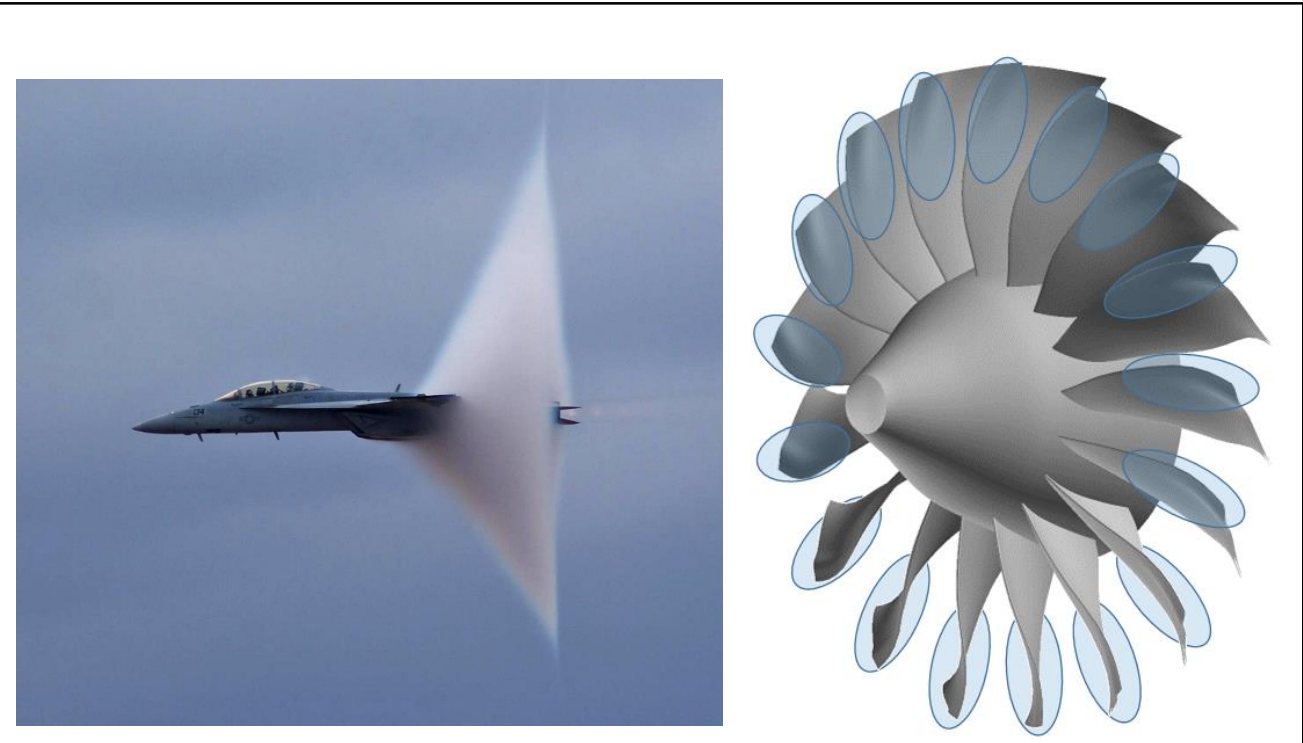


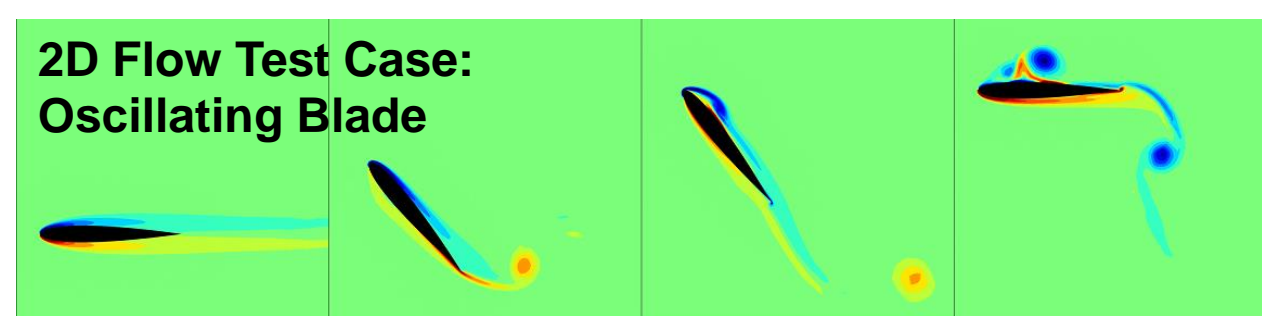
Background



Shock wave over jet

Supersonic flow around gas turbine engine fan

Shock Wave Modeling

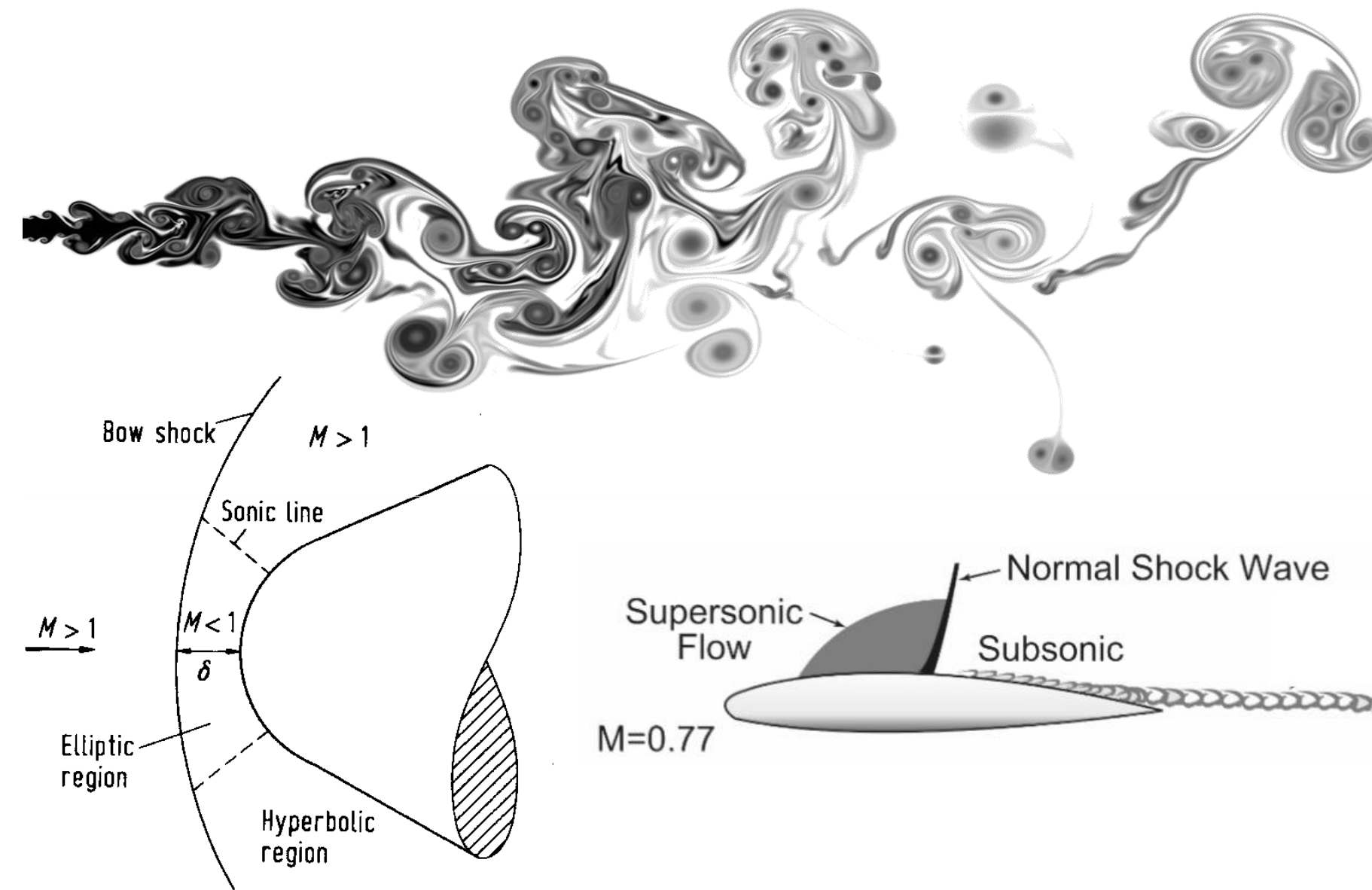


2D Flow Test Case: Oscillating Blade

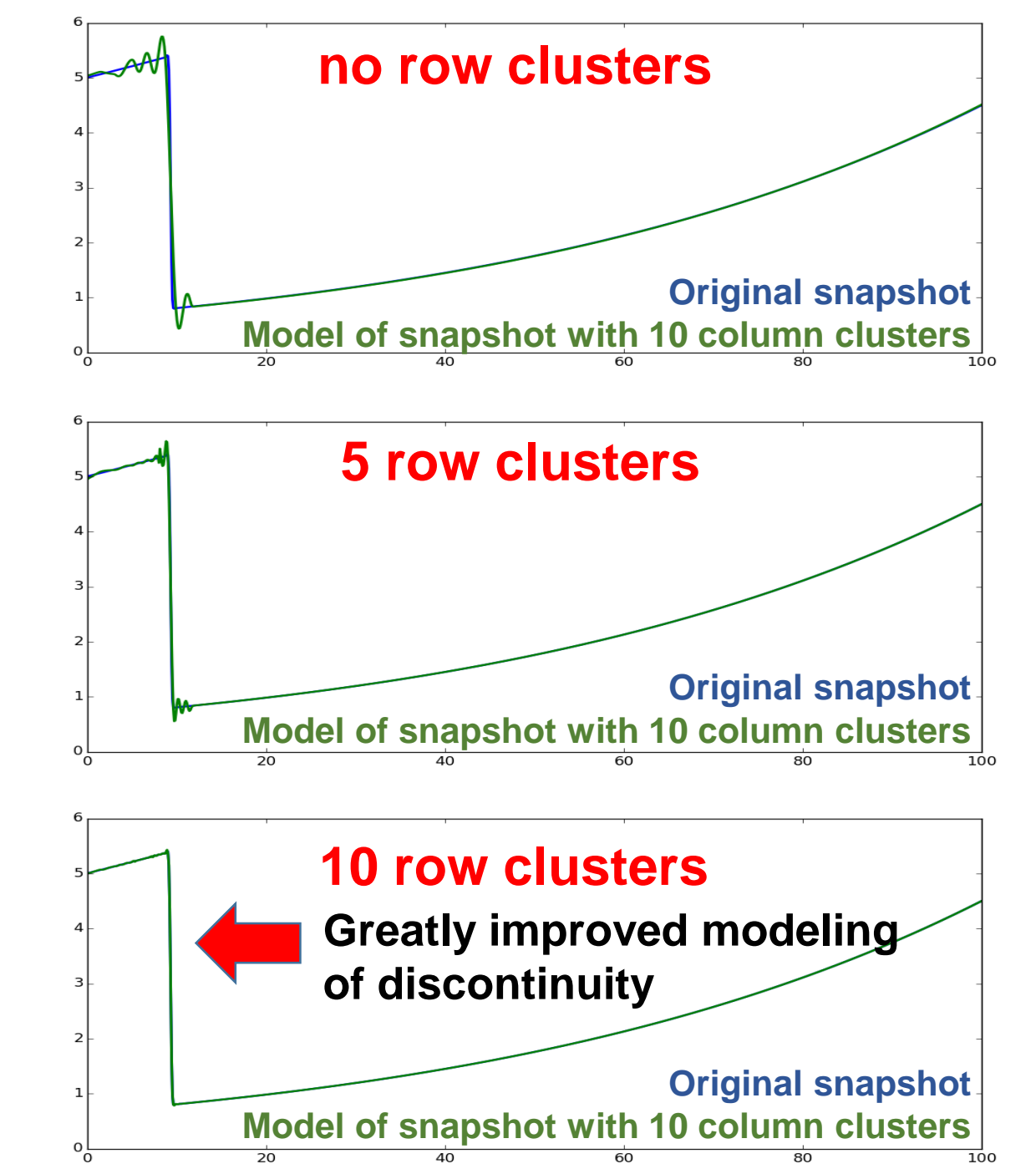
2D Flow Modeling

A clustering algorithm for reduced order modeling of shock waves

Flow Domain Structures

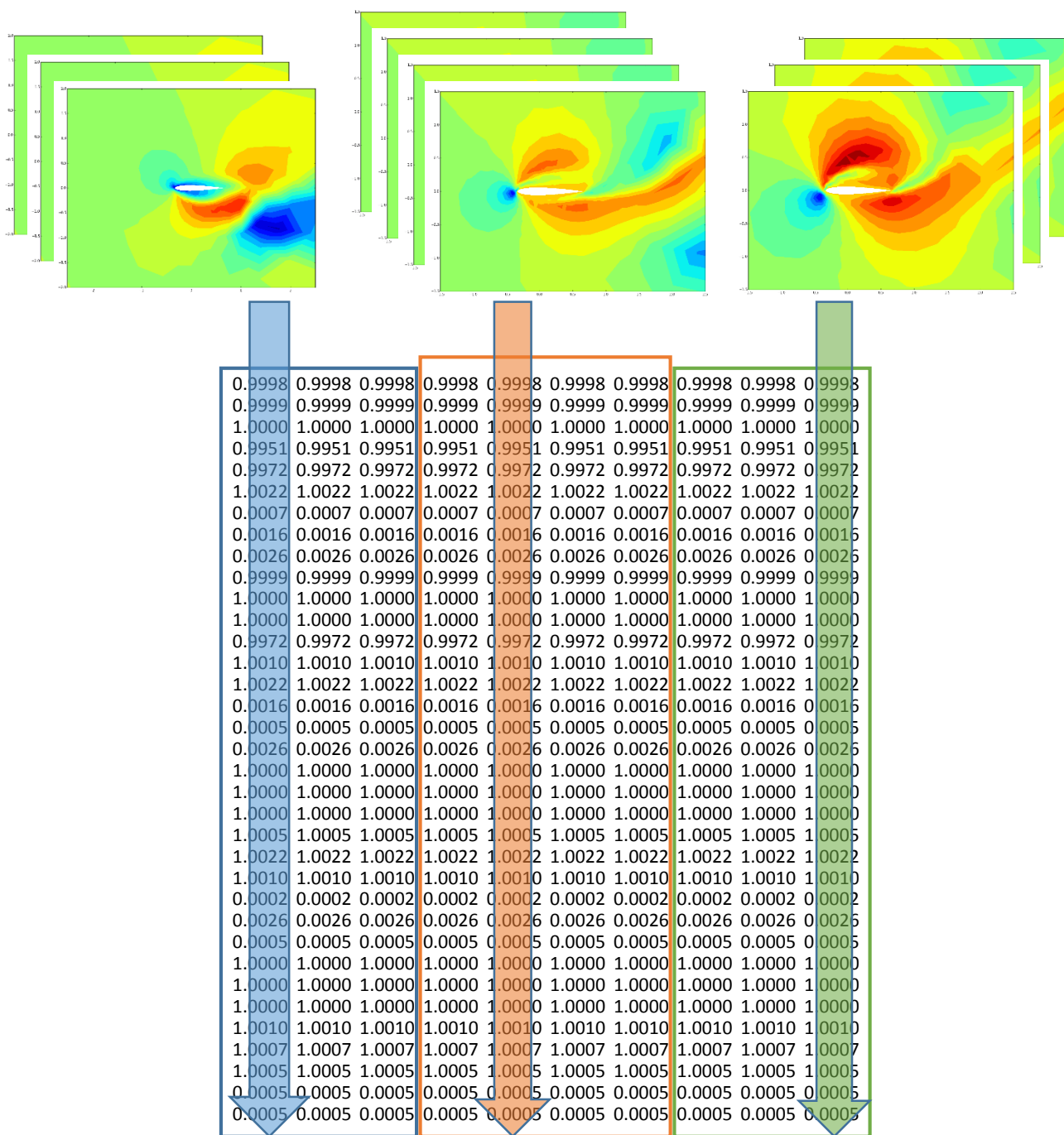


Results – Shock wave



- Simple 1D Berger's equation solution
- Demonstration case for shock modeling

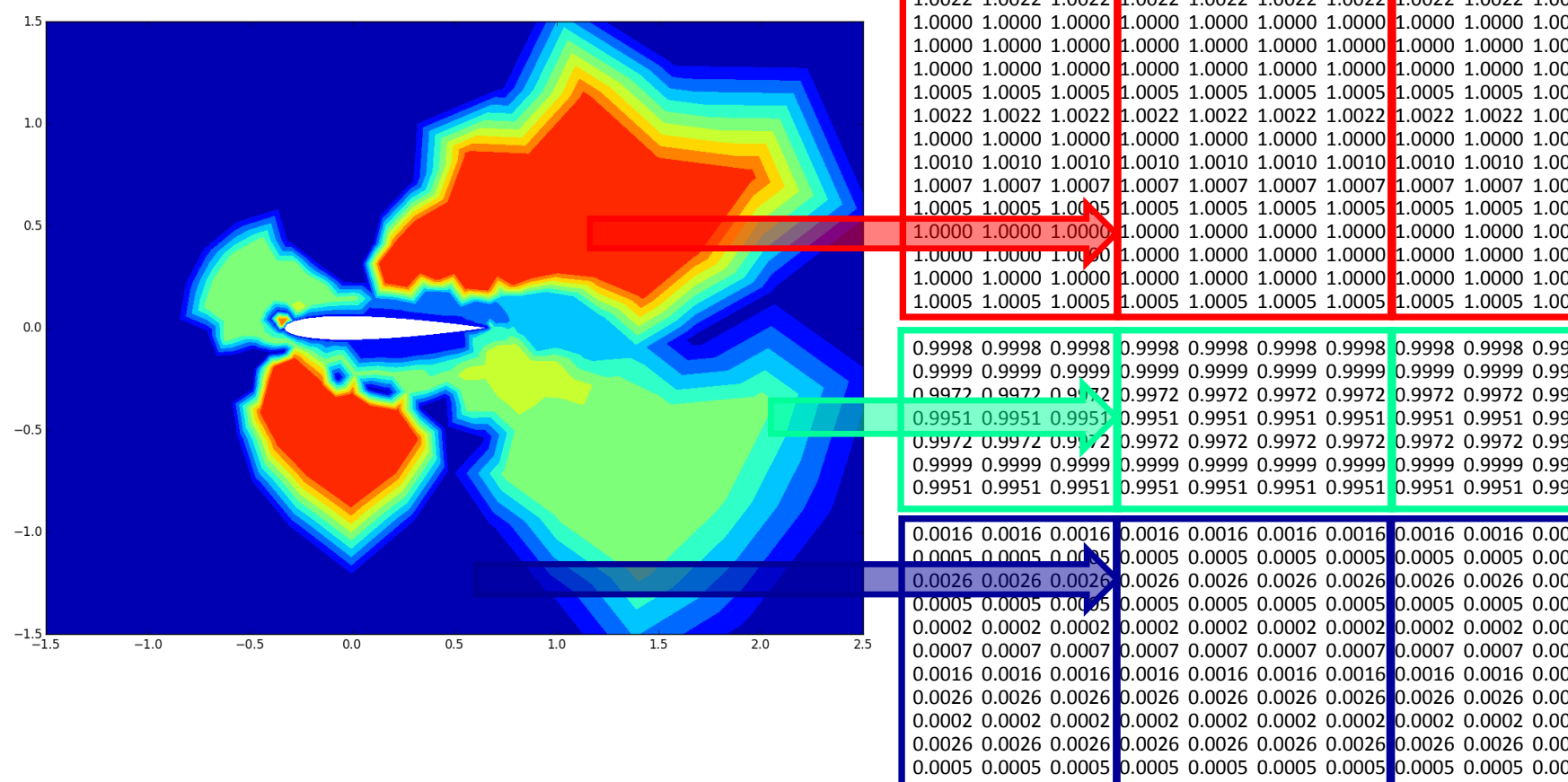
K-Means Column Clustering



- Snapshots of the simulation data stored in a vector
- Multiple snapshots stored in columns of matrix
- K-means clusters the columns into similar snapshots

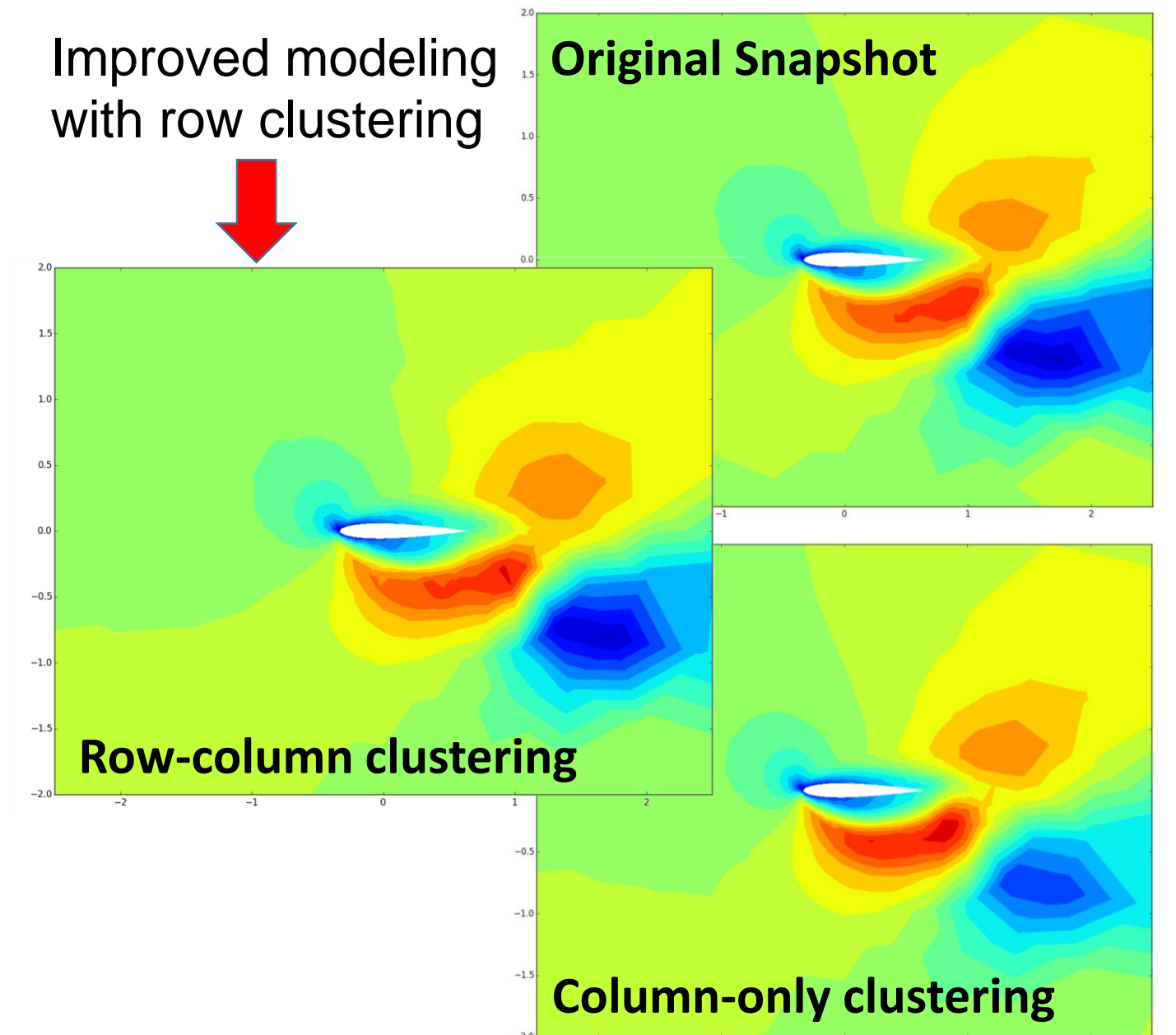
K-Means Flow Domain Clustering

NEW METHOD



- K-means clusters the rows of each computed column cluster
- Creates a board of sub-matrices for reduced order model

Results – 2D Flow



- 2D URANS solution of oscillating airfoil
- Improvement for flows without shocks