



Wir schaffen Wissen – heute für morgen

## **Impact of Research Facilities at a Regional Scale and Cooperation with Universities**

NORDTEK Conference

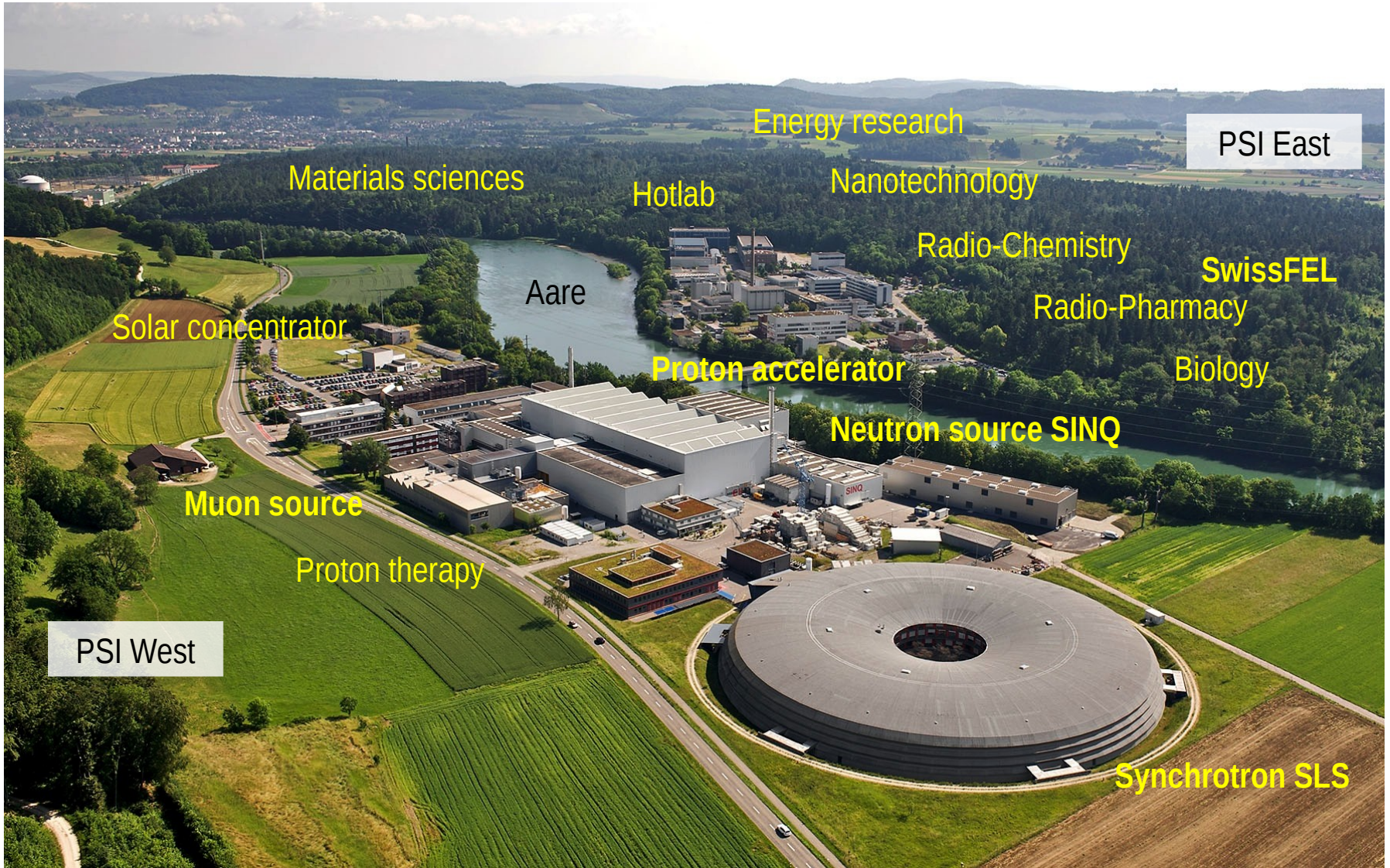
Lund, 15 Juni 2013

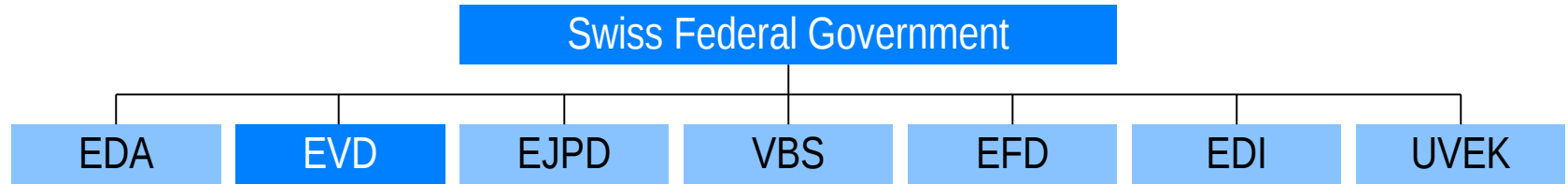
Kurt Clausen

**Paul Scherrer Institut**

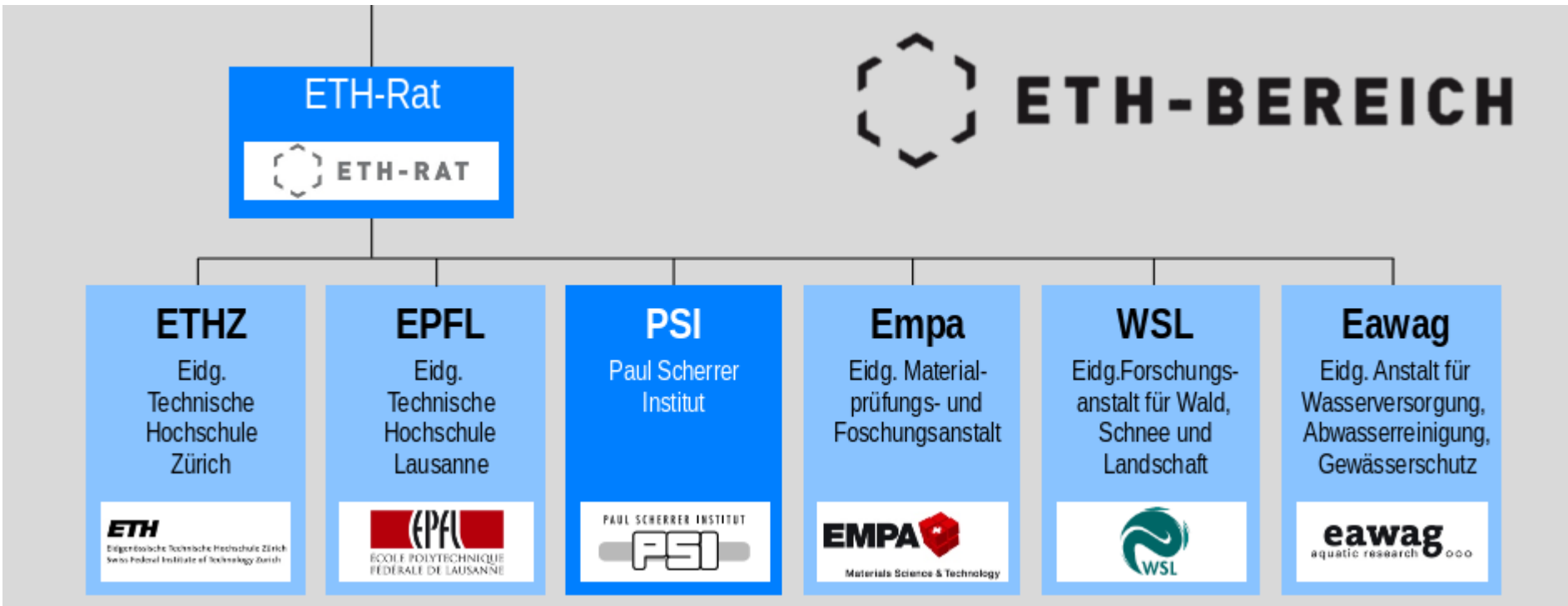
- Introduction to PSI – facilities and key figures
- Regional impact
- University collaboration

# PSI located in Switzerland – ca 15 km south of the German border





(SBFI)



1'000

500

250

----- 125 -----

PSI funds (global budget)	250	MCHF
External funding	~ 70	MCHF
Staff	~ 1500	PJ
Of which externally financed	~ 400	PJ
Doctoral students (PhD)	~ 300	
Apprentices	84	
External users	~ 2100	
Number of scientific publications	~ 1000	
PSI-employees with teaching duties at ETH and universities	~ 110	
Patient visits – Proton therapy	- 6000	

# Our Mission

- To play a leading role on an international level in
  - physics of condensed matter and materials sciences
  - structural biology
  - radiochemistry, radiopharmacy and proton radiation therapy
  - particle physics and accelerator technologyby using large-scale facilities (SLS, SINQ, S $\mu$ S, particle beams)
- To be a UserLab for external science community
- Energy research towards an efficient, environmentally friendly and reliable energy supply (primarily using complex facilities)

**point** - PSI is the only single-site institution within the ETH domain



### regional

- “university of canton Aargau”
- major employer and investor with large social-economic impact
- valued partner for regional communities, canton, SMEs



### national

- enables and educates CH researchers/industry access to large-scale facilities
- valued partner for joint-projects  
(using large-scale facilities, energy research)
- representing CH in photons, muons, neutrons, XFEL communities
- unique specialties: proton therapy, nuclear competence



### international

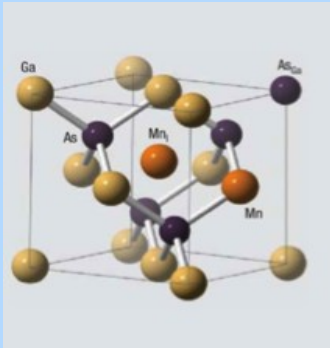
- valued partner for joint-projects  
(developing, building, operating large-scale facilities)
- good example of a today’s modern multi-disciplinary research institute

## PSI

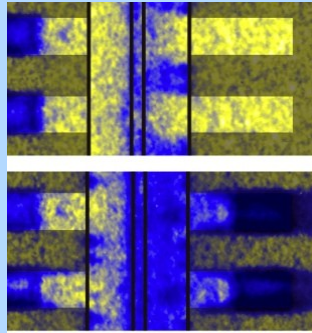
- The **Swiss National Research Laboratory** (à la US definition)  
with international outreach for academia and industry

# main areas of research, large scale facilities, user lab

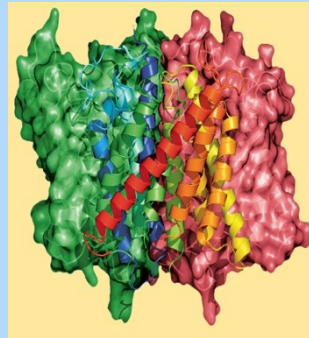
structure of matter  
and materials



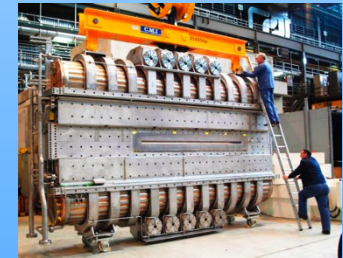
energy and  
environment



life sciences



development  
construction  
operation



large scale  
research facilities



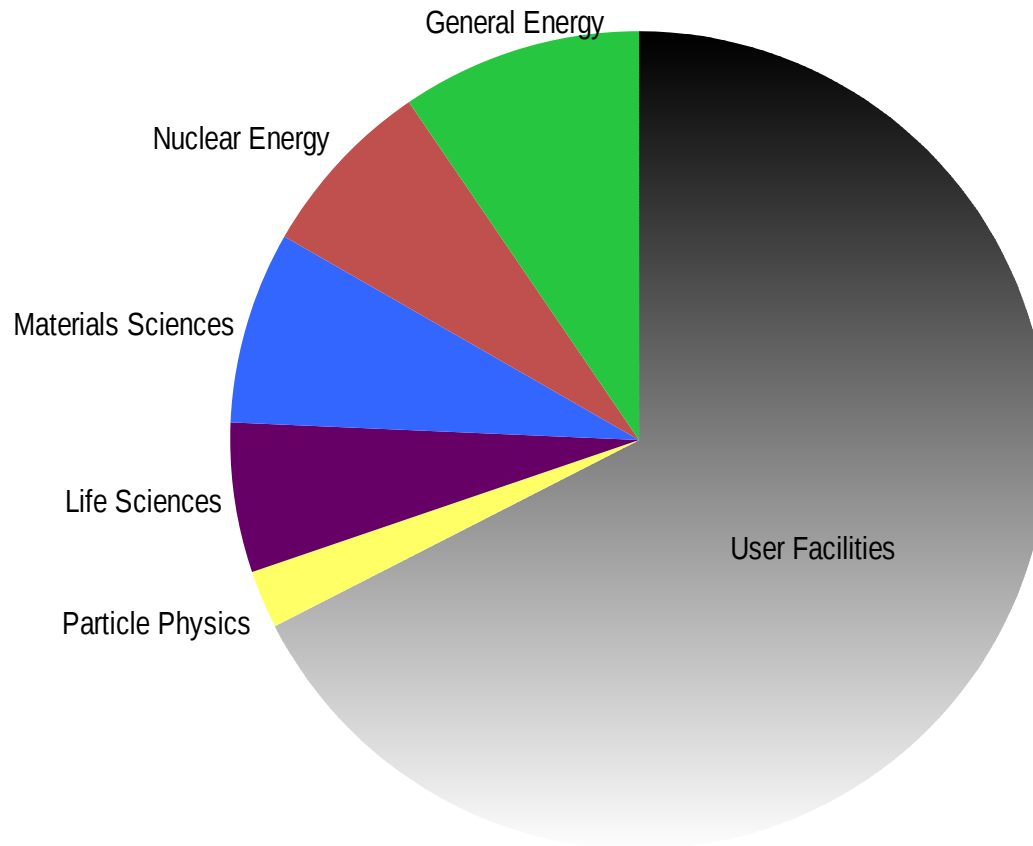
national and international users  
academia and industry

> 2000 external users / year

Knowledge, Training  
Tech. Transfer, Spin off



# Distribution of 1st party funding



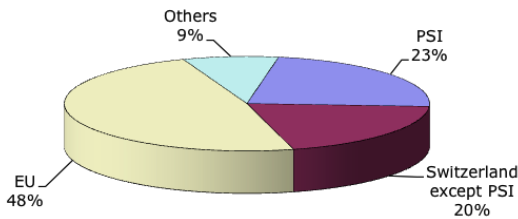
total 1st party funding 2011: 250 MCHF

## trans-national outreach

**2100** users / year

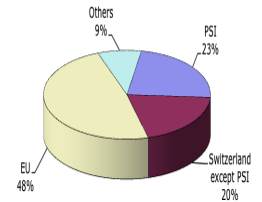
SLS: 48% from EU

average overbooking >2



## impact in innovation

SLS: **10 %** industrial proprietary use  
(other synchrotrons on average 4 %)

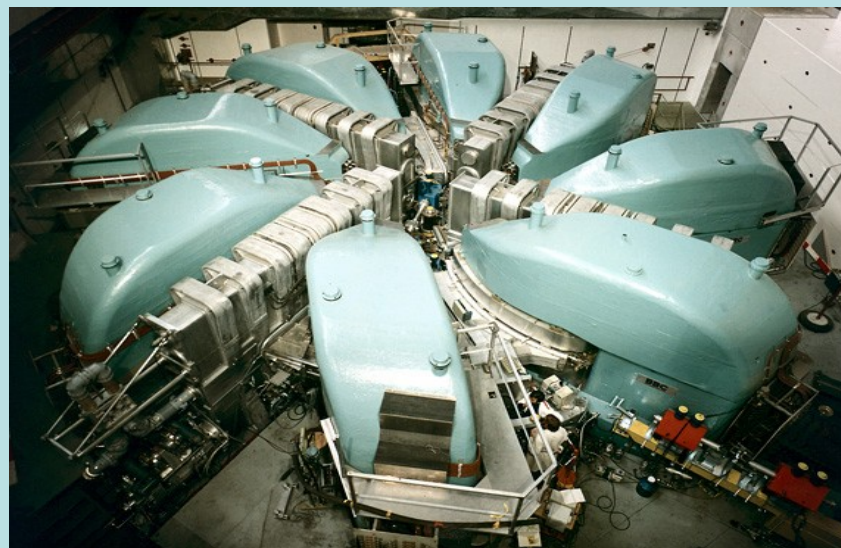
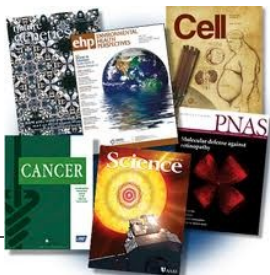


Swiss Synchrotron Light Source (SLS), Swiss Neutron Source SINQ, Swiss Muon Source  $\mu\text{S}$  at the Paul Scherrer Institut

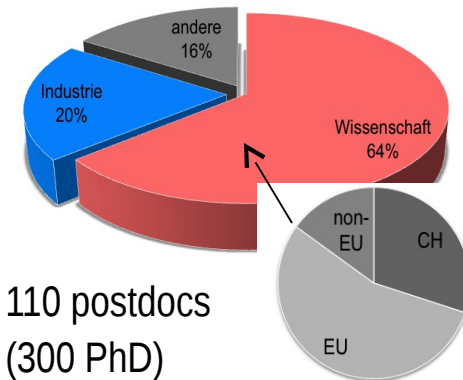
## scientific excellence

>**600** publications per year

109 publications with impact factor >7.1 (PRL)



## knowledge dissemination



110 postdocs

(300 PhD)

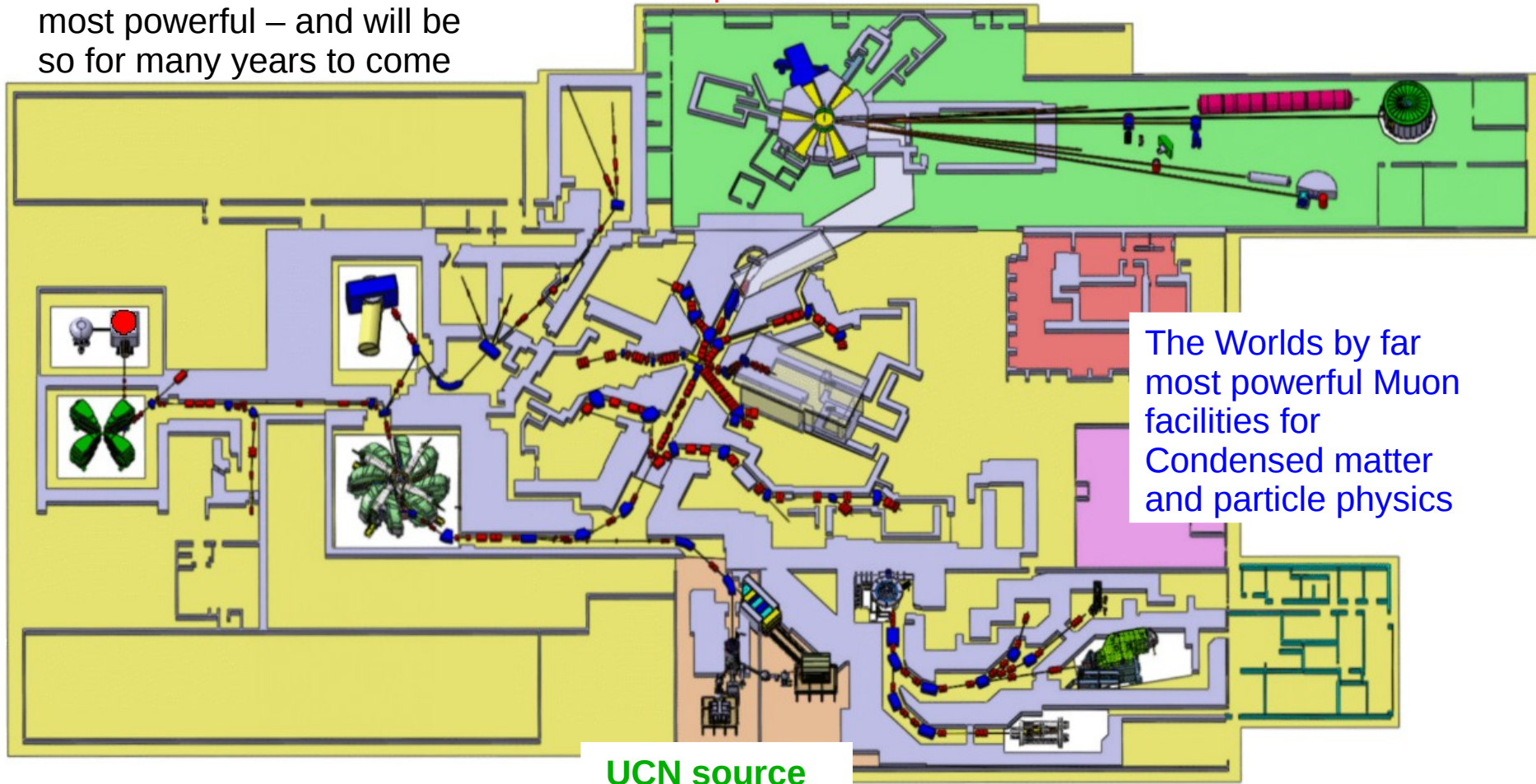
64% stay in science

great majority in EU

# Proton accelerator complex PSI

590 MeV CW – 2.2 mA (2.4 mA test operation 2012) i.e. With 1.3+ MW the PSI proton accelerator is still the Worlds most powerful – and will be so for many years to come

One of the best performing and most modern Medium Flux neutron sources – special sample environment and instrumentation make also this facility unique for many experiments

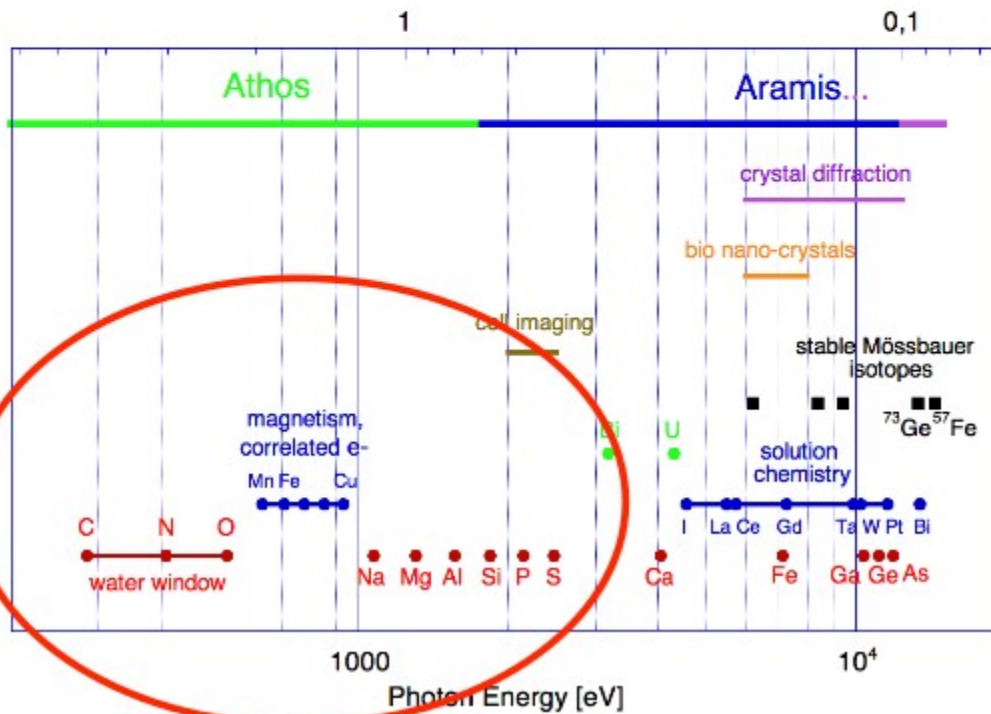
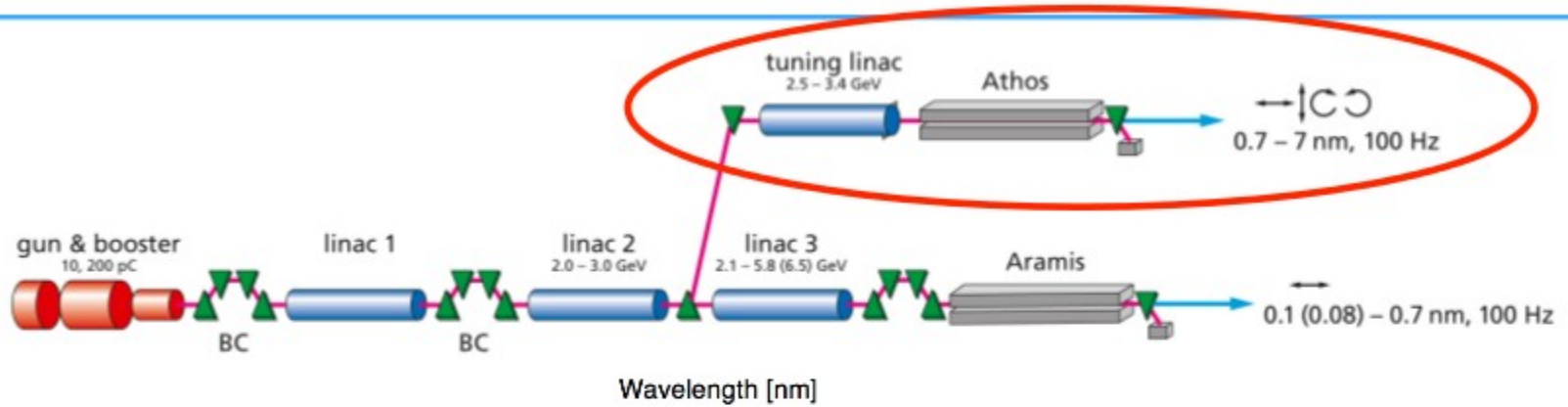


The Worlds by far most powerful Muon facilities for Condensed matter and particle physics

UCN source

World leading centre for Proton Therapy

# SwissFEL – the new Large facility



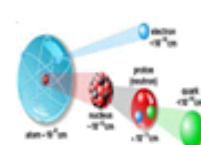
2<sup>nd</sup> Phase

Project approved  
2012

Start of construction  
Jan 2013

250 MCHF plus  
PSI own contribution

1st Photons 2017

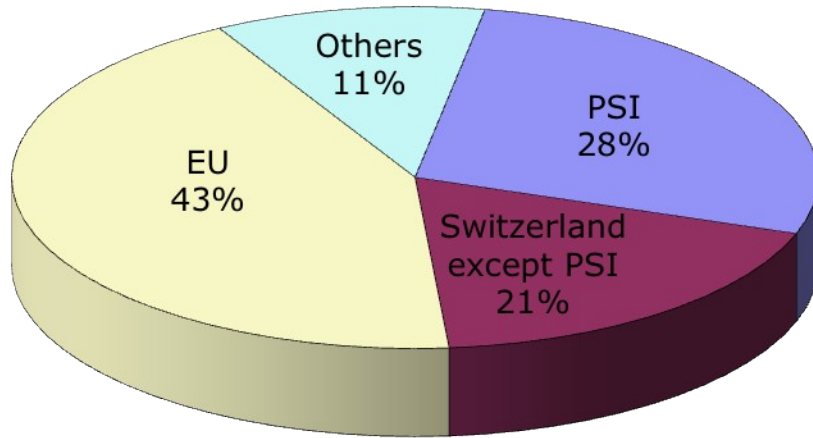


2012	SLS	SINQ	SμS	LTP	PSI total
Beamlines	18	12	4	5	39
Instrument Days	1855	2086	651	480	5072
Experiments	1187	474	214	5	1880
User Visits	3825	1001	359	597	5782
Individual Users	1793	519	167	270	2749
New Proposals	808	397	207	3	1415

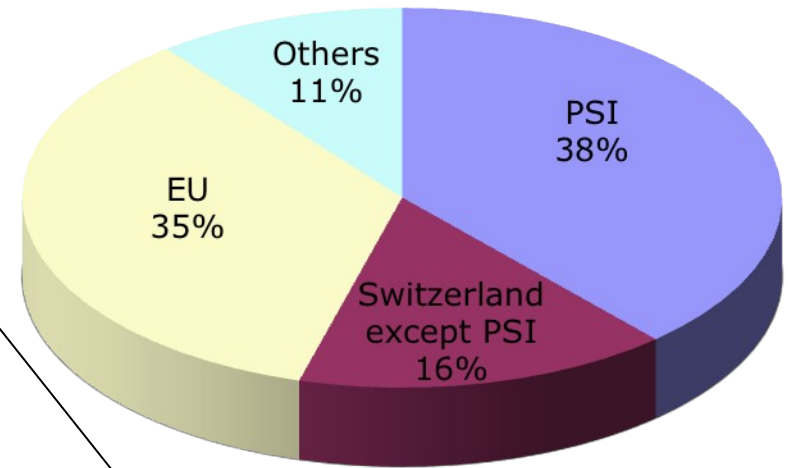
**Proton accelerator**

# Use of facilities 2012

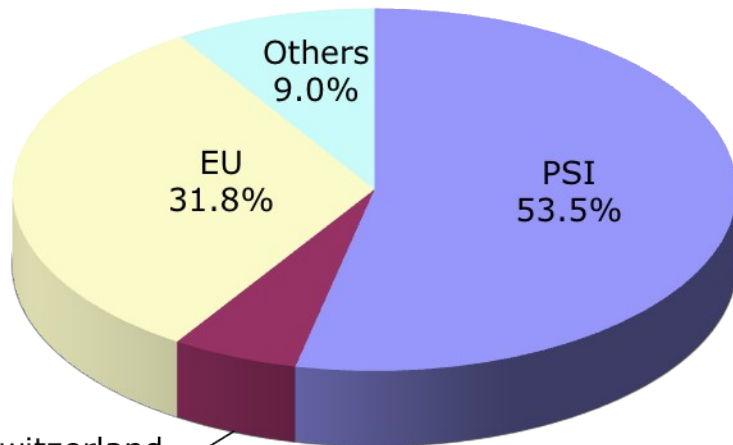
**Geographic distribution SLS users 2012**



**Geographic distribution of SINQ users 2012**



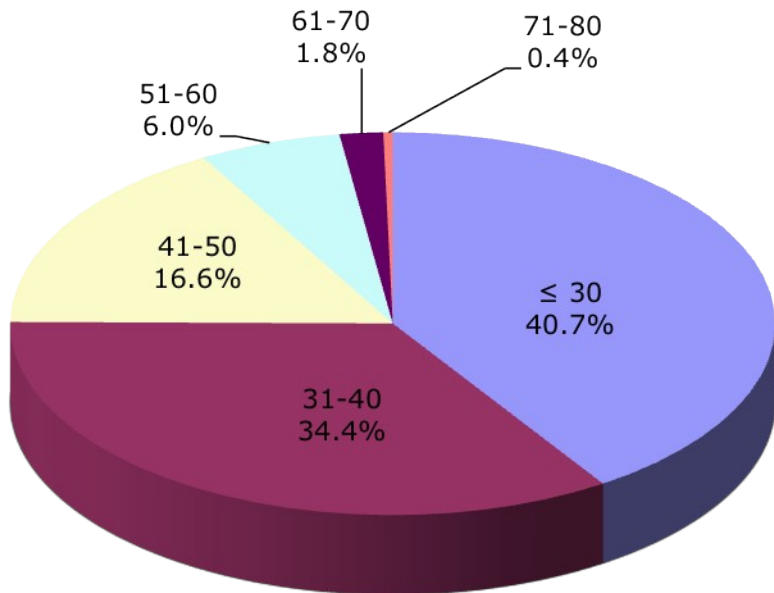
**Geographic distribution of SμS users 2012**



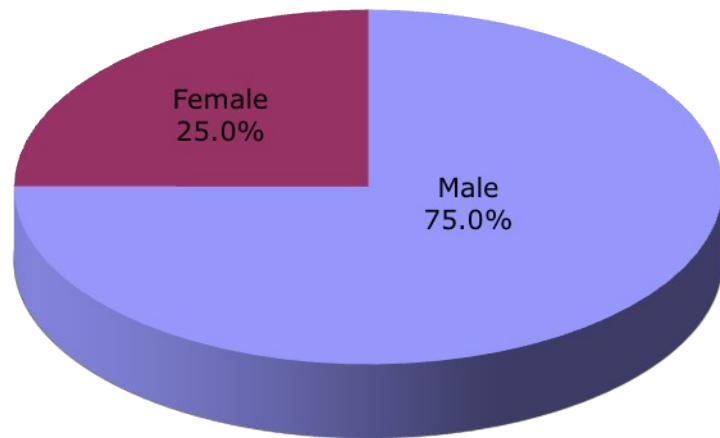
Switzerland  
except PSI  
5.7%

# Structure of users 2012

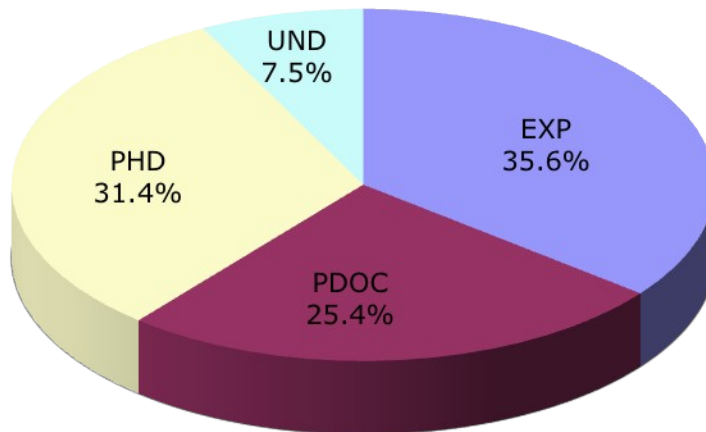
**age of SINQ/SLS/S $\mu$ S/PP users 2012**



**gender of SINQ/SLS/S $\mu$ S/PP users 2012**



**position of SINQ/SLS/S $\mu$ S/PP users 2012**



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# Regional --- Impact



## psi forum – Visitors center



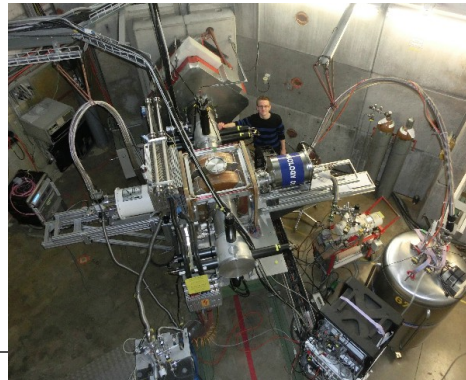
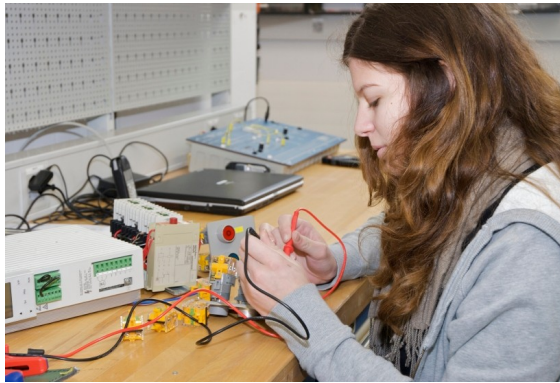
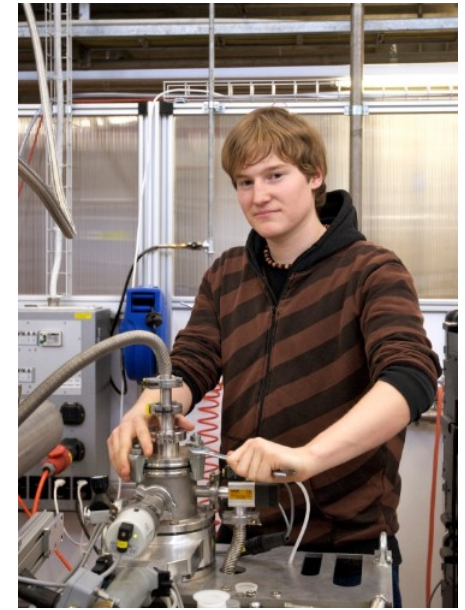
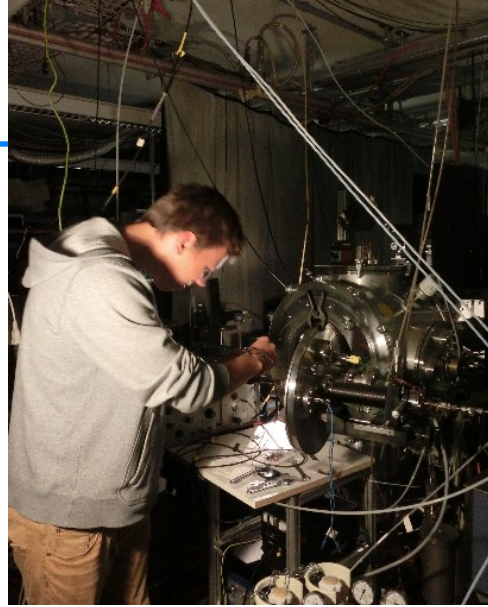
15'000 Visitors / year

## iLab – „Schülerlabor“



Opening 4. April 2008:  
about 6000 kids (12-15)  
(350 classes) until end 2010

**CH industry lack national staff – promoting the interest in science and Technology**



# Apprentices – largest training location in the Canton (AG)

Automatiker/in

- Automobilfachfrau/-mann
- Elektroniker/in
- Fachfrau/mann Betreuung (Kinder)
- Fachfrau/mann Betriebsunterhalt
- Informatiker/in Applikationsentwicklung
- Informatiker/in Systemtechnik
- Kauffrau/Kaufmann
- Koch/Köchin
- Konstrukteur/in
- Küchenangestellte/r
- Laborant / Chemie
- Logistiker/in
- Polymechaniker/in
- Physiklaborant/in



94 apprentices – 33% Women

- 50% → Local industry
- 25% → ETH or FH → Engineer
- 25% → PSI permanent or for some time

*Very important for the region*  
*Very important for PSI*

## Wohnorte der PSI-Mitarbeitenden



2011 figures:

1511 FTE  
59 Nationalities

CH – 51 %

Neighbour Countries

DE – 22 %

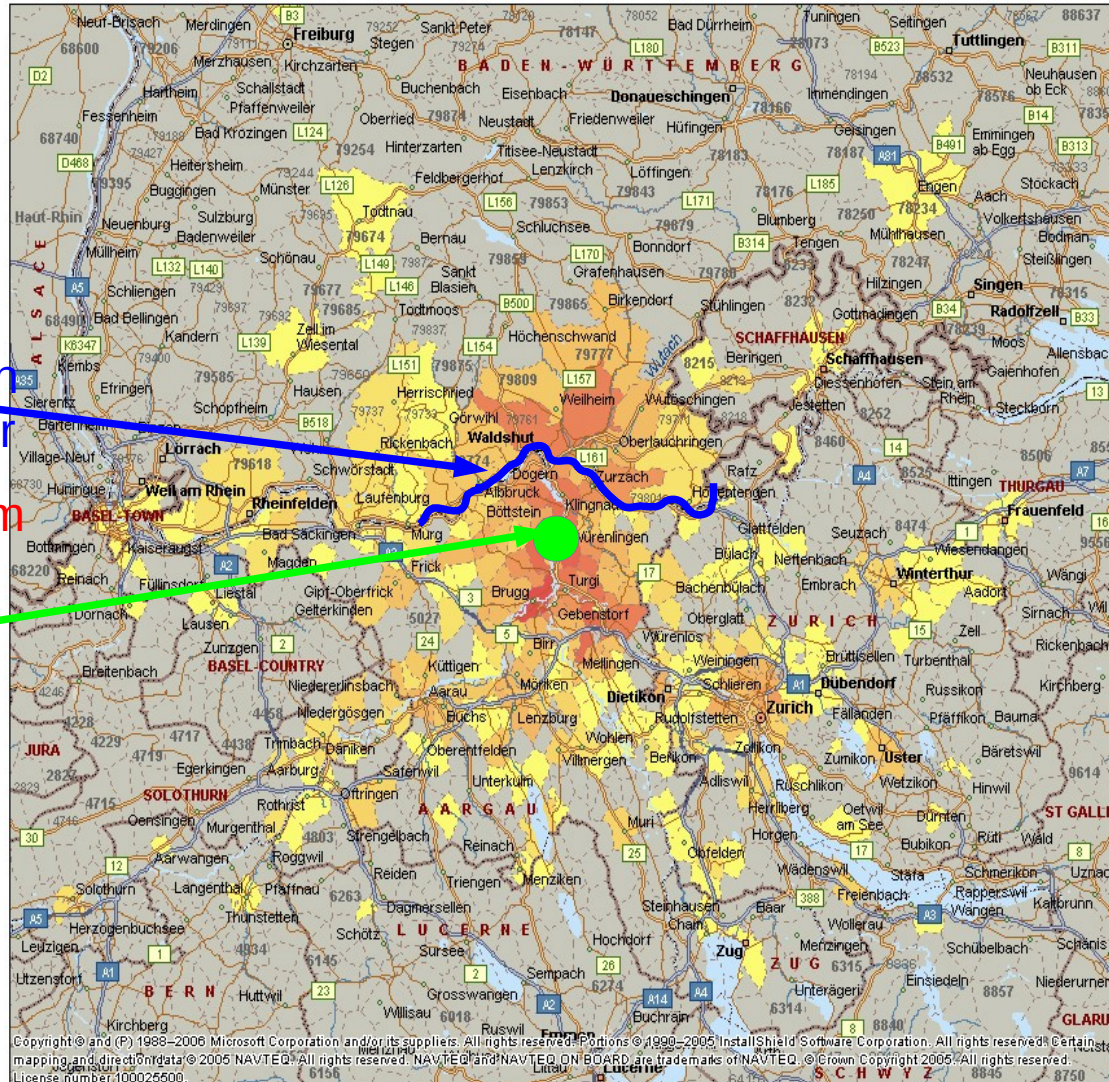
IT – 4 %

FR – 3 %

AT – 2 %

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## Wohnorte der PSI-Mitarbeitenden



2011 figures:

1511 FTE  
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Neighbour Countries

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German  
Boarder  
~15 km  
PSI

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# PSI spenditure – incl salaries



## Umsatz 2007:

AG: 51 M  
 CH: 166 M  
 Total: 195 M

Name der Institution Paul Scherrer Institut						
Kanton bzw. Gemeinde	Gegenstand der Finanzierung, Barmittel oder Sachleistungen  (Einrichtungen, Projekte, Grundstücke, Immobilien, usw.)	Art der vereinbarten Beitrags- oder Fonds  (Schenkungen, zinsbringende bzw. zinslose Darlehen, Baurechte, usw.)	Betrag bzw. Wert (CHF) >CHF1 Mio. pro Periode			
			BFI-Periode 2004-2007	BFI-Periode 2008-2011(12)	BFI-Periode 2013-2016	Total Beträge pro Kanton
Aargau	SLS	Darlehen (2000), musste jedoch im 2004 nicht zurückbezahlt werden	2'000'000			
Aargau	Protonentherapie	Darlehen (2003/2004)	2'500'000 + 2'500'000			
Aargau	CCBM-CH	Darlehen (2006)	10'000'000			
Aargau	Protonentherapie	Schenkung (2007)	10'000'000			
Aargau	Protonentherapie	Schenkung (2008)		10'000'000		
Aargau	SwissFEL	Schenkung (2012)		6'000'000	24'000'000	
<b>Aargau Total</b>						<b>32'000'000</b> <b>15'000'000</b>
<b>Zürich</b>	Protonentherapie	Schenkung (2012) Gantry3		6'000'000	14'000'000	<b>20'000'000</b>
<b>Total Beträge pro Periode</b>			<b>€ 12'000'000</b> <b>€ 15'000'000</b>	<b>€ 22'000'000</b>	<b>€ 38'000'000</b>	<b>€ 72'000'000</b> <b>€ 15'000'000</b>

Financial contributions  
from cantonal governments to PSI

SLS  
proton therapy  
energy research  
SwissFEL

preview to be reported to ETH board  
by 15.3.2013

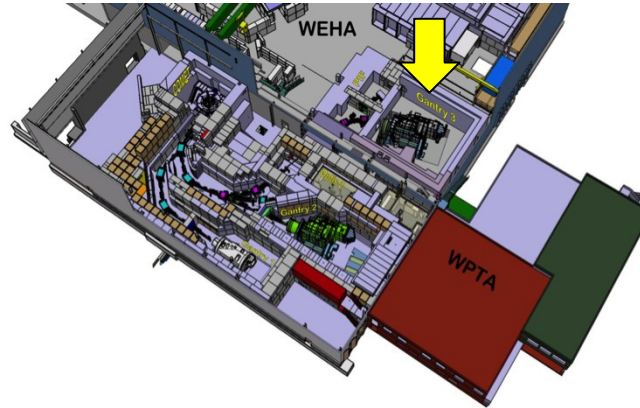
donations  
loans

**Gantry 2** – clinical commissioning first patient in summer 2013



20 MCHF  
from Canton [Aargau](#)

**Gantry 3** – commissioning in 2015 construction to start in winter 2013



20 MCHF  
from Canton [Zurich](#)

**New Head** of Proton Therapy Center from UniS [Geneva](#)



seeking joint professorship (novum)  
UniS [Zurich](#) – UniS [Berne](#) – PSI



# Spin-Off companies ---- PSI technology inside !



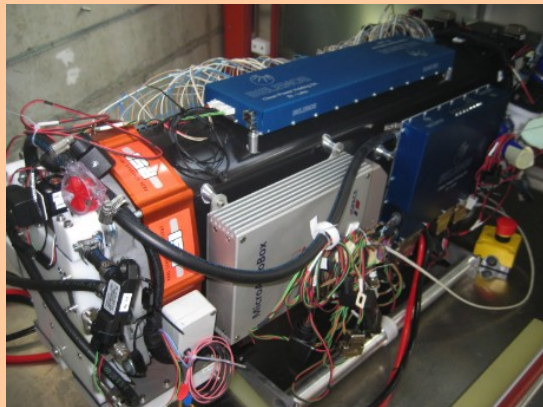
**Detektoren**  
Marktführer DECTRIS



**Elektronik**  
Oszilloskop auf einem Chip



**Protonentherapie**  
Entwicklung Beschleuniger mit Varian

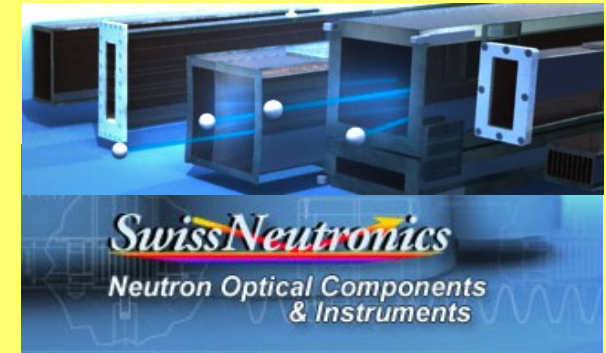


**Brennstoffzellen**  
Zusammenarbeit mit BELENOS



*get ready for  
SwissFEL*

**Ultraschnelle Elektronik/Detektoren**  
EIGER – nächste Generation, 1-Chip



**Neutronenoptik**  
Marktführer SwissNeutronics

# University collaboration

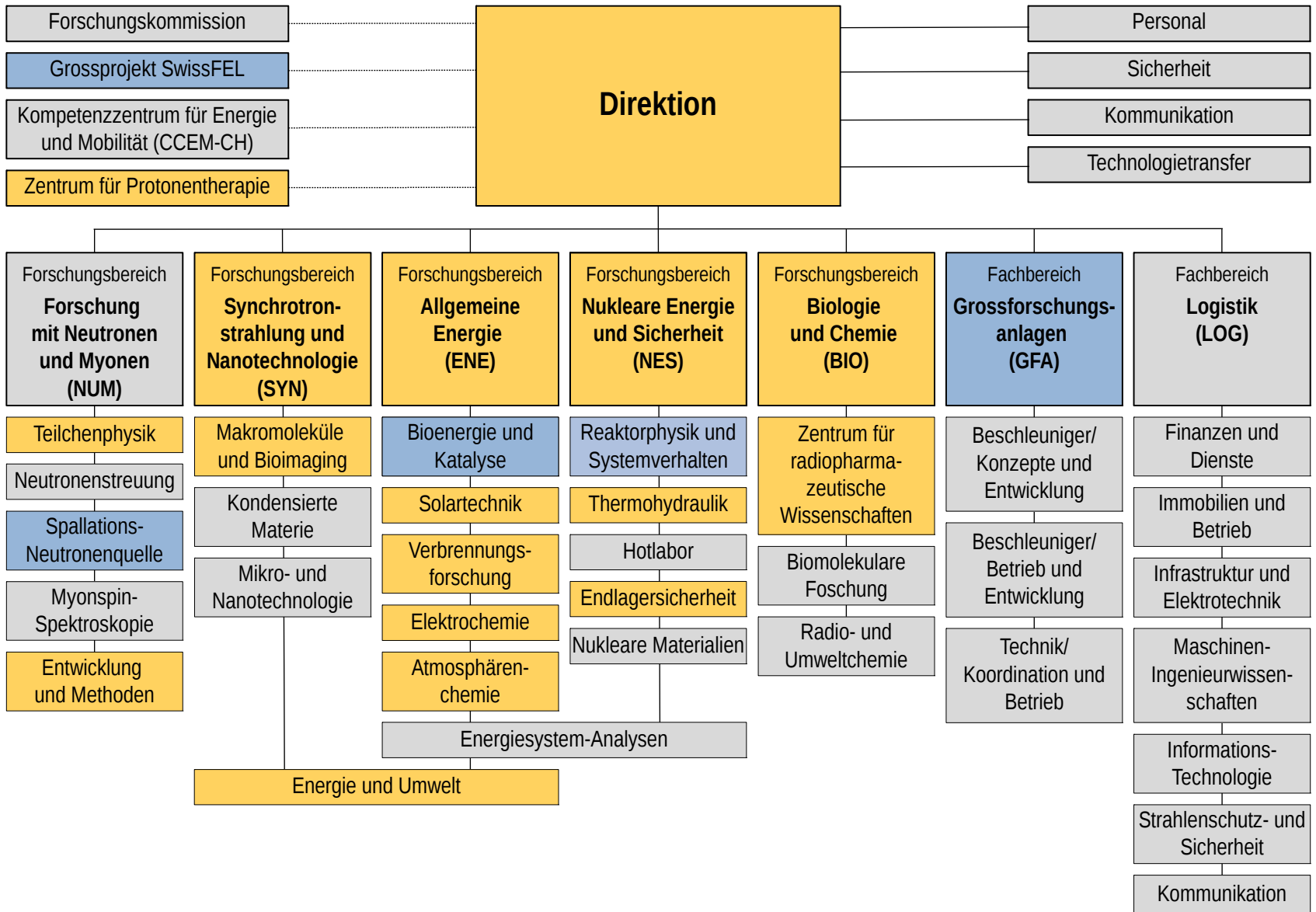
PSI-employees with teaching duties at ETH and universities ~ 110

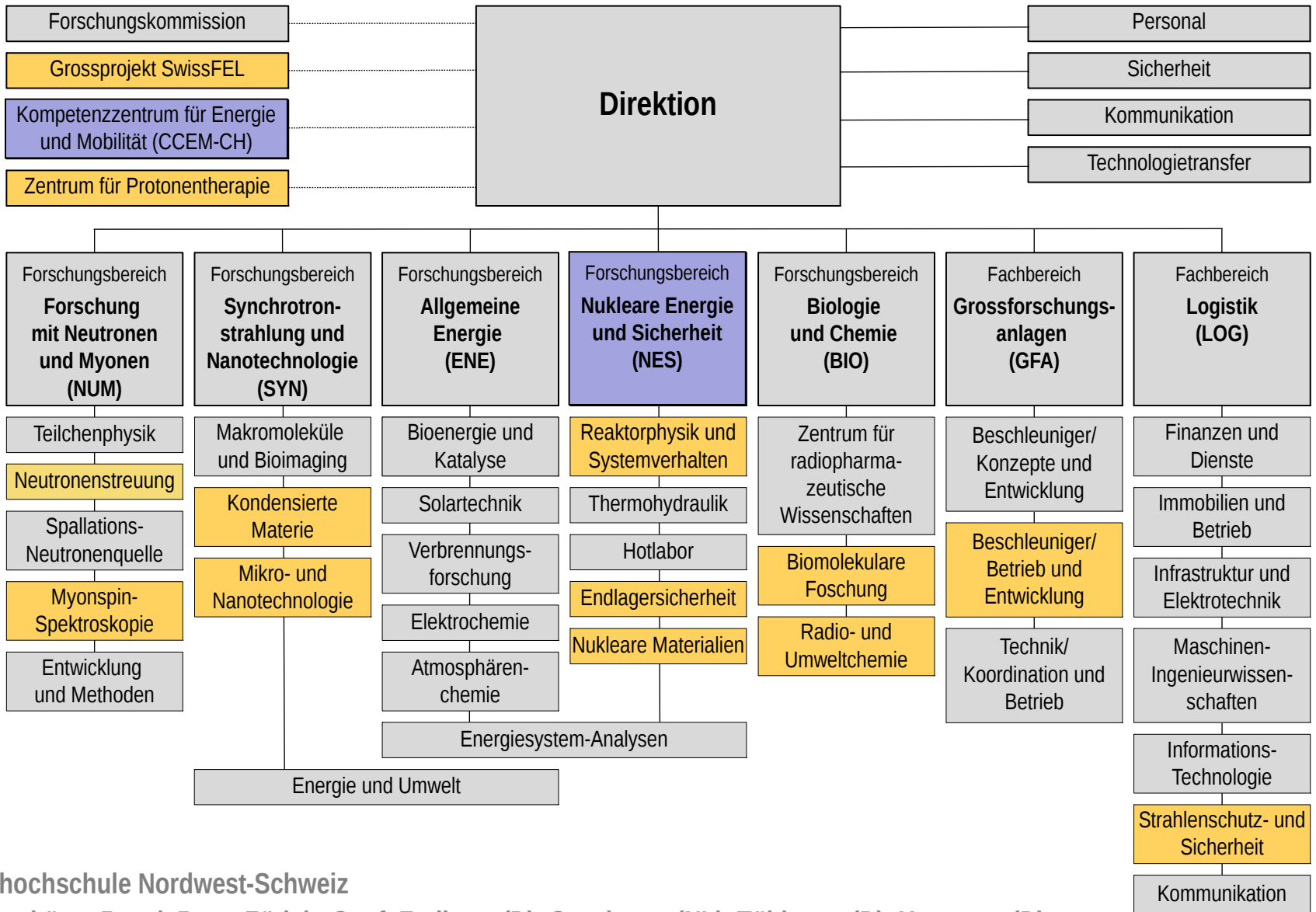
# Synoptic view over Switzerland's university landscape

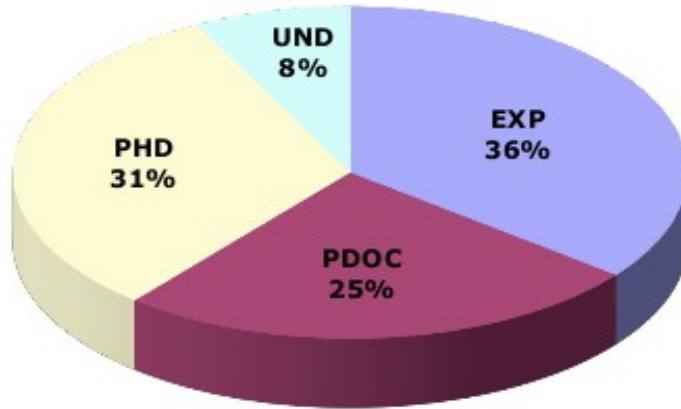


- **2 Federal Institutes of Technology**  
 (ETH Zurich and Lausanne)
- **17 Federal Research Institutes**  
 (among them the four national research labs for energy, materials, natural risks and water)
- **10 Cantonal Universities**
- **50 Universities of Applied Sciences (UAS, Fachhochschulen)**  
 organized in 8 regional clusters  
 (seven are public, one is a Public-Private Partnership, PPP)







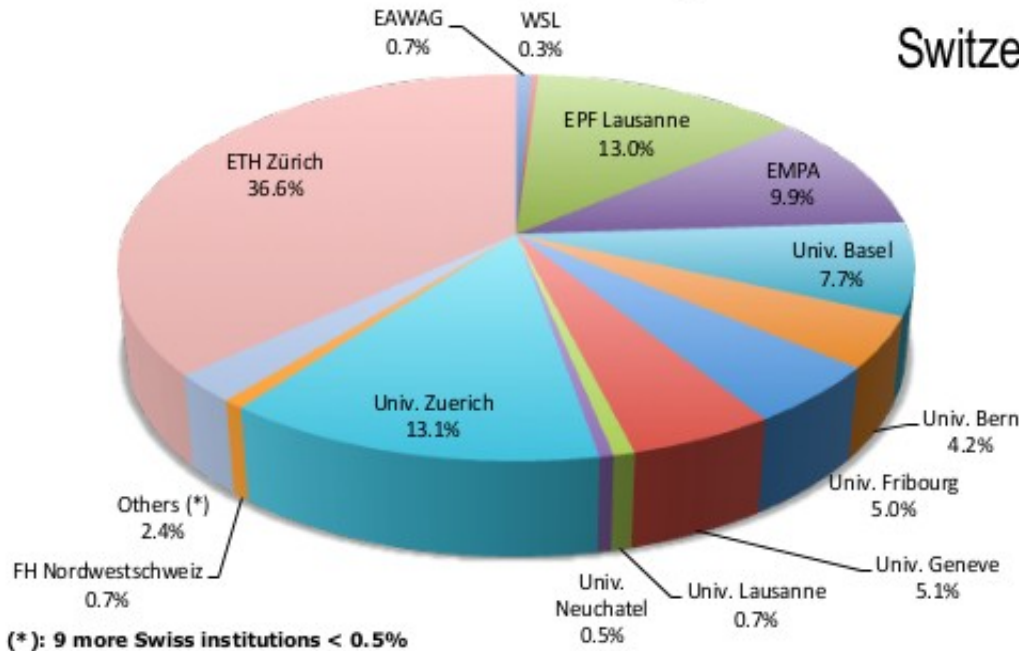
**position of SINQ/SLS/S $\mu$ S/PP users 2012**

- **779** external PhD students use PSI large-scale facilities (**1617** visits at PSI in 2012)
- PSI supervises 300 PhD students most of them using large-scale facilities at PSI
- CH has extraordinary high success rate to get beam time at ESRF, ILL and other large-scale facilities



# External users (w/o PSI) – academic research

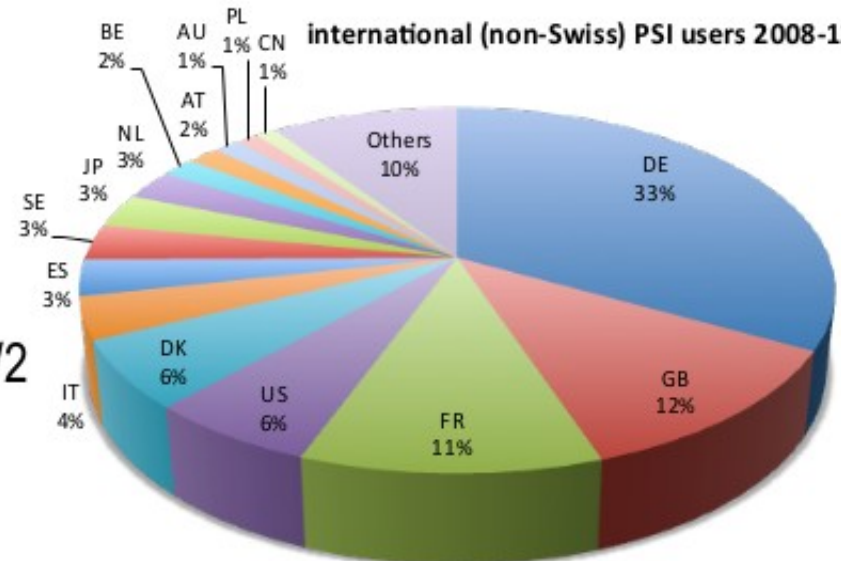
Swiss academic users (individuals) 2008-12



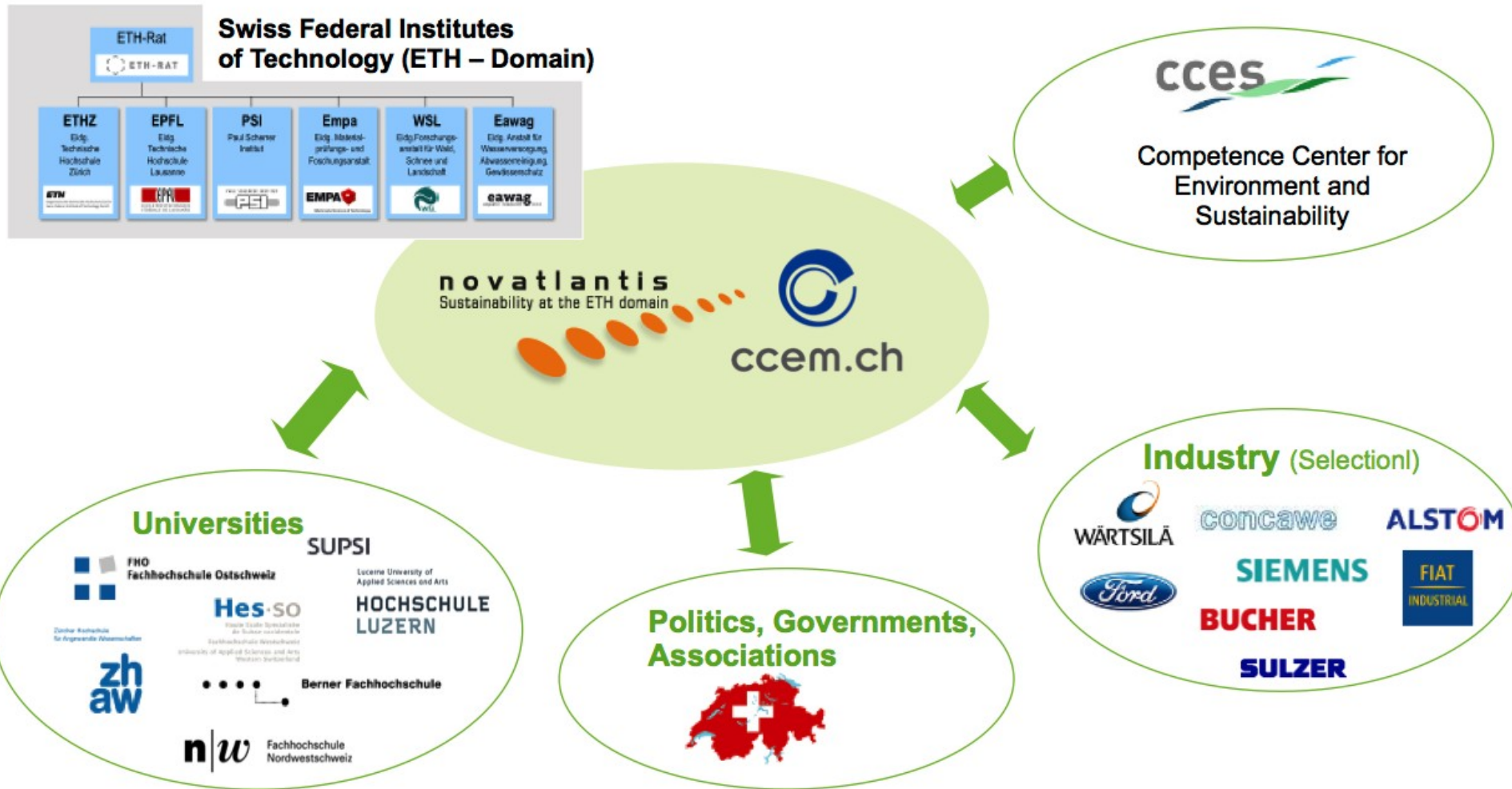
Switzerland  $\approx 1/2$

international  $\approx 1/2$   
(EU  $\approx 75\%$ )

international (non-Swiss) PSI users 2008-12

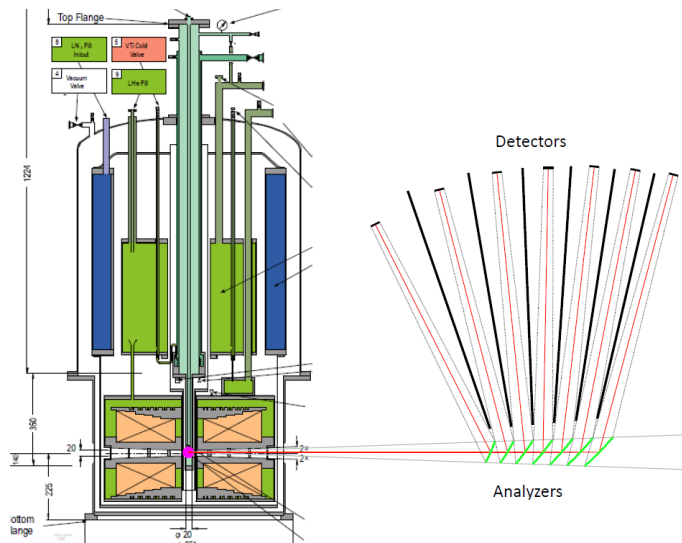


PSI is the leading house of CCEM / Novatlantis





## Multi-Analyzer CAMEA for the RITA-2 Spectrometer at SINQ

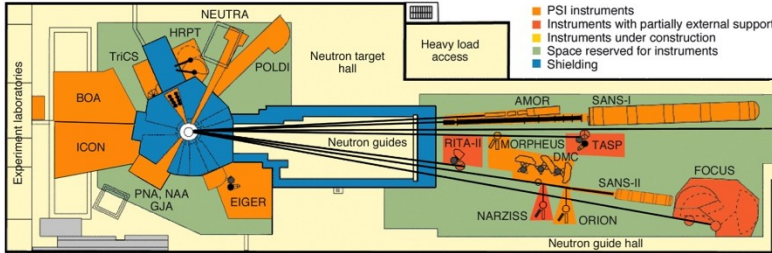


### SINQ-CAMEA

- Transfer of knowhow from ESS development
- Successful R'equip SNF/EPFL: 1.5 MCHF
- New Swiss collaboration EPFL-PSI:  
(group Prof. H.M. Ronnow, 1 postdoc at PSI)

□ shared instruments and beamlines at PSI's large-scale facilities

## today: neutron source SINQ



**FOCUS:** BMBF/University of Saarbrücken, Germany (constr./op.)

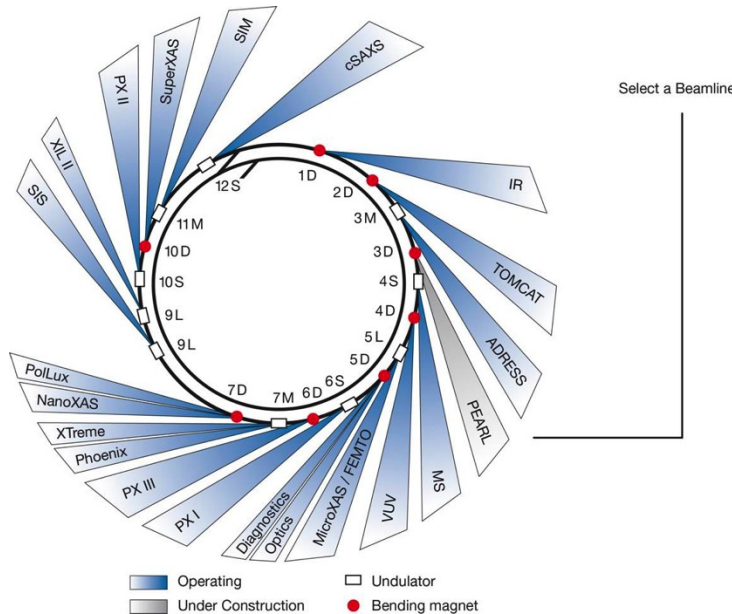
**TASP:** ETH Zurich / EPF Lausanne (operation)

**RITA-II:** Risoe Denmark (constr./operation)

**SANS-II:** Risoe Denmark (constr.)

**NARZISS:** Industry (SwissNeutronics) (operation)

## today: synchrotron SLS



**LUCIA:** Synchrotron Soleil, France (constr./operation, now at SOLEIL)

**PX-II:** Novartis, Hofmann La-Roche, Max Plank (full constr./operation)

**PX-III:** pharmaceutical industry (operation 40%)

**PoILUX:** BMBF, Germany (constr. endstation / operation)

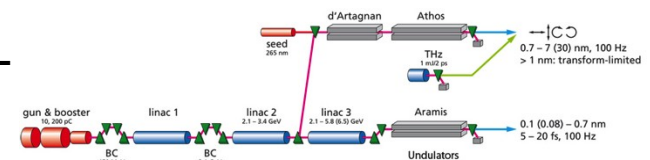
**NanoXAS:** BMBF, Germany (constr. beamline / operation)

**Pearl:** Empa, Unis Zurich, Fribourg, Basel (constr./operation)

**XTreme:** EPFL (constr. endstation / operation)

**SIS:** Uni Zurich (constr. endstation / operation)

## tomorrow: SwissFEL



additional experimental station at day one with China (tbc)

experimental stations at soft X-ray beamlines with XY (tbd)

---

These were some examples from 20 years of  
hard work!

These were some examples from 20 years of  
hard work!

**Will and net positive contribution from ALL  
parties**

State, Region, Universities, Facilities, Industri ....

These were some examples from 20 years of  
hard work!

**Will and net positive contribution from ALL  
parties**

State, Region, Universities, Facilities, Industri ...

The total is far more than the sum of parts.

*Thank you for listening*