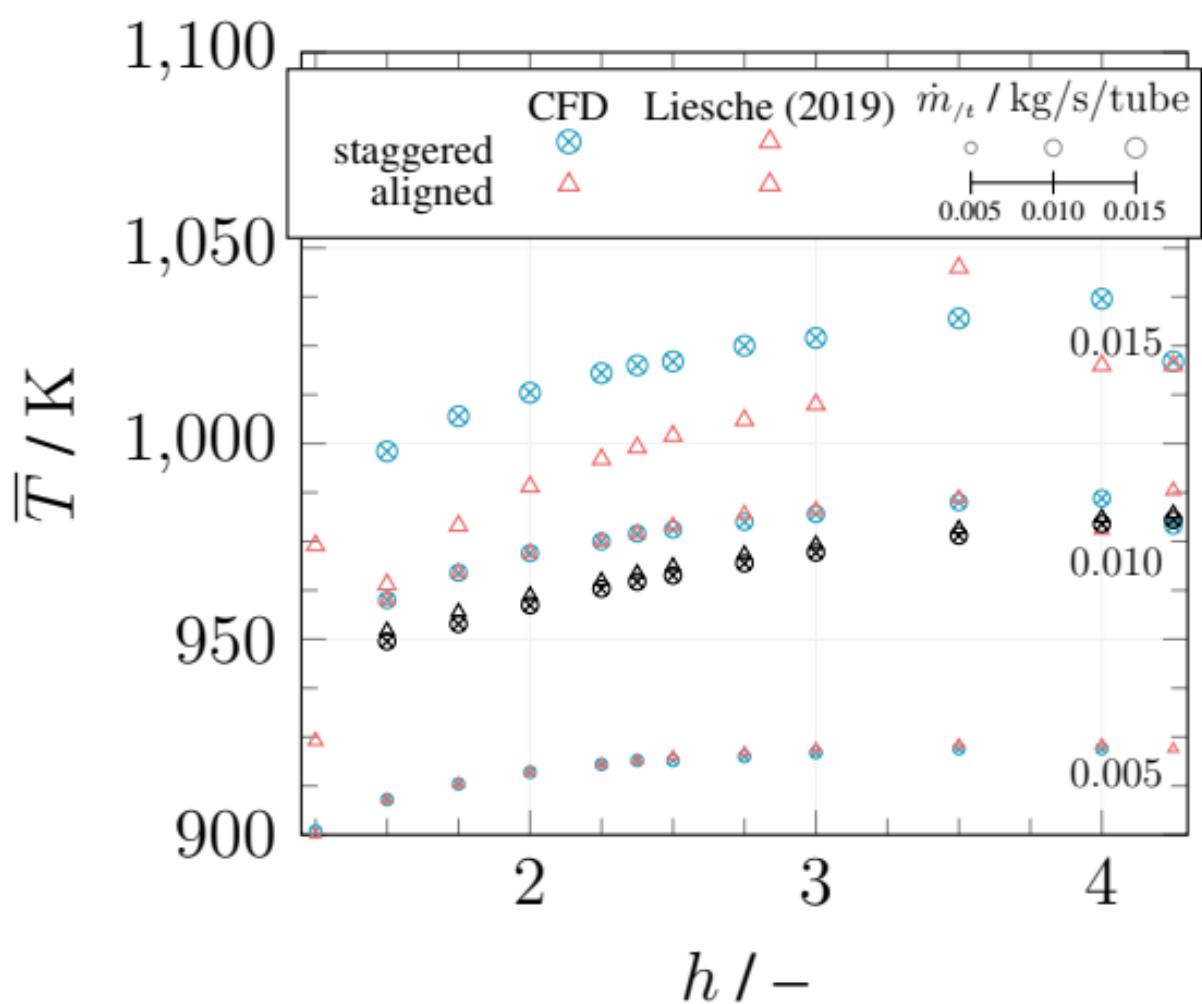


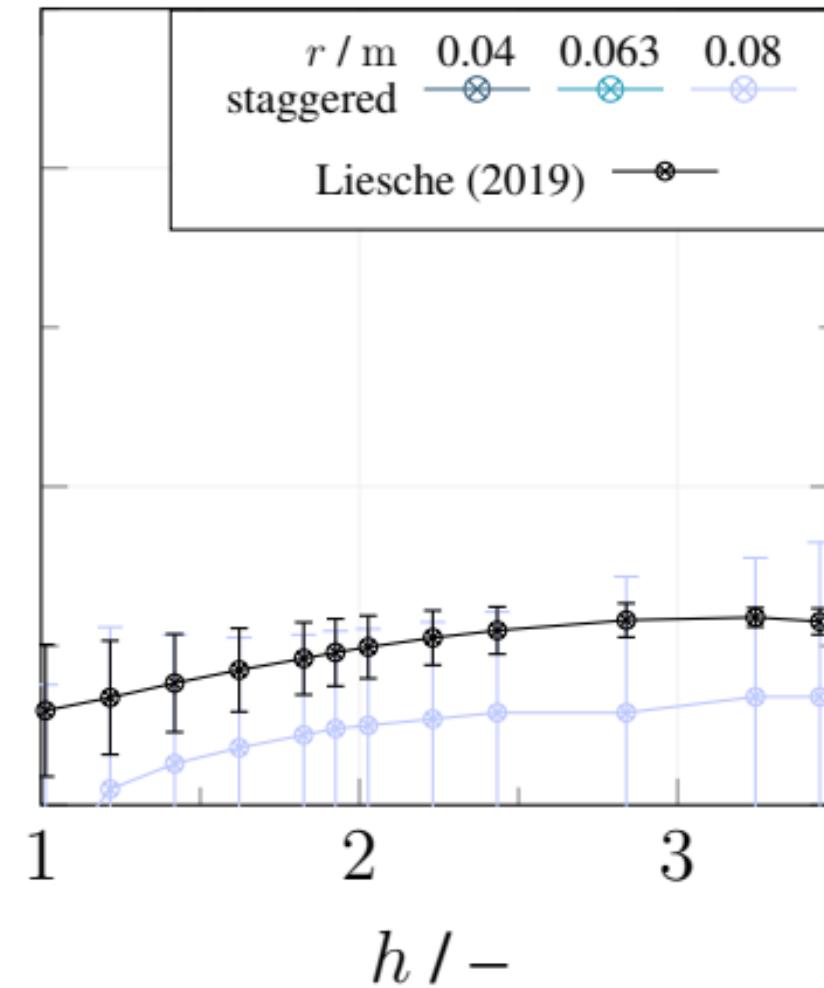
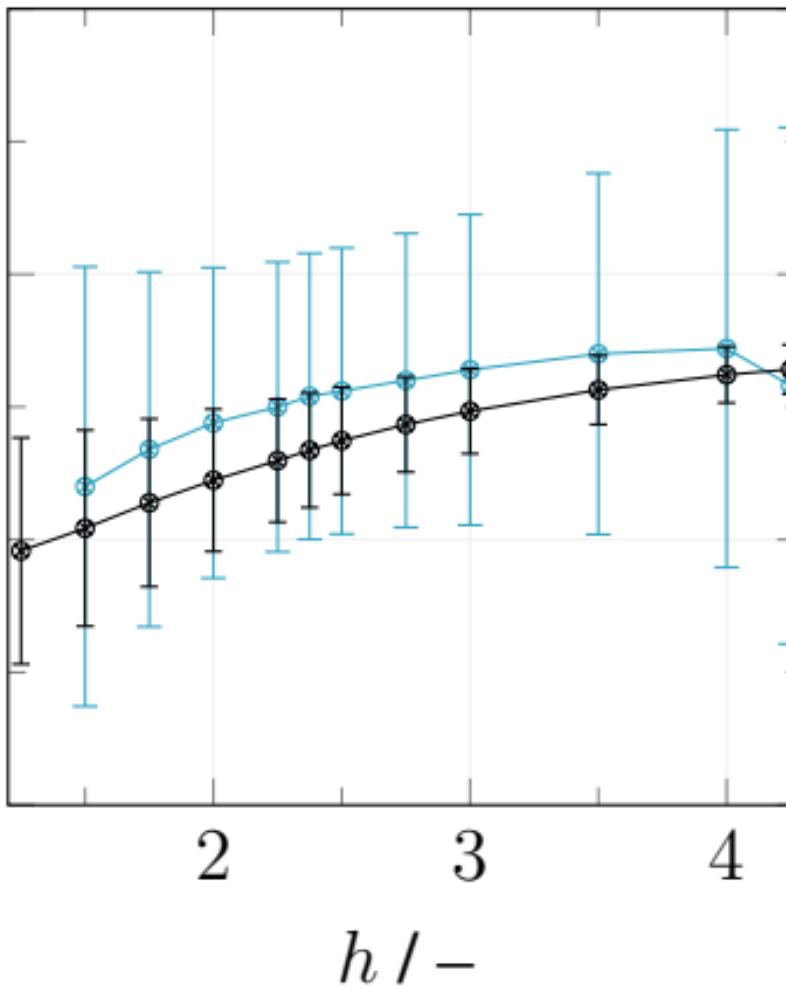
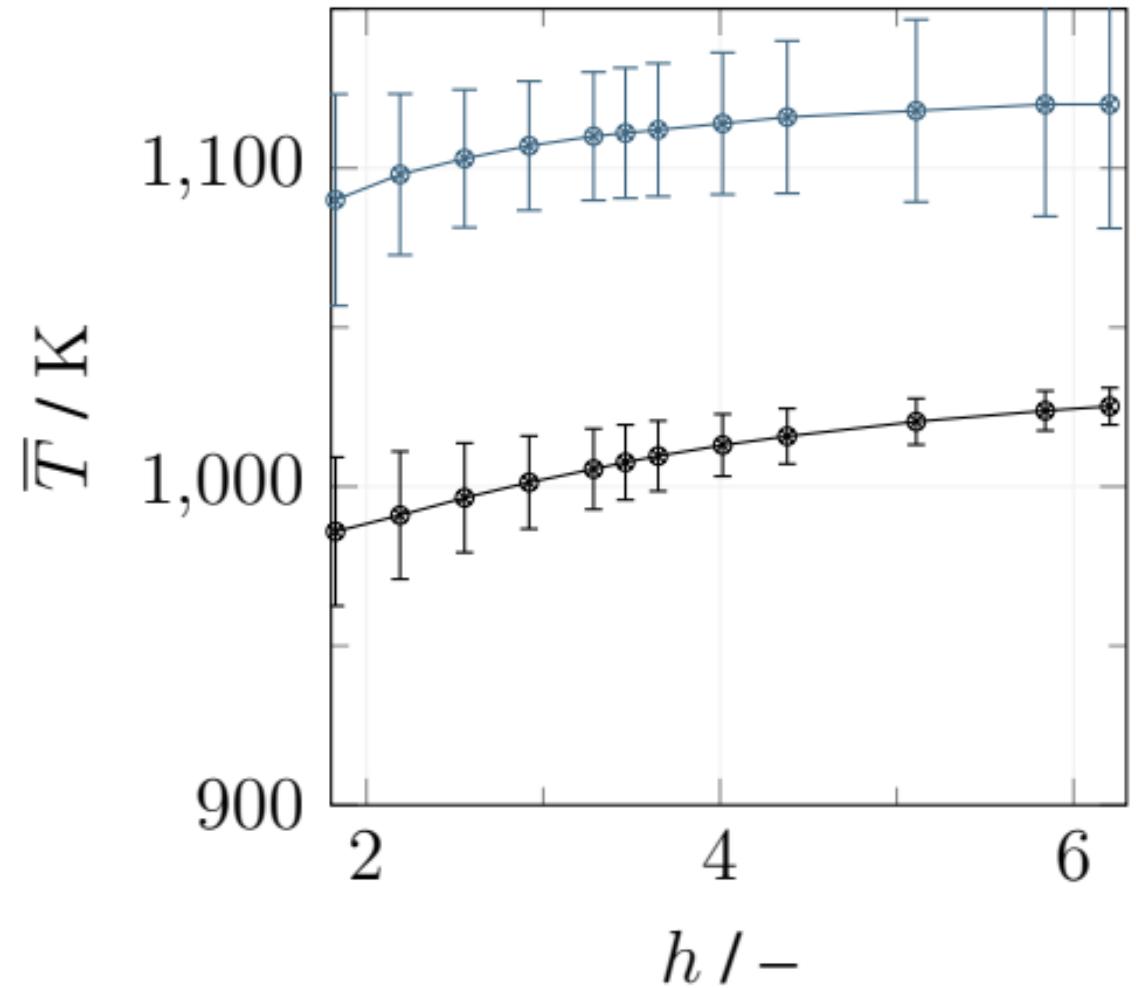
$$\begin{aligned} h &= 3.50 \\ \underline{q}^{(r)} &= 91.88\% \\ \dot{\underline{Q}} &= 17319\text{W} \\ \bar{\varphi} &= 0.22 \end{aligned}$$



$$\begin{aligned} h &= 4.00 \\ \underline{q}^{(r)} &= 91.92\% \\ \dot{\underline{Q}} &= 17920\text{W} \\ \bar{\varphi} &= 0.19 \end{aligned}$$


 \bar{Q} / W






r / m 0.04 0.063 0.08
staggered
Liesche (2019)

