

# 2021 Code Performance Series: From analysis to insight

First session

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## Welcome notes

- ▶ Intro
- ▶ Rationale behind this course
- ▶ Organisation
- ▶ Anticipated outcomes



## Fact sheet:

- ▶ Professor in Computer Science
- ▶ Head of Scientific Computing research group  
(we are hiring—see NA Digest and SIAM-CSE maillist, e.g.)
- ▶ Director of MSc in Scientific Computing and Data Analysis (MISCADA)

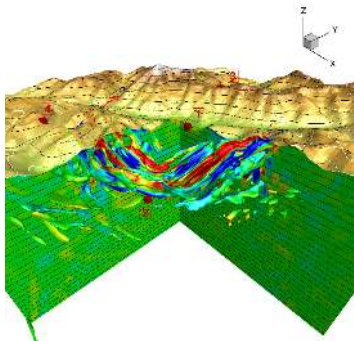
## Scientific agenda:

- ▶ Algorithmic ideas behind numerical (HPC) codes
- ▶ Implementation techniques used in numerical (HPC) codes
- ▶ Hardware-algorithm interplay
- ▶ Multigrid
- ▶ Hyperbolic equation system solvers

## Two ExCALIBUR projects

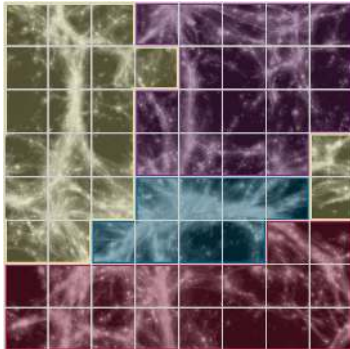
### ExaClaw

Clawpack-enabled ExaHyPE for heterogeneous hardware



### SPH

Massively Parallel Particle Hydrodynamics for Engineering and Astrophysics



ExCALIBUR is about

- ▶ research projects (software) plus
- ▶ evaluation of novel hardware plus
- ▶ establishing training for HPC research software engineers (RSEs) plus
- ▶ ...

# Why training around performance analysis?

**My impression/opinion:** Methodologically sound, in-depth analysis is rarely (not often enough) done. If it is used, then not as a companion to/guide for actual code development. Absent or postponed (a posteriori) analysis leads to inferior HPC code.

(Attempts of an) Explanation:

- ▶ Developers/RSEs don't know about tools  
(though there's the EPCC/PRACE training, e.g.)
- ▶ Tools lack critical features
- ▶ No in-depth training available
- ▶ Tool output too difficult to digest  
(most teams dominated by domain experts)

## Doing things differently ...

- ▶ Run a series of (shorter) workshops
  - ⇒ our day job often stops us to dive into a tool and to understand it
- ▶ Focus on non-commercial/academic/research analysis tools and bring developers in
  - ⇒ look into the in-depth features that normal courses cannot discuss
- ▶ Establish bi-directional exchange
  - ⇒ allow users to give feedback to tool developers
- ▶ Write down explicitly how performance data is presented
  - ⇒ hidden HPC-domain knowledge that's difficult to digest for new RSEs
- ▶ Write down explicitly how performance data is digested
  - ⇒ improve communication with application specialists (PIs + grant authors?)

# Doing things differently ...



- ▶ No, we have not forgotten the “Analysis”
- ▶ We want to go beyond sole analysis
- ▶ But we need your help

- ▶ Series of workshops over the year
- ▶ Mornings
  - ▶ Introduce some new tools
  - ▶ Brief about progress with individual codes
  - ▶ Additional presentations (as this one)
- ▶ Afternoons & in-between workshop days
  - ▶ Try out tools
  - ▶ Discuss with developers
  - ▶ Document progress
- ▶ Create series of blogs/write-ups (my todo)



## Expected outcomes

- ▶ Teams
  - ▶ Better performance characterisation
  - ▶ Faster codes
  - ▶ Skills to continue with further analysis
- ▶ Developers
  - ▶ Insight how people use the tools
  - ▶ Dissemination
- ▶ Project
  - ▶ Performance analysis landscape review
  - ▶ Catalogue of performance data presentation techniques

## Partners and faces behind Zoom



**Marion Weinzierl**

RSE Theme Leader of the  
N8 Centre of Excellence  
for Computationally Inten-  
sive Research (CIR)



**Alastair Basden**

Technical Manager for  
the COSMA High Perform-  
ance Computing system  
at Durham (DiRAC)



**Brian J. N. Wylie**

Division Application Sup-  
port  
Jülich Supercomputing  
Centre (JSC)

## Famous last words

- ▶ Please use the Slack
- ▶ Give us feedback, spam us with wishes, ...
- ▶ Run the PR campaign for us  
Twitter, acknowledgments, joint follow-up activities, speak to people, ...

Break

## Running order

1. George Bisbas: Devito
2. Sebastian Wolf: SeisSol
3. Jonathan Frawley: Swift
4. Illektra Christidi: Zacros et al
5. Jon McCulloch: HemeLB
6. David Schaich: SUSY LATTICE (first sign-up!)
7. Sean Barrett: Oxford RAMSES
8. Claire Cashmore: FLASH and burn
9. Marek Schönherr: Sherpa
10. Sophia Vorderwuelbecke: Firedrake
11. Frédéric Simonis: preCICE
12. Nikita Chaturvedi: CIFS
13. Holger Schulz: Peano/ExaHyPE
14. Lewis Sampson: Met Office - OFRD / WAVEWATCH III - Source term mini-app
15. Joseph Parker: BOUT++
16. Ileyk El Mellah: Zeltron

We asked all participating teams to upload their slides to the #presentations channel on Slack. Order: removed individuals or teams that preferred not to present, FUFs (first upload first served), then in order of sign-up