



## 33rd VI-HPS Tuning Workshop

Jülich Supercomputing Centre, 24-28 June 2019

<http://www.vi-hps.org/training/tws/tw33.html>

**Cédric Valensi &  
Emmanuel Oseret**  
UVSQ

**Sameer Shende**  
University of Oregon

**Markus Geimer, Michael Knobloch,  
Marc Schlütter, Ilya Zhukov & Brian Wylie**  
Jülich Supercomputing Centre

**German Llort & Lau Mercadal**  
Barcelona Supercomputing Center

**Matthias Weber  
& Bill Williams**  
TU Dresden

**Florent Lebeau**  
ARM

**Joachim Protze**  
RWTH Aachen

**Alexandru Calotoiu**  
TU Darmstadt

## Agenda (Monday)

Time	Topic	Presenter
09:00	Welcome	
	Introduction to VI-HPS & overview of tools	Wylie
	Introduction to parallel performance engineering	Schlütter
	Introduction to lab setup; Building and running NPB/BT-MZ	Knobloch
10:30	<i>Break</i>	
11:00	TAU performance system	Shende
	TAU hands-on exercises	
12:30	<i>Lunch</i>	
13:30	Hands-on coaching to apply tools to analyze your own code(s)	all
17:30	Review of day and schedule for remainder of workshop	
18:00	<i>Adjourn</i>	

## Agenda (Tuesday)

Time	Topic	Presenter
09:00	MAQAO x86 performance analysis tools	Oseret & Valensi
	MAQAO hands-on exercises	
10:30	<i>Break</i>	
11:00	MUST MPI runtime error detection	Protze
	ARCHER OpenMP runtime error detection	Protze
12:30	<i>Lunch</i>	
13:30	Hands-on coaching to apply tools to analyze your own code(s)	all
17:30	Review of day and schedule for remainder of workshop	
18:00	<i>Adjourn</i>	

## Agenda (Wednesday)

Time	Topic	Presenter
09:00	Score-P instrumentation & measurement	Knobloch
	CUBE profile explorer	Geimer
10:30	<i>Break</i>	
11:00	Score-P analysis scoring & measurement filtering	Knobloch
	Scalasca automated trace analysis	Geimer
12:30	<i>Lunch</i>	
13:30	Hands-on coaching to apply tools to analyze your own code(s)	all
17:30	Review of day and schedule for remainder of workshop	
18:00	<i>Adjourn</i>	

## Agenda (Thursday)

Time	Topic	Presenter
09:00	VAMPIR interactive trace analysis	Weber & Williams
	VAMPIR hands-on exercises	
10:30	<i>Break</i>	
11:00	BSC tracing tools	Llort & Mercadal
	BSC tools hands-on exercises	
12:30	<i>Lunch</i>	
13:30	Hands-on coaching to apply tools to analyze your own code(s)	all
17:30	Review of day and schedule for remainder of workshop	
18:00	<i>Adjourn</i>	



## Agenda (Friday)

Time	Topic	Presenter
09:00	FORGE MAP and performance reports	Lebeau
	JUBE workflow execution environment	Zhukov
10:30	<i>Break</i>	
11:00	Extra-P automated performance modeling	Calotoiu
12:15	Review of workshop	Valensi
12:30	<i>Lunch</i>	
13:30	Hands-on coaching to apply tools to analyze your own code(s)	all
17:00	<i>Adjourn</i>	

# Virtual Institute – High Productivity Supercomputing

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- **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.)



### Arm Ltd.

- Allinea Software



### Barcelona Supercomputing Center

- Centro Nacional de Supercomputación



### Lawrence Livermore National Lab.

- Center for Applied Scientific Computing



### Leibniz Supercomputing Centre



### Technical University of Darmstadt

- Laboratory for Parallel Programming

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## VI-HPS partners (cont.)

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### Technical University of Munich

- Chair for Computer Architecture



### University of Oregon

- Performance Research Laboratory



### University of Stuttgart

- HPC Centre



### University of Versailles St-Quentin

- LRC ITACA

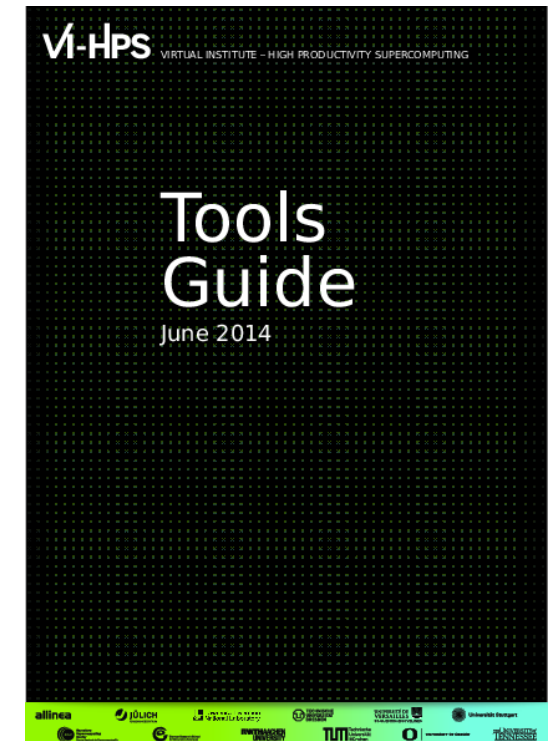


# Productivity tools

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- **MUST & Archer**
  - MPI & OpenMP usage correctness checking
- **PAPI**
  - Interfacing to hardware performance counters
- **Periscope Tuning Framework**
  - Automatic analysis and Tuning
- **Scalasca**
  - Large-scale parallel performance analysis
- **TAU**
  - Integrated parallel performance system
- **Vampir**
  - Interactive graphical trace visualization & analysis
- **Score-P**
  - Community-developed instrumentation & measurement infrastructure

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



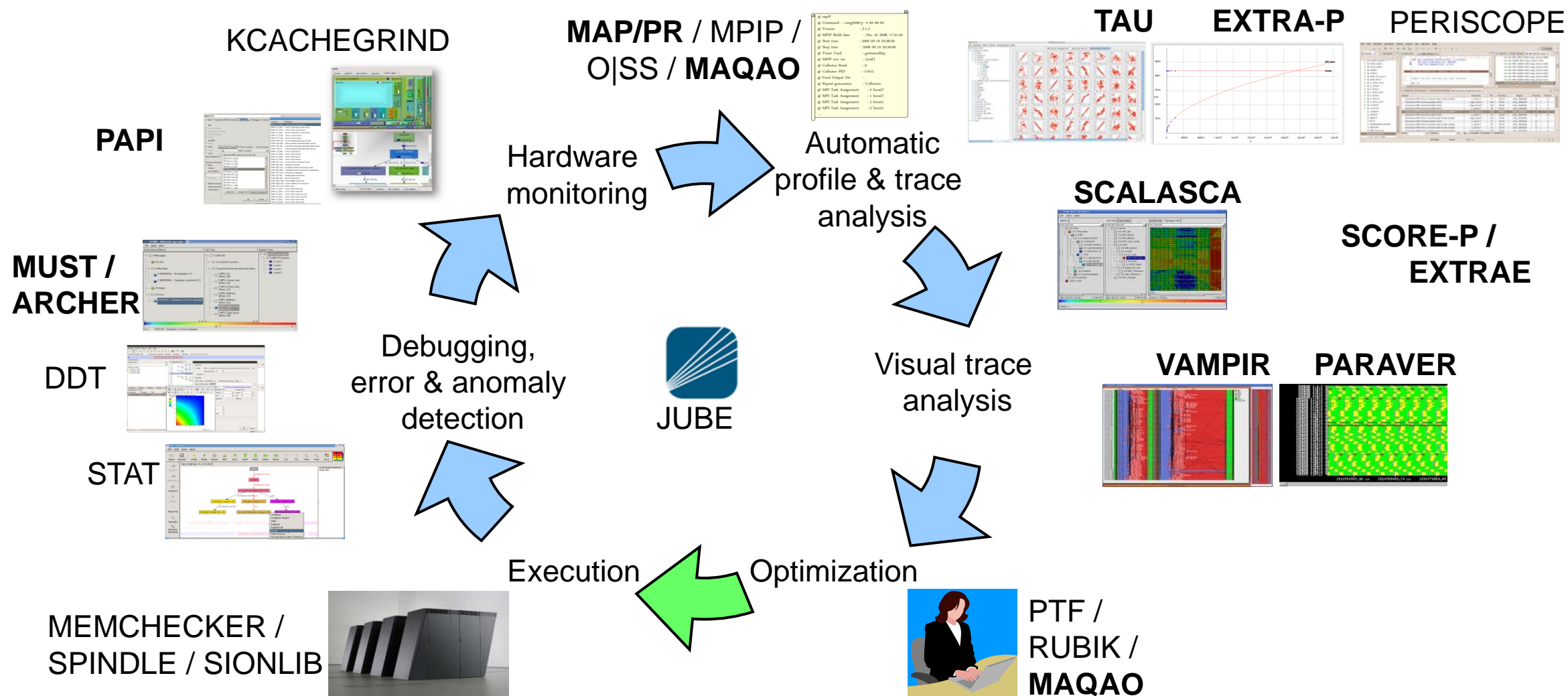
## Productivity tools (cont.)

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- **FORGE DDT/MAP/PR**: Parallel debugging, profiling & performance reports
- **Extra-P**: Automated performance modelling
- **Kcachegrind**: Callgraph-based cache analysis [x86 only]
- **JUBE**: Workflow execution environment
- **MAQAO**: Assembly instrumentation & optimization [x86-64 only]
- **mpiP/mpiPview**: MPI profiling tool and analysis viewer
- **Open MPI**: Integrated memory checking
- **Open|SpeedShop**: Integrated parallel performance analysis environment
- **Paraver/Dimemas/Extrae**: Event tracing, graphical trace visualization & analysis
- **Rubik**: Process mapping generation & optimization [BG only]
- **SIONlib/Spindle**: Optimized native parallel file I/O & shared library loading
- **STAT**: Stack trace analysis tools



# Technologies and their integration





## Disclaimer

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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

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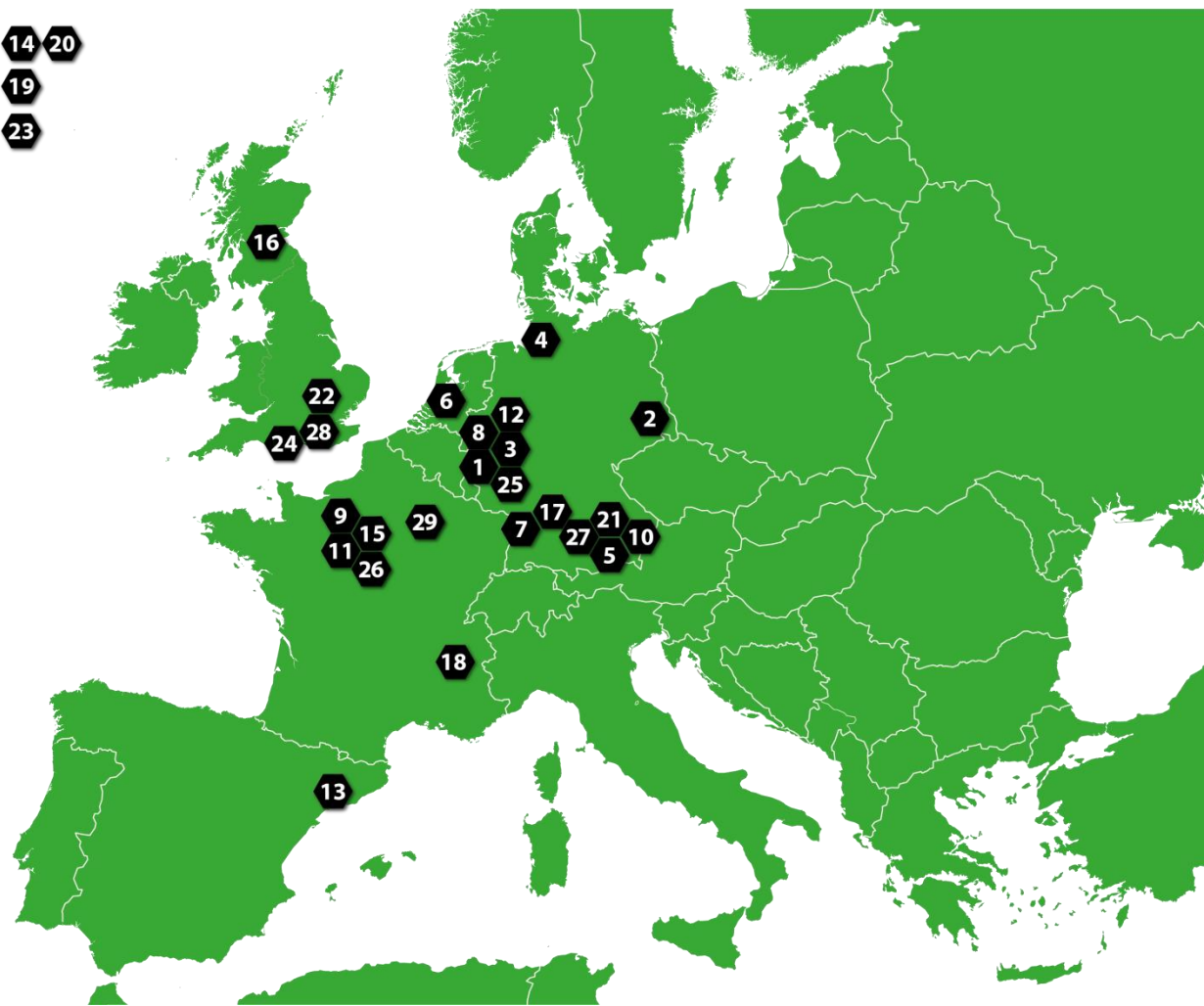
- Goals
  - Give an overview of the programming tools suite
  - Explain the functionality of individual tools
  - Teach how to use the tools effectively
  - Offer hands-on experience and expert assistance using tools
  - Receive feedback from users to guide future development
- For best results, bring & analyze/tune your own code(s)!
- VI-HPS Hands-on Tutorial series
  - **SC'08-11/13/14/15/16/17**, 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](#))





# VI-HPS Tuning Workshop series

JP 14 20  
CL 19  
US 23



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

## Upcoming events

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- Hands-on tutorial at SC19 conference (18 Nov 2019, Denver, CO, USA)
- Further 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](http://www.vi-hps.org/training) for announced events
- Contact us if you might be interested in hosting a training event