The CERN Accelerator School

40th CAS advisory board meeting

CERN, Tuesday 7th May 2019

Outline

- Welcome
- CAS courses in the year 2018/2019
  + Briefly: CAS financial overview → potential cost savings
- Comparison USPAS <> CAS: Possible “take away” for CAS
- Proposal for countries and topics for the years 2021 - 2023

  - Lunch break
- University credits for CAS course attendance?
- CAS&MOOCs → CASopedia?
- AOBs:
  - student count / parallel competitive schools
  - VISA strategy
  - late registrations & payments

Welcome

- External to CERN:
  - K.Wittenburg (DESY)
  - O. Boine-Frankenheim (TU-Darmstadt)
  - P. Lebrun (JUAS)
  - N. Delerue (IN2P3)
  - M. Ferrario (INFN)
  - L. Rivkin (EPFL, PSI)
  - A. Wolski (STFC)
- CERN:
  - F. Bordry
  - P. Collier
  - M. Meddahi
  - E. Chapochnikova
  - E. Metral
- CAS team:
  - W. Herr
  - Y. Papaphillipou
  - F. Tecker
  - D. Rivoiron
  - M. Filippova
  - A. Safronava
  - H. Schmickler

Feb/2018: Introduction to Future Colliders/ Zuerich

- Planned as continuation of 10 previous “Linear Collider Schools” + as first “FCC school”
- Low number of students, 95% from CERN
- FCC management proposed Switzerland as location -→ very expensive
- Very good program treating the basic beam dynamics and technologies of circular and linear future colliders (introductory levels)

	Wed, 21.2.2018	Thu, 22.2.2018	Fri 23.2.2018	Sat, 24.2.2018	Sun, 25.2.2018	Mon, 26.2.2018	Tue, 27.2.2018	Wed, 28.2.2018	Thu, 1.3.2018	Fri,2.3.2018	Sat, 3.3.2018	Sun, 4.3.2018	Mon, 5.3.2018	Tue,6.3.2018
08:30	Arrival day and registration	Course Opening / Seminar H.Schmickler / L. Rivkin	Detectors for high energy colliders/Machine detector interface I L.Linssen	Recap of long. BD F.Tecker	Collider Diagnostics / Measurement of critical beam parameters I J.Wenniger	Beam-Beam Effects/Beamstrahlung I W.Herr	Instabilities in high energy colliders and their mitigation I O.Boine-Fr...	Excursion	Superconducting RF systems I E.Jensen	Normalconducting & permanent magnets T. Zickler	Low Level RF challenges/timing systems I A. Gallo	Interaction of particles with matter N. Mokhov	Normal conducting high gradient Rf systems II W.Wuensch	Departure day
09:20		Discussion								Discussion				
09:30		High energy physics at colliders M. Mangano	Recap of transverse BD I H.Schmickler	Large colliders critical technologies to be announced	Circular Hadron Collider beam dynamics I M.Syphers	Circular Lepton Collider beam dynamics/damping rings I K. Oide	Circular Lepton Collider beam dynamics/damping rings II K. Oide		positron production M. Kuriki	Superconducting RF systems III E.Jensen	Low Level RF challenges/timing systems II A. Gallo	Normal conducting high gradient Rf systems I W.Wuensch	Kickers & Septa M.Paraliev	
10:30		Coffee							Coffee					
11:00		Luminosity goals, critical parameters B. Muratori	Detectors for high energy colliders/Machine detector interface II L.Linssen	Circular Hadron Collider beam dynamics III D. Schulte	Collider Diagnostics / Measurement of critical beam parameters II J.Wenniger	Beam-Beam Effects/Beamstrahlung II W.Herr	Instabilities in high energy colliders and their mitigation II O.Boine-Fr...		Superconducting RF systems II E.Jensen	magnet vibration and feedbacks A.Seryi	RF power systems, CLIC drive beam S. Doebert	machine protection concepts N. Mokhov	alignment&metrology/ requirements and realization D. Missiaen	
11:50		Discussion							Discussion					
12:00		Introduction to a Muon Collider and Gamma Collider W.Chou	Recap of transverse BD II H.Schmickler	Discussion Session I B. Holzer	Circular Hadron Collider beam dynamics II M.Syphers	injection and extraction M.Aiba	Discussion Session II B. Holzer		Large colliders civil engineering and siting J.Osborne	Lessons learnt from SLC F. Zimmermann	Discussion III B. Holzer	Final Focus layouts and stability considerations A. Seryi	High Energy Ion Colliders J. Jowett	
13:00		Lunch								Lunch				
14:30		Linear Collider studies overview S.Stapnes	Linear Collider Beam dynamics I D.Schulte	Case Studies Introduction WH/BH/DS	Free	Case Studies II WH/BH/DS	Case Studies IV WH/BH/DS		Superconducting material/cables C. Senatore	Case Studies VI WH/BH/DS	Free	Case Studies VIII WH/BH/DS	Reliability Engineering/Availibity of a large collider complex M.Zerlauth	
15:30		Large circular colliders overview(including h-e option) M.Benedikt	Emittance Preservation in Hadron Machines H. Schmickler	Case Studies I WH/BH/DS		Case Studies III WH/BH/DS	Case Studies V WH/BH/DS		Superconducting magnets /Low temperature Superconductors L. Bottura	Case Studies VII WH/BH/DS		Case Studies IX WH/BH/DS	Case Studies Presentations I WH/BH/DS	
16:30		Coffee				Coffee				Coffee			Coffee	
17:00		Lessons learnt from LEP/LHC M.Lamont	Linear Collider Beam dynamics II D.Schulte	polarized electron beams/energy calibration J.Wenninger		SwissFEL, the X-ray free electron laser at PSI H. Braun	Vacuum Challenges R.Kersevan		Superconducting magnets /High temperature Superconductors L. Bottura	Advanced future Collider Concepts P. Muggli		collimators & Dumps & Masks M.Seidel	Case Studies Presentations II WH/BH/DS	
18:00		Reception											Closing	
18:30		Podium discussion: Future of high energy colliders							Medical Applications of accelerator technologies at PSI					

June 2018 Beam Instrumentation, Tuusula (FI)

- 98 participants
- One of the major topical courses
- High quality lectures
- Afternoon Hands-ON courses

- Very active local organizer
  → very good (expensive) social program

The CERN Accelerator School

	2.6.	3.6	4.6.	5.6.	6.6.	7.6.	8.6	9.6	10.6	11.6	12.6.	13.6.	14.6.	15.6
08:30	Arrival day and registration	Opening	BD Requirements Overview/Measurement Principles III	Numerical methods, mathematical background I	Numerical methods, mathematical background II	Diagnostics Examples from CTF3	Bunch Length Diagnostics II	Excursion	Diagnostics Examples from light sources	BPM systems II	Free	Collective Effects & its diagnostics I	Timing and Synchronization II	Departure day
		local speaker/ H.Schmickler	G. Kube	L. Nadolski	L. Nadolski	F.Tecker	A. Gillespie		K. Wittenburg	M.Wendt		V. Kornilov	A. Gallo	
09:30		BD Requirements Overview/Measurement Principles I	Analog Electronics I	Tune, Chromaticity & Coupling Measurements	Diagnostics examples from HE colliders	Bunch Length Diagnostics I	Application of Lasers in Beam Instrumentation		BPM systems I	Medical Applications Instrumentation & Diagnostics	Beam Loss Monitors	Timing and Synchronization I	Collective Effects & its diagnostics II	
		G. Kube	J. Bellemann	R. Jones	R.Jones	A. Gillespie	S. Gibson		M. Wendt	A. Peters	K. Wittenburg	A. Gallo	V. Kornilov	
10:30		Coffee							Coffee					
11:00		Transverse beam dynamics recap I	RF measurement techniques	Analog Electronics II	Linear Imperfections and Corrections I	Lasers (technologies & setups)	Transverse Profile Measurements I		Transverse Profile Measurements II	Analog Digital Conversion	Schottky Diagnostics	Halo diagnostics	Diagnostic Needs for Wakefield Accelerator Experiments	
		H.Schmickler	M. Wendt	J. Bellemann	J. Wenninger	S. Gibson	E. Bravin		E. Bravin	M. Gasior	P. Kowina	K. Wittenburg	A. Cianchi	
12:00		BD Requirements Overview/Measurement Principles II	Video Cameras (signal generation and transmission)	Discussion/Q&A I	Introduction to Optics (basics, components, diffraction)	Linear Imperfections and Corrections II	Discussion/Q&A II		Intensity Measurements	Emittance Measurements	Diagnostics Examples from lepton-linacs and FELs	Discussion/Q&A III	Transverse Feedbacks	
		G. Kube	B. Walasek-Hoehne	H.Schmickler	S. Gibson	J. Wenninger	H.Schmickler		A. Peters	E. Bravin	A. Cianchi	H.Schmickler	H.Schmickler	
13:00		Lunch								Lunch				
14:30		Transverse beam dynamics recap II	Block A -1	Block A- 4	Free	Block B -1	Block B- 4		Block C -1	Block C- 4	Free	Block D -1	Block D- 4	
		H.Schmickler	Course Team	Course Team		Course Team	Course Team		Course Team	Course Team		Course Team	Course Team	
15:30		Longitudinal beam dynamics recap	Block A- 2	Block A -5		Block B- 2	Block B -5		Block C- 2	Block C -5		Block D- 2	Block D -5	
		F. Tecker	Course Team	Course Team		Course Team	Course Team		Course Team	Course Team		Course Team	Course Team	
16:30		Coffee	Coffee			Coffee			Coffee			Coffee		
17:00		Transverse beam dynamics recap III	Block A -3	Block A- 6		Block B -3	Block B- 6		Block C -3	Block C- 6		Block D -3	Block D- 6	
		H.Schmickler	Course Team	Course Team		Course Team	Course Team		Course Team	Course Team		Course Team	Course Team	
18:00		OneS-OneM				How the forest breathes	Poster session			Space and Space Weather			Closing	
		All				M. Kulmala	Organizer			M. Palmroth				
19:30		Dinner			Dinner in Helsinki	Dinner								
21:00										social event				

Statistics Tuusula

June 2018: CAS@ESI

- Continuation of previous local CAS courses in Divonne and Chavannes (previously every 3 years)
- Max 62 students:
  = 3 x 15 from CERN-ATS +
  7 from CERN non ATS +
  10 from member states
- Non residential, but 3 hotels close by
- Compact 5 days basic introduction on technician level; inexpensive: 350 CHF

The CERN Accelerator School

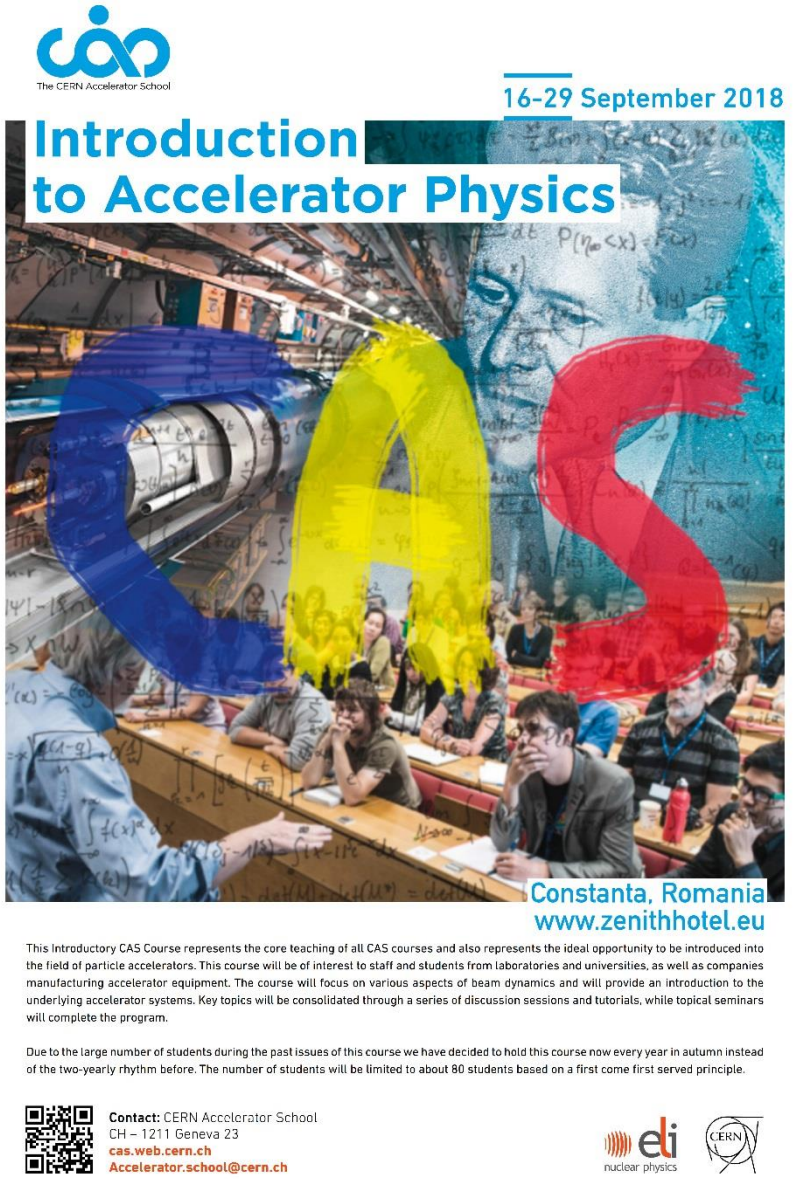
Program for the CAS@ESI - Basics of Accelerator Physics and Technology - Archamps, 25-29 June					
	Mon 25	Tue 26	Wed 27	Thu 28	Fri 29
08:30	Coffee				
09:00	Accelerators for Beginners and the CERN Complex Steerenberg	Transverse Beam Dynamics I Holzer	Longitudinal Beam Dynamics II Tecker	Injection, Extraction and Beam Transfer Forte	Machine Protection Zerlauth
10:00	Pause				
10:15	Basic Mathematics and Units Steerenberg	Longitudinal Beam Dynamics I Tecker	Beam Instrumentation Schmickler	Luminosity and Beam-Beam at the LHC Pieloni	Collective effects Cornelis
11:15	Coffee				
11:45	Electromagnetic Theory Herr	Standard Model and Beyond Sphicas	Transverse Beam Dynamics III Holzer	Kickers, Septa and Protection Elements Kramer	Vacuum Systems Baglin
12:45	Lunch				
14:00	Relativity Herr	Transverse Beam Dynamics II Holzer	Linacs Lombardi	Discussion	Discussion
15:00	Particle Sources Scrivens	Discussion	Discussion	Cryogenics Claudet	CLIC Schmickler
16:00	Coffee				
16:30	Warm Magnets De Rijk	RF Systems Tecker	Linear Imperfections Wenninger	Superconducting Magnets Schoerling	LHC upgrades and Future Circular Colliders Benedikt
17:30					
Chair	Hermann	Hermann	Hermann	Hermann	Hermann
Reserve	Werner	Werner	Werner	Werner	Werner

Sept 2018: Introductory General Course, Constanta (RO)

The CERN Accelerator School

- 89 students (only?)
  (2012 Granada: 141,
  2014: Prague: 120
  2016: Budapest 120)
- “standard” intorductory level course
- New: Computational exercises
  (linear optics, defined and entertained by Volker Ziemann (Uppsala)
- Defined 10 “core” lectures:

- slides 6 months before school
- Review meeting at CERN in July 2018



Program for the 2018 CAS - Introduction to Accelerator Physics - Constanta

	Su,16.9.	Mo, 17.9	Tu, 18.9	We, 19.9	Th, 20.9.	Fr, 21.9	Sa,22.9	Su, 23.9	Mo, 24.9	Tu, 25.9	Me, 26.9	Th, 27.9	Fr, 28.9.	Sa, 29.9.
08:30	Arrival day and registration	Opening local/Schmickler	Transverse Linear Beam Dynamics I Hillert	Linear Accelerators I Alesini	Longitudinal Beam Dynamics in Circular Machines II Tecker	Luminosity and Colliders Herr	Collective Effects I Li	Excursion	Collective Effects III Li	Electron Beam Dynamics II Rivkin	Free	Sources Faircloth	Secondary beams and targets Knie	Bus transfer to Bukarest, ELI visit
09:30														
09:45		Accelerator Applications Sheehy	Transverse Linear Beam Dynamics II Hillert	Linear Accelerators II Alesini	Transverse Linear Beam Dynamics V Hillert	Injection and Extraction Fraser	Collective Effects II Li		Collective Effects IV Li	Discussion electron beam dynamics Rivkin		RF systems I Damerau	RF systems II Damerau	
10:45		Coffee							Coffee			Coffee		
11:15		Electromagnetic Theory I Herr	Particle motion in Hamiltonian Formalism I Sheehy	Transverse Linear Beam Dynamics III Hillert	Discussion transverse BD Hillert	FFA's Sheehy	Advanced accelerator concepts Mostacci		Discussion collective effects Li	Linear Imperfections III/Corrections Ziemann		Laser induced particle acceleration and secondary radiation sources Stutmann	Machine & People Protection Issues Forck	
12:15		Lunch							Lunch					
13:45		Electromagnetic Theory II Herr	Particle motion in Hamiltonian Formalism II Sheehy	Transverse Linear Beam Dynamics IV Hillert	Free	Kickers, Septa and Beam Transfer Fraser	Warm Magnets/power converters de Rijk		Linear Imperfections I Ziemann	A first taste of Non-Linear Beam Dynamics I Papaphilippou	A first taste of Non-Linear Beam Dynamics II Papaphilippou	Beam Instrumentation Forck	Introduction to Non-Linear longitudinal Beam Dymanics Damerau	late lunch at ELI
14:45														
15:00		Kinematics of Particle Beams - Relativity Ferrario	Hands-ON Lattice calulations - introduction Ziemann/Herr/Sterbini	Longitudinal Beam Dynamics in Circular Machines I Tecker		Discussion longitudinal BD Tecker/Alesini	Superconducting Magnets de Rijk		Linear Imperfections II /Corrections Ziemann	Cyclotrons I Seidel	Synchrotron light machines &FELs Diaconescou	Beam Diagnostics Forck	Q&A/study time V all	
16:00		Coffee				Coffee			Coffee					
16:30		Statistical Description of Particle Beams Ferrario	Hands-ON Lattice calulations I Ziemann/Herr/Sterbini	Hands-ON Lattice calulations II Ziemann/Herr/Sterbini		Hands-ON Lattice calulations IV Ziemann/Herr/Sterbini	Hands-ON Lattice calulations VI Ziemann/Herr/Sterbini		Electron Beam Dynamics I Rivkin	Cyclotrons II Seidel	Designing a synchrotron - a real life example Papaphilippou	Q&A/study time IV all	closing Schmickler	departure
17:30		1 slide 1 minute		Hands-ON Lattice calulations III		Hands-ON Lattice calulations V	Posters		Q&A/study time I	Q&A/study time II	Q&A/study time III	** Seminar ** tbd		
		all		Ziemann/Herr/Sterbini		Ziemann/Herr/Sterbini	all		all	all	all			
18:30		Welcome Reception												
19:30		Dinner at Hotel											Banquet	
21:00		poster preparation								cinema event				

Nov. 2018; Computational Methods; Thessaloniki (GR)

- Very specialized course, “first time” ever
- Expected 50 students, got 67
- Very intense, very positive feedback from students
- Some organizational issues; in particular very bad internet

The CERN Accelerator School

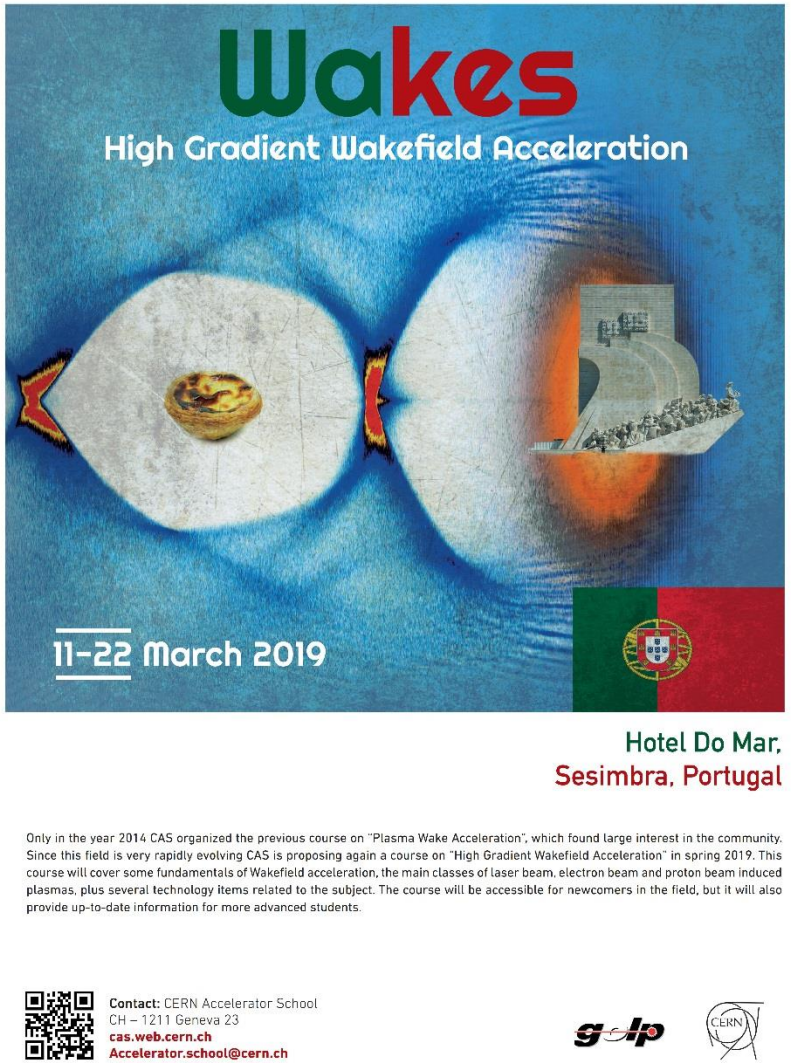
Numerical Methods for Analysis, Design and Modelling of Particle Accelerators, 11-23 November 2018, Thessaloniki, Greece

	Sunday, 11-Nov	Monday, 12-Nov	Tuesday, 13-Nov	Wednesday, 14-Nov	Thursday, 15-Nov	Friday, 16-Nov	Saturday, 17-Nov	Sunday, 18-Nov	Monday, 19-Nov	Tuesday, 20-Nov	Wednesday, 21-Nov	Thursday, 22-Nov	Friday, 23-Nov
08:30		Opening, introduction to afternoon courses Schmickler	Monte Carlo - Simulation Techniques Qiang	Truncated Power Series Algebra I (TPSA) Forest	Dynamical Systems, Representation of Particle Beams Chao	Machine Learning I Ratner	Partial differential equation Russenschuck		Reserve/Poster Session Schmickler	Computing Techniques I Buffat	Field Solvers III de Gersem	Analysis Techniques II Papaphilippou	
09:30		Linear Algebra I Adelmann	Genetic Optimisation I Adelmann	Imperfections and corrections I Tomas	Partial differential equation Russenschuck	Multi Particle Simulation Techniques II Qiang	Machine learning II Ratner		Reserve/Poster Session Schmickler	Simulation of Interaction with material I Mokhov	Direct Vlasov Solvers I Mounet	Direct Vlasov Solvers II Mounet	
10:30		Coffee							Coffee				
11:00		Numerical computing Herr	Nonlinear Beam Dynamics Herr	Truncated Power Series Algebra II (TPSA) Forest	Imperfections and corrections II Tomas	Analysis Techniques I Papaphilippou	Study time and discussion Schmickler		Field Solvers I de Gersem	Computing Techniques II Buffat	Field Solvers IV de Geersem	Reserve	
12:00		Linear Optics calculations I Sterbini	Genetic Optimisation II Adelmann	Hamiltonian Dynamics Herr	Multi Particle Simulation Techniques I Qiang	TPSA III Forest	Study time and discussion Schmickler	EXCURSION	Field Solvers II de Gersem	Simulation of Interaction with Material II Mokhov	Discussion session	Comparison of various codes for interaction with material Mokhov	DEPARTURE DAY
13:00		Lunch							Lunch				
14:30	Hotel arrival	Linear Algebra II Adelmann	Computer setup Herr	Block A- 4 Forest	FREE	Block B -1 Qiang	Block B- 4 Qiang		Block C -1 de Gersem	FREE	Block C-4 Russenschuck	Discussion and closing Schmickler	
15:30		Ordinary differential equations Adelmann	Block A -1 Sterbini	Block A -5 Forest		Block B- 2 Qiang	Block B -5 Qiang		Block C- 2 de Gersem		Block C-5 Russenschuck		
16:30		Coffee				Coffee			Coffee		Coffee		
17:00	CAS Registration	Linear Optics calculations II Sterbini	Block A- 2 Sterbini	Block A- 6 Forest		Block B -3 Qiang	Block B- 6 Qiang		Block C -3 de Gersem		Block C-6 Russenschuck	FREE	
18:00		OneS-OneM All	Block A -3 Sterbini	Seminar I: Gravitational Waves: The Sound of Silence Kokkotas		FREE			FREE		Seminar II: From Newtonian Cosmology to Strings Lazaridis		
19:00		FREE									FREE		
19:30		Dinner										Gala dinner	
						Social event							

Feb/2019: Wakefield Acceleration, Sesimbra (PO)

- collaboration with ARIES WP5
- Last course on same subject 2014
- Difficulties to get enough students, very late registrations, many grant requests
- Finally 67 students (19 grants)

- Good program with smooth organization



Statistics Teachers:

- Future Colliders: 67%
- Instrumentation: 51%
- CAS@ESI 100%
- Introduction 55%
- Thessaloniki 57%

% of teachers, but not of hours tought

Since beginning of 2018: Online evaluation

Evaluation form: access

Access to web-form is granted to participants using the email addresses indicated in their Indico registrations

Step 1:

email with the link has been sent to all participants

If you did not receive the email, contact Anastasiya.Safronava@cern.ch

Step 2:

to login use the same email account; it will certainly work for CERN and for Google accounts, but not only

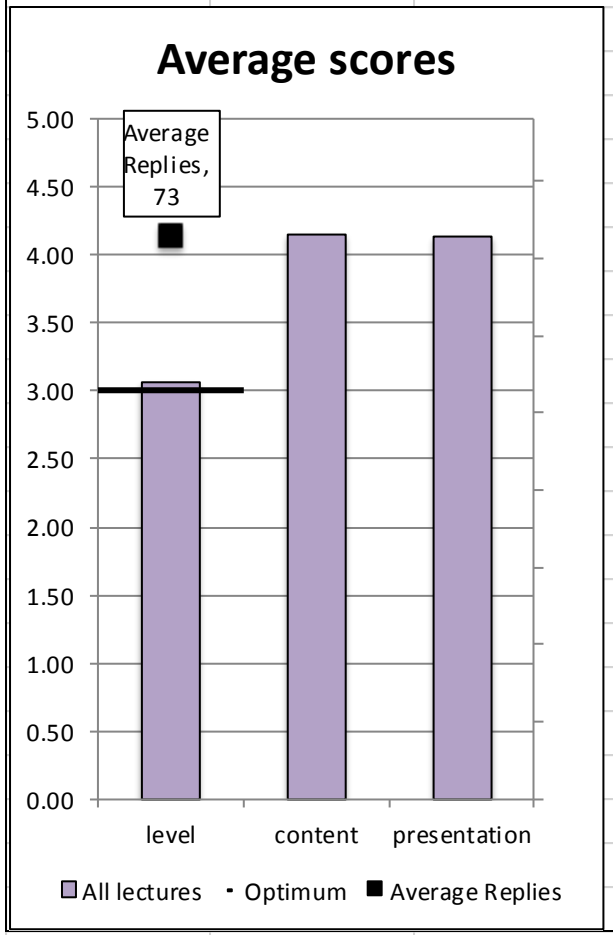
If you can not login, contact Anastasiya.Safronava@cern.ch

Solutions: provide your Google account if you have one, or a temporary CERN account will be created for you

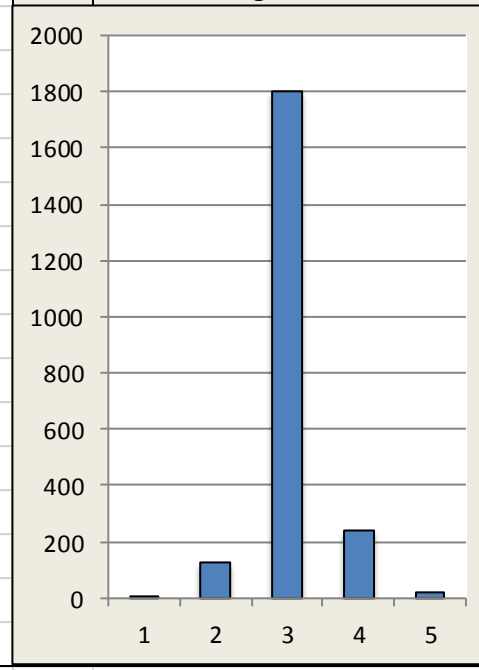
Typical result

CAS on Beam Instrumentation, Tuusula, Finland 2018 - Replies from 81/98 students

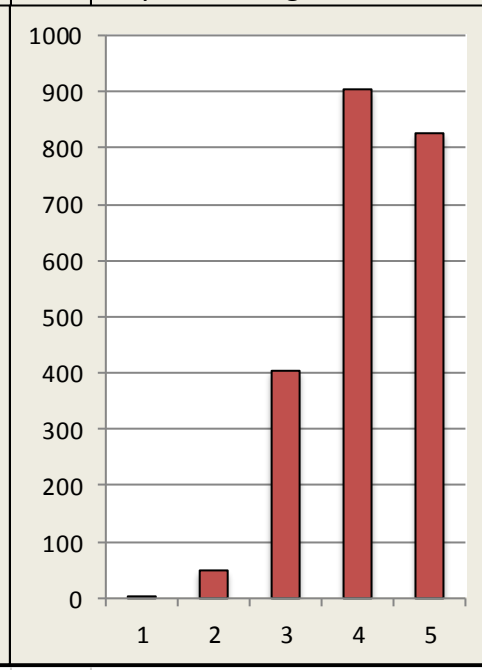
All lectures



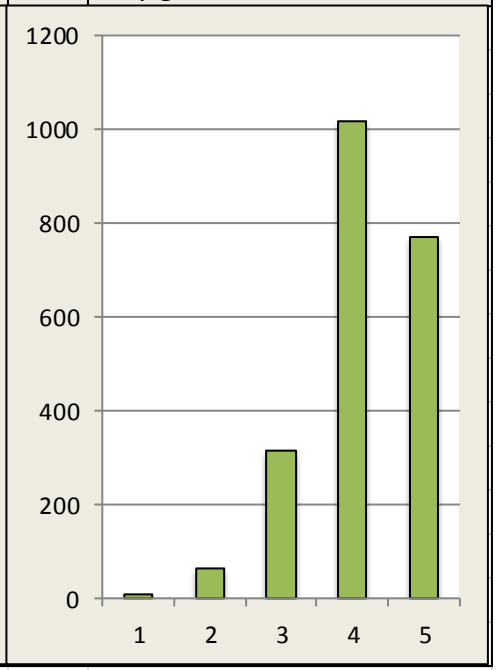
	Level
1	Much too low
2	Too low
3	Just right
4	Too high
5	Much too high



	Content
1	Completely uninteresting
2	Uninteresting
3	Of some interest
4	Interesting
5	Very interesting



	Presentation
1	Very poor
2	Poor
3	Fair
4	Good
5	Very good



What do we extract from feedback?

- Average impression (last slide)
- Detailed impression for each teacher (sent to teacher personally)
- Detailed comments on: Venue, organization, food, excursion…

Programme of High Gradient Wakefield Accelerators, 11-22 March 2019, Sesimbra, Portugal

Time	Mo, 11.03.2019	Tu, 12.03.2019	Wed, 13.03.2019	Thu, 14.03.2019	Fri, 15.03.2019	Sat, 16.03.2019	Sun, 17.03.2019	Mo, 18.03.2019	Tu, 19.03.2019	Wed, 20.03.2019	Thu, 21.03.2019	Fri.22.03.2019
09:00		Welcome & Opening *B. Holzer*	Introduction to plasma physics II *P. Gibbon*	Plasma sources I *J. Osterhoff*	Plasma sources II *J. Osterhoff*	Plasma wake generation (non-linear) *L. Silva*		Blow out regime *L. Silva*	Particle beam diagnostics *B. Marchetti*	Electron sources from plasma I *B. Cros*	Staging (incl. Synchr. & tolerances) *C. Lindstrom*	
10:00		Conventional Acc. & their limits I *M. Ferrario*	Laser beam physics *L. Corner*	Plasma wake generation (linear *Z. Najmudin*	Modelling and simulation I *J.L. Vay*	Modelling and simulation II *J.L. Vay*		Laser driver propag. in plasmas *S. Mangles*	Plasma diagnostics *J. Osterhoff*	Dielectrical Acc Structures (Theory) *N. Schoenenberger*	Positron acc. in plasmas *S. Corde*	D E P
11:00	A R	Coffee	Coffee	Coffee	Coffee	Coffee		Coffee	Coffee	Coffee	Coffee	A
11:30	R I V	Conventional Acc. & their limits II *M. Ferrario*	Laser diagnostics *L. Corner*	Acceleration of e- in a plasma II *A. Thomas*	Injection extraction and matching I *M. Ferrario*	Modelling and simulation III *J.L. Vay*	E X	Beam driven (experiment) *E. Gschwendtner*	Beam driver propogation (beams *R. Assmann*	Electron sources from plasma II *B. Cros*	case study *A. Walker*	R T U
12:30	A	Lunch	Lunch	Lunch	Lunch	Lunch	C	Lunch	Lunch	Lunch	Lunch	R
14:30	L	Introduction & hist. overview *V. Malka*	Laser driven wakefields I *S. Karsch*		Injection extraction and matching II *M. Ferrario*	Mod & simul hands on II *J. Vieira, R. Fonsecca*	U R S	Laser driven (experiment) *S. Mangles*	Beam driven systems (PWFA) I *P. Muggli*	Dielectrical Acc Structures (Exp) *N. Schoenenberger*	Radiation generation *F. Albert*	E
15:30	D A Y	Introduction to plasma physics I *P. Gibbon*	Acceleration of e- in a plasma I *A. Thomas*	Free	Applications *Z. Najmudin*	Mod & simul hands on III *J. Vieira, R. Fonsecca*	I O N	case study *A. Walker*	Beam driven systems (PWFA) II *P. Muggli*	Seminar 2 *IST* *J. Vieira*	case study presentations *A. Walker*	D A Y
16:30		Tea	Tea	Afternoon	Tea	Tea		Tea	Tea	Tea	Tea	
17:00		Introduction to laser physics I *L. Corner*	Laser driven wakefields II *S. Karsch*		Discussion 1 *B. Holzer*	Seminar I *IST*		Seminar: Acceleration of protons & ions *L. Willingale*	case study *A. Walker*	case study *A. Walker*	case study presentations *A. Walker*	
18:00		1 slide / 1 minute *B. Holzer*	case study Introduction *A. Walker*		Mod & simul hands on I *J. Vieira, R. Fonsecca*	case study *A. Walker*		case study *A. Walker*	**Departure** **Gala Dinner: 19:00h**	case study *A. Walker*	Coherent X-rays and applications *M. Fajardo*	
		Welcome Drink										
20:00	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Gala_Dinner	Dinner	Dinner	

Financial overview (numbers +-5%)

The CERN Accelerator School

	CAS Zurich (23105)	CAS Tuusula (10838)	CAS Archamps (23105)	CAS Roumanie (10837)	CAS Thessaloniki (10836)	CAS Sessimbra (10842)
Hotel site	-227967	-231601	-7260	-138321	-153331	-105000
pauses café			-15068			
Gala - dinner	-4954	-7000			-9219	-4000
Excursion (s)	-3160	-19700		-6338	-10372	-2900
Cadeaux	-720	-933		-685		-650
External financial resources	150000					14500
Registration fee:			15000			
Simple	37400	52000		92500	75400	27700
Double	59400	117600		84000	86100	83600
Local	3200					2700
Transport excursion	-5410					
Transport		-3875				-1000
Transport equipement		-4592				
Location pc		-5555			-2500	
Posters	-547	-639		-520	-520	-520
Sacs, badges... : 25 CHF/pers		-2500		-2500	-2500	-2500
others (PCB)						
Invitation lecturers	-7000	-15000		-8000	-10000	-27000
Total	**242**	**-121795**	**-7328**	**20136**	**-26942**	**-15070**

…compared to previous years

The CERN Accelerator School

School	Topic	Nights	Students	Lecturers	Single Fee	Shared Fee	Single Fee	Shared Fee	Income	Outcome	CERN cost
Bilbao, Spain 11	High Power	9	67	32	1,300 €	1,100 €	CHF 1,690	CHF 1,430	96,584	127,431	CHF 30,847
Chios, Greece 11	Advanced	12	74	33	1,600 €	1,200 €	CHF 1,920	CHF 1,440	139,817	198,332	CHF 58,515
Senec, Slovakia 12	Ion Sources	10	60	30	1,300 €	1,100 €	CHF 1,560	CHF 1,320	91,200	134,115	CHF 42,915
Granada, Spain 12	Introductory	12	141	25	1,500 €	1,200 €	CHF 1,800	CHF 1,440	208,725	219,224	CHF 10,499
Erice, Italy 13	SC	10	94	30	1,400 €	1,200 €	CHF 1,680	CHF 1,440	130,416	132,273	CHF 1,856
Trondheim, Norway 13	Advanced	11	70	27	CHF 2,700	CHF 2,200	CHF 2,700	CHF 2,200	212,819	259,891	CHF 47,072
Baden, Switzerland 14	PC	7	80	25	CHF 2,400	CHF 2,000	CHF 2,400	CHF 2,000	180,504	177,997	-CHF 2,507
Prague, Czech 14	Introductory	12	120	25	CHF 2,000	CHF 1,600	CHF 2,000	CHF 1,600	180,800	173,486	-CHF 7,314
CERN, 14	PWA	6	100	22	CHF 1,200	CHF 1,000	CHF 1,200	CHF 1,000	112,100	74,044	-CHF 38,056
Vienna, Austria 15	Medical	10	75	28	2,000 €	1,600 €	CHF 2,200	CHF 1,760	109,322	124,704	CHF 15,382
Warsaw, Poland 15	Advanced	12	70	25	1,800 €	1,500 €	CHF 1,980	CHF 1,650	107,779	136,189	CHF 28,410
CERN, 15	IL	9	70	25	CHF 1,400	CHF 1,200	CHF 1,400	CHF 1,200	62,622	52,818	-CHF 9,803
DESY, Germany, 16	FEL	10	70	32	CHF 2,400	CHF 2,000	CHF 2,400	CHF 2,000	105,000	136,214	CHF 31,214
Budapest, Hungary, 16	Introductory	12	120	25	CHF 2,000	CHF 1,600	CHF 2,000	CHF 1,600	201,600	247,746	CHF 46,146
Erice, Italy,17	IET	9	70	20	CHF 1,200	CHF 1,200	CHF 1,200	CHF 1,200	84,000	80000	-CHF 4,000
Lund, Swwden, 17	Vacuum	10	80	35	CHF 2,000	CHF 1,600	CHF 2,000	CHF 1,600	133,100	177,000	CHF 43,900

Totals		**161**	**1,361**	**439**	**28,200**	**23,300**	**30,130**	**24,880**	**2,156,389**	**2,451,465**	**295,076**
Averages		**10**	**85**	**27**	**1,763**	**1,456**	**1,883**	**1,555**	**134,774**	**153,217**	**18,442**

Potential cost savings (come back in AOBs)

The CERN Accelerator School

- CAS has now a rota of 4 (5) courses/year. Define one or two courses, which every year go to the same place (very economical choice) and do the “CERN political correct rota” with the other courses.
  → proposed several times to CERN management
- Demand the receiving host state a financial commitment depending on their possibilities.
- Collaboration with projects and topical workshops
  …
- Small things:
  - no printed proceedings?
  - invitation for lecturers with at least two hours

The CERN Accelerator School

Cost for 50 hours of lectures

Transport:	500
night	100
delegate rate	70

		Number of lectures per lecturer									
Number of nights at CAS		1	2	3	4	5	6		10	16	50
	1	33500	16750								
	2	42000									
	3	50500									
	4										
	5										
	6										
	7										
	8										
	9										
	10								11000		
	11										
	12										
	13									8130	2710

CAS

USPAS

Comparison CAS <-> USPAS

- …after two visits at USPAS courses
- USPAS: basically 8 to 10 parallel CAS topical and general courses of one week or two weeks length
- Student numbers: 150 and more
- Students per course: 8…30
- Teachers per course 1 + 2-3 assistants
  (ex: beam instrumentation this year: Manfred Wendt + 2 assistants from FNAL)
- Courses curriculum defined by director with help of a committee, but much autonomy for course teachers
- Feedback similar to CAS from students

Possible “take-away” for CAS?

The CERN Accelerator School

- Organize in the future the two general courses (introduction and advanced) together at the same time in the same place!
- Gain:
  - Use most teachers commonly for both courses
  - Students can switch between courses (except afternoon hands-ON courses)
  - This arrangement is more tolerant for fewer students in one of the two courses
  - BOTH courses can be offered every year
- But
  - need bigger conference venue with two presentation rooms
  - several organizational issues, in particular teachers schedule

	Period I Feb-April	Period II May-June	Period IIb End June	Period III Sept-Oct	Period IIIb Oct	Period IV Nov-Dec
2017						**JAS 2017: RF** Japan (Hayama)
2018	**Future Colliders** Switzerland (Zuerich)	**Beam Instrumentation** Finland (Tuusula)	**Short Introduction** France (Archamps)	**General Introduction** Romenia (Constanta)		**Comp. Methods** Greece (Thessaloniki)
2019	**Advanced Acc. Concepts** Portugal (Sesimbra)	**General Advanced** Denmark (Metalskolen)		**General Introduction** Slovakia (Vysoke)	**Short Introduction** France (Archamps)	**JAS: Ion Colliders** Dubna
2020	**RF** Lithuania (Kaunas)	**Mechanical Engineering** Holland (Eindhoven)		**Combined general courses (Ukraine?)**		**Warm magnets** Austria
2021	**Digital Signal Processing** tbd		**Short Introduction** France (Archamps)	**Combined general courses**		**JAS: Lightsources beam dynmaics** Canada, Saskatoon
2022				**Combined general courses**	**Short Introduction** France (Archamps)	
2023				**Combined general courses**		**JAS: Asia**

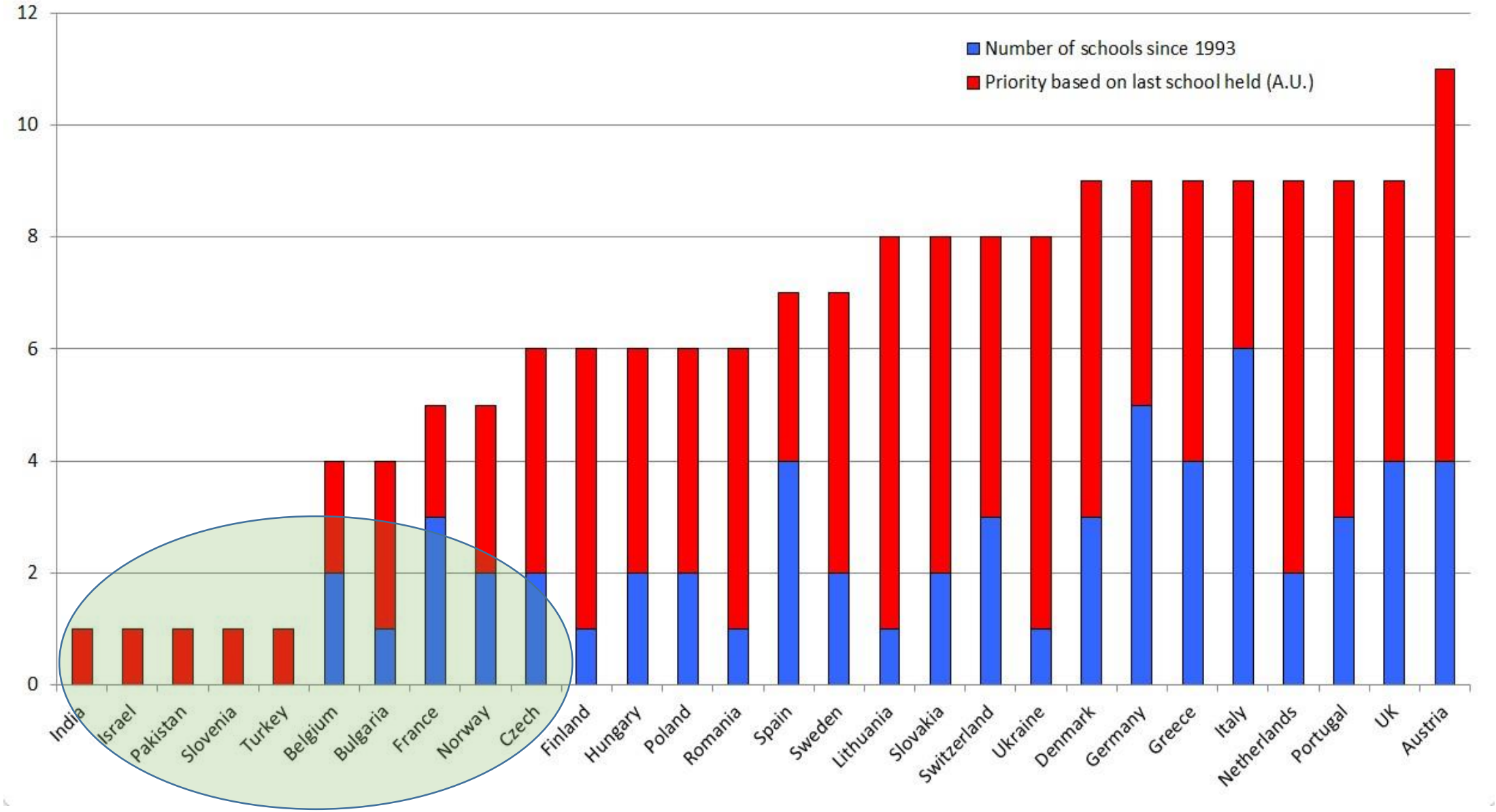
green: done

yellow: contracts signed

6 free slots

The CERN Accelerator School

Up to and including 2020, 61 CAS courses



1983	Antiprotons for Colliding Beam Facilities	Geneva	Switzerland
1986	Applied Geodesy for Particle Accelerators	Geneva	Switzerland
1989	Synchrotron Radiation and Free Electron lasers	Chester	UK
1990	Power Converter for Particle Accelerators	Montreux	Switzerland
1991	RF Engineering for Particle Accelerators	Oxford	UK
1992	Magnetic Measurements and Alignment	Montreux	Switzerland
1993	RF Engineering for Particle Accelerators	Capri	Italy
1994	Cyclotrons, Linacs and their Applications	La Hulpe	Belgium
1995	Superconductivity in Particle Accelerators	Hamburg	Germany
1996	Synchrotron Radiation and Free Electron Lasers	Grenoble	France
1997	Measurement and Alignment of Accelerator and Detector Magnets	Anacapri	Italy
1999	Vacuum Technology	Snekkersteen	Denmark
2000	RF Engineering	Seeheim	Germany
2001	Particle Accelerators for Medicine and Industry	Pruhonice	Czech Republic
2002	Superconductivity and Cryogenics for Accelerators and Detectors	Erice	Italy
2003	Synchrotron Radiation and Free Electron Lasers	Brunnen	Switzerland
2004	Power Converters	Warrington	UK
2005	Small Accelerators	Zeegse	Netherlands

2006	Vacuum in Accelerators	Platja D'Aro	Spain
2007	Digital Signal Processing	Sigtuna	Sweden
2008	Beam Diagnostics	Dourdan	France
2009	Magnets	Bruges	Belgium
2010	RF for Accelerators	Ebeltoft	Denmark
2011	High Power Hadrons Machiines	Bilbao	Spain
2012	Ion Sources	Senec	Slovakia
2013	Superconductivity for Accelerators	Erice	Italy
2014	Power Converters	Baden	Switzerland
2014	Plasma Wake Acceleration	CERN	Switzerland
2015	Accelerators for Medical Applications	Vienna	Austria
2015	Intensity Limitations in Particle Accelerators	CERN	Switzerland
2016	Free Electron Lasers and Energy Recovery Linacs (FELS and ERLS)	Hamburg	Germany
2017	Beam Injection, Extraction and Transfer	Erice	Italy
2017	Vacuum for Particle Accelerators	Glumslov	Sweden
2018	Beam Dynamics and Technologies for Future Colliders	Zurich	Switzerland

University credits for CAS course attendance?

- Demanded occasionally by students, in particular for the introductory course
- JUAS and USPAS have system in place
- CAS runs a special collaboration with EPFL for credits:
  After a course one hour oral examination of each individual candidate

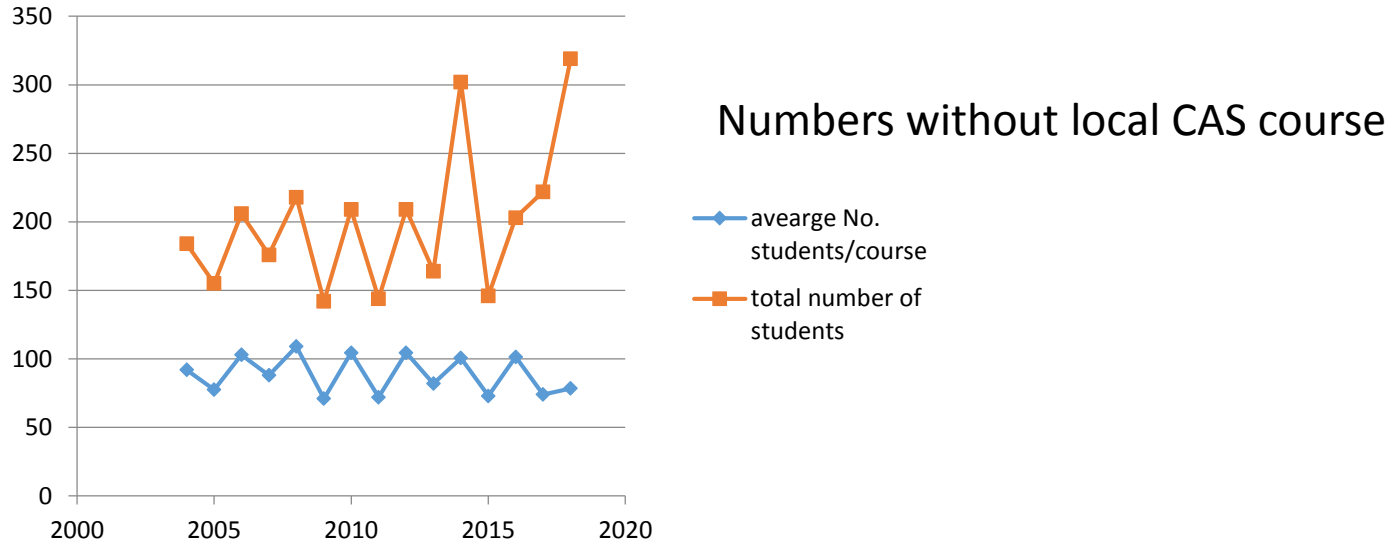
- Change this setup?
- Publicize this setup?

CAS&MOOCs → CASopedia?

The CERN Accelerator School

- At least two activities on MOOCs existing
  - Nordic Accelerator School
  - ARIES WP 5
- Plus many other e-learning at universities
  (i.e. Graeme Burt, Lancaster…)
- CAS team demanded by CERN management to elaborate a proposal in that domain.
- First thought: CASopedia = online support for general CAS courses
  - key word search and short (1..2 min videoclips with explanations)

CAS student count



- Looks good, BUT: 4 out of 6 CAS courses with student-count below expectation:

- Future Collider school: 57, 95% from CERN
- Introduction Constanta: 89 (average of last 3 introductory was 126)
- Wakefields (Sesimbra): after two weeks of prolongation 30 students…got it up to some 60
- Advanced (upcoming in Denmark): we will be below 60 (normal average 75)