pMatlab Takes the HPCchallenge

Ryan Haney, Hahn Kim, Andrew Funk, Jeremy Kepner, Charles Rader, Albert Reuther and Nadya Travinin

HPEC 2004

*** This work is sponsored by Defense Advanced Research Projects Administration, under Air Force Contract F19628-00-C-0002. Opinions, interpretations, conclusions and recommendations are those of the author and are not necessarily endorsed by the United States Government.**

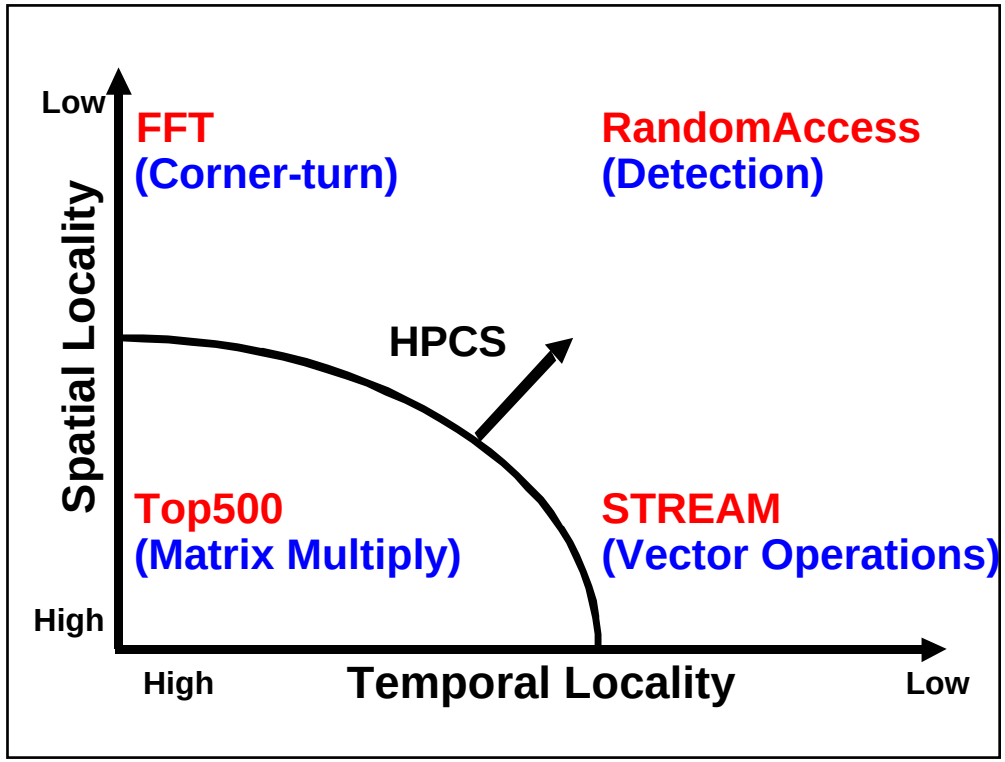
Motivation and Goals

- **Motivation**
  - **The DARPA HPCS program has created the HPCchallenge benchmark suite in an effort to redefine how we measure productivity in the HPC domain**
  - **Implementing the HPCchallenge benchmarks using pMatlab allows a unique opportunity to explore the merits of pMatlab with respect to HPEC**

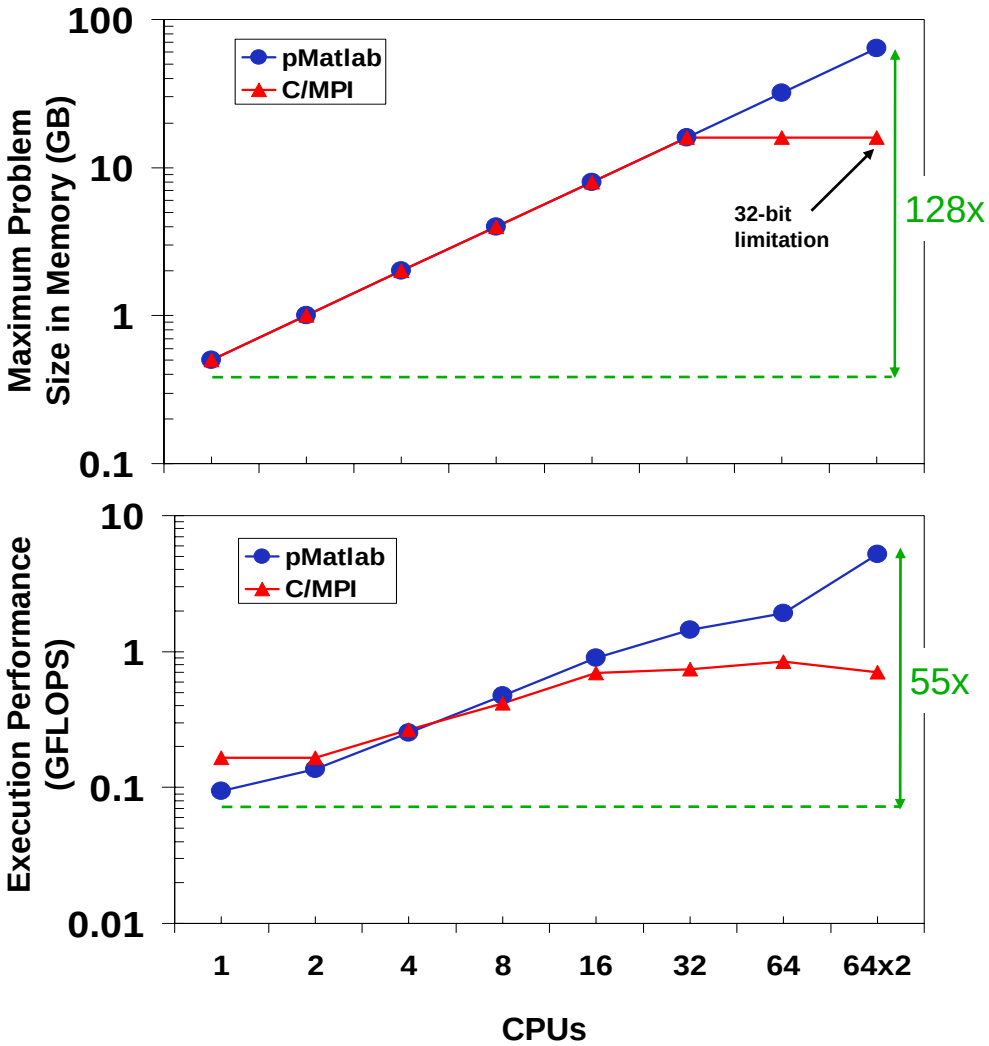
- **Goals**
  - **Compare traditional C/MPI with pMatlab. Measurements of productivity include:**
    - **Maximum problem size: Largest problem that can be solved or fit into memory**
    - **Execution performance: Run-time performance of the benchmark**
    - **Code size: Software lines of code (SLOC) required to implement the benchmark**

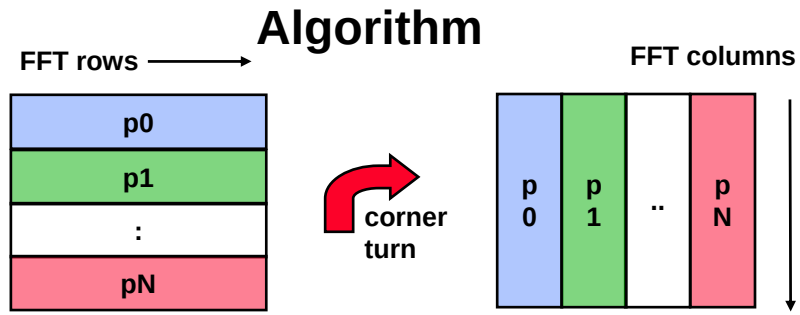
HPCchallenge Relevance to HPEC

- HPCchallenge benchmarks encompass key embedded signal processing operations
  - FFT: Distributed corner turn and FFTs important in multi-sensor signal processing
  - RandomAccess: Random data accesses typical of "post detection" operations
  - Top500: Matrix-matrix multiplies typical of multi-element beamforming
  - STREAM: Distributed vector operations common to signal processing



FFT Results





Software Code Size

	C/MPI	pMatlab	Ratio
SLOC	2509	72	35

- pMatlab memory scalability comparable to C/MPI (128x on 128 CPUs)
- pMatlab execution performance comparable to C/MPI (55x on 128 CPUs)
- pMatlab code size is 35x smaller than C/MPI