EPFL-ETHZ-PSI Master Program in Nuclear Engineering

Journée d'Accueil EPFL, 09/06/2024

- General information about the program
- A word from our industrial partners
- Tour of CROCUS
- Apéro by the lake

Mathieu Hursin
Deputy Head LRS

École polytechnique fédérale de Lausanne

Master Program “Nuclear Engineering”: People in Charge

Annalisa Manera
Reactor Technology

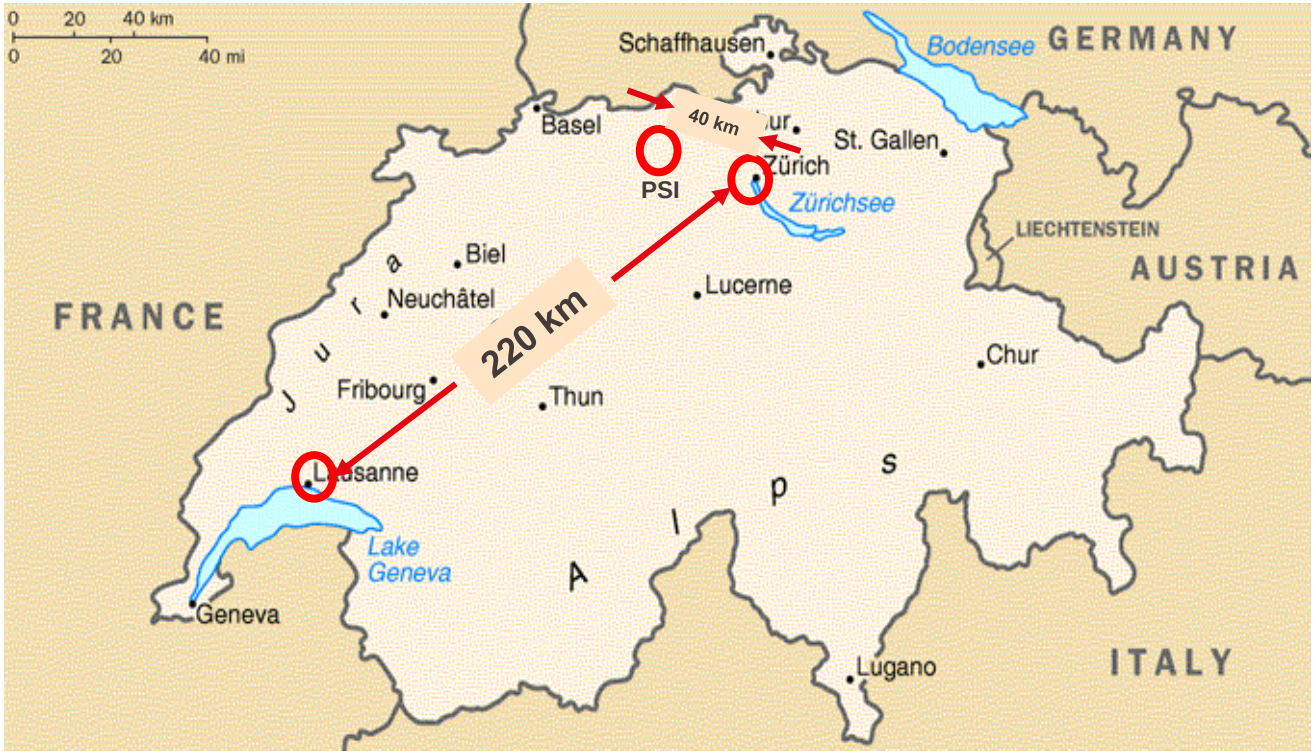
Andreas Pautz
Reactor Physics

École polytechnique fédérale de Lausanne

The Swiss Nuclear Engineering Master Program

- **First (and for a long time the only) joint degree of the two Swiss Federal Institutes of Technology**
  - École Polytechnique Fédérale de Lausanne (EPFL)
  - Eidgenössische Technische Hochschule Zürich (ETHZ)
- **Important synergies with Paul Scherrer Institut (PSI), Villigen**
  - The Nuclear Energy and Safety Division (NES) at PSI (6 laboratories, ~ 200 scientists and technicians) is the **national center of excellence for nuclear energy and safety research**
- **Your batch (2024) is the seventeenth to follow our four-semester curriculum**

Location of the Three Nuclear Schools



Aerial View of Paul Scherrer Institut (PSI)

General Scope of the Nuclear Engineering Master Program

Focus:

- Fundamentals & technology of employing nuclear fission for a safe and sustainable energy supply

Complement:

- Nuclear techniques in medicine & industry, and also nuclear fusion

Integration into energy systems as a whole, considering:

- *Nuclear + Renewables + Efficient energy use = Sustainability of energy supply*

Degree open to Bachelors in various disciplines

- Physics, Chemistry, Mechanical, Chemical, Civil and Electrical Engineering and more: nuclear engineering requires a high level of interdisciplinarity!

Main Program Features - 1

- **Degree awarded**
  - ***Master of Science EPF-ETH in Nuclear Engineering***
- **Combines the strengths of the nuclear schools of Switzerland**
  - 1st semester (autumn) - students attend courses at Lausanne
  - 2nd semester (spring) - students attend courses at Zurich
  - 3rd semester (autumn) - students at PSI
  - 4th semester (spring) - Master's thesis at PSI/EPFL/ETHZ
- **Some flexibility and individuality granted by spectrum of elective courses**
- **Tutor aided program: a professor to be identified by each student**

Teaching Personnel, Tutors

- **Professors**
  - A. Pautz (EPFL), A. Manera (ETHZ)
  - Others at EPFL: M.Q. Tran, A. Fasoli, F. Bochud, M. Seidel,…
  - Others at ETHZ: K. Boulouchos, P. Jenny, R. Abhari,…

- This semester you will work and study with the team from the Laboratory for Reactor Physics and System Behavior (LRS):


Mathieu Hursin


Vincent Lamirand


Oskari Pakari


Linyi Yang


Thomas Ligonnet


Milica Krstovic


Michel Saliba


Thomas Guilbaud


Sara Maccario

Teaching Personnel, Tutors

- **Professors**
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- This semester you will work and study with the team from the Laboratory for Reactor Physics and System Behavior (LRS):

- **Tutors**
  - Entirely advisory role, research supervisor may be another person
  - Andreas Pautz, Quang Minh Tran at EPFL
  - Annalisa Manera, Tony Lomax at ETHZ

A few words on Quang Tran

- Prof. Emeritus of Plasma Physics
- I was one of the founding fathers of the MNE programme, and have been functioning as “Tutor” since the beginning.
- After my “real” retirement in 2021, I kept some activities such as “Advisor” for the European Strategic Working Group ENERGY of European Strategic Forum for Research Infrastructure, Visiting Professor at the Academia Sinica Institute of Plasma Physics as Special Advisor for Heating and Current Drive of tokamak plasma or experts for Fusion for Energy and the Helmholtz Society.
- Contact: minhquang.tran@epfl.ch. Answer will be given with 48 hours (normally!). Otherwise please send a reminder.

Courses, Semester Project, Internship

- Eleven compulsory courses: **50 ECTS**
- **4 ECTS** from School of Management or Humanities course during 1st or 2nd semester
- Elective courses: **20 ECTS**, 8 ECTS thereof can in principle be freely selected from EPFL/ETH master courses (tutor's agreement needed), the remaining ones from approved list of elective core courses
- Industrial internship: **8 ECTS** (conducted partly outside semesters)
- Mandatory semester project: **8 ECTS** (during 3rd semester, at PSI), voluntary semester project (8 ECTS) any time in semester 1-3
- Master thesis (during the 4th semester): **30 ECTS**

Compulsory Courses

Code	Matières		Enseignants sous réserve de modification	Sections	Semestres MA1 EPFL			MA2 ETHZ			MA3 PSI			Crédits EPFL	ETHZ	PSI	Nbre places	Période des épreuves *	Type examen *
					c	e	p	c	e	p	c	e	p						
	Groupe 1 "Compulsory core courses"														70				
ETH-530	Advanced topics in nuclear reactor materials	(block course)	Pouchon/Streit/Spätig	PH							2	1				4		sem A	
ETH-532	Beyond-design-basis safety	(block course)	TBD	PH							2	1				4		sem A	
MGT-nnn	**Course of entrepreneurship**		**Divers enseignants**	**MTE**	←			**4**		→				**4**				**sem A ou P**	
ETH-533	Decommissioning of nuclear power plants	(block course)	Pautz	PH							2	1				4		sem A	
ETH-531	Nuclear computations lab	(block course)	Ferroukhi/Clifford/Pautz	PH							1	3				4		sem A	
ETH-401	Fuel cycle and waste managment		Eichler/Streit/Churakov	ETHZ				2	1						4			E	**
ETH-402	Nuclear Fuels and Materials		Pouchon/Spätig	ETHZ				3							4			E	**
PHYS-443	**Physics of nuclear reactors**		**Hursin/Pautz**	**PH**	**4**	**2**								**6**				**H**	**oral**
PHYS-451	**Radiation and reactor experiments**		**Hursin/ Lamirand/Pakari**	**PH**			**4**							**6**			**30**	**sem A**	**sans retrait**
PHYS-450	**Radiation biology, protection and applications**		**Damet/Grilj/Pakari**	**PH**	**2**	**1**								**4**				**H**	**écrit**
ETH-522	Reliability Engineering and quantitative risk analysis		Sansavini/Dang/Podofillini	–	–	–	–	2	1	–	–	–	–		4	–	–	E	**
ETH-403	Technology and safety of nuclear power plants		Manera	ETHZ				4	1						6			E	**
ETH-590	Semester Project Nuclear Engineering		Divers enseignants	PH									8			8		sem A	
PHYS-595	Stage d'ingénieur (master en Génie nucléaire)		Divers enseignants	PH									8			8		sem A	

Elective Core Courses

Code	Matières		Enseignants sous réserve de modification	Sections	Semestres MA1 EPFL			MA2 ETHZ			MA3 PSI			Crédits EPFL	Crédits ETHZ	Crédits PSI	Nbre places	Période des épreuves *	Type examen *
	Groupe 2 "Elective core courses"													-	**20**				
ETH-441	Advanced Techniques for the Risk Analysis of Technical Systems		Sansavini	ETHZ				***2***	***1***						**4**			E	**
ETH-427	Biomedical Imaging		Kozerke/Prüssmann	ETHZ				***5***							**6**			E	**
ETH-433	Computational Multiphase Thermal Fluid Dynamics		Prasser/Dehbi/Niceno	ETHZ				***2***	***1***						**4**			E	**
ETH-444	Computational Neuroimaging Clinic		Stephan	ETHZ				***2***							**3**			E	**
PHYS-490	**Elective project nuclear engineering**		**Divers enseignants**		←			***8***					→			**8**		sem A	
ETH-454	Electrochemical Energy Conversion and Storage Technologies		Gubler/Fabbri/Herranz Salañer	ETHZ				***3***							**4**			E	**
ME-409	**Energy conversion and renewable energy**		**Maréchal/Nguyen T.-V.**	GM	***2***	***1***	***1***							**4**				H	écrit
PHYS-405	**Experimental methods in physics**		**Dwir/Cantoni**	PH/MX	***2***	***1***								**3**				H	oral
ME-453	**Hydraulic turbomachines**		**Vagnoni**	GM	***3***	***1***								**4**				H	écrit
MICRO-511	**Image processing I**		**Unser/Van De Ville**	MT	***3***									**3**				H	écrit
PHYS-455	**Introduction to medical radiation physics**		**Bochud**	PH	***2***	***1***								**4**				H	écrit
PHYS-448	**Introduction to particle accelerators**		**Seidel**	PH	***2***	***2***								**4**				H	écrit
ETH-445	Introduction to Quantum Mechanics for Engineers		Norris	ETHZ				***2***	***2***						**4**			E	**
ETH-446	Magnetic Resonance Imaging in Medicine		Kozerke/Weiger	ETHZ				***3***							**4**			E	**
ETH-442	Materials Analysis by Nuclear Techniques		Doebeli	ETHZ				***2***	***1***						**6**			E	**
ETH-452	Medical Physics II		Manser	ETHZ				***2***	***1***						**6**			E	**

Elective Core Courses

Code	Matières		Enseignants sous réserve de modification	Sections	Semestres MA1 EPFL			Semestres MA2 ETHZ			Semestres MA3 PSI			Crédits EPFL	Crédits ETHZ	Crédits PSI	Nbre places	Période des épreuves *	Type examen *
	Groupe 2 "Elective core courses"													-	**20**				
ETH-453	Micro and Nano-Tomography of Biological Tissues		Stampanoni/Kaestner	ETHZ				*3*							4			E	**
ME-454	**Modeling and optimization of energy systems**		**Maréchal**	**ME**	*2*	*2*								4				H	oral
ETH-447	Monte Carlo in Medical Physics		Stampanoni/Fix	ETHZ				*3*							4			E	**
ETH-434	Multiphase Flow		TBD	ETHZ				*3*							4			E	**
PHYS-640	**Neutron and X-ray Scattering of quantum materials**		**Fogh/Schmitt**	**PH**	*2*	*2*								4				H	oral
PHYS-445	**Nuclear fusion and plasma physics**		**Fasoli**	**PH**	*2*	*2*								4				H	oral
PHYS-461	**Nuclear interaction : from reactors to stars**		**Rochman**	**PH**	*2*	*2*								4				H	écrit
MATH-468	**Numerics for fluids, sructures and electromagnetics (pas donné en 24-25)**		**vacat**	**MA**	*2*	*2*								5				H	oral
ETH-443	Physics Against Cancer: The Physics of Imaging and Treating Cancer		Lomax/Schneider	ETHZ				*2*	*1*						6			E	**
ETH-404	Physics of Nuclear Reactor II		Pelloni/Mikityuk/Pautz	ETHZ				*3*							4			E	**
PHYS-423	**Plasma I**		**Theiler**	**PH**	*2*	*3*								6				H	oral
PHYS-452	**Radiation detection**		**Lamirand**	**PH**	*2*	*1*								4				H	oral
ETH-448	Radiation Imaging for Industrial Applications		Prasser/Adams	ETHZ				*2*	*1*						4			E	**
ETH-449	Therapeutic Applications of Particle Physics: Principles and Practice of Particle Therapy		Lomax	ETHZ				*2*	*1*						6			E	**
	"Free" elective courses																		
---	**Master courses from the catalogue of courses EPFL or ETHZ (provided the tutor supports this choice)**		**Divers enseignants**	Divers										max. 8 credits				H ou E	**

Points to Note - 1

- **Choice of electives relatively uniform in the 3 semesters**
  - 1st Sem… 3 compulsory courses + management course(s)
  - 2nd Sem… 4 compulsory courses + management course(s)
  - 3rd Sem… 4 compulsory (block) courses + 8-credit Internship + 8-credit semester project (at PSI)

- **“Free” electives (total: 8 ECTS) can be one of the following:**
  - An extra NE elective (any of the above list)
  - An Other-Master elective which reinforces your “strengths”/interests
  - An Other-Master elective which strengthens your “weaknesses” and/or broadens your basic knowledge

Points to Note - 2

- There is time to decide on options until Friday, **September 20th** (deadline)
  - Worth “visiting” alternatives during these first 2 weeks
- Exam session from **January 13th to February 1st 2025**
- Deadline to unregister to an exam is **November 22nd**
- **Monday, September 16th is a holiday – no class! (Lundi du Jeûne)**
- **New : holiday 21st to 27th October 2024 – no class**

4-Credit Course in Entrepreneurship

- Both at EPFL and ETHZ, each Master student must have had a minimum number of “non-technical” credits

- For the NE Master, the 1st and 2nd semester is foreseen for clearing this condition
  - Minimum of 4 credits in either Humanities or Management of Technology (MTE-xxx or FIN-xxx)

These courses can be taken at either EPFL or ETHZ

Time Table – Nuclear Engineering Master

Compulsory Course

Speaker

LUNDI						
08:15-10:00	BS260	72	C	OPT	Modelling and optimization of energy systems	Enseignant-e-(s): Maréchal François
09:15-11:00	CM1221	64	C	OPT	Numerics for fluids, structures & electromagnetics	Enseignant-e-(s): Vacat .
10:15-11:00	CO3	218	E	OPT	Energy conversion and renewable energy	Enseignant-e-(s): Maréchal François, Nguyen Tuong-Van
10:15-12:00	BS260	72	E	OPT	Modelling and optimization of energy systems	Enseignant-e-(s): Maréchal François
11:15-13:00	CO3	218	C	OPT	Energy conversion and renewable energy	Enseignant-e-(s): Maréchal François, Nguyen Tuong-Van
11:15-13:00	CM1221	64	E	OPT	Numerics for fluids, structures & electromagnetics	Enseignant-e-(s): Vacat .
13:15-15:00	INR219	79	C	OPT	Nuclear fusion and plasma physics	Enseignant-e-(s): Fasoli Ambrogio
	MED21124	38				
13:15-15:00	CM013	60	C	OPT	Nuclear interaction : from reactors to stars	Enseignant-e-(s): Rochman Dimitri
15:15-17:00	INR219	79	E	OPT	Nuclear fusion and plasma physics	Enseignant-e-(s): Fasoli Ambrogio
15:15-17:00	CM013	60	E	OPT	Nuclear interaction : from reactors to stars	Enseignant-e-(s): Rochman Dimitri
MARDI						
08:15-12:00	PHxx	999	T	OBL	Radiation and reactor experiments Salle(s) ou Labo(s) selon enseignant(s)	Enseignant-e-(s): Frajtag Pavel, Hursin Mathieu, Lamirand Vincent Pierre
	PHH331	30	C	OBL	Physics of nuclear reactors	Enseignant-e-(s): Hursin Mathieu, Pautz Andreas
	GCB330	71	C	OPT	Neutron and X-ray Scattering of Quantum Materials	Enseignant-e-(s): Fogh Ellen, Schmitt Thorsten
	PHH331	30	E	OBL	Physics of nuclear reactors	Enseignant-e-(s): Hursin Mathieu, Pautz Andreas
	GCB330	71	E	OPT	Neutron and X-ray Scattering of Quantum Materials	Enseignant-e-(s): Fogh Ellen, Schmitt Thorsten
MERCREDI						
08:15-12:00	PHxx	999	T	OBL	Radiation and reactor experiments Salle(s) ou Labo(s) selon enseignant(s)	Enseignant-e-(s): Frajtag Pavel, Hursin Mathieu, Lamirand Vincent Pierre
	PHH331	30	C	OBL	Physics of nuclear reactors	Enseignant-e-(s): Hursin Mathieu, Pautz Andreas
	PHH331	30	E	OBL	Physics of nuclear reactors	Enseignant-e-(s): Hursin Mathieu, Pautz Andreas

PHYS-451 Rad. Exp.

PHYS-443 Phys. Nucl. Reactors

PHYS-451 Rad. Exp.

PHYS-443 Phys. Nucl. Reactors

Time Table – Nuclear Engineering Master

JEUDI						
08:15-10:00	CO120	40	C	OPT	Plasma I	Enseignant-e-(s): Theiler Christian Gabriel
09:15-11:00	BS150	64	C	OPT	Radiation detection	Enseignant-e-(s): Lamirand Vincent Pierre
10:15-11:00	CO120	40	E	OPT	Plasma I	Enseignant-e-(s): Theiler Christian Gabriel
10:15-12:00	ELA2	88	C	OPT	Hydraulic turbomachines	Enseignant-e-(s): Vagnoni Elena
10:15-13:00	CO2	218	C	OPT	Image processing I	Enseignant-e-(s): Unser Michaël, Van De
	CO4	30				Ville Dimitri Nestor Alice
11:15-12:00	BS150	64	E	OPT	Radiation detection	Enseignant-e-(s): Lamirand Vincent Pierre
13:15-14:00	ELA2	88	C	OPT	Hydraulic turbomachines	Enseignant-e-(s): Vagnoni Elena
14:15-15:00	ELA2	88	E	OPT	Hydraulic turbomachines	Enseignant-e-(s): Vagnoni Elena
14:15-16:00	BSP626	36	C	OPT	Introduction to particle accelerators	Enseignant-e-(s): Seidel Mike
16:15-18:00	BSP626	36	E	OPT	Introduction to particle accelerators	Enseignant-e-(s): Seidel Mike
VENDREDI						
08:15-10:00	CM1104	49	E	OPT	Plasma I	Enseignant-e-(s): Theiler Christian Gabriel
09:15-11:00	CM1113	22	C	OPT	Introduction to medical radiation physics	Enseignant-e-(s): Bochud François
09:15-11:00	CE1100	64	C	OPT	Experimental methods in physics	Enseignant-e-(s): Cantoni Marco, Dwir Benjamin
11:15-12:00	CM1113	22	E	OPT	Introduction to medical radiation physics	Enseignant-e-(s): Bochud François
11:15-12:00	CE1100	64	E	OPT	Experimental methods in physics	Enseignant-e-(s): Cantoni Marco, Dwir Benjamin
PHYS-450 Rad. Bio.	BS150	64	C	OBL	Radiation biology, protection and applications	Enseignant-e-(s): Damet Jerome, Grilj Veljko, Pakari Oskari Ville
	BS150	64	E	OBL	Radiation biology, protection and applications	Enseignant-e-(s): Damet Jerome, Grilj Veljko, Pakari Oskari Ville

Examples for Courses in Entrepreneurship at EPFL (1)

Horaire	Salles			Matières	Engagements
LUNDI					
09:15-12:00	MAB111	C	OPT	Mathematics of data: from theory to computation	Enseignant-e-(s): Cevher Volkan
13:15-17:00	CM14	C	OPT	Global business environment Special schedule. See the MFE website: https://go.epfl.ch/fe Une semaine sur deux dès la 2e semaine	Enseignant-e-(s): Felli Chiara
14:15-17:00	BS260	C	OPT	Value chain management in practice	Enseignant-e-(s): Riboni Stefano
MARDI					
08:15-10:00	INR219	C	OPT	Statistical inference and machine learning	Enseignant-e-(s): Kiyavash Negar
10:15-12:00	ODY016	C	OPT	Corporate strategy	Enseignant-e-(s): Schad Jonathan Leon Fabian
10:15-12:00	CE11	E	OBL	Principles of finance	Enseignant-e-(s): Isakov Dusan
10:15-12:00	INR219	E	OPT	Statistical inference and machine learning	Enseignant-e-(s): Kiyavash Negar
10:15-12:00	RLC E1 240	C	OPT	Machine learning	Enseignant-e-(s): Flammarion Nicolas Henri Bernard, Jaggi Martin
10:15-12:00	CE14	C	OPT	Management de projet et analyse du risque	Enseignant-e-(s): Wieser Philippe
10:15-12:00	CE14	P	OPT	Management de projet et analyse du risque	Enseignant-e-(s): Wieser Philippe
MERCREDI					
08:15-10:00	RLC E1 240	C	OPT	Applied data analysis	Enseignant-e-(s): West Robert
09:15-12:00	BS150	C	OPT	Information: strategy & economics	Enseignant-e-(s): Weber Thomas Alois
10:15-12:00	ODY016	C	OPT	Globalisation, robotics and the future of work	Enseignant-e-(s): Baldwin Richard Edward
10:15-12:00	RLC E1 240	C	OPT	Machine learning course given in STCC auditorium C on the 23th of November	Enseignant-e-(s): Flammarion Nicolas Henri Bernard, Jaggi Martin
10:15-12:00	CM1100	C	OPT	Foundations of digital humanities	Enseignant-e-(s): Kaplan Frédéric
10:15-12:00	ODY016	C	OPT	Climate entrepreneurship	Enseignant-e-(s): Wadhwa Inderpreet Singh
10:15-12:00	GRB330	C	OPT	Data science for business	Enseignant-e-(s): Dunbar Liza Carol Andrea
10:15-12:00	ODY016	P	OPT	Climate entrepreneurship SHS : Introduction au projet	Enseignant-e-(s): Wadhwa Inderpreet Singh

PHYS-451 Rad. Exp.

PHYS-443 Phys. Nucl. Reactors

PHYS-451 Rad. Exp.

PHYS-443 Phys. Nucl. Reactors

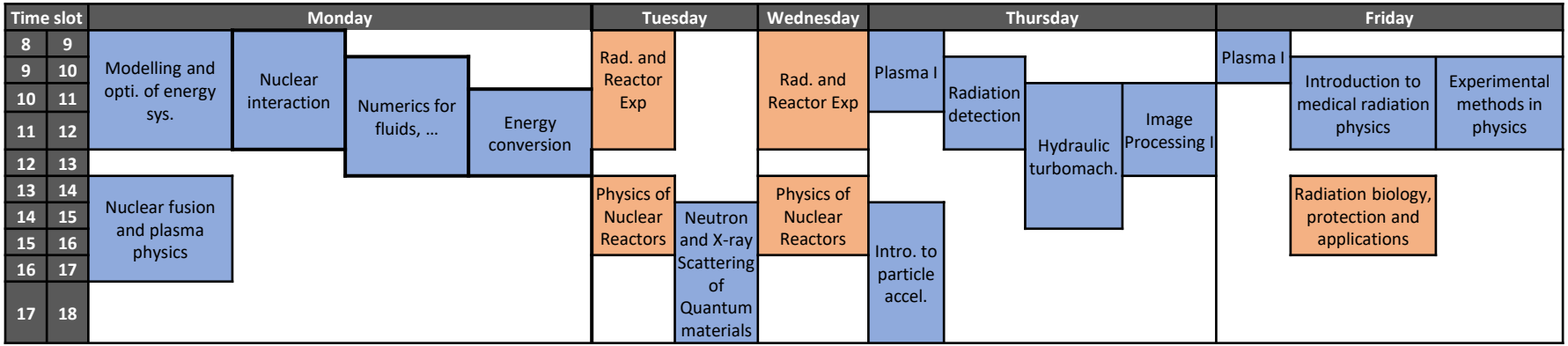
Examples for Courses in Entrepreneurship at EPFL (2)

Horaire	Salles	Nb Places		Matières	Engagements
JEUDI					
09:15-12:00	ODY016	C	OBL	Accounting for finance Special schedule. See the MFE website: https://go.epfl.ch/fe	Enseignant-e-(s): Cauvin Eric
09:15-12:00	BCH2201	C	OBL	Principles of microeconomics	Enseignant-e-(s): Mack Jan Alexander Karl
10:15-12:00	BC03	C	OPT	Foundations of digital humanities	Enseignant-e-(s): Kaplan Frédéric
10:15-12:00	SG0211	C	OPT	Convex optimization	Enseignant-e-(s): Kuhn Daniel
12:15-13:00	BCH2201	E	OBL	Principles of microeconomics	Enseignant-e-(s): Mack Jan Alexander Karl
13:15-15:00	BC03	T	OPT	Foundations of digital humanities	Enseignant-e-(s): Kaplan Frédéric
13:15-16:00	ODY016	C	OBL	Performance Management Special schedule. See the MTE website: https://go.epfl.ch/mte	Enseignant-e-(s): Cauvin Eric
14:15-16:00	ODY-10021	C	OPT	Intercultural presentation skills Special schedule. See the MTE website: https://go.epfl.ch/mte Groupe 1/2 Selon arrangement	Enseignant-e-(s): Everett Jane Elizabeth
14:15-16:00	INF1 INF119 INJ218 INM202 INR219	E	OPT	Machine learning	Enseignant-e-(s): Flammarion Nicolas Henri Bernard, Jaggi Martin
14:15-16:00	CM1121	E	OPT	Convex optimization	Enseignant-e-(s): Kuhn Daniel
16:15-18:00	ODY-10021	E	OPT	Intercultural presentation skills Special schedule. See the MTE website: https://go.epfl.ch/mte Groupe 1/2 Selon arrangement	Enseignant-e-(s): Everett Jane Elizabeth
16:15-18:00	CM13	C	OBL	Principles of finance	Enseignant-e-(s): Isakov Dusan
16:15-19:00	CE13	C	OPT	Venture capital	Enseignant-e-(s): Fahlenbrach Rüdiger

Examples for Courses in Entrepreneurship at EPFL (3)

Horaire	Salles	Nb Places		Matières	Engagements
VENDREDI					
08:15-09:00	GRA330	P	OPT	Innovation & entrepreneurship in engineering Selon indication de l'enseignant	Enseignant-e-(s): Michaud Véronique, Weber Thomas Alois
08:15-10:00	ODY-10021	C	OPT	Intercultural presentation skills Special schedule. See the MTE website: https://go.epfl.ch/mte Groupe 2/2 Selon arrangement	Enseignant-e-(s): Everett Jane Elizabeth
09:15-10:00	CM1120	E	OPT	Data science for business	Enseignant-e-(s): Dunbar Liza Carol Andrea
09:15-11:00	GRA330	C	OPT	Innovation & entrepreneurship in engineering	Enseignant-e-(s): Michaud Véronique, Weber Thomas Alois
10:15-12:00	ODY-10021	E	OPT	Intercultural presentation skills Special schedule. See the MTE website: https://go.epfl.ch/mte Groupe 2/2 Selon arrangement	Enseignant-e-(s): Everett Jane Elizabeth
11:15-18:00	GRA330	P	OPT	Innovation & entrepreneurship in engineering Selon indication de l'enseignant	Enseignant-e-(s): Michaud Véronique, Weber Thomas Alois
PHYS-450 Rad. Bio.	CM1121	C	OBL	Applied probability & stochastic processes	Enseignant-e-(s): Sutter Tobias
	BCH2201	P	OPT	Applied data analysis	Enseignant-e-(s): West Robert
	CE1106 CM13	C	OPT	Production management	Enseignant-e-(s): Kaboli Amin
	GCB330	C	OPT	Strategic marketing & technology commercialization	Enseignant-e-(s): Eckardt Thilo Hans Martin
	CM11	E	OBL	Applied probability & stochastic processes	Enseignant-e-(s): Sutter Tobias
	CM13 GCA330 GCA331 GRA332	P	OPT	Production management	Enseignant-e-(s): Kaboli Amin
	CM13 GCA330	P	OPT	Production management	Enseignant-e-(s): Kaboli Amin

Nuclear Engineering



Obligatory

Optional

Main Program Features - 2

- **3rd semester**
  - Industrial internship (3 months minimum) to be started around July => **Start applications not later than January 2025!**
  - The **Swiss Nuklearforum** supports us by providing a web platform where internships will be offered: **https://www.nuklearforum.ch/de/praktikumsplattform**
  - Block courses & mandatory semester project at PSI during weeks 5-14 of the 3rd semester
    - **In May 2025, we will invite you to PSI to explore the possibilities for thesis projects at PSI**

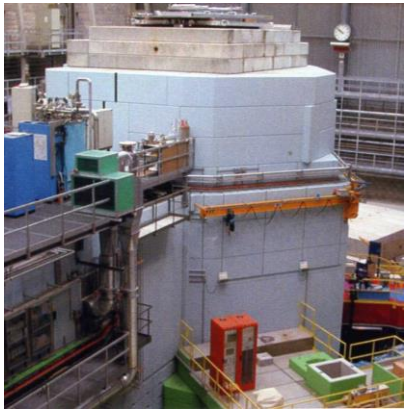
What should the internship look like?

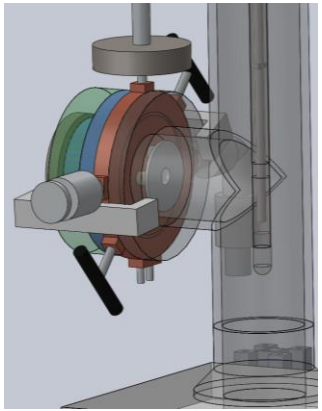
- **The design of the industrial internship is very flexible.** It can be completed in NPPs, industrial companies, but also e.g. in hospitals with radiology departments, or other non-academic institutions.
- **Routine work** (e.g. in dosimetry/radiation protection, recurring maintenance work)
- **Smaller project work** that can be easily completed in 3 months, e.g., minor software development tasks, assistance with core design, design of measurement protocols, etc.
- Duration: **three months, typically from July to September**.
- **Possible alternative: 6 months internship**, starting in July (several students have already taken this option).
- **We do NOT expect a detailed internship report** (this is up to the host institution), a simple certificate from the employer about the internship done is sufficient.

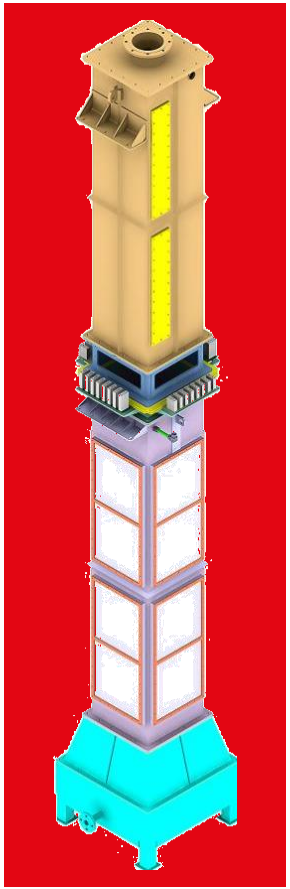
Main Program Features - 3

- **4th semester**
  - **Master thesis project** recommended at PSI/ETH/EPFL
  - **25 weeks of research** (can be selected as a continuation of your semester project theme)
  - Conditions: at least 80 ECTS of courses for entering the Master project; completion of project and full 90 ECTS of course work for degree
  - **To avoid confusion: master thesis is NOT paid! However, (only) PSI has committed to a monthly reimbursement of expenses of 400 CHF/month**

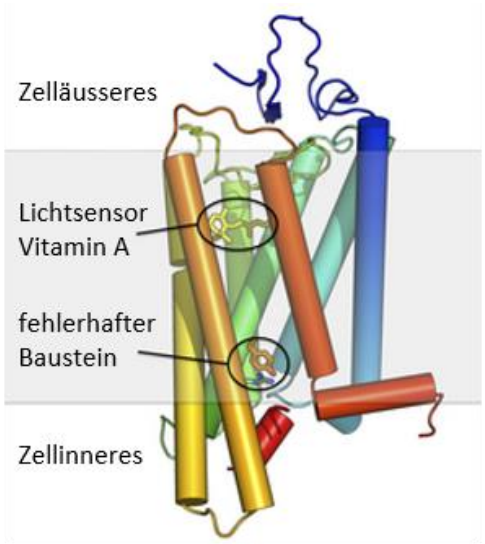
PSI – Powerful scientific infrastructure

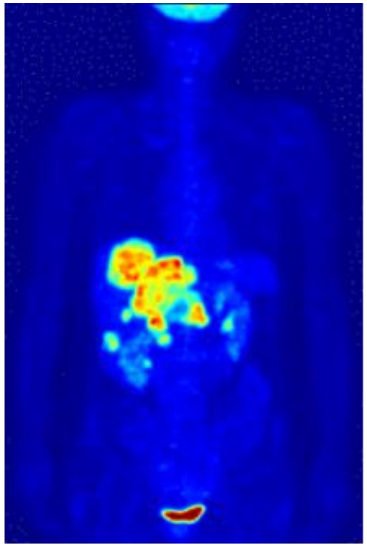






Proton Therapy and Radiopharmacy at PSI





Structure of Proteins
For the targeted development of new ddrugs

Radiopharmaceuticals
for the diagnosis and therapy of cancer

Proton therapy
- Treatment of tumors
- Little damage to surrounding tissues

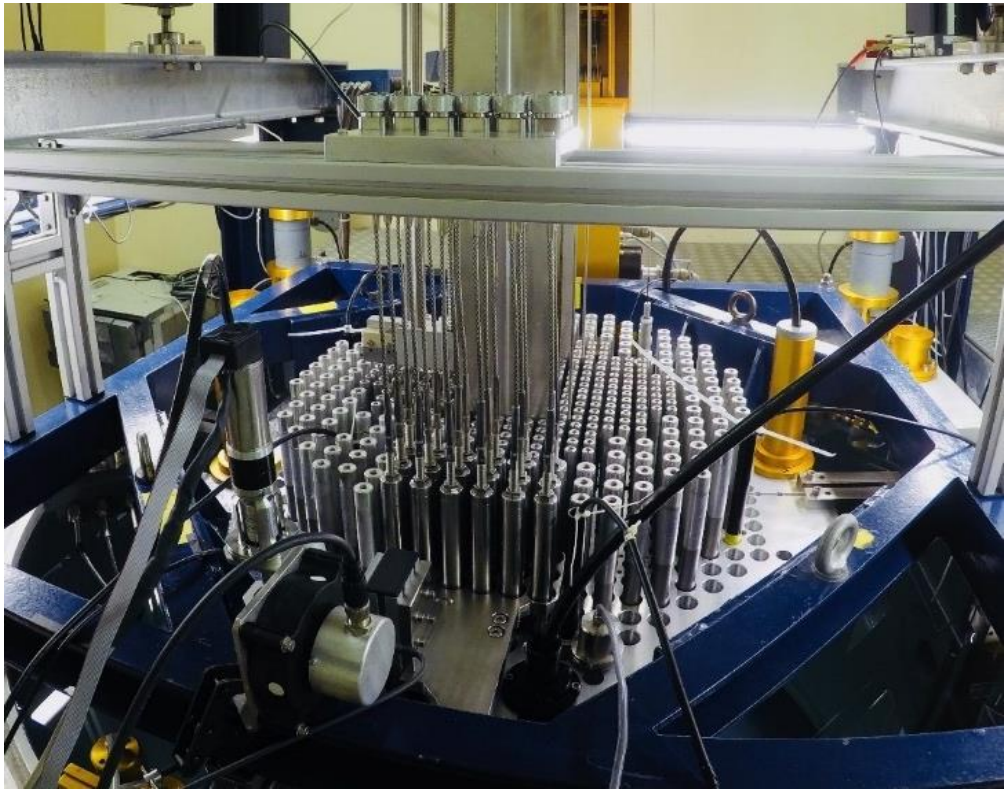
SPC: The Swiss Plasma Center at EPFL and its mission

National laboratory with international facilities in an academic environment

Aim: make ITER a success
develop the science and technology basis of DEMO
prepare the ITER/DEMO generations of scientists and engineers
exploit plasma and fusion spinoffs for industry and society

Size: 145 staff, 36 PhDs, 32MCHF/y

CROCUS reactor – exciting experimental training



Teaching:

- Critical experiment
- Reactor kinetics
- Neutron flux profile measurements
- Activation experiments

Research:

- Neutron noise theory
- Neutron detectors, measurements and applications
- Generation and validation of nuclear data for reactor technology

For questions regarding the nuclear master program, administration, etc.

Valerie.schaererbusinger@epfl.ch
Andreas.Pautz@epfl.ch

At LRS:
Alessandro.Scolaro@epfl.ch (Code developments)
Oskari.Pakari@epfl.ch (Chef des Installations)
Mathieu.Hursin@epfl.ch (Deputy Head LRS)
Vincent.Lamirand@epfl.ch (Experimental programs)

At ETH Zurich, an introduction meeting will be held at the beginning of the second semester. For the time being, contact maneraa@ethz.ch in case of questions.

More information on the Nuclear Master Program:
http://master.epfl.ch/nuclearengineering
or http://www.master-nuclear.ethz.ch/

Context

EPFL is a community of around 20,000 people

- Who enrich our community every day with their skills, identities, and differences
- By joining EPFL, we commit to upholding values based on **respect and well-being**
- To live up to these values EPFL has created the **Trust and Support Network**
- Easy access through **Trust Point**

Towards a culture of respect and well-being

- **Health days**

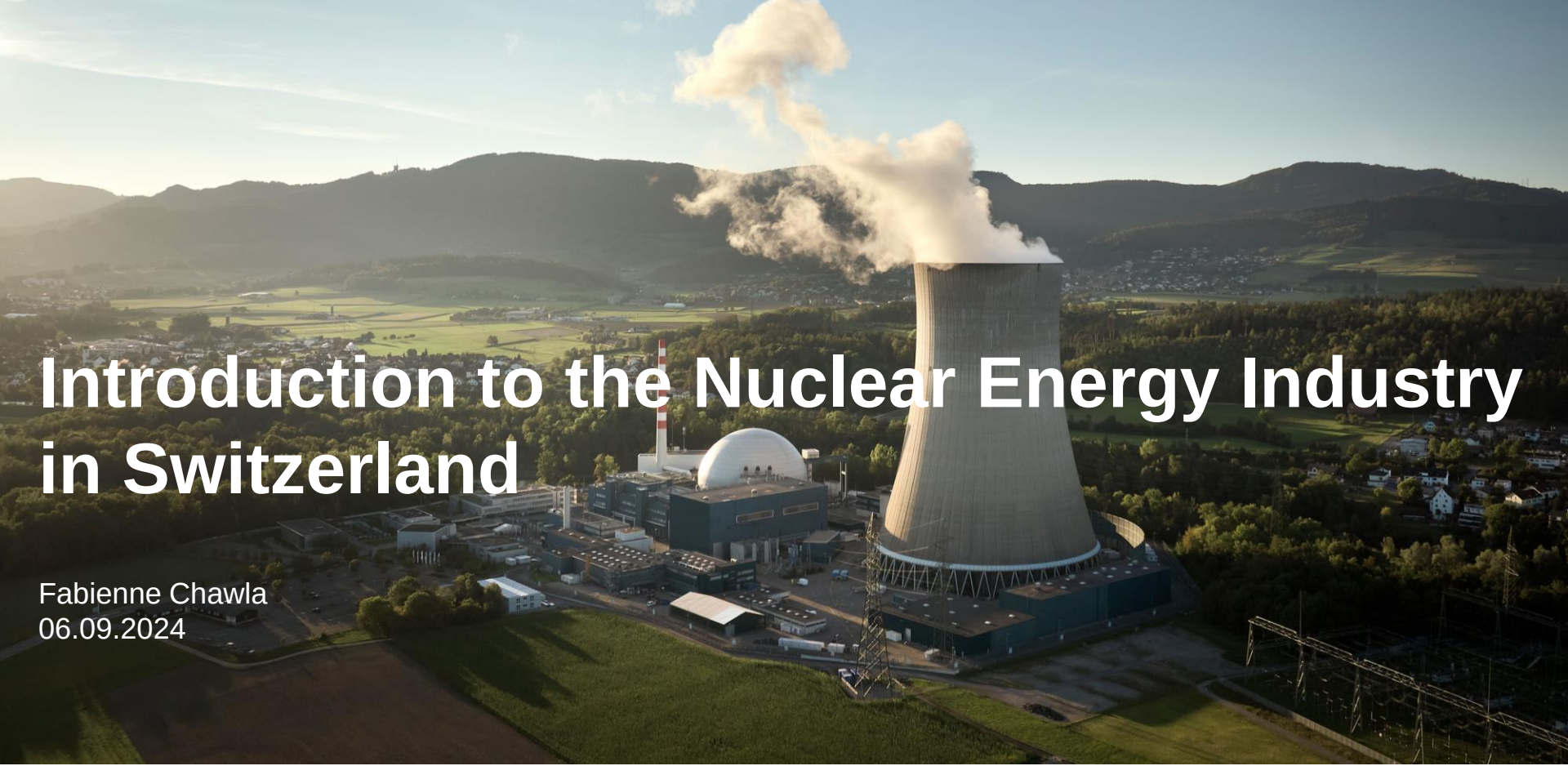
- Get **trained** to know how to **act** and **react**
  Moodle Promoting respect >>>>>>>>>
- **Speak up** and **seek support**
  Trust & Support Network (TSN) >>>>>>>>>
- Internal entity to file formal complaints
  Respect Compliance Office (RCO)

Everyone has a role to play!

We are all concerned!

Merci

Mathieu Hursin



Introduction to the Nuclear Energy Industry in Switzerland

Fabienne Chawla
06.09.2024

NPPs in Switzerland

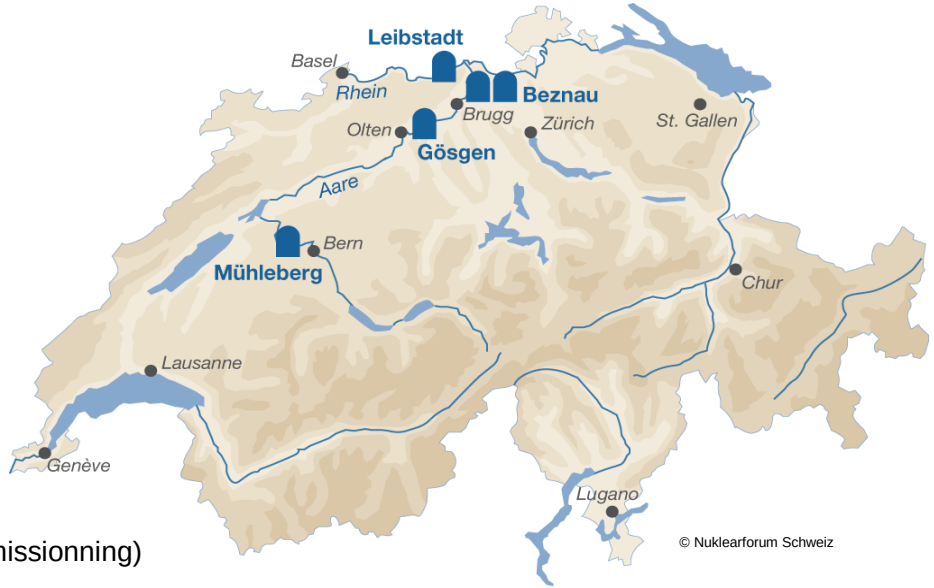
NPP Beznau I & II (KKB I / II)
PWR, 2x 365 MWe
Westinghouse 2 Loop
Sept. 1969 / Dez. 1971

NPP Gösgen (KKG)
PWR, 1010 MWe
Siemens –KWU
Nov. 1979

NPP Leibstadt (KKL)
BWR, 1220 MWe
GE BWR 6 / Mark 3
Dez. 1984

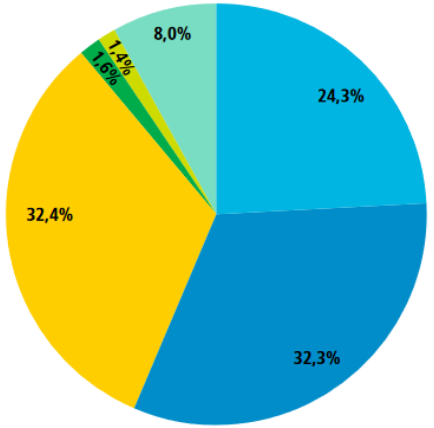
NPP Mühleberg (KKM)
BWR, 373 MWe
GE BWR 4 / Mark 1
Nov. 1971 – Dez. 2019 (in decommissionning)

Population 8.4 million; area 41285 m2
Electricity consumption: 60TWh
33% nuclear power



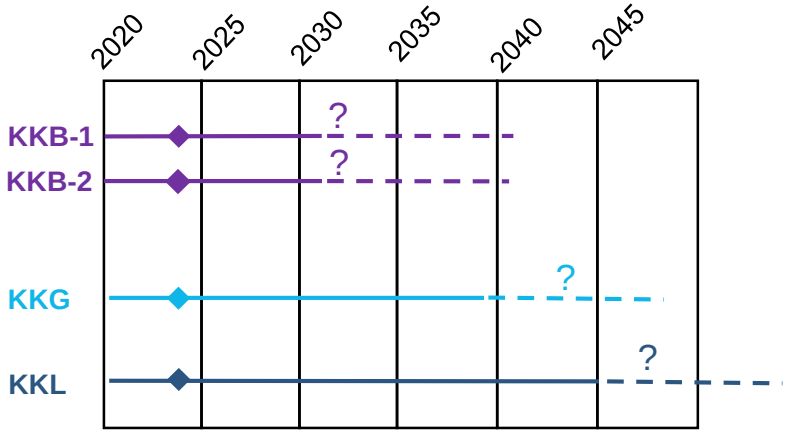
Swiss electricity production mix

- Laufkraftwerke
  Centrales au fil de l'eau
- Speicherkraftwerke
  Centrales à accumulation
- Kernkraftwerke
  Centrales nucléaires
- Konventionell-thermische Kraft- und Fernheizkraftwerke (nicht erneuerbar)
  Centrales thermiques classiques et centrales chaleur-force (non renouvelable)
- Konventionell-thermische Kraft- und Fernheizkraftwerke (erneuerbar)
  Centrales thermiques classiques et centrales chaleur-force (renouvelable)
- Diverse erneuerbare Energien
  Energies renouvelables diverses



BFE, Schweizerische Elektrizitätsstatistik 2023 (Fig. 1)
OFEN, Statistique suisse de l'électricité 2023 (fig. 1)

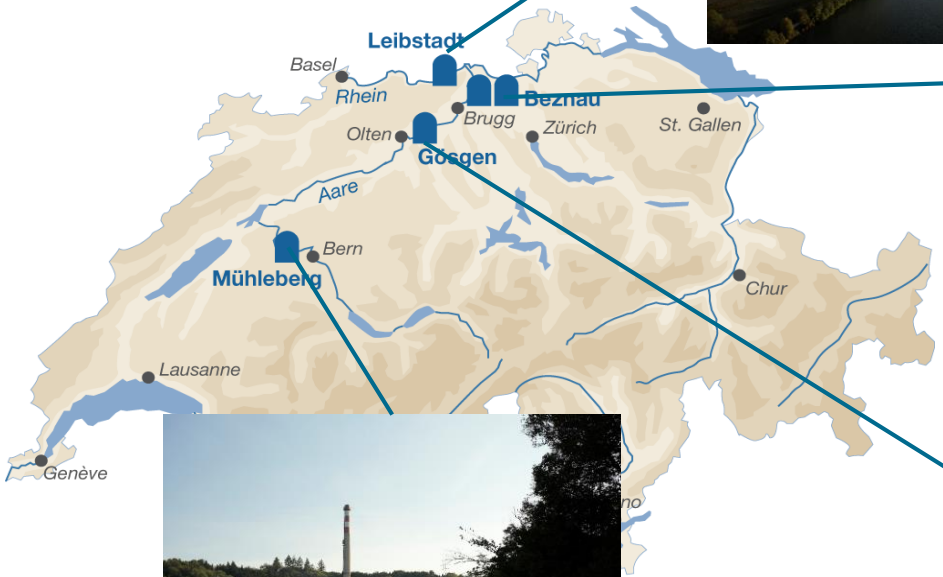
Timeline of NPP Operation



- Current assumption: 60 years of operation

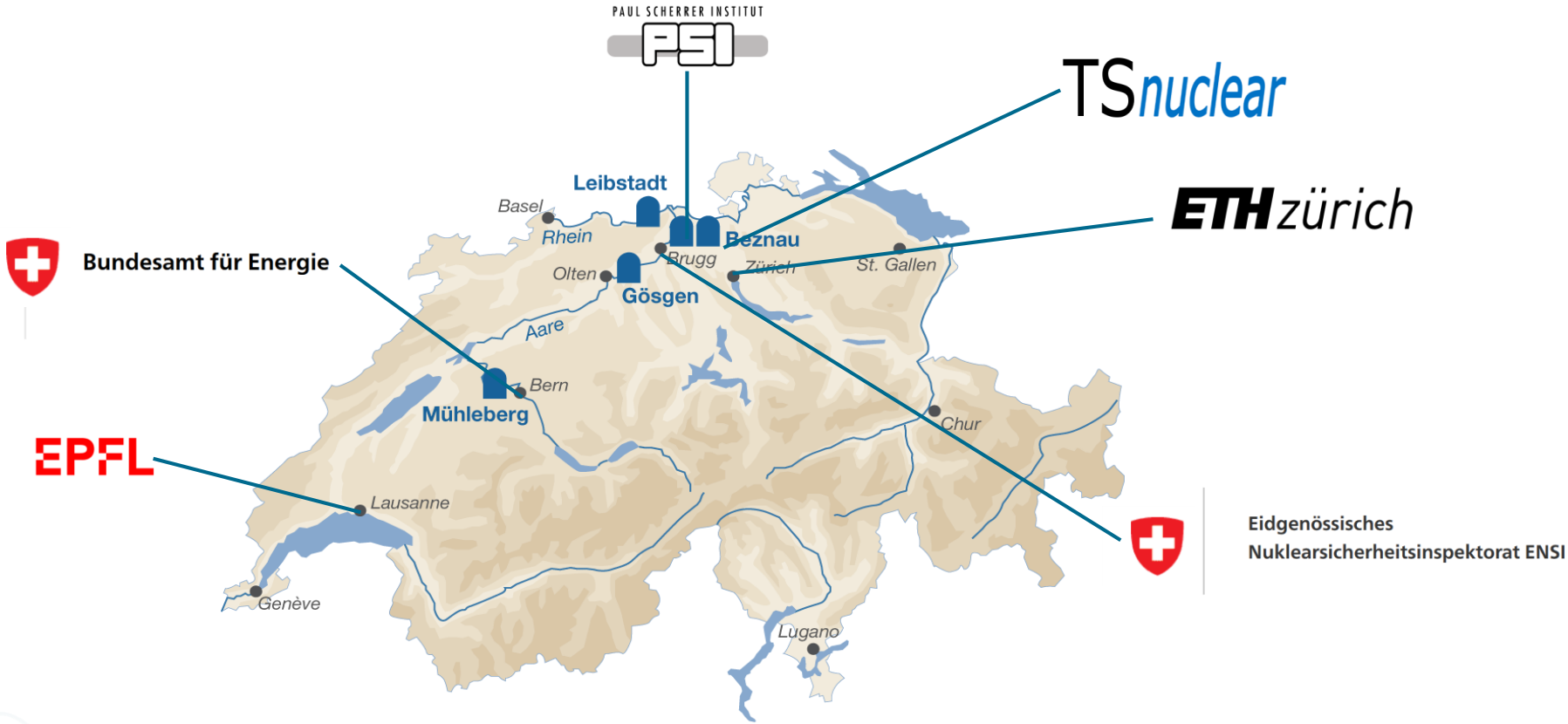
- > 60 years of operation?
  - Unlimited operating license, as long as deemed safe
  - Technically possible (at least up to 80 years)
  - Return on investments
  - Workforce planning
  - ➢ **In Review in all NPP**

Not only NPP…

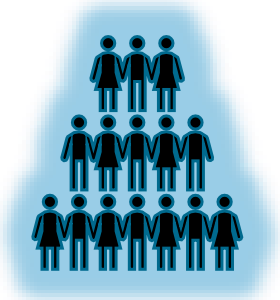

Leibstadt
Basel
Rhein
Beznau
Brugg
Zürich
St. Gallen
Olten
Gösgen
Aare
Bern
Mühleberg
Chur
Lausanne
Genève

…but a whole Microcosm

…but a whole Microcosm



Some Numbers



2200
Employees in the nuclear sector

100
physicists and nuclear engineers

350-450
need of new employees in the next 5 years

Diversity of Jobs

Operation
Plant operator
Reactor operator
On-call engineer

Technical Experts
Safety analyst
Risk manager
Instructor

NPP

Radiation Experts
Radiation officer
Radiation protection specialist
Radiation protection technician

Other
Chemist
Psychologist
Firefighter
HR Manager

https://swissnuclear.ch/jobs/

Operation

Laura Perez, Shift Supervisor at KKG
MSc Nuclear Engineering ETHZ

Olivier Nusbaumer,
Senior Scientist at KKL
PhD Nuclear Safety

Nuclear Fuel

Safety

René Sarrafian
Head Nuclear Fuel at KKG
Reactor Safety and Technology,
RWTH Aachen

Karl Baur, Department Head Risk Management at KKB
MSc Nuclear Engineering ETHZ

Supporting the next generation

Research Projects at PSI
11 Projects in 2024-2025

Co-Financing ETH Chair

Internships

Industry

Supporting CROCUS Reactor

PhD Grant

Tag der Forschung

How to get in contact with the industry

- **Meet us at:**
  - EPFL Forum: https://www.forum-epfl.ch/; 08.10.2024, Room 1C
  - ETH AMIV Kontakt: https://kontakt.amiv.ethz.ch/de; 08.-09.10.2023, Stand B20
- **Visit us at:**
  - https://www.kkl.ch/besucherangebote/infozentrum
  - https://www.kkg.ch/de/werksbesuch/besuchen-kernkraftwerk.html
  - https://www.zwilag.ch/de/fuehrungen-_content---1--1076.html
- **Internship in the NPP**
  - https://www.nuklearforum.ch/de/praktikumsplattform
- **Research projects and PhD Grant at PSI**

Contact: fabienne.chawla@swissnuclear.ch

To go further

- **General information on nuclear energy:**
  - https://www.kernenergie.ch/
- **Networking (Swiss nuclear society)**
  - https://www.kernfachleute.ch/
  - Young generation Group/ Women in Nuclear Group
- **Information plattform: Nuklearforum**
  - https://www.nuklearforum.ch/de
- **Association of the Swiss nuclear operators**
  - https://www.swissnuclear.ch
  - Open positions in the NPP


Thank you for your attention