Numerical simulation of trans- and supersonic jets at moderate Reynolds numbers using quasi-gas dynamic equations

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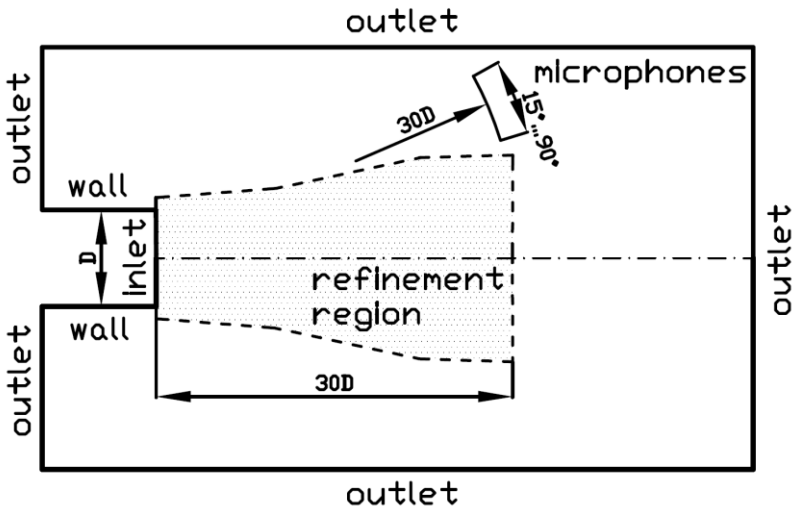
Compressible jet at low Reynolds number

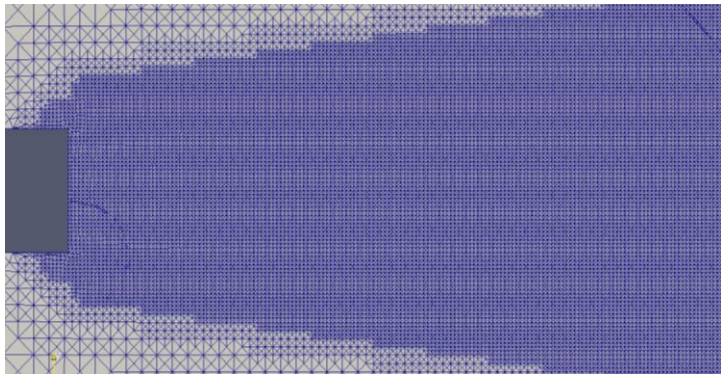
M=0.9, Re=3600.

QGDFoam, $Sc_{QGD} = 0$, $\alpha_{QGD} = 0.05\text{-}0.3$

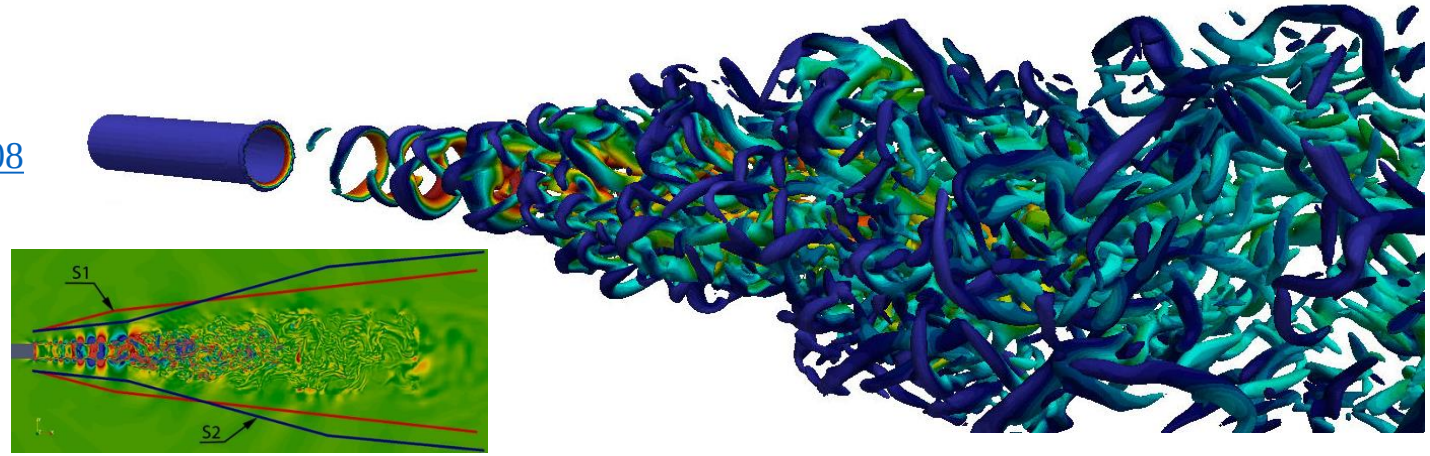
Ref. paper DOI: https://doi.org/10.1051/e3sconf/201912810008



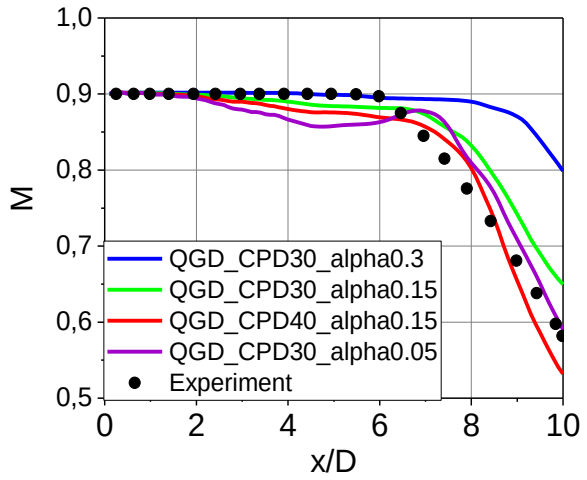
Computational domain and boundary conditions



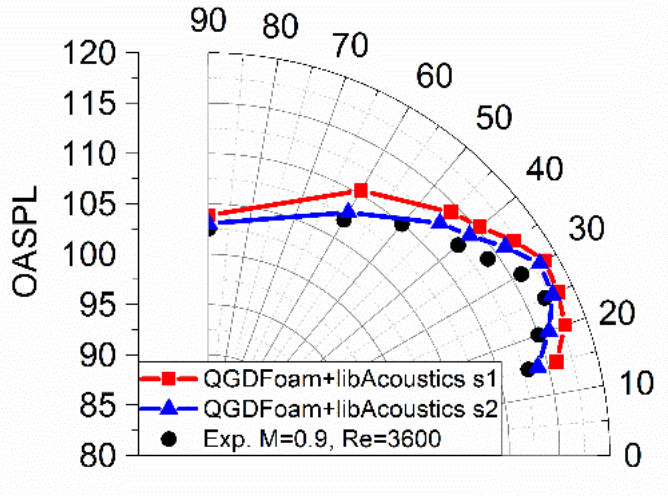
The fragment of the computational mesh



Instantaneous iso-surface of Q-criteria M=0.9, Re=3900



Axial distribution of centerline mean Mach number



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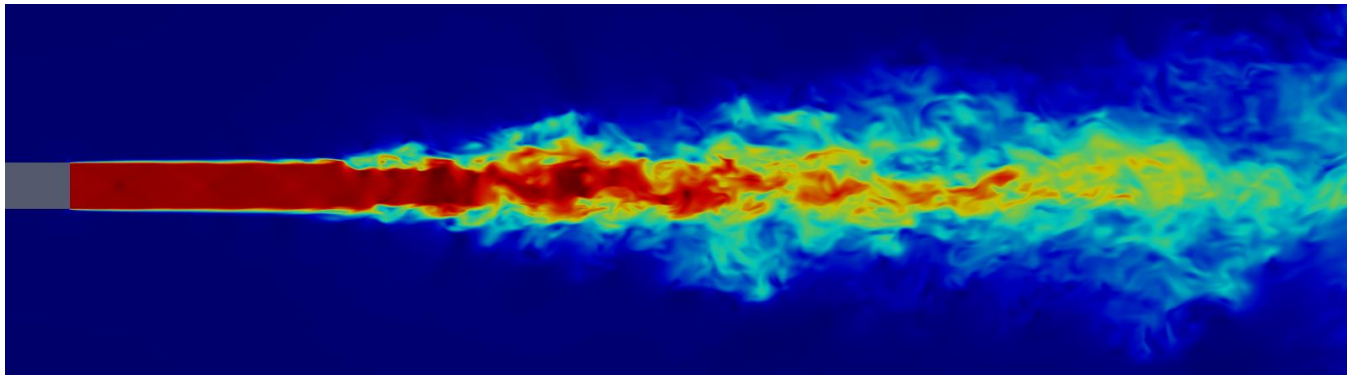
Compressible jet at moderate Reynolds number

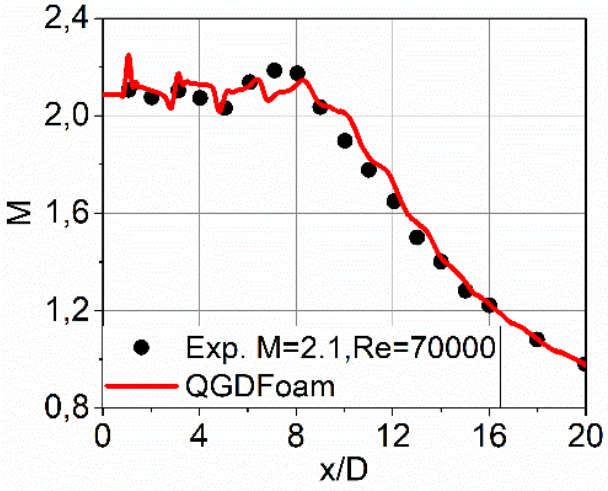
M=2.1, Re=70000.

QGDFoam, $Sc_{QGD} = 0$, $\alpha_{QGD} = 0.15$

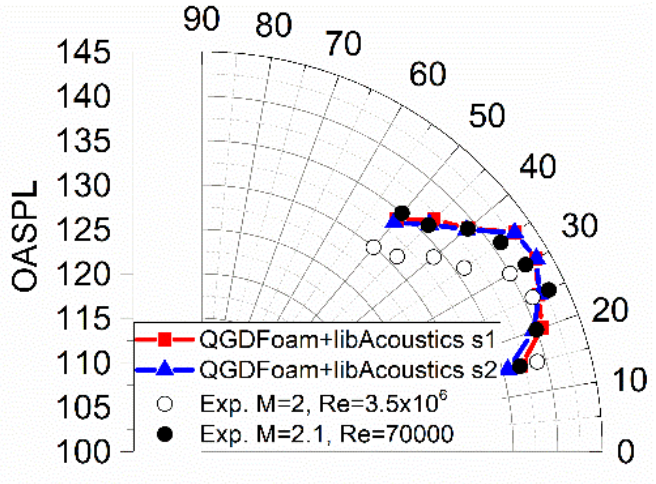
Ref. paper DOI: https://doi.org/10.1007/978-3-030-50436-6_16



The jet velocity distribution at M=2.1, Re=70000



Axial distribution of centerline mean Mach number



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Summary

1. Validation of QGDFoam solver was performed on the problems of trans- and supersonic jets of perfect viscous gas and acoustic noise generated by them at small and moderate Reynolds numbers.
2. The resolution of the calculated grid should be at least 40CPD, and the regularization parameters are $Sc_{QGD} = 0$, $\alpha_{QGD} = 0.15$.
3. The QGD algorithm makes it possible to correctly model the process of formation and propagation of hydrodynamic instabilities at a lower mesh resolution compared to the hybrid method for approximating convective terms and the Kurganov-Tadmore scheme (pimpleCentralFoam solver).

References information

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- Kraposhin, M. V., Epikhin, A. S., Elizarova, T. G., & Vatutin, K. A. (2019). Simulation of transonic low-reynolds jets using quasi-gas dynamics equations. Journal of Physics: Conference Series, , 1382(1) doi:10.1088/1742-6596/1382/1/012019
- Epikhin, A., & Kraposhin, M. (2020). Prediction of the free jet noise using quasi-gas dynamic equations and acoustic analogy. Lecture Notes in Computer Science, vol 12143. doi:10.1007/978-3-030-50436-6_16

- Telegram: https://t.me/qgd_qhd
- QGDSolvers: https://github.com/unicfdlab/QGDsolver.git
- libAcoustics: https://github.com/unicfdlab/libAcoustics.git