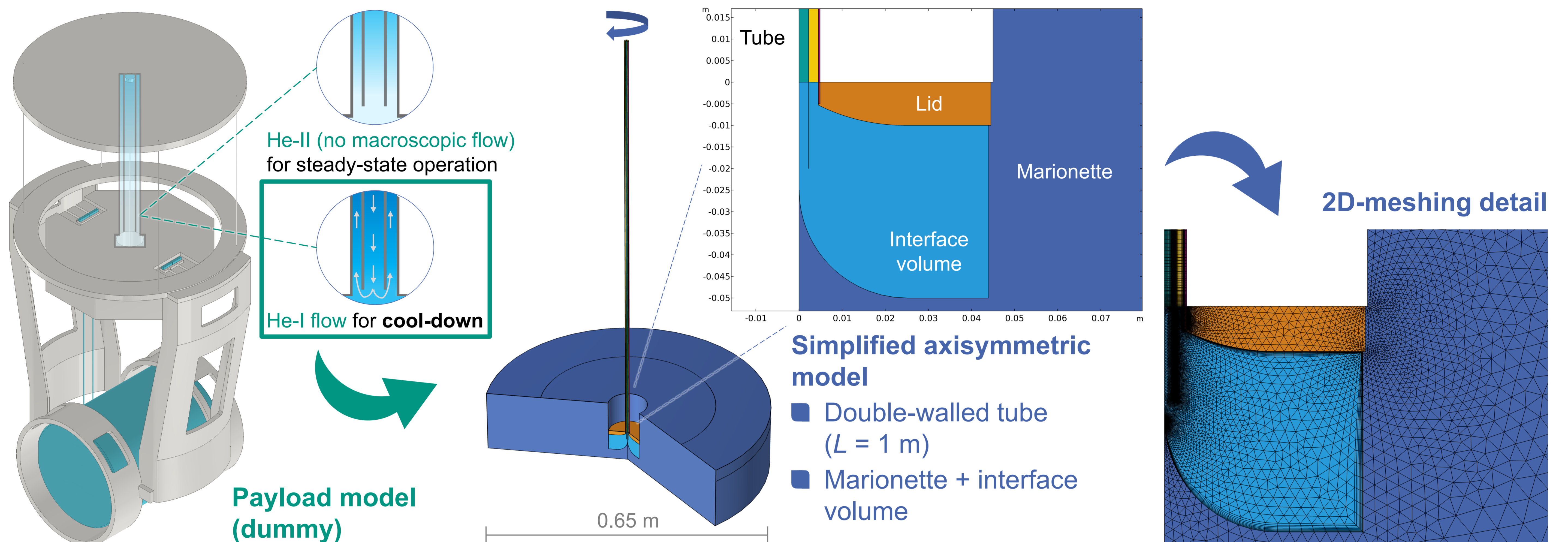


Cool-down studies of the low-frequency interferometer in the Einstein Telescope

L. Busch and S. Grohmann

Helium-fed suspension tube: CFD model geometry



System parameters and boundary conditions

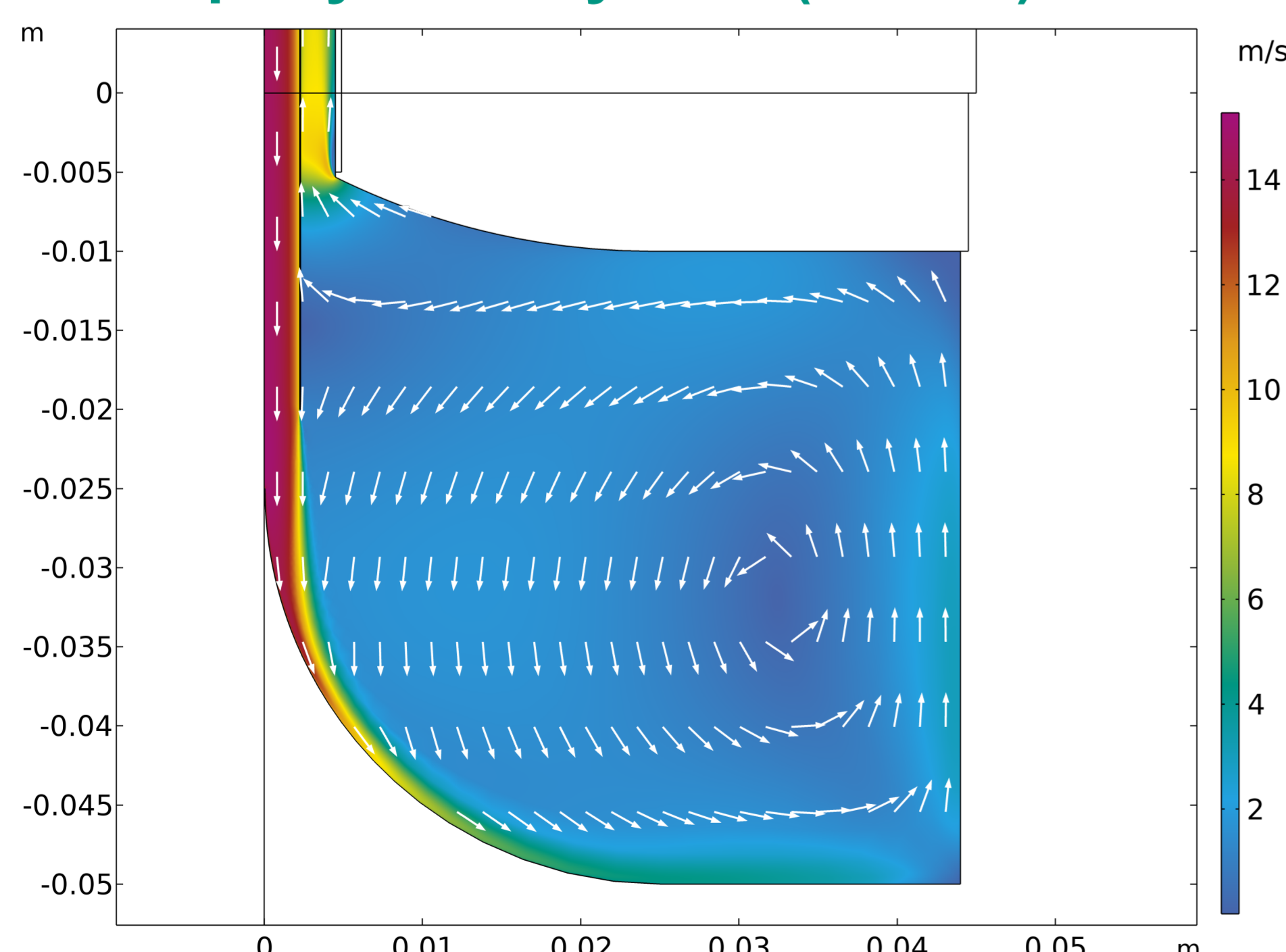
Parameter	Description	Expression / value
\dot{m}_{He}	Helium mass flow	up to $> 1000 \text{ mg/s}$
$T_{\text{He,in}}(t)$	Helium supply temperature	$\bar{T}_{\text{MAR}}(t) - \Delta T(t)$
$\bar{T}_{\text{MAR}}(t)$	Average marionette temperature	From transient solution data
$\Delta T(t)$	Temperature difference	50...110 K
$T_{\text{He,in,min}}$	Lowest He-I supply temperature	3.0 K
$p_{\text{He,out}}$	Absolute pressure at helium outlet	3.0...4.0 bar(a)

Key conditions

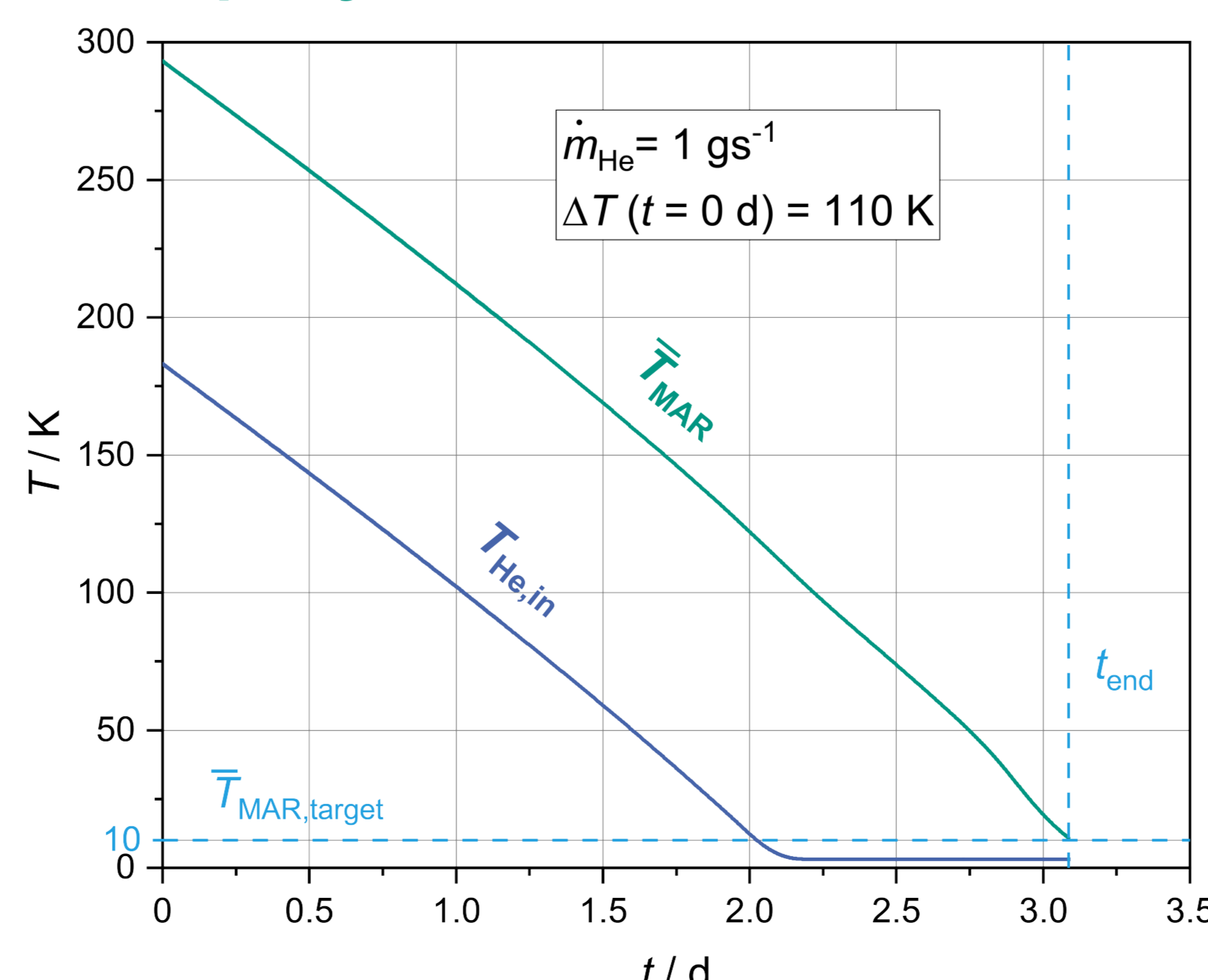
- Marionette
 - Material: stainless steel 314L
 - Mass: ca. 400 kg
 - Suspension tube
 - Material: Ti6Al4V
 - Wall thicknesses: 390 μm (outside), 50 μm (inside)
 - Helium
 - EOS: Peng-Robinson-Twu / Ideal Gas
 - Turbulence model: k- ϵ (compressible fluid)
- X. Korovesi (2022)*

Current status and preliminary results

Exemplary velocity field ($t \approx 2$ d)



Exemplary MAR cool-down curve



Conclusions

- $t_{\text{end,MAR}} < 7$ d appear achievable
- Mostly turbulent flow regimes ($\forall t$) $Re_{\text{max}} \approx 10^3 \dots 10^5$
- $\Delta p_{\text{global}} < 100$ mbar

Prospects

- Real gas behavior to be implemented
- Conduct parameter studies

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