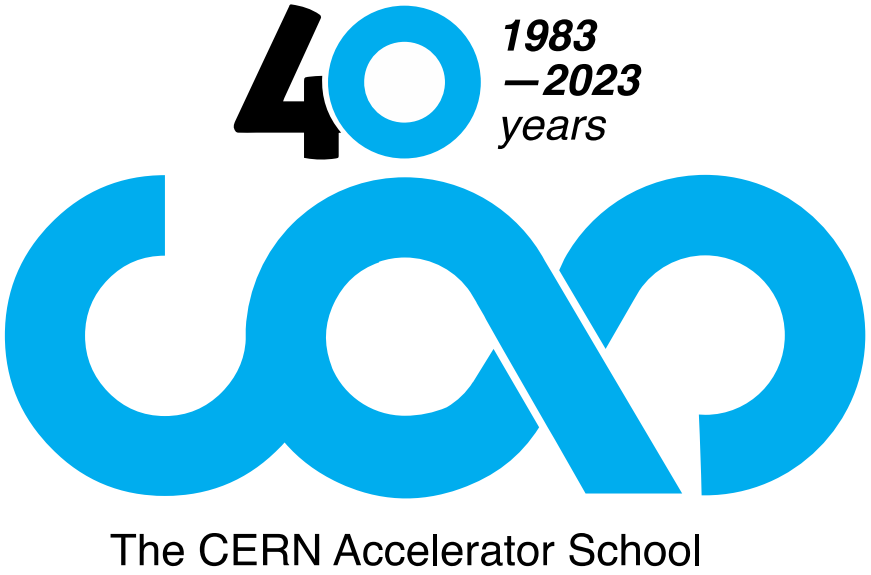
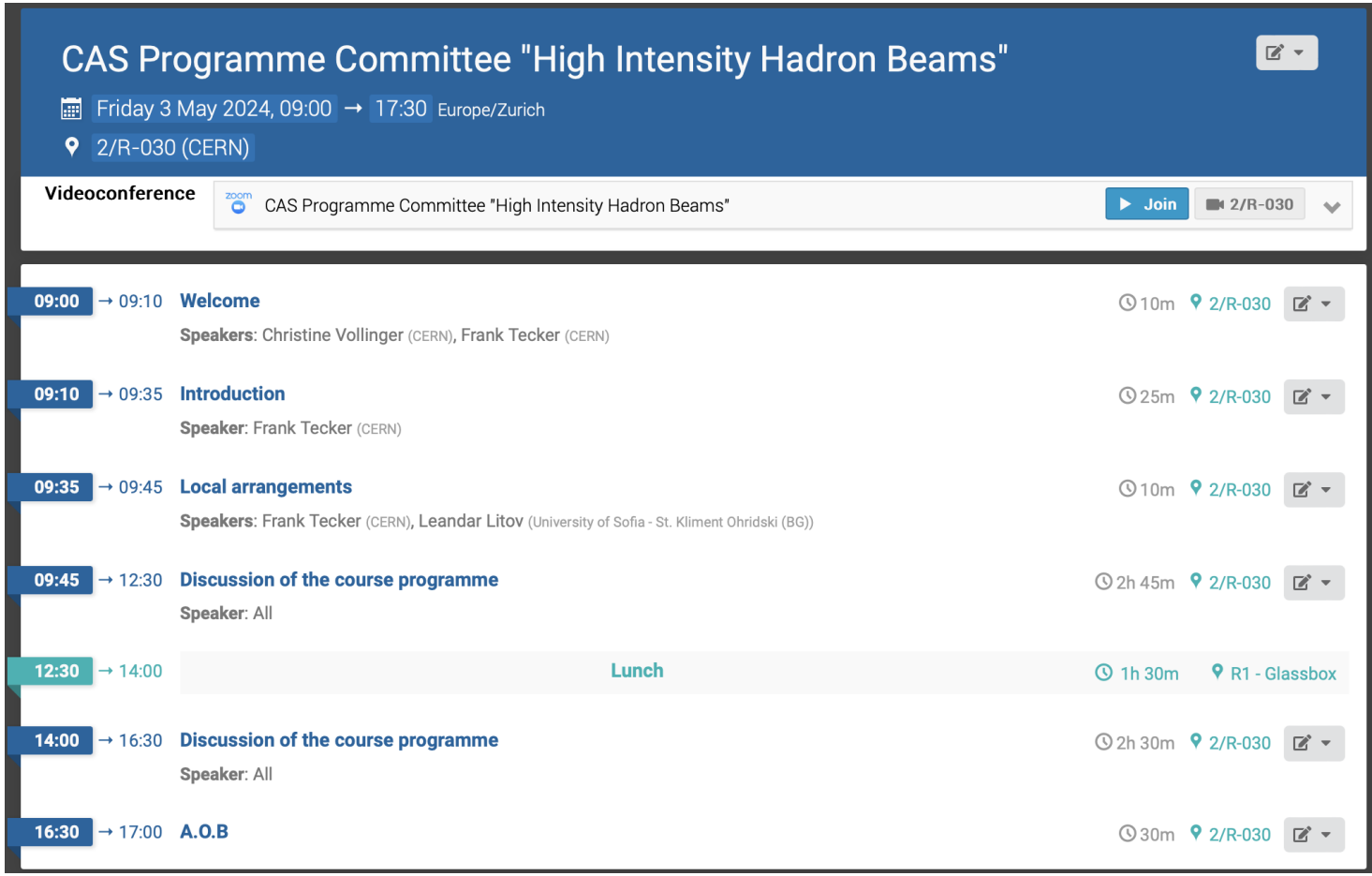


CAS Program Committee Meeting
“High-Intensity Hadron Beams”

3.5.2024

Program Committee Meeting - Schedule

- Many thanks for participating as Program Committee Member!
- 1st post-COVID meeting
  - Other recent programs (RF, Magnets) were already defined before
- Common lunch today (R1 Glassbox)



Program Committee Members

Name	Affiliation
Christine Völlinger	CERN - CAS
Daniel Schulte	CERN
Delphine Rivoiron	CERN - CAS
Francesco Cerutti	CERN
Frank Tecker	CERN - CAS
Giuliano Franchetti	GSI
Ivan Karpov	CERN
Kevin Shing Bruce Li	CERN
Mamad Eshraqi	ESS
Maria Filippova	CERN - CAS
Mike Seidel	PSI, EPFL
Rob Williamson	ISIS
Stefano Redaelli	CERN
Yacine Kadi	CERN
Yannis Papaphilippou	CERN

Many thanks!
We count on your active participation ☺

The CERN Accelerator School

The CAS Team

Noemi Caraban Gonzalez
CASopedia, Social media

Christine Völlinger
Deputy Director

Maria Filippova
Administrative Assistant

Frank Tecker
Director

Delphine Rivoiron
Administrative Manager

Introduction

The CERN Accelerator School - CAS

- Established at the beginning of 1983 => 40 years in 2023!
  - 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)
  - 16 schools held so far (since 1985), lately Superconductivity course July 2023

CAS Backbone - Residential CAS Courses

- **Introduction to Accelerator Physics** (yearly – in September)
  - 22 Sep – 4 Oct 2024 (in Santa Susanna, Spain), 13 nights
  - General introduction to accelerator physics and technology
  - Hands-on exercises in transverse and longitudinal beam dynamics
- **Advanced Accelerator Physics** (every two years)
  - 6 – 18 Nov 2022 (in Sévrier (near Annecy), France) – next in 2024 in Spa, Belgium
  - Hands-on exercises in RF, Beam Instrumentation and Beam Dynamics
- **Special Topical Courses**
  - 2023: Radiofrequency, Normal- and Superconducting Magnets
  - 2024: Mechanical and Material Engineering, …
- High-level expert lecturers from CERN and many other institutes
- Networking is an essential part of each CAS course!

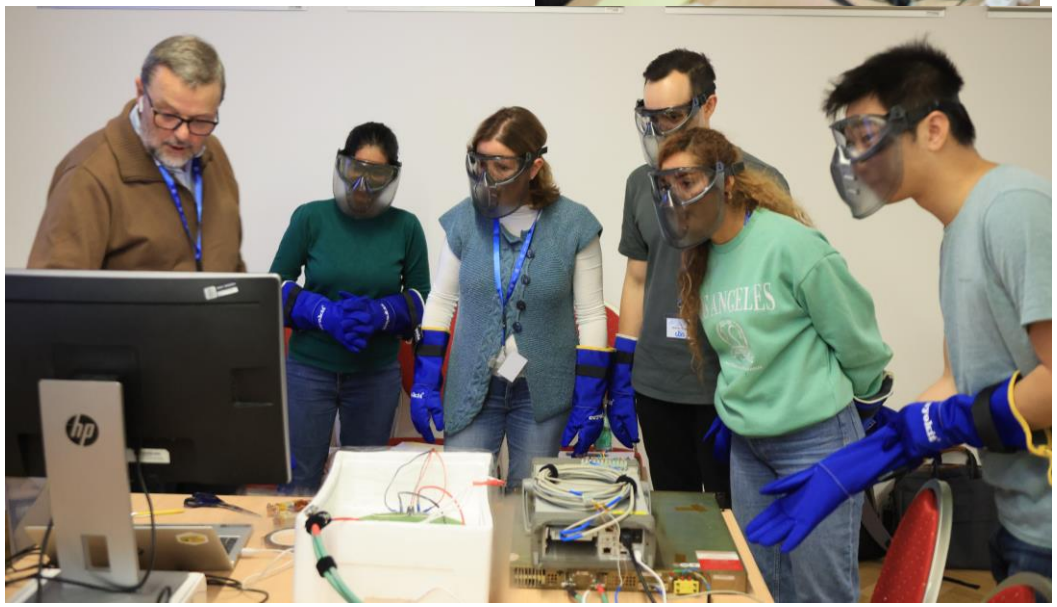
2023 RF CAS

- **106 participants** (25 CERN, 76 external, 5 grants)
- **Waiting list**, limited by hotel capacity
- 18 female / 88 male
- 27 participating nationalities
- 35 (16 CERN/ 19 ext.) colleagues present for lectures/hands-on + 4 CAS
- **Hands-on training** offered (**all followed by all students**):
  - RF measurements (12 experiments)
  - RF simulations (CST Microwave Studio, etc.)
  - Longitudinal beam dynamics
- **very positive feedback!**

Photo credits: Noemi Caraban

2023 Normal- and Superconducting Magnets

- **95 participants** (29 CERN, 63 external, 3 grants)
- **Waiting list**, limited by hotel capacity (limit 100 from hands-on)
- 30 female / 65 male, 22 different nationalities
- 37 (25 CERN / 12 ext.) colleagues for lectures/hands-on, +4 for the CAS
- **Hands-on courses** offered (**all followed by all students**):
  - Superconducting magnet design
  - Resistive magnet design
  - Magnet Measurement techniques
  - Superconductivity experiments (**liquid nitrogen**!)

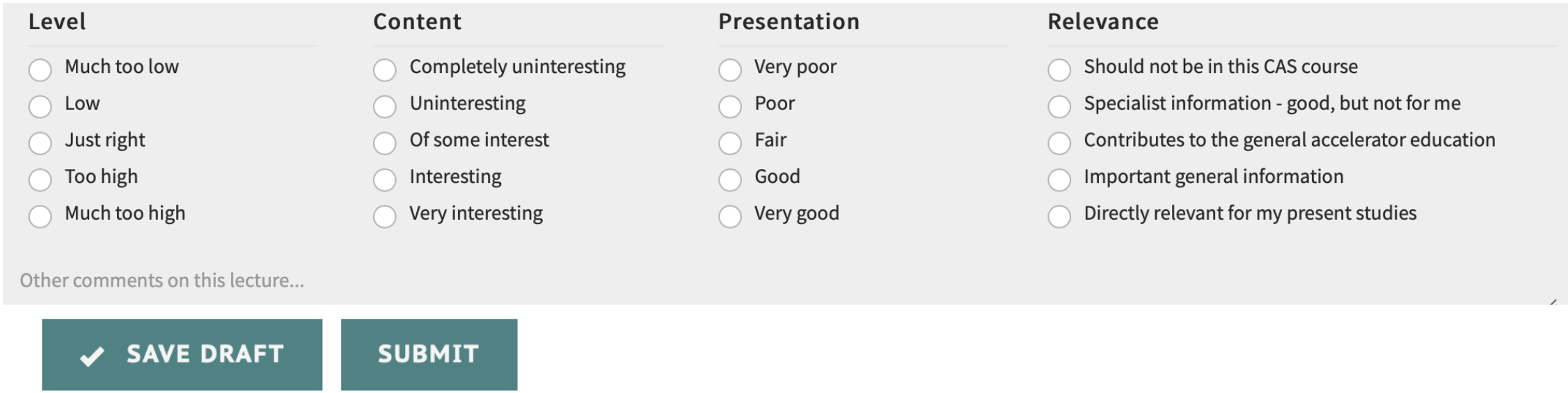


Networking is a CAS feature

- Next to the course teaching the most important aspect of the school
  " digital training cannot replace **residential** CAS courses"
- **Networking nowadays essential for daily work**
  - strong **students <-> teachers** interactions
  - meals taken together
  - people socialising (working and leisure)
    up to late in the evenings
  - "1 slide – 1 minute" as icebreaker
  - Poster session
  - Cinema evening, CASaoke
  - Excursion
  - WhatsApp group for the courses + WhatsApp community (information exchange)
- LinkedIn
  - CAS profile: https://www.linkedin.com/in/cern-cas/ (more than 5k members!)

The CERN Accelerator School

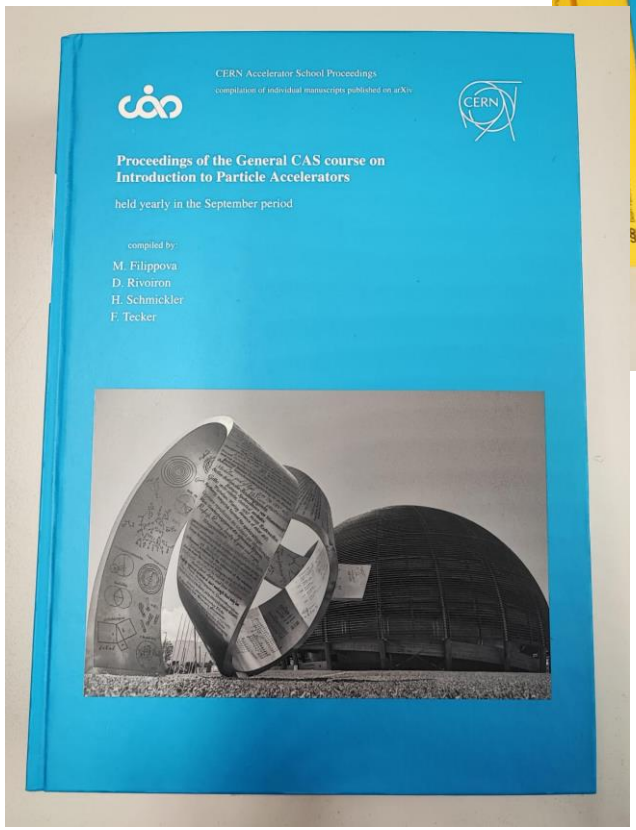
Online Evaluation Form



- Important to maintain / improve the high quality of teaching
- Log in with CERN account or many other ways (Google, LinkedIn, …)
- One can **save it** during the CAS course and come back to it later at any time
- **Can be completed after the course**
- typically **2/3** of participants **complete evaluation**

Recent CAS Proceedings

- Contributions in LaTeX or Word
- Edited by CAS team (streamlining, format editing)
- Contributions published in ArXiv by CAS team
- Author can claim ownership
- Completed (during Covid period) and printed:
  - Vacuum
  - Beam Instrumentation
  - Numerical Methods
  - Wakefield Acceleration
  - Introduction (without (3) 2 contributions)



The CERN Accelerator School

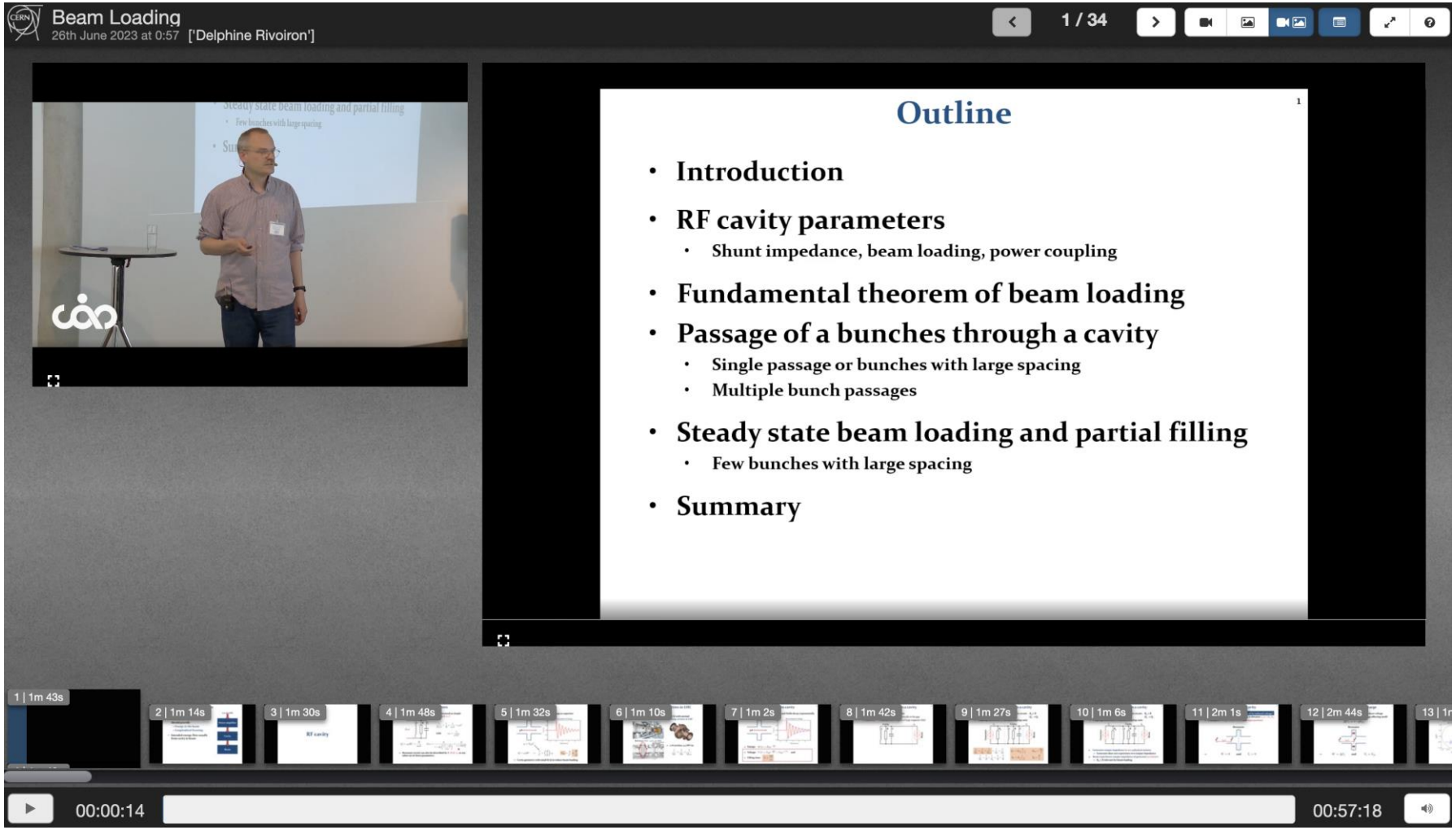
CASopedia

- **Goal:** List of keywords that point to relevant sections of CAS videos
  - Searchable keyword index based on lecturer-provided keywords points to videos (entire video first, sequence later)
  - Keyword search in transcripts and transparencies in the videos (feature exists in player but not exploited by CERN)

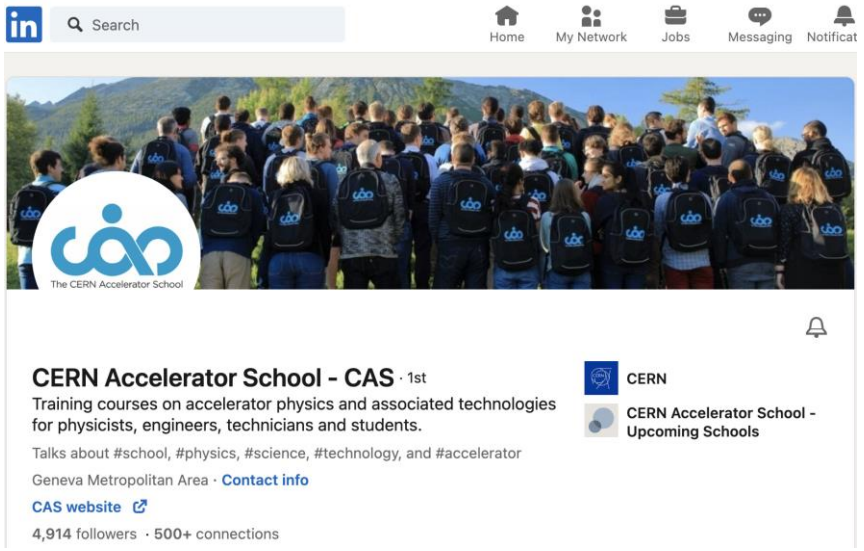
- Newer videos filmed with 3 cams + slide stream with virtual laser pointer
- Noemi collects metadata: abstracts and keywords from lecturers
- transcripts of the videos produced
- CDS Webservice publishes video through Indico
- Available on Indico from CAS courses and CDS
- RF CAS published, Magnet CAS in preparation

CASopedia – Example Video

- https://cds.cern.ch/record/2882185



Social Media / Digital Presence



- Expand CAS networking with digital tools
- Started by Michaela Lancellotti (Admin Student)
- Developed and significantly extended by Noemi
- LinkedIn
  - CAS profile: https://www.linkedin.com/in/cern-cas/ (more than 5k members!)
  - Creating a community of accelerator scientists for general accelerator news, jobs, etc.
- CERN general social media (Facebook, Instagram, X (Twitter))
- Accelerating News - https://acceleratingnews.eu/
- CERN Bulletin

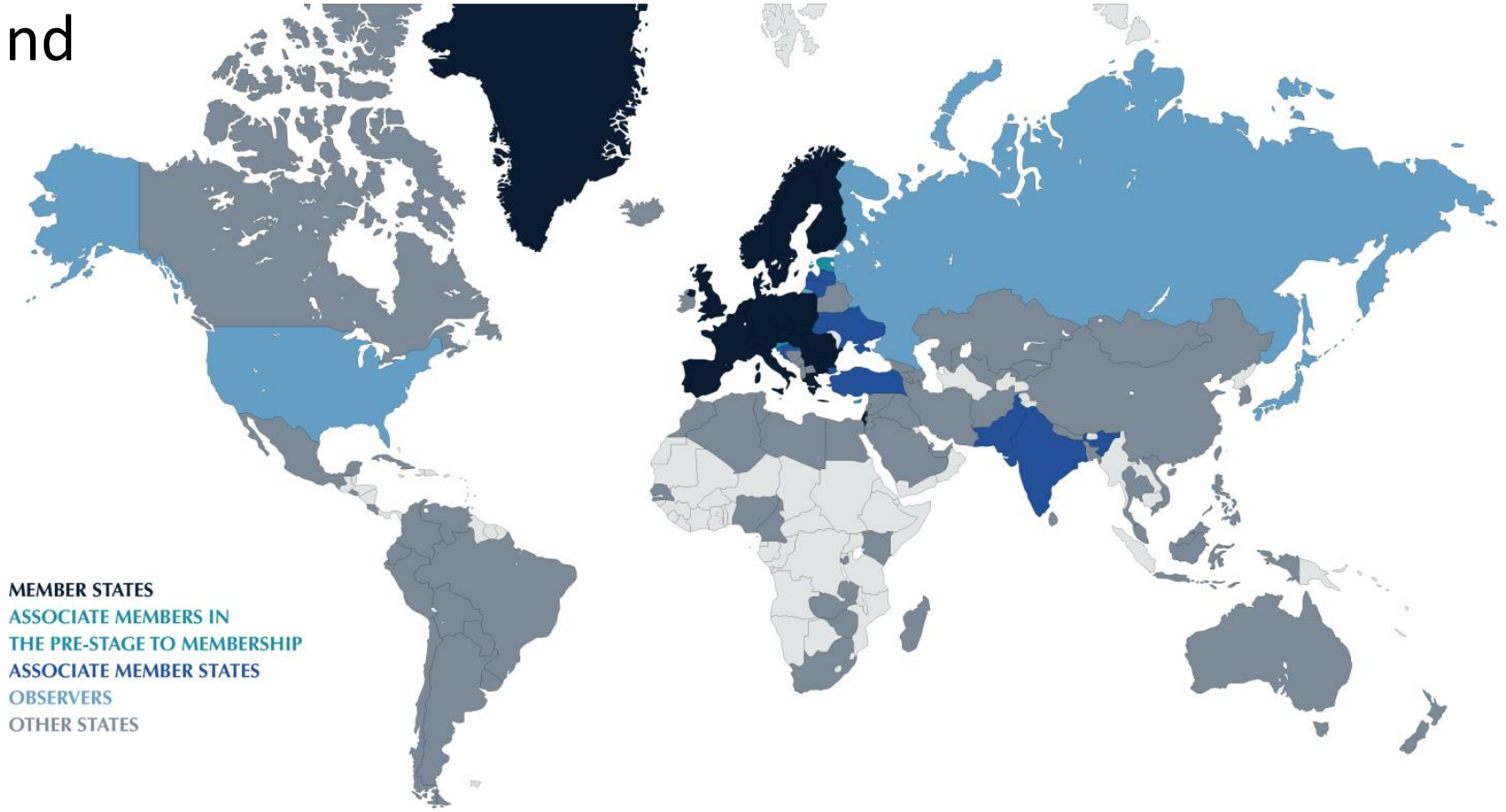
Bulletin for the CERN Community

- CERN Courier (Feature article in present Jan/Feb issue)

CERNCOURIER

CAS Locations

- CERN is financed by 23 member states and 11 associated member states
- **CAS visits** all **CERN member states and associated member states in turn** as return to countries and to foster contacts
- Courses organised in collaboration with local organiser from institute in the country
- Support for
  - hotel selection, local organization, lab visit,…



Country priority

- Facts to consider:
  - current geopolitical situation
  - ease of shipping material for hands-on
  - local accelerator infrastructure
    - general in countries with less developed accelerator infrastructure
  - member / assoc. member states

- not yet visited
  - Brazil
  - Croatia
  - Cyprus
  - Estonia
  - India
  - Israel
  - Latvia
  - Pakistan
  - Serbia
  - Slovenia
  - Türkiye
  - Ukraine

associated member
pre-stage to membership
member state

Country	Last CAS	# of CAS (1993)
Netherlands	2005	1
Belgium	2009	2
Bulgaria	2010	1
Norway	2013	2
Czech	2014	2
Poland	2015	2
Hungary	2016	2
Sweden	2017	2
UK	2017	4
Italy	2017	7
Finland	2018	1
Romania	2018	1
Greece	2018	4
Slovakia	2019	2
Denmark	2019	3
Portugal	2019	3
Switzerland	2021	4
Lithuania	2022	1
France	2022	4
Spain	2023	5
Germany	2023	6
Austria	2023	4

CAS course planning

	Period I Feb-April	Period II May-June	Period IIb July	Period III Sept-Oct	Period IV Nov-Dec
2021				**General Introduction** **Switzerland**	
2022		**Basic** **local**		**General Introduction** **Lithuania**	**Advanced General** **France**
2023		**RF** **Germany**	**IAS: SC** **Canada**	**General Introduction** **Spain**	**NC + SC Magnets** **Austria**
2024	**Basic** **local**	**Mechanical Engineering** **Netherlands**		**General Introduction** **Spain**	**Advanced General** **Belgium**
2025	**Basic** **local**	**High Intensity** Bulgaria	**IAS?** Australia	**General Introduction** Turkiye	**Topical**
2026	**Basic** **local**	**Topical**		**General Introduction**	**Advanced General**
2027	**Basic** **local**	**Topical**	**IAS?** Europe	**General Introduction**	**Topical**

High Intensity Hadron Beams

- Topic already put on future course list in Advisory Board Meeting 2019
  - Intensity limitation and high power (hadron) accelerators
- ESPPU high priority
- Recent Advisory Board Meeting confirmed importance
- Various communities concerned
  - HL-LHC, FCC-hh
  - ESS
  - ISIS
  - FAIR
  - Cyclotrons
  - Muon Collider
  - ADS

2011 – High Power Hadron Machines

- 7 lecture days
- Up to 7 lectures/day
- 46 lectures

PROGRAMME High Power Hadron Machines
24 May – 2 June 2011, Bilbao, Spain

Time	Wednesday 25 May	Thursday 26 May	Friday 27 May	Saturday 28 May	Sunday 29 May	Monday 30 May	Tuesday 31 May	Wednesday 1 June	Thursday 2 June
08:30	Introduction I K. Clausen	Multiparticle Beam Dynamics in Linacs II A. Letchford	RF Generation R. Carter	Tuners and Couplers G. Devanz		Specific Beam Diagnostics II K. Wittenburg	New Target Concepts I. Efthymiopoulos	Radio Protection H. Vincke	Departure to airport
09:30	Challenges and Beam Parameters of Machines I	Linacs	RF Basics I	SC versus NC Cavities		Vacuum I	Ion Sources I	Activation & Radiation Damage of Components in the Environment of Proton Accelerators	
10:30	M. Lindroos	M. Vretenar	F. Gerigk	G. Clemente		G. Franchetti	D. Faircloth	D. Kiselev	
	C O F F E E				E X C U R S I O N	C O F F E E			
11:00	Introduction II	Multiparticle Beam Dynamics in Rings I	RF Basics II	H^- Injection		Vacuum II	Ion Sources II	Remote Handling	
12:00	K. Clausen	C. Prior	F. Gerigk	C. Prior		G. Franchetti	D. Faircloth	M. Wohlmuther	
12:00	Challenges and Beam Parameters of Machines II	Multiparticle Beam Dynamics in Rings II	Beam Loading I	Lattice Design I		Fundamentals of Cryogenics I	Collimation	Comments on Case Study	
13:00	M. Lindroos	C. Prior	A. Gamp	B. Holzer		P. Pierini	S. Wronka		
	L U N C H					L U N C H			
14:30	Beam Dynamics with Space Charge I	Cyclotrons	Beam Loading II	Lattice Design II		Fundamentals of Cryogenics II	Case Study	Commissioning Strategies	
15:30	C. Prior	M. Seidel	A. Gamp	B. Holzer		P. Pierini	A. Jansson/ C. Oyon	J. Galambos	
15:30	Multiparticle Beam Dynamics in Linacs I	Synchrotrons	RF Transport	RFQ		Targets and Beam Dumps I	Case Study	Reliability & Tolerance Case of ADS	
16:30	A. Letchford	O. Boine-Frankenheim	S. Choroba	M. Vretenar		M. Wohlmuther	A. Jansson/ C. Oyon	J.-L. Biarrotte	
	T E A					T E A			
17:00	Beam Dynamics with Space Charge II	FFAGs	HOMs	Specific Beam Diagnostics I		Targets and Beam Dumps II	Case Study	Closing Talk	
18:00	C. Prior	S. Machida	H.-W. Glock	K. Wittenburg		M. Wohlmuther	A. Jansson/ C. Oyon	R. Bailey	
19:00 20:00	**Welcome Drink Dinner**	**Dinner**	**Dinner**	**Dinner**	**Special Dinner**	**Dinner**	**Dinner**	**Dinner**	

2015 – Intensity Limitations in Particle Beams

Intensity Limitations in Particle Beams, CERN, Geneva, Switzerland, 2-11 November, 2015

- 7 lecture days
- 37 lectures, 1 seminar
- 2 hours study
- 2 hours tutorial

Time	Monday 2 November	Tuesday 3 November	Wednesday 4 November	Thursday 5 November	Friday 6 November	Saturday 7 November	Sunday 8 November	Monday 9 November	Tuesday 10 November	Wednesday 11 November
8:30		Opening Talks	Bench Measurements and Simulations of Beam Coupling Impedance	Beam Instabilities in Linear Machines II	Observations and Diagnostics in High Brightness Beams	Space Charge Effects in Linacs		Electron Cloud I	High Brightness Photo Injectors	
9:30	A		U. Niedermayer	M. Ferrario	A. Cianchi	I. Hofmann		G. Rumolo	E. Chiadroni	D
9:30	R	Introduction and Needs for High Intensity and High Brightness	Beam Dynamics with High Intensity II	Beam-Beam Effects in Hadron Colliders I	Sources and Low Energy Beam Transfer	Intrabeam Scattering		Beam-Beam Effects in Linear Colliders	Electron Cloud II	E
10:30	R I V A L	L. Rivkin	A. Chao	T. Pieloni	R.Scrivens	M. Martini	E X C U R S I O N	D.Schulte	G. Rumolo	P A R T U R E
		COFFEE	COFFEE	COFFEE	COFFEE	COFFEE		COFFEE	COFFEE	
11:00		Overview of Limitations	Beam Based Impedance Measurements	Effects near Transition	Space Charge and Impedances	Space Charge in Circular Machines		Passive Mitigation	Active Mitigation	A
12:00		W. Herr	E. Shaposhnikova	E. Metral	O. Boine-Frankenheim	G. Franchetti		V. Kornilov	H. Schmickler	F T E R
12:00	D	Wakefields and Impedances I	Beam Instabilities in Circular Machines II	Beam-Beam Effects in Hadron Colliders II	Numerical Methods I			Machine Protection	Beam Loss Consequences	
13:00	A	R. Wanzenberg	A. Chao	T. Pieloni	K. Li			R. Schmidt	F. Cerutti	B
	Y	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH		LUNCH	LUNCH	R E A K F A S T
14:30		Beam Dynamics with High Intensity I	Beam Instabilities in Linear Machines I	F R E E A F T E R N O O N	Coherent Beam-Beam Effects	C E R N V I S I T		Study	Ions	
15:30		A. Chao	M. Ferrario		X. Buffat				R. Nagaoka	
		TEA	TEA		TEA			TEA	TEA	
16:00		Wakefields and Impedances II	Observations and Diagnostics in High Intensity Beams		Beam-Beam Effects in Circular Lepton Colliders			Vacuum Issues	Numerical Methods II	
17:00	**Registration**	M. Dohlus	V. Kornilov		C. Milardi			P.Chiggiato	K. Li	
17:00		Beam Instabilities in Circular Machines I	Study		Tutorial			Tutorial	Seminar Design Options for High Intensity Linacs	
18:00		A. Chao							D. McGinnis	
		Welcome Drink								
19:00	DINNER	DINNER	DINNER	DINNER	DINNER	DINNER	Special Dinner	DINNER	DINNER	

2014 – JAS Beam Loss and Accelerator Protection

The CERN Accelerator School

- 7 lecture days
- 1h30 lectures
- 26 lectures => 39 hours
- case studies

Joint International Accelerator School on Beam Loss and Accelerator Protection

November 5-14, 2014

Time	Wednesday Nov. 5	Thursday Nov. 6	Friday Nov. 7	Saturday Nov. 8	Sunday Nov. 9	Monday Nov. 10	Tuesday Nov. 11	Wednesday Nov. 12	Thursday Nov. 13	Friday Nov. 14
8:30		Introduction to Accelerator Protection Course Rudiger Schmidt [Lecture]	Beam Material Interaction, Heating & Activation (Part I) Nikolai Mokhov (2 hrs) [Lecture]	Beam Transfer and Machine Protection Verena Kain [Lecture]	FREE DAY	Detection of Equipment Failures Before Beam Loss John Galambos [Lecture]	Machine Protection and Interlock Systems for LHC Rudiger Schmidt [Lecture]	Machine Protection and Operation for LHC Jorg Wenninger [Lecture]	Personnel Protection Systems Sayed Rokni [Lecture]	
10:00										
		COFFEE				COFFEE				
10:30	ARRIVAL DAY	Beam Dynamics and Beam Losses - Circular Machines Verena Kain [Lecture]	Beam Material Interaction, Heating & Activation (Part II) Francesco Cerutti (1 hr) [Lecture]	Beam Induced Damage Mechanisms and Their Calculation (Part I) Alessandro Bertarelli [Lecture]		Controls and Machine Protection Enzo Carrone [Lecture]	Machine Protection and Interlock Systems - Linear Machines Marc Ross [Lecture]	Machine Protection and Operation for Linear Machines Marc Ross [Lecture]	Medical Facilities Anthony Mascia [Lecture]	DEPARTURE DAY
12:00										
		LUNCH				LUNCH				
13:30		Beam Dynamics and Beam Losses - Linear Machines Mike Plum [Lecture]	Reliability and Availability Ferdinand Willeke [Lecture]	Beam Induced Damage Mechanisms and Their Calculation (Part II) Alessandro Bertarelli [Lecture]	FREE DAY	Beam Instrumentation for Machine Protection Tom Shea (2 hrs) [Lecture]	Protection of Hardware: Powering Systems (PC, NC and SC Magnets) Howard Pfeffer [Lecture]	Beam Cleaning and Collimation Systems Stefano Redaelli (2 hrs) [Lecture]	Present Case Studies	
15:00										
		STUDY				STUDY				
17:00		High Intensity Synchrotron Radiation Effects Yusuke Suetsugu [Lecture]	Intro to Risk Management of Complex Systems John Thomas [Lecture]	Protection Related to High Power Targets Mike Plum [Lecture]		Beam Loss Monitors at LHC Bernd Dehning (1 hr) [Lecture]	Protection of Hardware: RF Systems Sang Ho Kim [Lecture]	Advanced Collimators for Future Colliders Tom Markiewicz (1 hr) [Lecture]		
18:30		DINNER				DINNER				
20:00	Dinner, Registration and Talk	Case Studies [Background material for the TT40 Groups]				Case Studies			Final Exam	
21:30										

Program to fill

- 9-10 lecture days
- 46-52 hours
- Exercises?

- Suggestion:
  - 1st iteration: topics
  - 2nd step: lecturers + backup
- Lecturers: try to give >=2 lectures if possible (travel cost reduction)

Program for the 2025 CAS - High Intensity Hadron Beams

	Mon 12/05	Tue 13/05	Wed 14/05	Thu 15/05	Fri 16/05	Sat 17/05	Sun 18/05	Mon 19/05	Tue 20/05	Wed 21/05	Thu 22/05	Fri 23/05	Sat 24/05
08:30	Arrival day and registration	Opening / Local presentation Tecker et al.	0 0	0 0			Excursion	0 0	0 0	Free	0 0	1 0	Departure day
09:30													
09:40		0 0	0 0	0 0		0 0		0 0	0 0		0 0	1 0	
10:40		Coffee						Coffee					
11:10		0 0	0 0	0 0		0 0		0 0	0 0		0 0	1 0	
12:15		Lunch						Lunch					
13:45		0 0	0 0	Free / Visit	0 0	0 0		0 0	0 0	0 0	0 0	1 0	
14:45													
14:55		0 0	0 0		0 0	0 0				0 0			
16:00		Coffee			Coffee			Coffee					
16:30		0 0	0		0 0	0 0						Closing Tecker et al.	
17:30													
17:45		1 slide 1 minute	Poster session										
18:45		Welcome reception											
20:00	Dinner at Hotel											Banquet	
21:00									Cinema event				

The CERN Accelerator School

AOB

Thanks a lot for your participation!

http://cern.ch/cas

The CERN Accelerator School

Spares

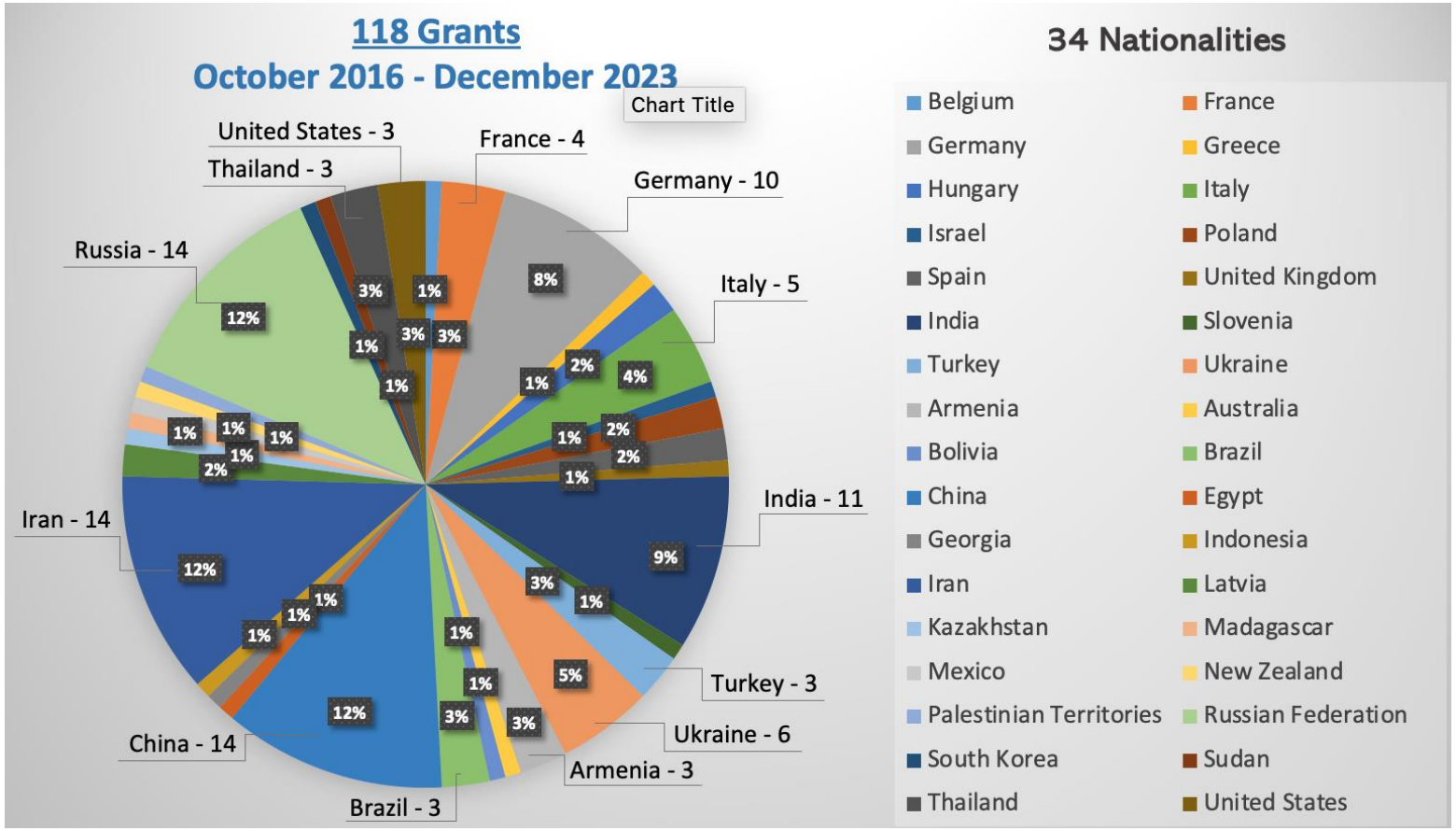
Local “Basic” CAS Course

- **Basic course** (5 days, non-residential) near CERN (Ferney-Voltaire)
  - Teaching **concepts** of accelerator physics and basic accelerator technology
  - (almost all) CERN lecturers
  - aimed at people
    - as first introduction or
    - working close to the field
  - open for limited number (~15) of external participants
  - aim at once per year
  - limited cost (400 CHF)
  - no grants
  - Fully booked, 81 places

Student Grants

- Created to boost accelerator technology for countries developing this field
- Participation offered (without travel)
- Priority to people who cannot otherwise attend
- studies/employment related to the course

- up to 50 applicants/course
- diverse origin of the selected



Teaching Material

- **Slides**
  - on Indico publicly accessible
- **Proceedings**
  - ~70 volumes of proceedings from past schools
  - publicly available, highly referenced
- **Lecture recordings – CASopedia**
  - all lectures filmed since 2021
  - abstract, keywords, transcript for easier search
  - topical courses will be freely available
  - general courses: accessibility being defined based on technical solutions

Photo credit: Noemi Caraban

Program for the 2023 CAS - Introduction to Accelerator Physics

The CERN Accelerator School

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
	25/09	26/09	27/09	28/09	29/09	30/09	01/10	02/10	03/10	04/10	05/10	06/10	07/10	08/10
08:30		Opening Tecker et al.	Kinematics of Particle Beams - Relativity Shreyber	Transverse Linear Beam Dynamics IV Hillert		Beam Instrumentation Forck	Electron Beam Dynamics I Rivkin		Cyclotrons Seidel	Vacuum Seidel		A first taste of Non-Linear Beam Dynamics I Bartosik	Advanced accelerator concepts II Ferrario	
09:30														
09:45		Electromagnetic Theory I Shreyber	Warm Magnets de Rijk	Computational tools I Latina	Free	Computational tools II Latina	Electron Beam Dynamics II Rivkin		RF systems I Damerau	Collective Effects I Li	Free / ALBA visit Bus will leave at 8:00 AM!!!	Secondary beams and targets Knie	Particle motion in Hamiltonian Formalism II Papaphilippou	
10:45		Coffee				Coffee			Coffee			Coffee		
11:15		History of particle acceleration Sheehy	Transverse Linear Beam Dynamics II Hillert	Transverse Linear Beam Dynamics V Hillert		Beam Diagnostics Forck	Injection and Extraction Dutheil		Sustainability for Accelerators Seidel	Introduction to Non-Linear longitudinal Beam Dymanics Damerau		A first taste of Non-Linear Beam Dynamics II Bartosik	Synchrotron light circular machines & FELs I Prat	
12:15		Lunch							Lunch					
13:45	Arrival day and registration	Electromagnetic Theory II Shreyber	Linear Accelerators I Alesini	Longitudinal BD in Circular Machines I Tecker	Longitudinal BD in Circular Machines II Tecker	Colliders and luminosity Schmickler	Machine & People Protection Issues Forck	Excursion --- Bus will leave at 8:00 AM!!!	RF systems II Damerau	Collective Effects II Li	Collective Effects III Li	Advanced accelerator concepts I Ferrario	Synchrotron light circular machines & FELs II Prat	Departure day
14:45														
15:00		Transverse Linear Beam Dynamics I Hillert	Transverse Linear Beam Dynamics III Hillert	Time and Frequency domain signals I Schmickler	Linear Imperfections I Ziemann	Linear Imperfections - corrections Ziemann	ALBA presentation Discussion session Biscari		Hands-ON calculations (longitudinal) - Intro Damerau et al.	Hands-ON calculations (longitudinal) - III Damerau et al.	Sources Knie	Particle motion in Hamiltonian Formalism I Papaphilippou	Designing a synchrotron - a real life example Papaphilippou	
16:00		Coffee							Coffee					
16:30		Accelerator Applications Sheehy	Linear Accelerators II Alesini	Hands-ON Lattice calulations I Gamba et al.	Time and Frequency domain signals II Schmickler	Hands-ON Lattice calulations III Gamba et al.	Hands-ON Lattice calulations V Gamba et al.		Hands-ON calculations (longitudinal) - I Damerau et al.	Hands-ON calculations (longitudinal) - IV Damerau et al.	Collective Effects IV Li	Study time	Closing Tecker	
17:30														
17:45		1 slide 1 minute	Superconducting Magnets de Rijk	Hands-ON Lattice calulations II Gamba et al.	Linear Imperfections II Ziemann	Hands-ON Lattice calulations IV Gamba et al.	Hands-ON Lattice calulations VI Gamba et al.		Hands-ON calculations (longitudinal) - II Damerau et al.	Hands-ON calculations (longitudinal) - V Damerau et al.	Discussion session	all		
18:45		Welcome reception			Discussion session						Poster session	** Seminar ** Fusion for Energy Paco Sánchez		
20:15		Dinner at Hotel											Banquet	
21:00										Cinema event			Show	

The CERN Accelerator School

Scope

Accelerator Physics

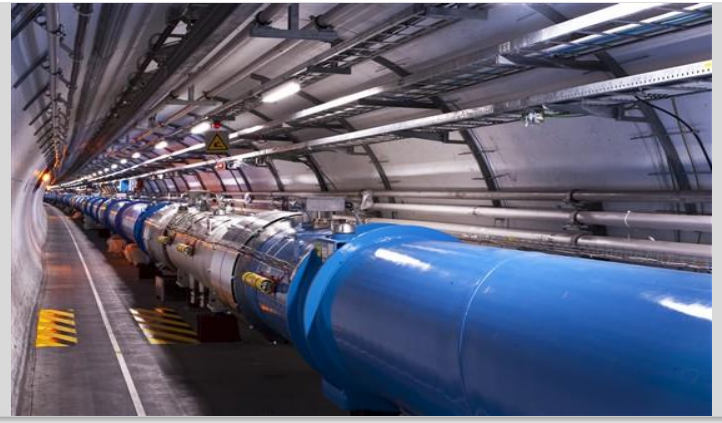
Relativity / Electro-Magnetic Theory / Transverse Beam Dynamics / Longitudinal Beam Dynamics / Linear Imperfections and Resonances / Synchrotron Radiation / Electron Beam Dynamics / Multi-Particle Effects / Non-Linear Dynamics Beam Instabilities / Landau Damping / Beam-Beam Effects

Accelerator Systems

Particle Sources / RFQ / LEBT
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
FFAs
Cyclotrons
Synchrotrons
Colliders



Applications

High Energy Physics
Nuclear Physics
Industrial Applications
Medical Applications
Cancer Therapy