

CAS in the landscape of European training in accelerator science & technology



Philip Burrows

Director,

John Adams Institute for Accelerator Science

The TIARA project 2011 – 2014



Test Infrastructure and Accelerator Research Area

EU 'preparatory phase' project: integrating activity

WP5: education and training (PNB):

- survey of accelerator training in Europe
- survey of needs for trained personnel
- action plan

Home page

General information

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TIARA consortium

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TIARA Committees

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The main objective of TIARA is the integration of national and international accelerator R&D infrastructures into a **single distributed European accelerator R&D facility** with the goal of developing and strengthening state-of-the-art research, competitiveness and innovation in a sustainable way in the field of accelerator Science and Technologies in Europe.



Besides maximizing the benefits for the owners of the infrastructures and their users, TIARA aims at establishing a framework for developing and supporting strong joint European programmes:

- › for accelerator Research and Development
- › for education and training
- › for enhancing innovation in collaboration with industry

NEWSLETTER >>



ACCELERATORS FOR SOCIETY >>



MEETING DATES

Governing Council

10:00 - 17:00
Governing Council meeting (CERN)
Governing Council

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TIARA Management

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HOT NEWS



TIARA-PP extended for one year



TIARA-PP final general meeting held at Daresbury lab, November 25-27

TIARA WP5 participants



CEA:	Phu-anh Phi Nghiem, Francois Kircher
CERN:	Roger Bailey (CAS), Kate Kahle/ Agnes Szeberenyi (EUCARD) Louis Rinolfi (JUAS)
CNRS:	Alex Muller, Catherine Clerc
CIEMAT:	Marisa Marco, Diego Obrador, Susanna Falcon
GSI:	Oliver Boine-Frankenheim, Sabrina Appel
INFN:	Vittorio Vaccaro, Francesca Galluccio
PSI:	Lenny Rivkin
STFC:	Philip Burrows, Max Bradbury
Nordic group:	Soren Pape Moeller, Ole Petter Nordahl
IFJ:	Piotr Malecki

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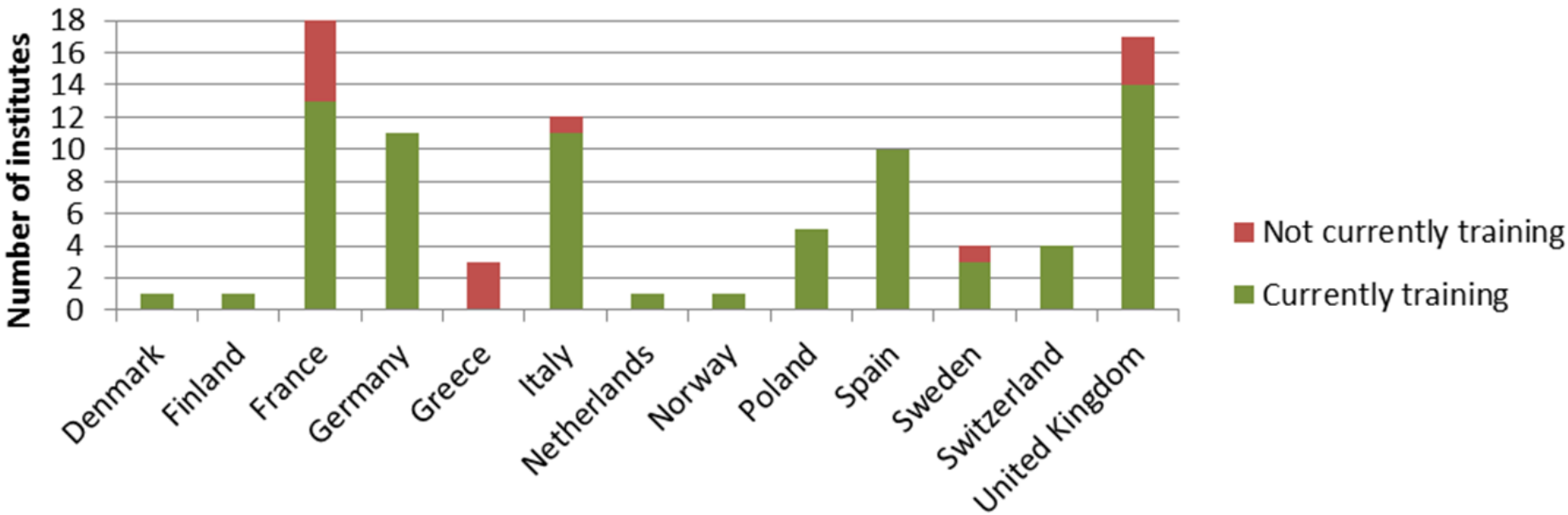
STFC: Philip Burrows, Max Bradbury

Nordic group: Soren Pape Moeller, Ole Petter Nordahl

IFJ: Piotr Malecki

Survey of institutes

- 88 responding institutes
- 3060 personnel engaged in accelerator science



Training survey report

<https://cds.cern.ch/record/1442599/files/TIARA-REP-WP5-2012-006.pdf>



Test Infrastructure and Accelerator Research Area

TIARA WP5 Deliverable 5.1 - ETR Education and Training Survey Report

2 May 2012

François Kircher, Phu-Anh-Phi Nghiem, CEA, France

Roger Bailey, Louis Rinolfi, CERN, Switzerland

M. Luisa Marco Arboli (WP Deputy), Susana Falcon, Diego Obradors, CIEMAT, Spain

Catherine Clerc, Alex C. Mueller (WP Deputy), CNRS/IN2P3/LLR, France

Leonid Rivkin, EPFL, Switzerland

Sabrina Appel, Oliver Boine-Frankenheim, GSI, Germany

Francesca Galluccio, Vittorio Vaccaro, INFN-Napoli, Italy

Piotr Malecki, Institute of Nuclear Physics, Polish Academy of Sciences, Poland

Søren Pape Møller, ISA, Aarhus University, Denmark

Philip Burrows (WP leader), Max Bradbury, John Adams Institute, University of Oxford, United Kingdom

Pauli Heikkinen, University of Jyväskylä, Finland

Ole Petter Nordahl, Steinar Stapnes, University of Oslo, Norway

The research leading to these results has received funding from the European Commission

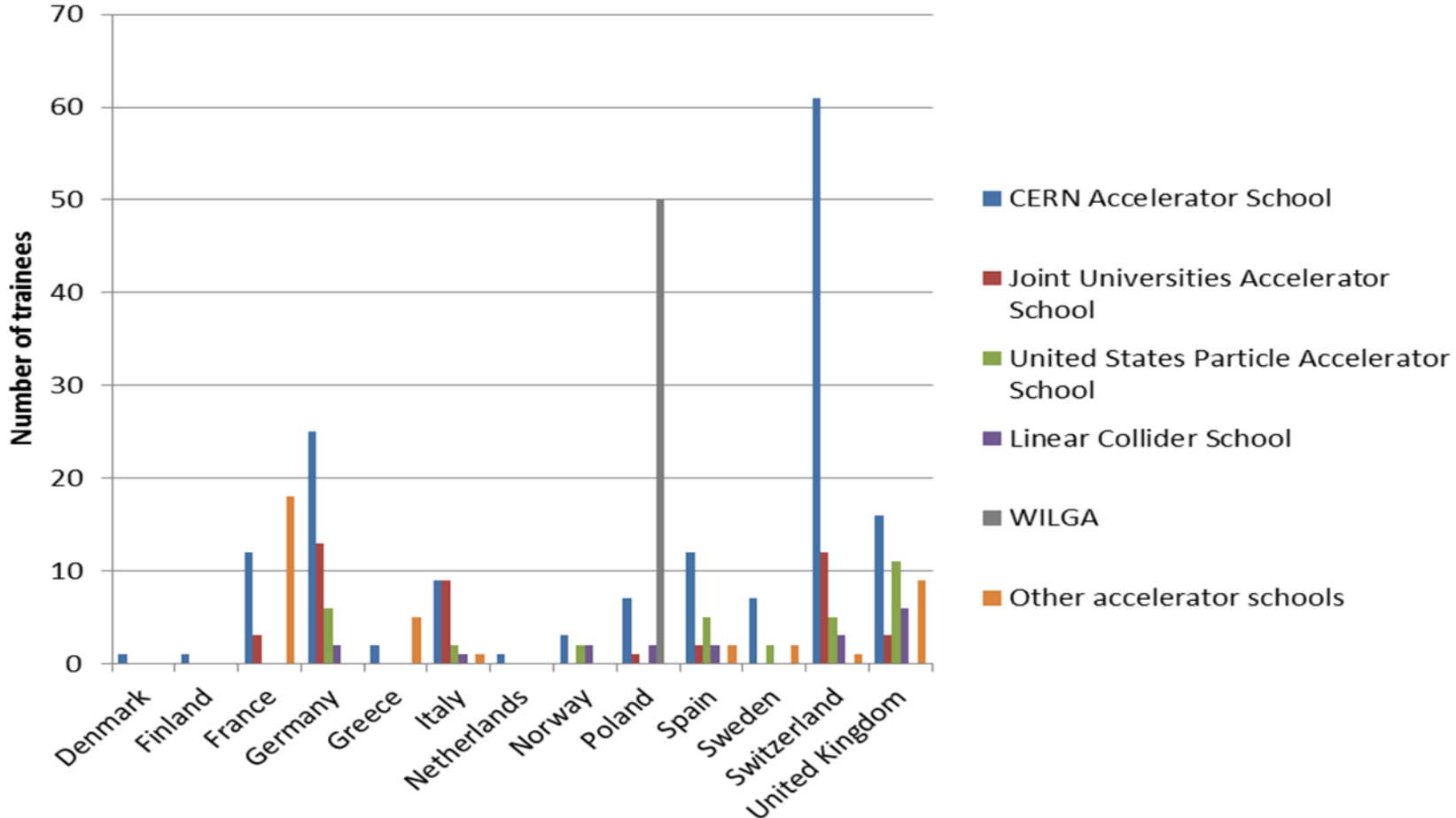
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Accelerator Schools

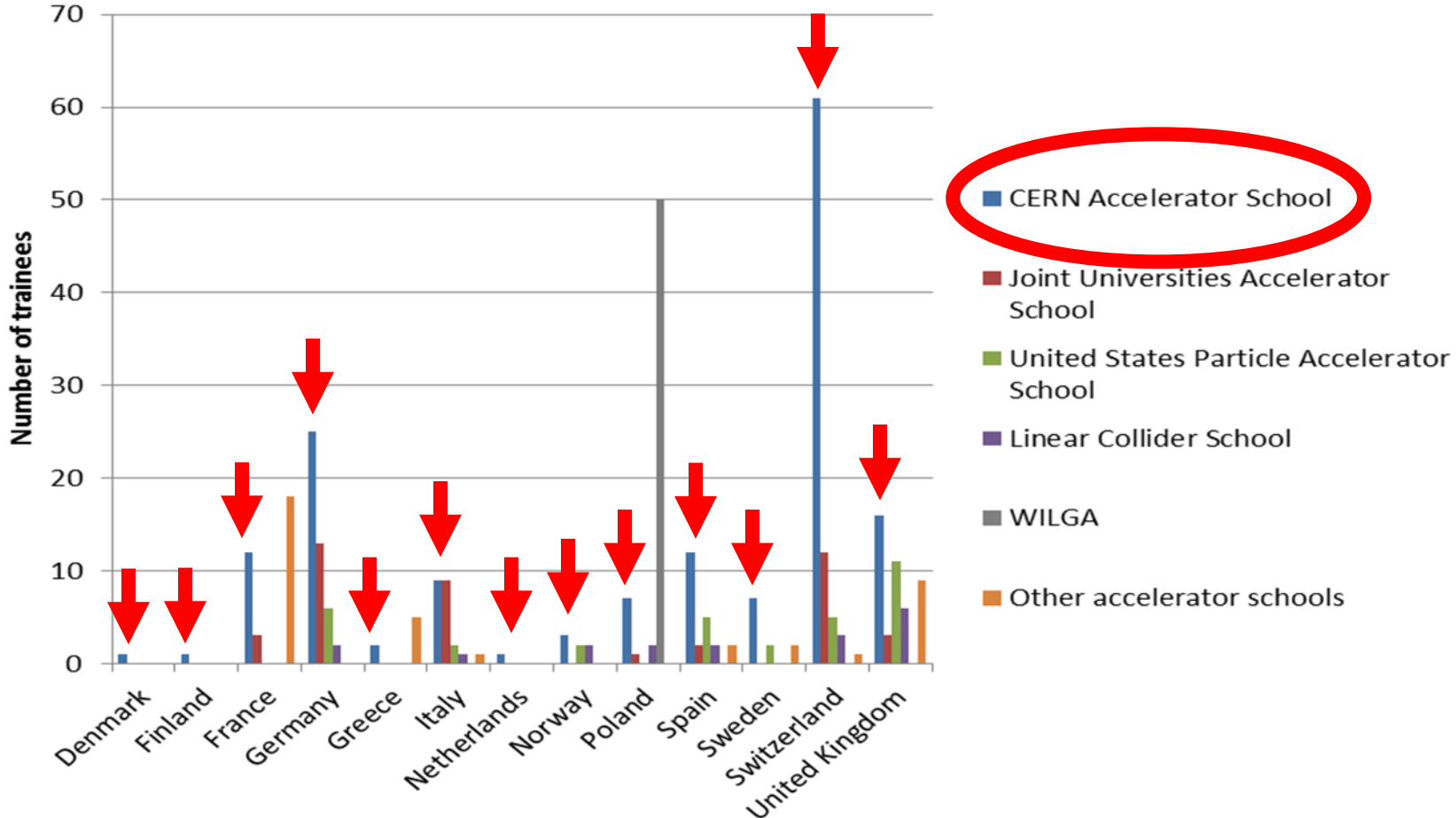


83 institutes sent people to accelerator schools:
339 people (2011)



Accelerator Schools

83 institutes sent people to accelerator schools:
339 people (2011)



CAS statistics

2006-2010

952 people

190/year

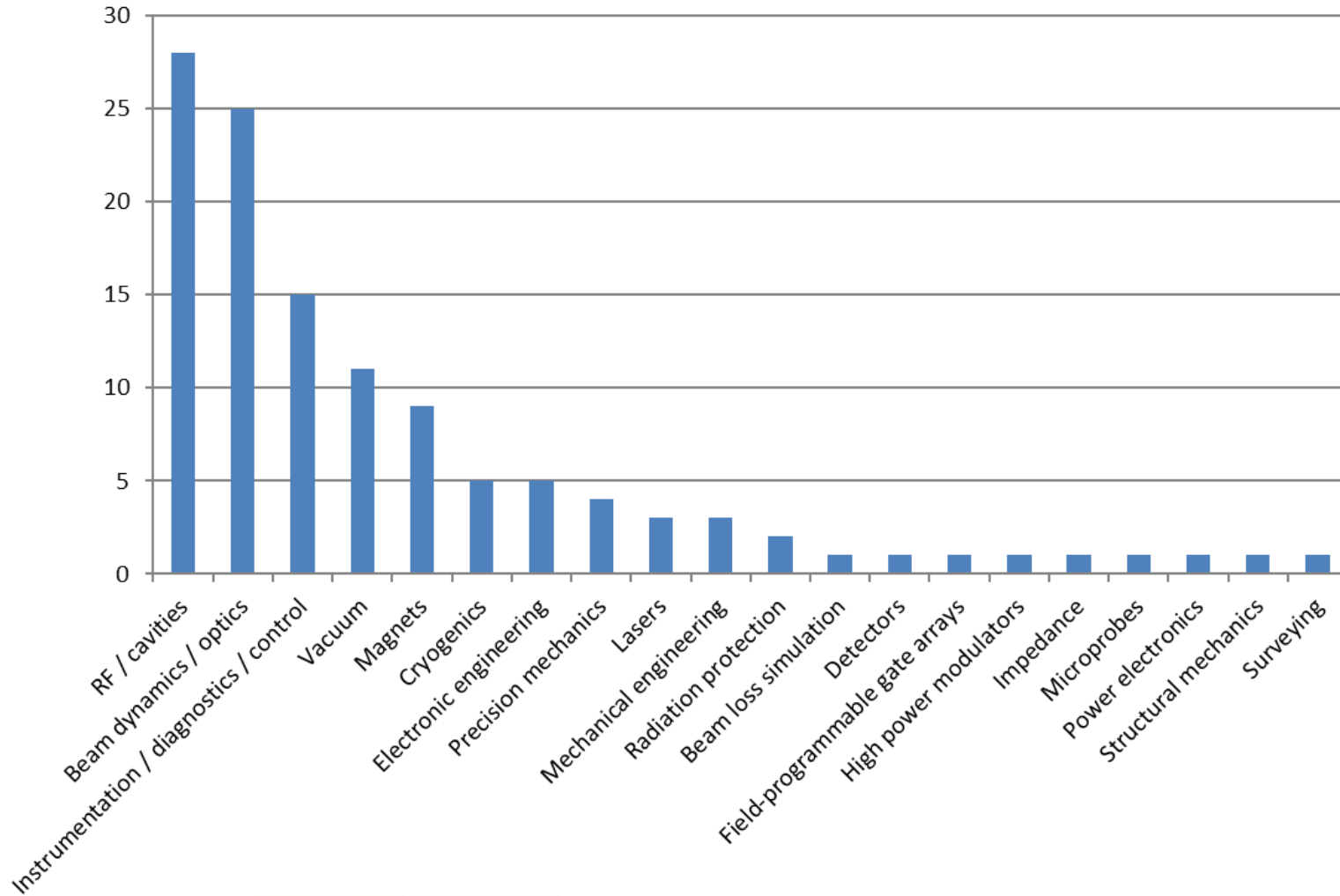
from institutes in
43 countries

of 60 nationalities

Student Home Institute Country at CERN Accelerator Schools 2006 to 2010

	Total	%	Average/yr	Poland06	Spain06	UK07	Sweden07	Italy07	France08	Germany09	Belgium09	Bulgaria10	Denmark10
	952												
SWITZERLAND	320	33.6	64	44	22	29	29	51	24	26	16	42	37
GERMANY	190	20.0	38	14	20	14	27	14	19	16	14	35	17
UNITED KINGDOM	101	10.6	20.2	22	3	11	4	14	10	13	13	3	8
FRANCE	72	7.6	14.4	12	4	7	3	6	16	2	7	6	9
ITALY	59	6.2	11.8	3	7	6	11	8	3	4	7	6	4
SPAIN	44	4.6	8.8	4	13	5	1	6	7	0	3	1	4
UNITED STATES	18	1.9	3.6	1	8	0	1	0	3	0	3	1	1
POLAND	14	1.5	2.8	4	1	0	3	0	1	0	0	2	3
DENMARK	13	1.4	2.6	4	1	0	2	2	2	0	2	0	0
SWEDEN	13	1.4	2.6	0	5	0	1	0	0	0	1	4	2
RUSSIA	12	1.3	2.4	2	1	0	3	0	3	2	0	0	1
CANADA	10	1.1	2	1	1	0	0	1	2	1	0	1	3
AUSTRALIA	8	0.8	1.6	0	0	0	0	2	3	0	0	1	2
BELGIUM	8	0.8	1.6	0	0	0	0	1	1	1	3	2	0
TAIWAN	7	0.7	1.4	0	2	0	3	0	0	0	2	0	0
TURKEY	6	0.6	1.2	1	0	1	0	2	1	0	0	1	0
INDIA	6	0.6	1.2	1	1	0	0	0	1	0	2	0	1
SLOVENIA	6	0.6	1.2	1	0	0	2	0	1	0	0	0	2
CZECH REPUBLIC	4	0.4	0.8	0	0	1	2	0	1	0	0	0	0
NETHERLANDS	4	0.4	0.8	0	0	0	2	1	1	0	0	0	0
AUSTRIA	4	0.4	0.8	0	0	0	0	1	1	0	2	0	0
PORTUGAL	3	0.3	0.6	0	1	0	0	2	0	0	0	0	0
BULGARIA	3	0.3	0.6	0	0	1	0	0	0	0	0	2	0
IRAN	3	0.3	0.6	0	0	3	0	0	0	0	0	0	0
JAPAN	3	0.3	0.6	0	0	0	1	0	1	0	0	0	1
UKRAINE	2	0.2	0.4	1	0	0	0	0	0	0	0	1	0
FINLAND	2	0.2	0.4	0	0	2	0	0	0	0	0	0	0
KOREA	2	0.2	0.4	0	0	0	0	0	0	0	0	0	2
GREECE	1	0.1	0.2	0	1	0	0	0	0	0	0	0	0
HUNGARY	1	0.1	0.2	0	1	0	0	0	0	0	0	0	0
JORDAN	1	0.1	0.2	0	1	0	0	0	0	0	0	0	0
BRAZIL	1	0.1	0.2	0	1	0	0	0	0	0	0	0	0
SOUTH AFRICA	1	0.1	0.2	0	0	0	1	0	0	0	0	0	0
LITHUANIA	1	0.1	0.2	0	0	0	0	1	0	0	0	0	0
ARMENIA	1	0.1	0.2	0	0	0	0	1	0	0	0	0	0
CHINA	1	0.1	0.2	0	0	0	0	1	0	0	0	0	0
UZBEKISTAN	1	0.1	0.2	0	0	0	0	1	0	0	0	0	0
SUDAN	1	0.1	0.2	0	0	0	0	0	1	0	0	0	0
NORWAY	1	0.1	0.2	0	0	0	0	0	1	0	0	0	0
MEXICO	1	0.1	0.2	0	0	0	0	0	0	1	0	0	0
MALAYSIA	1	0.1	0.2	0	0	0	0	0	0	1	0	0	0
VIETNAM	1	0.1	0.2	0	0	0	0	0	0	0	0	1	0
KENYA	1	0.1	0.2	0	0	0	0	0	0	0	0	0	1
	43	952	100	190.4									

Skills shortages



TIARA training survey: some findings

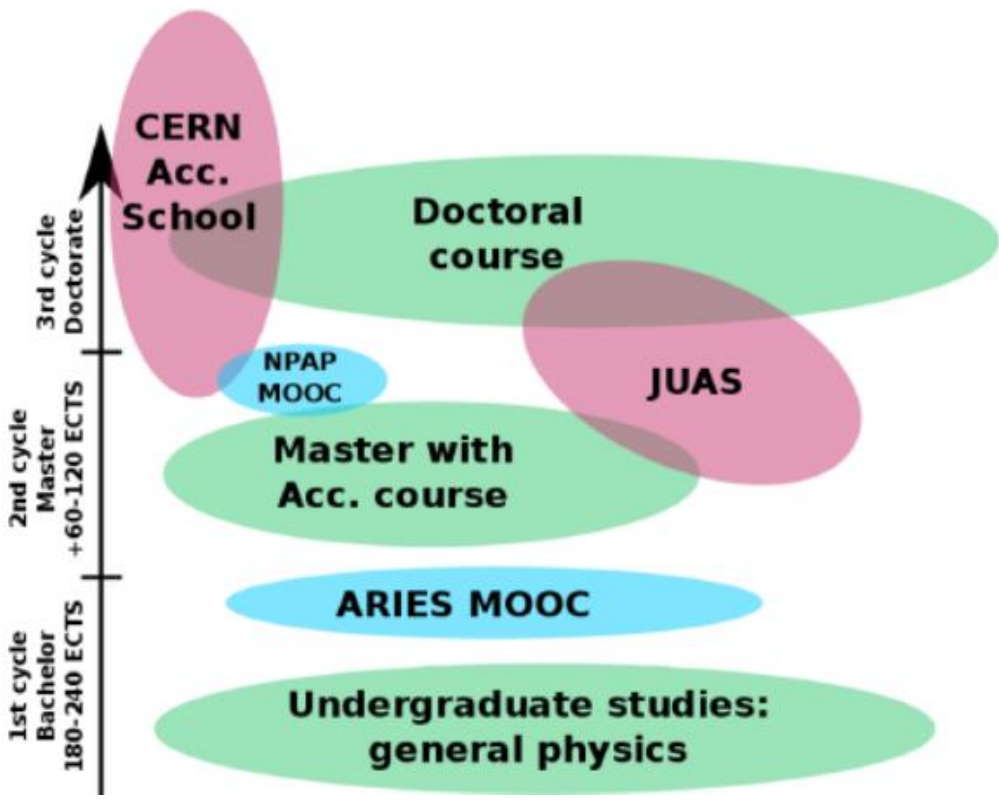
**CAS (+ JUAS) provide under-pinning training for the field
in Europe (and beyond)**

‘if it ain’t broke, don’t fix it!’

**They should continue to be strongly supported, and, if
resources are available, be strengthened eg. to cover
areas of skills shortage**

‘if you can’t beat them, join them!’

Follow-on training initiatives with EU support: ARIES WP2



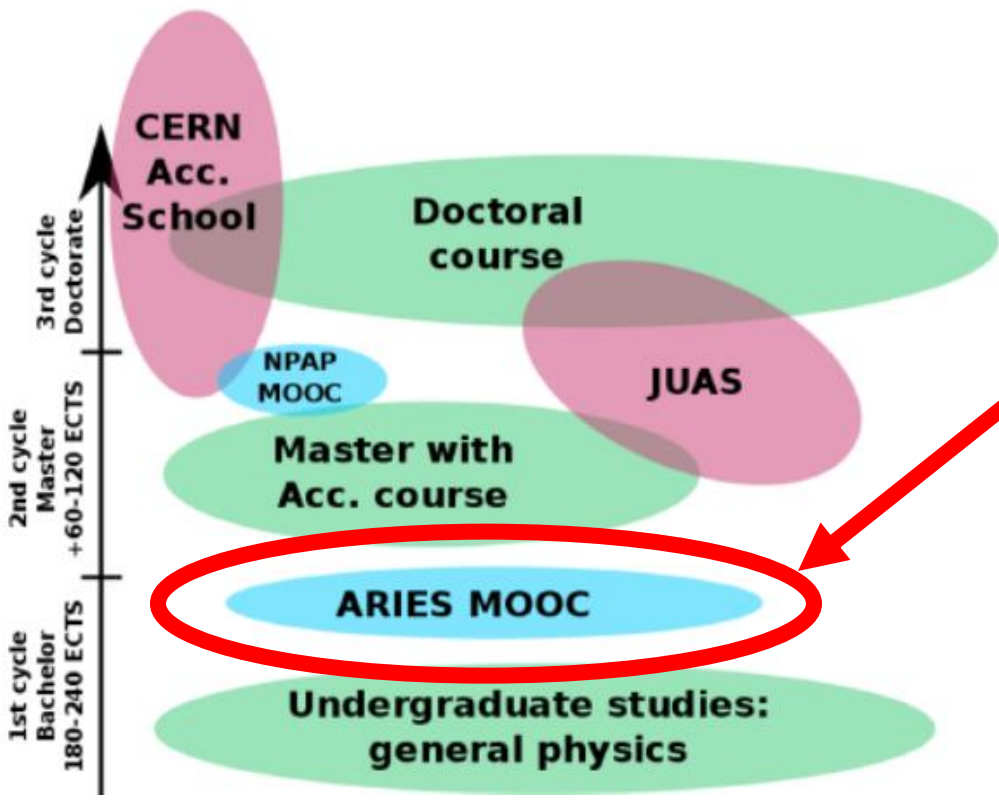
e-learning course on accelerators aimed at undergraduates:

- Introduction
- Electromagnetism
- Special relativity
- Applications
- RF

<http://mooc.particle-accelerators.eu/>



Follow-on training initiatives with EU support: ARIES WP2



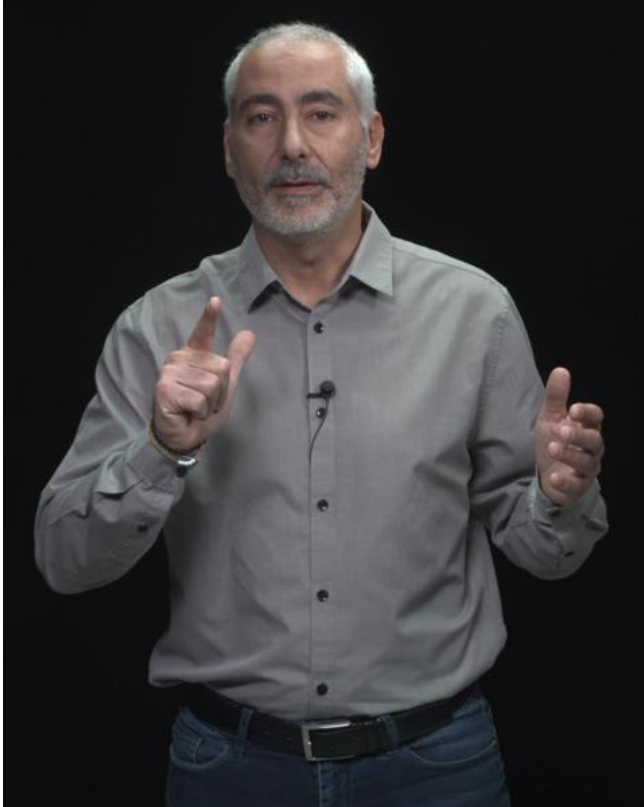
e-learning course on accelerators aimed at undergraduates:

- Introduction
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- Special relativity
- Applications
- RF

<http://mooc.particle-accelerators.eu/>



Screenshots from the Relativity module



Follow-on training initiatives with EU support: I.FAST WP2



ACCELERATORS FOR THE ENVIRONMENT

10-DAY CHALLENGE @ ESI & CERN

25 JULY - 03 AUGUST 2023

Are you...
...a senior bachelor or master student
(all backgrounds)
...from a European university
...interested in making an impact

APPLY NOW ➔

ifast-cbi.particle-accelerators.eu



Follow-on training initiatives with EU support: I.FAST WP2



Accelerators for healthcare?



Come to take part in a challenge to imagine new multidisciplinary solutions to address health issues by using particle accelerators. This challenge will be tackled by multidisciplinary teams invited to stay, all expenses covered, for 10 days at the European Scientific Institute, near Geneva.

10-day innovation challenge open to all students

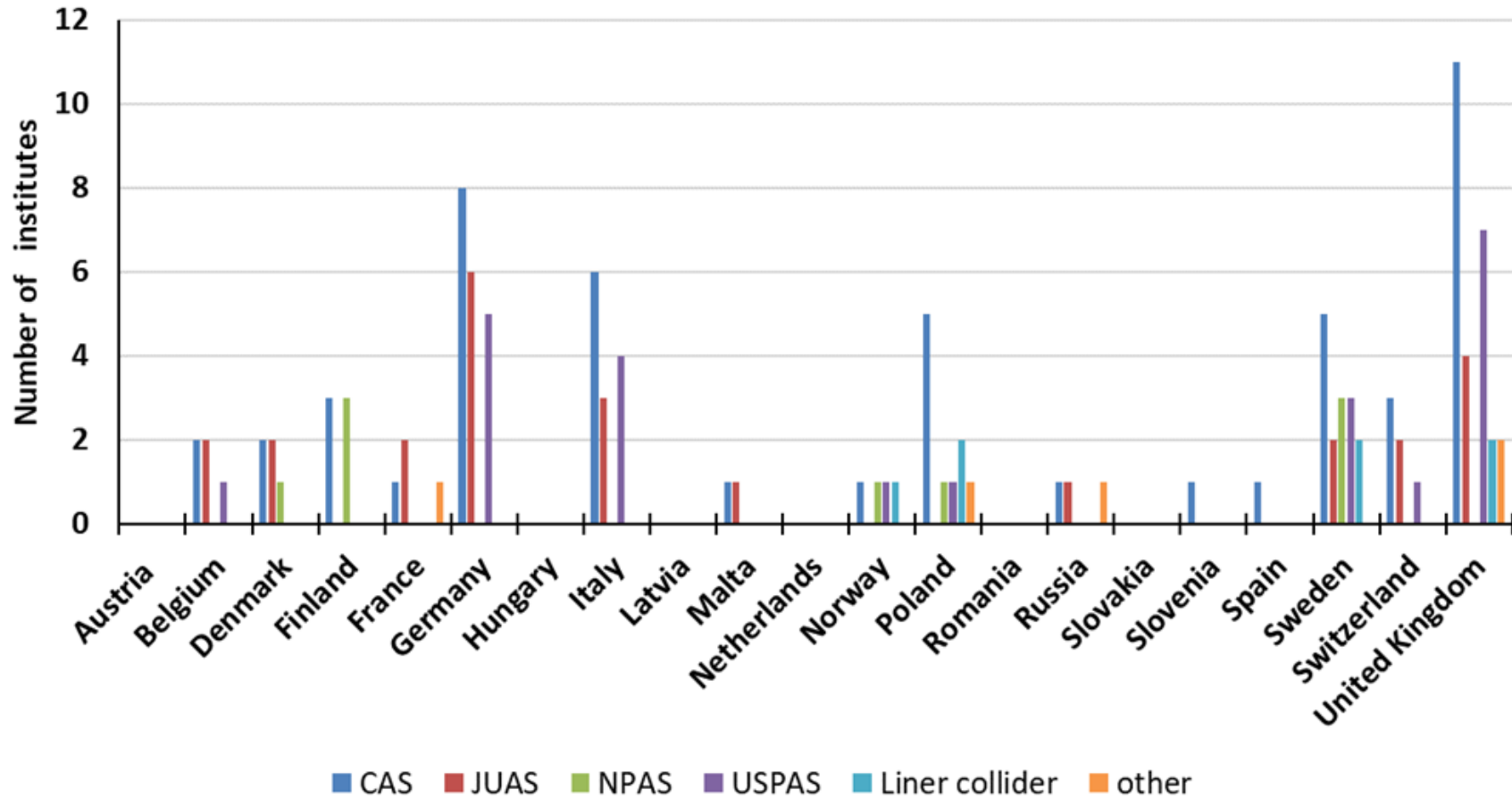
ACCELERATOR **PHYSICS** ENGINEERING
CHEMISTRY LIFE SCIENCE **MEDICINE**

From 23 July to 1 August, near Geneva

Apply now at:
ifast-project.eu

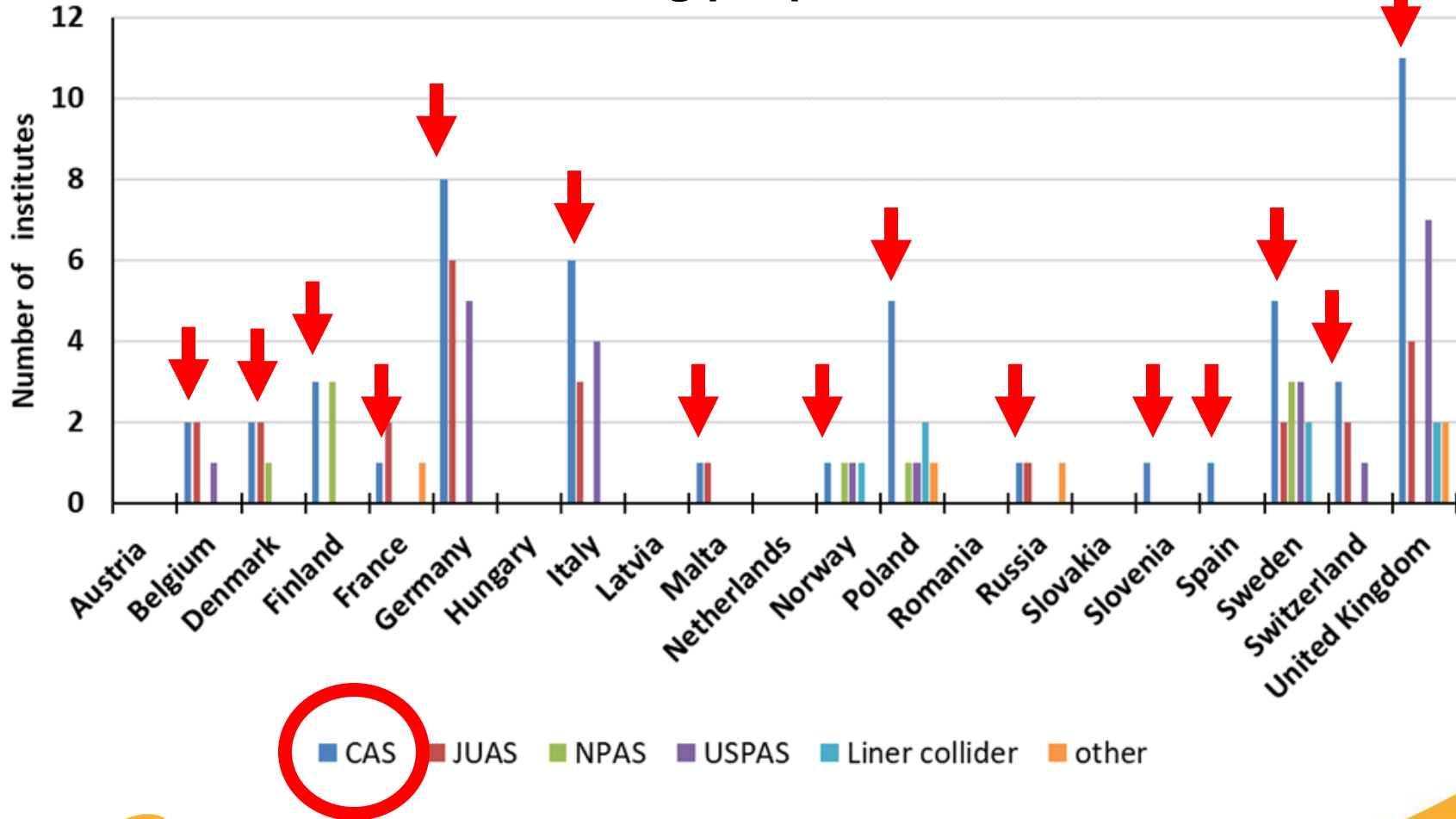


ARIES WP2: training survey updated in 2020



ARIES WP2: training survey updated in 2020

Institutes sending people to CAS in 2019



CAS statistics

2016-2019



1048 people:

- 262 / year
- 48 countries

4 courses / year

2022 Advanced CAS:

- RF
- Beam optics
- Beam instrumentation

Specialist courses:

- RF (2023)
- N+SC magnets (2023)
- Mech. Engineering (2024)

Sr.No.	Countries	Attendees during 2016			Attendees during 2017			Attendees during 2018			Attendees during 2019		
		Participants	Grant	lecturers	Participants	Grant	lecturers	Participants	Grant	lecturers	Participants	Grant	lecturers
1	Austria				4			6			4		
2	Australia	1										2	
3	Armenia								1			2	
4	Belarus												1
5	Belgium	2						1			1		
6	Canada				3			1			3		
7	Brazil											2	
8	Bulgaria												
9	China	1			13	1		9	4		2	1	
10	Czech Republic	1			2			1			1		
11	Denmark												1
12	Finland							3		2			
13	France	5	1		16		1	27	4	1	30	1	3
14	German	12	1	3	23	1	9	36	4	12	30	4	7
15	Greece												
16	Hungary	2				1							
17	India							1	1				6
18	Indonesia								1			1	
19	Israel										2	1	1
20	Iran					3		2	6				
21	Italy	3		2	7	2	6	5	2	6	8	3	3
22	Japan				2					3	1		2
23	Jordan				1								
24	Latvia											1	
25	Mexico				1				1				
26	Netherlands												
27	Norway												
28	Poland	3						3					
29	Portugal										12	1	4
30	Russia	2			7	3		7	9	2	4	4	1
31	Romania	1						2		4	2		
33	Slovenia							4			4		
34	Spain	5			4			3			2		
35	Sweden	4		1	10		4	5	1	1	3		1
36	Switzerland	65		13	202		53	165			83		58
37	Turkey				1								
38	United Kingdom	8		4	15		6	13		6	24	3	8
39	South africa	2						1				1	
40	turkey		2					1	1				
41	Thailand							1	1		0	1	
42	Tunis										1		
43	ukrane		1						2			1	
44	United states	1			3			1	1	7	6	2	4
45	Madagascar								1				
46	Malta							1					
47	Zimbabwe									1			
48	Saudi arabia										1		



Conclusions

- CAS is at the heart of accelerator training in Europe (and well beyond)
- It complements and extends training that can be provided at our labs, universities, and industry
- Training by world experts, in a highly focussed, effective and efficient way
- Responsive to the needs of the community
- Superb organisation – thanks to CERN and all supporting institutes
- Happy 40th anniversary!
- Now to the next 40 years ...