Opportunities for Science Teachers

in

Physics Education

&

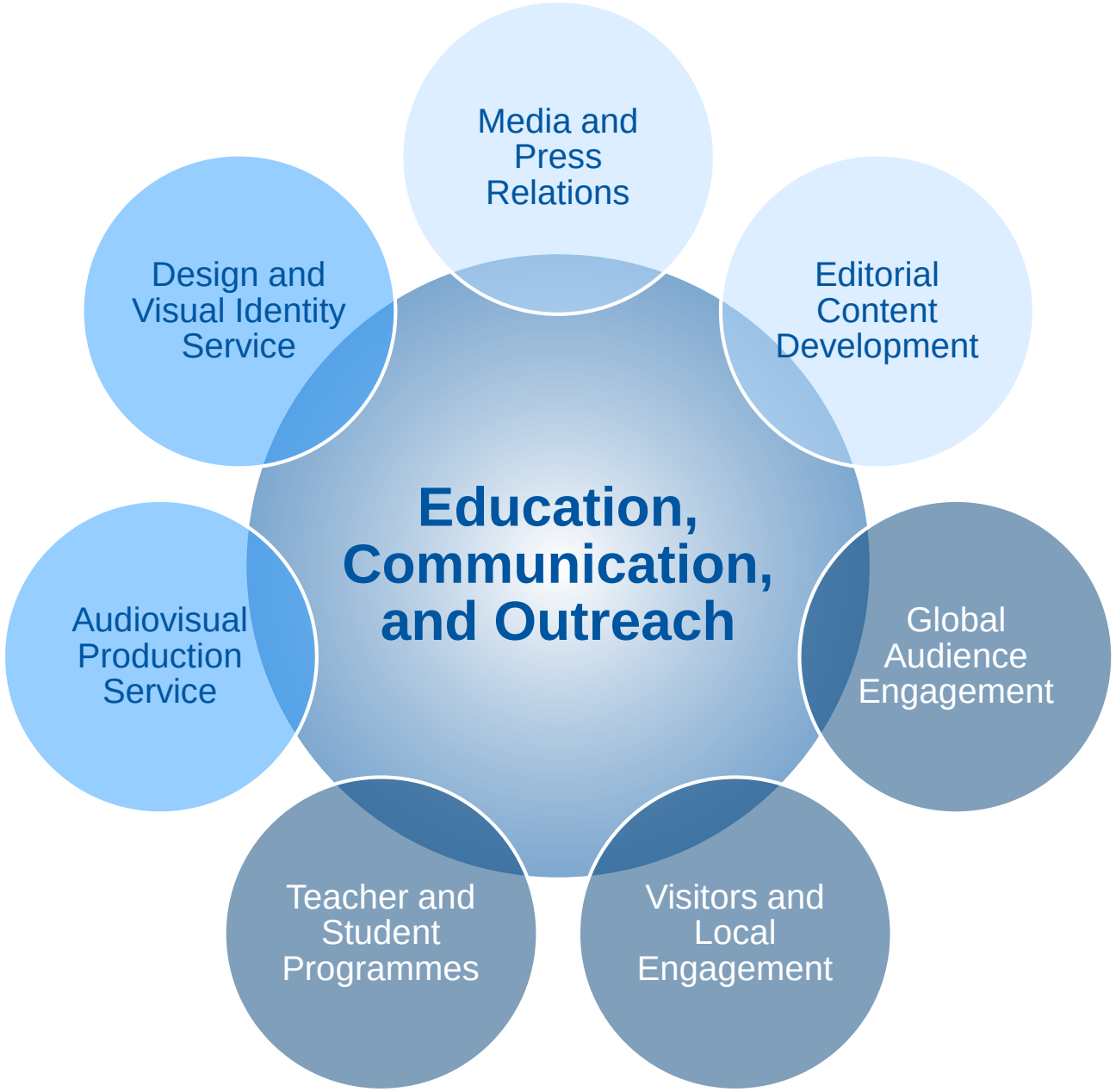
Physics Education Research

at

CERN

Dr. Sascha Schmeling

Head of Teacher and Student Programmes



Education, Communication, and Outreach @CERN

CERN Teacher Programmes

National Teacher Programmes | International Teacher Programmes | Contact

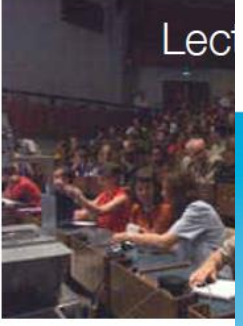
"There is nothing more enriching and gratifying than learning." [Fabiola Gianotti, CERN Director-General]

Every year, CERN offers various professional development programmes for teachers to keep up-to-date with the latest developments in particle physics and related areas, and experience a dynamic, international research environment. All programmes are facilitated by experts in the field of high energy physics and include an extensive lecture and visit itinerary.

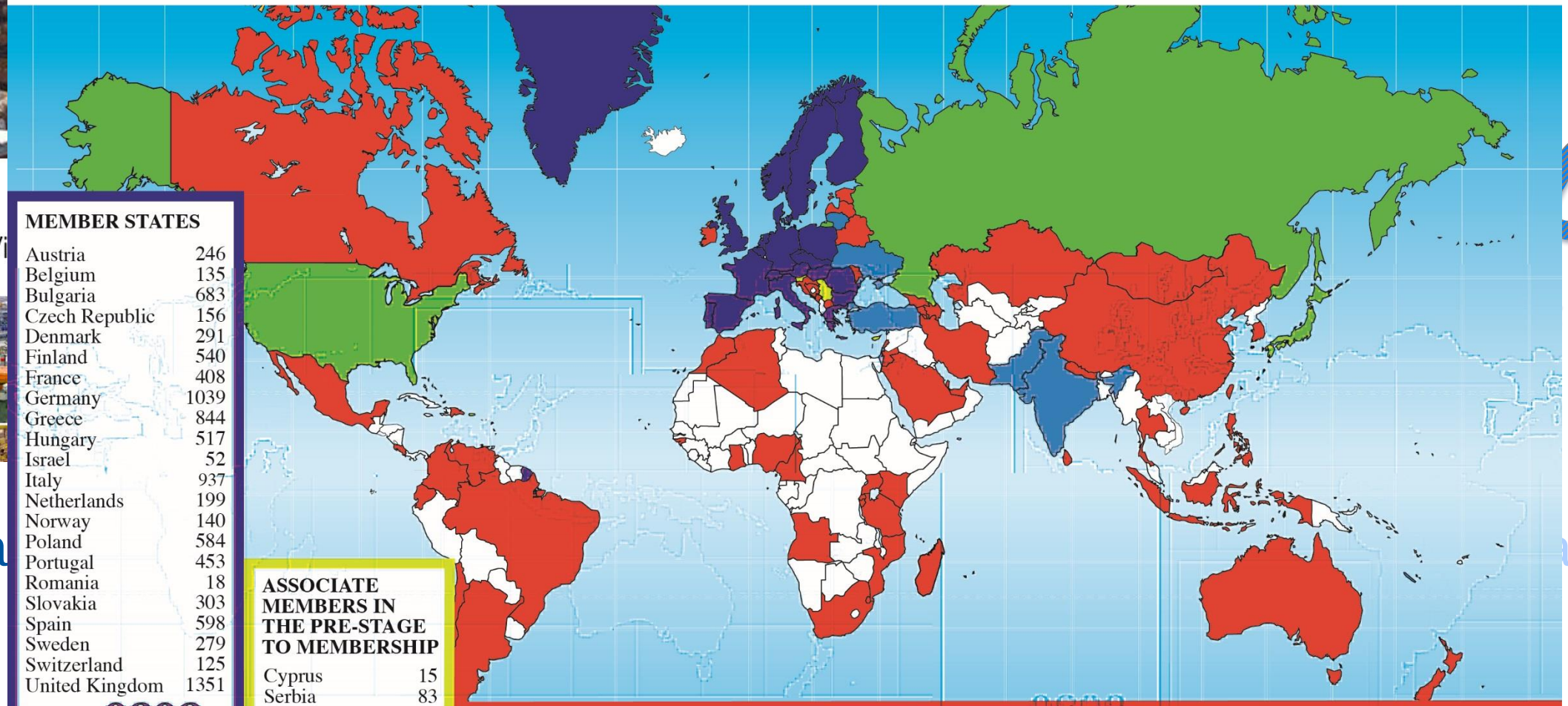
Furthermore, CERN's teacher programmes enable you to meet with teaching colleagues from your country or from all around the World. We offer teacher programmes in English or in one of the national languages of CERN Member States, lasting between 3 days and 3 weeks. Take part!

National Teacher Programmes & International Teacher Programmes

Teacher Programmes



Teacher Programme Participants 1998 - 2018 (Total: 12320)



MEMBER STATES

Austria	246
Belgium	135
Bulgaria	683
Czech Republic	156
Denmark	291
Finland	540
France	408
Germany	1039
Greece	844
Hungary	517
Israel	52
Italy	937
Netherlands	199
Norway	140
Poland	584
Portugal	453
Romania	18
Slovakia	303
Spain	598
Sweden	279
Switzerland	125
United Kingdom	1351

9898

ASSOCIATE MEMBERS IN THE PRE-STAGE TO MEMBERSHIP

Cyprus	15
Serbia	83
Slovenia	21

119

ASSOCIATE MEMBERS

India	10
Lithuania	54
Pakistan	7
Turkey	327
Ukraine	179

577

OBSERVERS

Japan	12
Russia	408
USA	116

536

OTHERS

Algeria	10	Burundi	2	Estonia	92	Lebanon	21	Palestine	5	T.F.Y.R.O.M.	13
Angola	7	Cameroon	9	Georgia	154	Madagascar	2	Philippines	2	Thailand	19
Argentina	2	Canada	14	Ghana	7	Malta	37	Qatar	1	Timor-Leste	9
Armenia	3	Cape Verde	4	Guinea Bissau	1	Mexico	83	Rwanda	20	Uganda	3
Australia	9	Chile	3	Indonesia	3	Moldova	4	Sao Tome	7	U.A.E.	1
Azerbaijan	2	China	2	Iran	12	Mongolia	1	Saudi Arabia	1	Venezuela	1
Bahrain	2	Colombia	2	Ireland	9	Montenegro	16	Singapore	2		
Belarus	8	Costa Rica	4	Jordan	13	Morocco	2	South Africa	8		
Bosnia and Herzegovina	6	Croatia	81	Kazakhstan	14	Mozambique	22	Sri Lanka	2		
Brazil	231	Dominican Rep.	72	Kenya	4	Nepal	3	Swaziland	1		
		Ecuador	2	Korea	49	New Zealand	4	Taiwan	1		
		Egypt	2	Latvia	62	Nigeria	1	Tanzania	1		

1190

- National and Multinational Teacher Programmes are organized with
  - specific contacts
    - at CERN
    - and in the country/region

Teacher Programme Checklist for National Contacts

jeff.wiener@cern.ch | +41 75411 9010 | 11 May 2016

At least 9 months in advance

Announce preferred week(s)
- ☐ Number of participants
- ☐ Funding
- ☐ Number of hotel rooms
- ☐ Number of external lecturers

Provided the preferred week is available we will reserve rooms at the CERN hotel. Once the reservation is confirmed we will set up the indico website, update the information on the TP website, and enter the preliminary programme into CERN's visit agenda. We will also book lecture rooms.

Please wait for confirmation before publicising the programme!

At least 3 months in advance

Send programme proposal
- ☐ Lectures
- ☐ Visits
- ☐ Social events

We will update the indico agenda accordingly and arrange the visits itinerary with the visits service. Furthermore, we will take care of booking the welcome reception and the official dinner.

Please inform us about any special requests (e.g. visa requirements) as soon as possible!

At least 2 months in advance

Inform external lecturers to contact Maureen for their travel arrangements

We will take care of all travel arrangements and reservations at the CERN hotel for external lecturers. We will also provide them with meal vouchers to be used at CERN's restaurants.

All travel arrangements and hotel reservations have to be made by Maureen!

At least 1 month in advance

Provide final list of participants
- ☐ TP spreadsheet

Fine-tune programme
- ☐ Lecturers
- ☐ Guides

We will update our reservation at the CERN hotel in accordance with the final list of participants. **Please note: this list needs to be final.** Furthermore, we will prepare the welcome envelopes for the teachers and send the list to the guards to ensure that all teachers can enter the CERN site when they arrive.

Please use the excel template for the list of participants!

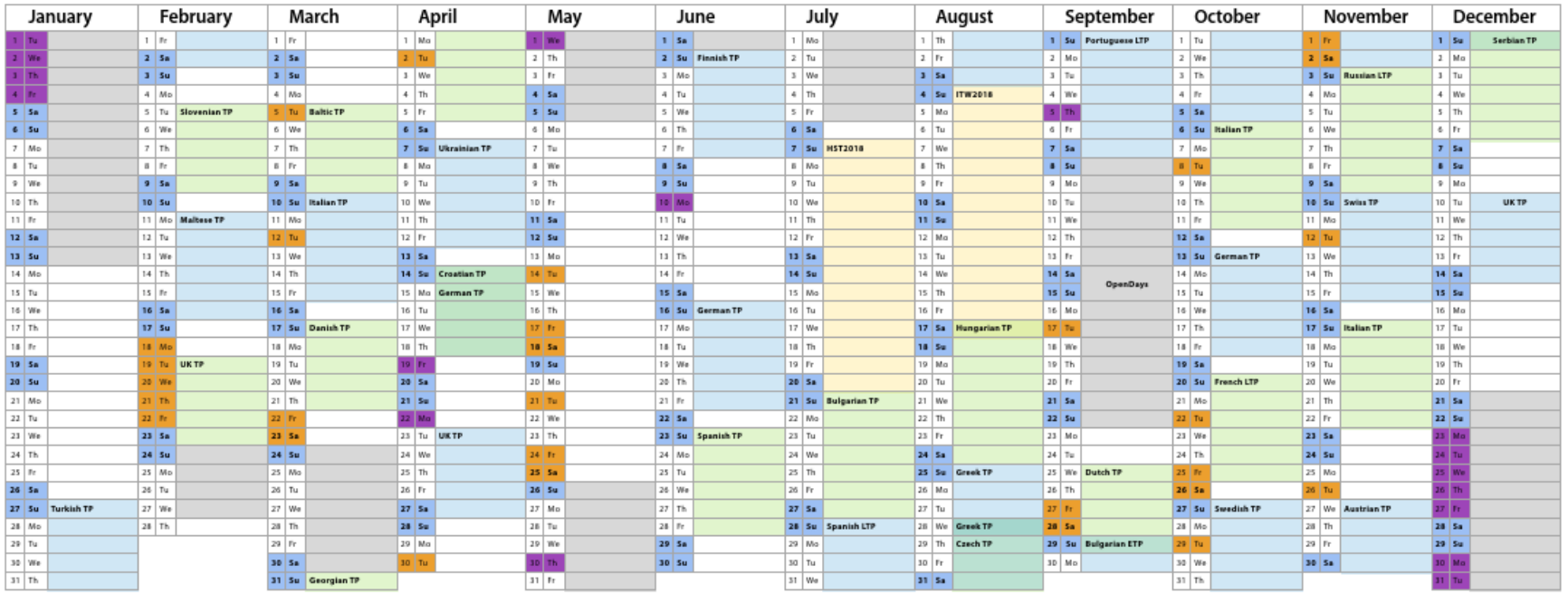
During the programme

Accompany the group
Facilitate the programme
Send translations if needed
Communicate with lecturers & guides

We will prepare the welcome reception, provide the treasure hunt documents (+ treasures), and try to partake in the official dinner. Based on the participants list we will also prepare the official certificates and provide CERN goodie bags for all teachers.

Please let us know if we can help in any way to ensure a smooth running of the programme!

TP Calendar 2019



Organising CERN TPs


S'Cool LAB
Welcome
There is always a way to do it better... find it!
If you can't explain it simply, you don't understand it well enc

What is S'Cool LAB?

high school students

hands-on & minds-on particle physics experiments

Physics Education Research

high school teachers

Test Bed for Physics Education Research

Impact of S’Cool LAB workshops, students' conceptions in particle physics, teachers' motivations for field trips, new (low-cost) experiments for classrooms

International Particle Physics Learning Laboratory

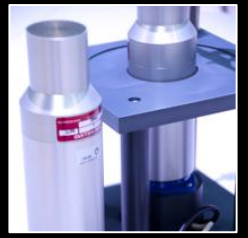
More than 7000 high-school students and teachers per year from more than 30 countries learning about physics and technologies at CERN

Hands-on Education for Students & Scientists

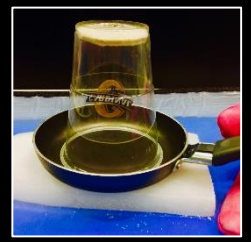
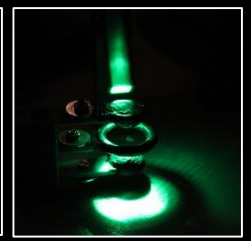
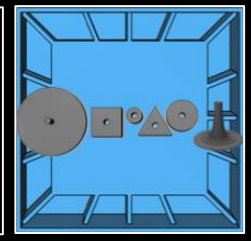
Independent experimentation in small groups
guided by diverse CERN volunteers,
Q&A with inspirational role models

Experiments: High-Tech vs. Low-Cost

In S'Cool LAB: High-Tech

	electrons in magnetic fields		cloud chambers
super-conductivity		pixel detectors	
PET			X-ray machines

For the Classroom: Low-Cost

3D printable magnet models		DIY cloud chambers	
	Bragg peak model		3D printable particle traps
3D compass			Rutherford scattering model

… and many more to come

Aims of S’Cool LAB

DISCOVERY

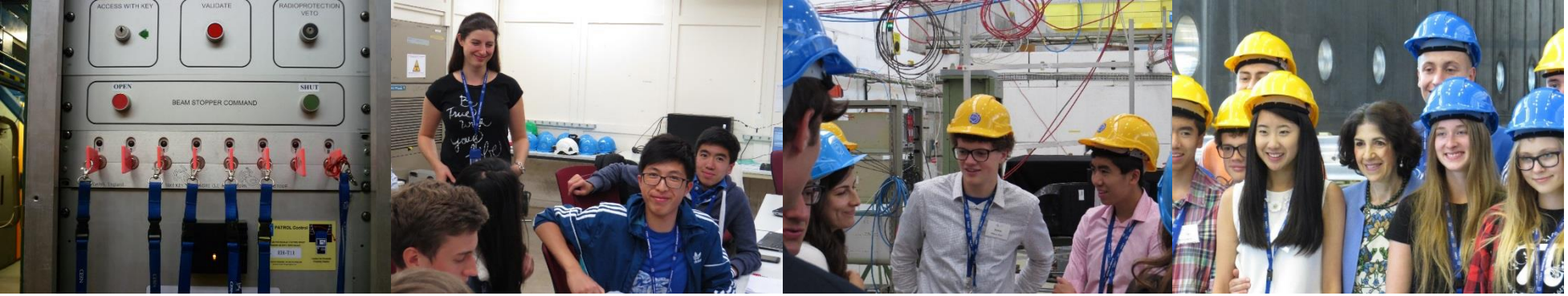
Give insights into the working methods, technologies and research of the world's largest particle physics laboratory

CURIOSITY

Spread CERN’s spirit of science curiosity, foster physics interest and self-concept

UNDERSTANDING

Make CERN’s physics and technologies understandable to students through hands-on experimentation



beamline for schools
cern.ch/bl4s
powered by CERN

BL4S is a worldwide competition for teams of high school students, aged at least 16 years and guided by a teacher, to use a fully equipped beam line at CERN's Proton Synchrotron

Teams have to design an experiment which uses a particle beam. They have to submit a written proposal and a one-minute video

The main goal is to motivate the students to learn about physics by treating them as if they were professional scientists

Launch: summer, proposal submission: 31 March of the following year

Beamline for Schools

2014
Odysseus' Comrades (GR)
Dominicuscollege (NL)

2015
Leo4G (IT)
Accelerating Africa (ZA)

2016
Relatively Special (UK)
Pyramid Hunters (PL)

Winners 2018:
R.N. Podar School, Mumbai, India
International School Manila, Philippines

Team “TCO-ASA” from Italy:
Test at CERN a Cherenkov detector that they have build at their school

Team “Charging Cavaliers” from Canada:
Challenge the Standard Model by looking for particles with a fractional charge

International Relations Sector
Secteur Relations Internationales

Brochure

- Content
  - special offers for teachers and students
    - Teacher Programmes
    - S'Cool LAB
    - High School Students Internship Programme
    - Beamline for Schools

- Target Audience
  - visitor groups
  - teacher programme participants
  - member state representatives

Did you know that CERN offers more than just tours of its premises? Check-out our educational programmes and get inspired to join one!

Physics Education Research

- Possibilities for interested students and teachers to research topics around the teaching of science exist at CERN
  - doctoral thesis
  - teacher in residence

- Research topics include
  - S'Cool LAB, its impact, development, …
  - Cosmology in the Classroom
  - K-12 Particle Physics
  - Silicon Detectors for School Use
  - Low-cost Experiments
  - …

Your Time, Your Questions!

… maybe my answers …

Research Topics

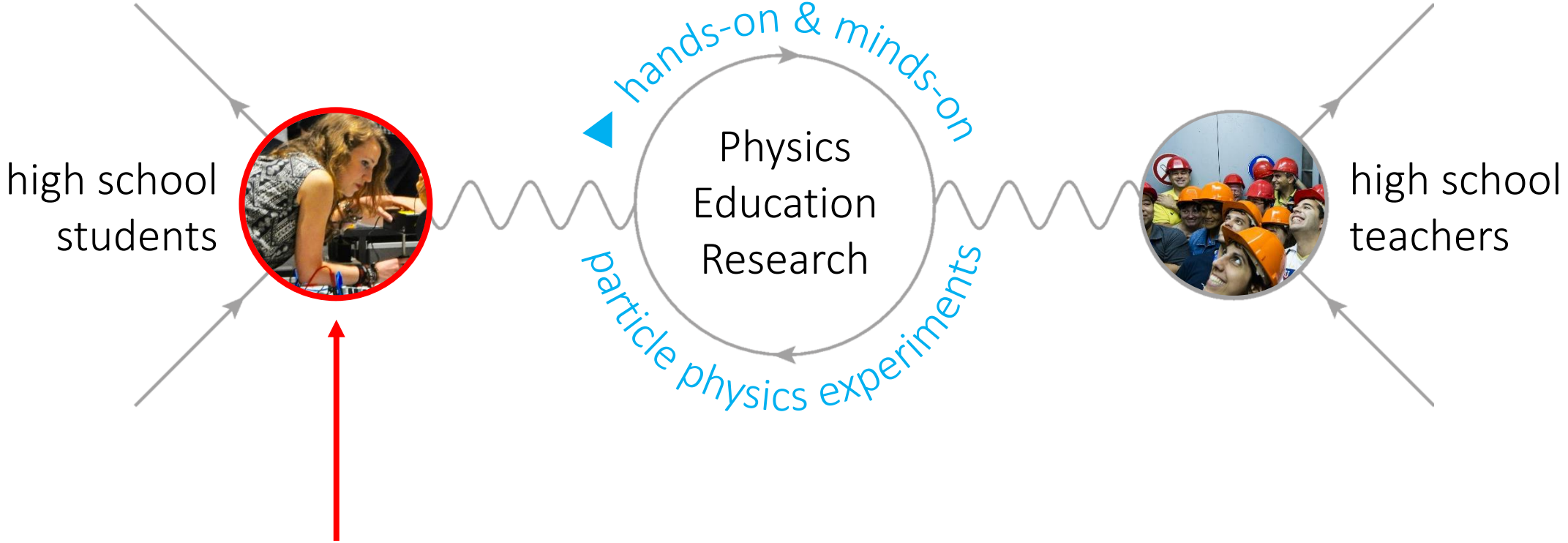
DEVELOPMENT AND EVALUATION OF THE HANDS-ON PARTICLE PHYSICS LEARNING LABORATORY S'COOL LAB AT CERN

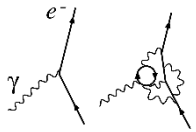
Effects of Student and Laboratory Characteristics on Cognitive and Affective Outcomes

Julia.woithe@cern.ch

Problem

Understanding the impact of S'Cool LAB Days on students





Coupling „constant" student ~ oslep effect as function of properties_student & properties_lab

Elementary particle physics in early physics education

Dr. Jeff Wiener

International Relations Sector
Secteur Relations Internationales

Development of a learning unit

on the subatomic structure of matter

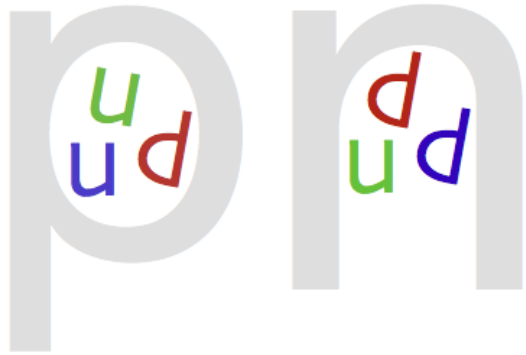
Model aspect of physics

"With the model of particle physics, we describe…"

Linguistic accuracy

particle vs. particle system

Typographic illustrations



DEVELOPMENT OF A TEACHING CONCEPT ON LEARNING ABOUT RADIOACTIVITY

Teaching of Physics Phenomena based on Randomness and the Benefits of New Devices

Alexandra.Jansky@cern.ch

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Design and Methods

Literatur

Develop Hypo-thesis

Interviews 1

Adapt Hypothesis

previous knowledge

Interviews 2

Develop teaching concept

Design for User Interface

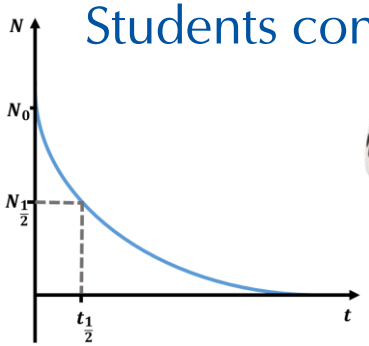
Adapt teaching concept

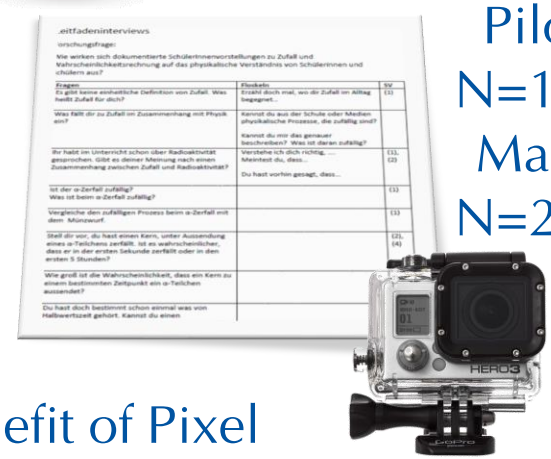
Adapt User Interface

Aim

Teaching concept

Students conceptions on randomness and chance in science





Pilot Interviews
N=10, aged 16-19
Main Interviews
N=23, aged 16-19

Benefit of Pixel Detectors

Learning about radioactivity using pixel detectors: Development and investigation of new experimental tools

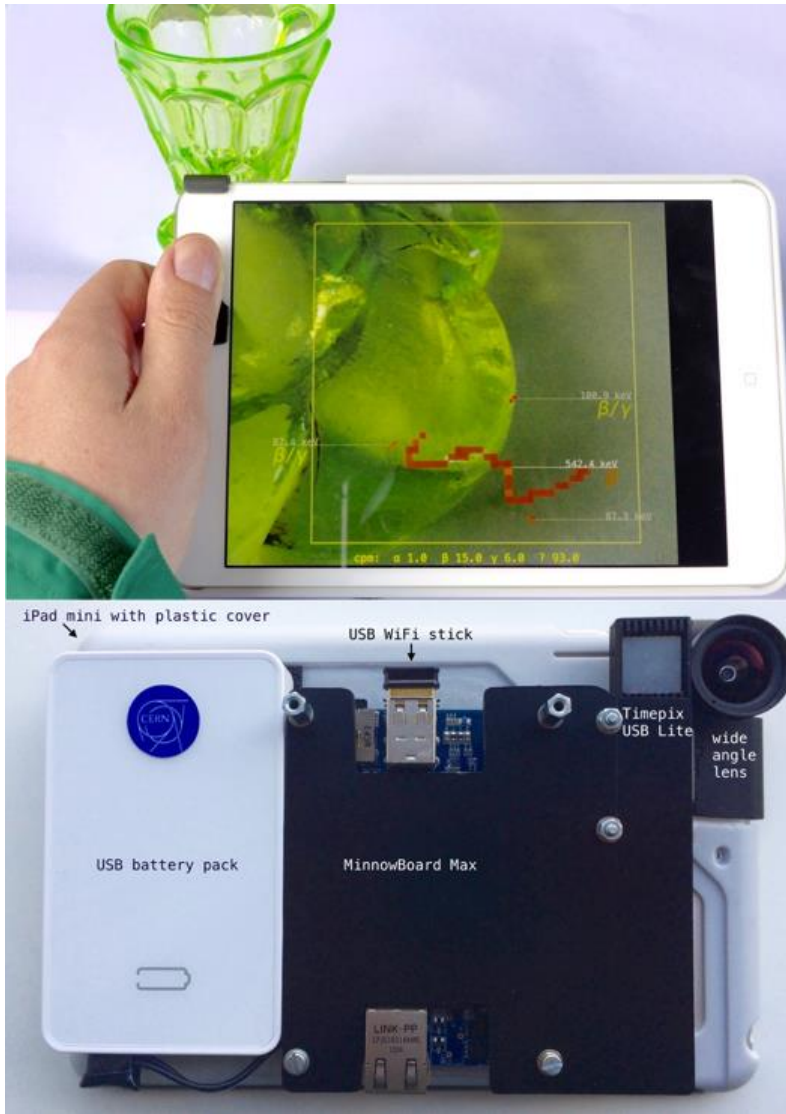
Oliver Keller
CERN & Université de Genève

Visualising Radioactivity using AR

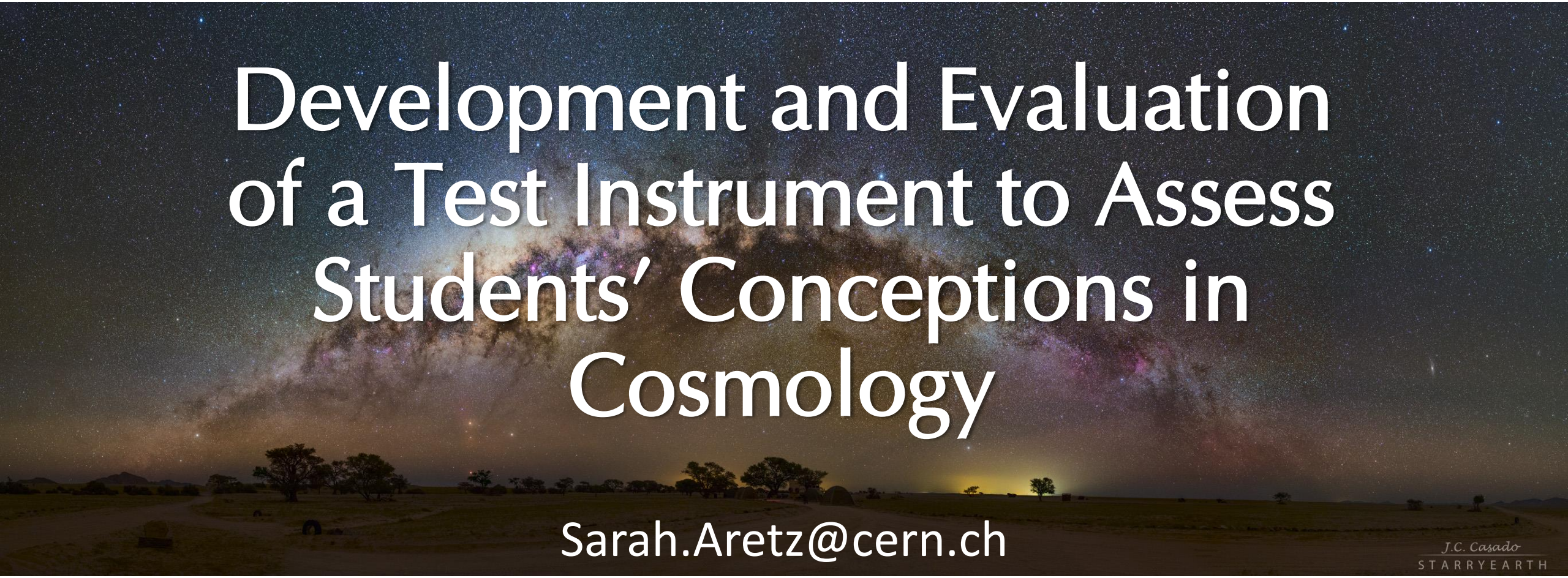
Idea: Create a visual instrument, inspired by cloud chambers, which is mobile and engaging to use

First prototype of its kind: iPadPix *

- Using augmented reality to discover particles on a live screen: Alphas, Betas/electrons, X-ray/gamma photons and cosmic rays
- Based on the Timepix pixel detector, developed within the Medipix Collaboration hosted at CERN
- Opportunities of Augmented Reality tools in education: gains in learning, motivation, interaction and collaboration (Bacca et al. 2014)



* *iPadPix - A novel educational tool to visualise radioactivity measured by a hybrid pixel detector, O. Keller et al. 2016 JINST 11 C11032 (Presented at PIXEL 2016)*



Development and Evaluation of a Test Instrument to Assess Students' Conceptions in Cosmology

Sarah.Aretz@cern.ch

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Evaluation of International Teacher Programmes

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Low-Cost Experiments for the Classroom

… and far too many ideas …