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Simon Ebner, et al. :: Paul Scherrer Institut

SwissFEL Beam Synchronous Data Acquisition - A Sneak peek under the hood

NOBUGS 2016 - Copenhagen - Denmark

Outline

- What is SwissFEL?
- Data Acquisition System
  - Basics
  - Design
- Conclusion

A **free-electron laser** (FEL), is a type of laser whose lasing medium consists of very-high-speed electrons moving freely through a magnetic structure, [...]

https://wikipedia.org

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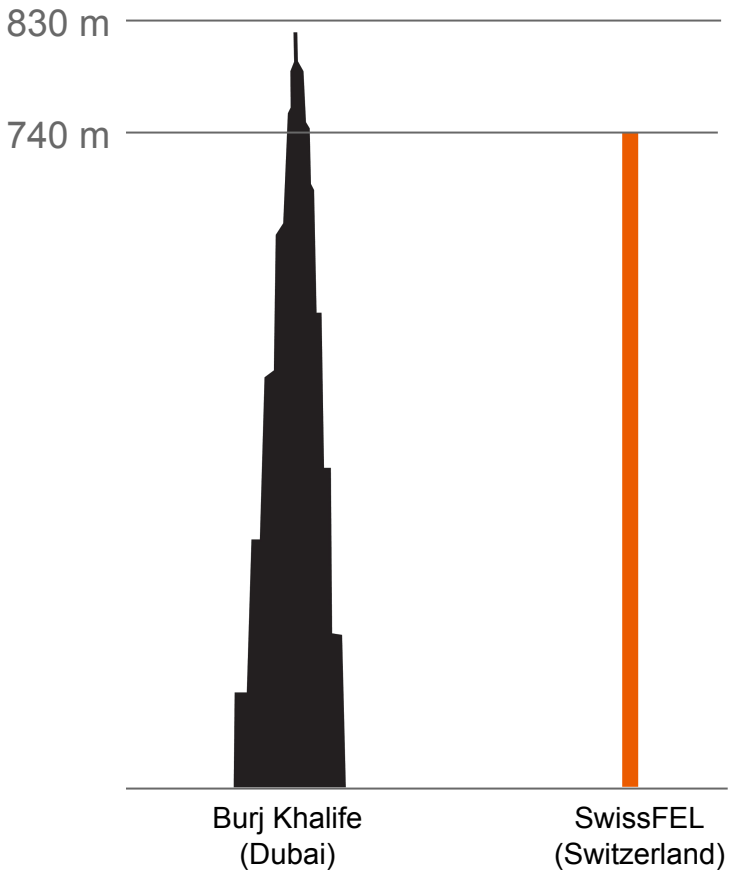
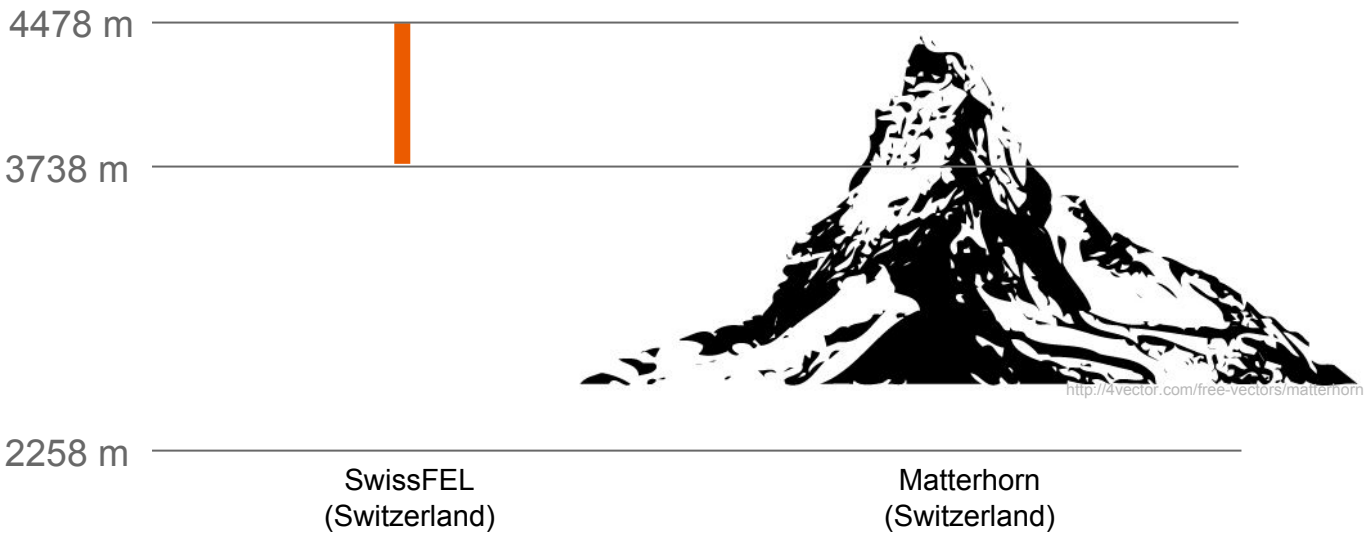
SwissFEL



SwissFEL


4478 m
3738 m
2258 m
SwissFEL
(Switzerland)
Matterhorn
(Switzerland)
http://4vector.com/free-vectors/matterhorn

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SwissFEL

DE EN FR

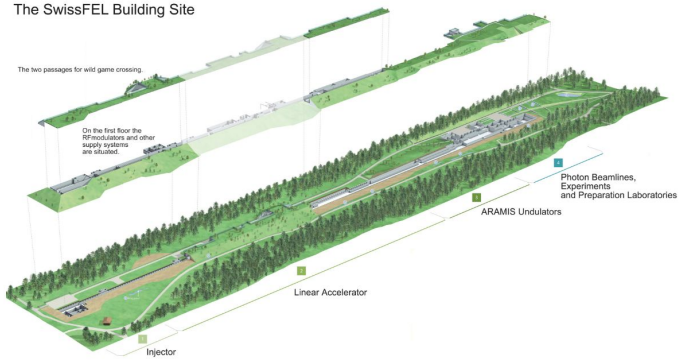
People, content...

Labs & User Services | Visitors | Industry | Our Research | Career & Further Education | About PSI

PSI Home > SwissFEL

- SwissFEL
- Overview
- About us
- Highlights
- Publications
- SwissFEL Workshops
- SwissFEL Facility
- SwissFEL Research
- Information for.....

The SwissFEL Building Site



Further information

Film of the future project SwissFEL

SwissFEL construction site

Information and webcams

Current SwissFEL Publications

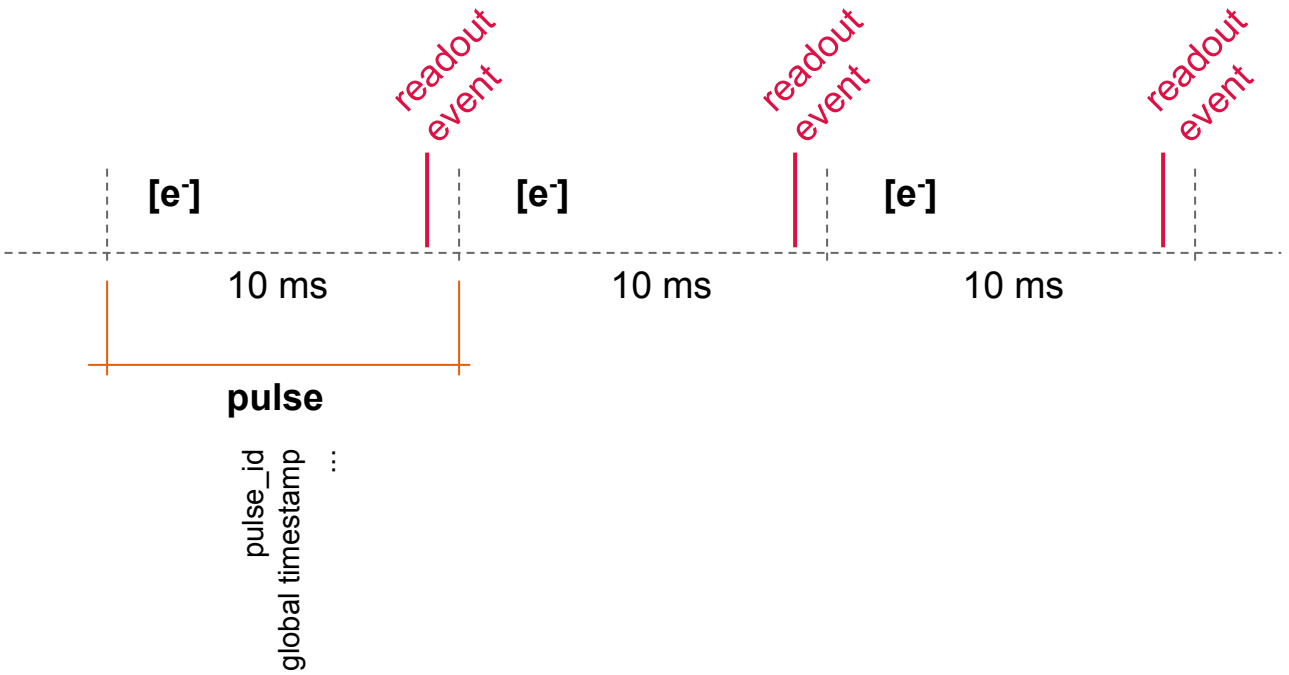
SwissFEL Technical Design Report Jungfrau Detector

https://www.psi.ch/swissfel


Injector
Linear Accelerator
Undulators
Photon Beamlines
Experimental Station

One Beam Synchronous DAQ System

What is Beam Synchronous Data ... ?

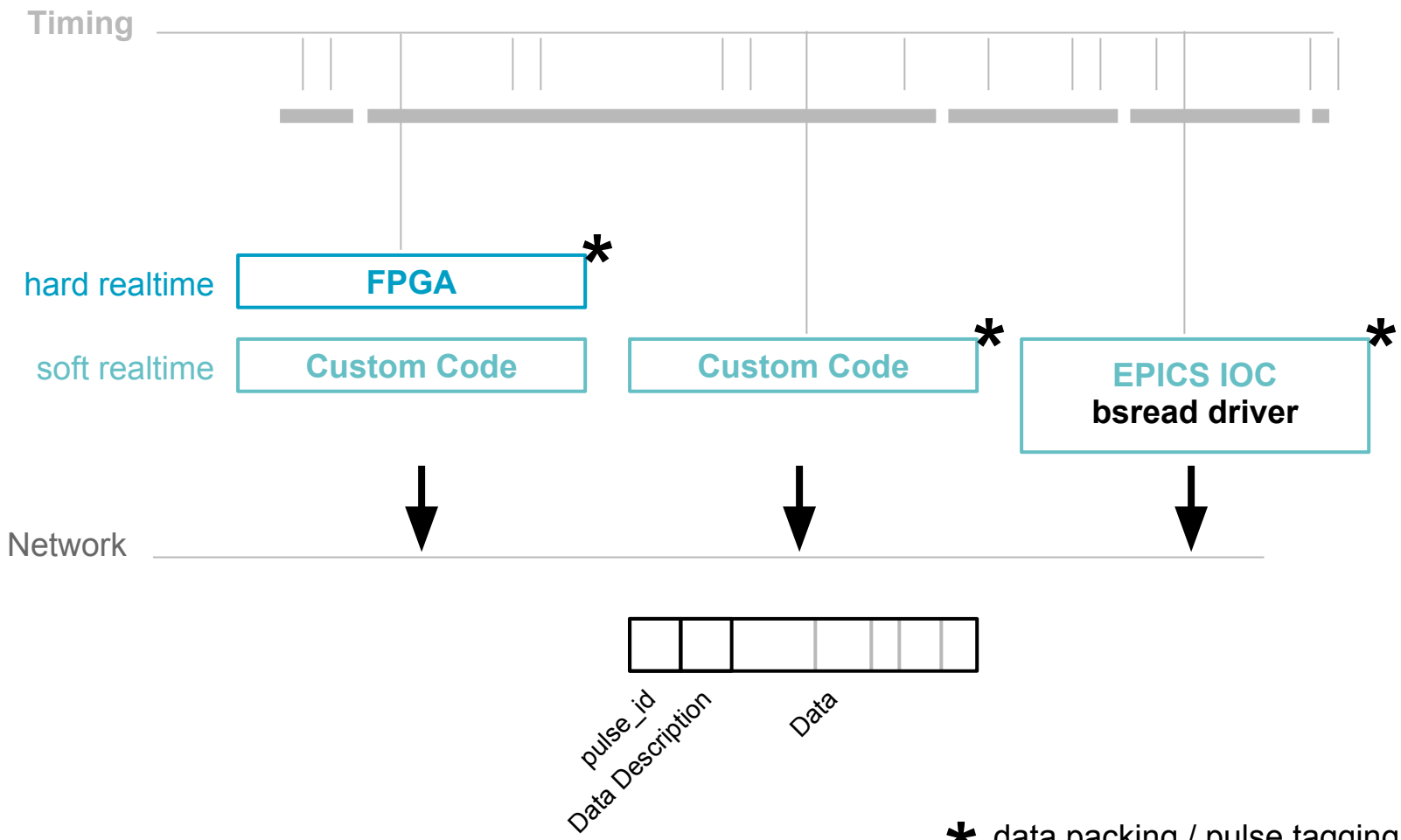


Timing System

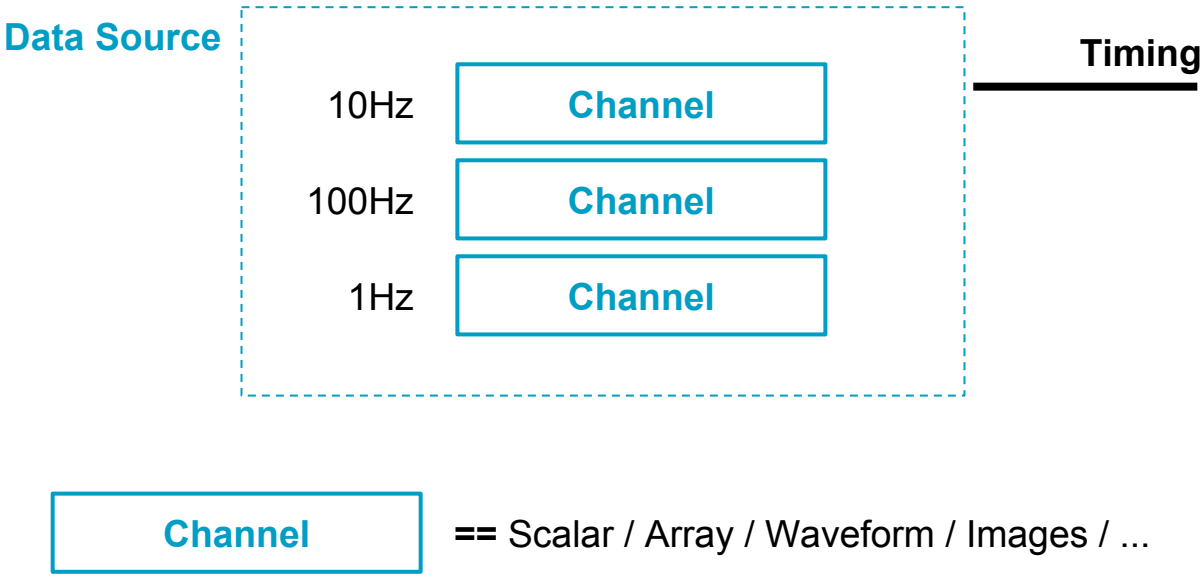
Master Timing System

- Micro Research Finland
- Active Delay Compensation
- Full Duplex Communication
- Integration into the Machine Protection System
- Central Monitoring

Data Sources



What is Beam Synchronous Data ... ?



Data Sources / Raw Data Rates

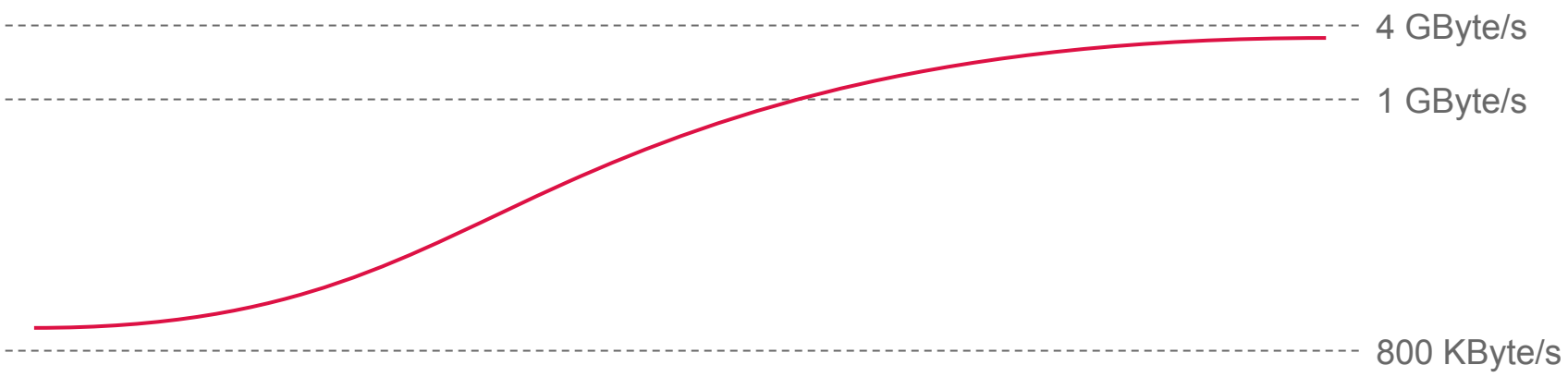
Diodes

Motors

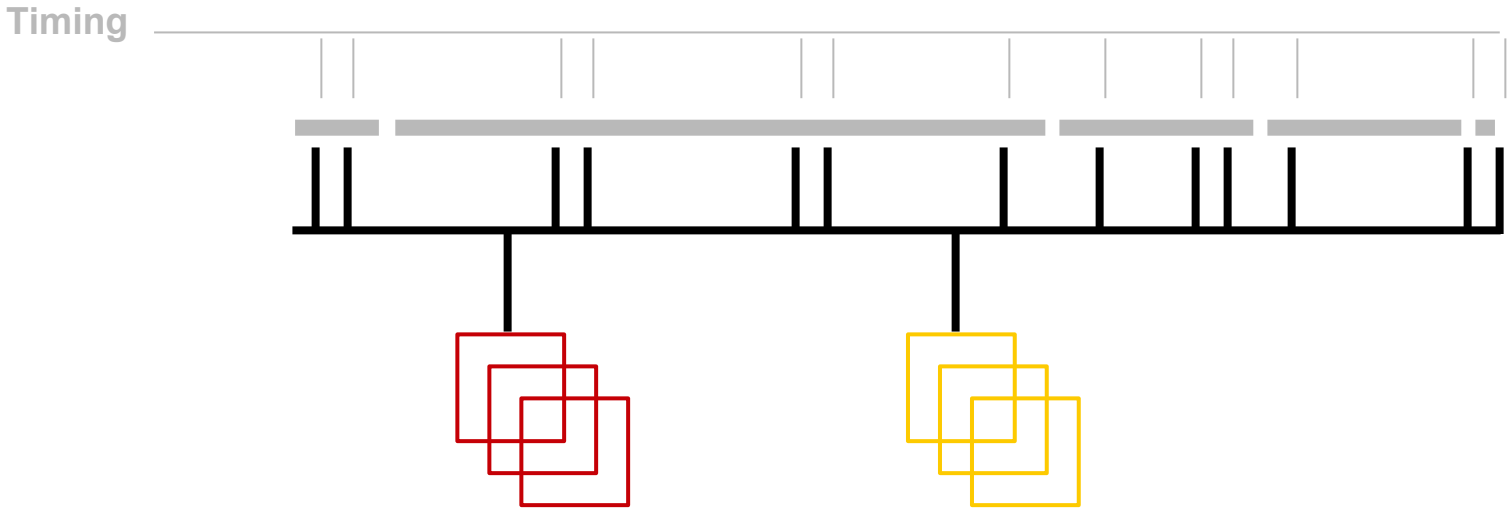
...

Cameras

Endstation Detectors



Data Buffer / Image Store



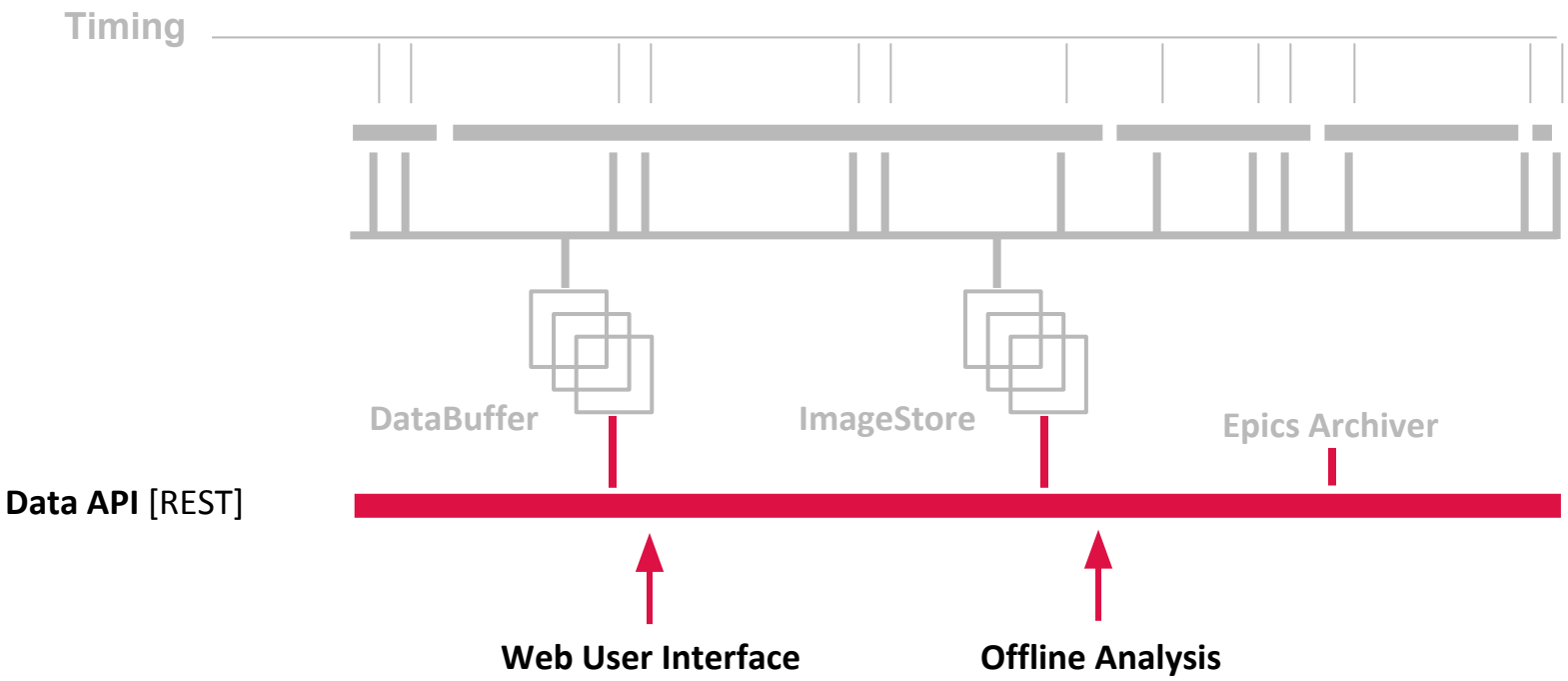
DataBuffer

- 12 Node Cluster
- Local SSDs
- Cassandra
- 120 TB Usable Space

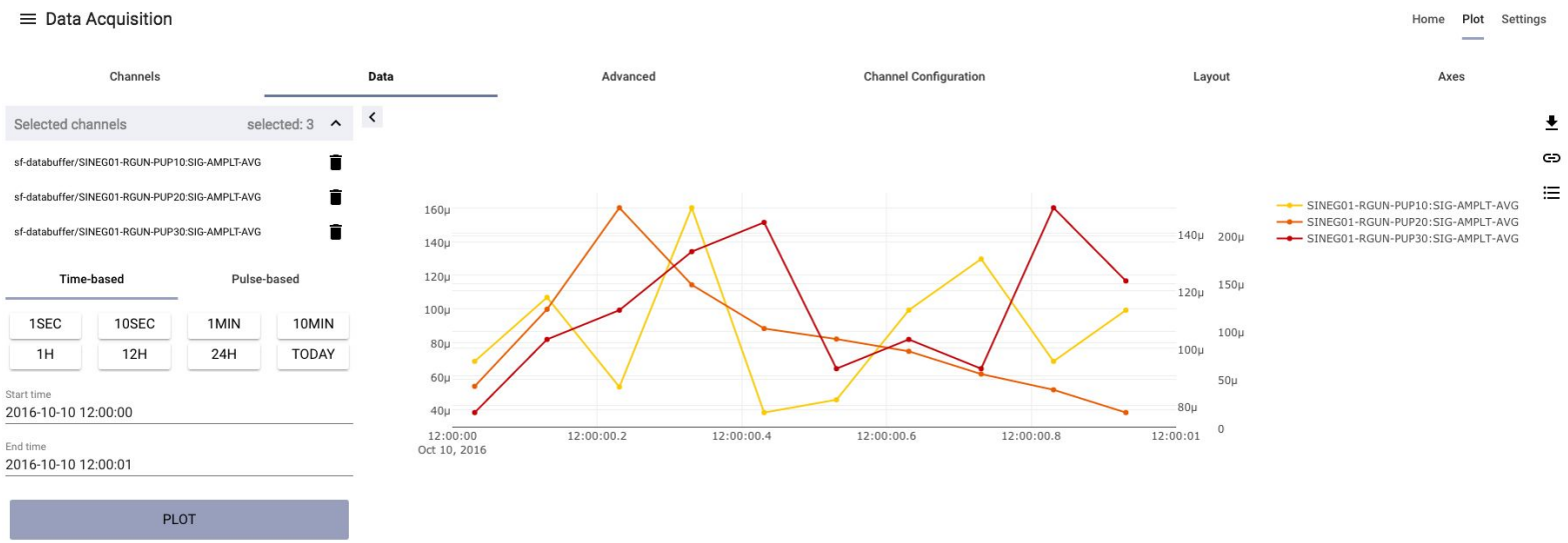
ImageStore

- n Nodes
- GPFS Cluster [Storage]
- Custom Code/Serialization
- 300 TB Usable Space

Data API


Timing
DataBuffer
ImageStore
Epics Archiver
Data API [REST]
Web User Interface
Offline Analysis

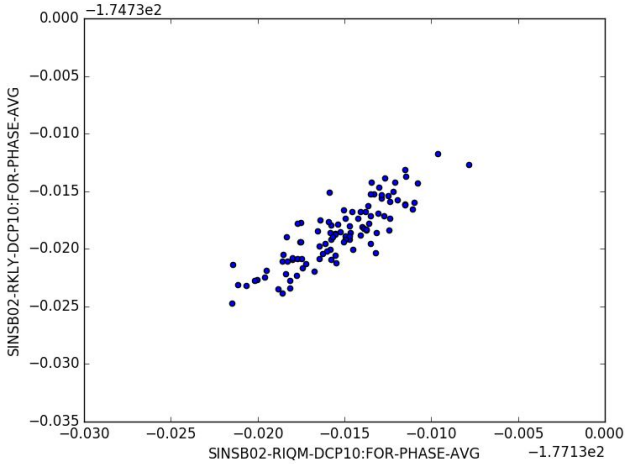
Web Interface



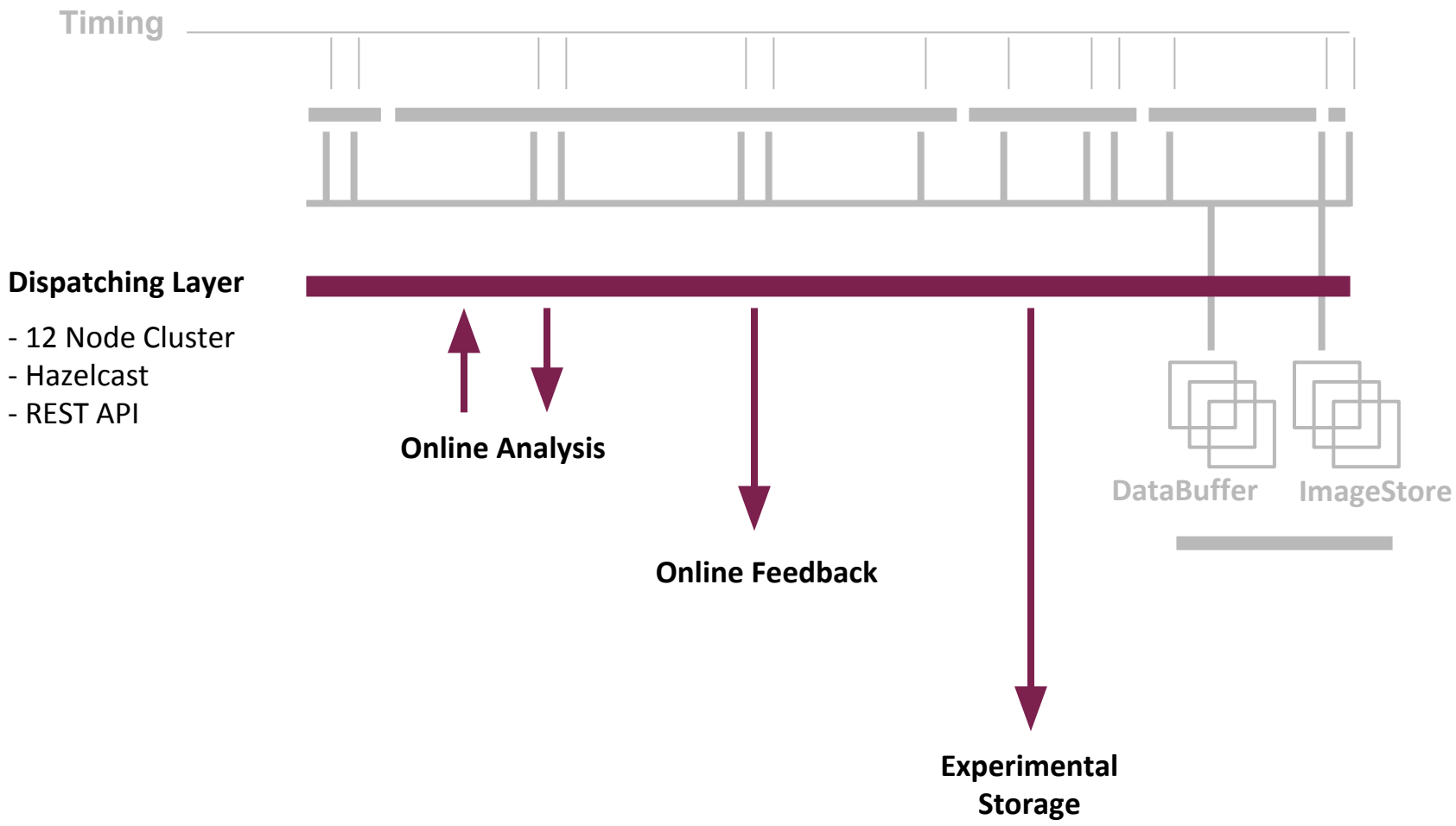
Web Interface

Offline Analysis

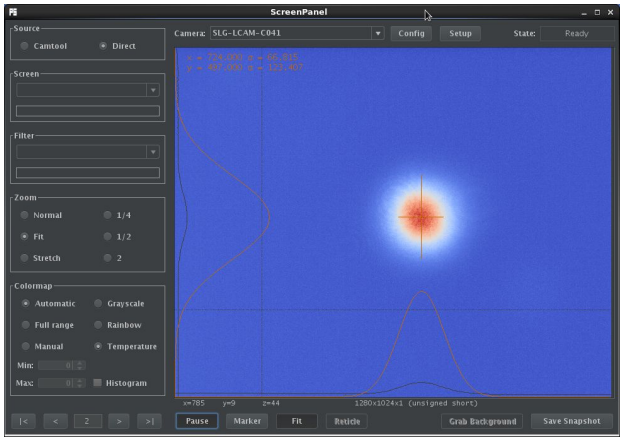
```
import data_api
api = data_api.configure()

data = api.get_data(channels=['SINSB02-RIQM-DCP10:FOR-PHASE-AVG', 'SINSB02-RKLY-DCP10:FOR-PHASE-AVG'],
start="2016-07-14 08:05", end="2016-07-14 09:05")

from matplotlib import pyplot
data.plot.scatter("SINSB02-RIQM-DCP10:FOR-PHASE-AVG", "SINSB02-RKLY-DCP10:FOR-PHASE-AVG")
pyplot.show()
```

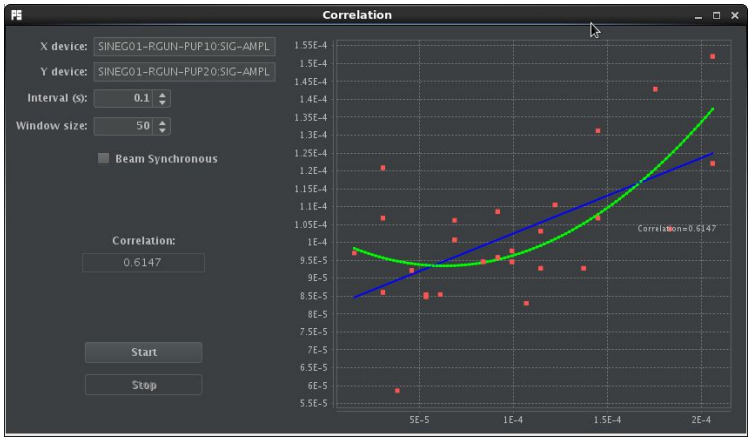


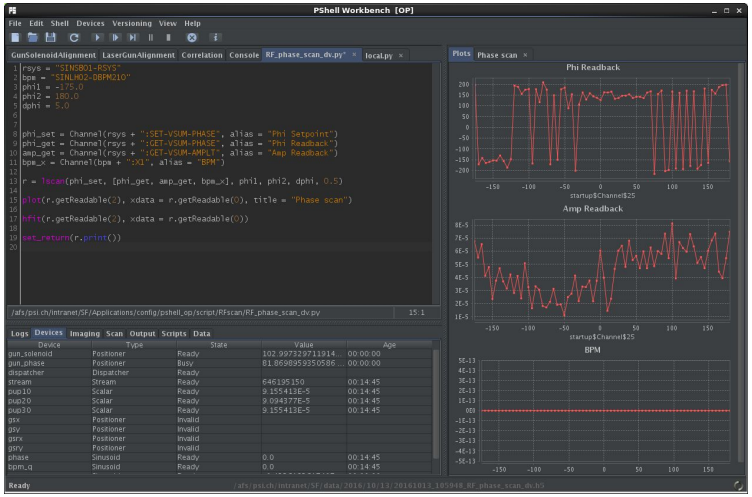
Dispatching Layer / Online Analysis

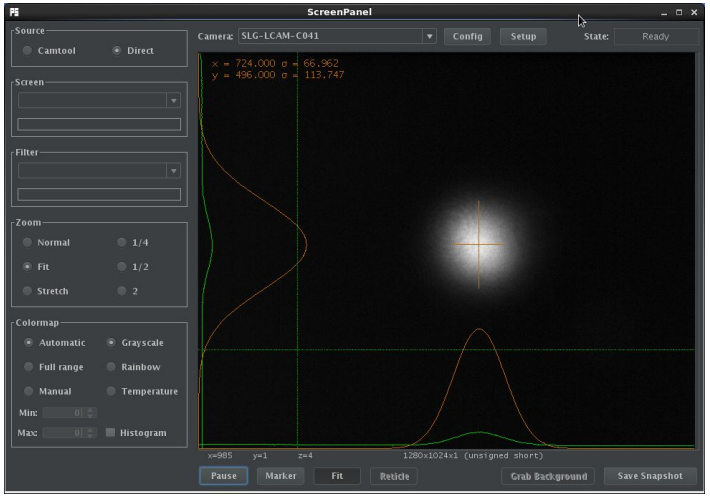


Online Feedback / PShell









Online Analysis / Online Feedback

```
from bsread import source

with source(channels=['SINSB02-RIQM-DCP10:FOR-PHASE-AVG', 'SINEG01-RKLY-DCP10:FOR-PHASE-AVG']) as stream:
    while True:
        message = stream.receive()
        print(message.data.data['SINSB02-RIQM-DCP10:FOR-PHASE-AVG'].value)
```

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Conclusion

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Conclusion

- Holistic view
- Data never hits the disk
- Use of available libraries / tools
- Simplicity / Ease of Use

Conclusion

- Holistic view
- Data never hits the disk
- Use of available libraries / tools
- Simplicity / Ease of Use
- No Frameworks / Lego Approach

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Questions ?

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Contact

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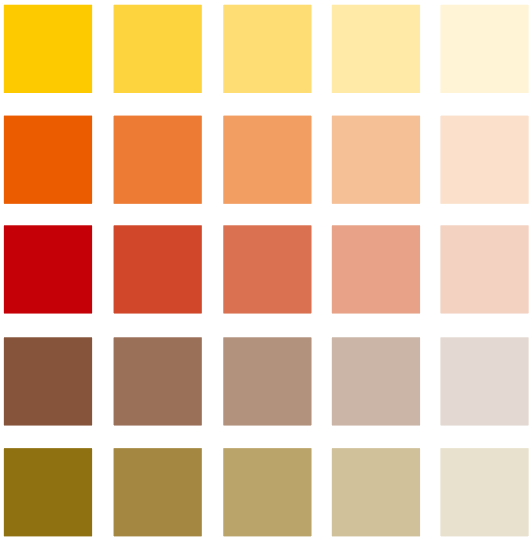
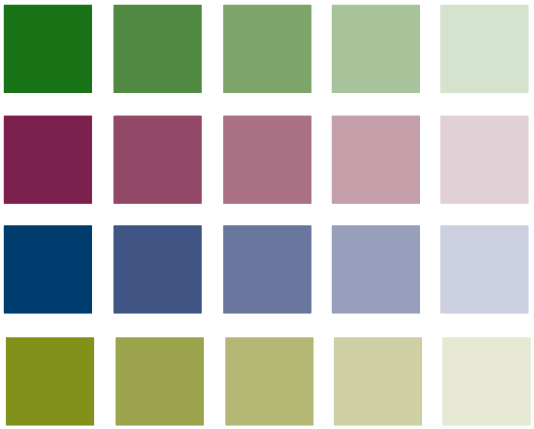
simon.ebner@psi.ch

PSI Colour Scheme

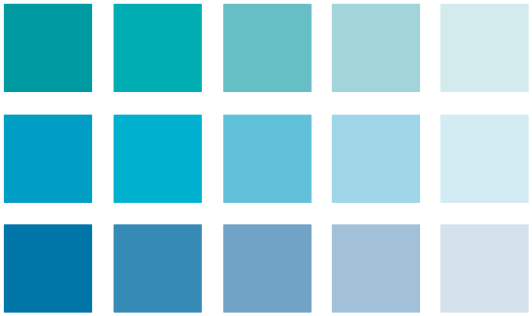
PSI's basic colours

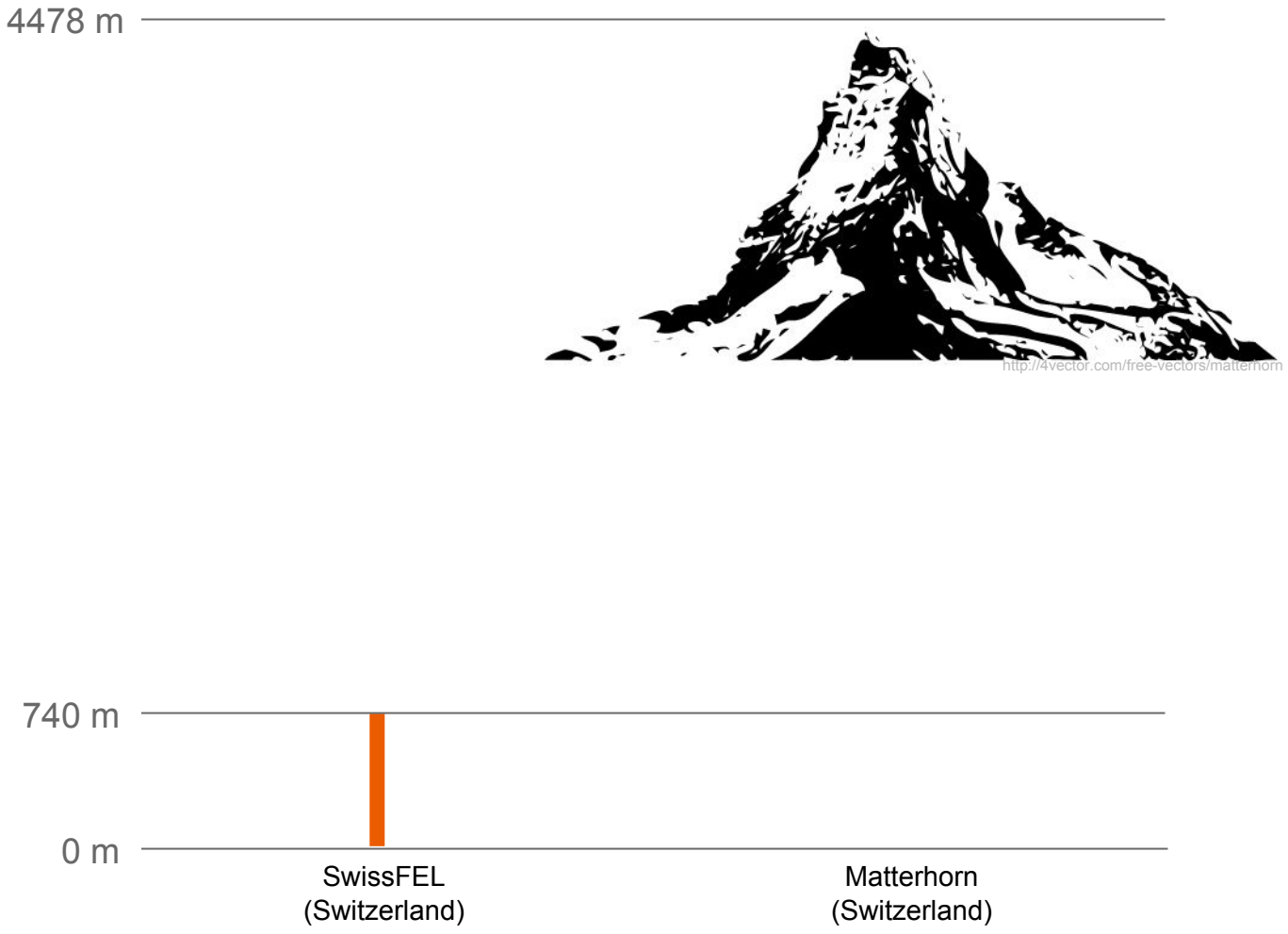
Colour options for graphs:
1st choice





Colour options for graphs:
2nd choice




4478 m
http://4vector.com/free-vectors/matterhorn
740 m
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(Switzerland)