PAUL SCHERRER INSTITUT

Wir schaffen Wissen – heute für morgen

Access to SINQ and SµS

NMI3-II Kick-off meeting

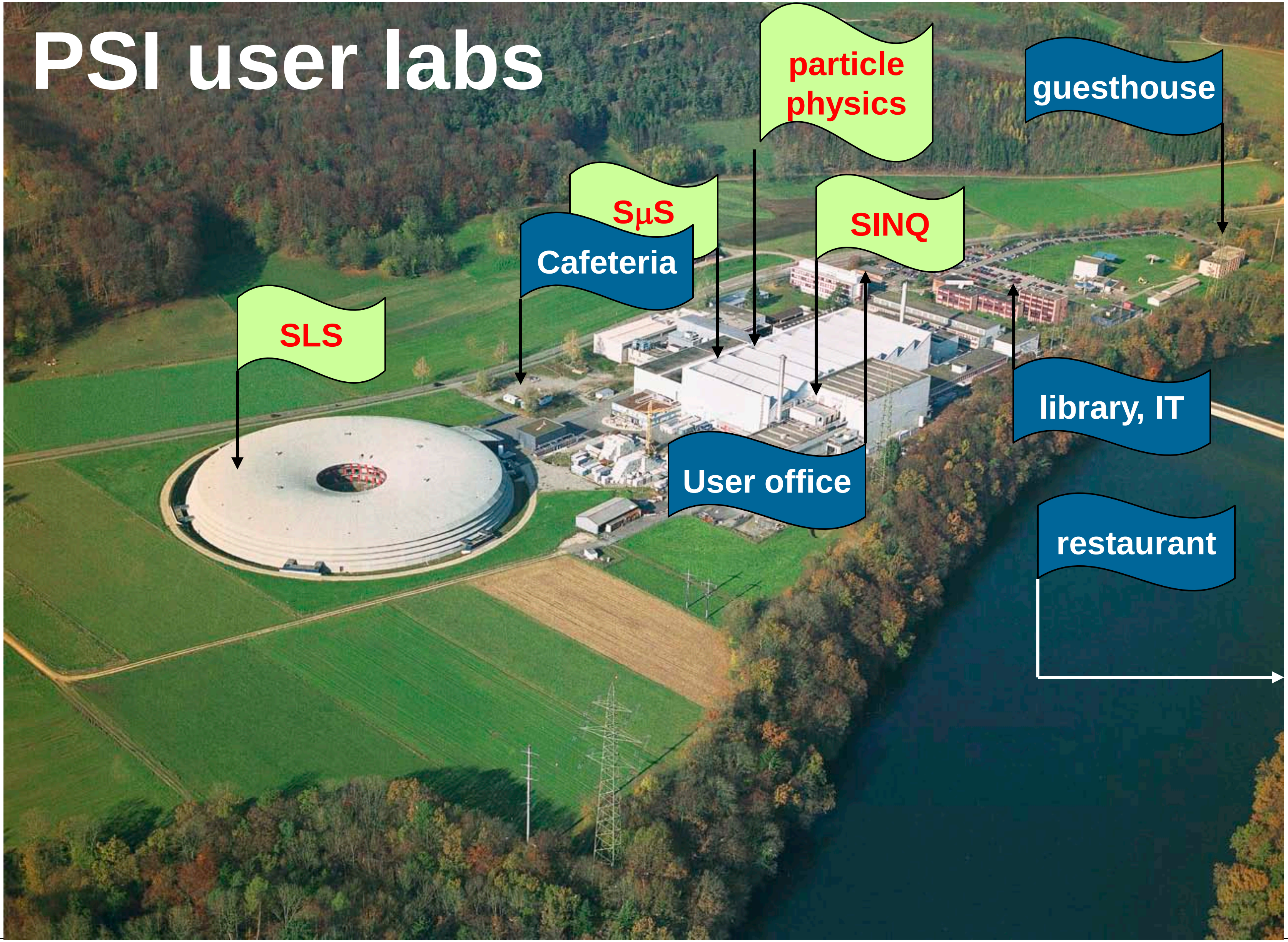
Stefan Janssen
Paul Scherrer Institut – User Office

March 13, 2012

Content:

- User lab PSI
- SINQ status and news
- SμS status and news

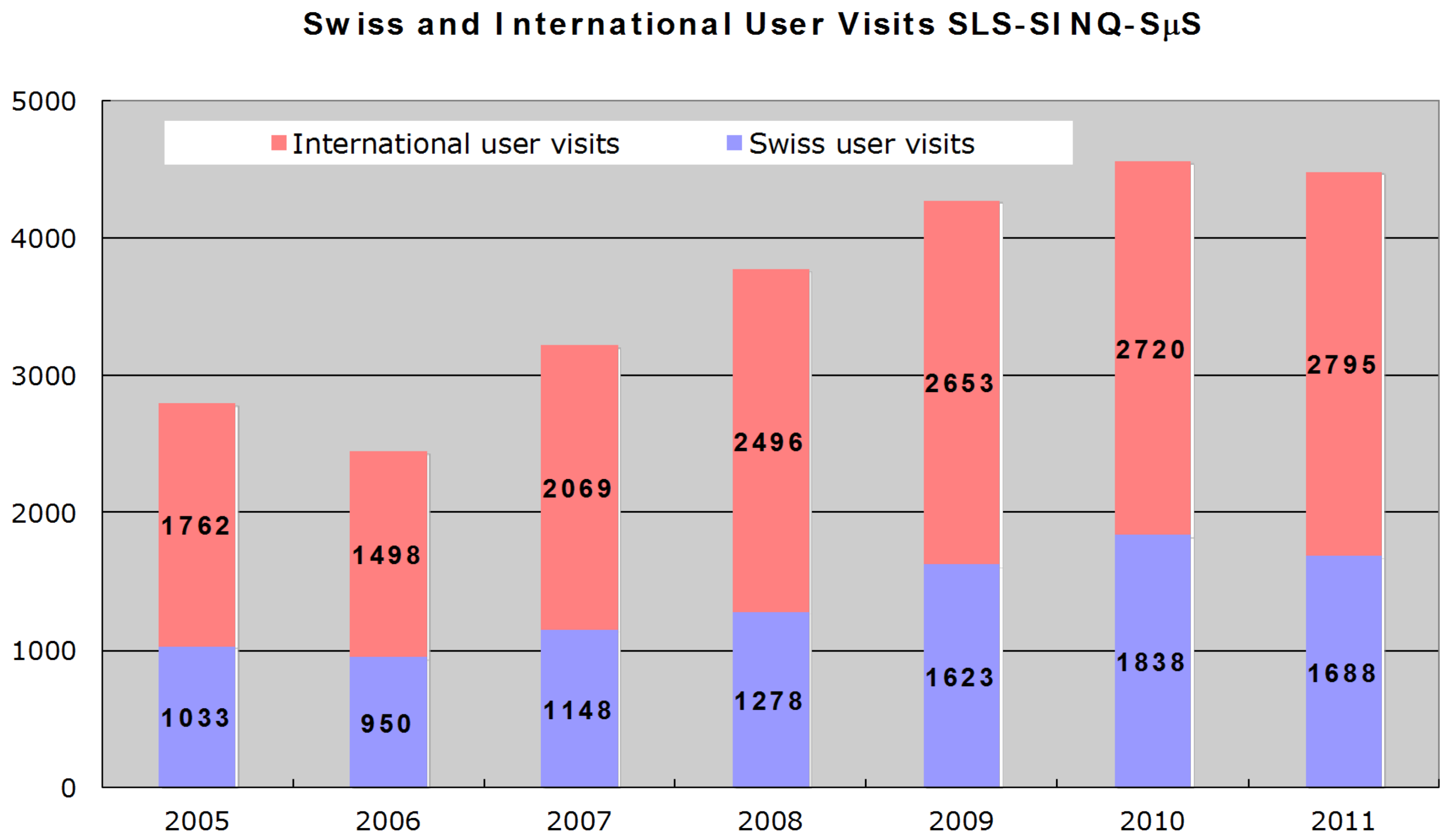
PSI user labs



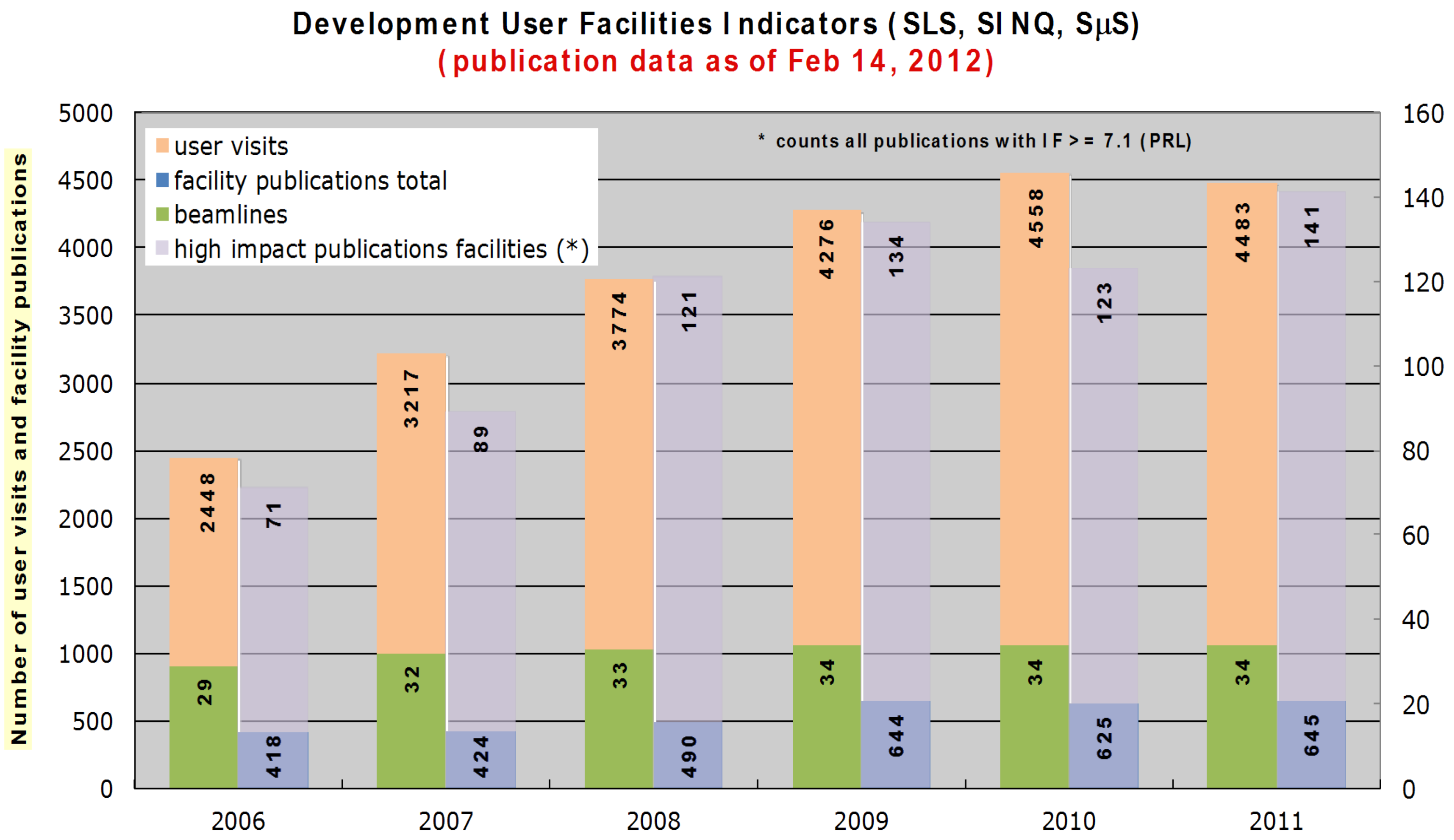
PSI user laboratory key numbers 2011

2011	SLS	SINQ	SμS	PSI total
Beamlines	16	12	6	34
Instrument Days	1787	1939	669	4395
Experiments	1058	439	226	1723
User Visits	3338	826	319	4483
Individual Users	1565	441	160	2096
New Proposals	778	403	196	1377

Swiss and foreign user visits



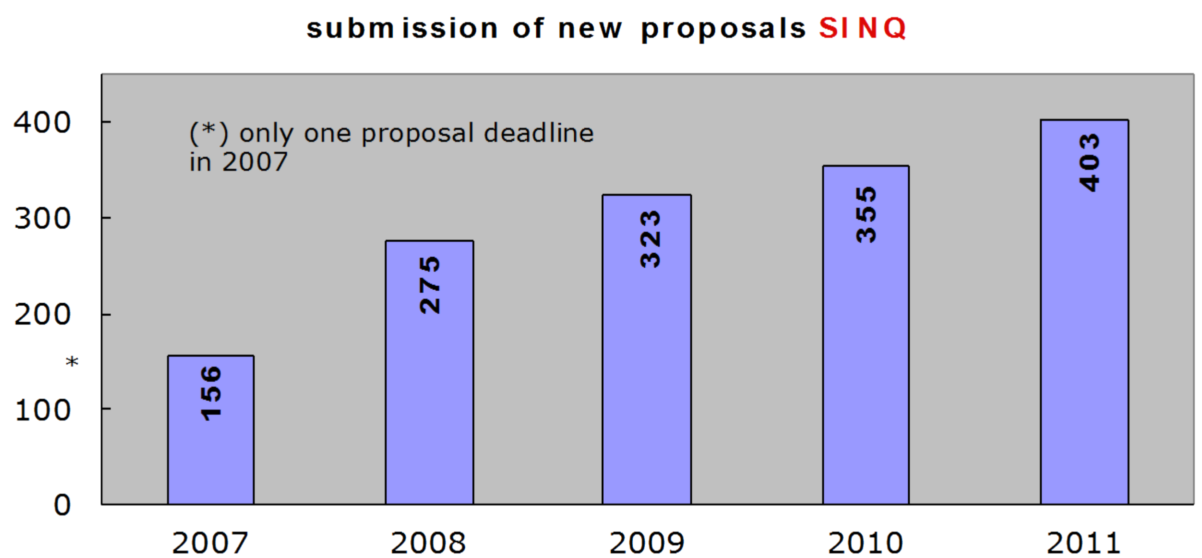
Indicators


Development User Facilities Indicators (SLS, SINQ, SμS)
(publication data as of Feb 14, 2012)
* counts all publications with IF >= 7.1 (PRL)
user visits
facility publications total
beamlines
high impact publications facilities (*)
Number of user visits and facility publications
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
160
140
120
100
80
60
40
20
0
2448
71
29
418
3217
89
32
424
3774
121
33
490
4276
134
34
644
4558
123
34
625
4483
141
34
645
2006
2007
2008
2009
2010
2011

SINQ key numbers 2011 (2010)

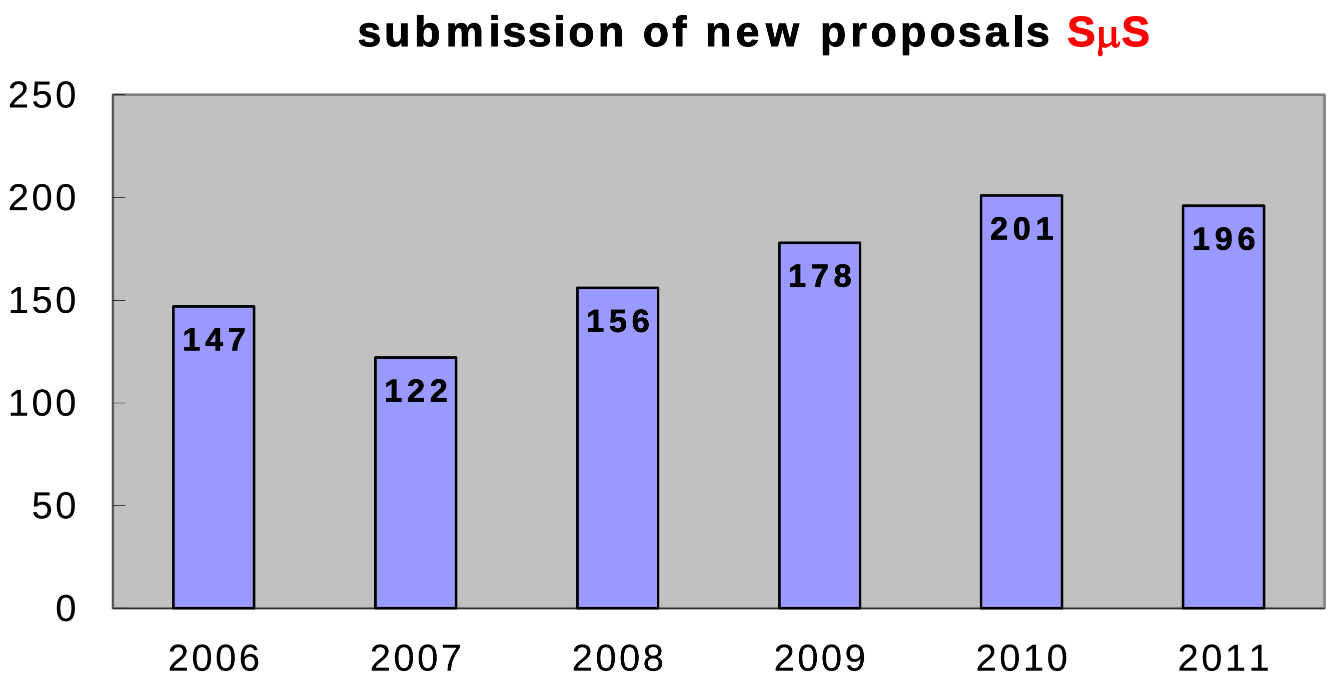
New proposals	:	403 (355)
Visits	:	826 (945)
Individual users	:	441 (465)
Experiments	:	439 (483)
Experimental days	:	1939 (1954)

submission of new proposals SINQ



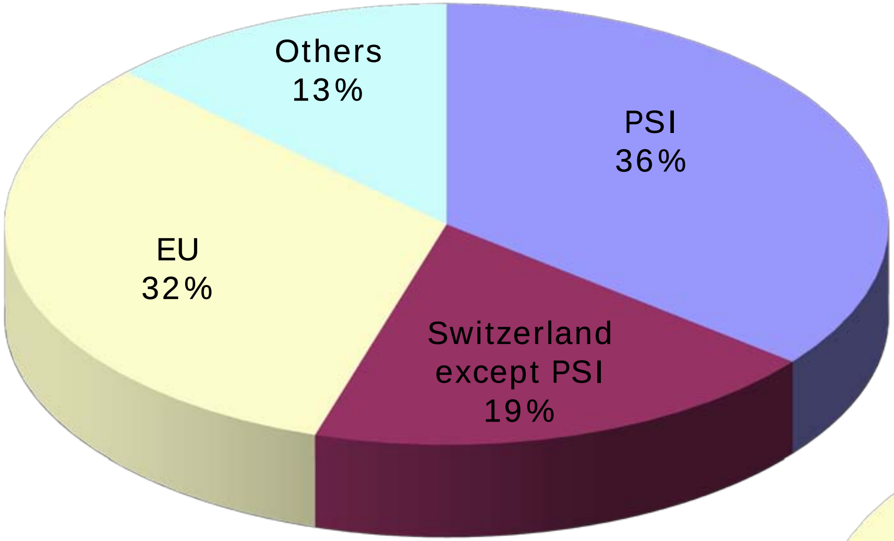
SμS key numbers 2011 (2010)

New proposals	:	196 (201)
Visits	:	319 (392)
Individual users	:	160 (171)
Experiments	:	226 (187)
Experimental days	:	669 (714)

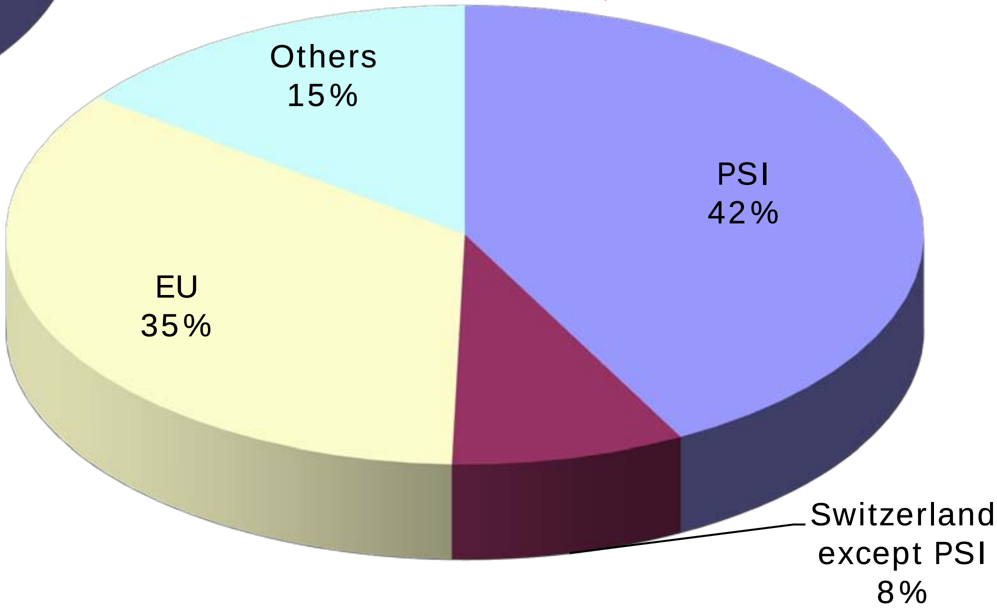


Geographic distribution of users

SINQ users 2011



SμS users 2011



NMI3 history @ SINQ and SμS

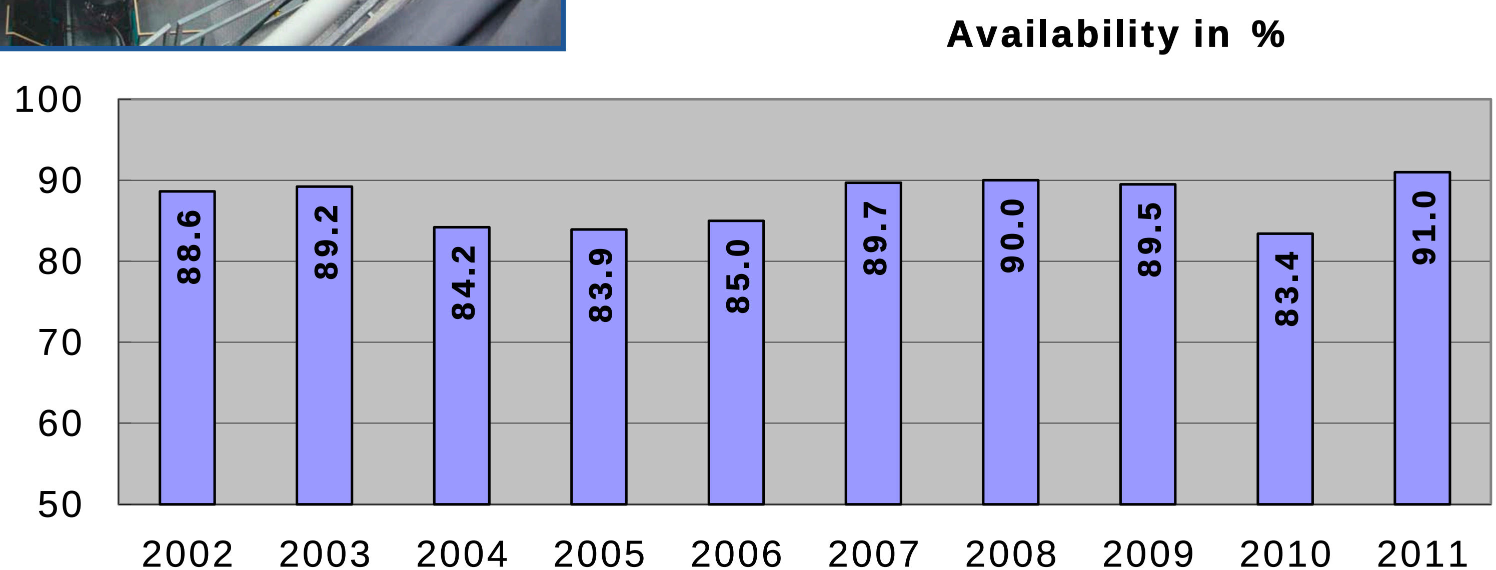
SINQ	funded projects	funded users	delivered days
2004	41	50	236
2005	78	ca 80	402
2006	22	23	112
2007-08	47	50	273
2009-10	73	74	434
2010-11	63	65	277

SμS	funded projects	funded users	delivered days
2004	18	20	88
2005	28	33	176
2006	24	24	114
2007-08	28	28	144
2009-10	35	35	184
2010-11	20	21	89

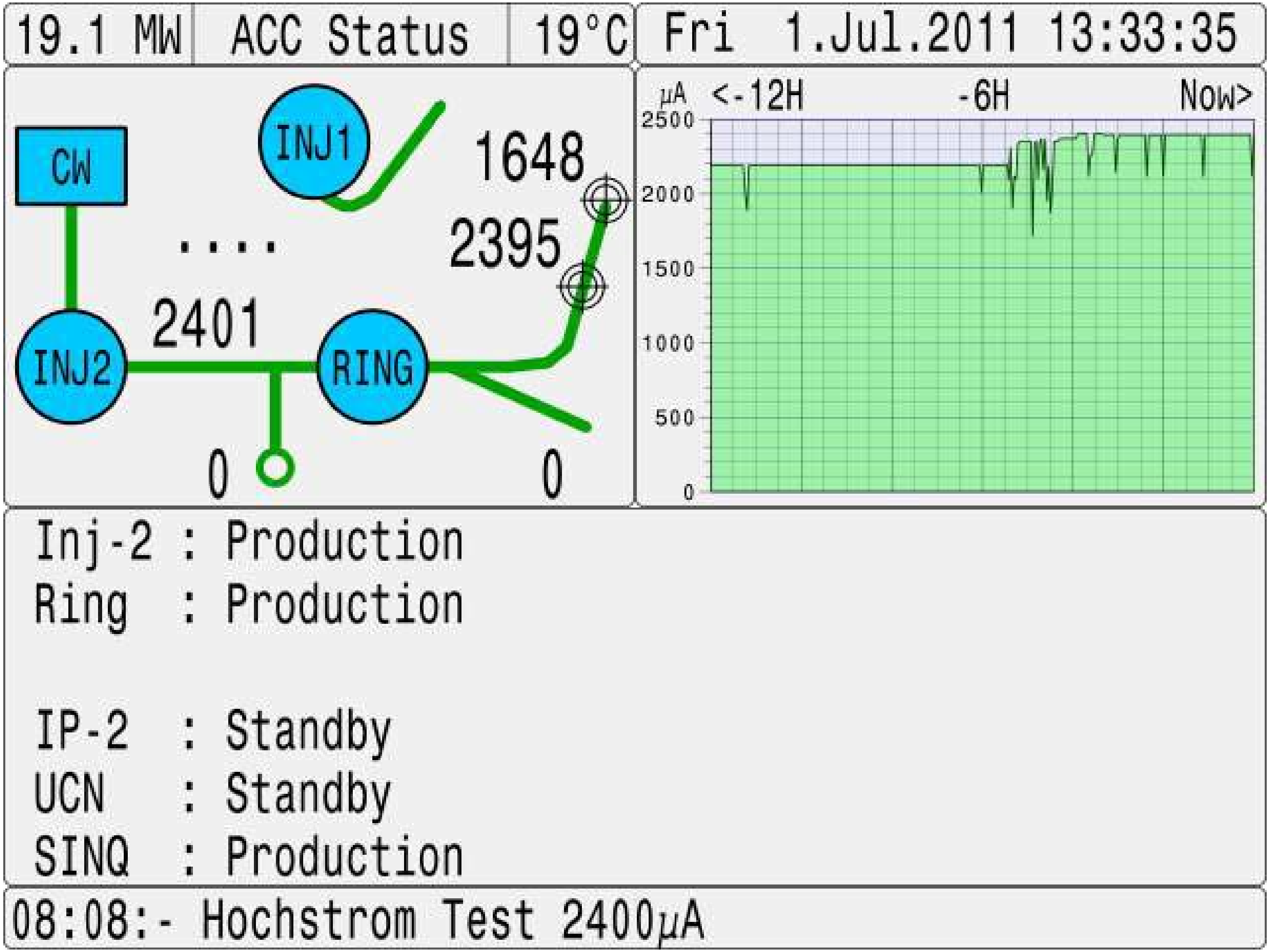
Total	**477**	**ca 500**	**2529**

PSI proton accelerator

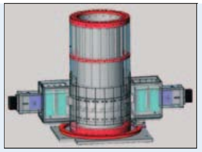
- 590 MeV cyclotron
- 50 MHz (continuous source)
- 2.2 mA, successful tests up to 2.4 mA
- 1.3 MW
- production of thermal neutron flux: approx 1.5×10^{14} n/cm^2/s

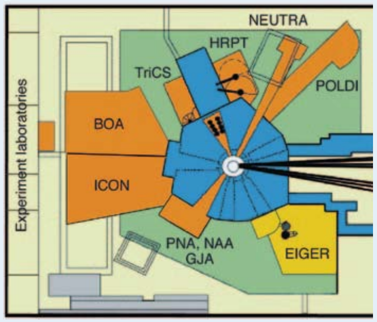


Performance accelerator



Neutron Scattering and Imaging Instruments at SINQ





Further Information: http://sinq.web.psi.ch/sinq/instruments.html

SINQ instrumentation

Full suite of modern instrumentation (cold and thermal neutrons):

- 2 SANS facilities (SANS-I, SANS-II)
- 1 reflectometer (AMOR)

- 2 powder diffractometers (HRPT, DMC)
- 1 X-tal diffractometer (TRICS)
- 1 strain scanner (POLDI)

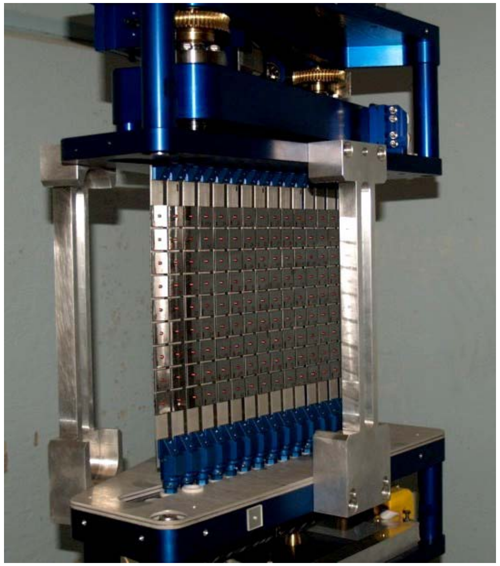
- 1 time-of-flight spectrometer (FOCUS)
- 2 triple-axis spectrometers (RITA-II, TASP)
- 1 backscattering spectrometer (MARS)

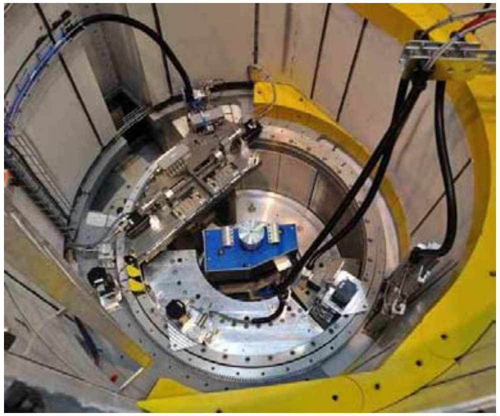
- 2 imaging/radiography beamlines (NEUTRA, ICON)

…..

- various test/adjustment facilities (MORPHEUS, BOA, ORION, NARZISS)

EIGER – The new thermal TAS at SINQ





Instrument:

primary spectrometer with virtual source and double focusing monochromator

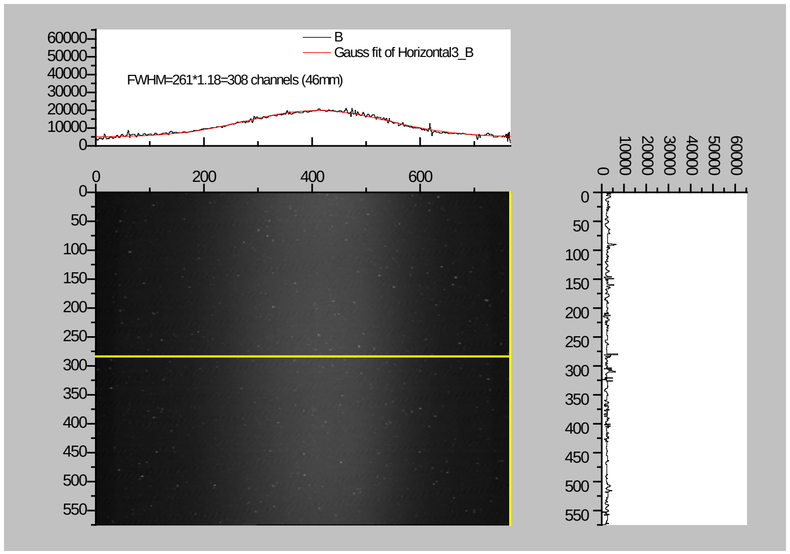
conventional secondary spectrometer with focusing analyzer and single ^{3}He- detector

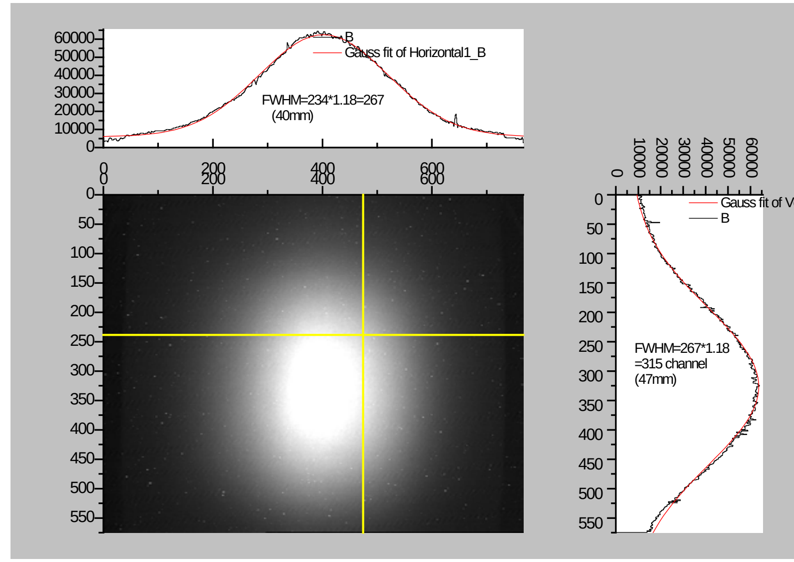
magnetic field at sample up to 15T (non-magnetic components)

Instrument responsibles:

Uwe Stuhr
Bertrand Roessli

First Tests (Nov 2011) – Monochromator Focusing

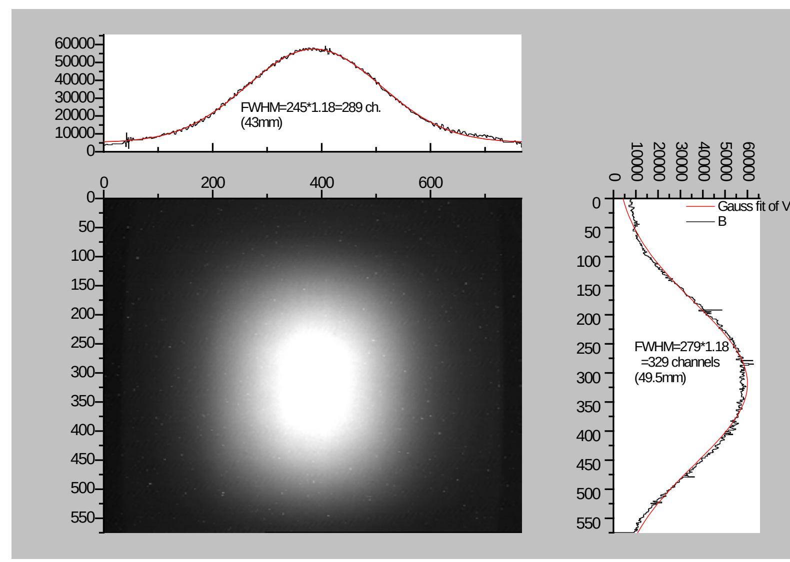




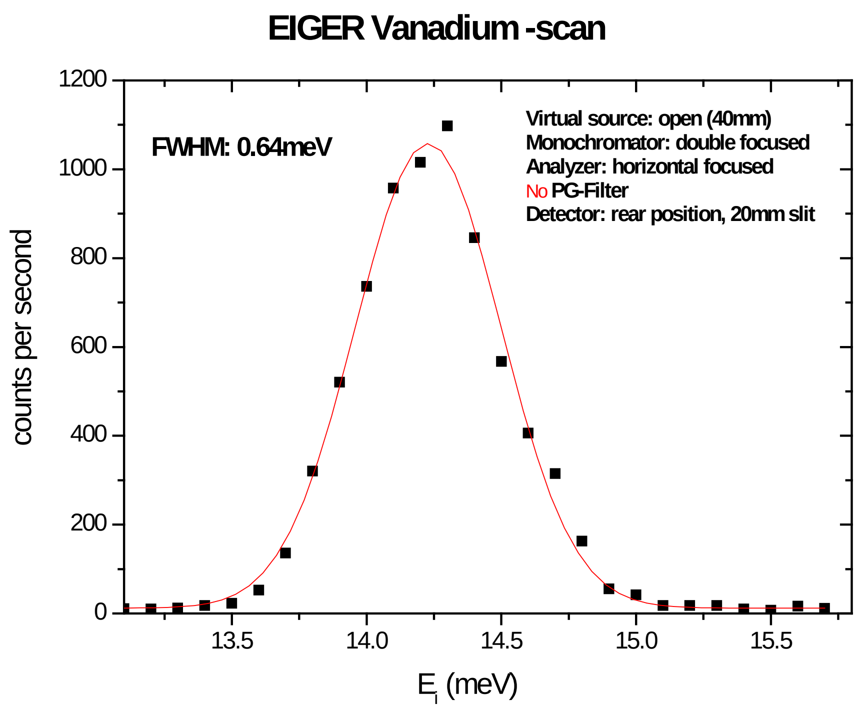
Focusing properties of the monochromator

Pictures taken with a neutron camera
at sample position

Top: horizontal and double focusing at λ=2.32Å
Right: double focusing at λ=1.2 Å



First Tests (Nov 2011) – First Spectrum



Energy resolution scan of EIGER
at 14.2 meV (Vanadium sample Ø 1cm)

Current Status:

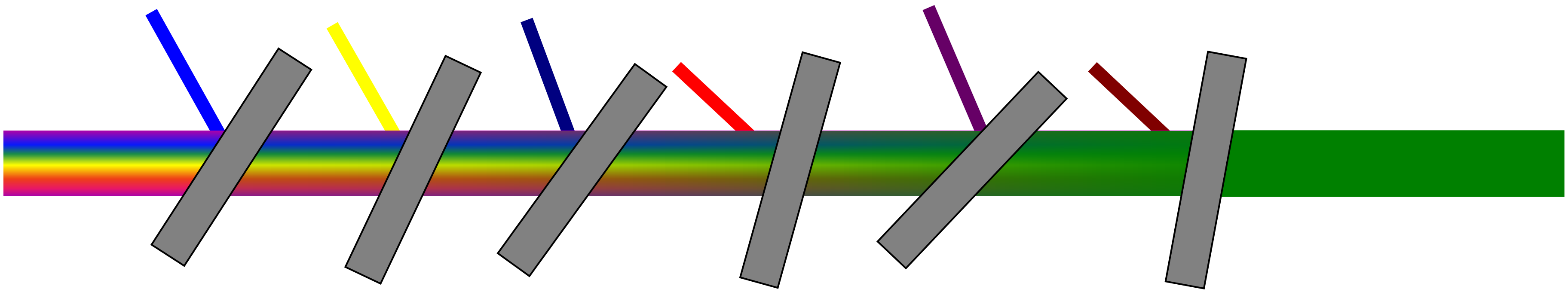
- EIGER construction is completed !
- successful first tests in Nov 2011
- good performance of the double focusing monochromator
- good energy resolution
- intensity as expected
- some improvements of the background necessary
- user service from 2013

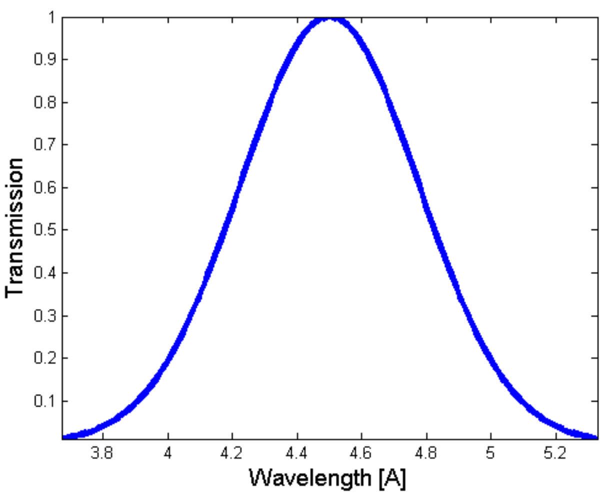
First experiments on EIGER after the shut down!

TESI: Transmission/Tamaki Energy Selective Imaging

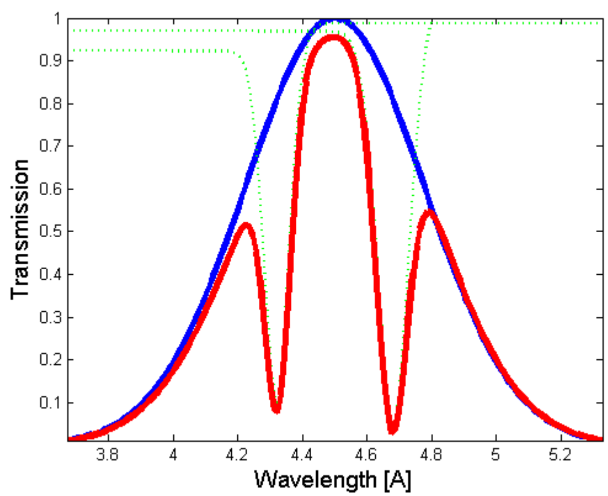
TESI working principle:

Neutrons of unwanted energies are scattered out of the direct beam by Bragg reflection at pyrolithic graphite single crystals



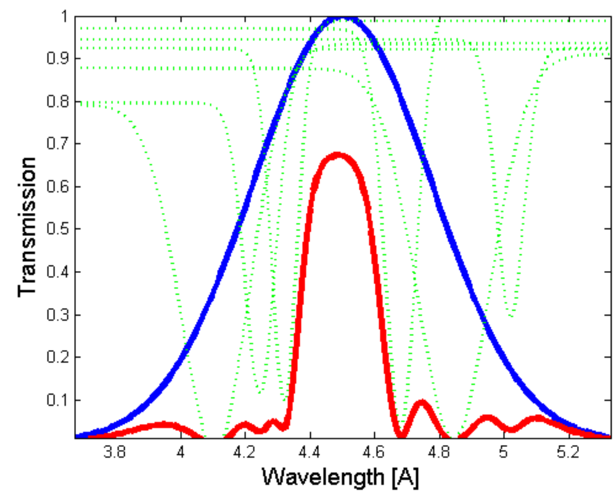


Velocity selector, Δλ/λ≈15%



Velocity selector, Δλ/λ≈15%

First crystal pair, Δλ≈0.1Å



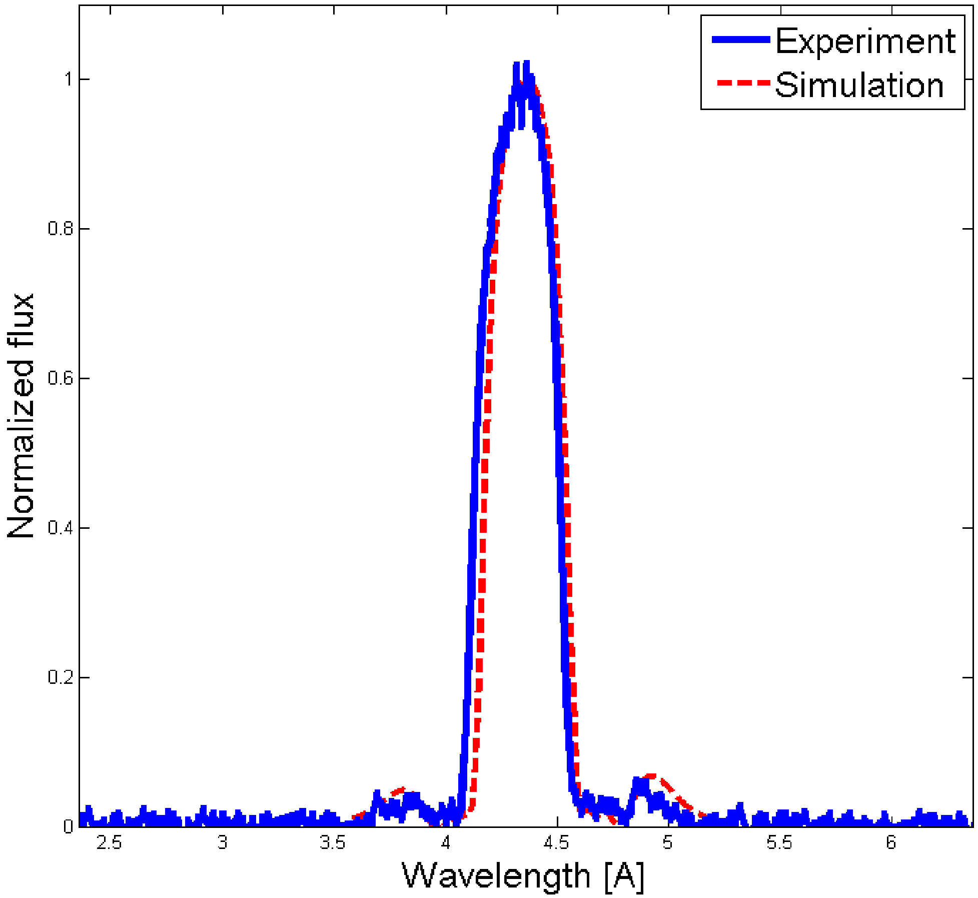
Velocity selector, Δλ/λ≈15%

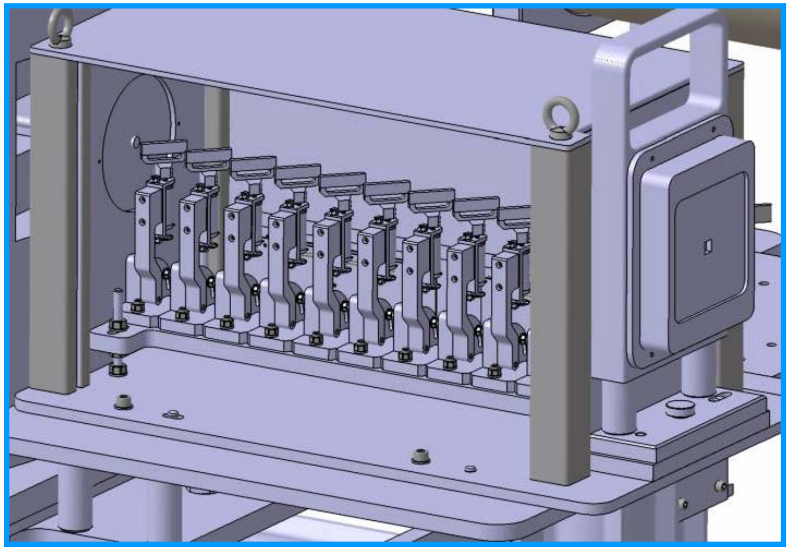
First crystal pair, Δλ≈0.1Å

Final spectrum Δλ/λ≈5%

TESI: first results @ ICON

Good agreement between simulation and time-of-flight spectral measurement !





Sample environment at SINQ

<u>Devices in user operation:</u>

- 11 closed cycle fridges
- 9 orange cryostats
- 3 dilution inserts
- 3 furnaces
- 7 cryo-magnets
- 2 electro-magnets
- 6 pressure cells

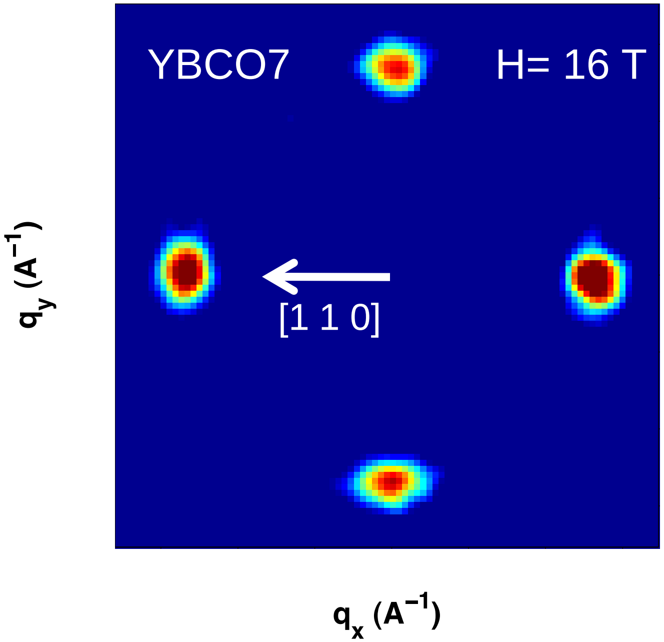
Operated by dedicated sample env group

<u>Parameter range:</u>

- 100 mK < T < 1800 K
- P < 100 kbar (Paris Edinburgh cell)
- B < 15 T (vert), B< 7 T (hor)
- SANS: B < 17 T !!

New 17T Magnet tested for Small Angle Neutron Scattering

- Superconducting solenoid (University of Birmingham, Cryogenic Ltd, EPSRC UK)
- 17 T maximum field, 10 deg opening angle
- July and Aug 2011: first experiments at SINQ (SANS-I)
- Used for hard and soft matter (HTC, fd virus)
- It will be available for future user experiments at SINQ

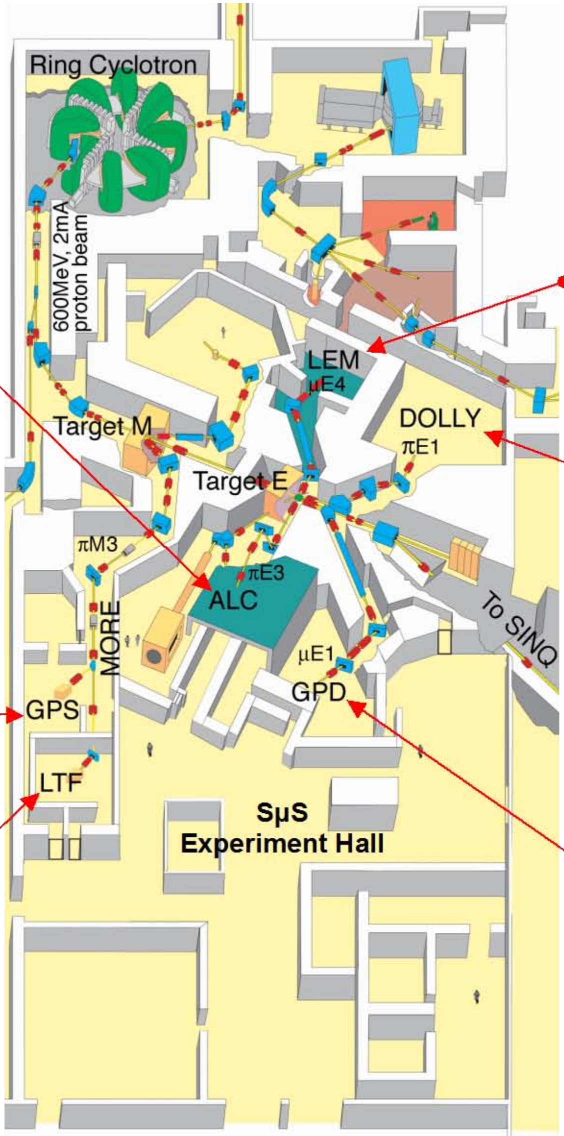


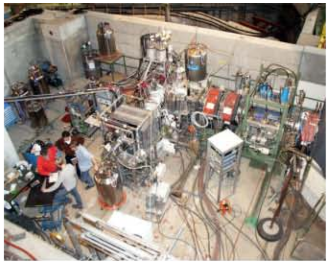
Flux lattice in a twinned YBCO7 crystal locking into a square VL at fields above 11 T (previous max field at SINQ). In an untwinned crystal (not shown) the VL moves through the square shape as a function of field.

The Swiss muon source SμS

ALC
Avoided Level Crossing
μSR Instrument
Muon energy: 4.2 MeV (μ^+)
Temperatures: 4.2 - 600 K
Magnetic Fields: 0 - 5 T

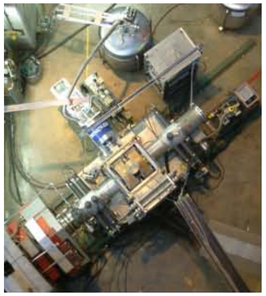
Contact: *A. Stoykov*
alexey.stoykov@psi.ch





LEM
Low Energy Muon Beam and Instrument
Tunable muon energy: 0.5 - 30 keV (μ^+)
Temperatures: 2.5 - 700 K
Magnetic fields: 0 - 0.1 T perpendicular,
0 - 0.03 T parallel to sample surface

Contact: *T. Prokscha*
Thomas.prokscha@psi.ch



GPS
General Purpose
Surface Muon Instrument
Muon energy: 4.2 MeV (μ^+)
Temperatures: 1.8 - 900 K
Magnetic Fields: 0 - 0.6 T
Muons on Request (MORE)

Contact: *A. Amato*
alex.amato@psi.ch

DOLLY
General Purpose
Surface Muon Instrument
Muon energy: 4.2 MeV (μ^+)
Temperatures: 1.8 - 900 K
Magnetic fields: 0 - 0.5 T

Contact: *R. Scheuermann*
robert.scheuermann@psi.ch

Shared Beam Surface Muon Facility

LTF
Low Temperature Facility
Muon energy: 4.2 MeV (μ^+)
Temperatures: 10 mK - 4.2 K
Magnetic fields: 0 - 3 T
Muons on Request (MORE)

Contact: *C. Baines*
chris.baines@psi.ch

GPD
General Purpose
Decay Channel Instrument
Muon energy: 5 - 60 MeV
(μ^+ or μ^-)
Temperatures: 2 - 500 K
Magnetic Fields: 0 - 0.5 T

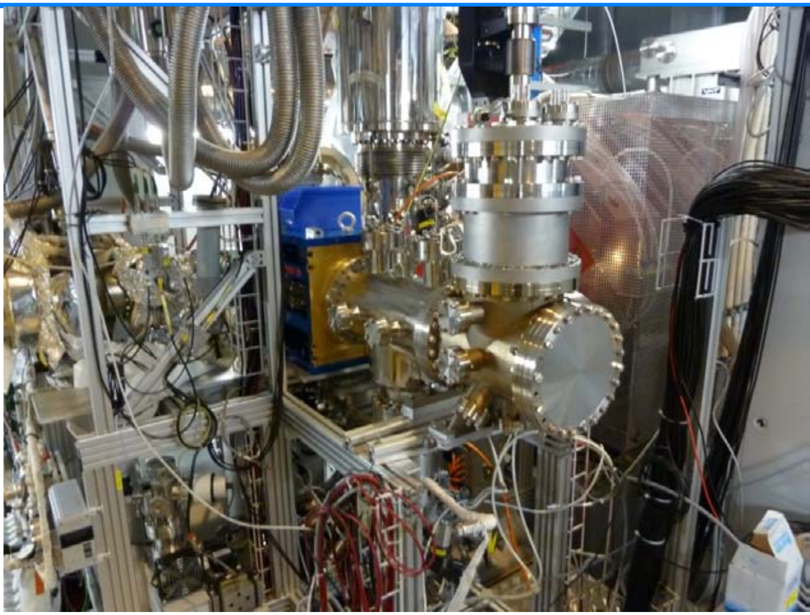
Contact: *R. Khasanov*
Rustem.khasanov@psi.ch

SµS instruments in user operation

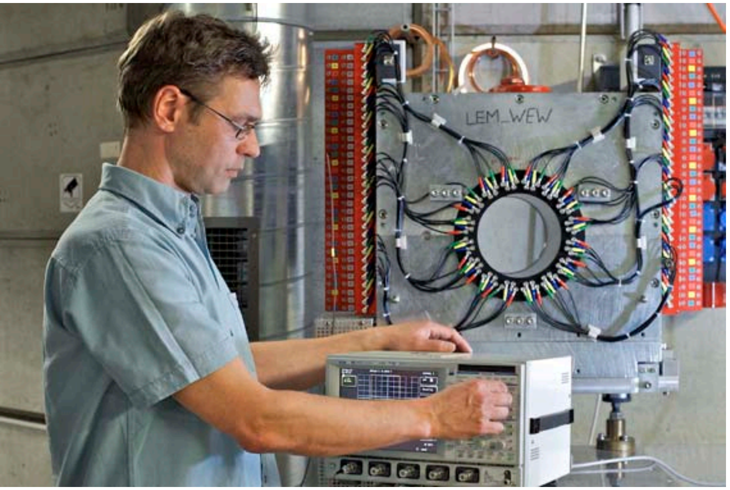
Overview SµS instruments

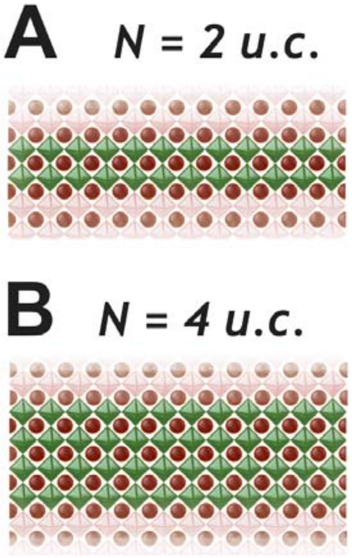
name	purpose	muon energy	T-range	B-field	contact
GPS	General purpose surface muon instrument	4.2 MeV	1.8-1200 K	0-0.6 T	A. Amato
GPD	General purpose decay channel instrument	5-60 MeV	0.3-500 K	0-0.5 T	R. Khasanov
LEM	Low energy muon instrument	0.5-30 keV	2.5-400 K	0-0.3 T	T. Prokscha
ALC	Avoided level crossing instrument	4.2 MeV	4.2-500 K	0-5 T	K. Sedlak
LTF	Low temperature facility	4.2 MeV	10 mK - 4.2 K	0-3 T	C. Baines
DOLLY	General purpose surface muon instrument	4.2 MeV	0.3-300 K	0-0.5 T	R. Scheuermann

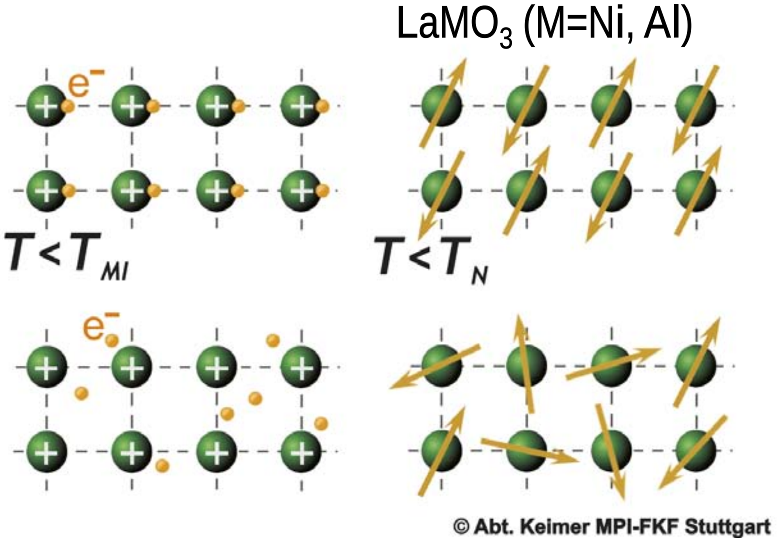
Unique: Low energy muon instrument - LEM



- tunable muon energies of 0.5 – 30 keV
- allows for the implantation of muons at small and controllable depths
- implantation depth: a few nm – several 100 nm





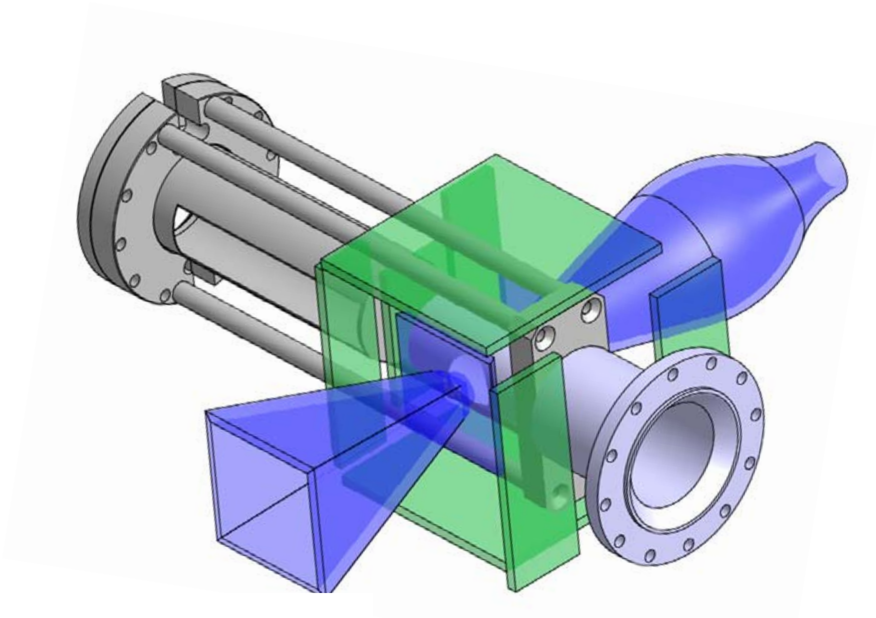


A. Boris et al, Science 332, 937 (2011), NMI3 funded !

Plans for upgrades 2012

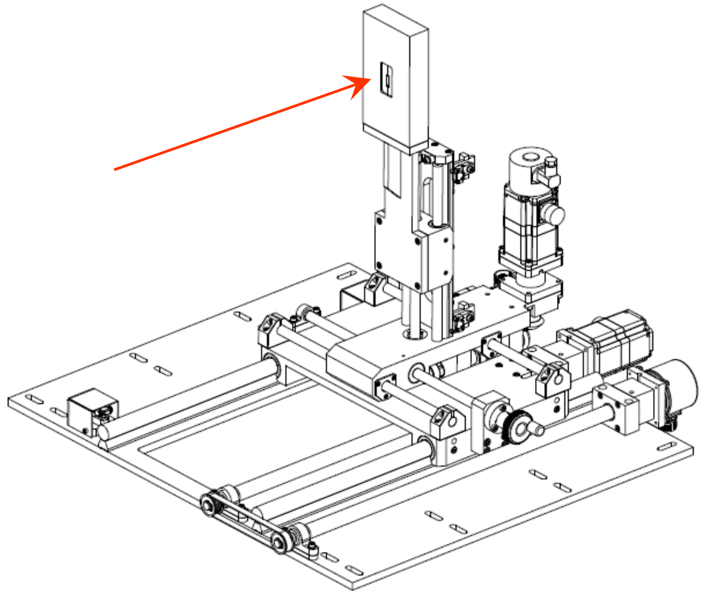
GPS:

- Design of new APDs-based detectors (→ 2013) with Right/Left detectors
- Replacement of old WED & WEP coils (commissioning; installation: next shutdown)
- Replacement of some magnets power supplies (Septum, Spin Rotator, Steering Magnets)
- Remote control of vacuum components



GPD:

- New collimator I (beginning of beamtime?)
- Automatic He-flow control for Variox cryostat
- EPICS control of the beamline power supplies

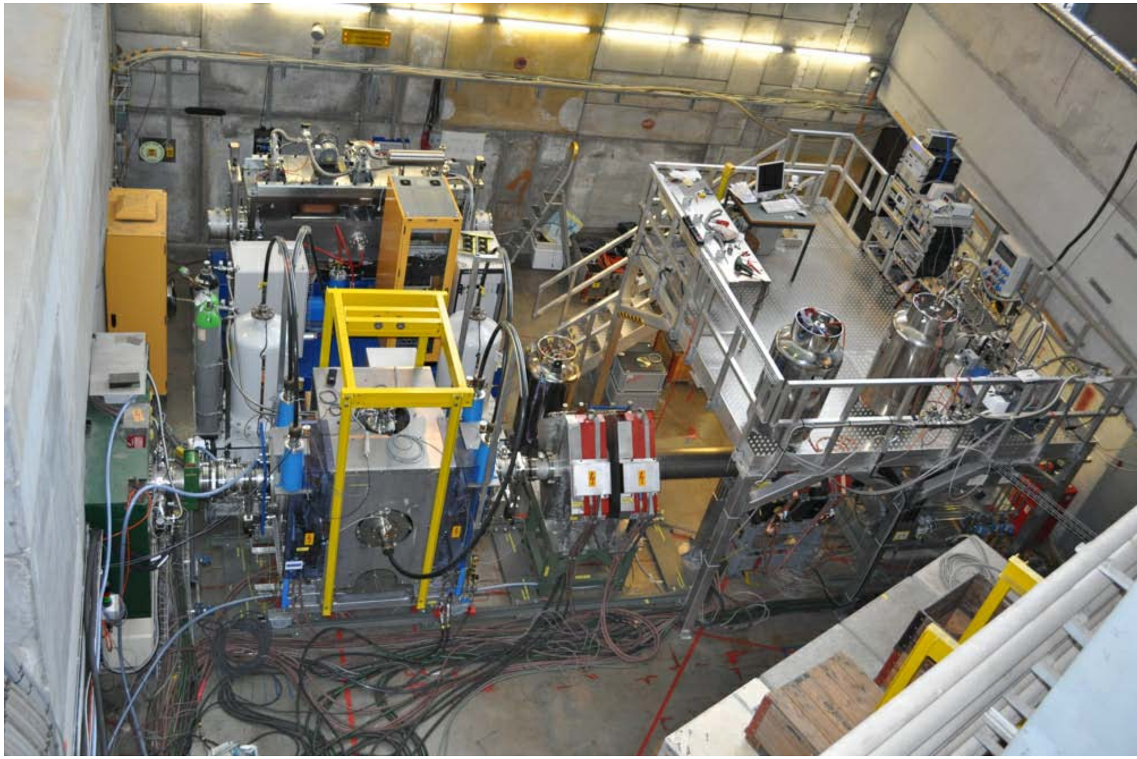


Plans 2012

DOLLY:
Dolly shares a beam area with particle physics experiments.

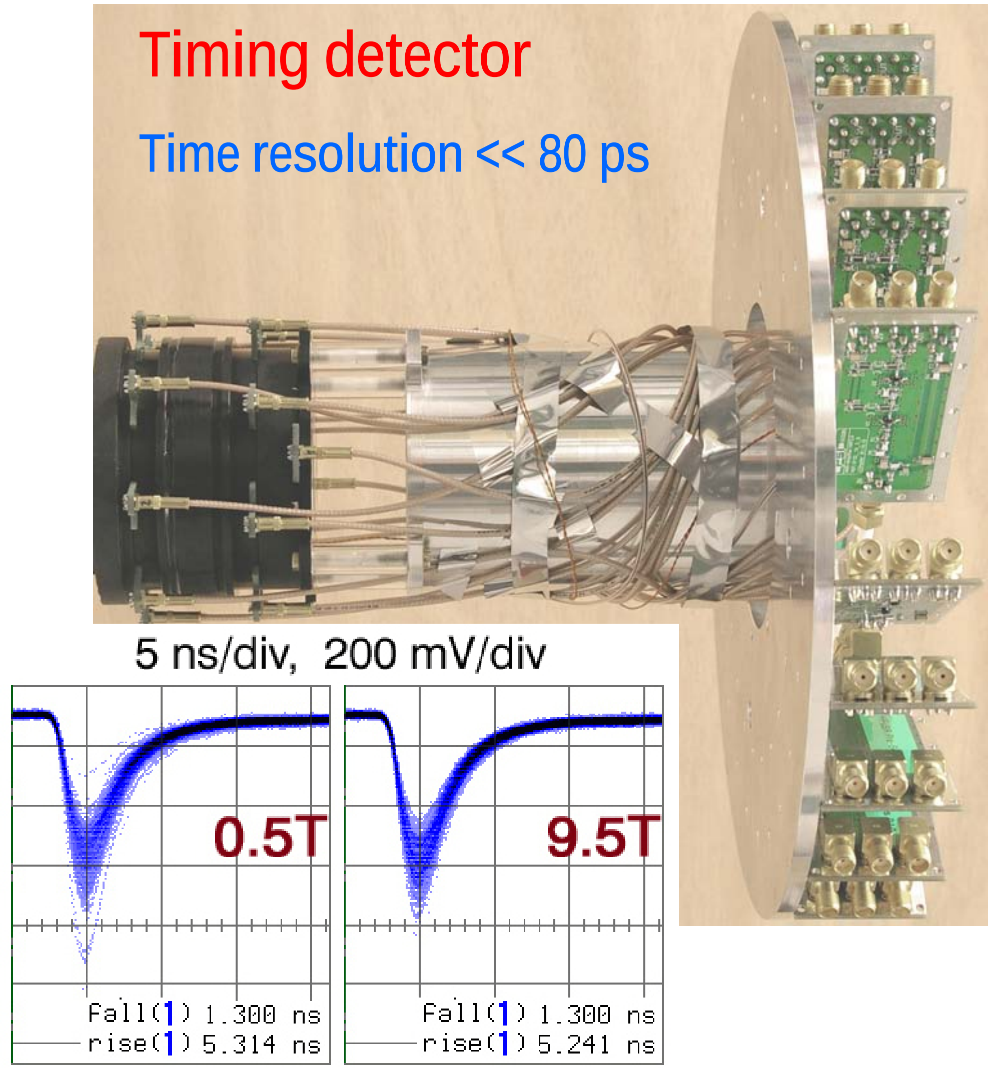
Big manpower investment to build/rebuild instrument with beam line.

Beam area redesign allows permanent installation of Dolly (under study)



New instrument: High Field μSR 9.5 T, ~20mK

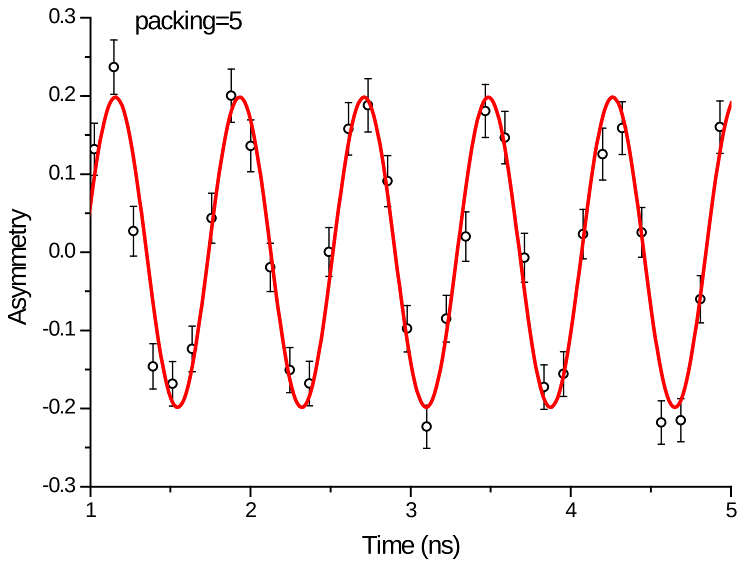
9.5 T with recondensing system
(10 ppm field homogeneity)

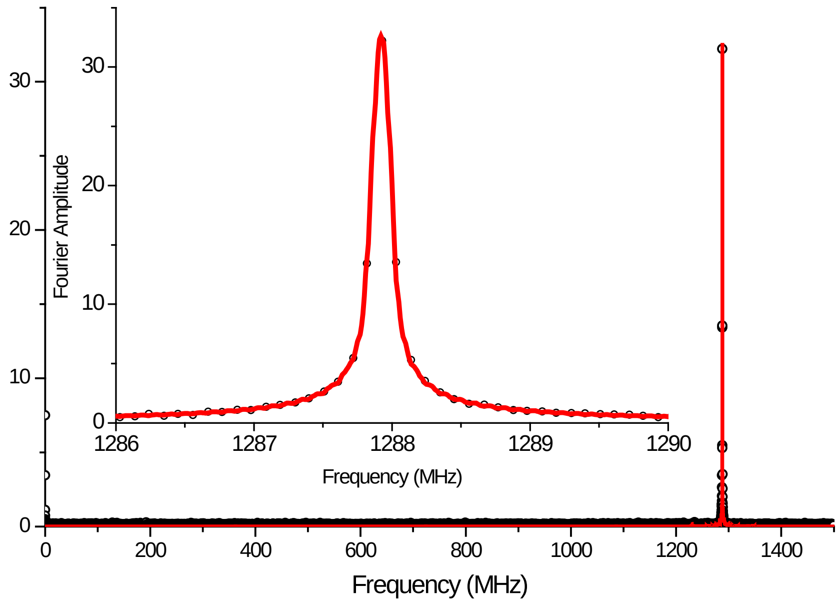


No change in performance up to 9.5 Tesla !

First Data at 9.5T on Ag sample (2011)

(sample 12×12×1mm³, collimator ∅5mm)





Fit parameters:

freq = (1287.9222 ± 0.0002) MHz

asym = (0.1985 ± 0.0004)

sigma = (0.069 ± 0.002) μs^{-1}

homogeneity: ΔB=0.08 mT (8.4ppm)

42° spin rotation (P_μ=67%)

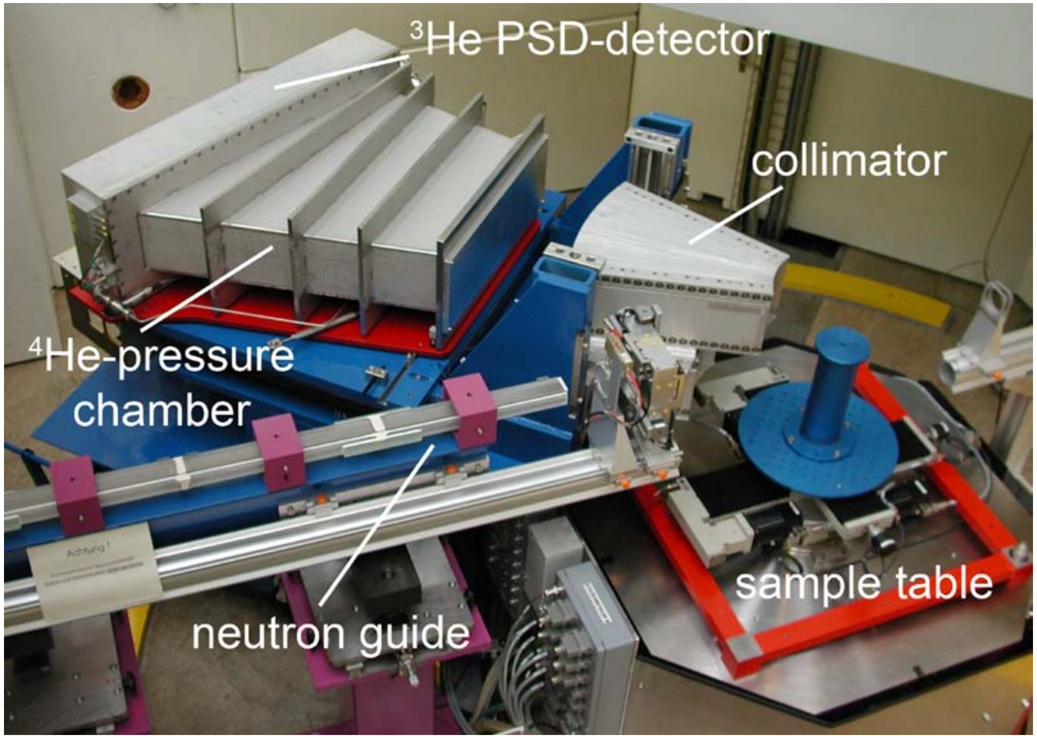
⇒ full asym at 9.5T = 0.3

NMI3-II @ PSI

- **Access to SINQ (262 days)**
- **Access to SμS (123 days)**
- **JRA neutron imaging**
- **JRA muons**
- **Networking activity: integrated user access**

Thanks for your attention … !!

Multiple Pulse Overlap TOF Diffractometer



- neutron flux at sample position 6×10^6 n cm^{-2} s^{-1}
- resolution ($\Delta Q/Q$) between 1×10^{-3} and 2×10^{-3}
- maximum neutron beam size 2.5mm x 30mm
- Minimum gauge volume: 0.6mm x 0.6 - 30mm

- New disk chopper – magnetic bearings – 21.000 rpm
- new biaxial tensile-compression-torsion machine
  for in-situ testing, combined with 1200 C furnace