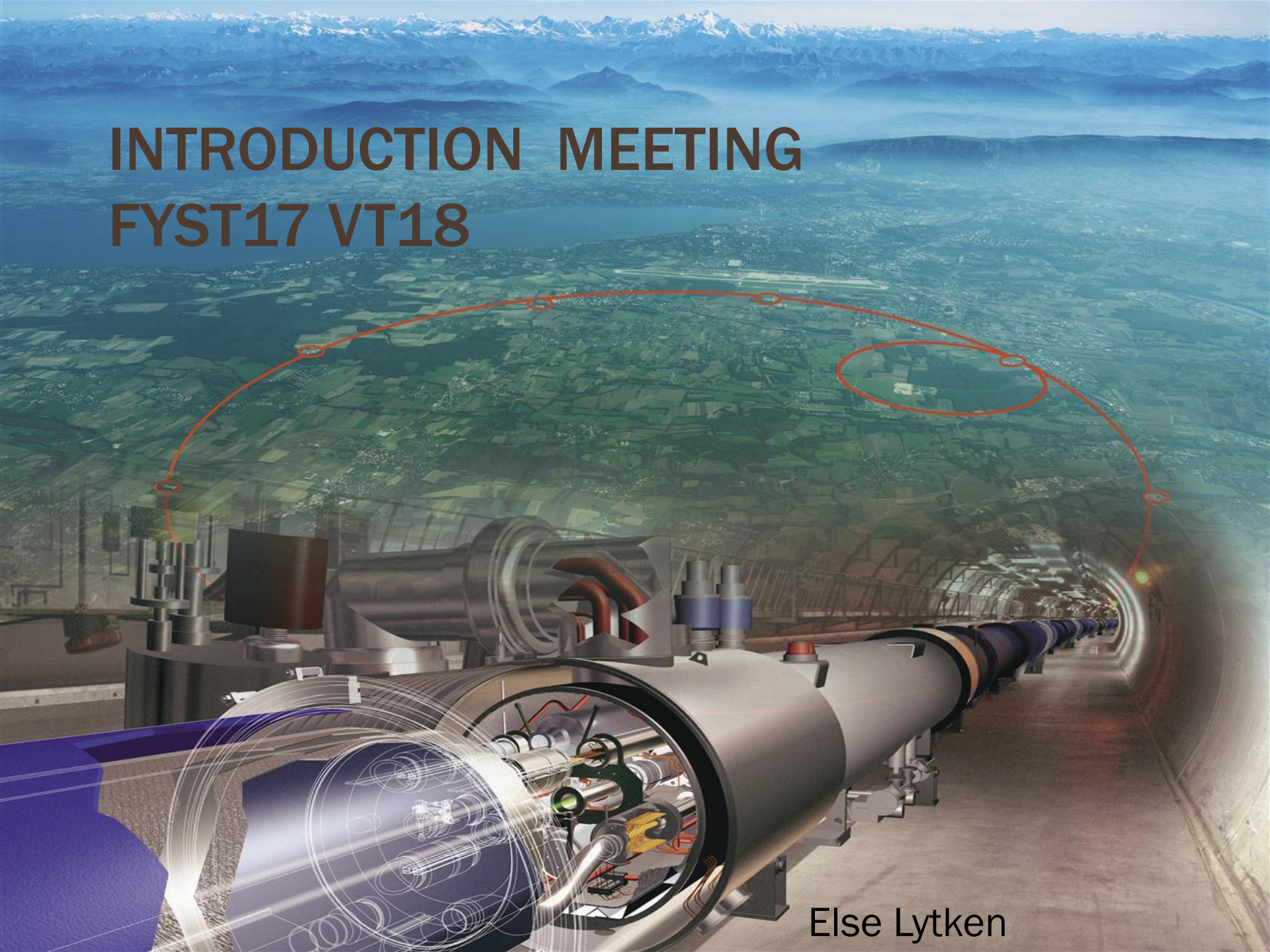
INTRODUCTION MEETING
FYST17 VT18



Else Lytken

TODAY'S AGENDA

- Learning outcomes and prerequisites
- Course plan
- Litterature and lecturers
- Evaluation
- Introducing the Particle Physics division
- Summer schools
- Remaining questions

LEARNING OUTCOMES

- The purpose of this course is to provide advanced knowledge of current aspects of experimental particle physics
  - Current status and challenges
  - Experimental programs current and future
  - Basic statistical methods in particle physics
- Students should also:
  - Learn to acquire scientific knowledge, including reading scientific papers
  - Improve their problem solving skills in the area
  - Improve communication skills, both written and oral

PREREQUISITES

- Basic knowledge of quantum mechanics and four-vectors and relativistic mechanics
  - More info on the homepage ”Notes on particle kinematics, cross-sections etc”
- Basic knowledge of the Standard Model of particle physics
  - For local students I presume you have taken the Physics 3 course FYSC14: High energy physics, accelerators and cosmology
  - Other useful courses are FYSN11, 15 ; FYTN04, MNXB01

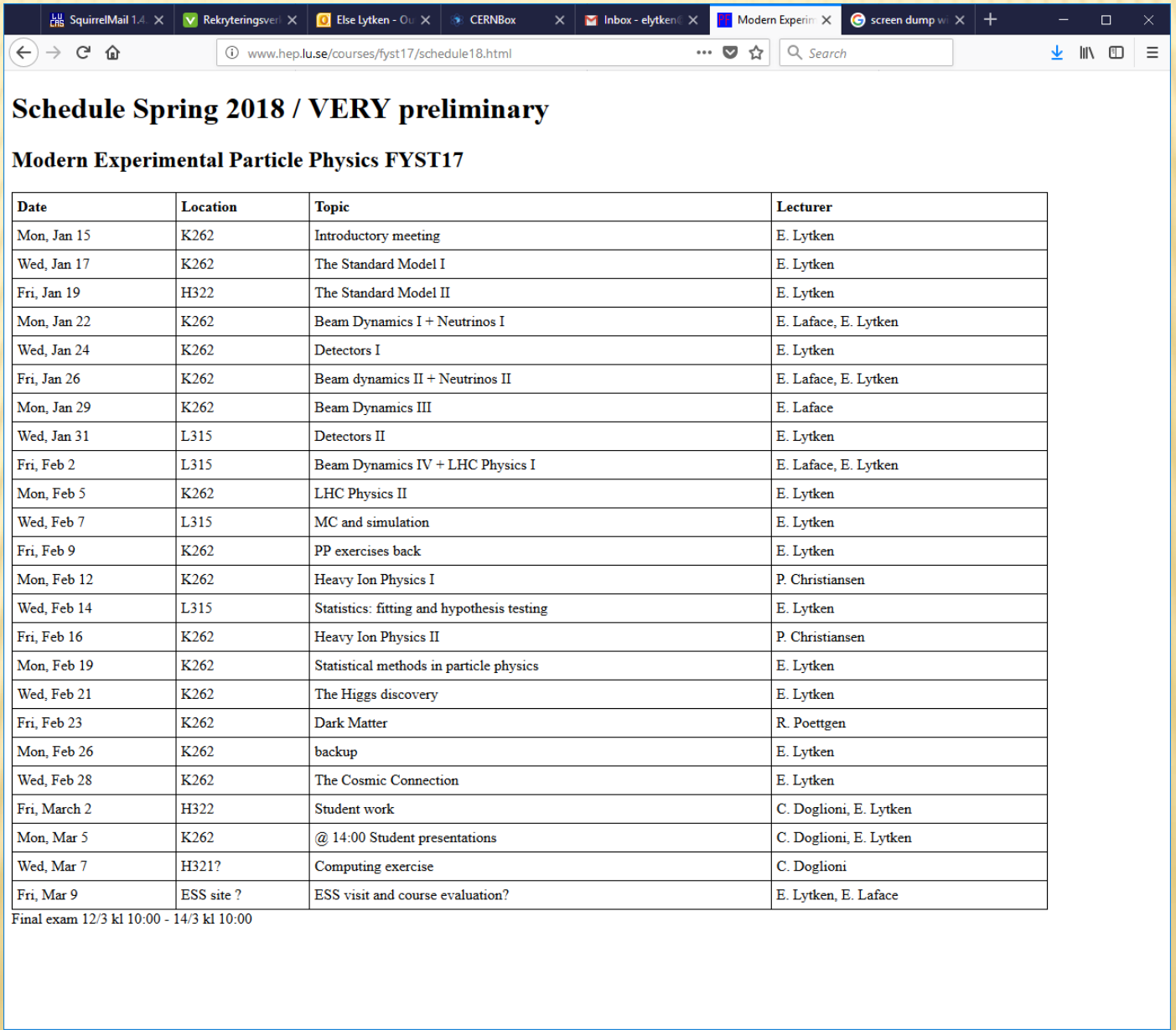
COURSE PLAN

- See detailed lecture schedule online
  - More details on the Standard Model, Beyond the Standard Model, and experimental techniques
  - Including special lectures on heavy ion physics and beam dynamics
  - Statistical tests and analysis examples
  - Hopefully a visit to the ESS site – more details from Emanuele when the beam dynamics lectures start
- 2 sets of written exercises
  - SM physics, Heavy ion physics.
  - BD exercises mainly in-class
- Student project work
  - Read up on topic, present to rest of class + computer exercise

STUDENT PROJECTS

- Group work. For the preparations and presentation group size can be ~4 . For the computing exercise we will try to get enough virtual machines set up to split you up into smaller groups
- Day 1: Pick and read outreach level article (will be provided) and prepare short (< 5mins) presentation
- End of day 2: present to class
- Day 3: Computing exercise. Learn how ROOT notebooks work and then plot distributions from your article. (and more, if time allows)

LECTURE PLAN (PRELIMINARY)



Schedule Spring 2018 / VERY preliminary

Modern Experimental Particle Physics FYST17

Date	Location	Topic	Lecturer
Mon, Jan 15	K262	Introductory meeting	E. Lytken
Wed, Jan 17	K262	The Standard Model I	E. Lytken
Fri, Jan 19	H322	The Standard Model II	E. Lytken
Mon, Jan 22	K262	Beam Dynamics I + Neutrinos I	E. Laface, E. Lytken
Wed, Jan 24	K262	Detectors I	E. Lytken
Fri, Jan 26	K262	Beam dynamics II + Neutrinos II	E. Laface, E. Lytken
Mon, Jan 29	K262	Beam Dynamics III	E. Laface
Wed, Jan 31	L315	Detectors II	E. Lytken
Fri, Feb 2	L315	Beam Dynamics IV + LHC Physics I	E. Laface, E. Lytken
Mon, Feb 5	K262	LHC Physics II	E. Lytken
Wed, Feb 7	L315	MC and simulation	E. Lytken
Fri, Feb 9	K262	PP exercises back	E. Lytken
Mon, Feb 12	K262	Heavy Ion Physics I	P. Christiansen
Wed, Feb 14	L315	Statistics: fitting and hypothesis testing	E. Lytken
Fri, Feb 16	K262	Heavy Ion Physics II	P. Christiansen
Mon, Feb 19	K262	Statistical methods in particle physics	E. Lytken
Wed, Feb 21	K262	The Higgs discovery	E. Lytken
Fri, Feb 23	K262	Dark Matter	R. Poettgen
Mon, Feb 26	K262	backup	E. Lytken
Wed, Feb 28	K262	The Cosmic Connection	E. Lytken
Fri, March 2	H322	Student work	C. Doglioni, E. Lytken
Mon, Mar 5	K262	@ 14:00 Student presentations	C. Doglioni, E. Lytken
Wed, Mar 7	H321?	Computing exercise	C. Doglioni
Fri, Mar 9	ESS site ?	ESS visit and course evaluation?	E. Lytken, E. Laface

Final exam 12/3 kl 10:00 - 14/3 kl 10:00

IMPORTANT DATES

- Lectures Mon-Wed- Fri 13:15 to 15:00 starting this Wednesday.
  - Most days we are here (K262) but for a few days will have to be in Sal D (L315, see TimeEdit for latest updates)
- Feb 02: turn in of first HW
- March 2-7: project work
- March 12: hand-out exam
- March 14: hand-in exam

LITTERATURE

- Main material covered in G. Barr et al. "Particle Physics in the LHC Era", Oxford Masters Series in Particle Physics, 2016
- Additional litterature: chapters 3, 8, and 10 in "Data analysis in high energy physics: a practical guide", O. Bahnke et al
- e-book links on homepage
- Additional lecture notes/material will be distributed at the lectures
- Slides will be posted on the homepage of course

LECTURERS

Main responsible: Else Lytken

Office A426, Else.Lytken@hep.lu.se

Peter Christiansen

Lecturer
Heavy ion
physics

Caterina Doglioni

Instructor
project
work

Emanuele Laface

Lecturer

ESS/beam dynamics

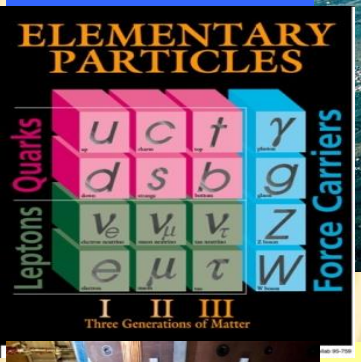
Ruth Pöttgen

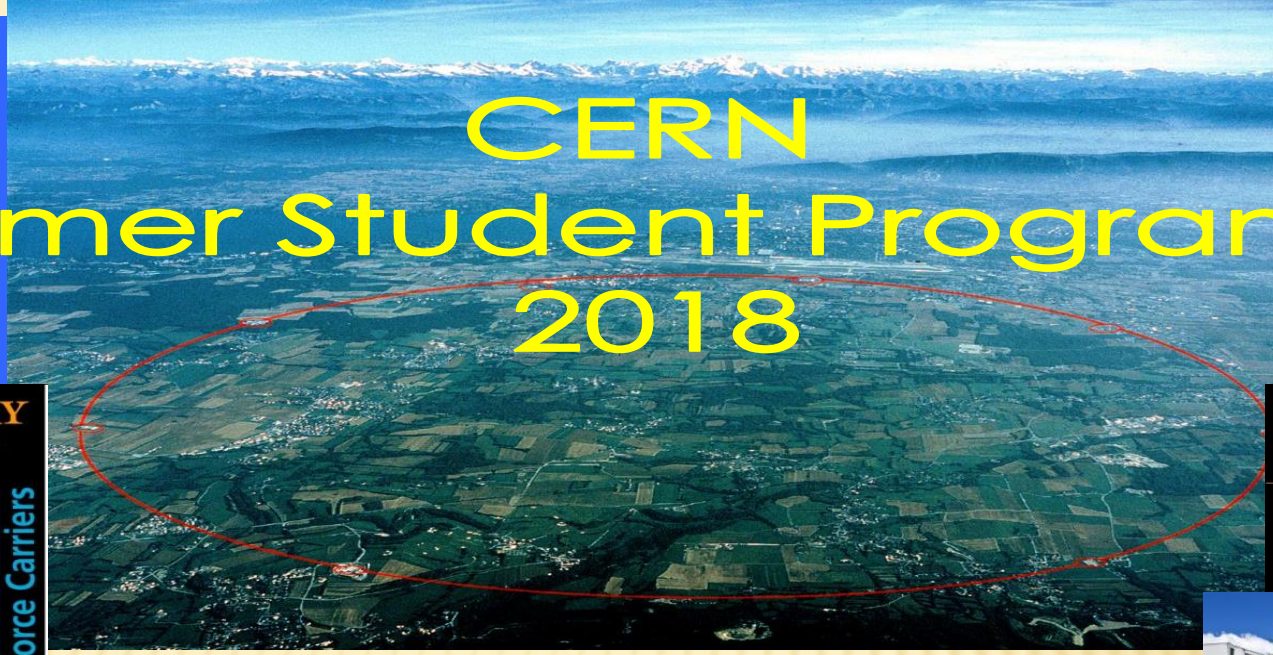
Guest lecturer Dark
Matter

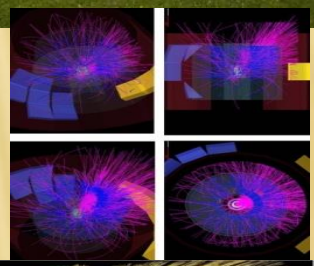
EVALUATION

- FYST17 gives 7.5 ECTS credits
- **Final exam** is a take-home written exam, will be passed out March 12 (tentatively) and turn-in date is March 14 (tentatively). *It must be the work of the individual student, no collaboration*
- **Homework***: must* be passed before examination. PP and HI homework grade counts as 20% in the final grade. Collaboration on ideas allowed but each student should write down individual solutions
- **Project work** *must* be passed before final examination. P/NP grade . Talk to me in advance for alternatives if you think this could be a problem for you

CERN Summer Student Programme 2018







Apply to experience CERN first-hand !

Participants in the CERN Summer Student programme join research activities and have lectures about particle physics from gifted lecturers

Every Summer about 100 students from around the world come to CERN as Summer students, to learn about fundamental physics, participate in research, enjoy the location near Geneva on the border of France and Switzerland, and to form new friendships.
Places are awarded on a competitive basis, to students who have finished the first years of their university education that Summer (typically bachelor in Science/engineering/computer science)

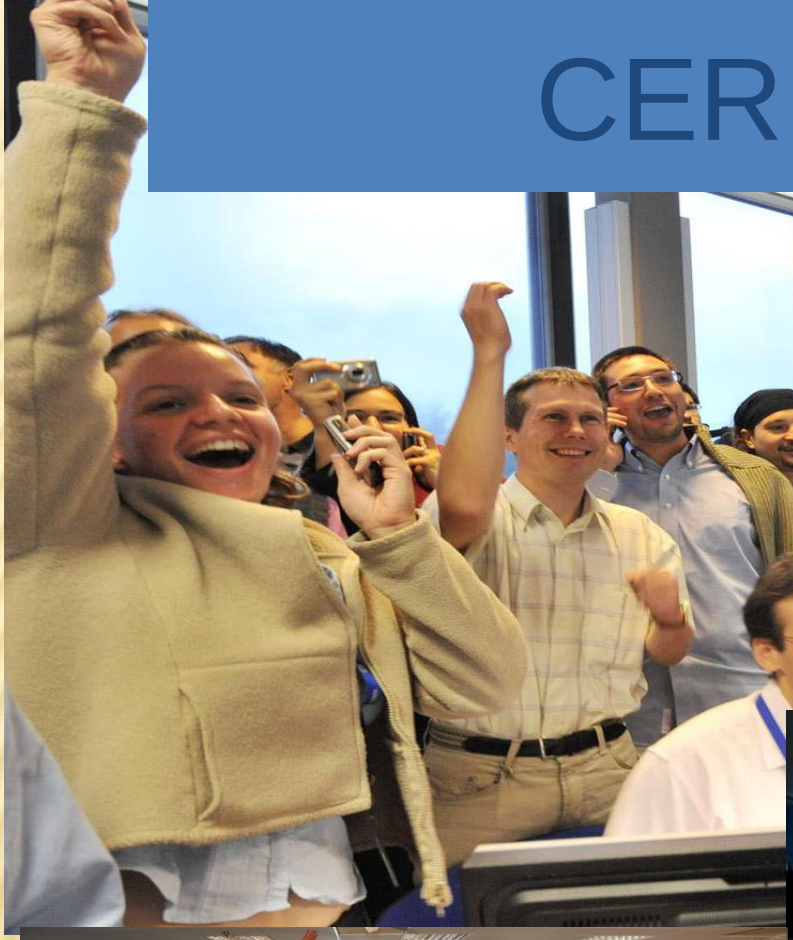
Application deadline is 28 January 2018

Travel + generous stipends paid
8-13 weeks in the
Summer of 2018

SUMMER STUDENT PROGRAMS

- Both CERN and DESY labs have summer student programs – find programs online
- Deadline every January – next deadlines are 28/1 (CERN) and 31/1 (DESY)
- Need letters of recommendation
  - Preferably from project supervisors – not necessarily particle physicists.
- Intended for university students in physics, engineering, and computer science
- You need at least 3 years of university studies and a good knowledge of English
- CERN: Preference for students from CERN member states

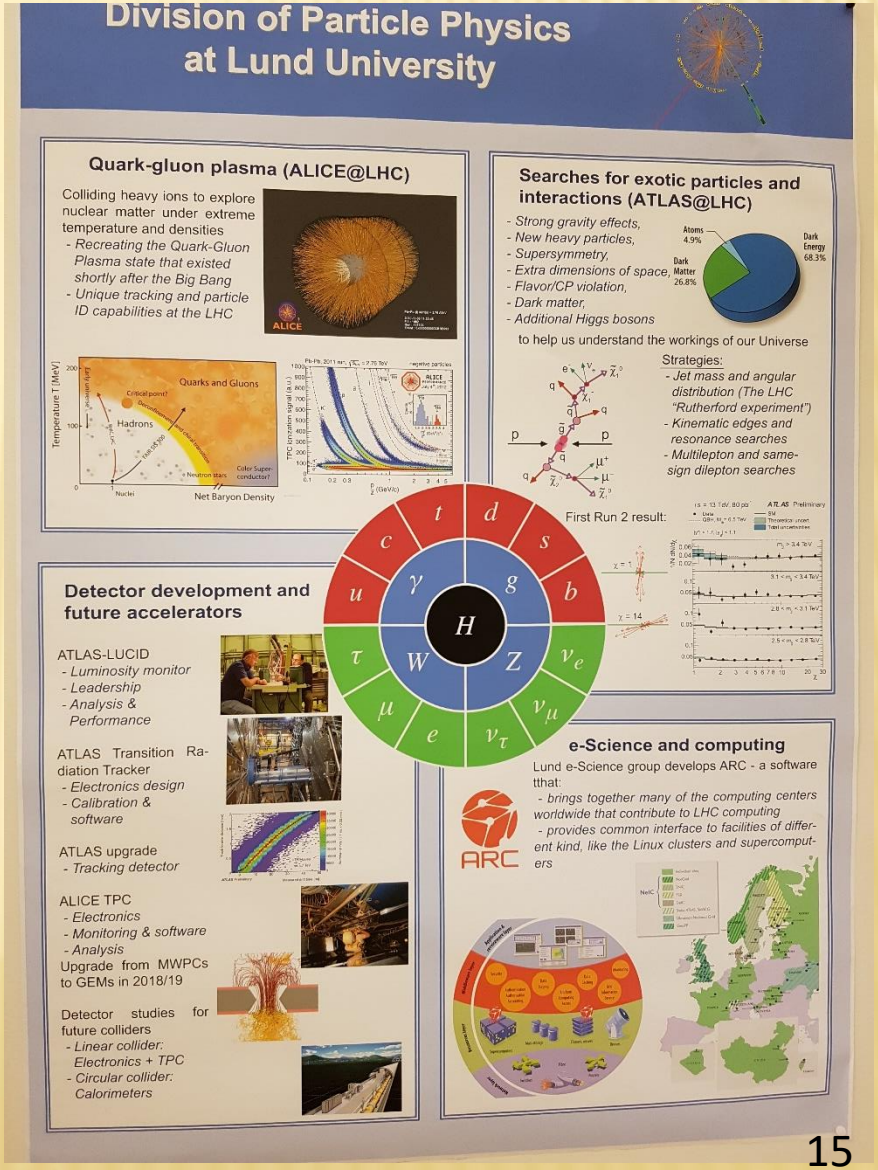
CERN researchers



THE LUND PARTICLE PHYSICS DIVISION

Mainly involved in the LHC experiments ALICE and ATLAS but also in the design of new experiments and e-Science

Come to the A400 corridor and ask about possible projects!



IF YOU HAVEN'T SIGNED UP FOR THIS COURSE YET

- and want to, check with Tomas or Yvonne if it is possible

YOUR EXPECTATIONS

- What is your background?
- Why (experimental) particle physics?
- What are some things you hope to learn from this course?