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Progress in Crossflow and BiGlobal Stability Analyses by Derek Dinzl

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U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration

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Work Performed by Derek Dinzl

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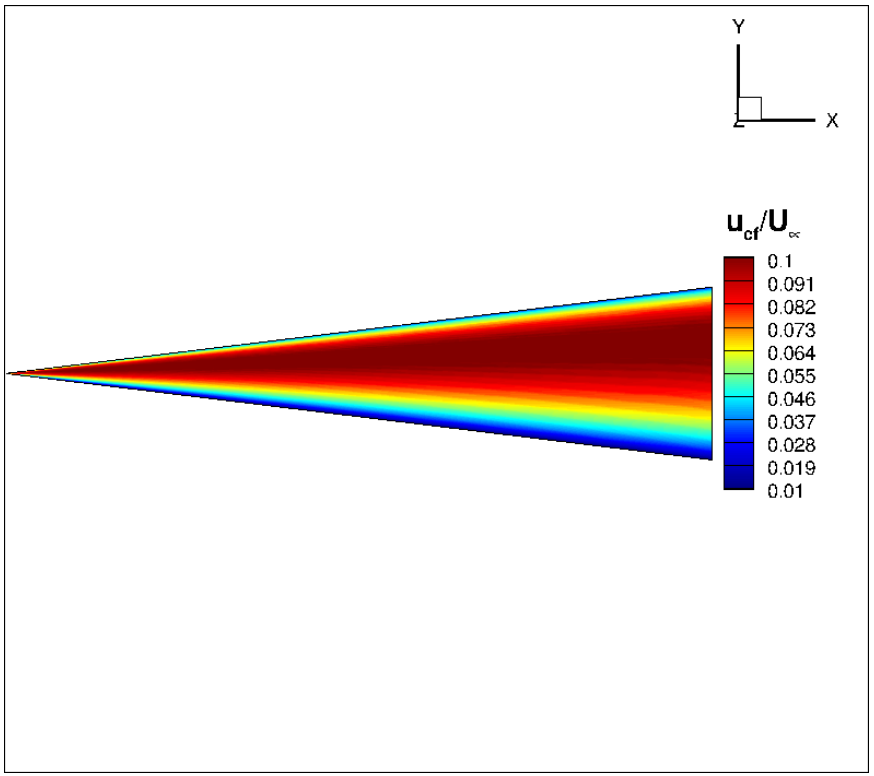
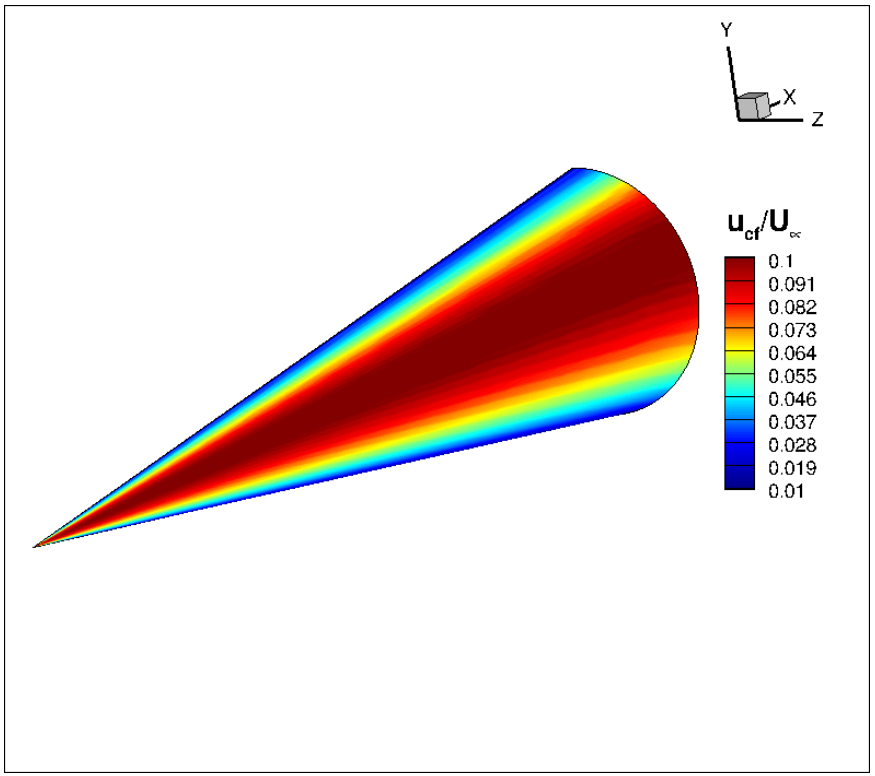
- Derek Dinzl is a intern in the Aerosciences department. He was tasked with two main tasks
  - Create a stream tracing method for STABL3D that tracks the generalized crossflow momentum inflection (GCMI).
    - This method has been shown to be critical for properly capturing the growth of a crossflow disturbance.
  - Formulate and code a BiGlobal stability analysis solver
    - Using generalized coordinates, as STABL3D does, write that linearized Navier-Stokes equations in a way to solver eigenvalue problems on 2D manifolds of 3D flowfields
    - Code the equations in a way that leverages the mechanics already existing in STABL3D and validate the solver.
- The following items are products of Dereks work and need to be cleared for inclusion in Derek's Ph.D. Thesis.

Conical Flow Test Problem

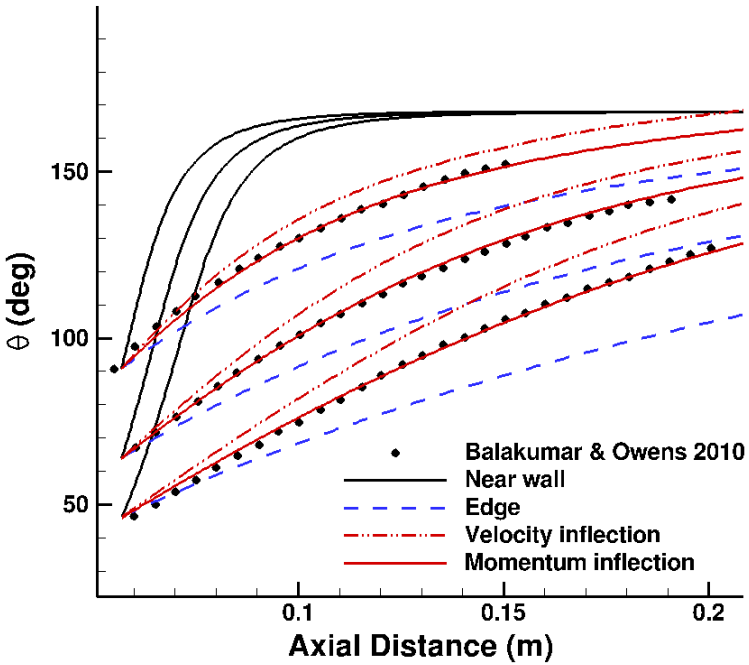
- Contour plots of normalized maximum crossflow velocity



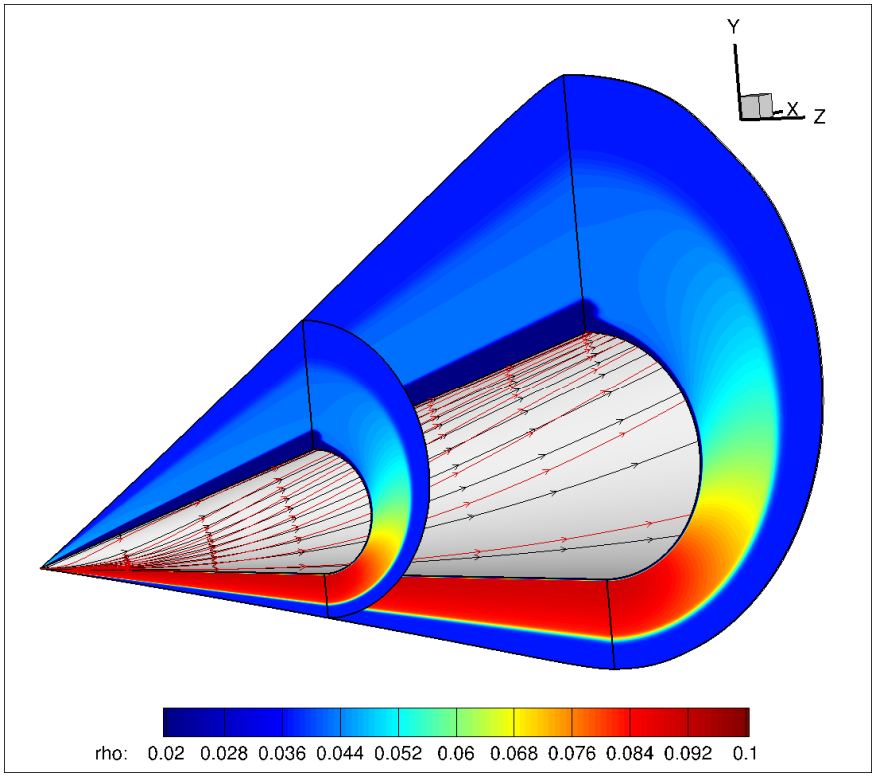


GCMI Streamlines

- Primary test case of generalized crossflow momentum inflection
  - Method proves accurate to DNS data



Verification of method based on DNS data



Demonstration of the difference between edge and GCMI streamlines

Embedded Equations for BiGlobal Solver