



Wir schaffen Wissen – heute für morgen

**Paul Scherrer Institut**

Martin A. Zimmermann

**Current NES Status**

**NES präsentiert, 27.03.2014**

1. Administrative matters
2. NES organization and numbers
3. Context for NES strategy
4. NES Mission
5. NES Strategy, Hotlab
6. New NES projects

09:00	Begrüßung und Einführung	<i>M. Zimmermann</i>
09:30	Reaktorphysik und Systemverhalten	<i>A. Pautz</i>
10:15	<i>Kaffeepause</i>	
10:30	Thermohydraulik	<i>H.-M. Prasser</i>
11:15	Hotlabor	<i>D. Gavillet</i>
11:45	<i>Mittagessen</i>	<i>OASE</i>
13:15	Nukleare Materialien	<i>H.-P. Seifert</i>
14:00	Endlagersicherheit	<i>S. Churakov</i>
14:45	<i>Kaffeepause</i>	
15:00	Energiesystemanalysen	<i>S. Hirschberg</i>
15:45	Schlussbetrachtungen und Verabschiedung	<i>M. Zimmermann</i>
16:15	Ende der Veranstaltung	

Für externe Besucher wird ein Bon für das Mittagessen abgegeben.

Bei Kaffeepausen gilt Selbstbedienung.

Die Präsentationen stehen als PDF ab nächster Woche zur Verfügung:

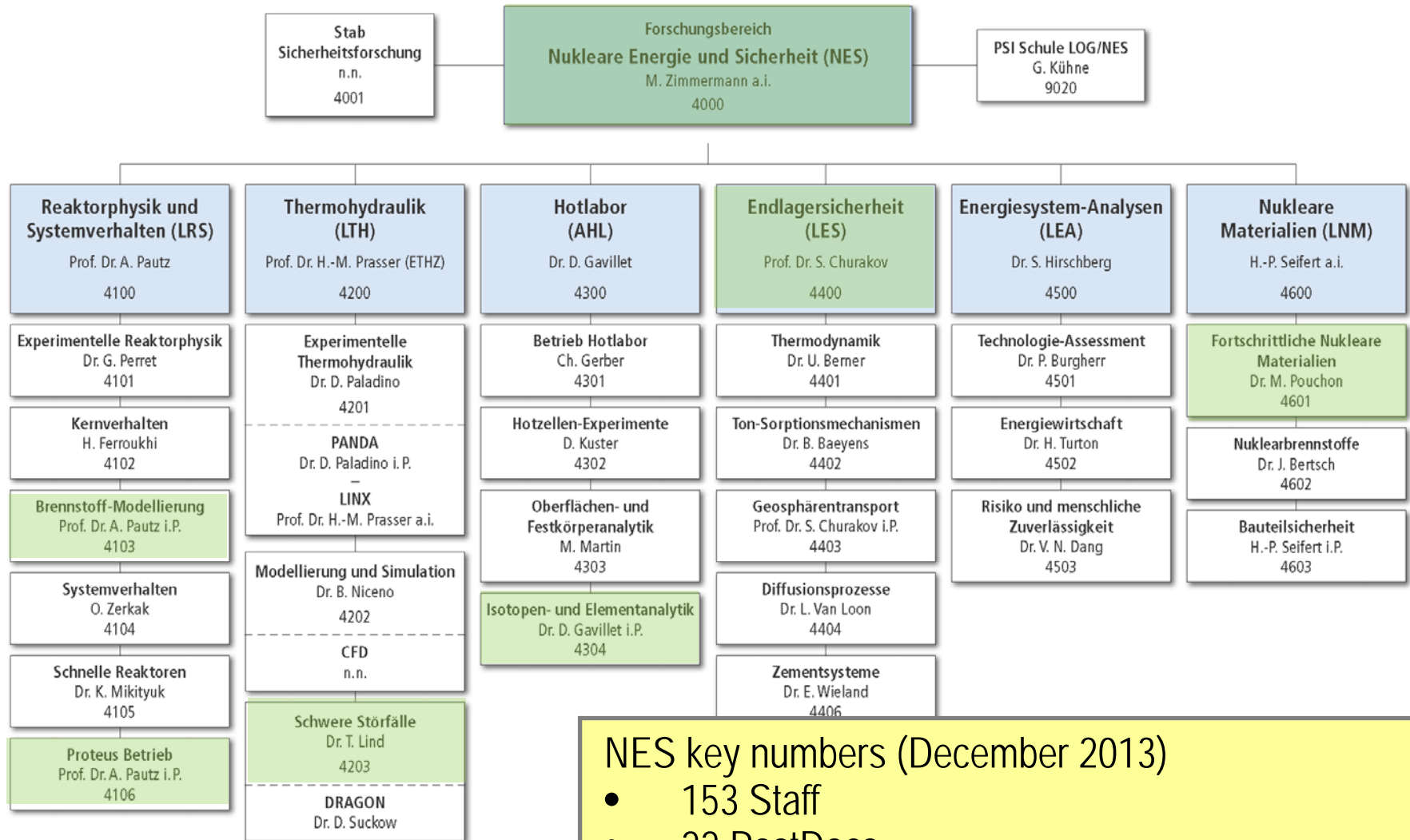
<http://nes.web.psi.ch/events/index.html>

Update on situation at NES

Presentation of capabilities available NES

- Holistic overview: Not restricted to either ENSI, swissnuclear or other partners

Showing selected highlights from the labs/projects



## NES key numbers (December 2013)

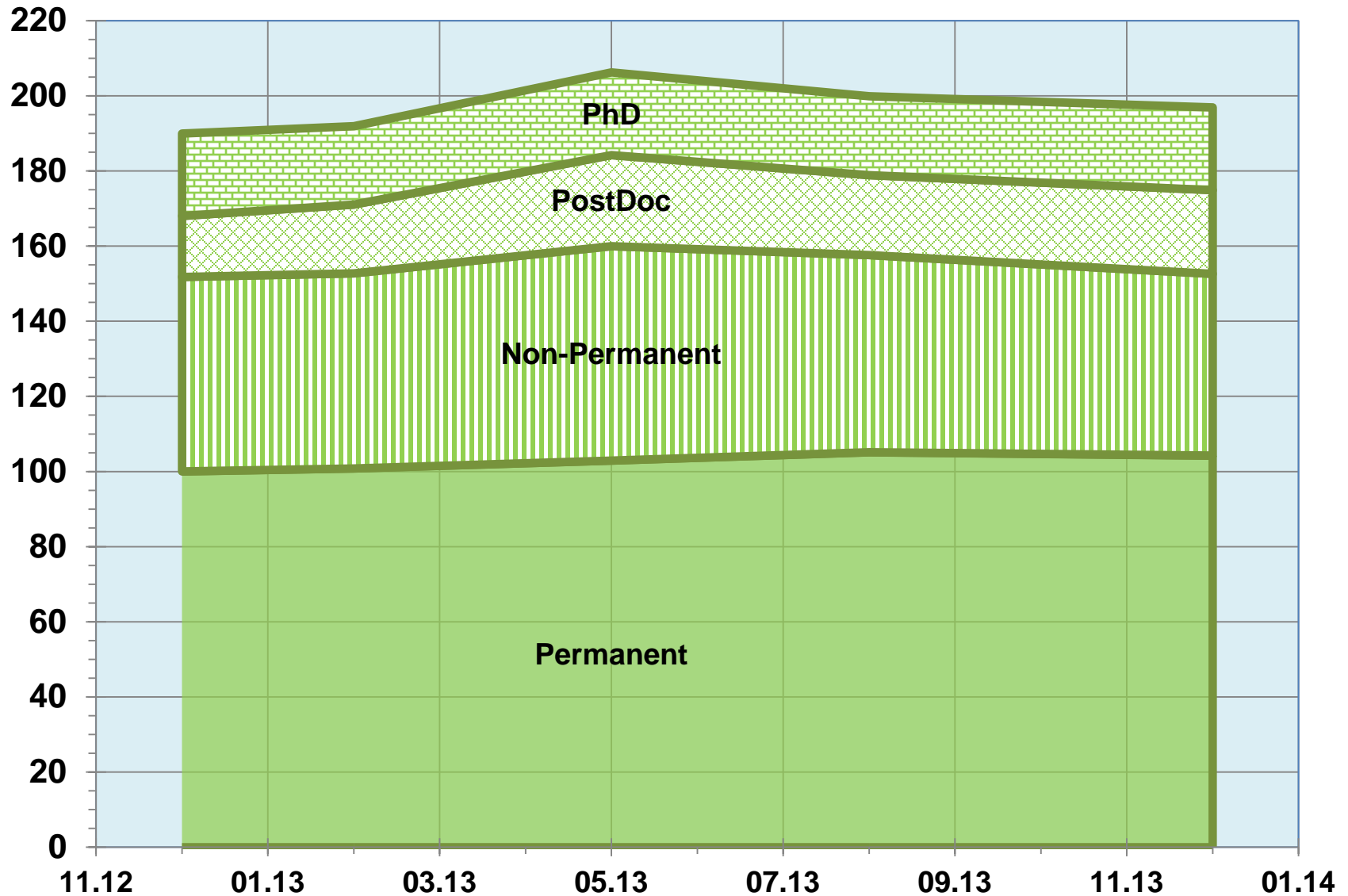
- 153 Staff
- 22 PostDocs
- 22 PhDs
- Salaries: 26 MCHF, 46% PSI / 54% external

## New leadership

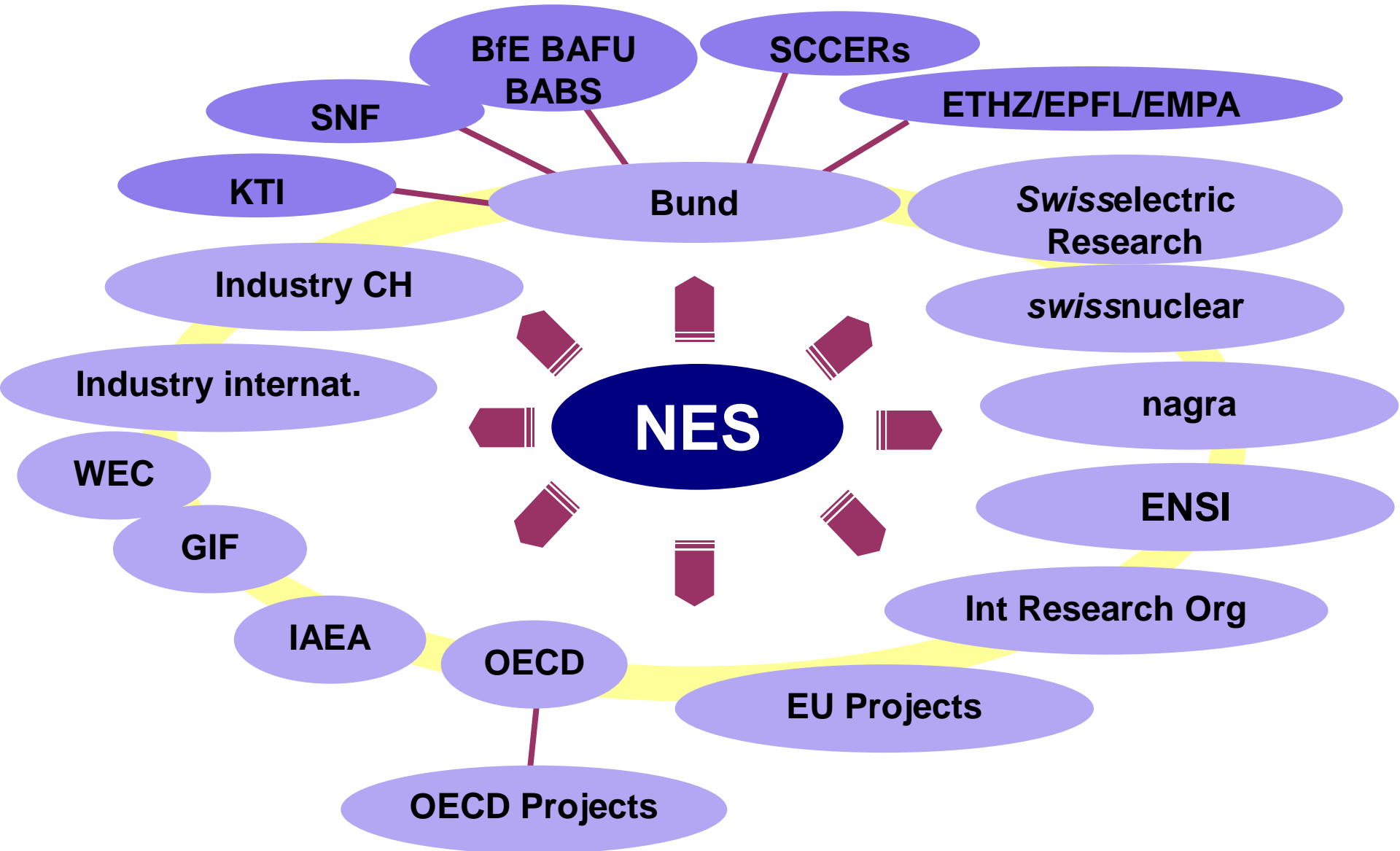
- Prof. Sergey Churakov (UniBE – NES/LES) (successor Dr. M. Bradbury)
- New head for Nuclear Materials (NES/LNM) in progress
- Dr. Marco Streit as GL for Isotopic and elemental Analysis (IEA/AHL)

## New Controller (as of April 1)

- Mrs. Margarita Engroñat







1. Introduction
2. NES organization and numbers
3. Relevant context for NES strategy
4. NES Mission
5. Building the NES strategy
6. NES Strategy, Hotlab
7. Abandoned activities, new activities
8. New NES projects
9. Outlook and Summary

- No replacement of the five nuclear power plants at the end of their operational life
- Shutdown of KKM in 2019 (or before?)
- Current debate: what will determine the life-time of Swiss NPPs ?
  - Safety → Economics
  - Political decisions
  - ...
- New Energy policy: efficiency, renewable energies, combined heat and power, (gas fired) large power plants, (imports) if necessary
- “New” nuclear technology: **“Zero Risk, Zero Waste”**

## Prioritären Schwerpunkte des Aktionsplans „Koordinierte Energieforschung Schweiz“ :

- **Sicherheitsforschung**
- **Strahlenschutz**
- **Bewirtschaftung radioaktiver Abfälle**
- **Betrieb und Rückbau der bestehenden Anlagen** (neue Verfahren, Komponenten, Systeme usw.),
- **technische Kompetenzen im Bereich der nuklearen Wissenschaften** („technology monitoring“)
- **Ausbildung von Fachleuten** aus dem Bereich des Ingenieurwesens, der Physik und der Technik.

Besonders wichtig:

- Ausbildung eines qualifizierten wissenschaftlichen und technischen Nachwuchses

Aber auch

- **Definition und Umsetzung von geeigneten Massnahmen, um Personalabgänge zur Vermeidung von Kompetenzverlusten aus bereits in Bearbeitung befindlichen Forschungsschwerpunkten**

From nuclear renaissance to phase-out

## **Maintain Nuclear Competence**

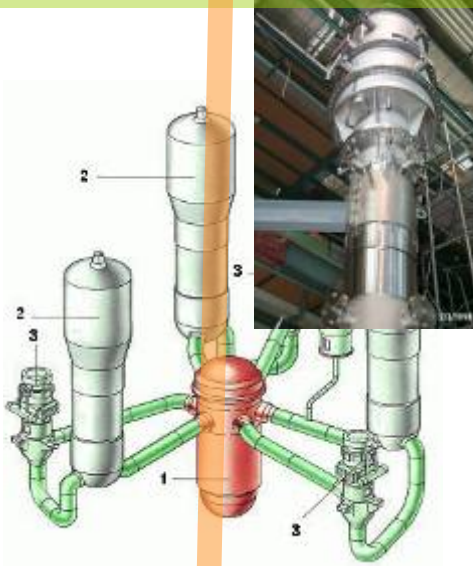
Monitoring of technologies

**Waste management**

**Nuclear Education**

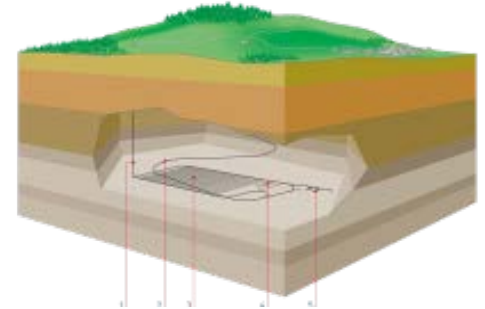
## Safety

Understanding/modeling relevant phenomena  
Normal Operation ... Severe Accidents  
Monitoring material integrity



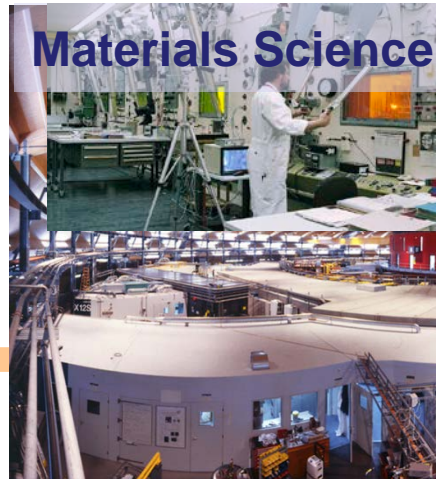
## Waste Management

Quantifying radionuclides retention  
Ascertaining safety of final repository



## Education

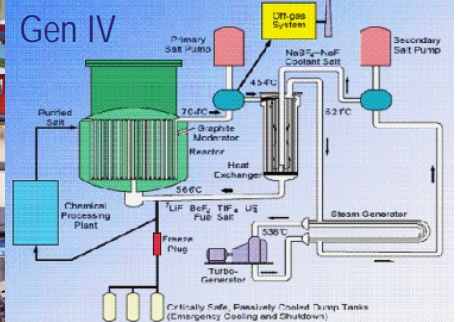
## Materials Science



## New Technologies

Reduced risk - Reduced waste

### Gen IV



- Safety orientation
  - Consideration of **nuclear SYSTEMS** and **Wastes**
- Nuclear education
- Necessary scientific / technical fields
  - Neutronics (core criticality and neutronic feedback evaluation)
  - Single / Two-Phase Thermal-hydraulics (systems, core, components)
  - Severe Accidents
  - HRA, PSA
  - Handling of active materials
  - Nuclear Materials Behavior (-> aging)
  - Waste management



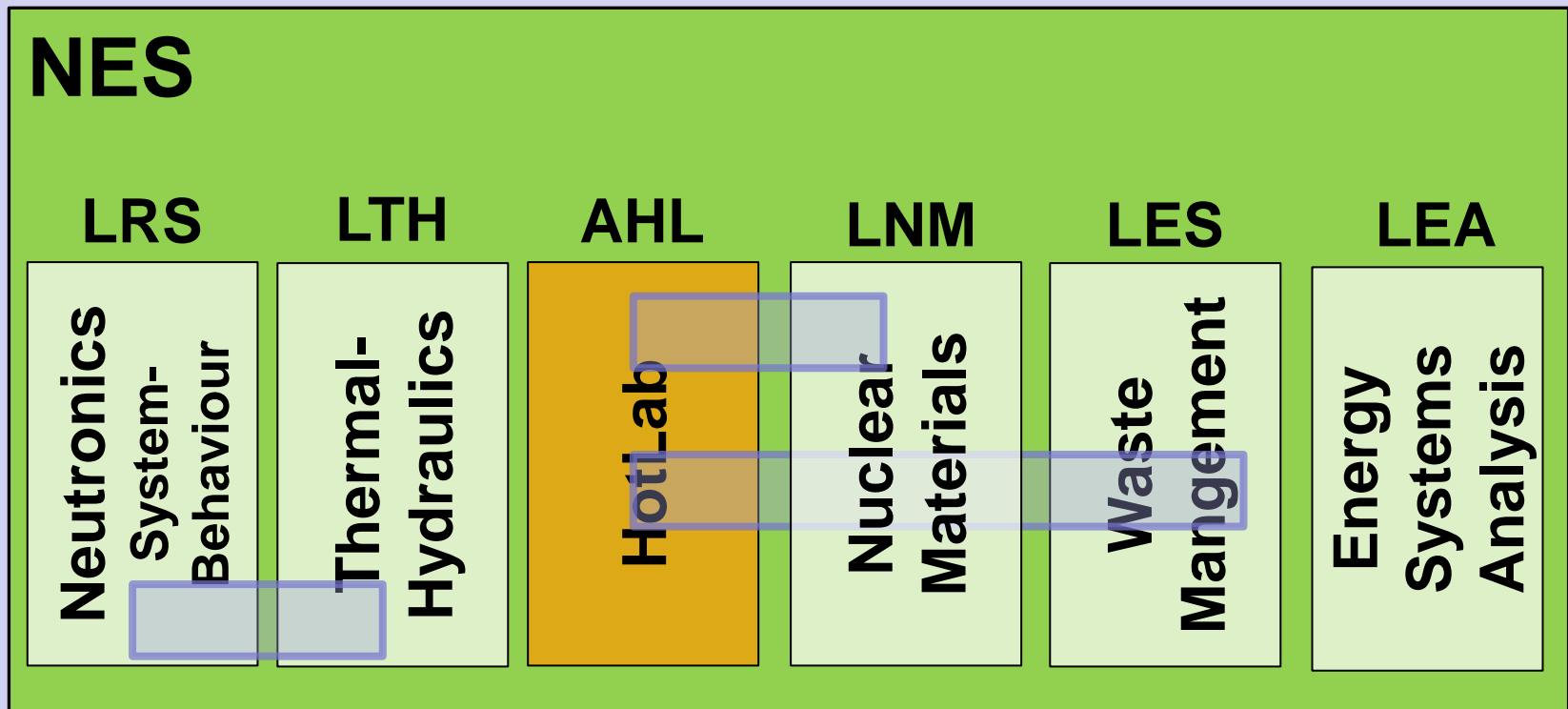
Waste Management

Maintain Nuclear Competence

→ Safety orientation

Hotlab facility of strategic importance

Monitoring Swiss Energy Policy



## LRS

Neutronics for reactor applications

Safety Assessment (DBA) for thermal and fast systems

## LTH

Severe Accidents

Containment  
Thermal-fluid-dynamics

## AHL

Scientific services for CH NPPs

Investigations of radioactive materials

Pu Handling (Until 2016)

## LES

Geochemistry of radionuclides

Multi-scale contaminant transport

Scientific basis for the safety assessment

## LEA

PSA & HRA

Interdisciplinary  
Technology Assessment

Energy-economic modeling

## LNM

Material ageing & life time assessment

LWR core materials Safety and Performance

Radiation damage assessment

PIE and failure analysis

1. Contribute to the current state-of-technology in the NES technical domains for thermal and fast systems
  - Maintain international competitiveness Participate in international initiatives (H2020, OECD/NEA, ETSO, ...)
  - Monitor evolving new technology
2. Maintain capability of handling and foster investigation of radioactive materials
3. Create a “project of the future” (Zukunftsprojekt) to integrate the technical domains into a comprehensive design project (involving “students”) aiming at “Zero Risk, Zero Waste”

4. Foster linking of NES materials research with PSI large user facilities (SLS, SINQ) to exploit outstanding research opportunities arising from the availability of burned fuel samples
5. Explore application of NES expertise to decommissioning
6. Manage governance issues
  - Independence
  - Conflict of Interest
7. Foster Nuclear Education by substantially contributing to the Swiss Nuclear Master Program and other programs
8. Adjust funding structure to gain more freedom of research
9. Apply NES competencies in neighboring fields

Waste Management

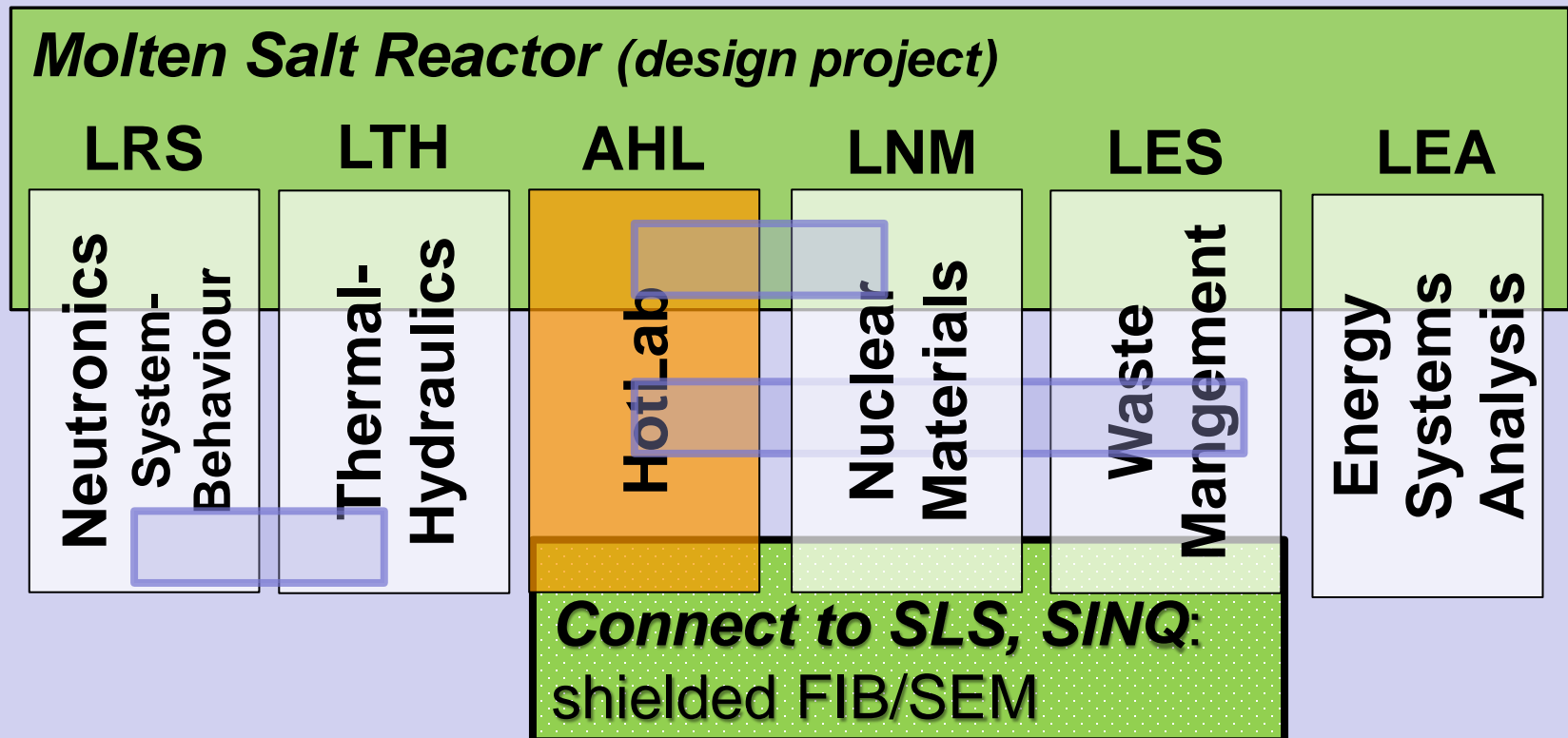
Maintain Nuclear Competence

→ Safety orientation

Hotlab facility of strategic importance

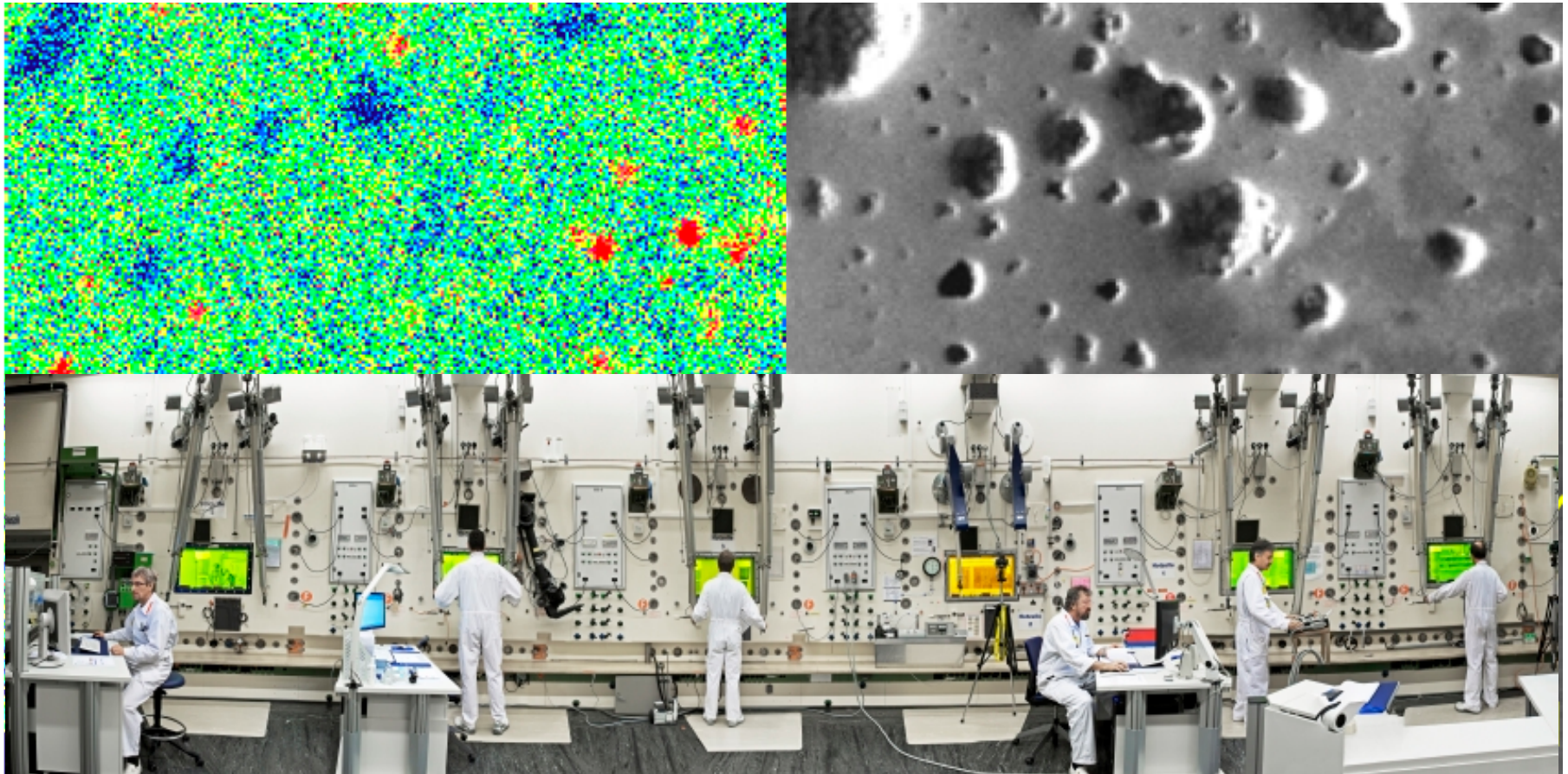
→ Connect to PSI large infrastructure (SLS, SINQ, ...)

Monitoring Swiss Energy Policy

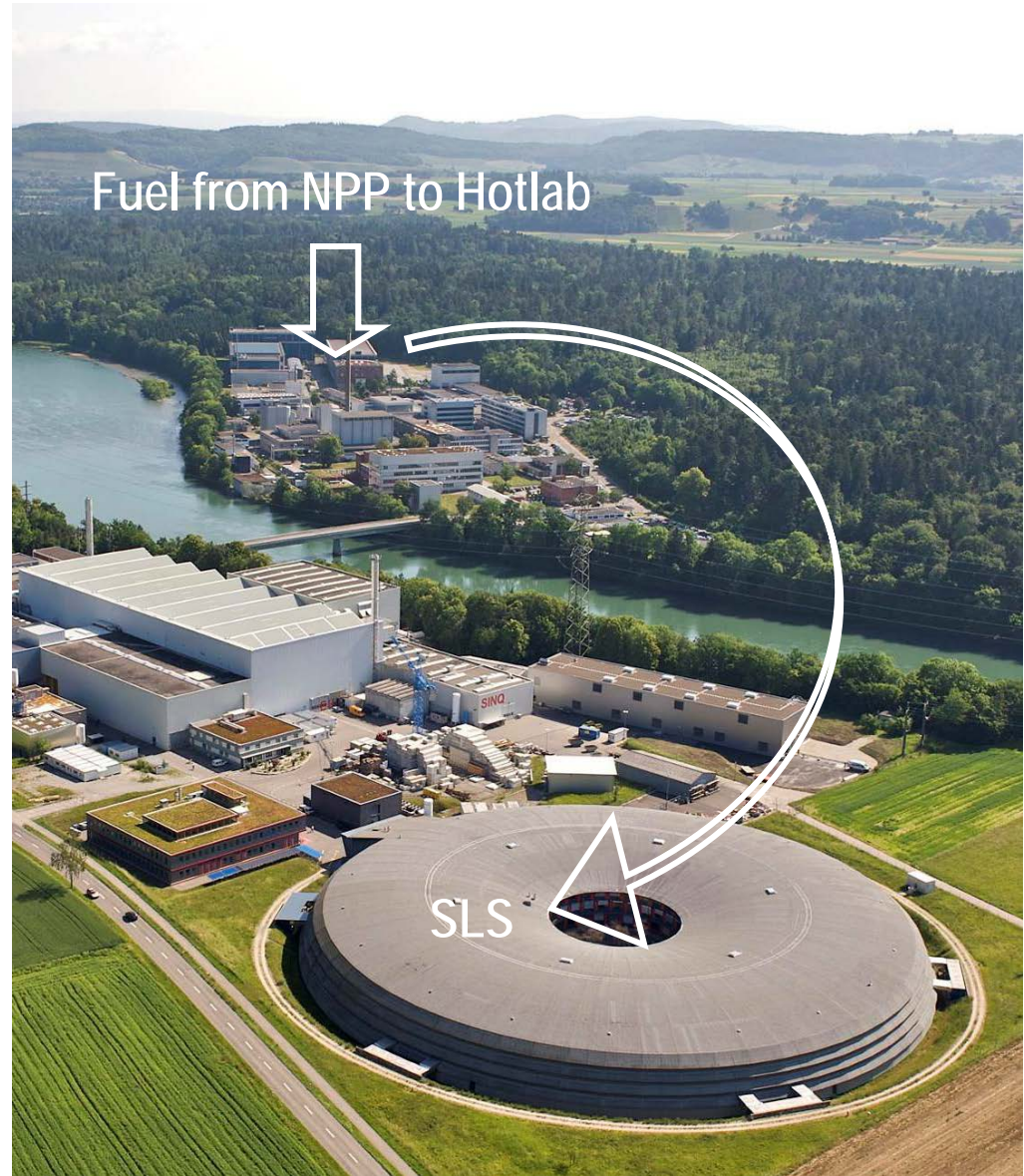


## Hotlab remains facility of high strategic relevance for NES

- Handling of active materials
- PIE of burned fuel → Swiss NPPs



Hotlab necessary for preparation of active micro-samples to be investigated at large user facilities at PSI-West (SLS, SINQ, ..)



Waste Management

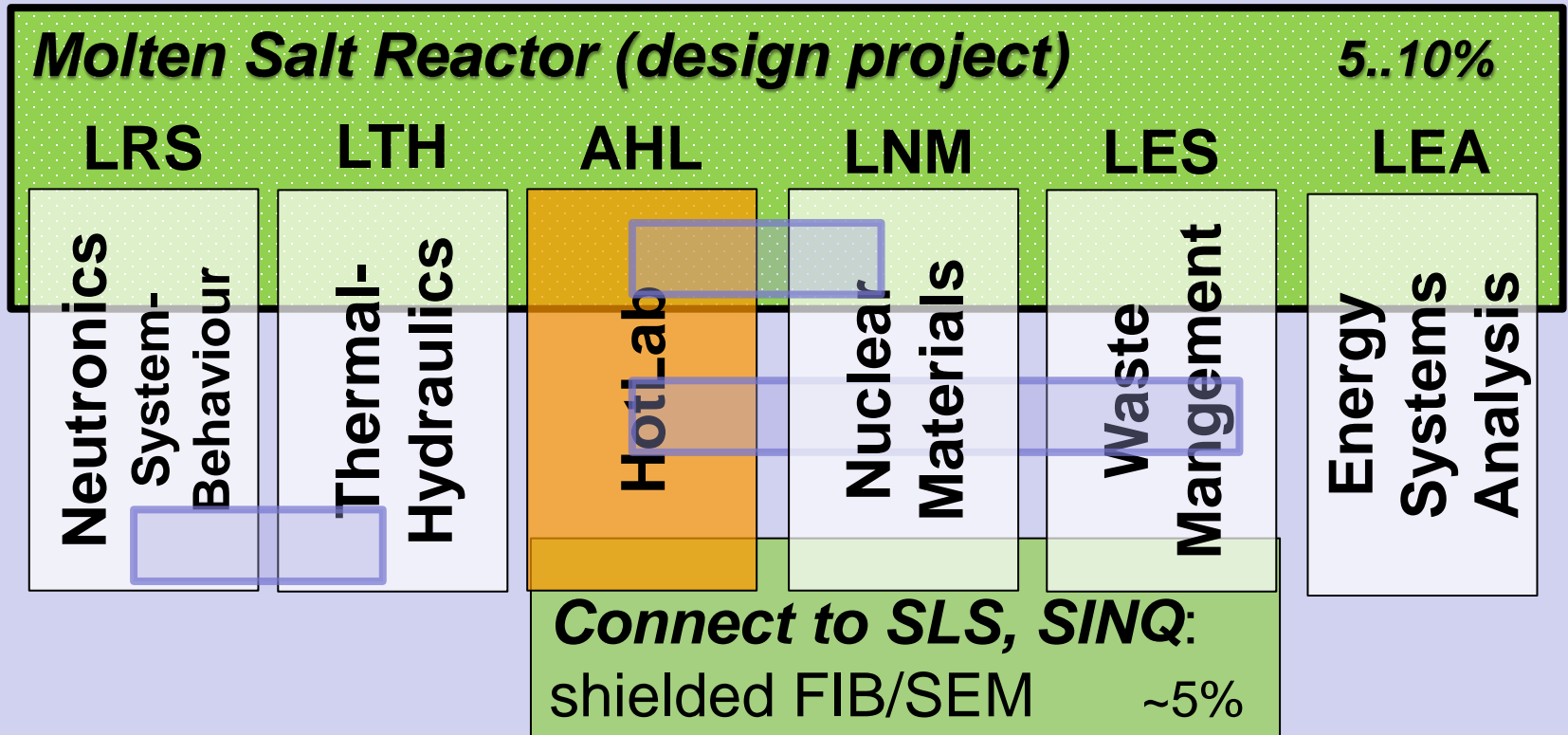
Maintain Nuclear Competence

→ Safety orientation

Hotlab facility of strategic importance

→ Connect to PSI large infrastructure (SLS, SINQ, ...)

Monitoring Swiss Energy Policy





- Has a significant ***system design component***  
(including design for integral safety)
- Supports a wide range of topics for MSc- and PhD-thesis projects
- Provides for innovative (NEW) topics with broad perspective for NES collaborators
- Addresses safety issues in an integral manner
- Allows for contributions from ALL NES labs
- Offers opportunities for international cooperation
- Not a Gen-III system

- MSR is a substantially different reactor concept compared to the ones already studied in NES
  - Allows for rethinking nuclear energy generation
  - Possibility of «crazy ideas»?
- Contributions from all labs possible
- Fast, thermal, as well as intermediate spectrum possible
- Good system to explore «zero risk, zero waste»
- Kernel of expertise already available in LRS and elsewhere in NES