

# Parallel Matlab: RTExpress™ on 64-bit SGI Altix with SCSL and MPT

## What is RTExpress™

• Development and Runtime Environment allowing MATLAB scripts to be compiled and executed on real-time/parallel High Performance Computers (HPC)

- Provides a flexible means to harness the power of a HPC using MATLAB
- User does not require detailed knowledge of parallel programming
- Supports:
  - Embedded parallel architectures such as Mercury
  - SUN Network of Workstations
  - High performance Linux PC Servers
- Support for FPGA functions
  - Library of FPGA functions directly callable from MATLAB source

• Now porting to SGI Altix systems

- [http://www.sgi.com/newsroom/press\\_releases/2004/june/altix\\_tcp.html](http://www.sgi.com/newsroom/press_releases/2004/june/altix_tcp.html)
- Intel / SGI Development Agreement
- Itanium 64-bit processing
- Shared Memory Architecture
- New RTExpress for SGI release expected by fall/winter of 2004

SGI® Altix™ 3000



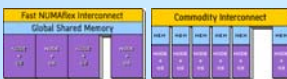
• FFT Benchmark tests – Computation and Communication

• 1D FFT, transpose (cornerturn), 1D FFT in-place

• Testing on SGI Altix Linux servers with Shared Memory Interconnect

- Results of Shared Memory interconnect shows improved scaling on cornerturn

SGI® NUMalink™ Interconnect Fabric



## 2D FFT Benchmark Test using RTExpress

• A Matlab script performs the 2D complex FFT

```
matrix = ones(fftsize, fftsize) + j * ones(fftsize, fftsize)
loop
store time t1
a = fft(init_matrix)
store time t2
a = a'
store time t3
a = fft(a)
store time t4
end loop
```

- RTExpress is used to run the MATLAB script on varying numbers of processors in data-parallel
- Elapsed times are computed, averaging time over several iterations
- First iteration is not counted

• Please note that all timing information gathered is not intended to provide a recommendation for any particular hardware, but to illustrate parallel operation with various combinations of processors and interconnect systems

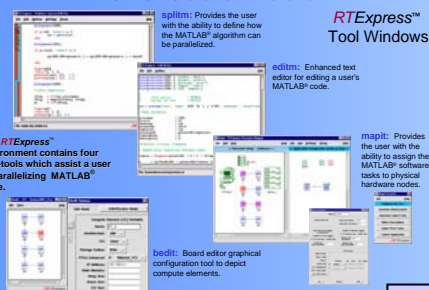
• Equipment used in the following tests may no longer be the hardware vendor's current offering

• Maximum RTExpress performance may be gained by fully using vector operations in MATLAB rather than using sequential loops

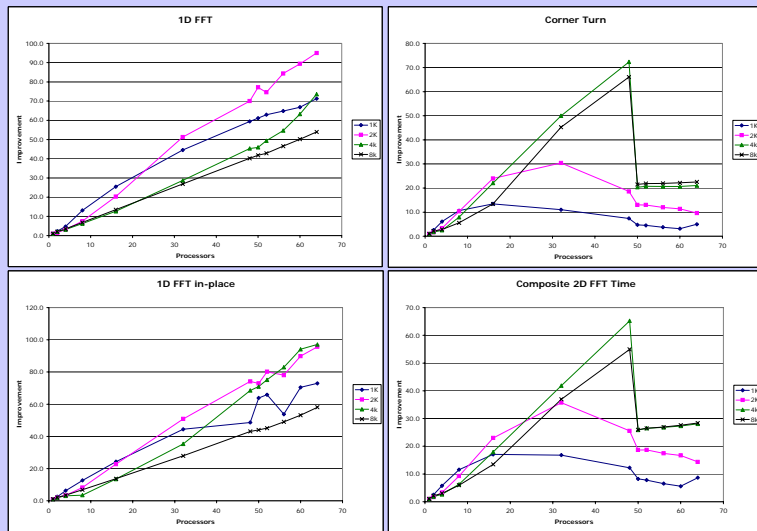
• Improvement, as compared to first-processor performance used to extrapolate scaling, is shown in the following plots

Parallelization with RTExpress™ is Flexible and Efficient

RTExpress™ Tool Windows

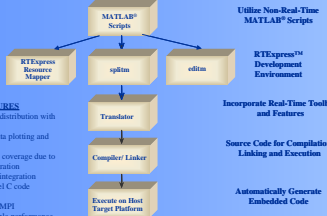


## 64-Processor System Cornerturn shows excellent scaling up to Memory Bandwidth



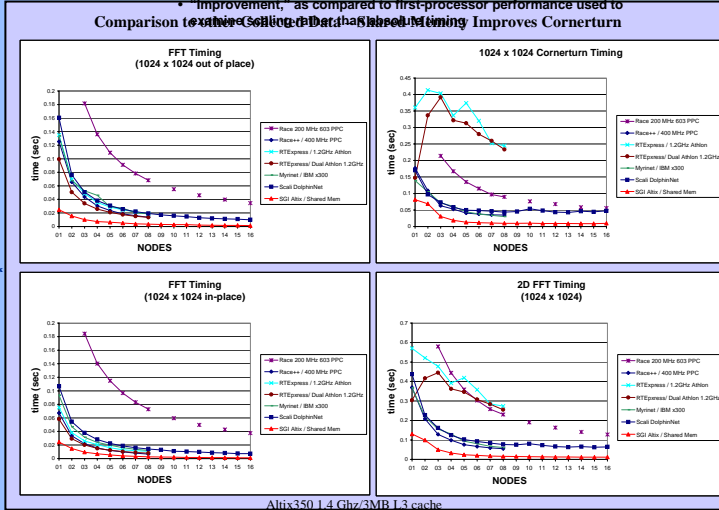
64p 1.7GHz/9MB cache Altix  
(note: production systems are 1.6GHz)

## Developing Parallel Applications with RTExpress™

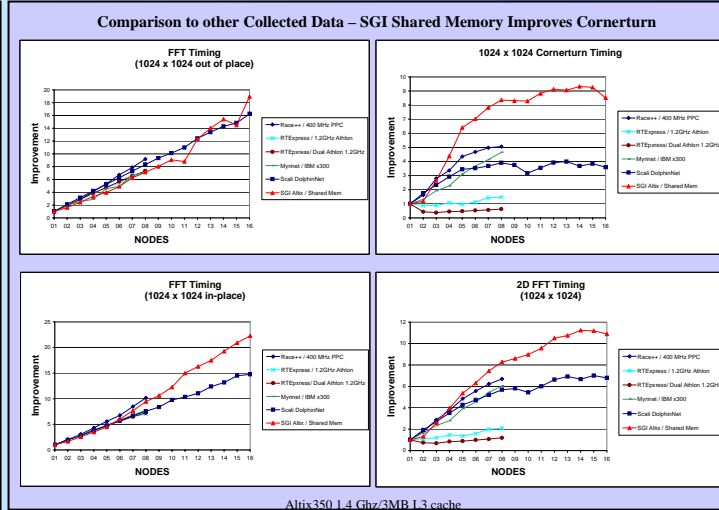


- FEATURES**
- Automatic data redistribution with scaling
  - Near real-time data plotting and image viewing
  - Greater life cycle coverage due to MATLAB® integration
  - Legacy software integration
  - Automatic parallel C code generation
    - Supports MPI
    - Compiler selectable performance monitoring and program instrumentation
    - Support for parallelization alternatives

- Utilize Non-Real-Time MATLAB® Scripts
- RTExpress™ Development Environment
- Incorporate Real-Time Toolsets and Features
- Source Code for Compilation, Linking and Execution
- Automatically Generate Embedded Code



Altix350 1.4 GHz/3MB L3 cache



Altix350 1.4 GHz/3MB L3 cache

