

PAUL SCHERRER INSTITUT



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Function and impact of a national lab

Example of the Paul Scherrer Institute

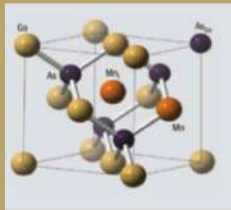
Impact of Research Infrastructures 2.0, (Lausanne), 16-17 September 2021

Paul Scherrer Institut – our large-scale RIs

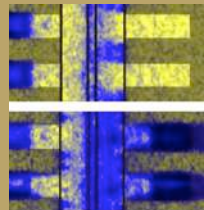


Paul Scherrer Institut – Mission

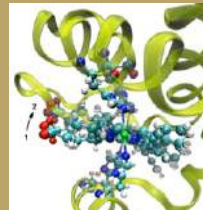
Matter and materials



Energy and environment



Human health



Development
Construction
Operation



Large research facilities



Swiss and foreign users
from academia and industry

more that 2400 external users/year
(38 beamports)

Knowledge & expertise



Education



Technology transfer





Key Figures

ETHZ

Swiss Federal
Institute of
Technology
Zurich

EPFL

Swiss Federal
Institute of
Technology
Lausanne

PSI

Paul Scherrer
Institute

Empa

Swiss Federal
Laboratories for
Materials Testing

WSL

Swiss Federal
Research Institute
for Forestry, Snow
and Landscape

Eawag

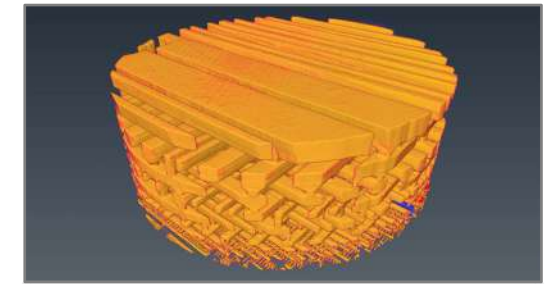
Swiss Federal
Institute of
Aquatic Science
and Technology

PSI funds (global budget from federal government)	290 MCHF
External funding	110 MCHF
Staff (heads)	2200
• Technicians and engineers	700
• Doctoral students	320
• Apprentices	100
External users: people / visits	2400 / 4600 per year
Number of scientific publications	1400 (12 % of which high impact) per year
PSI employees with teaching duties at both ETH and universities	100
Patient visits (proton therapy treatment)	5700 per year

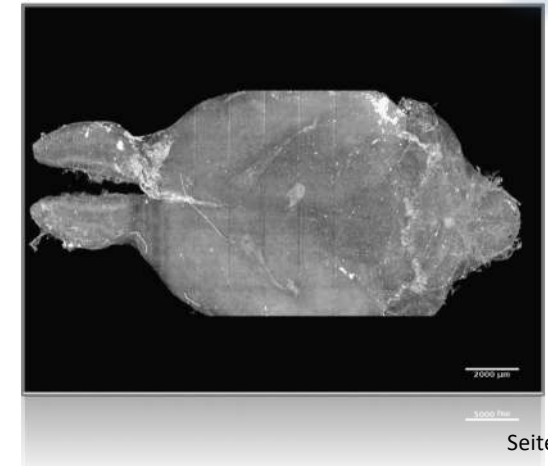
Large-scale research infrastructures, like the Swiss Light Source (SLS)



Intel processor
Holler *et al.*



3D mouse brain
Miettinen *et al.*



Large-scale research facilities, like the Swiss Light Source (SLS)

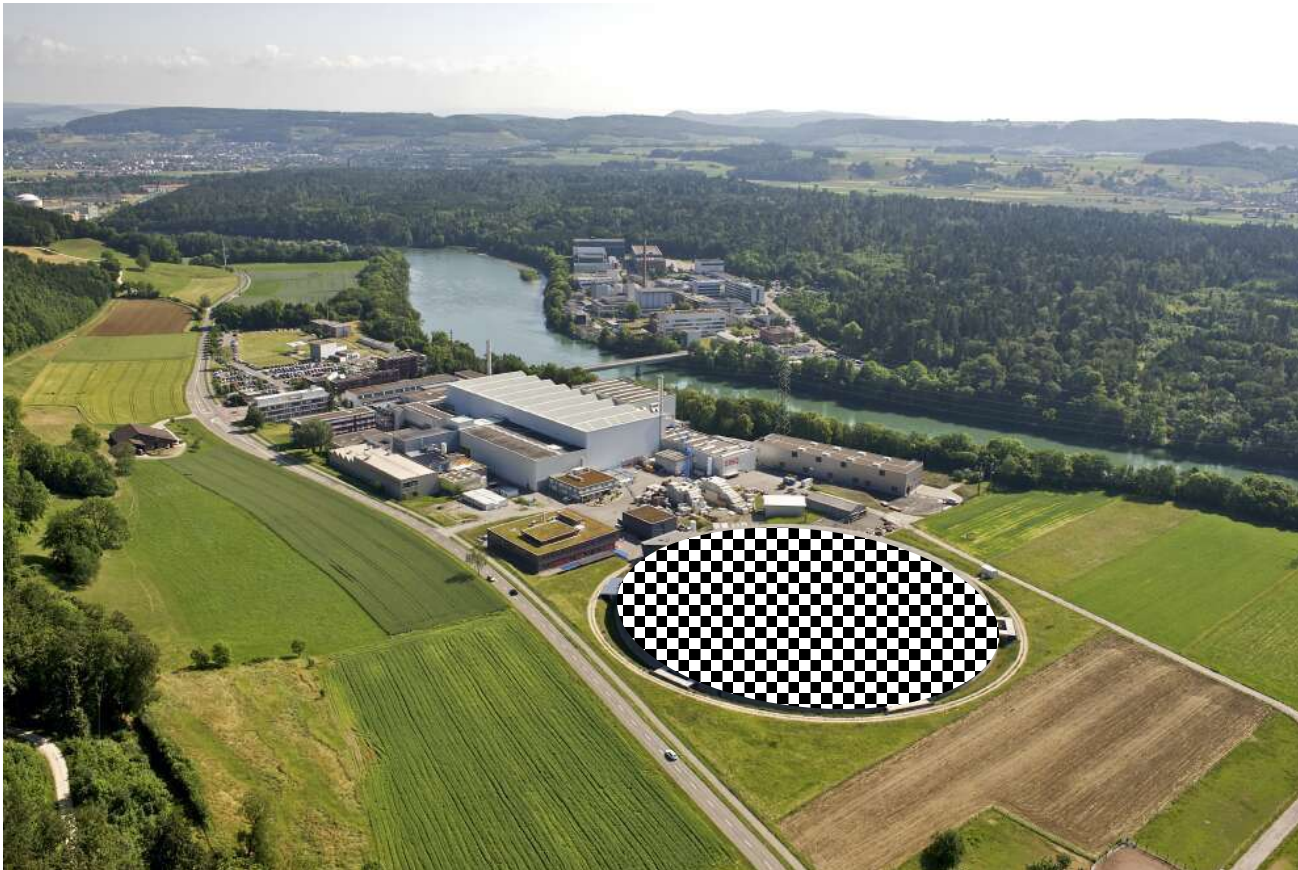


How to measure Impact?

A pedestrian's
(physicist's) approach:

1. measure world -> A

Large-scale research facilities, like the Swiss Light Source (SLS)



How to measure Impact?

A pedestrian's
(physicist's) approach:

1. measure world -> A
2. **suspend**
3. wait (a long time...)
4. measure world -> B

Large-scale research facilities, like the Swiss Light Source (SLS)

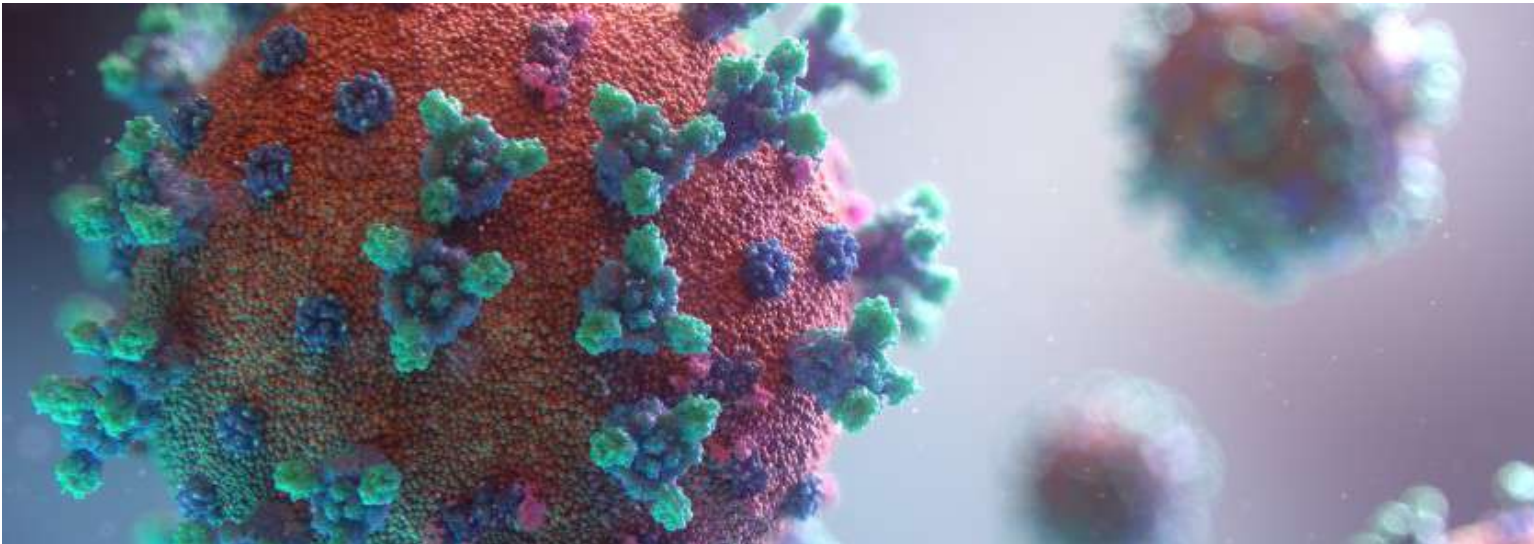


How to measure Impact?

A pedestrian's
(physicist's) approach:

1. measure world -> A
2. **suspend**
3. wait
4. measure world -> B
5. **compare A/B**

April – June 2020



With Covid-19 we considered to suspend operation of SLS (and proton therapy).
If we did, we could now show you the pedestrian's measurement of impact.

We decided to **keep running** this research infrastructure because **we knew it generates impact...**

Protein structures of COVID-19 virus from SLS

The structural biology work was performed at the macromolecular crystallography beamline **X06SA-PXI** at the **SLS** following the opening of the "**PRIORITY COVID-19 Call**". The crystallographic data were collected on **9 April 2020**.

The planned **Easter shutdown of the SLS** was cancelled for this specific experiment. The paper was submitted within one month after answering the proposal call and **published in Nature on 29 July 2020**.

nature

<https://doi.org/10.1038/s41586-020-2601-5>

Accelerated Article Preview

Papain-like protease regulates SARS-CoV-2 viral spread and innate immunity

Online attention



517 tweeters

1 blogs

3 Facebook pages

22 news outlets

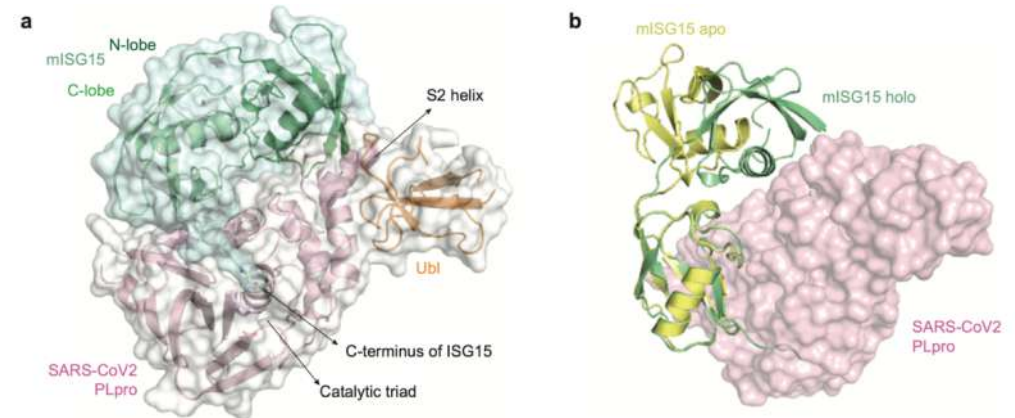
3 Redditors

1 Video uploaders

Access & Citations

51k

Article Accesses

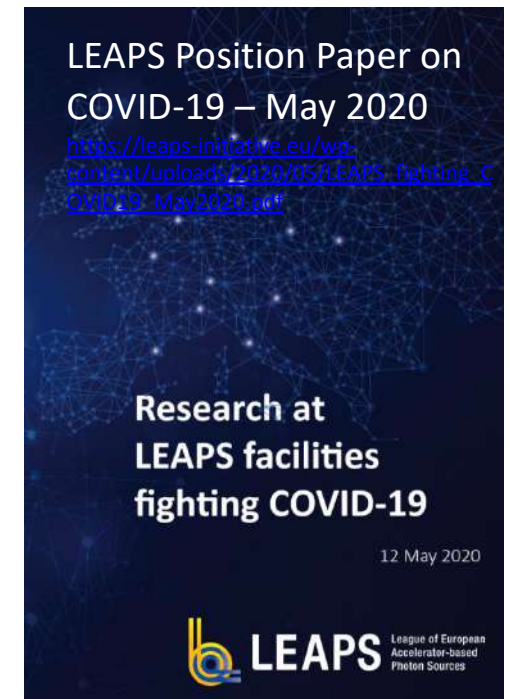
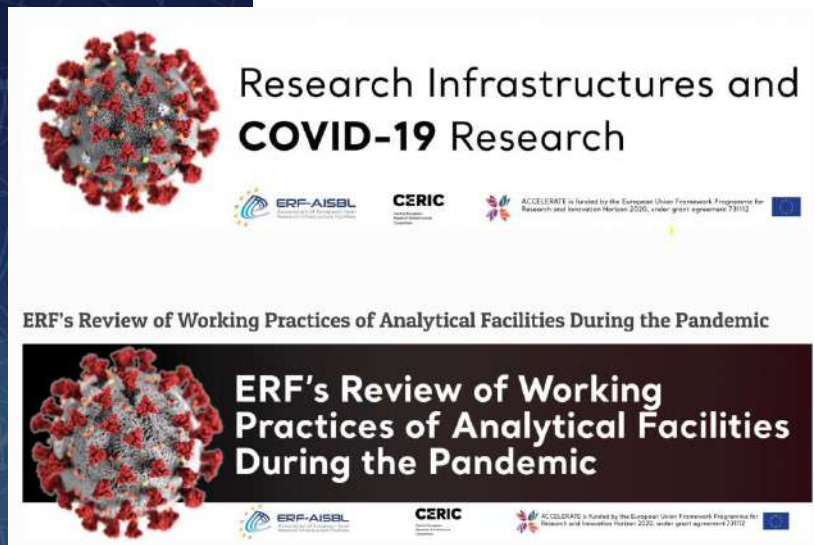


Shin, D., Mukherjee, R., Grewe, D. *et al.* Papain-like protease regulates SARS-CoV-2 viral spread and innate immunity. Nature (2020). <https://doi.org/10.1038/s41586-020-2601-5>

Structural analysis of SARS-CoV-2 PLpro in complex with full length ISG15

Answering to COVID-19 Pandemic

Dedicated **fast track access mode** on almost all LEAPS facilities, addressed to Academy and Industry from the very first moment, compatibly with each country pandemic conditions

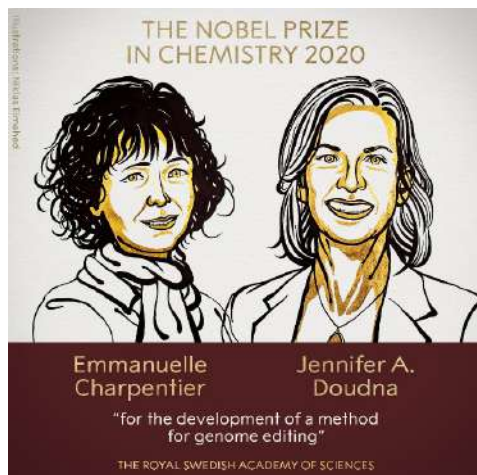


Sharing experiences and solutions through webinars

- Operation during and after the pandemic
- Scientific contribution to fight the pandemic

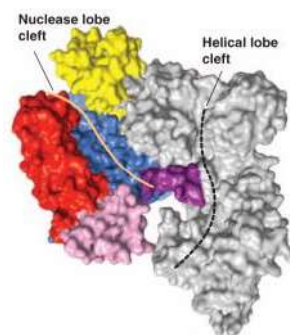
*Reaction to
Pandemic*

Nobel Prize winning structures from SLS

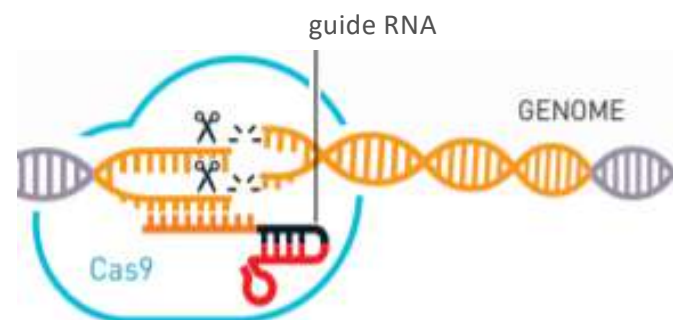


Nobel Prize for Chemistry 2020: Genome editing by CRISPR/CAS9

- The structure of the Cas9 «scissor protein» was determined based on **data recorded at the SLS**¹
- **Method development at PSI** enabled *de novo* structure determination of Cas9 bound to guide RNA and target RNA^{2,3}



Cas9 protein structure reveals two nucleic acid binding sites ¹



«Scissor protein» Cas9 bound to artificially constructed guide RNA, which leads the scissor to where the genome should be cut ⁴

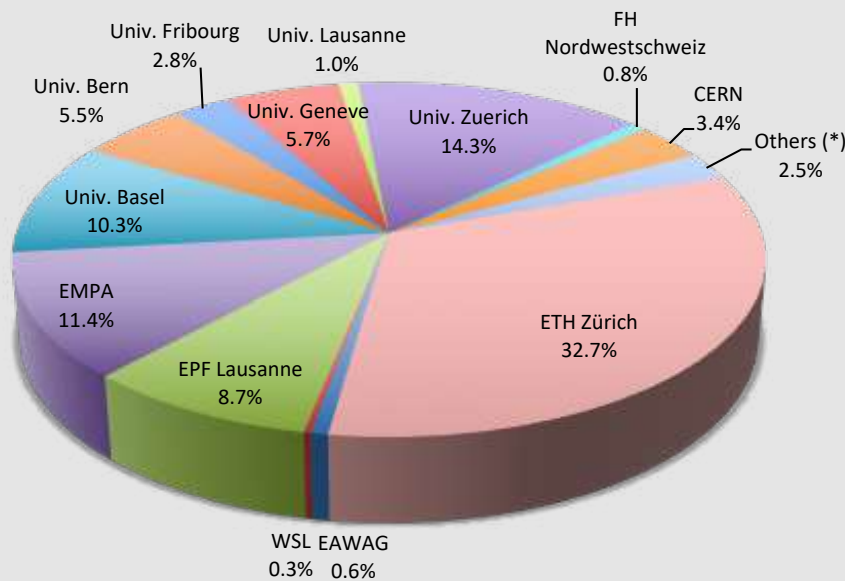
¹Jinek, M. et al. Charpentier E., Doudna, J. A., *Science* **2014**, 343, 6176, 1247997.

²Weinert T. et al. *Nature Methods* **2015**, 12, 131-133. ³Olieric V. et al. *Acta Cryst. D* **2016**, 72, 421-429.

⁴adapted from: The Nobel Prize in Chemistry 2020 – Popular science background

Origins of our external users – academic research «Swiss» Impact in Europe

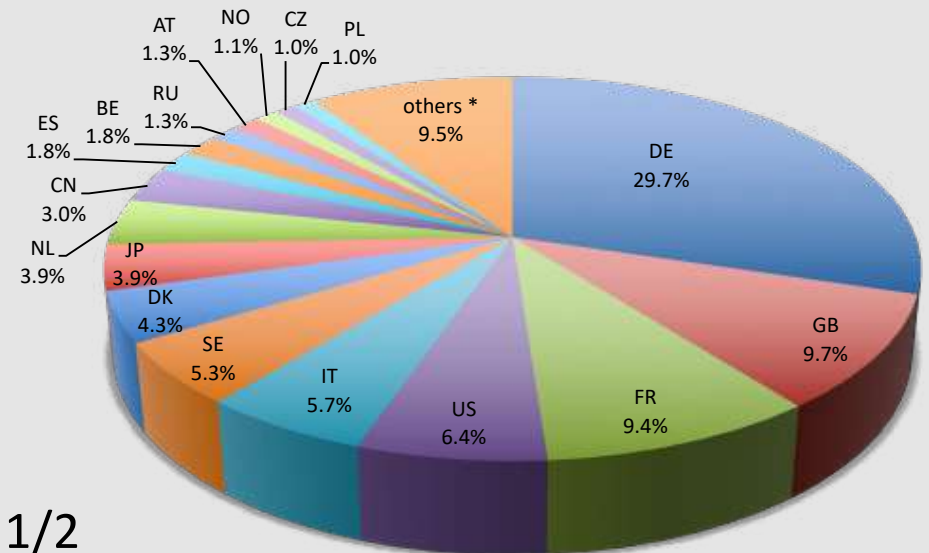
Swiss academic users (individuals) 2015-19



(*): 15 further Swiss institutions < 1%

In total: **2400 individual users / year**
Switzerland $\approx 1/2$

international (non-Swiss) PSI users 2015-19

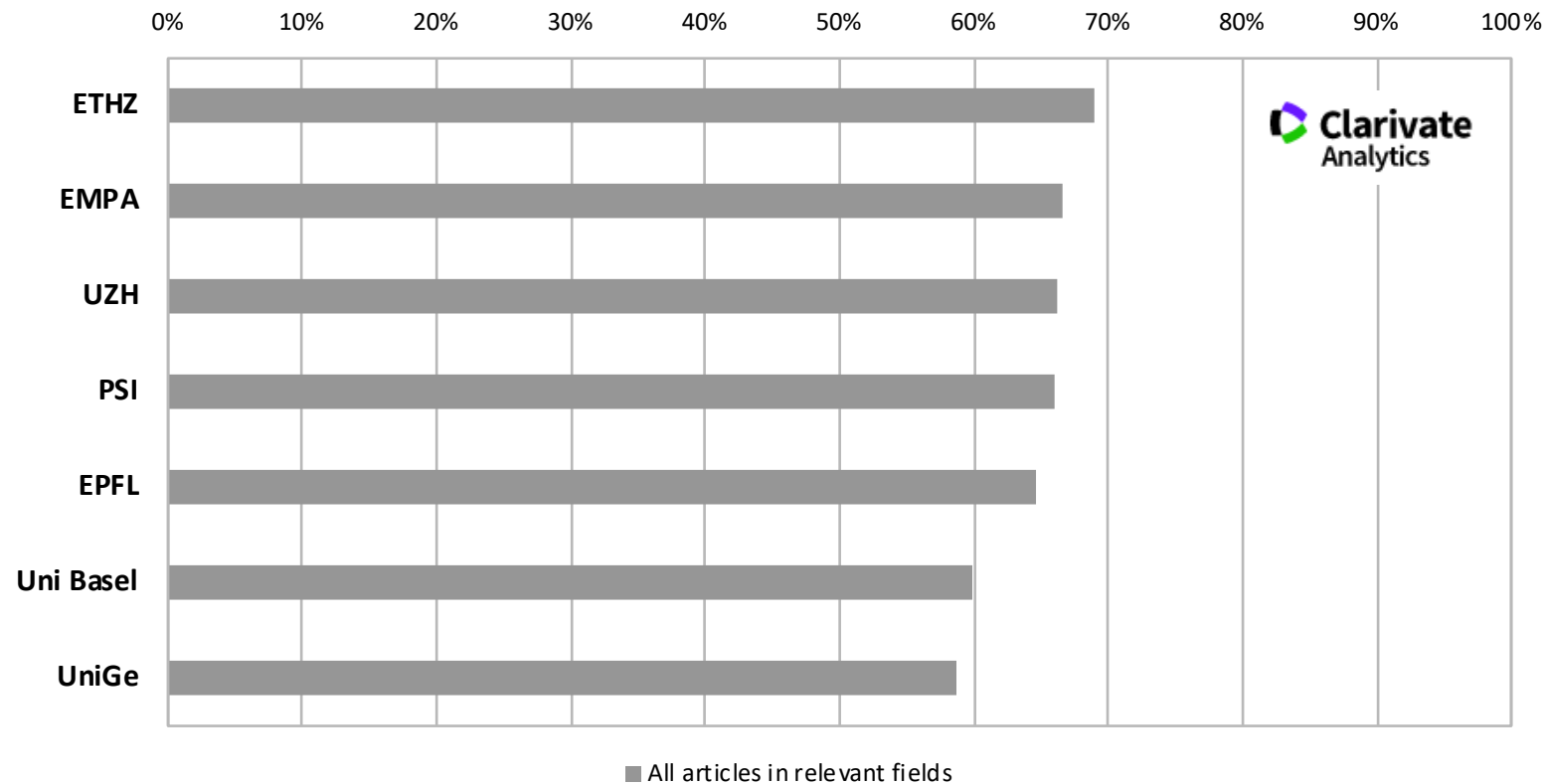


(*): 13 further countries < 1%

international $\approx 1/2$
(EU: 80%)

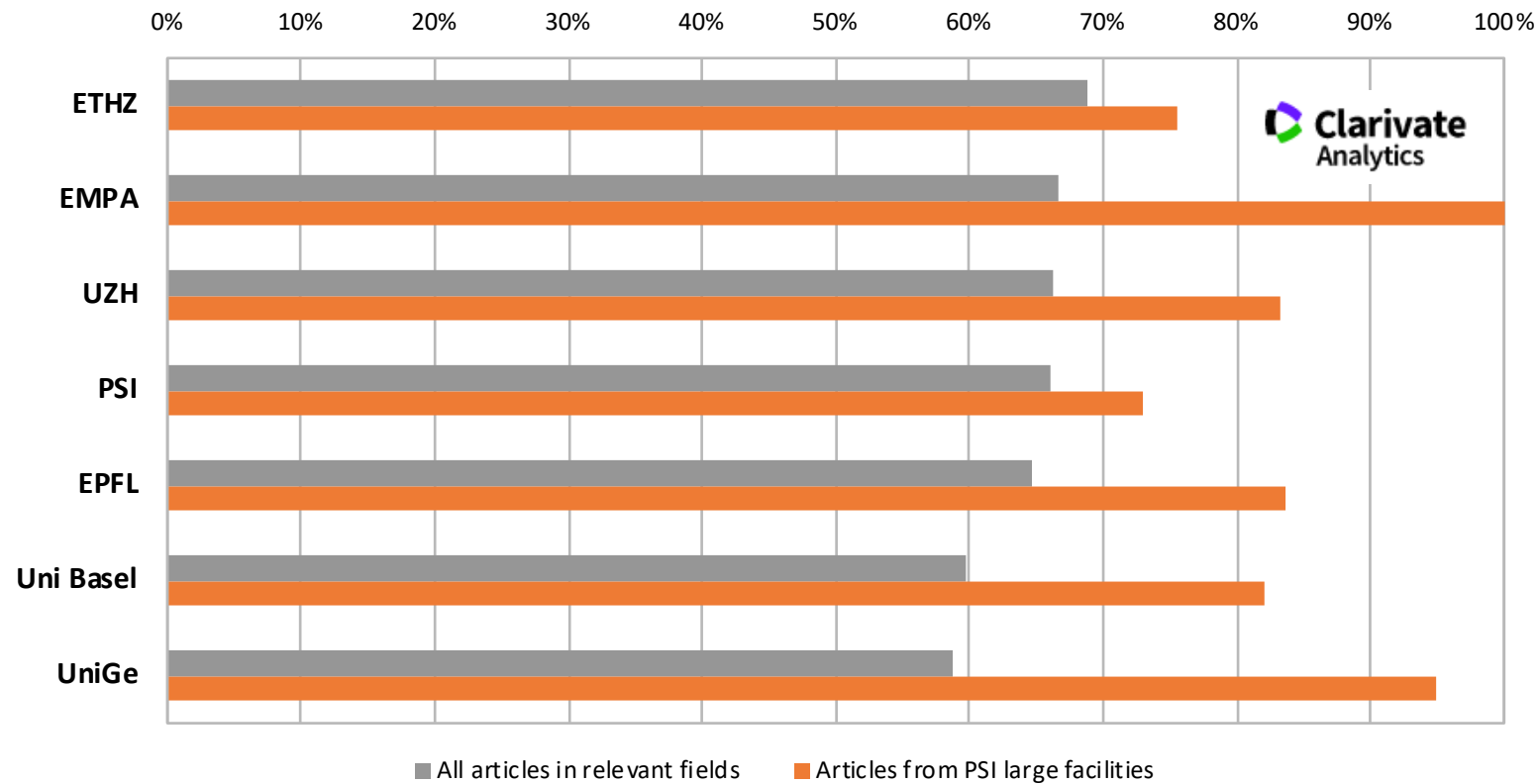
RIs boost publication impact

Science using large facilities at PSI is more likely to be published in a journal ranked in Quartile 1 of the *InCites* Journal Citation Report



RIs boost publication impact

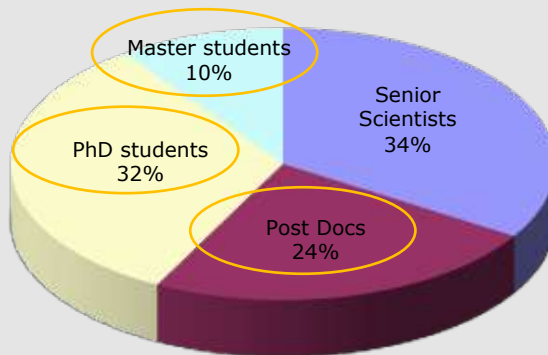
Science using large facilities at PSI is more likely to be published in a journal ranked in Quartile 1 of the *InCites* Journal Citation Report



Structure of our users- strong communities

Building up strong science communities

position of PSI users 2019



fostering raising stars...

*Countries **with national RIs**
tend to be **more competitive** on
using international RIs
than countries without*

- distinct larger proposal success rates
- larger scientific/technological contributions
- geo-return usually >1 on international RIs

From national (RI) to international (RI) impact

CH-DK: Extreme Environment Spectrometer – **CAMEA**

Submitted proposal 2013, **approved for construction by SAC and StC**



CH-DK: Focusing Reflectometer - **ESTIA-SELENE**

Submitted proposal 2013, **approved for construction by SAC and StC**



CH-DK: Compact Chopped SANS - **BioSANS**

Submitted proposal 2012/13, **science covered by ESS instrument**



CH-DK: Diffraction Instrument - **HEIMDAL**

Submitted proposals 2013, **approved for construction by SAC and StC**



D-CH: Neutron Imaging - **ODIN**

Submitted proposal 2012, **approved by SAC and StC, construction started**

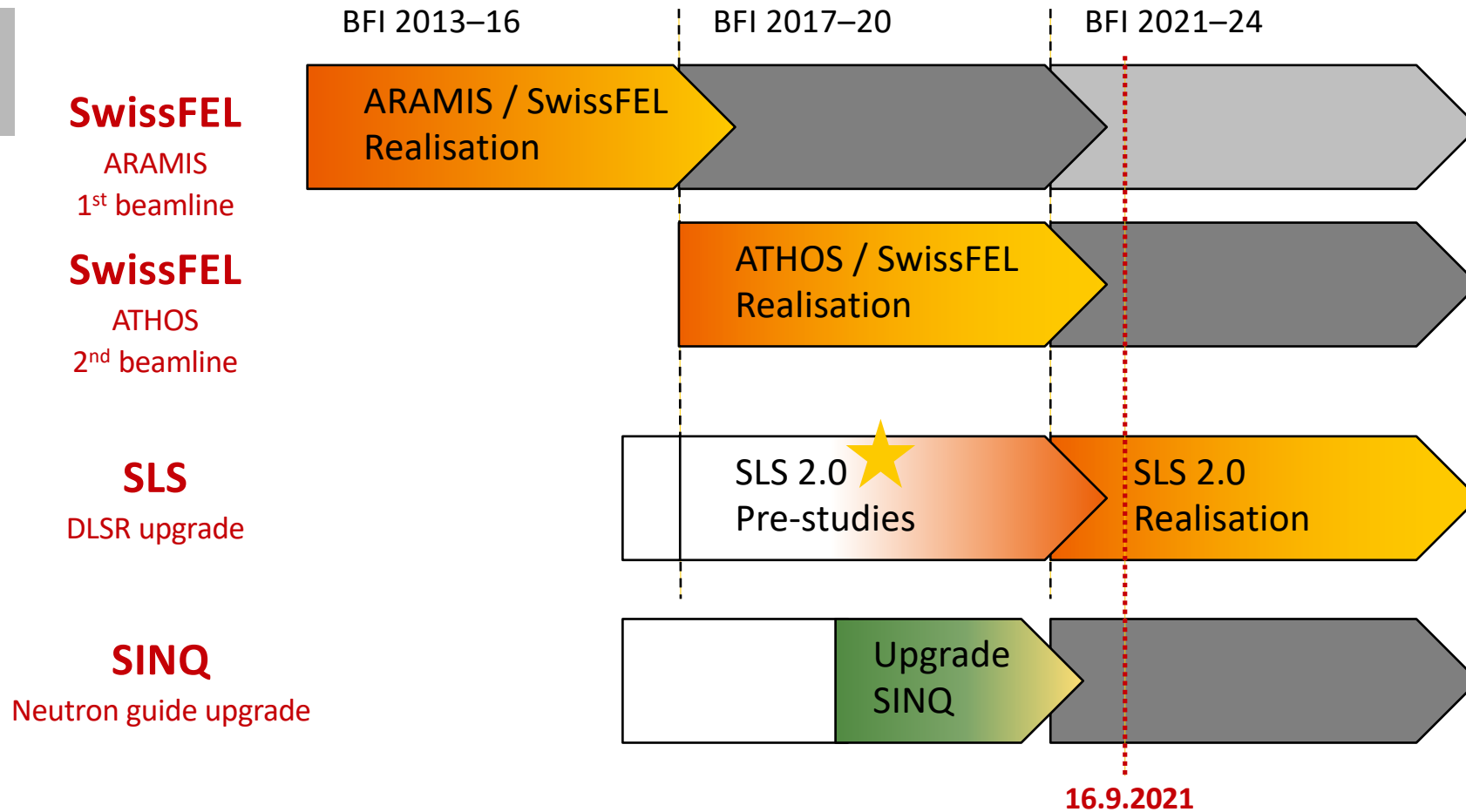


Neutron Optics and Background Simulations

Continuous activity in collaboration with ESS

CH contributes in **5 instruments** of ESS !
(European Spallation Source in Lund, Sweden)

Investments into new RIs and upgrade



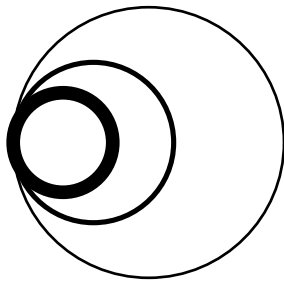
Socio-Economic Impact of our RIs

Hardware /year

109 MCHF expenses in total

(2019, incl. upgrade SINQ, realisation ATHOS)
of which

- **83 MCHF in Switzerland**
of which
 - **65 MCHF** in Kanton Aargau and neighboring Kantons
(proximity of 80 km)
of which
 - **29 MCHF in Kanton Aargau**
(proximity of 30 km)



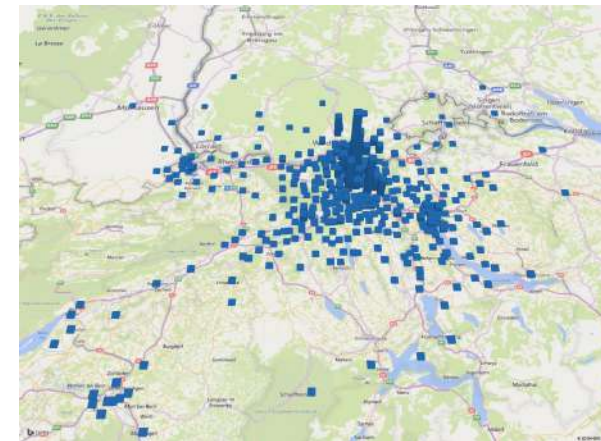
1 CHF = 0.92 €

Brains /year

2200 staff

178 MCHF net payroll
of which

- **150 MCHF in Switzerland**
of which
 - **123 MCHF in Kanton Aargau**
(proximity of 30 km)



Caution with «exact impact»

Impact of an RI could be measured by comparing **what if it was not** there or suspended - *difficult*

To be **fair** one would need to ask **what if none of similar RIs** existed - *slightly less difficult*

Metrics for the 'classical' impact are defined and repeated studies exist
-> *no surprises.*

Host countries for international RIs are for good reasons **easier to find** than contributing countries
-> *ergo, there must be a (socio-economic) impact (of non-distributed RIs).*