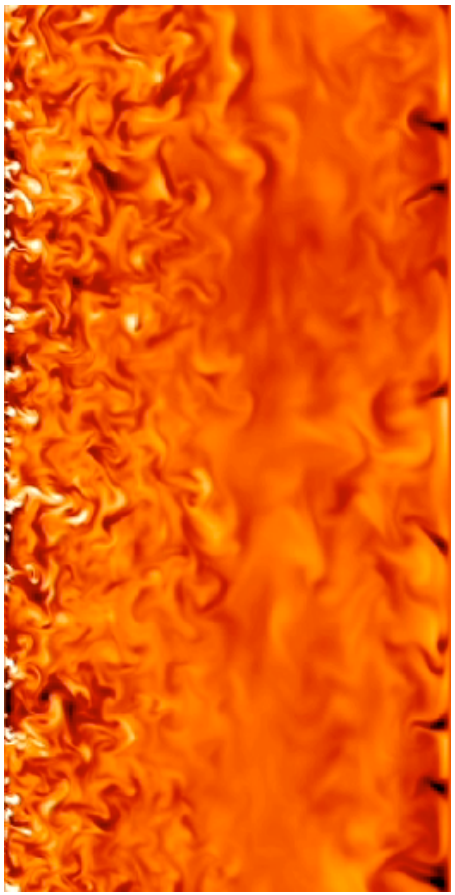

MRI-Driven Turbulence & Thermal Hydraulics

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in collaboration with

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Workshop on Scientific Data Analysis and Visualization for Petascale Computing

Granlibakken, Tahoe City, CA

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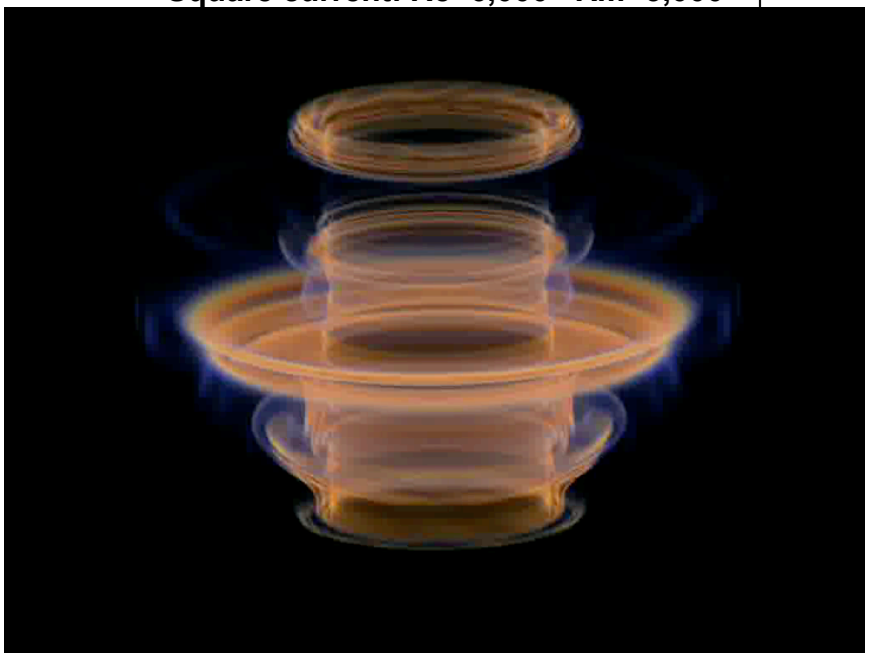
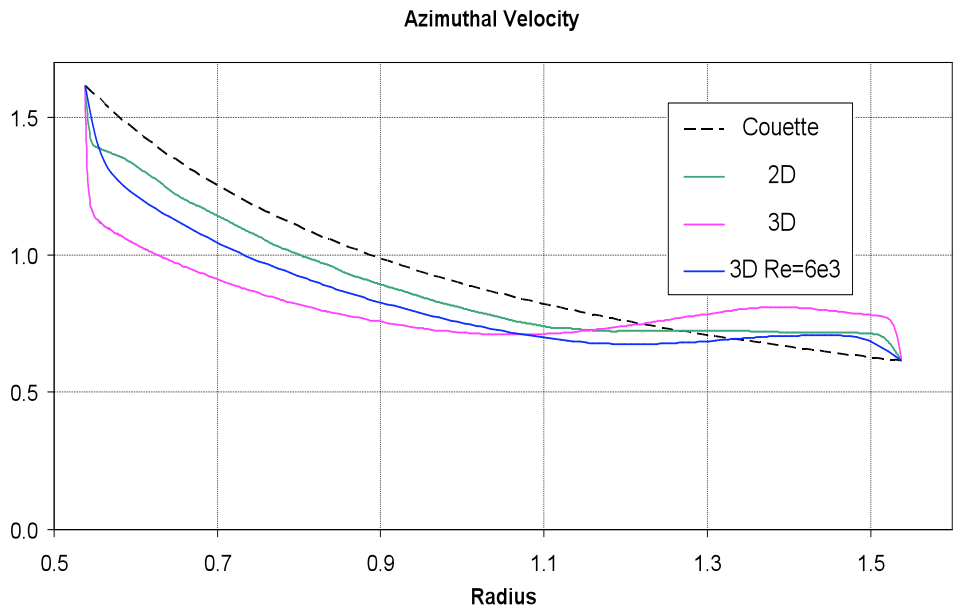
Axisymmetric vs 3D (z-periodic, Bz_0=0.05)

Square current: *Re*=6,000 *Rm*=3,000 *† §



Re=60,000 *Rm*=30,000 ϒ



⇒ **Axisymmetric solution is strongly unstable to 3D perturbations**

⇒ **Saturation both through dissipation and modification of background velocity for axisym / 3D toward constant azimuthal / constant angular velocity (cf. Julien & Knobloch 2005)**

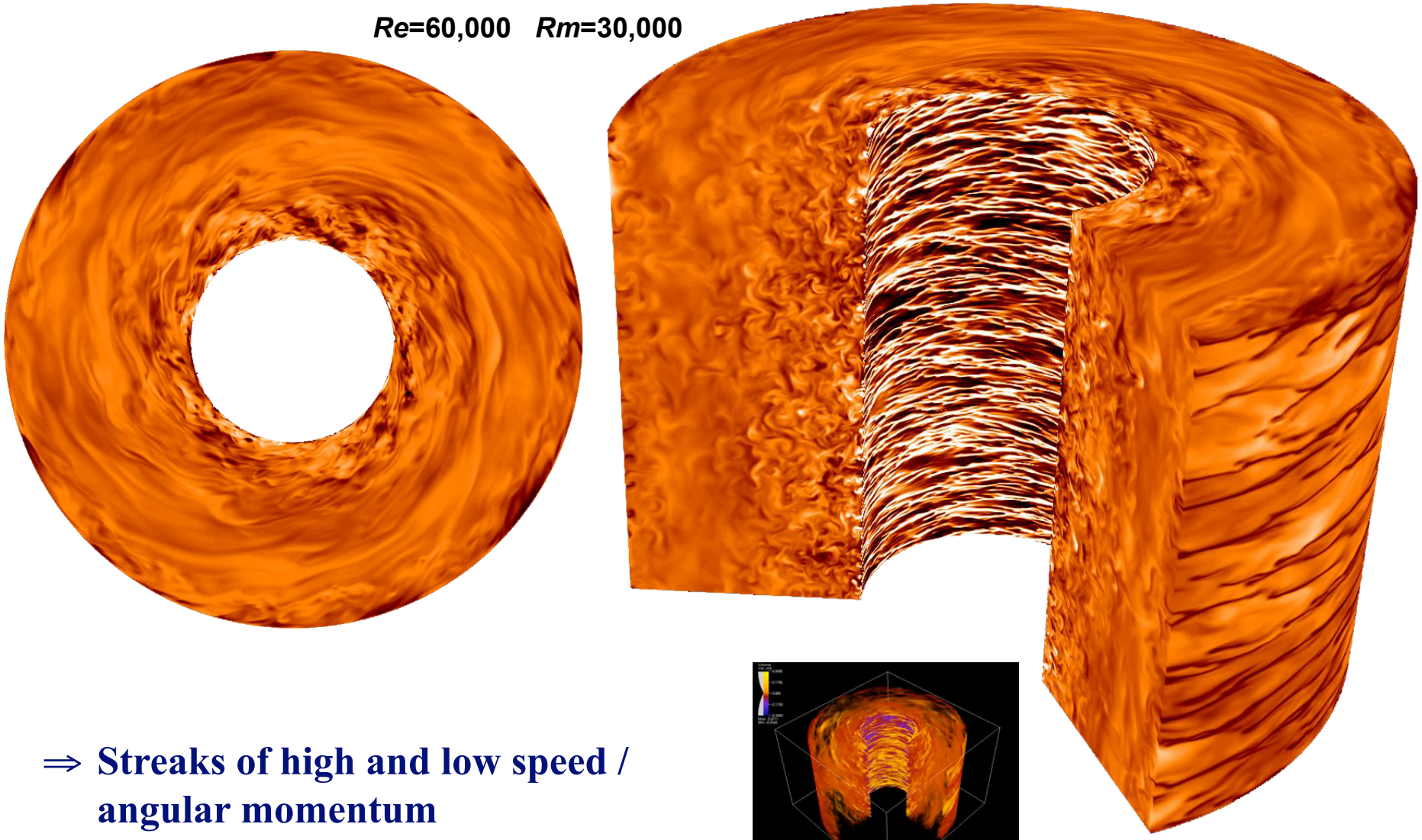
*† Acknowledge the use of resources of NERSC at Lawrence Berkeley National Laboratory (as INCITE 2005)

§ Acknowledge the help of NERSC Visualization Group, LBNL

ϒ Run time on 32,768 processors of Blue Gene Watson (BGW) was provided courtesy of the IBM Corporation & acknowledgement of the use of resources of Argonne Leadership Computing Facility operated by ANL

MRI-Driven Turbulence: u'_θ

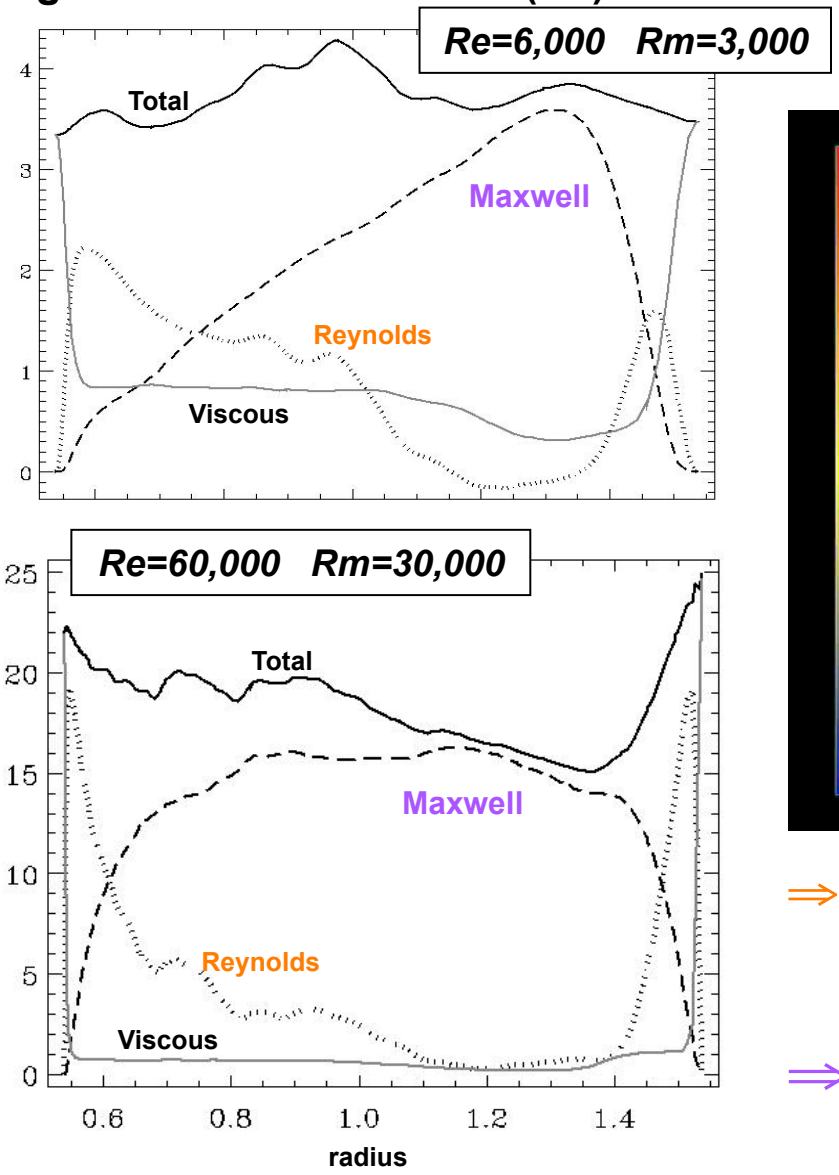
Re=60,000 *Rm*=30,000



⇒ **Streaks of high and low speed / angular momentum**

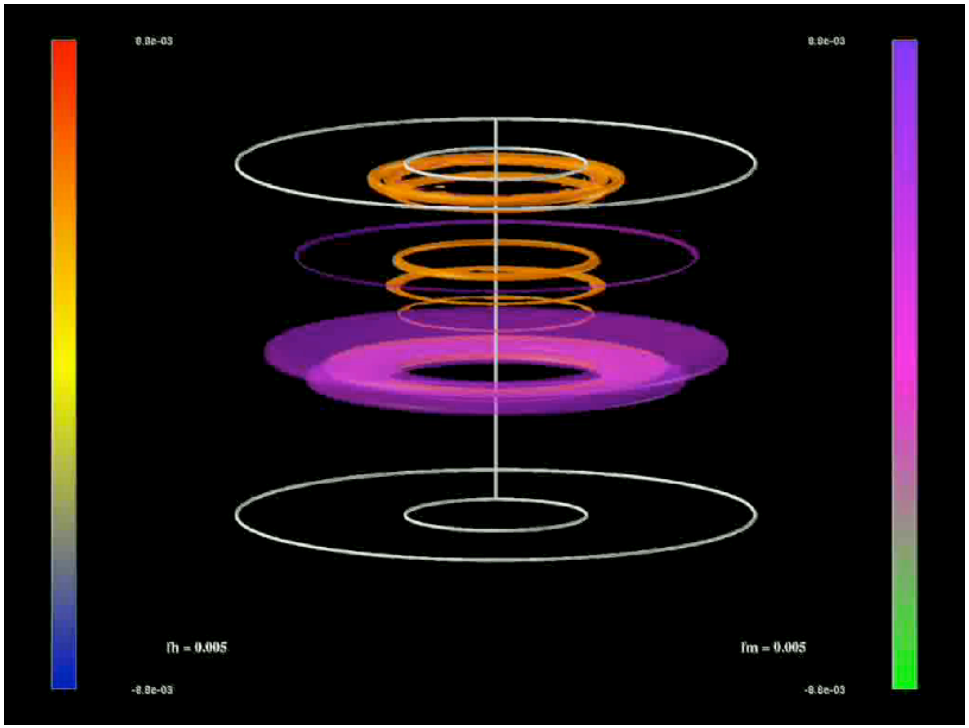
Angular Momentum Transport

Angular momentum fluxes (x r)



Reynolds and Maxwell stress fluxes of AM

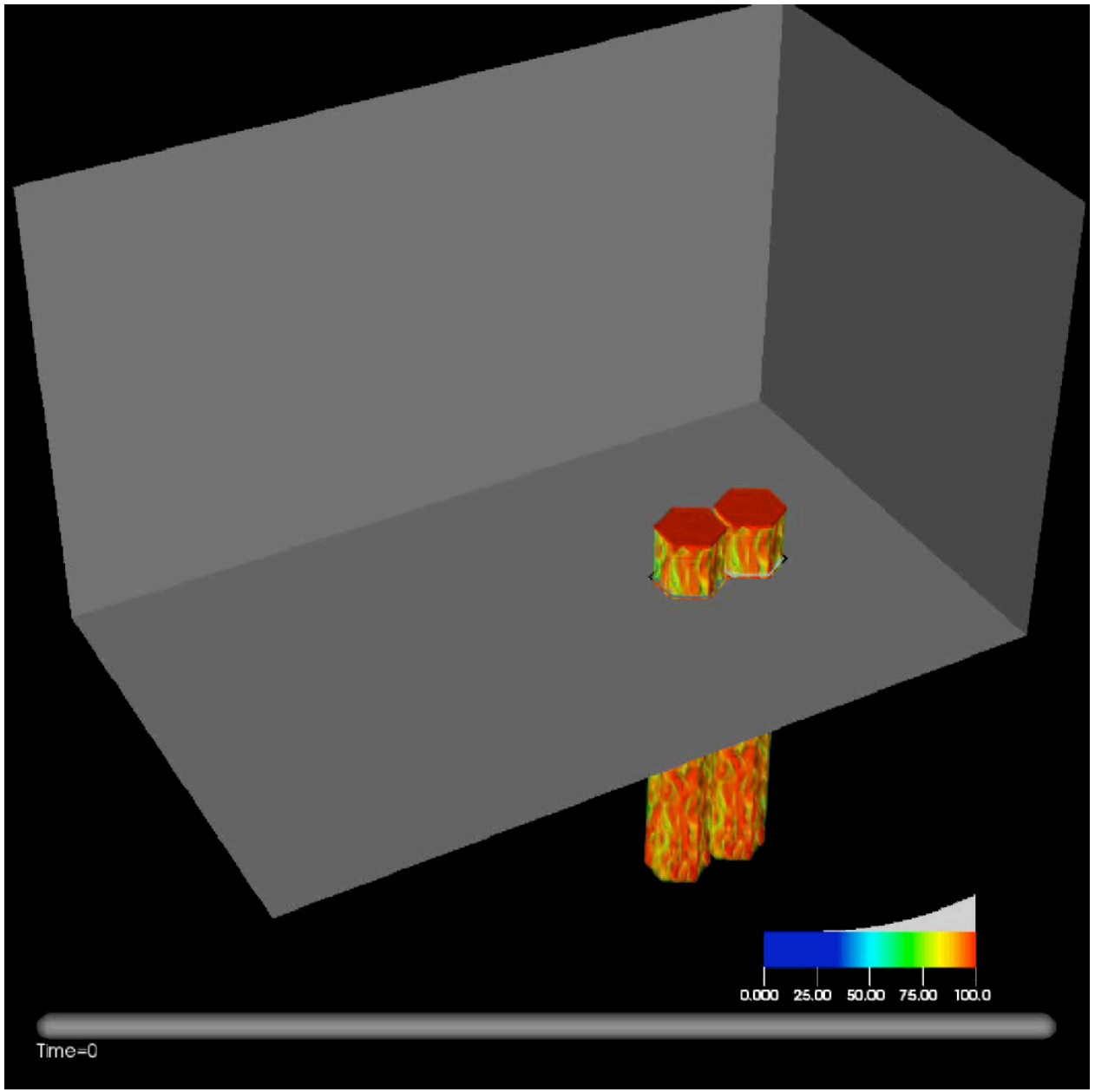
$r u'_\theta u_r$ $\quad -r B_\theta B_r$



⇒ **Reynolds stress flux confinements to cylinder "boundary layers"**

⇒ **Maxwell stress flux domination**

Thermal Hydraulics



$V \quad T$

LES
***Re*=50,000**

Visualization: Hank Childs (LLNL/LBNL)

ANL 2008