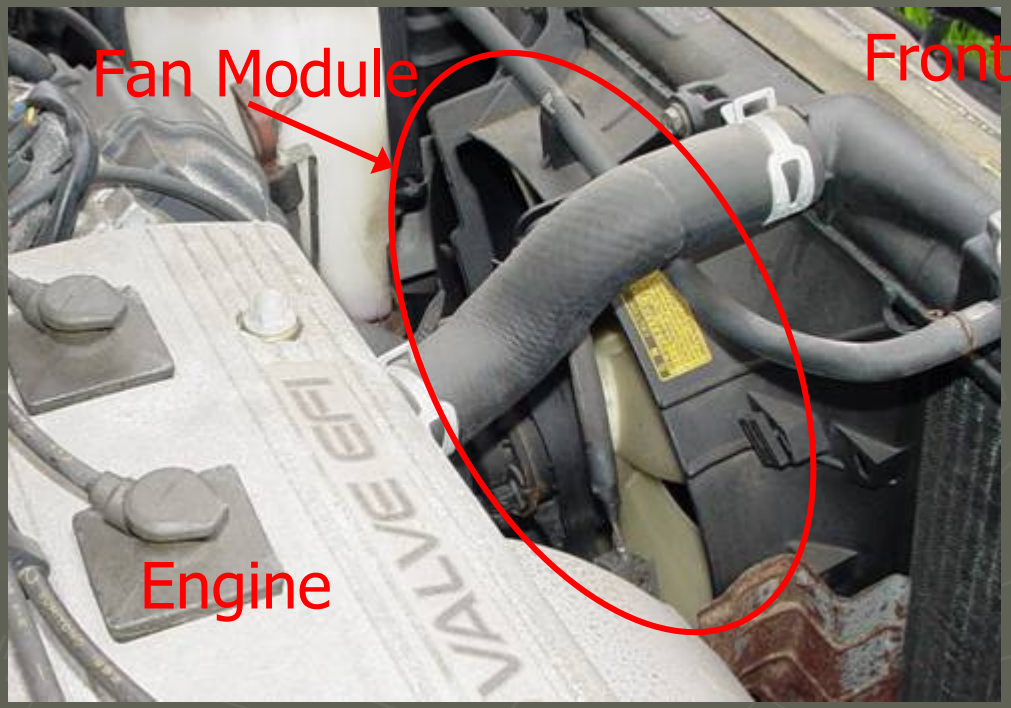
Low-Pressure Fan Development Progress

N. L. Gifford
R. J. Martinuzzi
E. Savory



Typical Engine Bay – Toyota Corolla

Partners: Siemens VDO Automotive
and Materials and Manufacturing Ontario

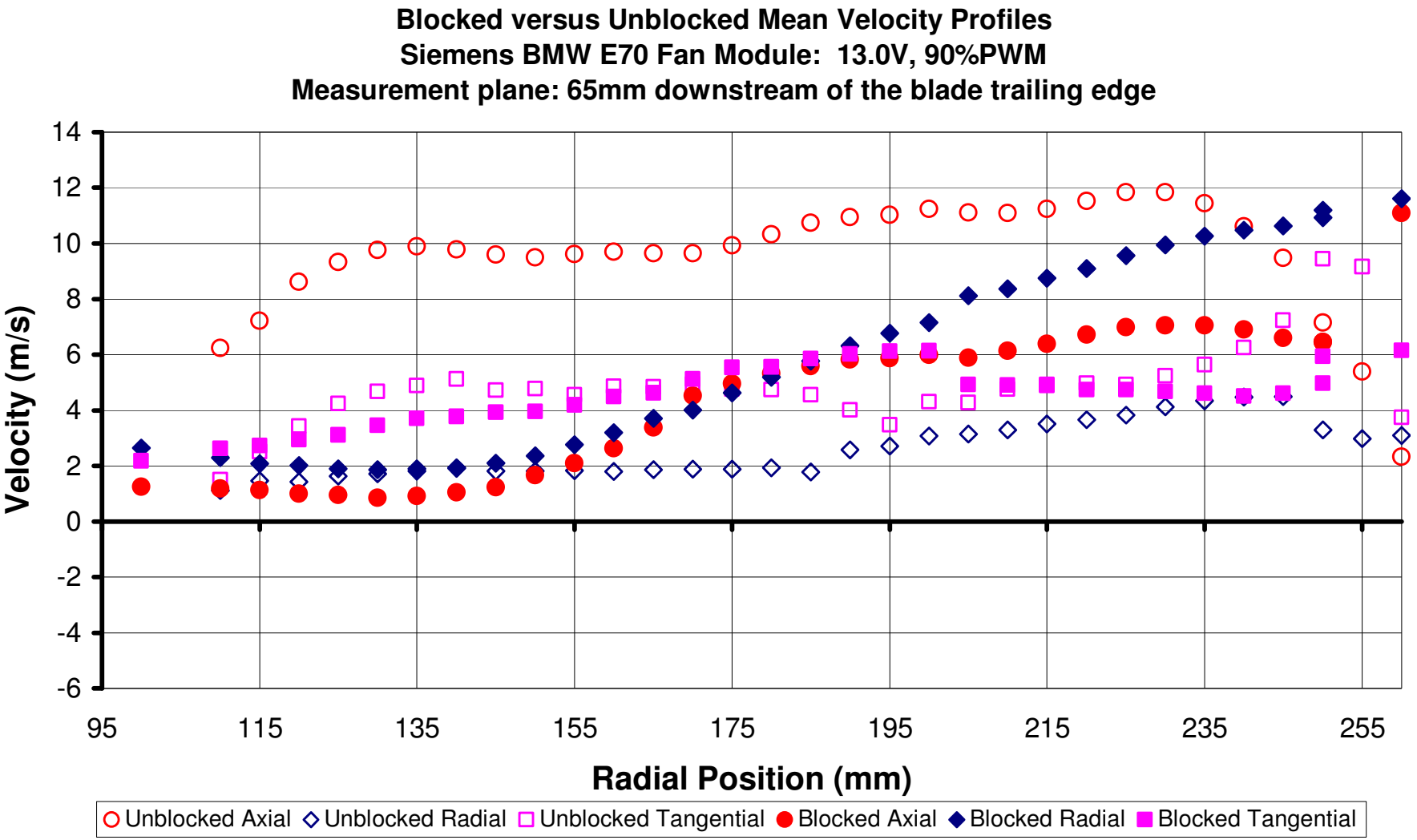
Outline

- Mean velocity plots
- Phase-averaged contour plots
- Future work

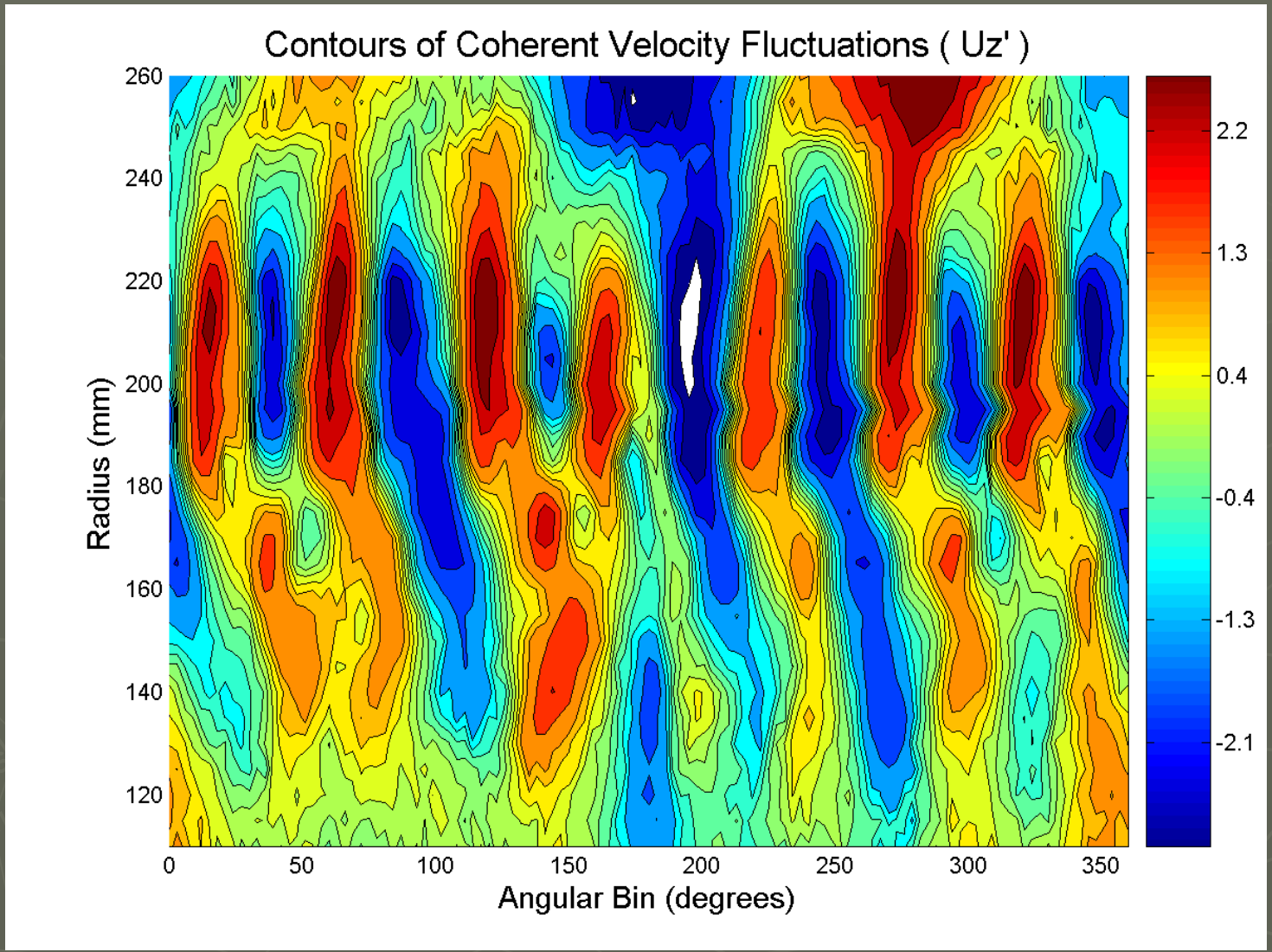
Experimental Details

- Location:
  - 65mm downstream of trailing edge
  - Vertical profile (90 degrees)
  - With phase-averaging by time stamp reset
- Measurements:
  - 60,000 data points at each radial location
  - Blockage plate installed 165mm from radiator
- Analysis
  - Excel plots of mean velocity profile
  - MatLab used to process into 3-degree bins
  - Contour plots generated for coherent and incoherent fluctuations

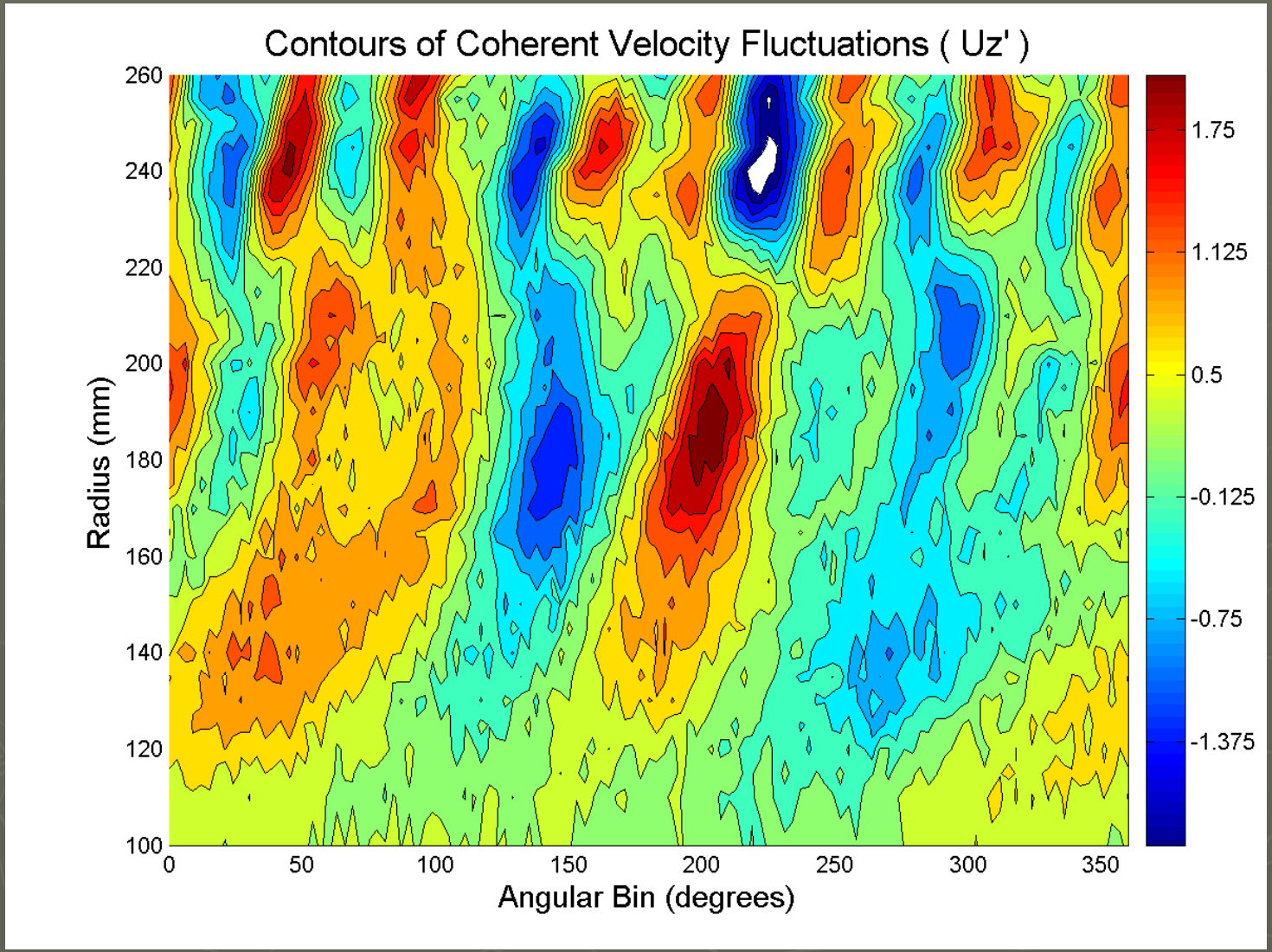
Mean Velocity Plot



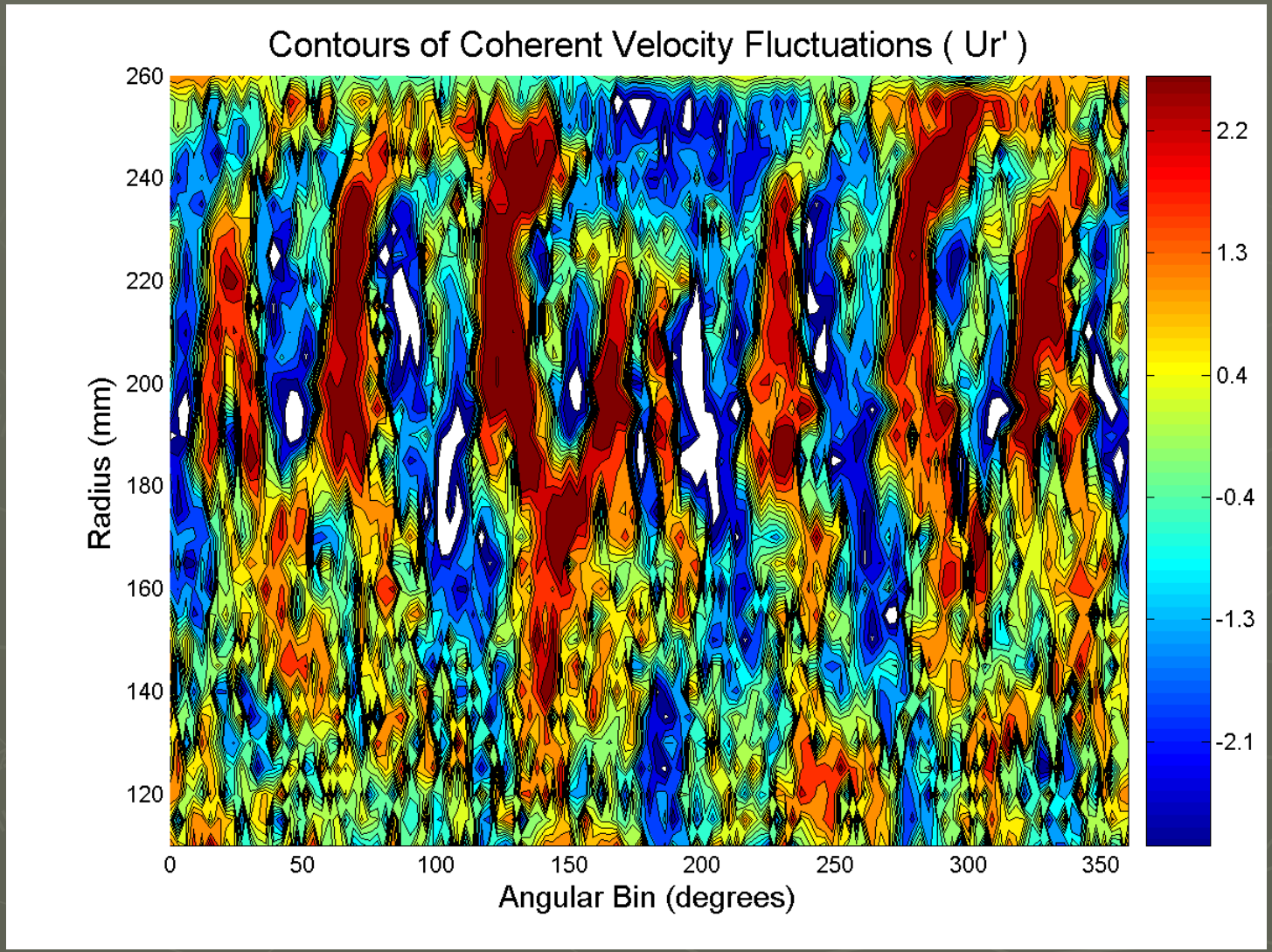
Unblocked, Axial, Coherent Velocity Fluctuations



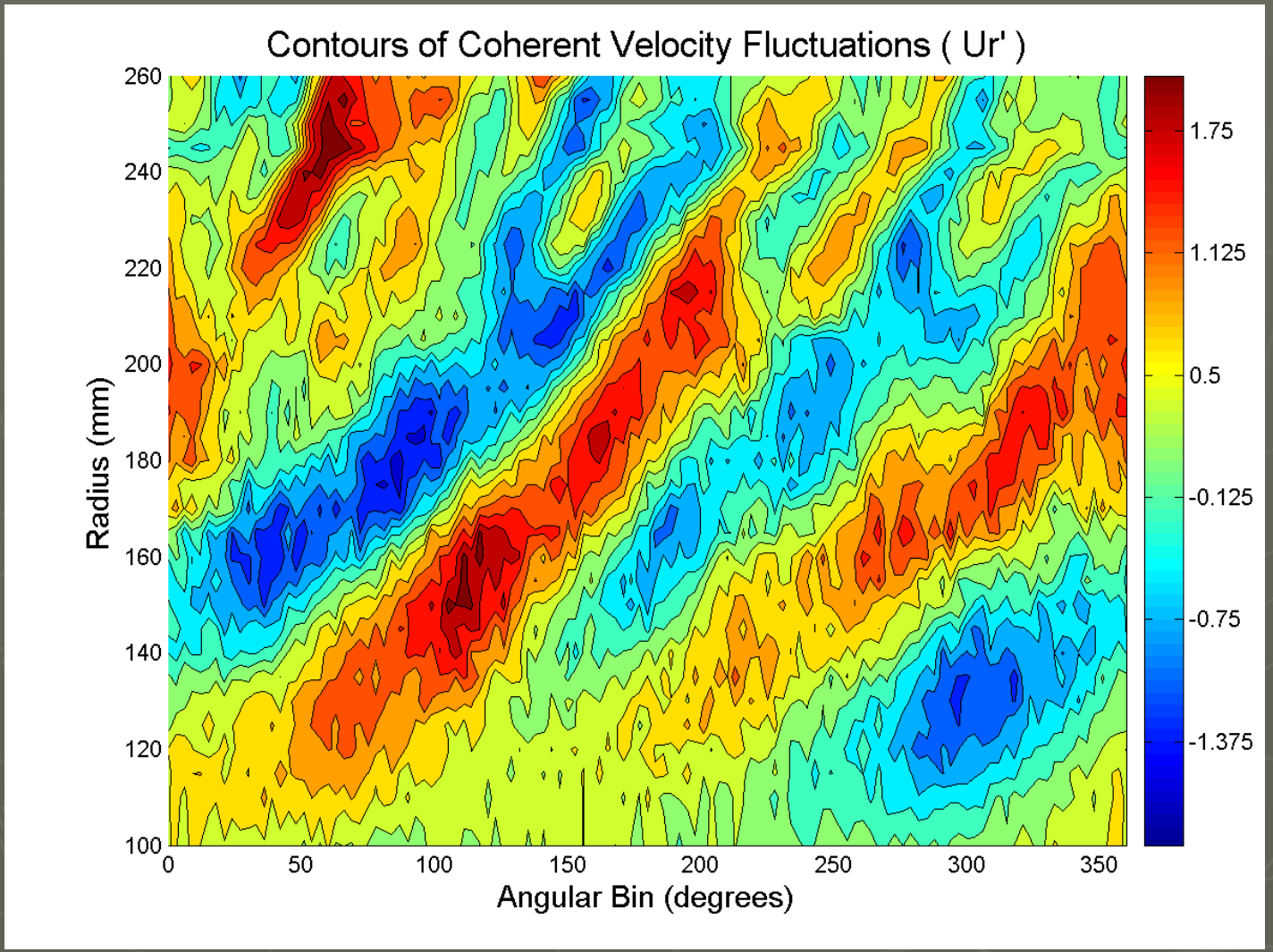
Blocked, Axial, Coherent Velocity Fluctuations



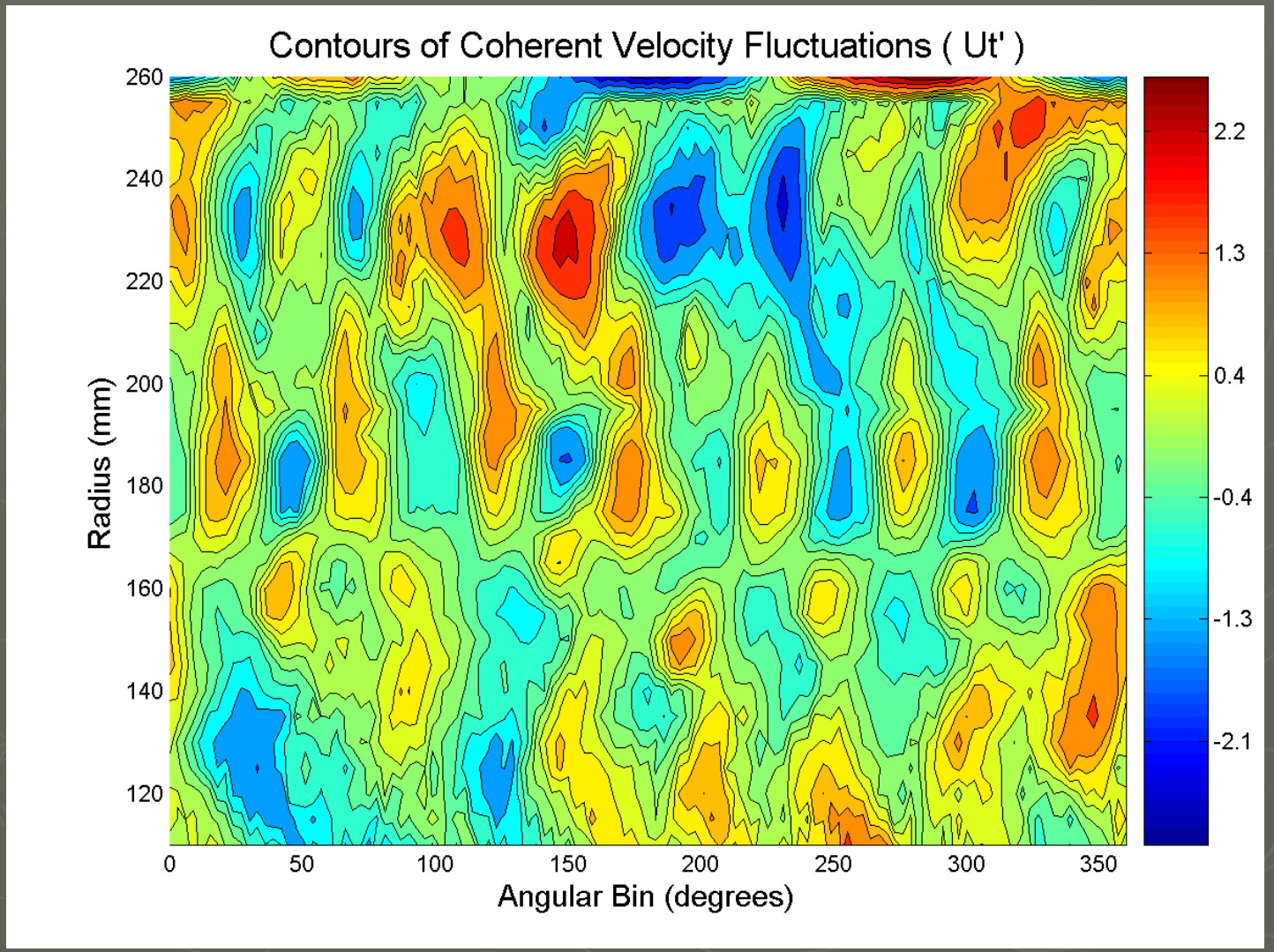
Unblocked, Radial, Coherent Velocity Fluctuations



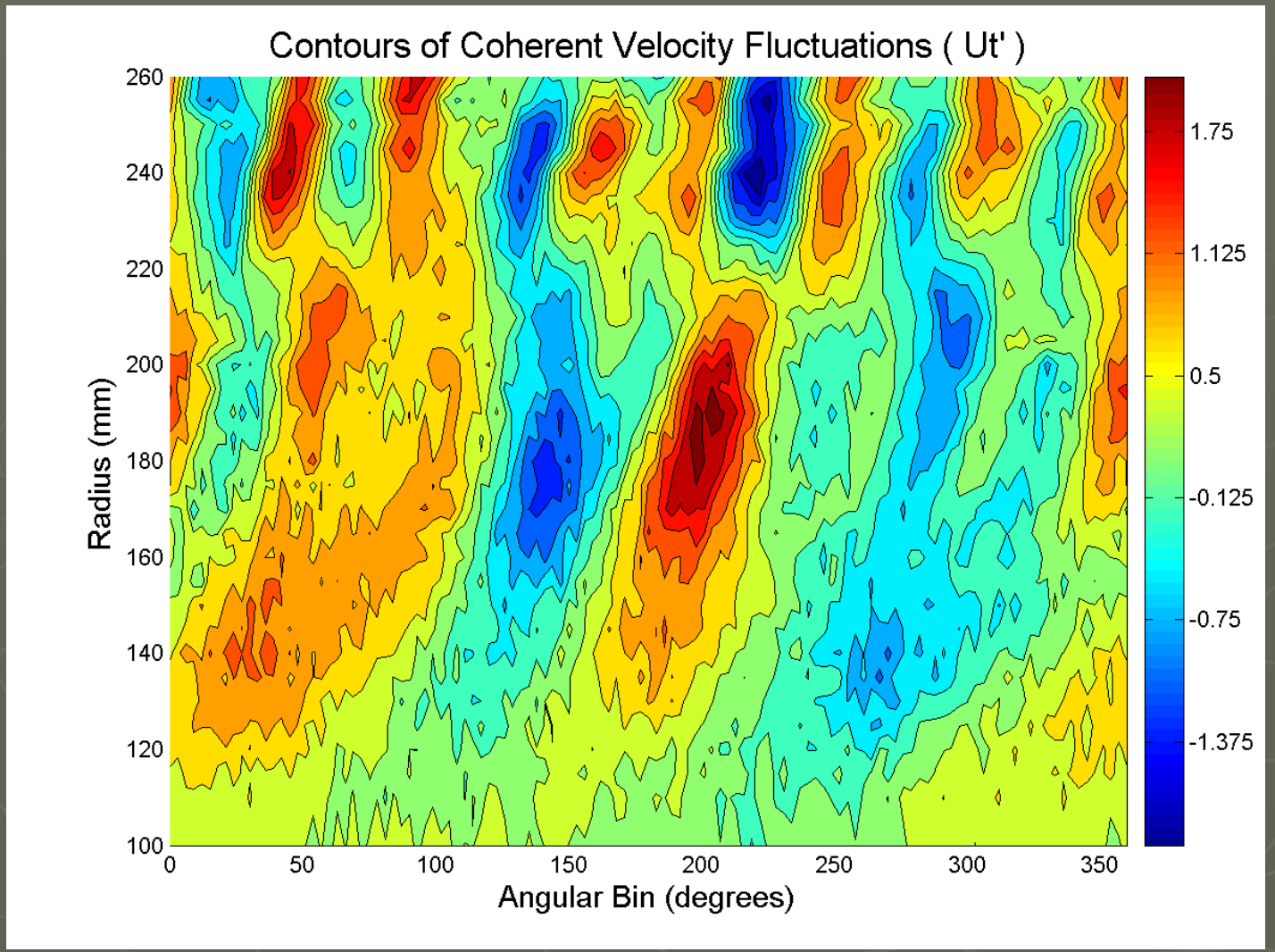
Blocked, Radial, Coherent Velocity Fluctuations



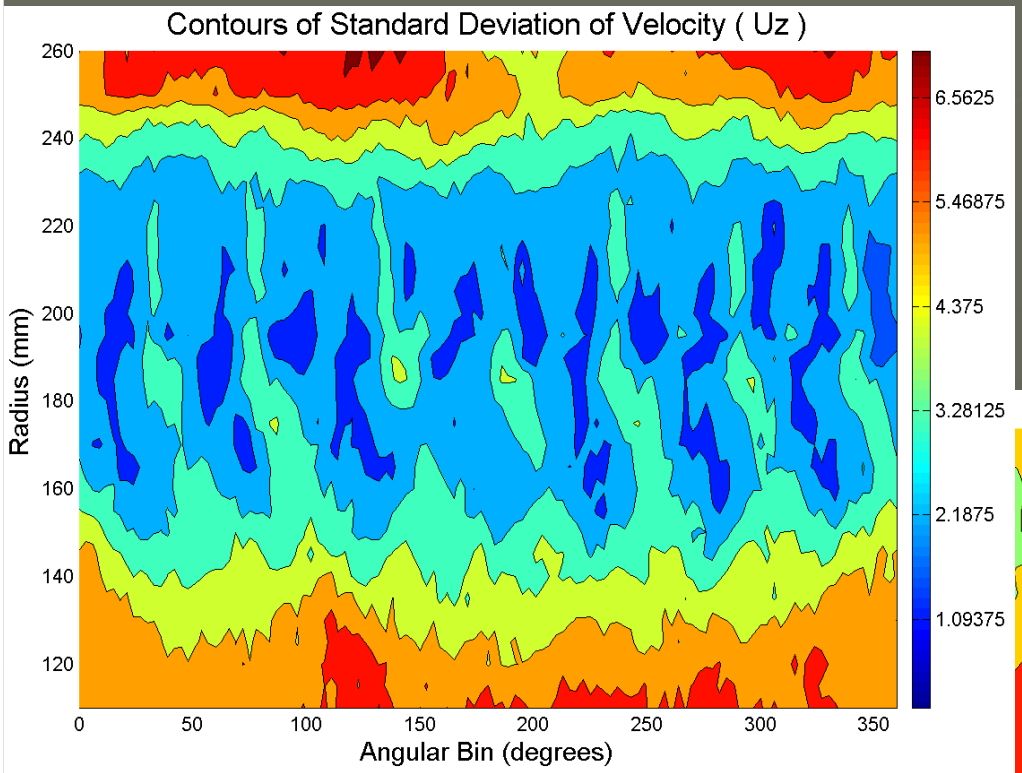
Unblocked, Tangential, Coherent Velocity Fluctuations

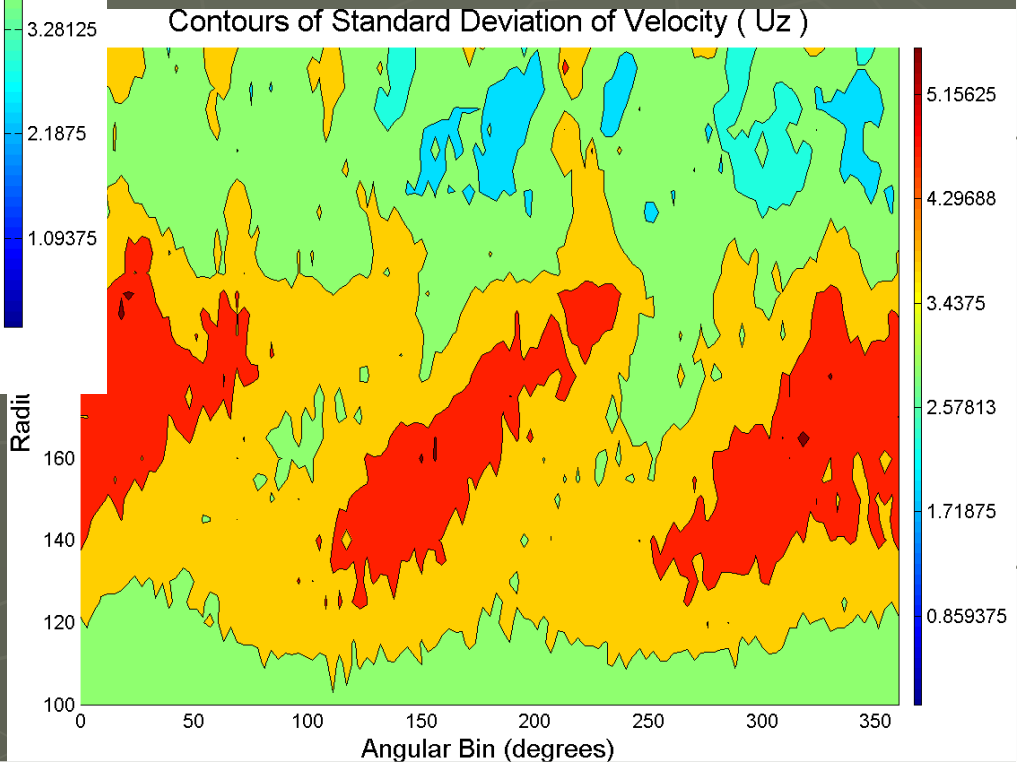


Blocked, Tangential, Coherent Velocity Fluctuations

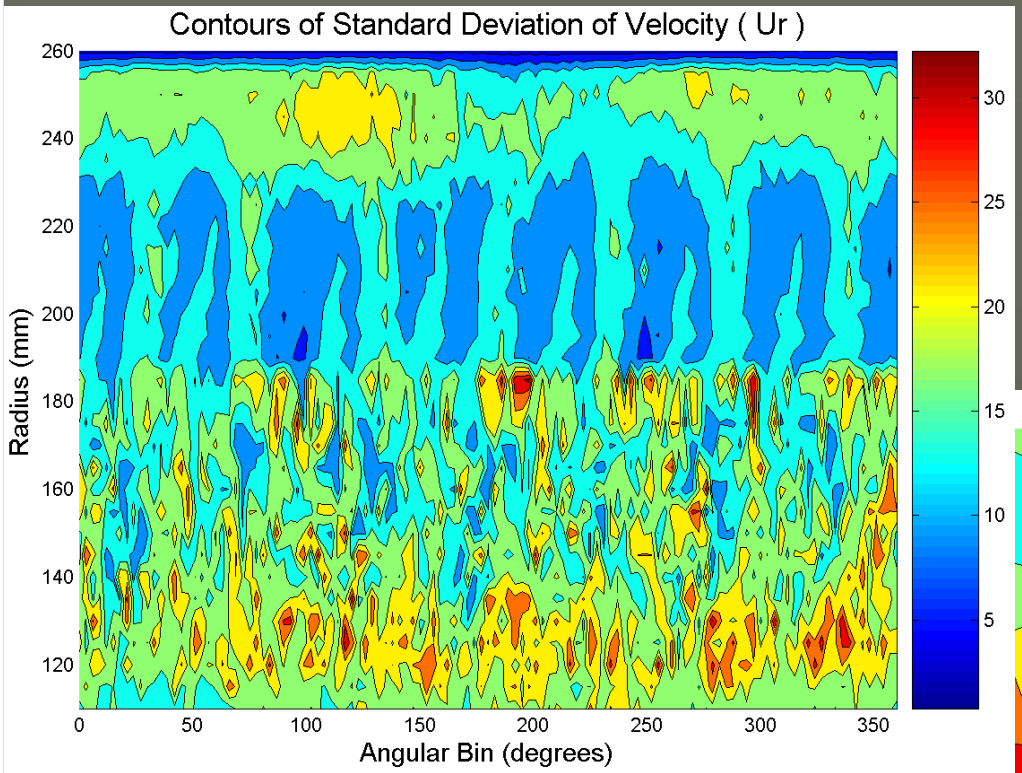


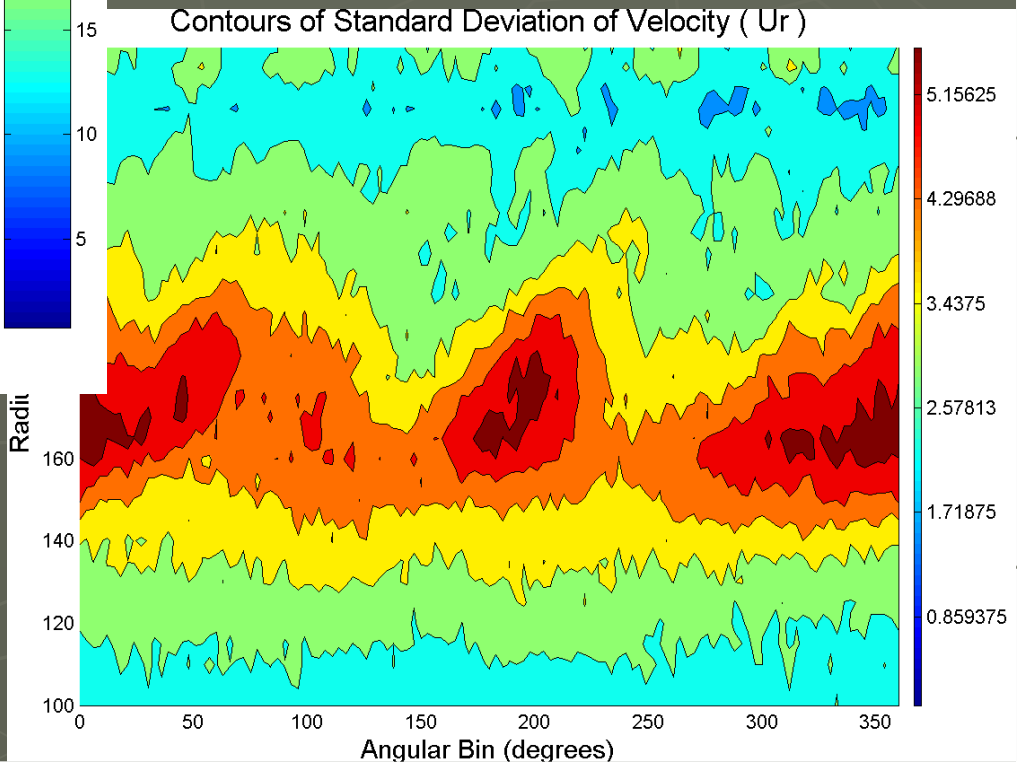
Incoherent Fluctuations: Axial



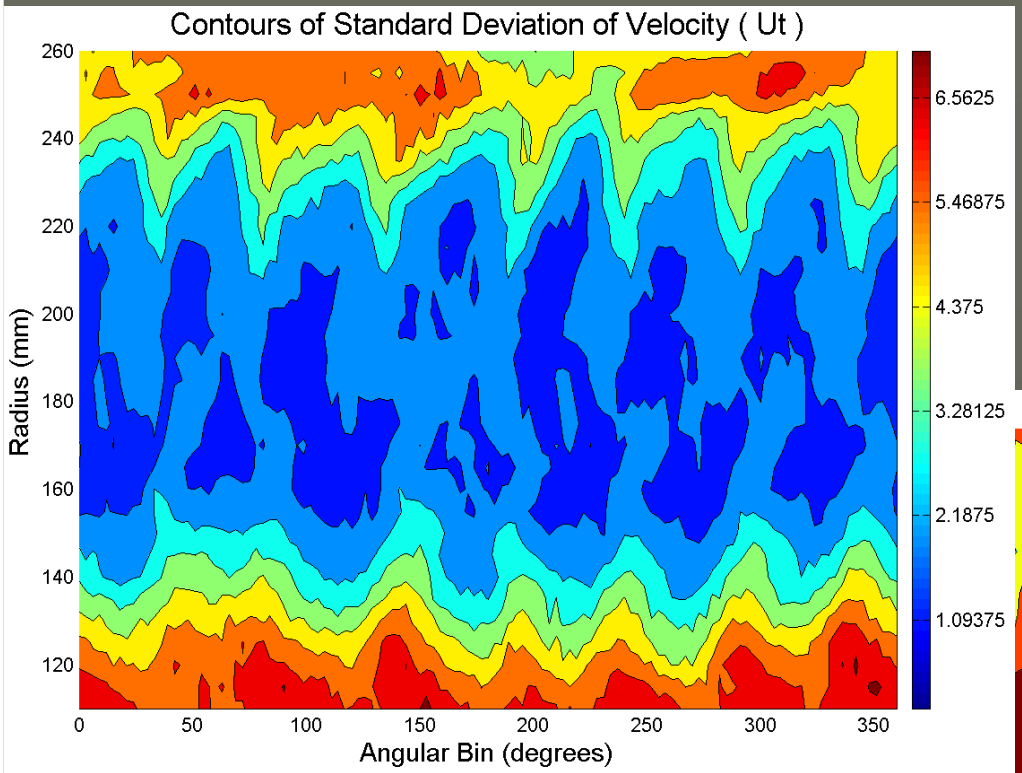


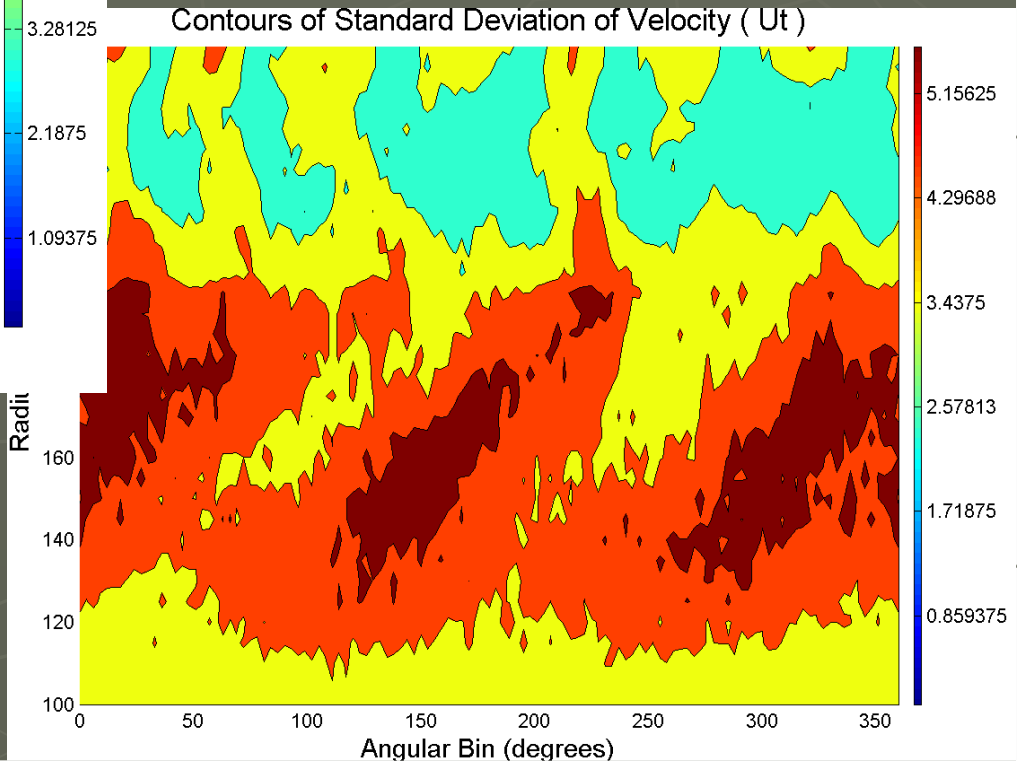
Incoherent Fluctuations: Radial





Incoherent Fluctuations: Tangential





Future Work

- Analysis
  - Scale phase averaged plots by mean velocity and radius (U_z/U_{mean}, r/r_{tip}, σ_z/U_{mean}) (July 22)
  - Convert standard deviation to turbulence intensity (July 22)
  - Locate blade positions on plots (July 22)
  - Equalize contour ranges where possible (July 22)
  - Check phase averaging at different locations around the circumference (July 22)
  - Process 3mm and 13mm downstream data (July 15)
  - Plot contour data as 3D vectors
  - Plots of estimated blade work (July 29)
- Measurements
  - 400W fan measurements (July 22, processed July 29)