

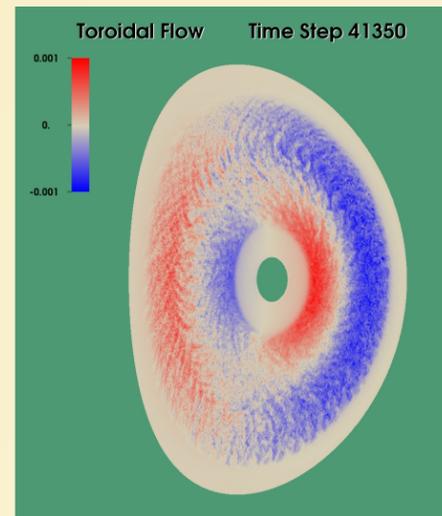
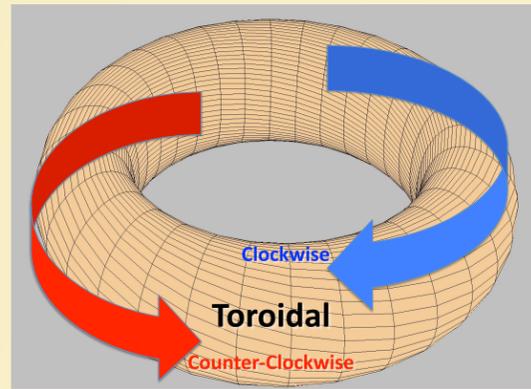
Visualization of Turbulence-Generated Intrinsic Rotation

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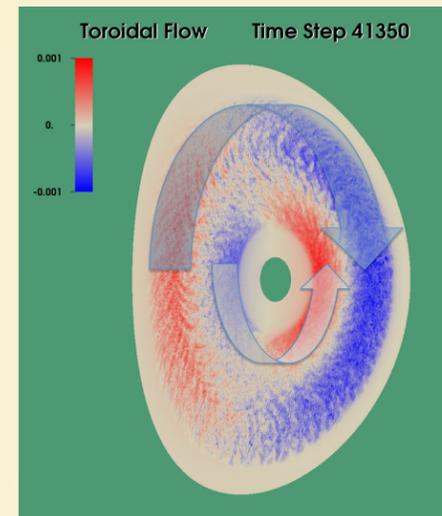
Gyrokinetic Tokamak Simulation (GTS) code

Computes 3-D vector field of toroidal & poloidal plasma flows.
 Visualization with animation provides insight into complex behavior.
 Excellent scaling of high performance computing on many processors.
 Distributed workflow between NERSC & PPPL optimizes resources.

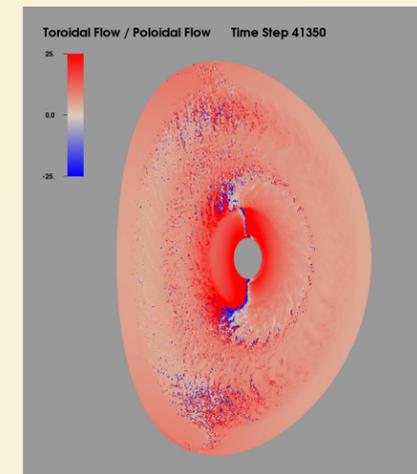
| GTS Run | Low Resolution | High Resolution |
|-------------|----------------|-----------------|
| Processors | 16,000 | 100,000 |
| Particles | 700 million | 20 billion |
| Grid Points | 7 million | 400 million |
| Time Steps | 250 | 1000 |
| Output Data | 250 GB | 1 TB |
| Run Time | 30 hours | 48 hours |



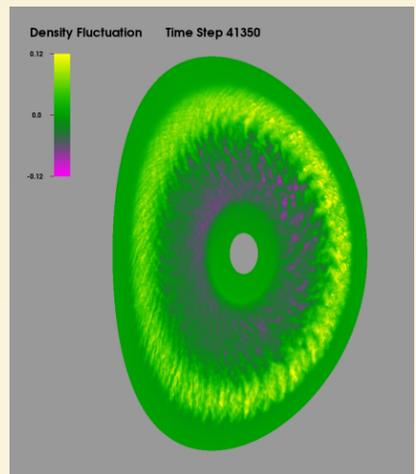
Direction, magnitude, & structure of plasma flow.
 V_ϕ Toroidal Flow:
 Blue - clockwise
 Red - counter-clockwise.



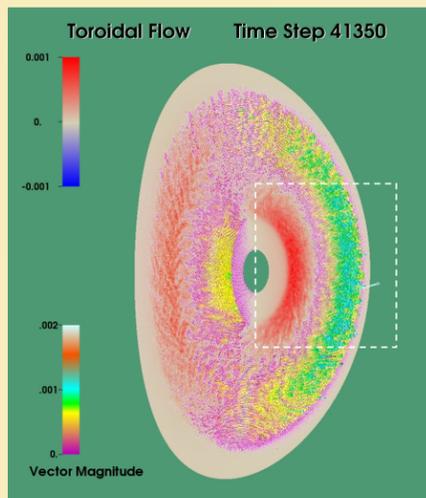
Poloidal rotation due to CTEM turbulence:
 Outer band - clockwise.
 Inner - counterclockwise.



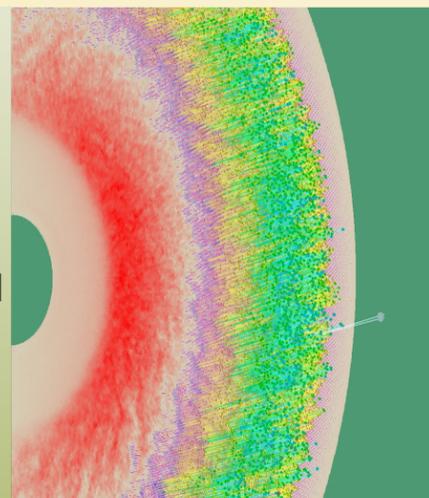
Poloidal flow tends to follow toroidal flow except where toroidal rotation changes from clockwise to counter-clockwise.



Density fluctuation varies from -12% in the center to +12% toward the edge.



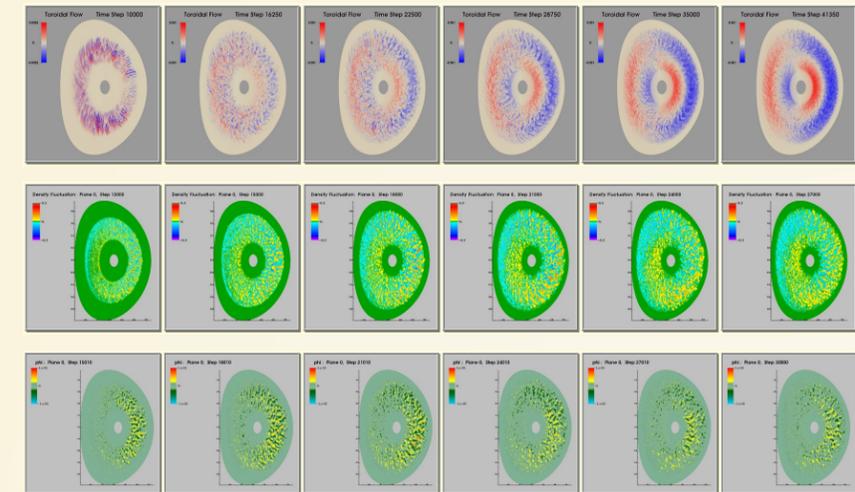
Vectors articulate toroidal component.
 Color scale maximizes contrast within the most heavily populated data range. Preserves local visibility within global min-max.



Visualization

Visit interactive display program - lnl.gov
 Parallel rendering at High Definition resolution.
Render scalar or vector per grid point to avoid complexity of radial mesh in fieldline following grid.
 Python scripting to customize movie generation.
 Establish workflow for additional simulation runs.

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Images assembled into movie files.
 Compressed for efficient, high quality playback.