# CCA Toolkit Components for Visualization

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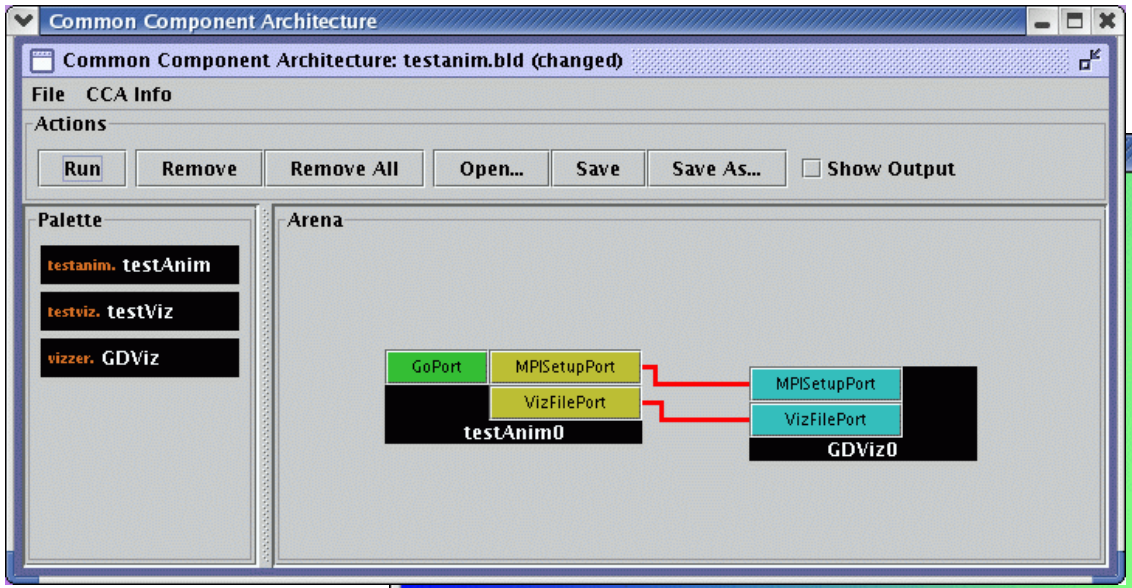
Research supported by the Mathematics, Information and Computational Sciences Office, Office of Advanced Scientific Computing Research, U.S. Department of Energy, under contract No. DE-AC05-00OR22725 with UT-Battelle, LLC.

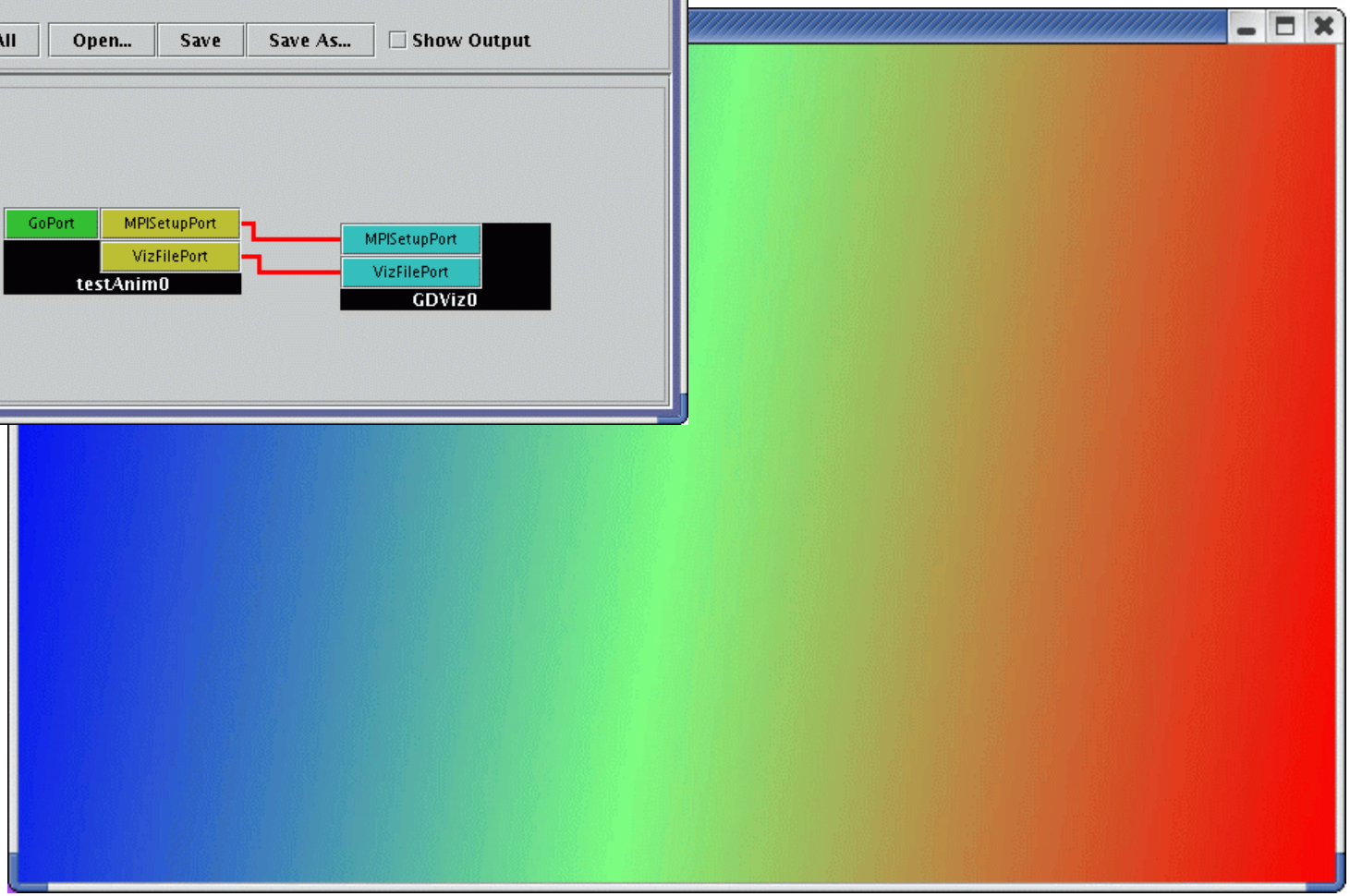
# Simple 2-D "Vizzer" Component!

- "Drop In" Component to Produce Image Files
  - Individual Snapshots or Animation Sequences…
- Handles Serial or Parallel Component Programs
  - Dump Individual Local Array Images (Per Processor)
  - Gather Distributed Array Patches ~ Composite Image
    - "MPISetup" Port Controls Parallelism (Set Communicator)
- Automatic Color Mapping Based on Data Range
  - Immediate or "Lazy" Color Map Adjustments…
- Variety of Output Formats ~ GIF, Jpeg, PNG

# Sample "Vizzer" Interface




Uses GD 2.0 library…



Play Back Animated Image Sequences w/mplayer!

# “Vizzer” Demos at SC04

- See the new Vizzer Component in action with Combustion demos in the ORNL booth!

# Integrated Fusion Simulation using CCA

Lee Berry, David Bernholdt,
Don Batchelor, Ed D'Azevedo, Wael Elwasif, Wayne Houlberg, Fred Jaeger, Ahmed Khamayseh, James Kohl, Don Spong

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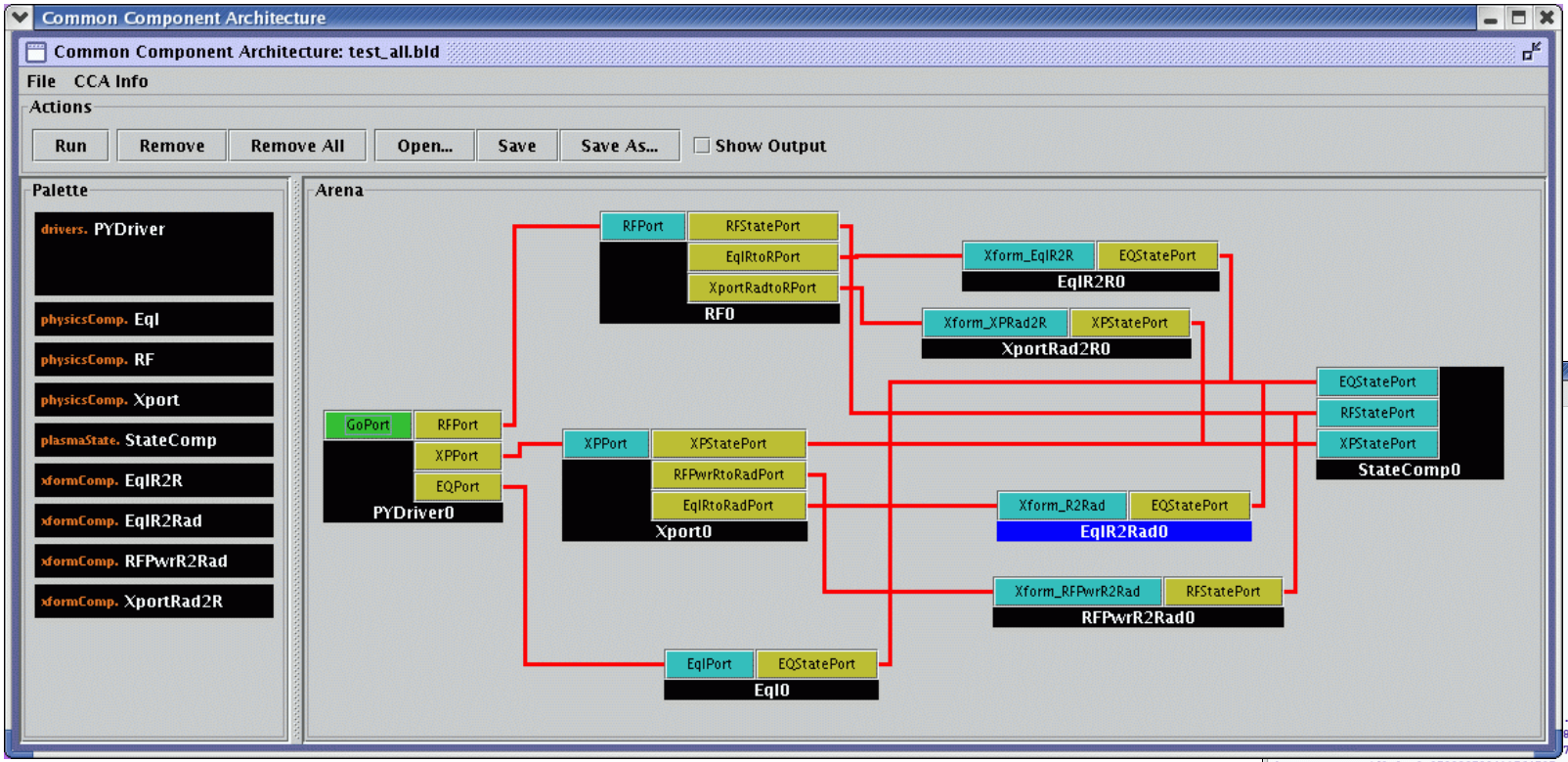
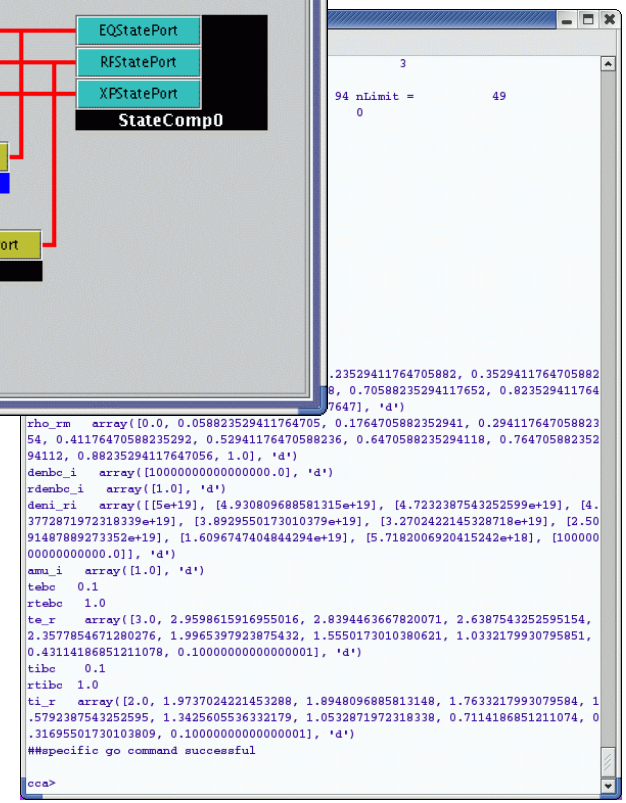
# Towards Integrated Fusion Simulation

- ***Currently:*** simulations of different physical processes are uncoupled, or very loosely coupled
- ***Need:*** integrated self-consistent simulations encompassing all relevant physics
- ***Our project:*** prototype integrated fusion simulation code to explore physical, mathematical and computational issues
- ***Approach:*** integrate Equilibrium, RF heating (AORSA) and Transport simulation codes within a CCA environment
  - Simulation components interact via "Plasma State" data holder
  - Evolutionary preconditioning for integration across time scales
- ***Status:*** initial interface development complete
  - "Evolutionary preconditioning" algorithm tested
  - Prototype components operational

# Fusion Components in Action




int init( in string xport_cont_name, out string init_xp_message, out int i_flag, in int n_i, in int n_r, in int nin, out array <int, 1> iz_i,
out array <double, 1> rho_r, out array <double, 1> rho_rm, out array <double, 1> denbc_i, out array <double, 1> rdenbc_i,
out array <double, 2> deni_ri, out array <double, 1> amu_i, out double tebc, out double rtebc, out array <double, 1> te_r,
out double tibc, out double rtibc, out array <double, 1> ti_r );

int pushN( in double time, in double dt, in array <int, 1> k_nbc_i, in array <double, 1> denbc_i, in array <double, 1> rdenbc_i,
in array <double, 2> den0_ri, in bool commit, out string d_n_message, out array <double, 2> den1_ri,
out array <double, 2> gam_rmi, out array <double, 2> baln_i );

int pushT( in double time, in double dt, in double tebc, in double tibc, in int k_tebc, in int k_tibc, in int n_r, in double rtebc,
in double rtibc, in array <double, 1> te0_r, in array <double, 1> dene_r, in array <double, 1> dnedt_r, in array <double, 1> ge_rm,
in array <double, 1> ti0_r, in array <double, 1> deni_r, in array <double, 1> dnidt, in array <double, 1> gi_rm, in bool commit,
out string d_t_message, out array <double, 1> te1_r, out array <double, 1> ti1_r, out array <double, 2> balei );

# Integrated Fusion Demos at SC04

- Talk about the latest prototypes of the CCA Fusion Components in the ORNL booth!