



CERNopenlab

Platform Competence Center Report

CERN openlab Major Review Sep 2013

Andrzej Nowak, CERN openlab CTO office

On behalf of T. Bach, G. Bitzes, M. Botezatu, J. Fumero, S.
Jarp, A. Nowak, P. Szostek, L. Valsan

- Manpower status
- Research and technical activities
- Teaching and workshops
- Conferences, visits and interaction
- Future plans

Manpower updates

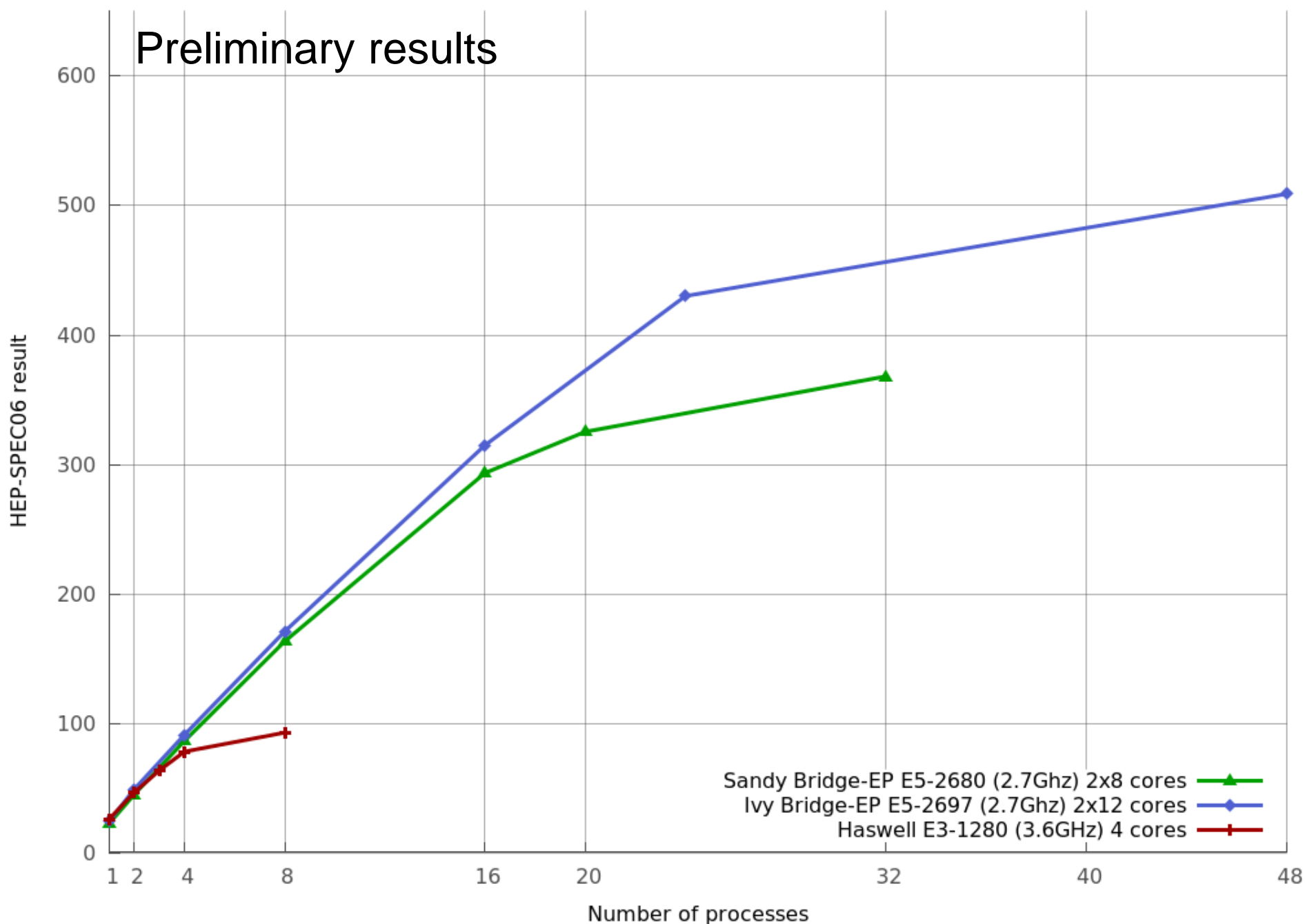
- Shorter visits and departures – thanks to all for their hard work!
 - Thomas Bach – Technical Student
 - Mirela Botezatu – Technical Student
 - Juan Fumero – Summer Student
 - Remote: Sertac Olgunsoylu – GSoC Student
 - Liviu Valsan – Staff
- Arrivals
 - Pawel Szostek – Fellow
 - Georgios Bitzes – Technical Student
 - Aram Santogidis – ICE-DIP Fellow (Oct)
 - Przemyslaw Karpinski – ICE-DIP Fellow (Nov)

Research and technical activities (1)

- New hardware
 - Mass upgrade of our Sandy Bridge systems to Ivy Bridge processors (thermal issues)
 - Xeon Phi workstations
- Ivy Bridge server
- Haswell desktop
 - In-depth investigation of AVX2 benefits
- Atom server tests underway
- New production Xeon Phi cards
 - HEPSPC06 compiled for MIC – tests underway
 - 16 devices at openlab now broadly available to physicists
 - Performance investigations with AMS

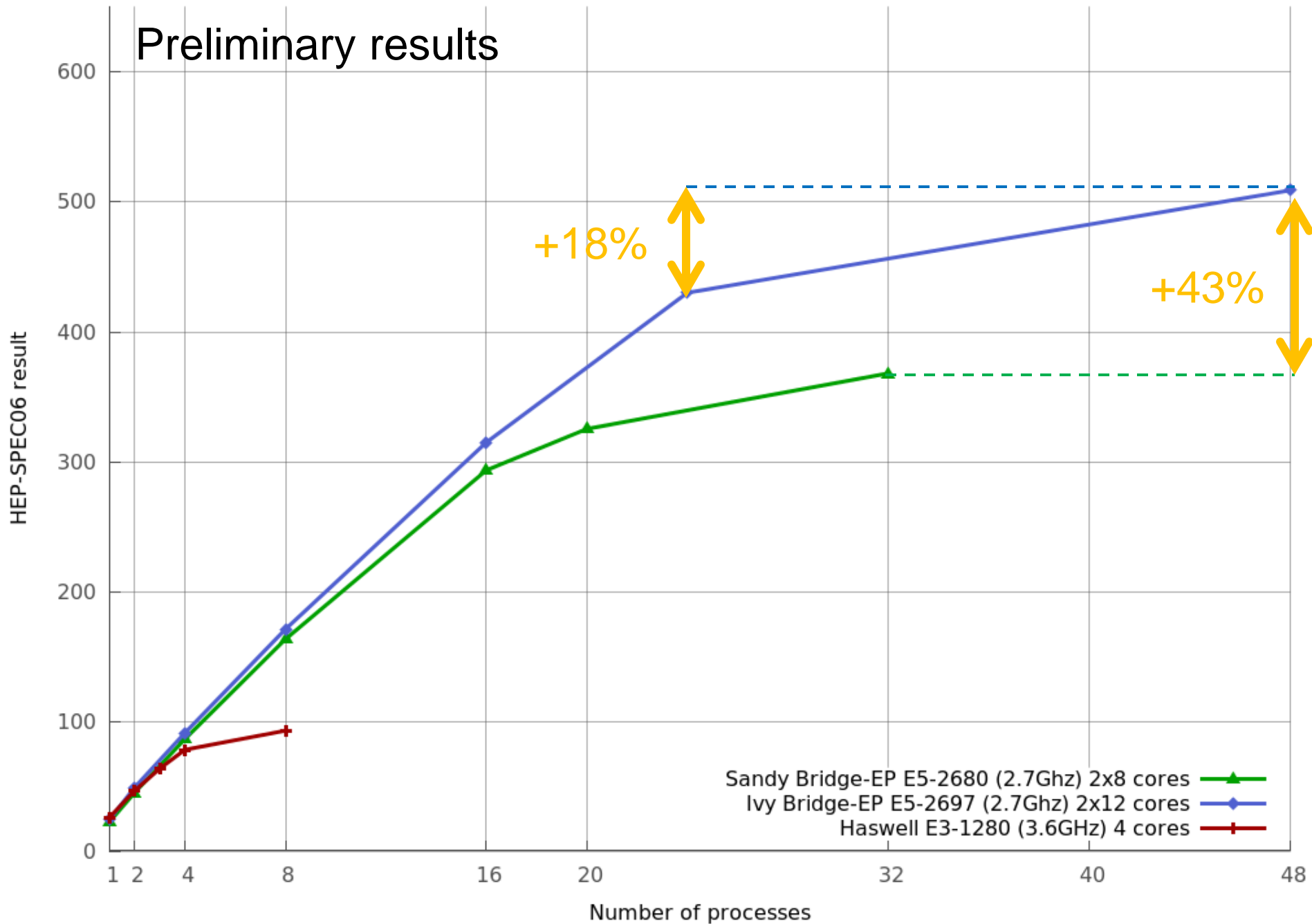
HEP-SPEC06 performance comparison, Turbo Boost disabled, frequency scaled (higher is better)

Preliminary results



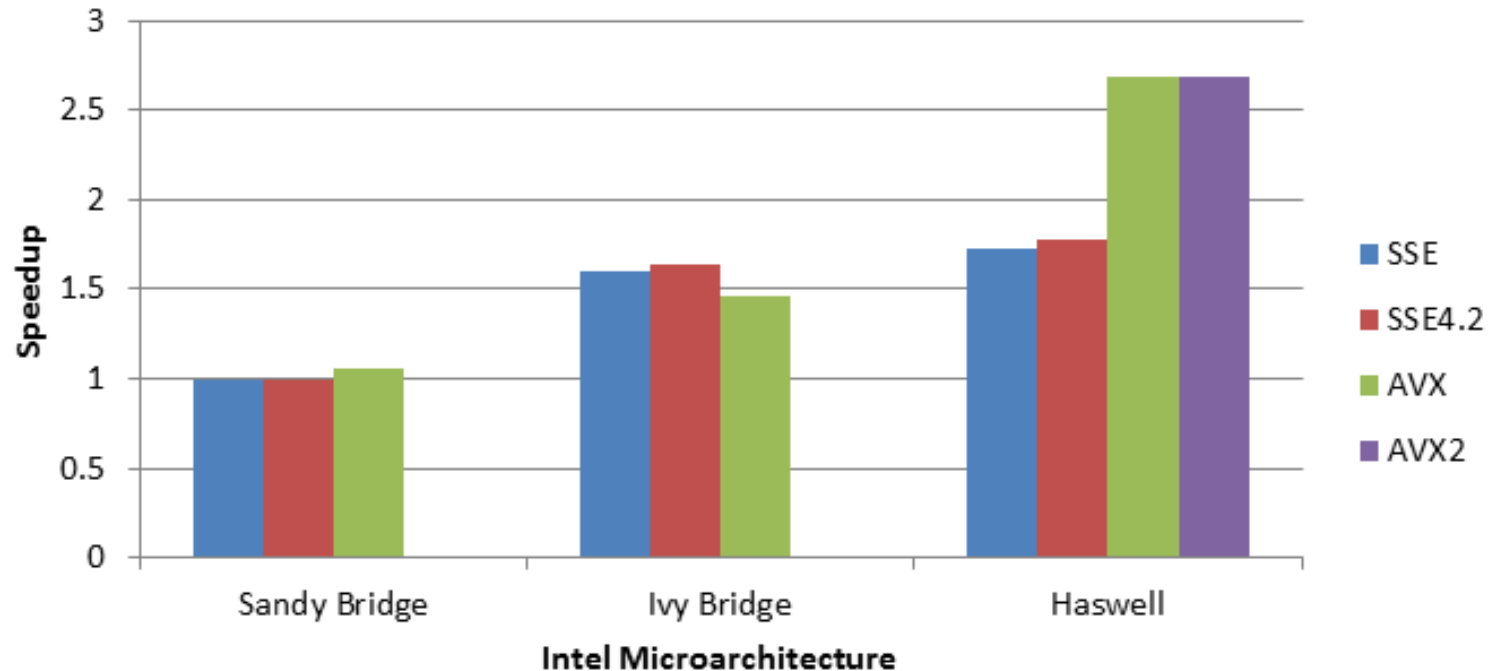
HEP-SPEC06 performance comparison, Turbo Boost disabled, frequency scaled (higher is better)

Preliminary results



Research and technical activities (1)

Speedup 500,000 events



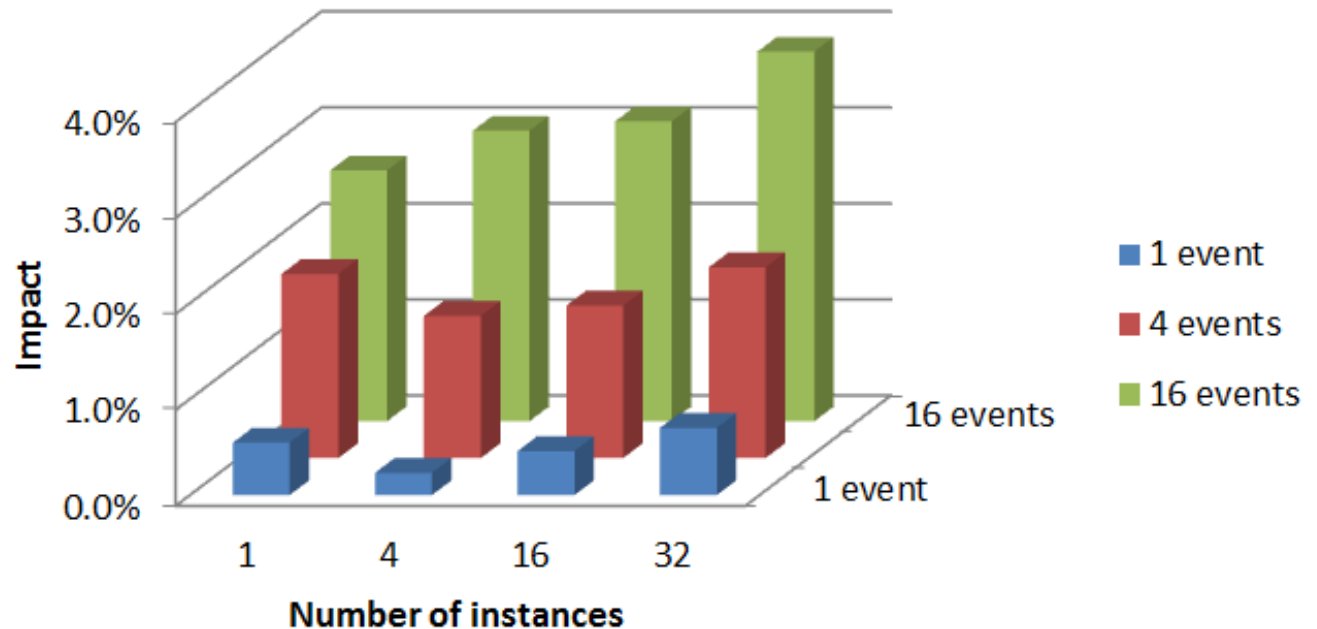
Speedup for MLfit with 500'000 events on different Intel microarchitectures (baseline: SSE on "Sandy Bridge")

Research and technical activities (2)

- **Compilers and tools**
 - The Intel C Compiler 14 and new Intel tools evaluated and made available CERN-wide
 - Georg Zitzberger now the main contact point
- **Performance tuning**
 - New paper submitted to an international conference in collaboration with Intel Israel
 - New performance tuning packages made available (Linux kernel 3.10 + addons)
 - Collaboration with PH on overhead mitigation
 - Contributed region based monitoring to perf via the GSoC project

Research and technical activities (2)

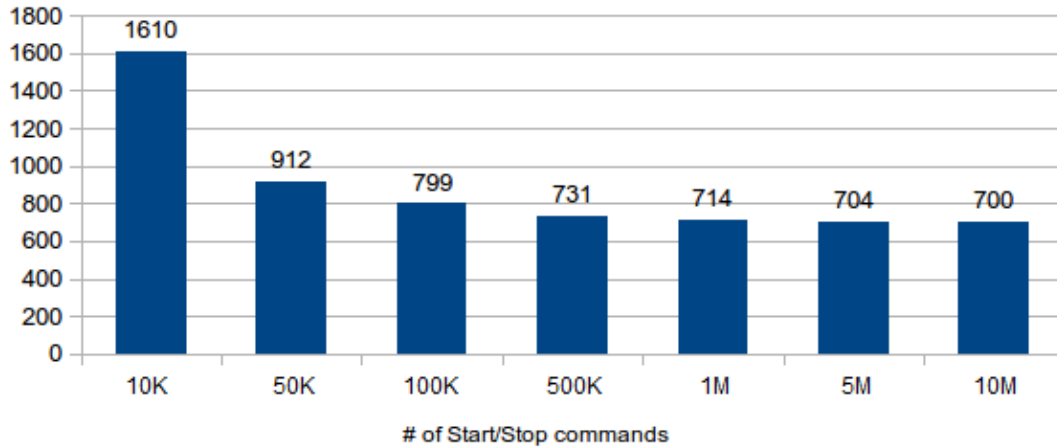
Performance impact in sampling mode for 444.namd



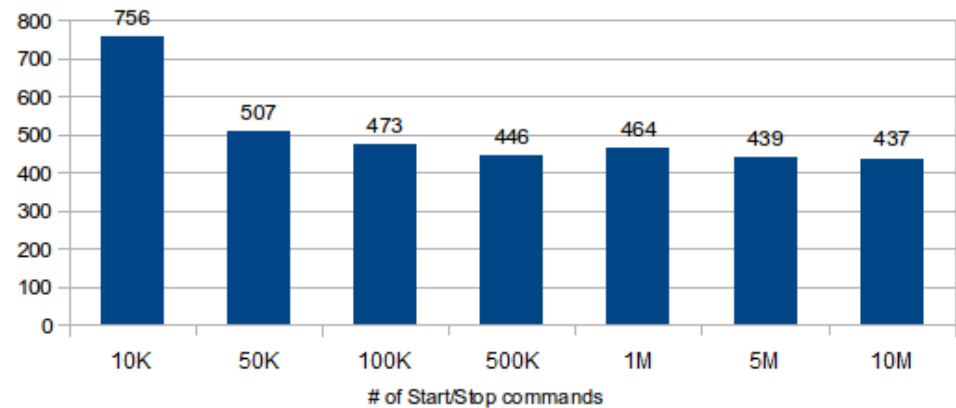
Linux-perf in kernel 3.10

linux-perf project with GSoC

Penalty per Command
(CPU Cycles)



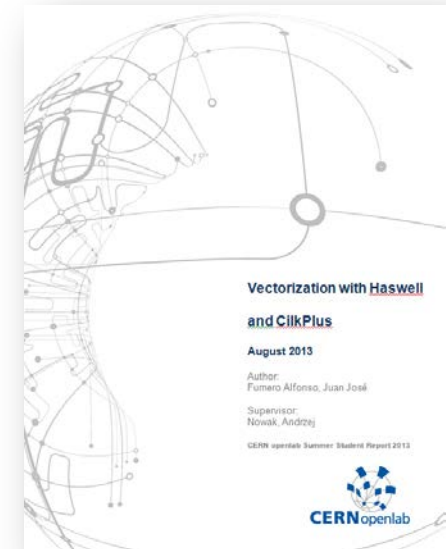
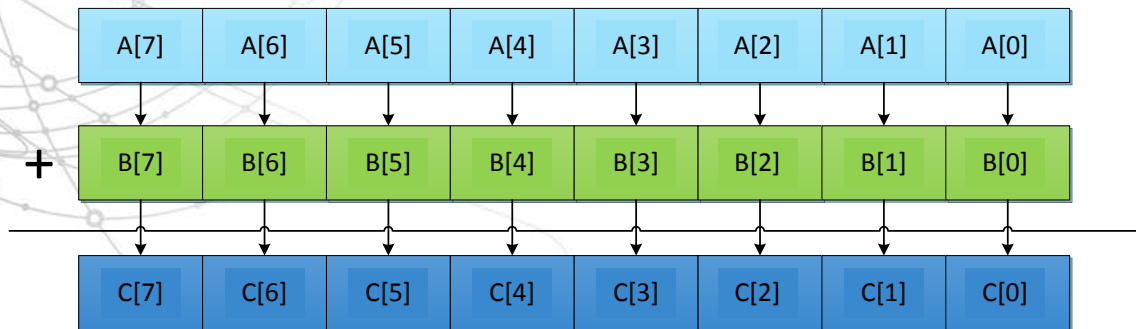
Penalty per Command
(Instructions)



Research and technical activities (3)

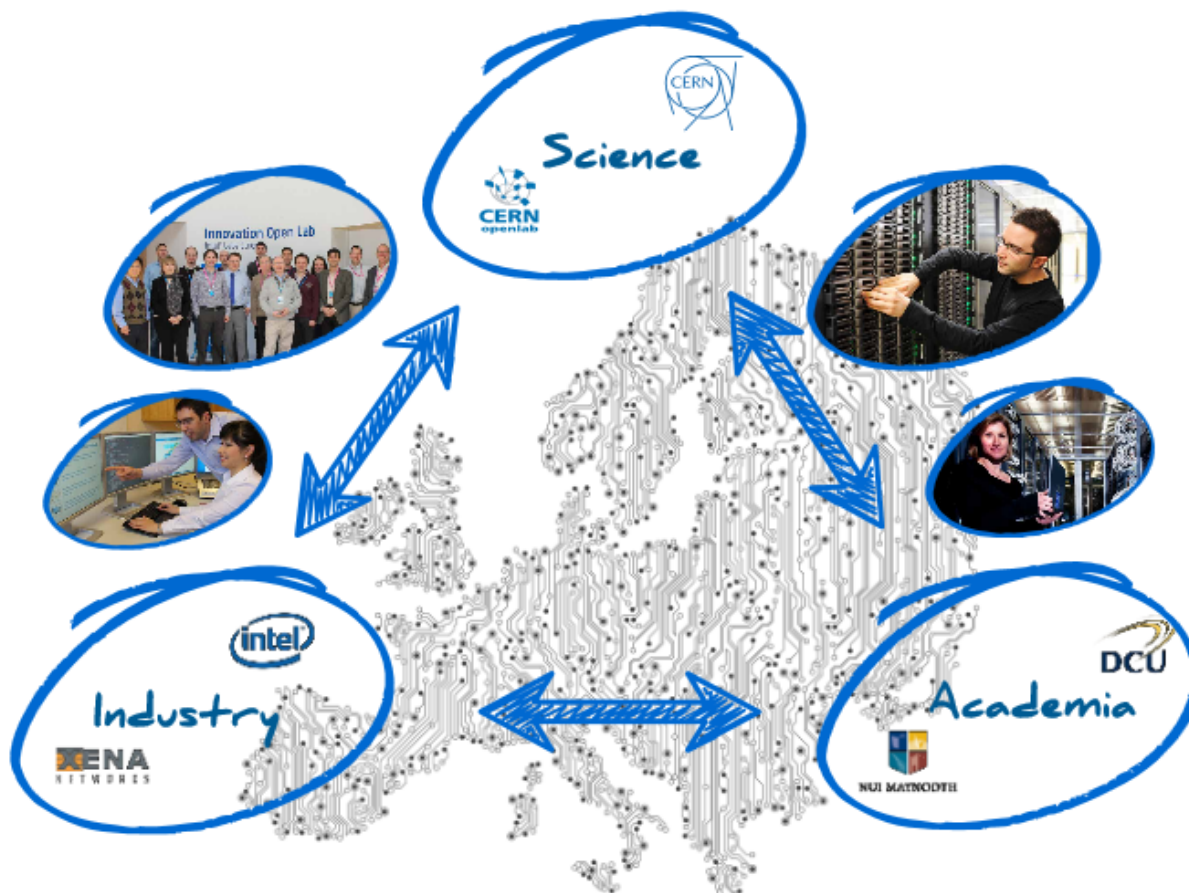
■ Geant-V

- Prototype of a next generation, data-oriented Geant4 – focus on vectorization and threading
- PH and Intel now have a direct link
- Evaluation of Cilk+, Vc and auto-vectorization capabilities in ICC and GCC
- Report to be published imminently



ICE-DIP 2013-2017: The Intel-CERN European Doctorate Industrial Program

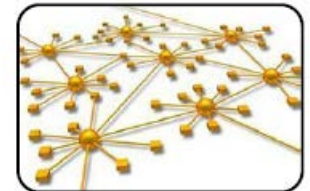
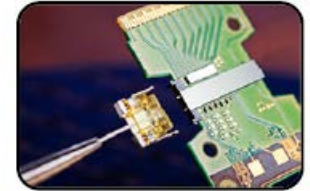
» A public-private partnership to research solutions for next generation data acquisition networks, offering research training to five Early Stage Researchers in ICT



Research topics:

- ▶ Silicon photonics systems
- ▶ Next generation data acquisition networks
- ▶ High speed configurable logic
- ▶ Computing solutions for high performance data filtering

- Pioneering Industrial Doctorate program with Intel as an EU FP7 grant
- Focus on evolving data-taking capabilities
- Singled out as an example by EU Commissioner for Education, Androulla Vassiliou
- Kicked off in February in Dublin
- Considerable legal efforts
- 5 Early Stage Researchers recruited and hired at CERN



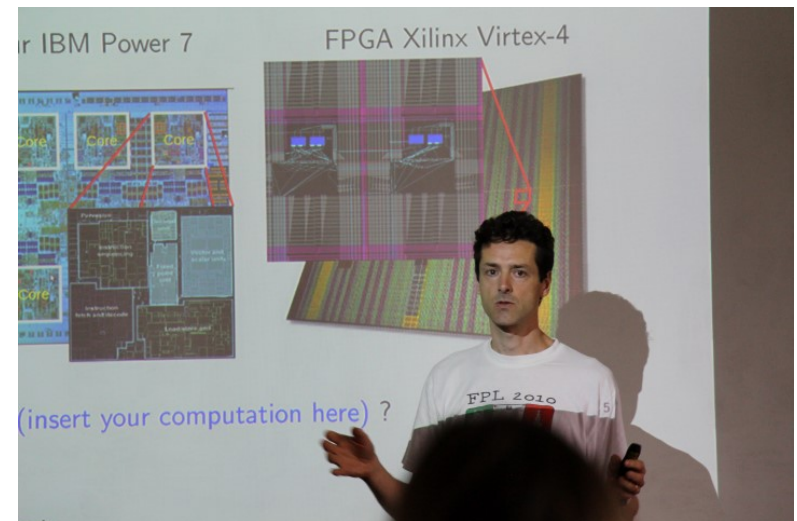


Workshops and teaching (1)

- Involved in 3 schools and 5 workshops
- Organized a Thematic CERN School of Computing – June 2013
 - Limited, highly qualified audience
 - 1 week long, single topic focus
- CERN School of Computing – August 2013
 - 60 participants
- Parallelism, Compilers and Performance workshop – 25-27 March 2013
 - ~30 participants
- Xeon Phi workshop – 11-12 April 2013
 - ~25 participants
- Numerical Computing Workshop – 27-28 May 2013
 - ~30 participants

Workshops and teaching (2)

- Workshop on next-gen Intel technologies for CERN experiments – July 2013
 - ~45 participants
- Mentoring for the iCSC 2013
- External training for a private company



Conferences and talks (1)

- 5 Keynotes, 6 other talks and 2 workshops
- Concurrency Forum, Fermilab Chicago – 4-6 Feb 2013
 - „A brief correlation study of x86 compiler flags and performance events” (A. Nowak on behalf of M. Botezatu)
 - „Practical results of the Intel MIC-Xeon Phi project at CERN openlab” (A. Nowak)
 - „Hardware facilities for vector computing” (A. Nowak)
- SFI’13, Krakow – 16 Feb 2013
 - Keynote + Workshop – „Software optimization in the many-core era” (A. Nowak)
- GPU in HEP, DESY – 16 Apr 2013
 - “What might be good software designs for the complexity of current CPUs, accelerators, and GPUs” (S. Jarp)
- ACAT’13, Beijing – 16-21 May 2013
 - Keynote – „Opportunities and choice in a new vector era” (A. Nowak)
- Parallel 2013, Karlsruhe – 16 May 2013
 - “The struggle to design software that fills the performance dimensions of modern CPUs” (S. Jarp)

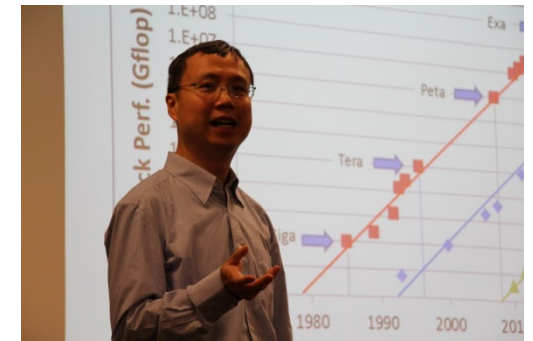
Conferences and talks (2)

- BDigital Global Congress, Barcelona – 12-14 June 2013
 - Keynote – „Big Data at the service of Big Science at CERN” (A. Nowak)
- ISC'13, Leipzig – 16-19 June 2013
 - Session chair - S. Jarp
 - Theater talk – „Big Science and Bigger Data - the Growth of Computing at CERN” (A. Nowak)
- Int'l Symposium on Computer Architecture – 23-26 June 2013
 - Tutorial on PMU technologies (A. Nowak)
- Big Data Innovation Summit, Boston – 12 Sep 2013
 - Keynote – Solving the Mysteries of the Universe with Big Data (S. Jarp)
- Big data ISC – Sep 2013
 - Program Committee chairman – S. Jarp
- Big Data Innovation Summit, London – 30 Apr 2013
 - Keynote – “Solving the Mysteries of The Universe With Big Data” (S. Jarp)



Visits and interaction

- Jeff Arnold, Intel
- Herbert Cornelius, Intel
- Stephane Eranian, Google
- Alan Gara, Intel
- Hans-Christian Hoppe, Intel
- Victor Lee, Intel
- Klaus-Dieter Oertel, Intel
- Hans Pabst, Intel
- Steve Pawlowski, Intel
- Marie-Christine Sawley, Intel
- Karl Solzenbach, Intel
- LABOS faculty, EPFL
- Intel ISEF winners



Future work – next three months

- Looking ahead to a whole range of exciting technologies, not only CPUs
- Focus on power efficiency
 - Atom, Xeon Phi
- Workshop and training period
 - Enlarged Performance, Compilers and Parallelism workshop
 - Potential second workshop on PMU technologies
- ICE-DIP technical program takes off
 - Communication in a PC platform
 - Parallelization technologies
 - Three other work packages in PH

Q & A

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