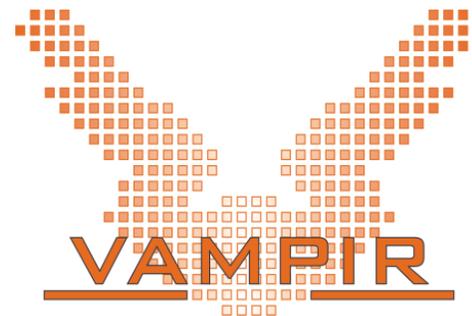


## Performance Analysis with Vampir

---

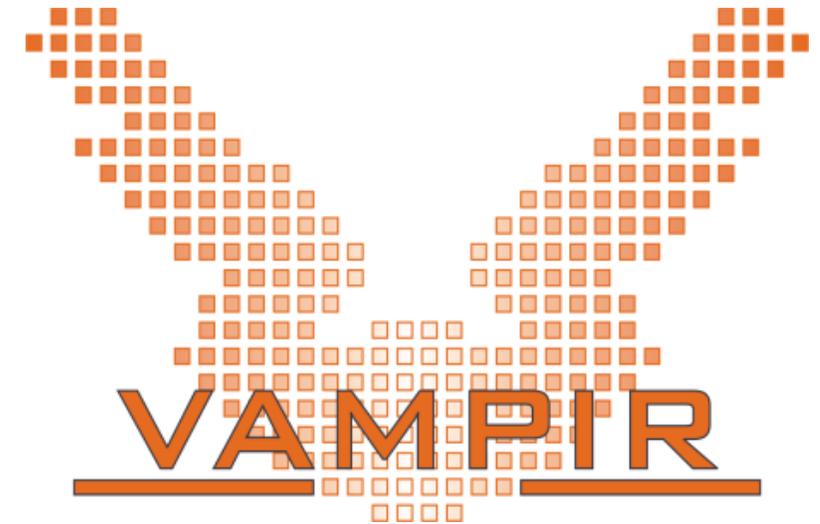
Johannes Ziegenbalg  
Technische Universität Dresden



# Outline

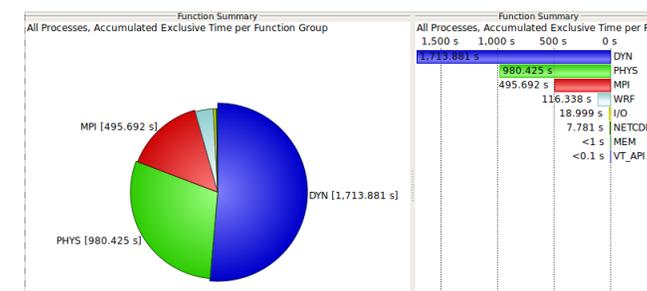
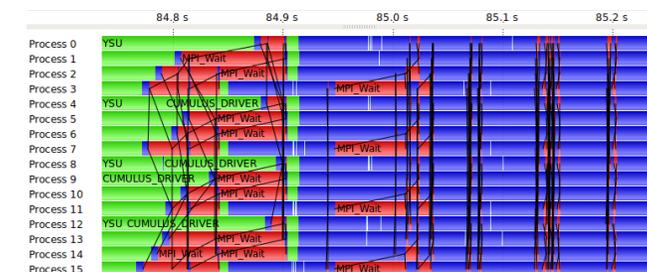
---

- **Part I: Welcome to the Vampir Tool Suite**
  - Mission
  - Event Trace Visualization
  - Vampir & VampirServer
  - The Vampir Displays
- **Part II: Vampir Hands-On**
  - Visualizing and analyzing NPB-MZ-MPI / BT



# Event Trace Visualization with Vampir

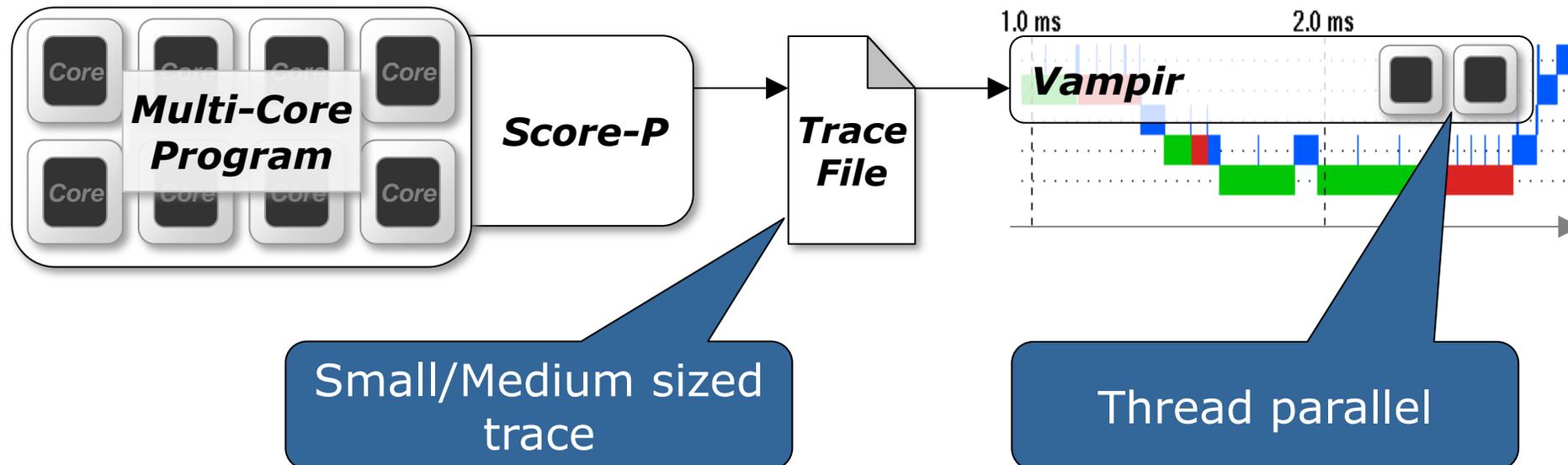
- Alternative and supplement to automatic analysis
- Show dynamic run-time behavior graphically at any level of detail
- Provide statistics and performance metrics
- **Timeline charts**
  - Show application activities and communication along a time axis
- **Summary charts**
  - Provide quantitative results for the currently selected time interval



# Visualization Modes (1)

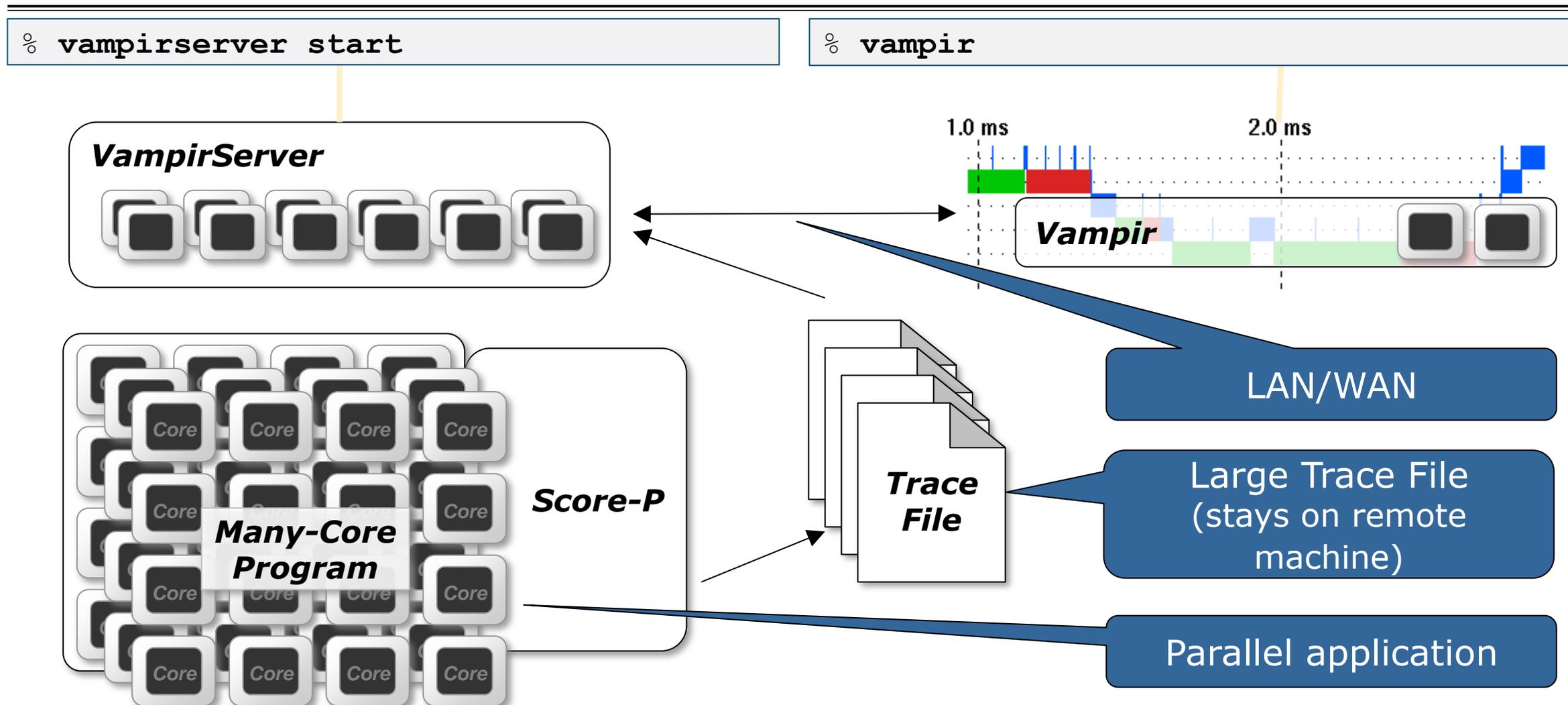
Directly on front end or local machine

```
% vampir
```



## Visualization Modes (2)

On local machine with remote VampirServer



# The main displays of Vampir

---

## ▪ Timeline Charts:

-  Master Timeline
-  Process Timeline
-  Counter Data Timeline
-  Performance Radar

## ▪ Summary Charts:

-  Function Summary
-  Message Summary
-  Process Summary
-  Communication Matrix View

# Hands-on: Visualizing and analyzing NPB-MZ-MPI / BT

---

## Help! Where is my trace file?

---

```
% ls $SCRATCHDIR/NPB3.3-MZ-MPI/bin.scorep/\
> scorep_bt-mz_C_8x8_trace
profile.cubex  scorep.cfg      traces/      traces.def   traces.otf2

% ls $FORMATION_HOME/scorep/scorep_bt-mz_C_8x8_trace+HWC
profile.cubex  scorep.cfg      traces/      traces.def   traces.otf2
```

- If you followed the Score-P hands-on up to the trace experiment
- If you did not follow to that point, take a prepared trace

# Start Vampir on INTI

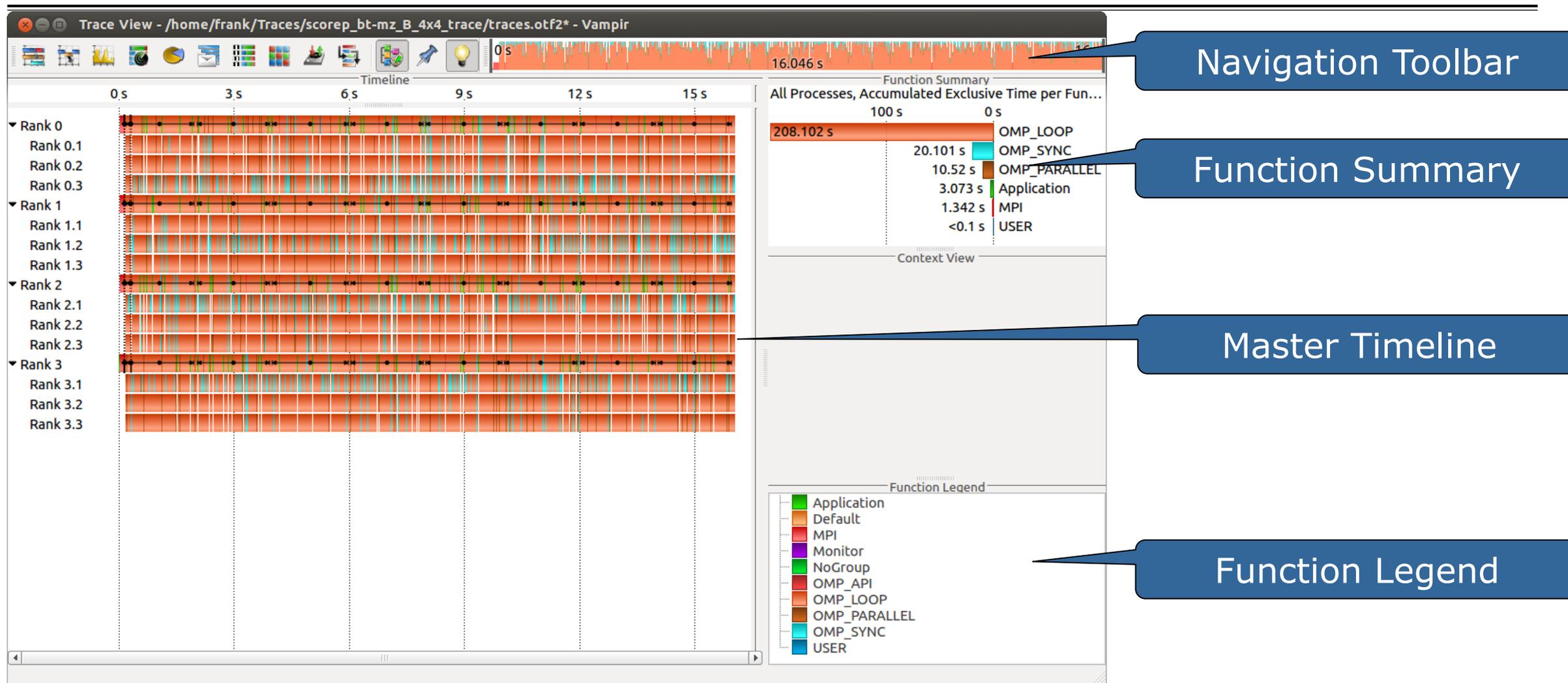
---

```
% module vampir/9.3.0
load module vampire/9.3.0 (Vampir)

% vampir $SCRATCHDIR/NPB3.3-MZ-MPI/bin.scorep/\
> scorep_bt-mz_C_8x6_trace/traces.otf2
```

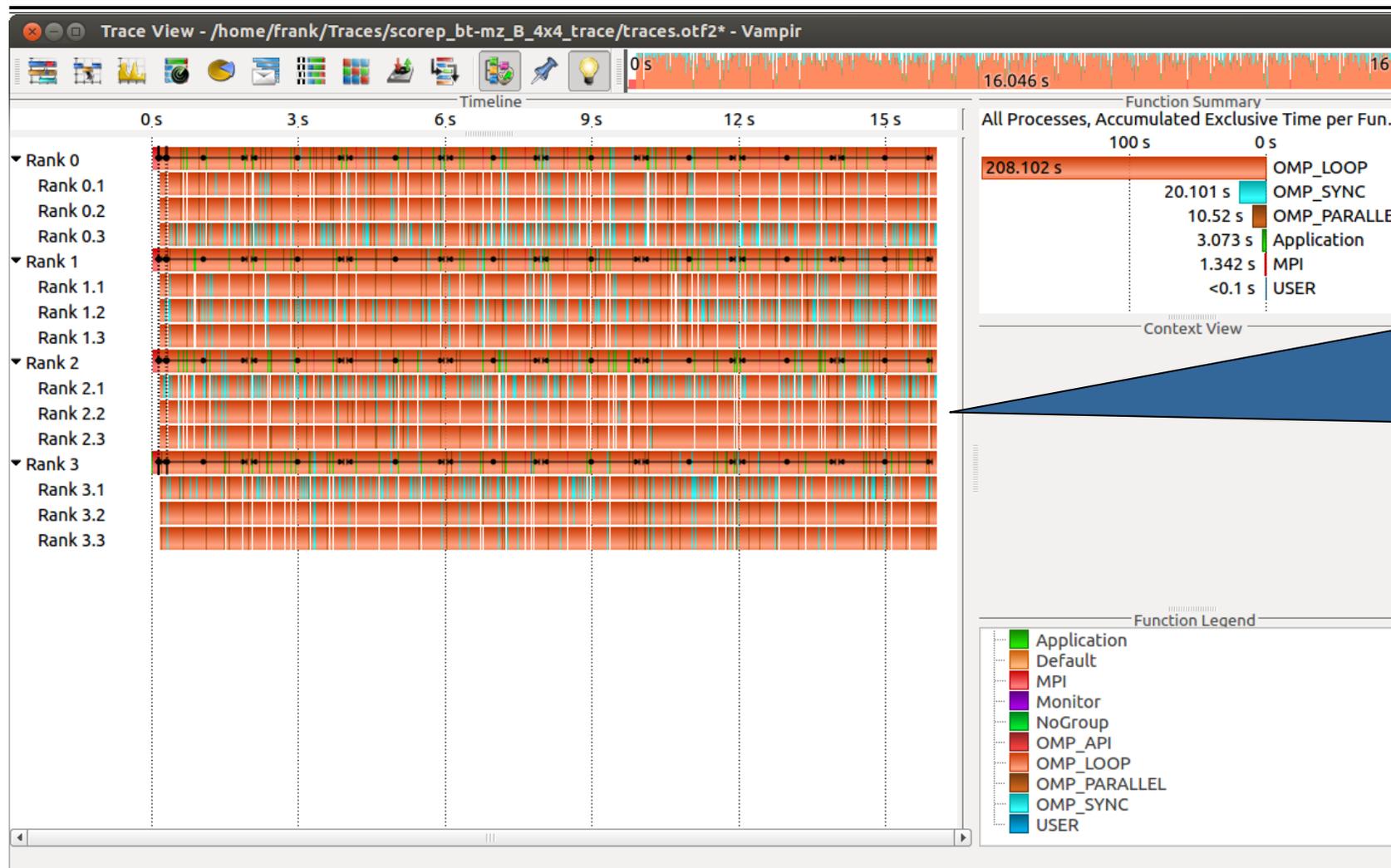
- Load correct module to add local tool installations to \$PATH (required for each shell session)
- Start Vampir on the current login-node (requires ssh X-forwarding)

# Visualization of the NPB-MZ-MPI / BT trace



# Visualization of the NPB-MZ-MPI / BT trace

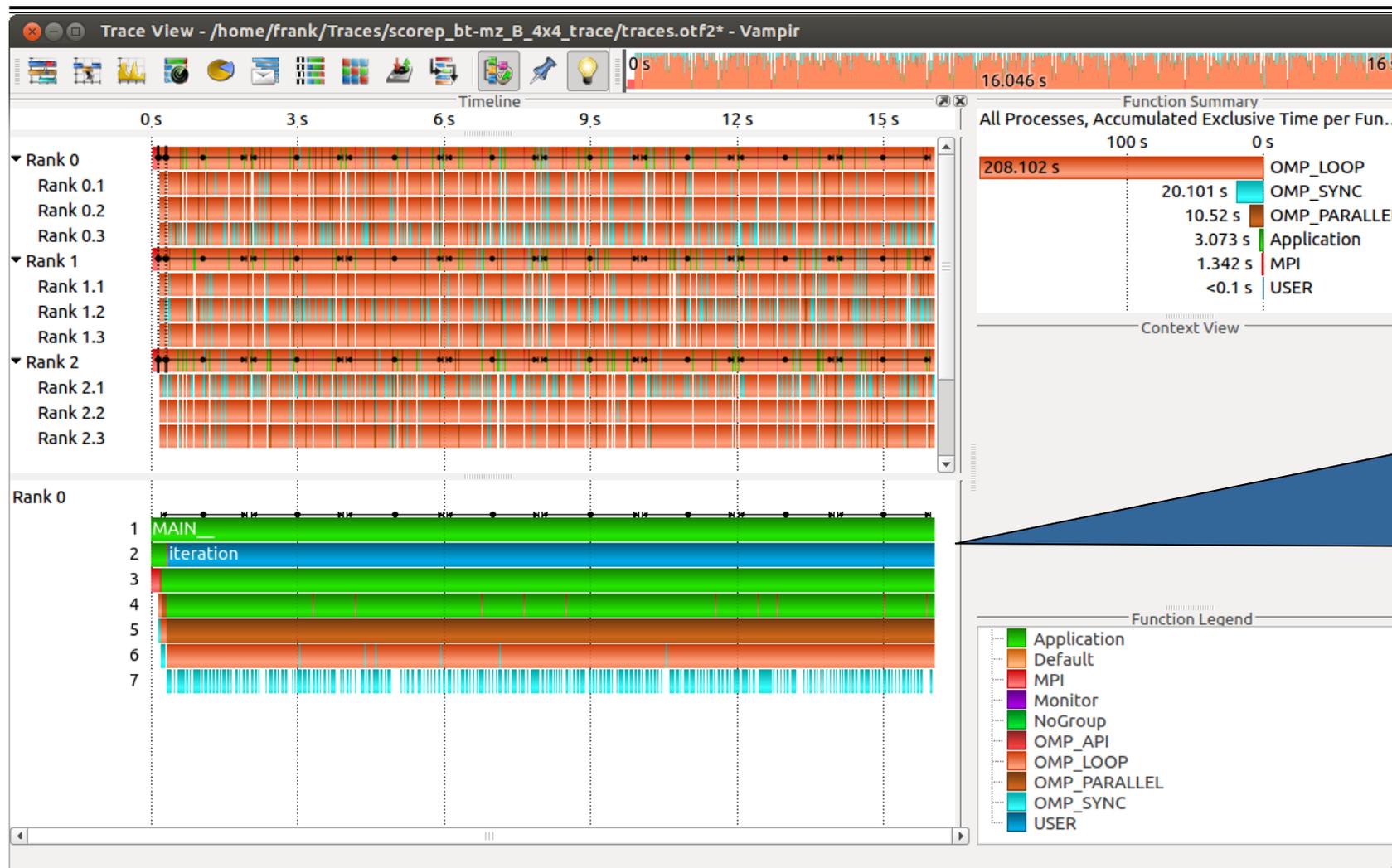
## Master Timeline



Detailed information about functions, communication and synchronization events for collection of processes.

# Visualization of the NPB-MZ-MPI / BT trace

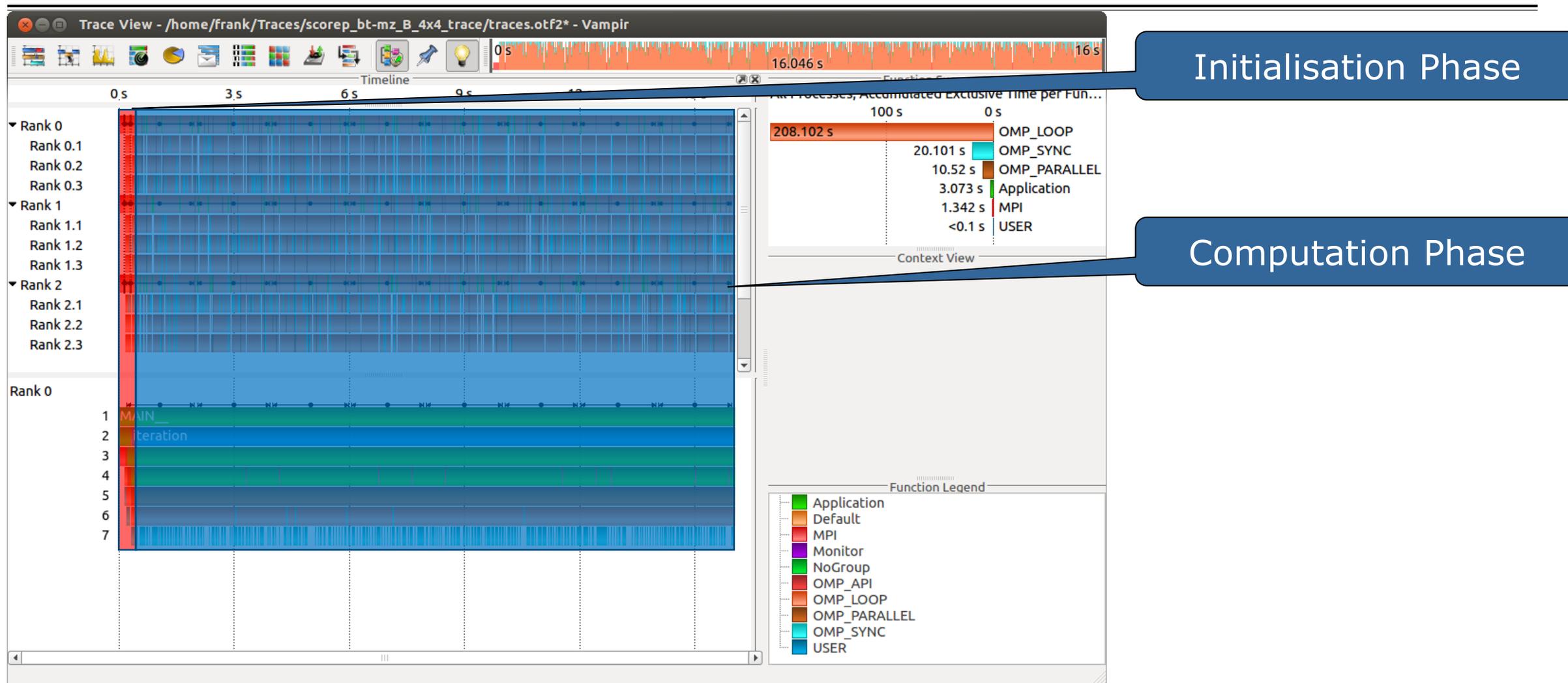
## Process Timeline



Detailed information about different levels of function calls in a stacked bar chart for an individual process.

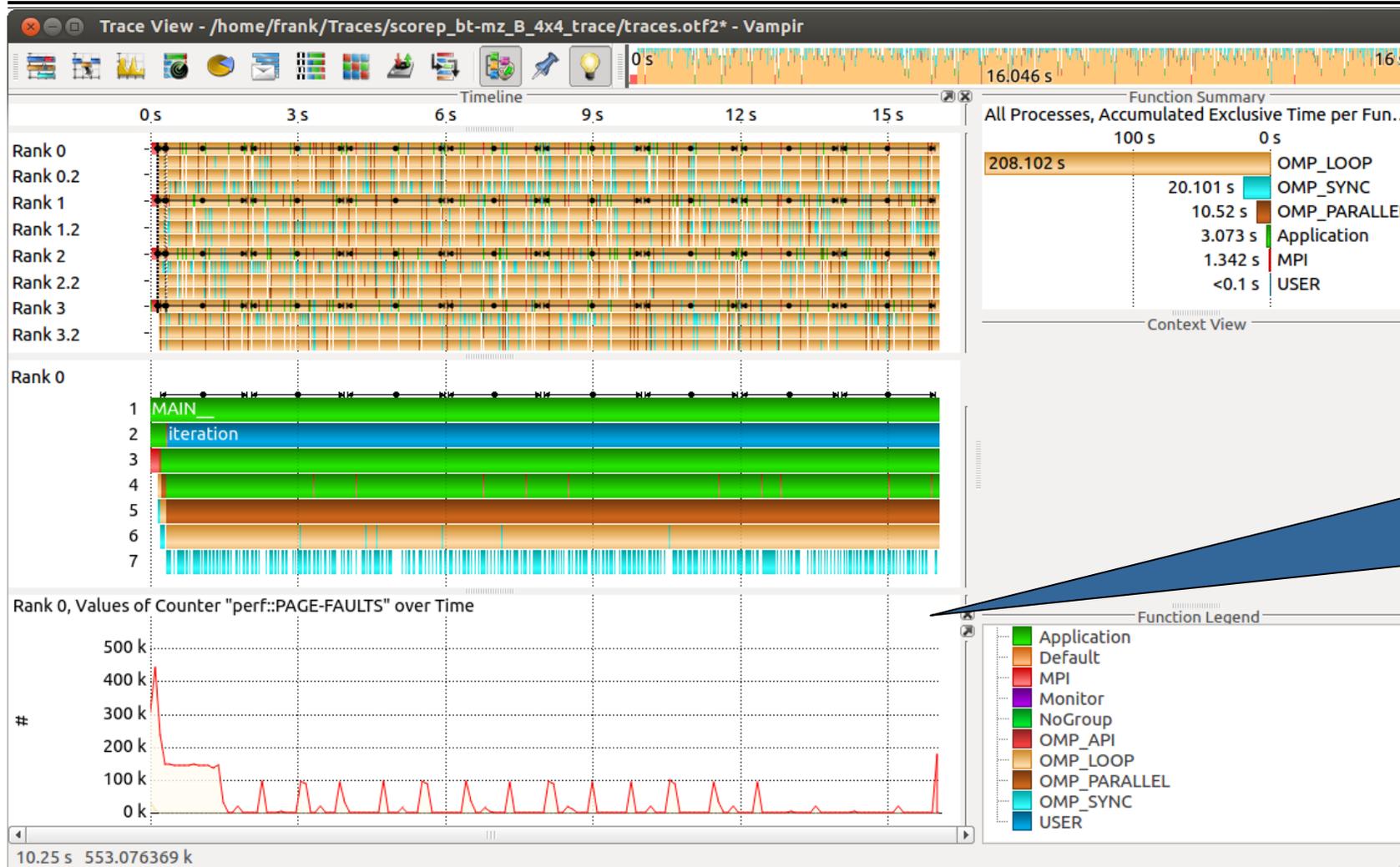
# Visualization of the NPB-MZ-MPI / BT trace

## Typical program phases



# Visualization of the NPB-MZ-MPI / BT trace

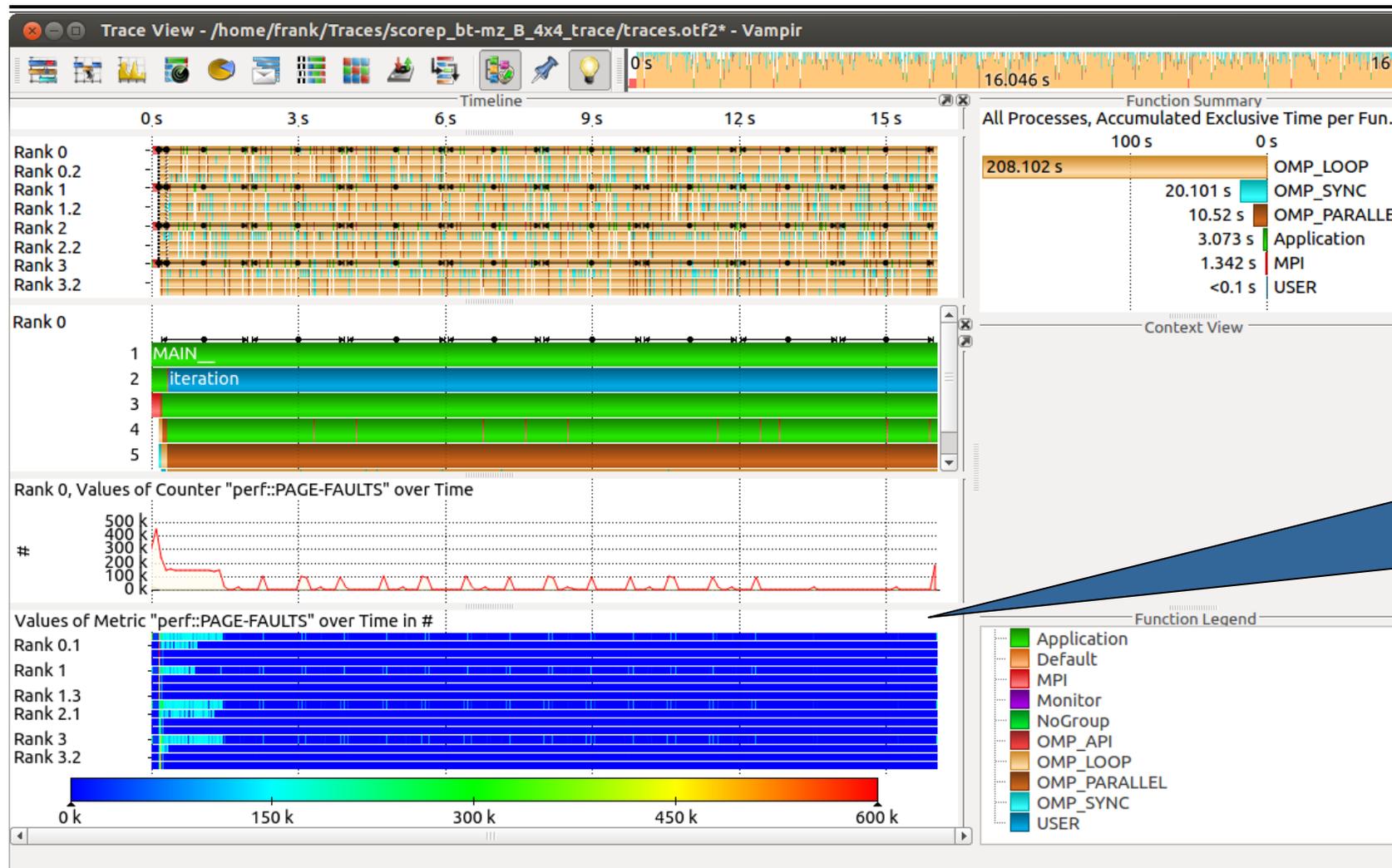
## Counter Data Timeline



Detailed counter information over time for an individual process.

# Visualization of the NPB-MZ-MPI / BT trace

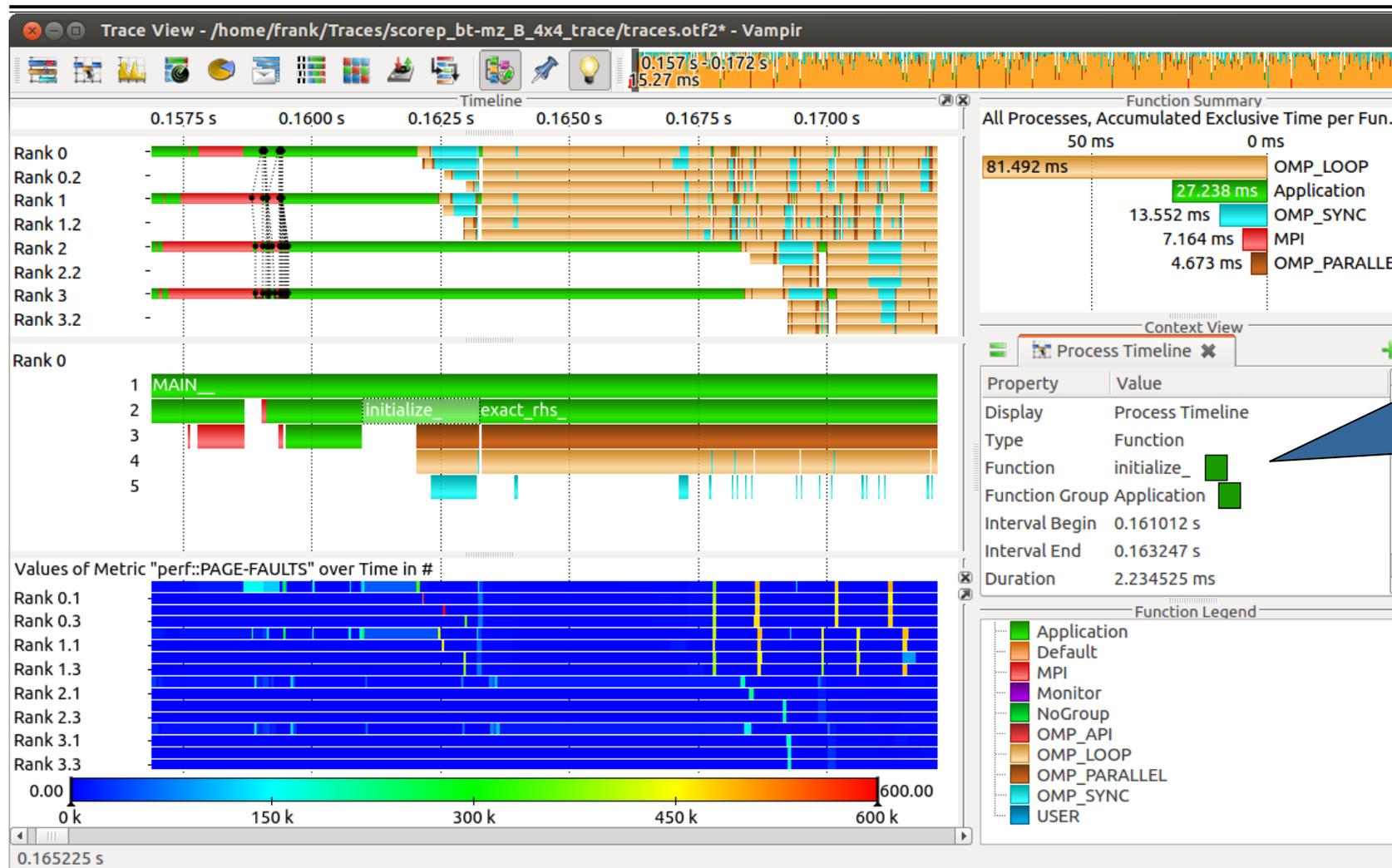
## Performance Radar



Detailed counter information over time for a collection of processes.

# Visualization of the NPB-MZ-MPI / BT trace

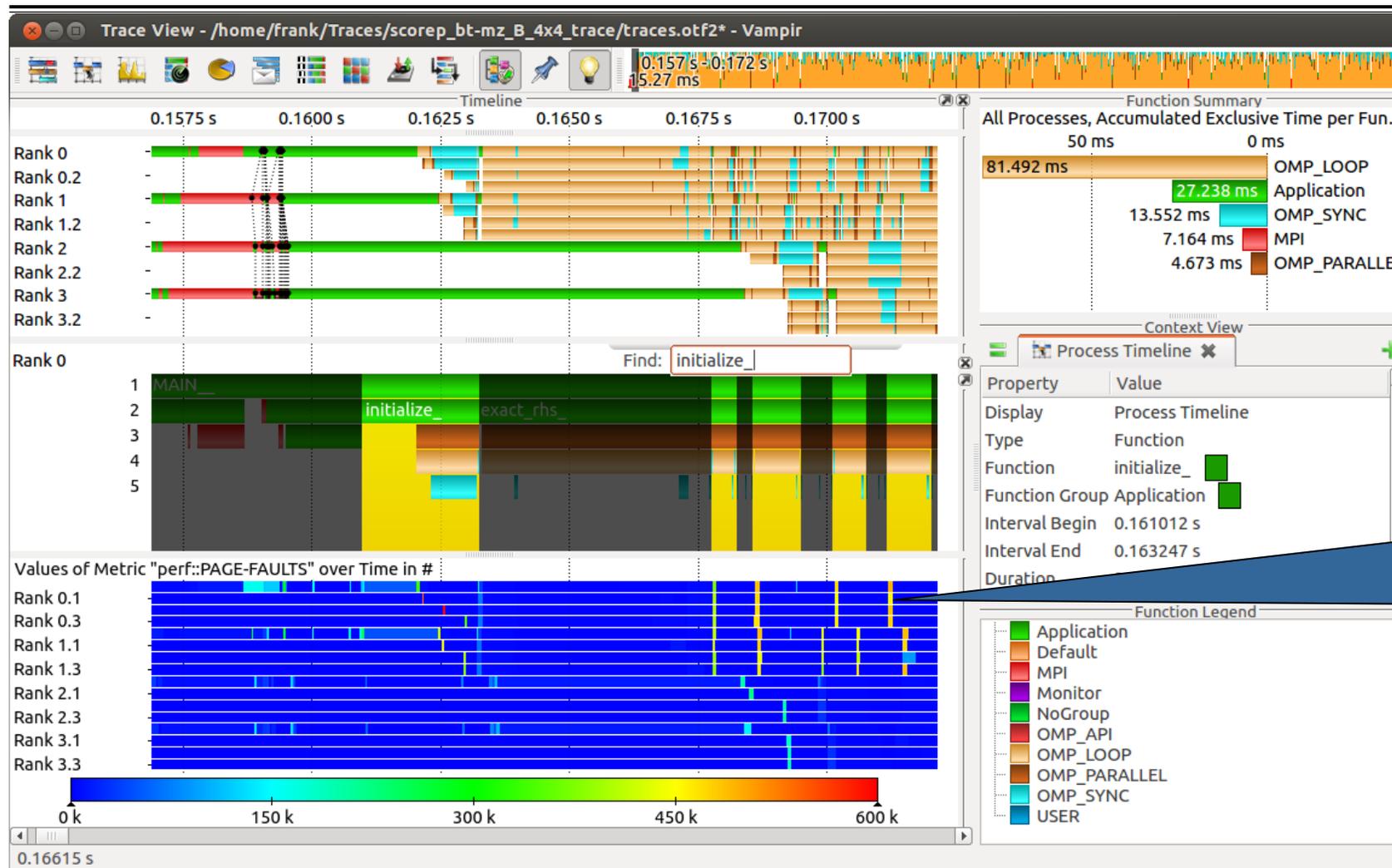
## Zoom in: Initialisation Phase



Context View:  
Detailed information  
about function  
"initialize\_".

# Visualization of the NPB-MZ-MPI / BT trace

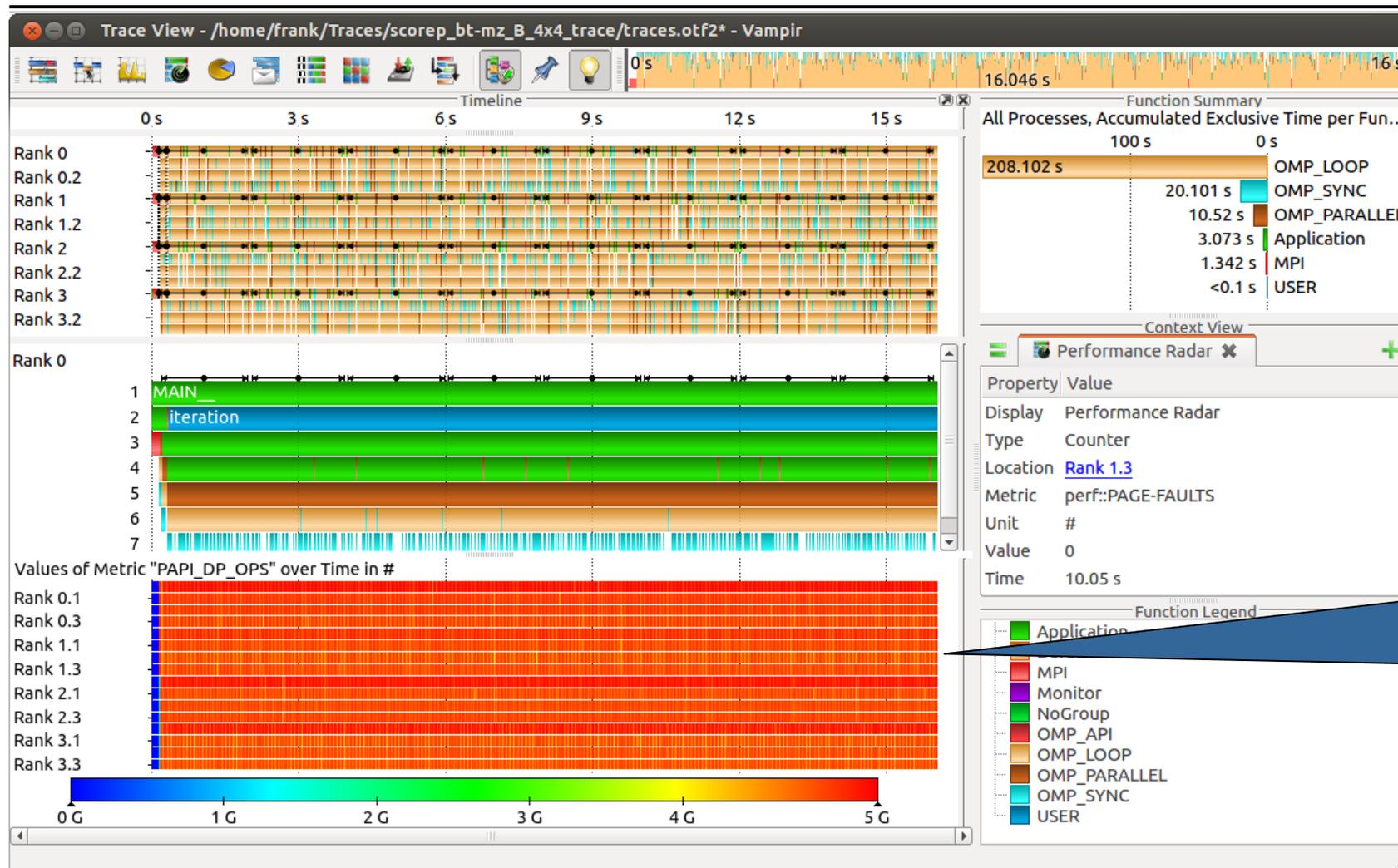
## Find Function



Execution of function "initialize\_" results in higher page fault rates.

# Visualization of the NPB-MZ-MPI / BT trace

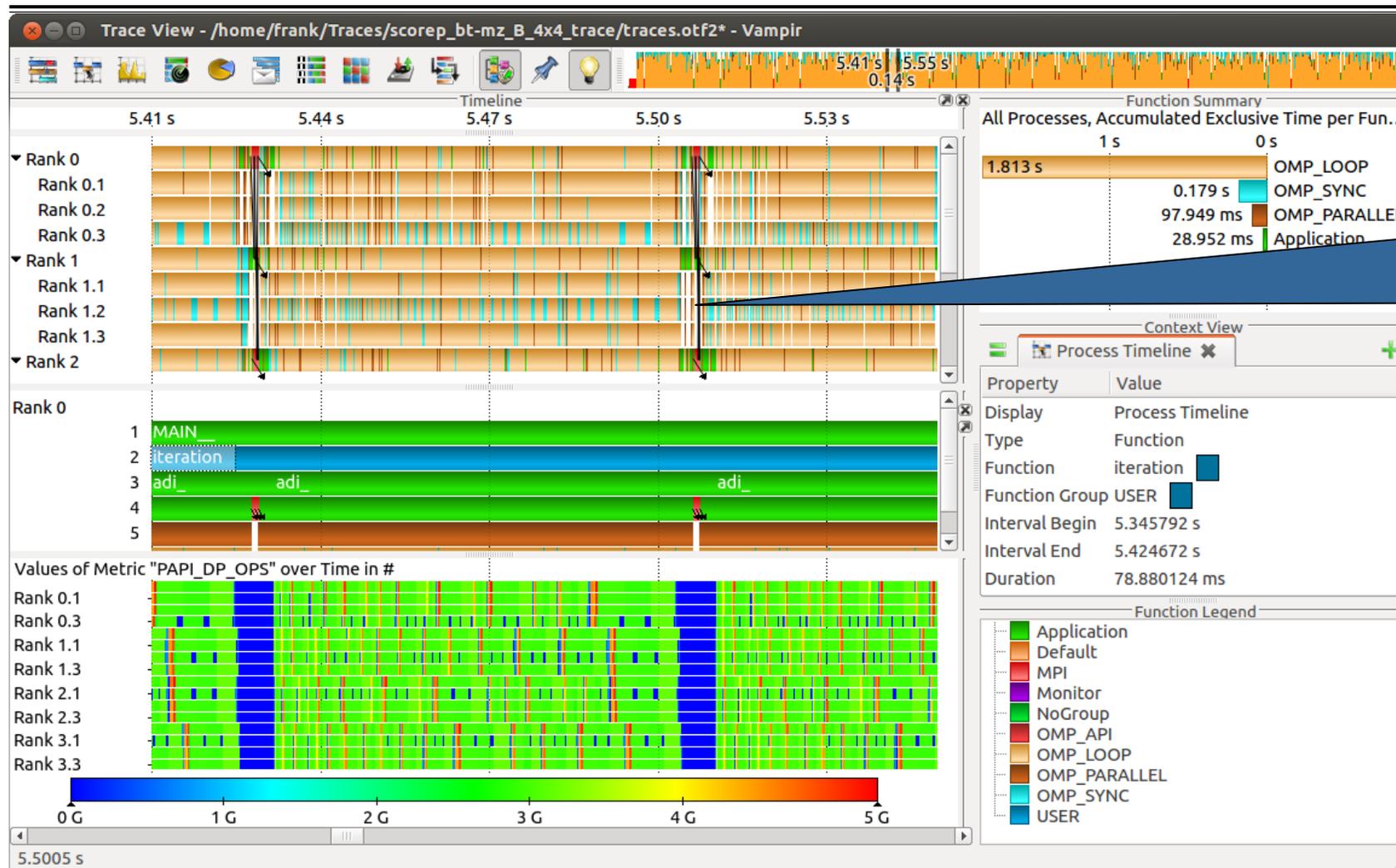
## Computation Phase



Computation phase results in higher floating point operations.

# Visualization of the NPB-MZ-MPI / BT trace

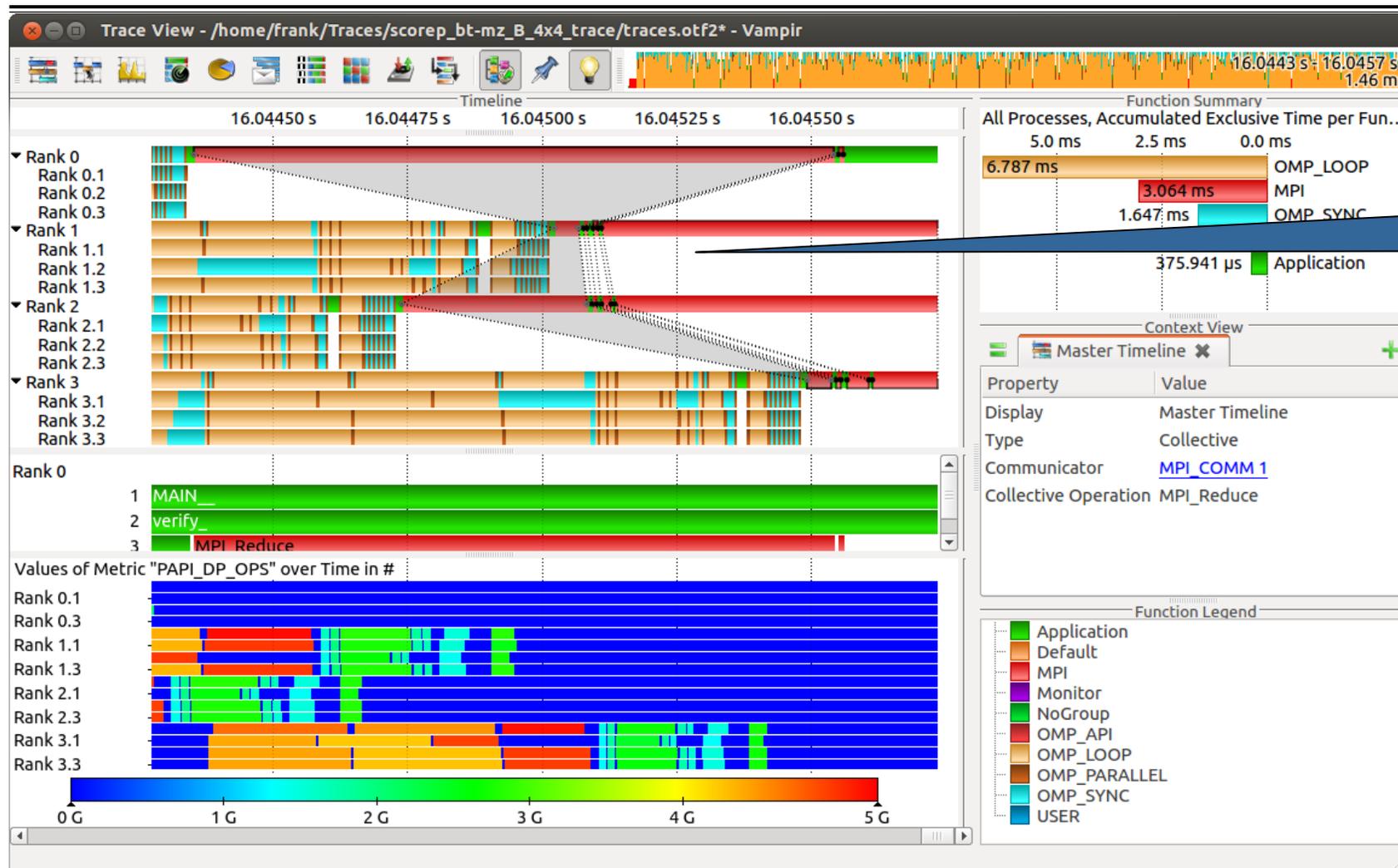
## Zoom in: Computation Phase



MPI communication results in lower floating point operations.

# Visualization of the NPB-MZ-MPI / BT trace

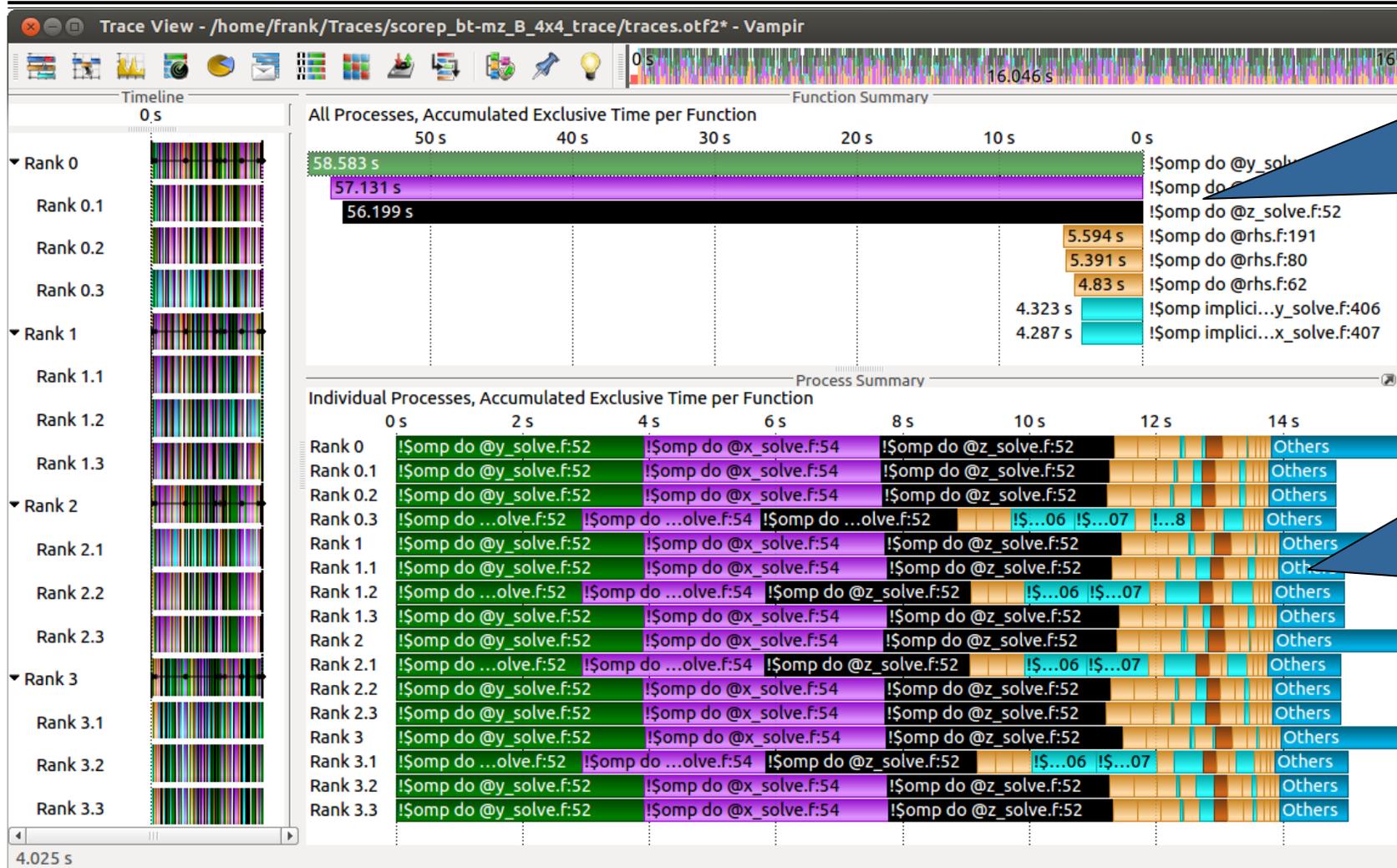
## Zoom in: Finalisation Phase



“Early reduce”  
bottleneck.

# Visualization of the NPB-MZ-MPI / BT trace

## Process Summary

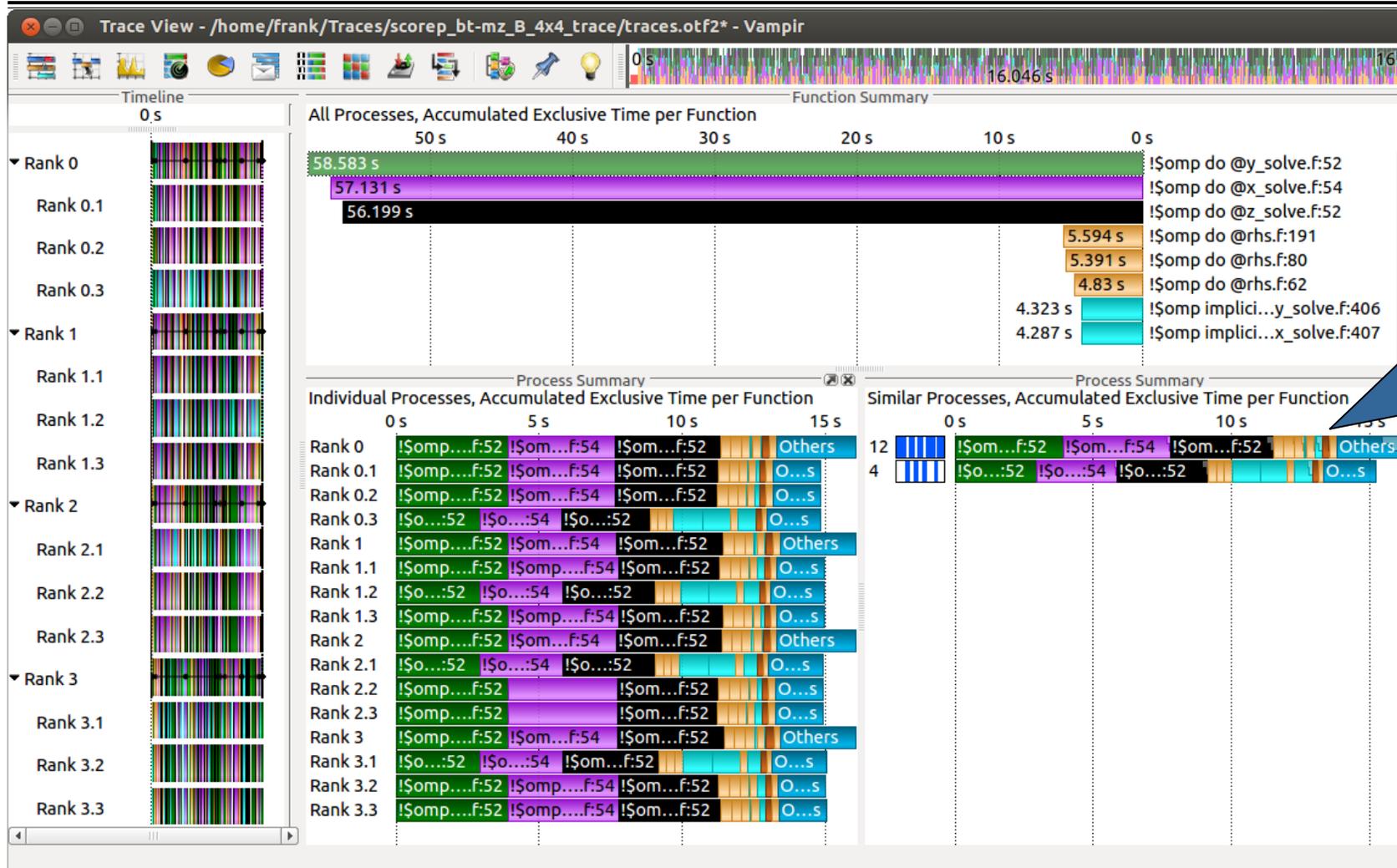


**Function Summary:**  
Overview of the accumulated information across all functions and for a collection of processes.

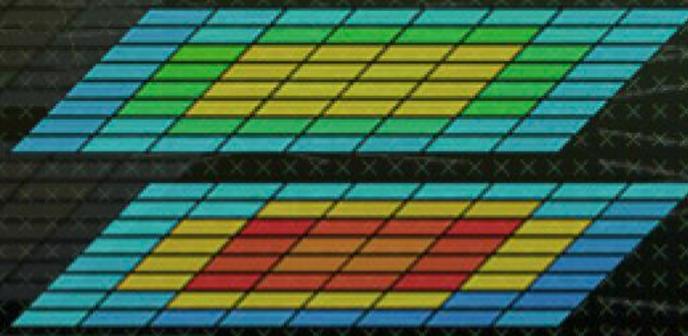
**Process Summary:**  
Overview of the accumulated information across all functions and for every process independently.

# Visualization of the NPB-MZ-MPI / BT trace

## Process Summary



Find groups of similar processes and threads by using summarized function information.



## Summary and Conclusion

# Summary

---

- Vampir & VampirServer
  - Interactive trace visualization and analysis
  - Intuitive browsing and zooming
  - Scalable to large trace data sizes (20 TiByte)
  - Scalable to high parallelism (200,000 processes)
  
- Vampir for Linux, Windows, and Mac OS X

