



The CERN Accelerator School

Advanced Accelerator Physics

6 – 18 November 2022

Neaclub, Sévrier, France

WELCOME!

The CERN Accelerator School - CAS

- Established at the beginning of 1983
 - To preserve and transmit knowledge accumulated, at CERN and elsewhere, on particle accelerators and colliders of all kinds
- This provided a framework for a series of courses
 - General accelerator physics
 - [Introduction to Accelerator Physics](#)
 - [Advanced Accelerator Physics](#)
 - Specialized topics in the field (RF, BI, magnets, vacuum, colliders, beam dynamics, plasma,...)
 - 50 to 70 hours teaching in **~2 week intensive residential courses**
- About 90 courses held so far
- Occasional courses in the framework of the US-CERN-Japan-Russia Joint Accelerator School (JAS), from 2022: IAS (International Accelerator School)
 - 14 schools held so far (since 1985), Superconductivity course upcoming in July 2023

Scope

Accelerator Physics

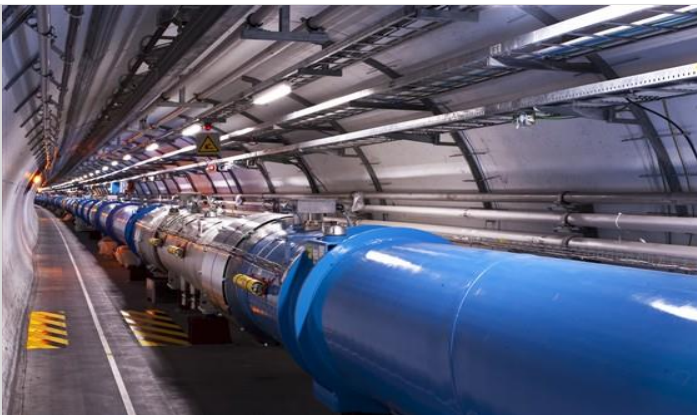
Relativity / Electro-Magnetic Theory /
Transverse Beam Dynamics /
Longitudinal Beam Dynamics / Linear
Imperfections and Resonances /
Synchrotron Radiation / Electron
Beam Dynamics / Multi-Particle
Effects / Non-Linear Dynamics Beam
Instabilities / Landau Damping /
Beam-Beam Effects

Accelerator Systems

Particle Sources / RFQ / LEPT
RF Systems / Beam Measurement /
Feedback Systems / Beam Injection
and Extraction / Beam Transfer Power
Convertors / Warm Magnets /
Superconducting Magnets / Vacuum
Systems Machine Protection Systems
Radiation and Radioprotection

Accelerators

Linear Accelerators
Synchrotron Light Machines
FELs
FFAGs
Cyclotrons
Synchrotrons
Colliders



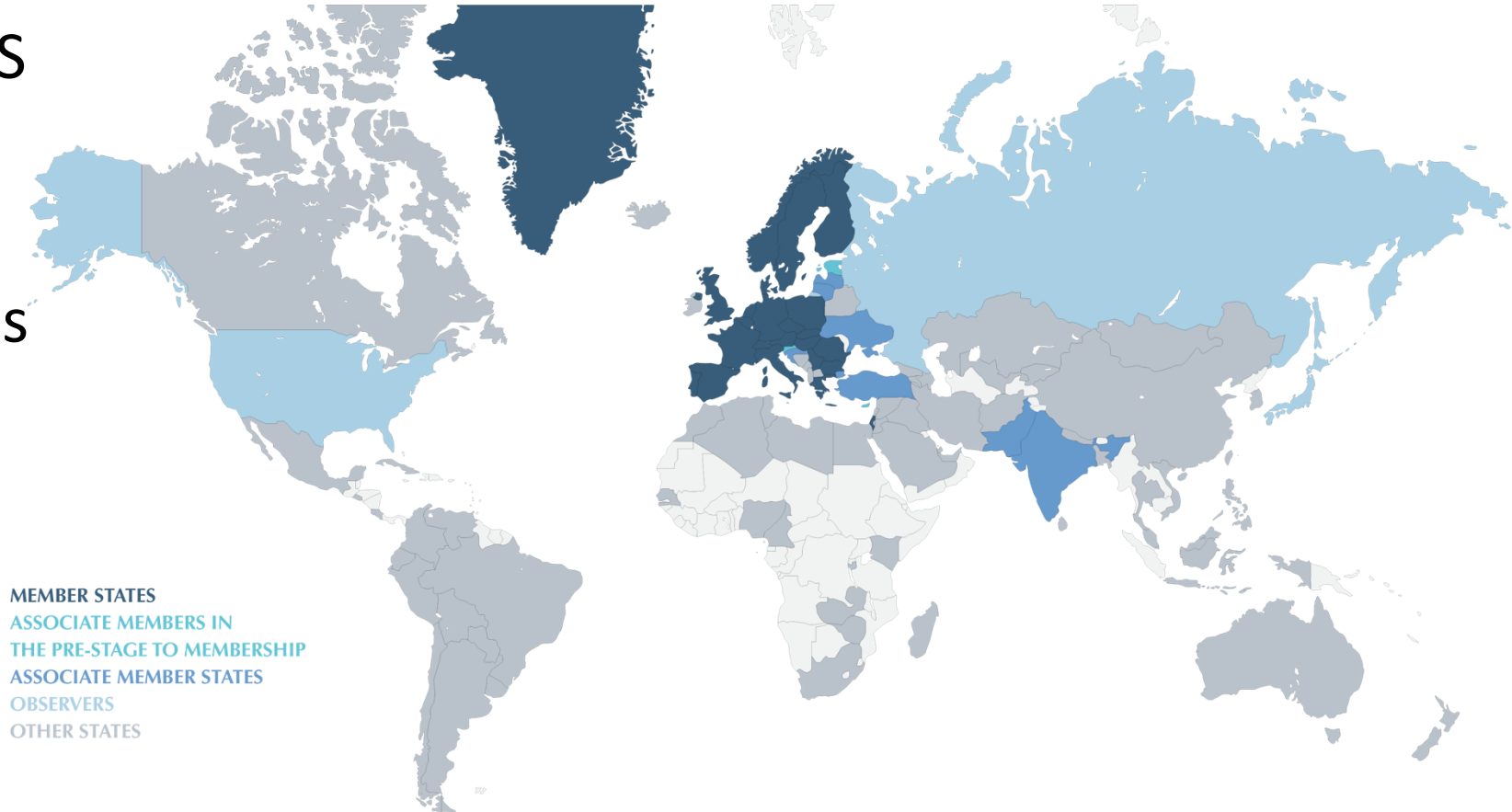
Applications

High Energy Physics
Nuclear Physics
Industrial Applications
Medical Applications
Cancer Therapy



Why are we in France now?

- CERN is financed by 23 member states and 10 associated member states
- CAS visits all CERN member states and associated member states in turn
- Previous residential CAS in France in 2008
- Vicinity of CERN might help for Covid measures



Residential CAS Courses

- Networking is an essential part of each CAS course!
- Introduction to Accelerator Physics (yearly – in September)
 - 18 Sep – 1 Oct 2022 (in Kaunas)
 - Hands-on in transverse and longitudinal beam dynamics
- Advanced Accelerator Physics
 - now!
 - Hands-on in RF, Beam Instrumentation and Beam Optics
- 2023+: Radiofrequency, Magnets, Mechanical and Material Engineering, ...
- Basic course (non-residential) near CERN – open for external participants

	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri		
	06/11	07/11	08/11	09/11	10/11	11/11	12/11	13/11	14/11	15/11	16/11	17/11	18/11		
08:30	Arrival day and registration	Opening	Lattice Cells	Recap Longitudinal Beam Dynamics I	Instabilities in Linacs	Recap Synchrotron Radiation	Beam Instabilities - Transverse	Excursion Annexey	Optics calculations	Landau Damping I	Free	HL-LHC I	Departure day		
		Tecker	Sterbini	Tecker	Ferrario	Wolski	Li		Sterbini	Buffat		Zerlauth			
09:30		Recap Transverse Beam Dynamics I	Accelerator issues overview	Space charge in linear machines	Collimation	Wakefields and Impedances	Insertion devices - Radiation		ERL I	Non Linear Dynamics - Methods and Tools I		HL-LHC II			
		Schmickler	Tecker	Ferrario	Redaelli	Rumolo	Clarke		Arnold	Papaphilippou		Brüning			
10:30		Coffee							Coffee			Coffee			
11:00		Intro to RF measurement techniques I	Intro to RF measurement techniques II	Recap Longitudinal Beam Dynamics II	Overview of Wakefield Acceleration	Low emittance lattices	Electron Cloud and instabilities		FEL I	Muon Colliders I		Non Linear Dynamics - Phenomenology II			
		Wendt	Wendt	Tecker	Ferrario	Wolski	Li		Hillert	Rogers		Papaphilippou			
12:00		Intro to Beam Instrumentation and Diagnostics I	Intro to Beam Instrumentation and Diagnostics II	Space charge in circular machines	Collimation + technical implementation	Beam Instabilities - Longitudinal	Discussion on Instabilities		ERL II	Landau Damping II		Discussion on Non Linear Dynamics			
		Jones	Jones	Ferrario	Redaelli	Rumolo	Rumolo/Li	Arnold	Buffat	Papaphilippou					
13:00		Lunch													
14:30		Recap Transverse Beam Dynamics II	Insertions & Dispersion Suppressors	Beam loading				RF Feedbacks	Insertion devices - Technology	Murder party	FEL II	Muon Colliders II		Non Linear Dynamics Methods and Tools II	Longitudinal beam diagnostics
		Schmickler	Sterbini	Damerau				Damerau	Clarke		Hillert	Rogers		Papaphilippou	Lefevre
15:30		Intro to Optics Design	C1/C2/C3	C1/C2/C3	RF			C1/C2/C3	C1/C2/C3		C1/C2/C3	BI/Optics		Beam-Beam effects	RF show
		Sterbini												Buffat	
16:30	Coffee						Coffee			Coffee					
17:00	151M	C1/C2/C3	C1/C2/C3	RF	Free for BI/Optics		C1/C2/C3	C1/C2/C3		C1/C2/C3	BI/Optics	Non Linear Dynamics Phenomenology I	Closing		
18:00												Papaphilippou	Tecker		
18:30	Welcome Drink												High Brightness Beam Diagnostics		
19:00													Lefevre		
			18:30 Seminar							RF lab ends	21:00 Cinema evening				
19:30	Dinner										Gala Dinner				

This course

- 61 participants (27 CERN, 31 external, 3 grants)
- Lectures 45-50 minutes + discussion
- Discussion sessions with lecturers
- Hands-on courses for RF measurements, Beam Instrumentation and Beam Optics

- Lunch and coffee breaks (bar area) between the lectures (no wine at lunch!)
- arrival at dinner buffet 19:30 – 20:30, buffet until 21:30
- use this for networking
- 1 slide – 1 minute today followed by Welcome drink
- Excursion to Annecy on Sunday, followed by ‘Murder Game’
- Cinema evening next week on Tuesday
- entertaining seminar by local professor

Hands-on courses

- Beam Optics Design and Correction
 - Python and cpyrad (on your own computer)
 - in this auditorium
- RF measurements
 - in “Salle Parmelan”
 - will end already on Monday 14/11 => course on Thursday 10/11
 - will use computers in “Salle Charvin” on Friday 11/11
- Beam instrumentation and diagnostics
 - Computer lab in “Salle Charvin”
 - other experiments in “Salle Soleil”



Networking

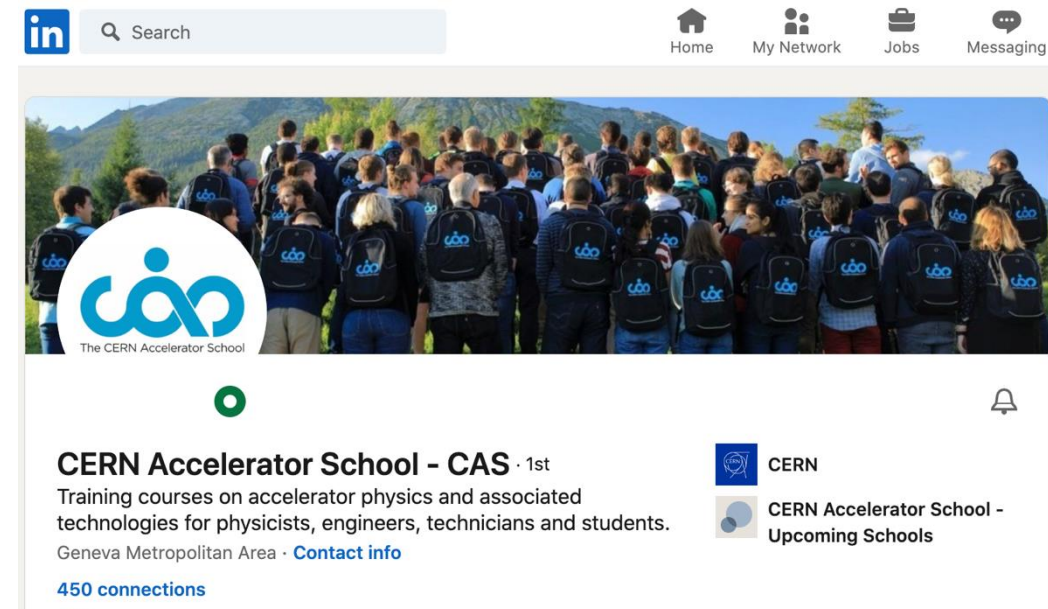
- Next to the course teaching the most important aspect of the school
“ digital training cannot replace CAS courses”

- people socialising (and even working)
up to late in the evenings
- lots of interactions students <-> teachers
- cinema evening
- excursion

- LinkedIn

- From the CAS web page

- CAS profile: <https://www.linkedin.com/in/cern-accelerator-school-a61367233>



COVID-19

- We want to hold the course in safe conditions
 - masks available
- French regulation:
 - in case of symptoms: antigen or PCR test required
 - if positive: 7/10 days of isolation (depending on vaccination status)
 - need to prepare a list of close contacts
 - contacts need to do an autotest after 2 days
- No other particular measures imposed
- In case of symptoms
 - Don't come to the course
 - Please test yourself first (ask us for test)

The CAS Team

Anastasiya Safronava

Web pages



Noemi Caraban Gonzalez

CASopedia, Social media

Christine Völlinger

Deputy Director

Maria Filippova

Administrative Assistant

Frank Tecker

Director

Delphine Rivoiron

Administrative Manager

Hermann Schmickler

previous Director

Ron Suykerbuyk

Filming

Online Evaluation Form

- Important to maintain / improve the high quality of teaching
- <https://cas.web.cern.ch/evaluation/sevrier-2022>
- Log in with CERN account or many other ways (Google, LinkedIn, ...)

Sign in with a CERN account


Username


Password

[Forgot Password?](#)


Sign In


Or use another login method

 Two-factor authentication

 Kerberos


Sign in with your email or organisation


 Home organisation - eduGAIN


 External email - Guest access


Or sign in with a social account

By clicking on the buttons below, you consent to CERN's transfer of your login request to the social provider and to receive your account name, name and e-mail for authenticating you. Click [here](#) for more details.

 Google

 LinkedIn

 GitHub

 Facebook

Online Evaluation Form

Level	Content	Presentation	Relevance
<input type="radio"/> Much too low	<input type="radio"/> Completely uninteresting	<input type="radio"/> Very poor	<input type="radio"/> Should not be in this CAS course
<input type="radio"/> Low	<input type="radio"/> Uninteresting	<input type="radio"/> Poor	<input type="radio"/> Specialist information - good, but not for me
<input type="radio"/> Just right	<input type="radio"/> Of some interest	<input type="radio"/> Fair	<input type="radio"/> Contributes to the general accelerator education
<input type="radio"/> Too high	<input type="radio"/> Interesting	<input type="radio"/> Good	<input type="radio"/> Important general information
<input type="radio"/> Much too high	<input type="radio"/> Very interesting	<input type="radio"/> Very good	<input type="radio"/> Directly relevant for my present studies

Other comments on this lecture...

✓ SAVE DRAFT

SUBMIT

- Please **fill it in** ideally **daily** during the course, when your memory is fresh
- You can **save it** and come back to it later at any time
- Just **DON'T submit it until** you have completed your evaluation at **the end**



The CERN Accelerator School

Advanced Accelerator Physics

Enjoy the course!

<http://cern.ch/cas>

