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Leaders in parallel software development tools

Allinea Unified environment

Pr. Stephen Hawking's Consortium gets a Bigger Bang from COSMOS

With special thanks to **James Briggs**
– COSMOS Parallel Programmer

JDEV2013

Agenda

- Introduction
- Current activity on COSMOS
- How Allinea can help S. Hawking’s team
- Conclusion

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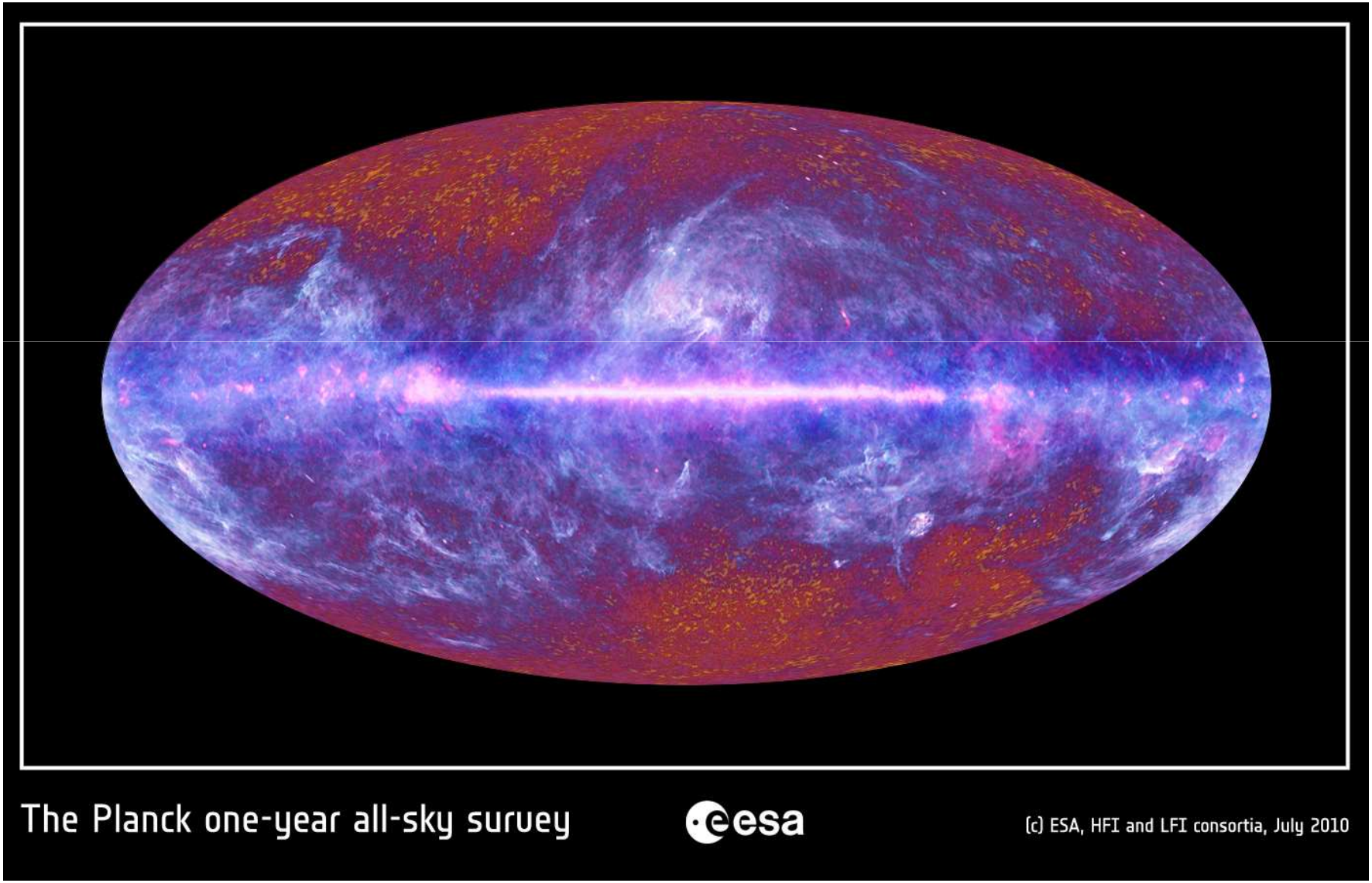
UK Computational Cosmology Consortium (UK-CCC)

- **UK Consortium created in 1996**
  - Principal Investigator : Stephen Hawking
  - Interdisciplinary scientific goals
  - Consists of the major UK groups studying cosmology

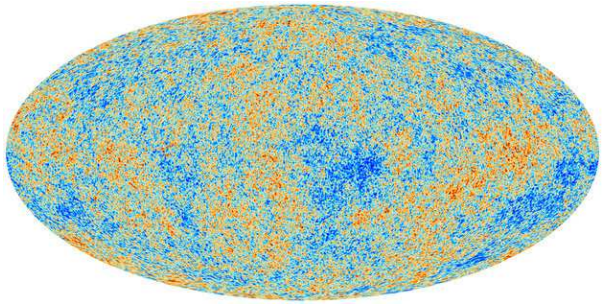
- **Advancing our understanding of the origin and structure of our universe**
  - Develop techniques to extract cosmological information from the Cosmic Microwave Background (CMB)
  - Characterize the fundamental nature of the primordial perturbations from which the structure in our universe formed
  - Understand the non-equilibrium dynamics of the early universe

In practical...



Planck, CAMB and CosmoMC

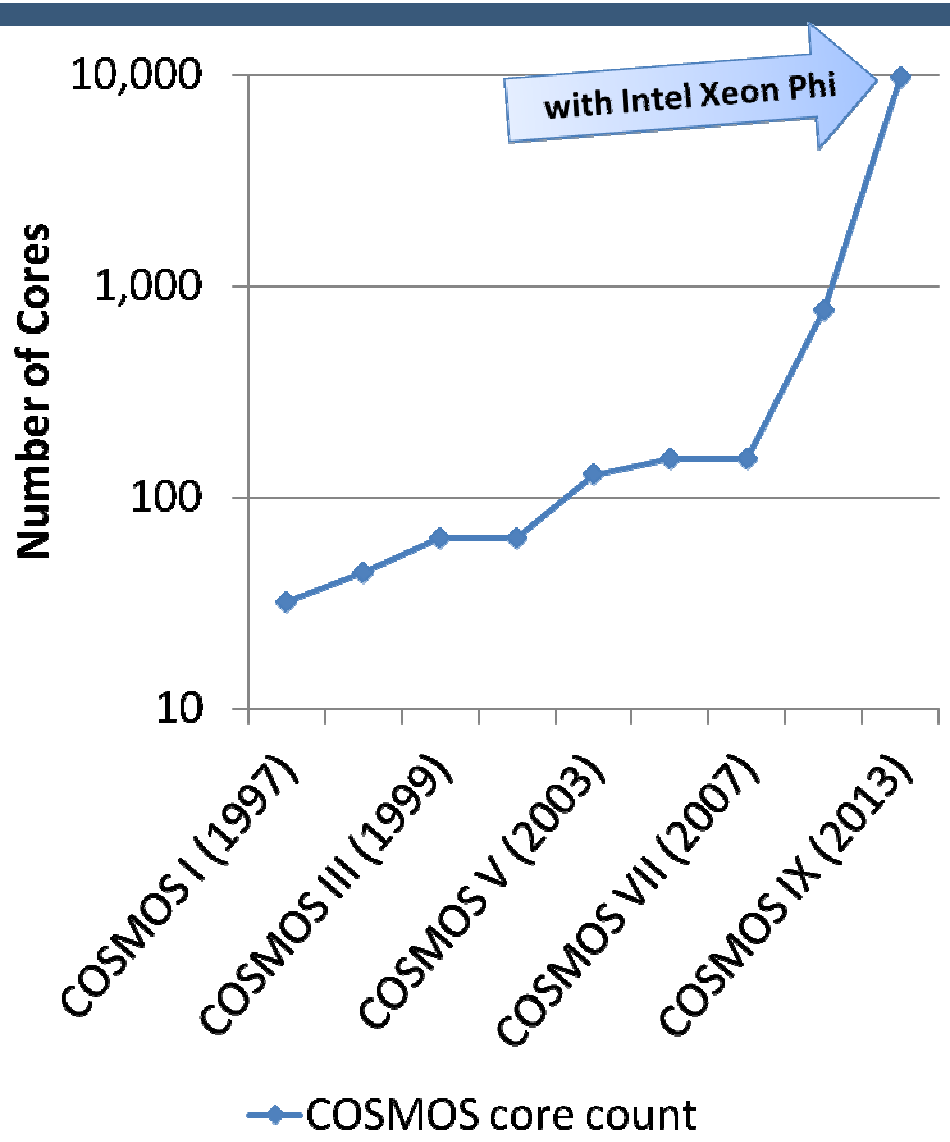
- **Planck satellite**
  - satellite that maps the universe (380 000 years after the Big Bang)
- **CAMB**
  - powerful program for simulating CMB spectra from different models
  - Heavily multithreaded application with OpenMP
- **CosmoMC**
  - searches for the best model among those simulations by comparing to the CMB observations
  - Monte-carlo code, based on MPI



Oldest light in our universe, as observed by Planck

Planck

Evolution of the supercomputer : COSMOS since 1997



Machine sizes are exploding

Accelerators (such as Intel Xeon Phi) are coming fast

Software scale grows

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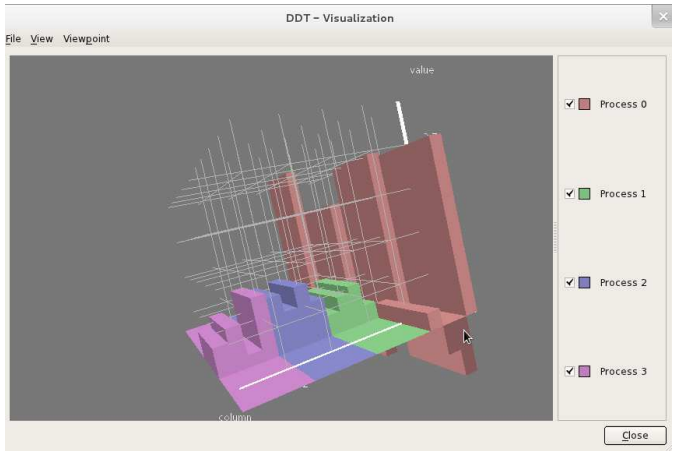
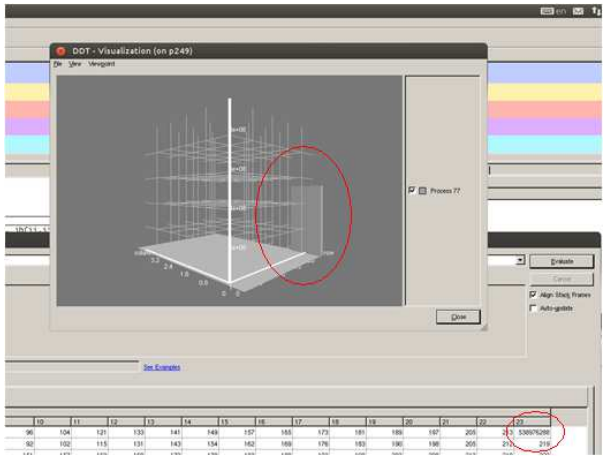
Migration to Intel Xeon Phi
Example of a challenge

- **Observation :**
  - Results between Xeon and Xeon Phi versions were different
  - Values blatantly wrong when running in “Offload Mode”

- **Identification of the problem :**
  - Comparing input/output arrays of values before/after offload region
  - Easier identification of the problem using Allinea DDT and its feature called “*Multi-Dimensional Array Viewer*”





Illustrations of Allinea DDT Multi-Dimensional Array viewer

The Allinea environment
Scalable from Workstation to Petascale

- **A modern integrated environment for HPC developers**

- **Supporting the lifecycle of application development and improvement**
  - **Allinea DDT :** Productively debug code
  - **Allinea MAP :** Enhance application performance

- **Designed for productivity**
  - Consistent easy to use tools
  - Enables effective HPC development

- **Improve system usage**
  - Fewer failed jobs
  - Higher application performance

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Allinea environment
Fix software problems - fast

- **Graphical debugger designed for:**
  - C/C++, Fortran, UPC, CUDA
  - Multithreaded code
    - Single address space
  - Multiprocess code
    - Interdependent or independent processes
  - Accelerated codes
    - GPUs, Intel Xeon Phi
  - Any mix of the above

- **Slash your time to debug :**
  - Reproduces and triggers your bugs instantly
  - Helps you easily understand where issues come from quickly
  - Helps you to fix them as swiftly as possible

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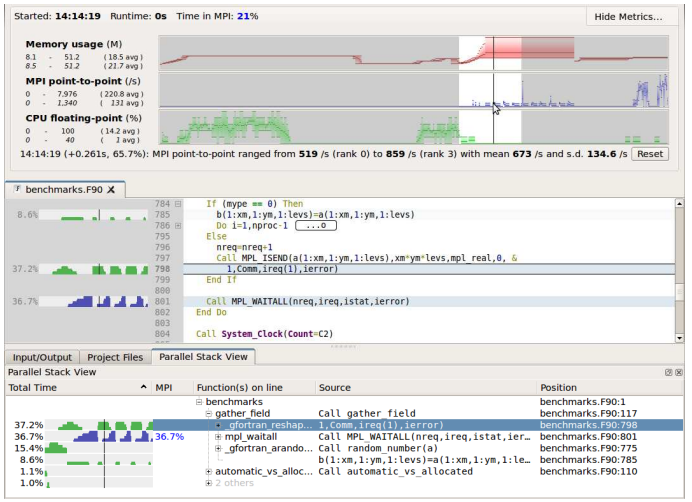
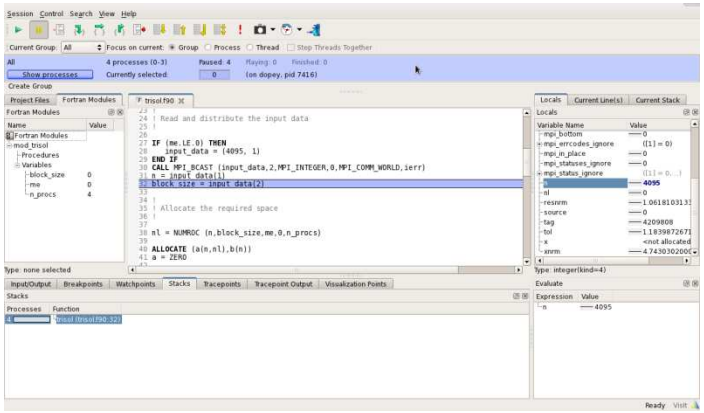
Unified building blocks in production since 2010

Shared Graphical Interface

Shared Configuration Files





Shared Scalable Architecture

Shared Intelligence and Data Consolidation

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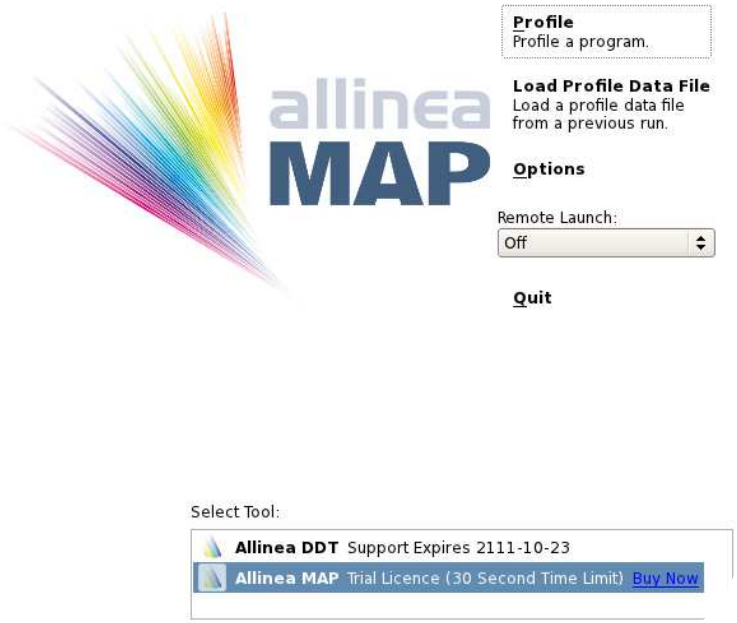
Allinea MAP
Increase application performance

- **Parallel profiler designed for:**
  - C/C++, Fortran
  - Multiprocess code
    - Interdependent or independent processes
  - Multithreaded code
    - Monitor the main threads for each process
  - **Accelerated codes**
    - GPUs, **Intel Xeon Phi**



- **Improve productivity :**
  - Helps you detect performance issues quickly and easily
  - Tells you immediately where your time is spent in your source code
  - Helps you to optimize your application efficiently

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Summary

- **UK-CCC: Leading Consortium for cosmology research**
- **In the process of migrating to Intel Xeon Phi cluster**
  - Offloading some workload from the Intel Xeon to Intel Xeon Phi : SUCCESS
  - Speeding up the time to result/amount of calculation : STILL IN PROGRESS
  - Complex issues are made easier with the help of debuggers/profilers such as Allinea tools
- **Allinea provide tools to ease the migration to Intel Xeon Phi**
  - Allinea DDT : help debug complex problems (crashes, incorrect results, etc.)
  - Allinea MAP : help profile and optimize parallel applications

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Leaders in parallel software development tools

TO LEARN MORE ABOUT ALLINEA PRODUCTS

Attend Allinea technical tutorial & presentation !

Technical tutorial :	Room PA2 “Gregory”	Friday 11h00-12h30
Presentation :	Amphi “Becquerel”	Friday 13h15-13h45

Thank you

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- Sales team : sales@allinea.com

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