

Virtual Institute – High Productivity Supercomputing

Virtual Institute – High Productivity Supercomputing

- **Goal:** Improve the quality and accelerate the development process of complex simulation codes running on highly-parallel computer systems
- Start-up funding (2006–2011)
by Helmholtz Association of German Research Centres
- Activities
 - Development and integration of HPC programming tools
 - Correctness checking & performance analysis
 - Academic workshops
 - Training workshops
 - Service
 - Support email lists
 - Application engagement

HELMHOLTZ
RESEARCH FOR GRAND CHALLENGES

<http://www.vi-hps.org>

VI-HPS partners (founders)



Forschungszentrum Jülich

- Jülich Supercomputing Centre



RWTH Aachen University

- Centre for Computing & Communication



Technische Universität Dresden

- Centre for Information Services & HPC



University of Tennessee (Knoxville)

- Innovative Computing Laboratory



VI-HPS partners (cont.)



Barcelona Supercomputing Center

- Centro Nacional de Supercomputación



Durham University



Federal University of Rio Grande do Norte

- Laboratory of Parallel Architectures for Signal Processing



Friedrich-Alexander-Universität

- Erlangen Regional Computing Center (RRZE)



INESC-ID.

- Instituto de Engenharia de Sistemas e Computadores: Investigação e Desenvolvimento em Lisboa



VI-HPS partners (cont.)



IT4Innovations

- Technical University of Ostrava



Lawrence Livermore National Lab.

- Center for Applied Scientific Computing



Leibniz Supercomputing Centre



Linaro Ltd.

- Linaro Forge



Technical University of Darmstadt

- Laboratory for Parallel Programming



VI-HPS partners (cont.)



Technical University of Munich

- Chair for Computer Architecture



University of Oregon

- Performance Research Laboratory



University of Stuttgart

- HPC Centre



University of Versailles St-Quentin

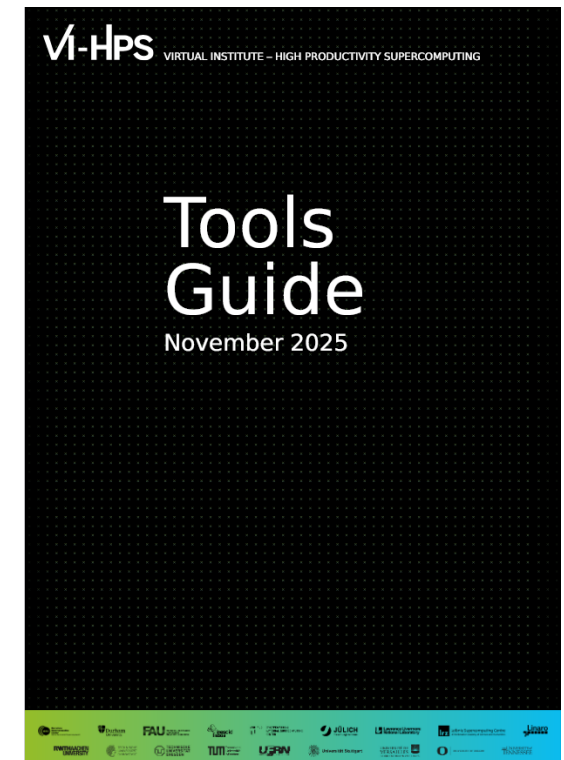
- Li-Parad



Productivity tools

- **MAQAO**: Assembly analysis & optimization
- **Paraver/Dimemas/Extrac**: Event tracing, graphical trace visualization & analysis
- **Score-P**: Community-developed instrumentation & measurement infrastructure
- **Scalasca**: Large-scale parallel performance analysis
- **Vampir**: Interactive graphical trace visualization & analysis
- **MUST & Archer**: MPI & OpenMP usage correctness checking

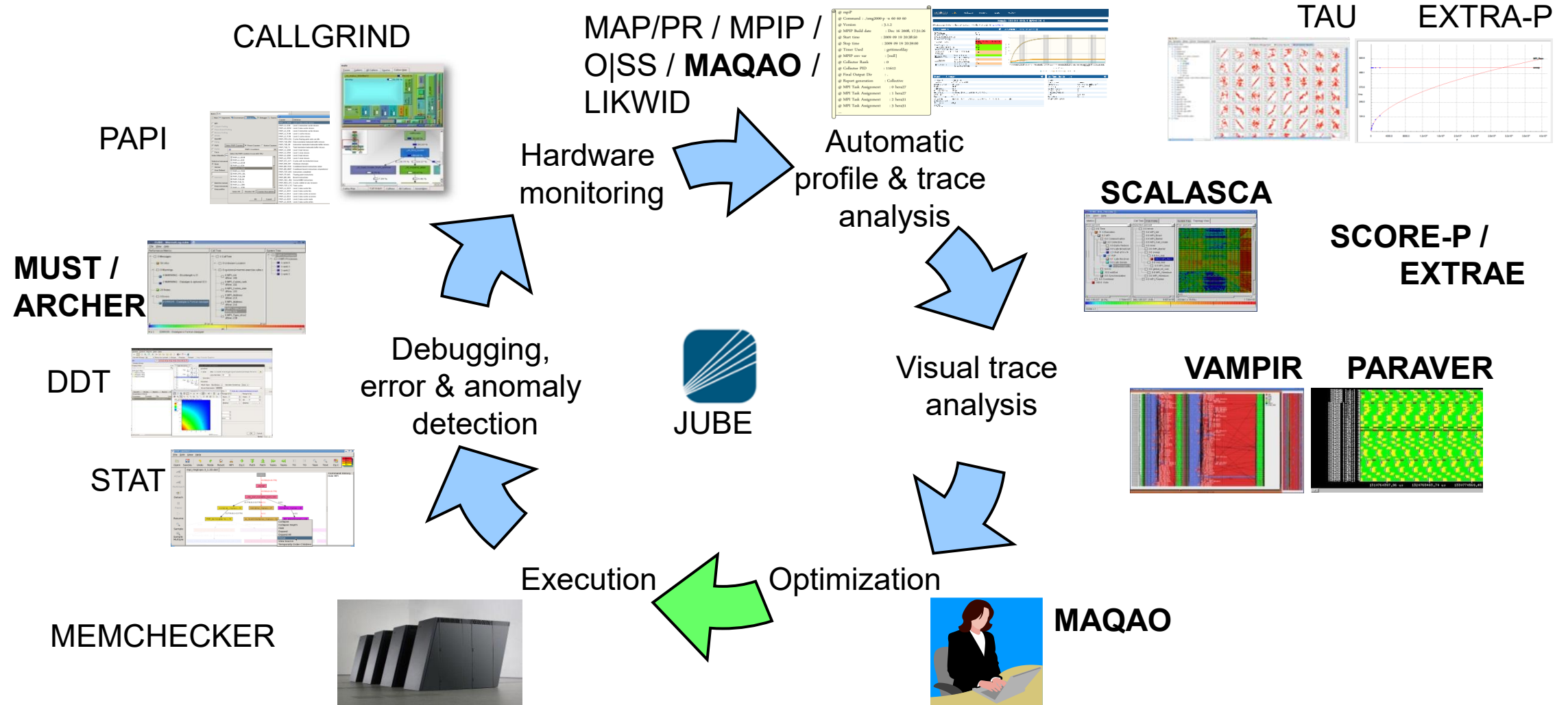
For a brief overview of tools consult the VI-HPS Tools Guide:



Productivity tools (cont.)

- **Extra-P**: Automated performance modelling
- **JUBE**: Workflow execution environment
- **Kcachegrind**: Callgraph-based cache analysis [x86 only]
- **LIKWID**: Command-line performance tools suite
- **Linaro FORGE DDT/MAP/PR**: Parallel debugging, profiling & performance reports
- **mpiP/mpiPview**: MPI profiling tool and analysis viewer
- **Open MPI**: Integrated memory checking
- **Open|SpeedShop**: Integrated parallel performance analysis environment
- **PAPI**: Interfacing to hardware performance counters
- **STAT**: Stack trace analysis tools
- **TAU**: Integrated parallel performance system

Technologies and their integration



Disclaimer

Tools will ***not*** automatically make you,
your applications or computer systems
more productive.

However, they can help you understand
how your parallel code executes and
when / where it's necessary to work on
correctness and performance issues.

VI-HPS training & Tuning Workshops

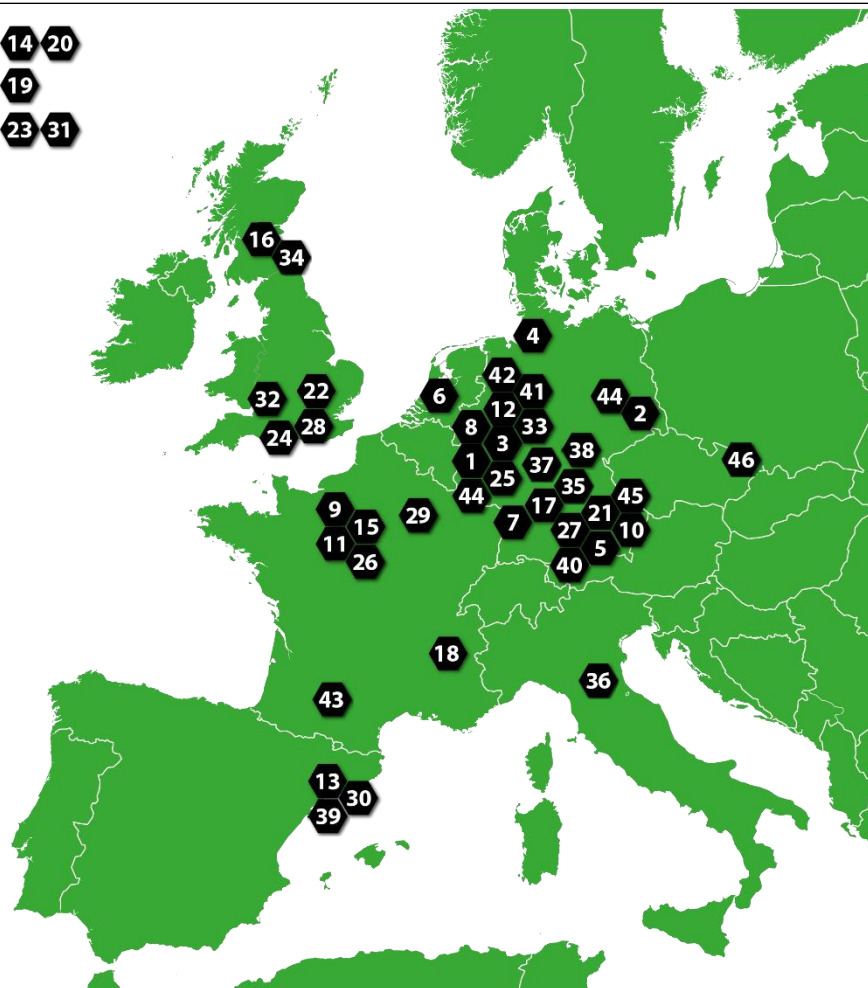
- Goals
 - Give an overview of the programming tools suite
 - Explain the functionality of individual tools
 - Teach how to use the tools effectively
 - Offer hands-on experience and expert assistance using tools
 - Receive feedback from users to guide future development
- For best results, bring & analyze/tune your own code(s)!
- VI-HPS Hands-on Tutorial series
 - SC'08-11/13/14/15/16/17/19, ICCS'09, Cluster'10, EuroMPI'12/14, XSEDE'13, ISC-HPC'15-19
- VI-HPS Tuning Workshop series
 - 2008 (x2), 2009 (x2), 2010 (x2), 2011 (x2), 2012 (x2), 2013 (x2), 2014(x4), 2015(x3)
 - 2016 (Kobe/Japan, [Garching/Germany](#), [Cambridge/UK](#), Livermore/USA)
 - 2017 ([Southampton/UK](#), [Aachen/Germany](#), Bruyères-le-Châtel/France)
 - 2018 ([Garching/Germany](#), [London/UK](#), [Reims/France](#))
 - 2019 ([Barcelona/Spain](#), Knoxville/USA, [Bristol/UK](#), [Jülich/Germany](#))
 - 2020 ([EPCC/Scotland / Online](#), [HLRS/Germany / Online](#), CINECA/Italy / *Online*, CSC/Germany / *Online*)
 - 2021 (NHR@FAU/Germany / *Online*, POP CoE / *Online*)
 - 2022 (JSC/RWTH/Germany / *Online*, POP CoE / *Online*)
 - 2024 (Toulouse/France, Aachen&Dresden/Germany / *Hybrid*, Garching b. München/Germany, Ostrava/Czechia / *Hybrid*)
 - 2025 (Essen/Germany)





VI-HPS Tuning Workshop series

JP 14 20
CL 19
US 23 31



1. 2008/03/05+3: RWTH, Aachen, Germany
2. 2008/10/08+3: ZIH, Dresden, Germany
3. 2009/02/16+5: JSC, Jülich, Germany
4. 2009/09/09+3: HLRN, Bremen, Germany
5. 2010/03/08+3: TUM, Garching, Germany
6. 2010/05/26+3: SARA, Amsterdam, Netherlands
7. 2011/03/28+3: HLRS, Stuttgart, Germany
8. 2011/09/05+5: GRS, Aachen, Germany
9. 2012/04/23+5: UVSQ, St-Quentin, France
10. 2012/10/16+4: LRZ, Garching, Germany
11. 2013/04/22+4: MdS, Saclay, France
12. 2013/10/07+5: JSC, Jülich, Germany
13. 2014/02/10+5: BSC, Barcelona, Spain
14. 2014/03/25+3: RIKEN AICS, Kobe, Japan
15. 2014/04/07+4: MdS, Saclay, France
16. 2014/04/29+3: EPCC, Edinburgh, Scotland
17. 2015/02/23+5: HLRS, Stuttgart, Germany
18. 2015/05/18+5: UGA, Grenoble, France
19. 2015/10/27+3: NLHPC, Santiago, Chile
20. 2016/02/24+3: RIKEN AICS, Kobe, Japan
21. 2016/04/18+5: LRZ, Garching, Germany
22. 2016/07/06+3: Uni. Cambridge, England
23. 2016/07/27+3: LLNL, Livermore, California, USA
24. 2017/02/08+3: Uni. Southampton, England
25. 2017/03/27+5: RWTH, Aachen, Germany
26. 2017/10/16+5: Lab. ECR, Ter@tec, France
27. 2018/04/23+5: LRZ, Garching, Germany
28. 2018/06/21+3: UCL, London, England
29. 2018/10/15+5: ROMEO, Reims, France
30. 2019/01/21+5: BSC, Barcelona, Spain
31. 2019/04/09+4: UTK-ICL, Knoxville/TN, USA
32. 2019/04/24+3: Uni. Bristol, England
33. 2019/06/24+5: JSC, Jülich, Germany
34. 2020/07/28+3: EPCC, Scotland / ONLINE
35. 2020/09/14+5: HLRS, Germany / ONLINE
36. 2020/09/30+3: CINECA, Italy / ONLINE
37. 2020/12/07+5: CSC, Germany / ONLINE
38. 2021/03/01+3: NHR@FAU, Germany / ONLINE
39. 2021/04/19+3: POP CoE / ONLINE
40. 2021/06/14+5: LRZ, Germany / ONLINE
41. 2022/02/07+4: JSC/RWTH, Germany / ONLINE
42. 2022/05/17+3: POP CoE / ONLINE
43. 2024/01/29+3: CALMIP, Toulouse, France
44. 2024/02/26+3: RWTH Aachen & ZIH, TU Dresden, Germany / Hybrid
45. 2024/06/10+3: LRZ, Garching, Germany
46. 2024/09/04+2: IT4I, Ostrava, Czechia / Hybrid
47. 2025/06/02+3: Uni. Duisburg-Essen, Germany

Upcoming events

- Tuning Workshop (JSC, Jülich, Germany, 06-10 July 2026)
- Tuning Workshop (Durham University, Durham, UK, Spring 2026)
- Future events to be determined
 - (one-day) tutorials: with guided exercises sometimes using a Live-ISO/OVA
 - (multi-day) training workshops: with your own applications on actual HPC systems
- Check www.vi-hps.org/training for announced events
- Contact us if you might be interested in hosting a training event