# Highlights from CAS, Slangerup 2019

**CERN Accelerator School course in Advanced Accelerator Physics**

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PITZ Physics Seminar
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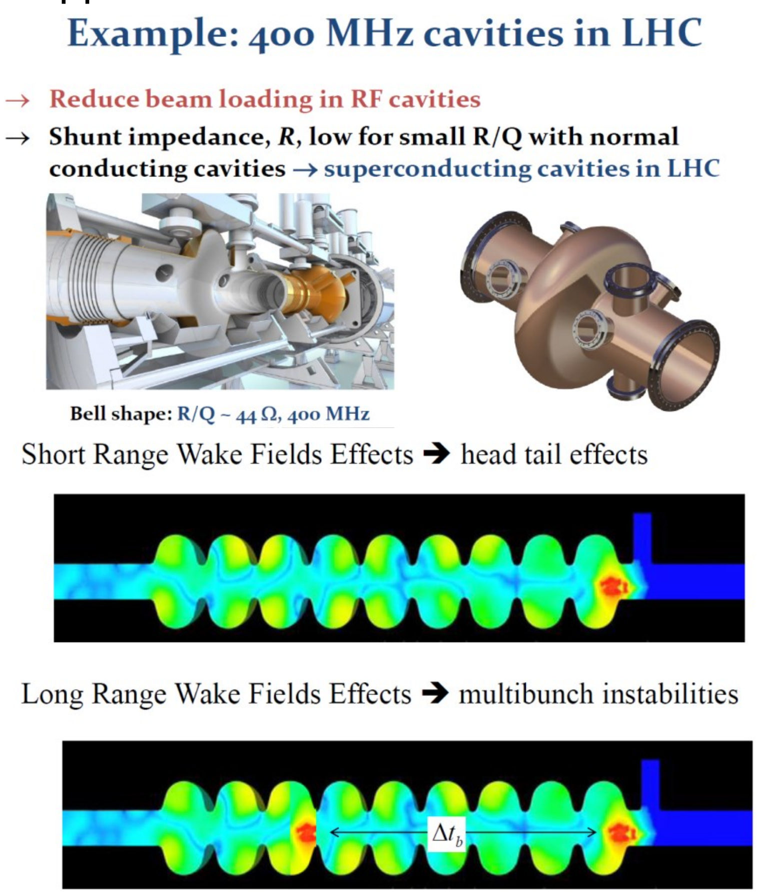
# Quick facts

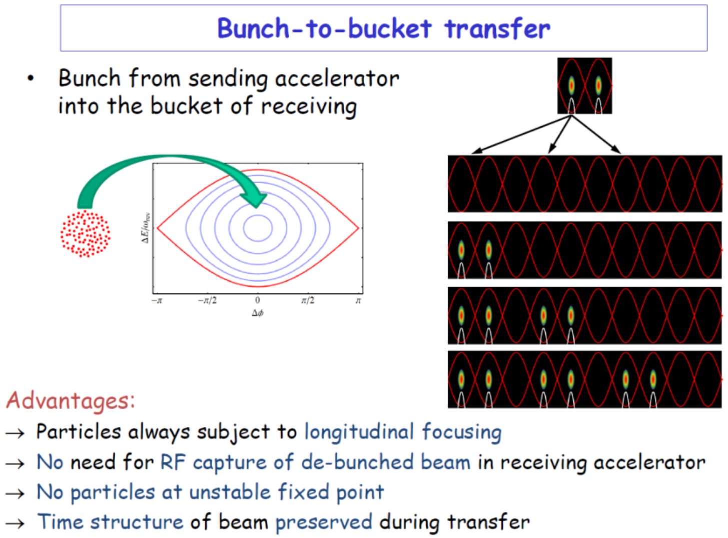
- Course in Advanced Accelerator Physics
    - Once every two years
    - General and broad set of topics
    - Different location (CERN member state)
    - About two weeks duration
        - 50% lectures, 50% hands-on exercise
        - 2 seminars, movie night, **excursion**
- This year
    - Metalskolen (Slangerup, Denmark)
- Other courses
    - Introduction to Accelerator Physics – every year
    - Specialized topics: RF, beam dinamics, DAQ, DSP…

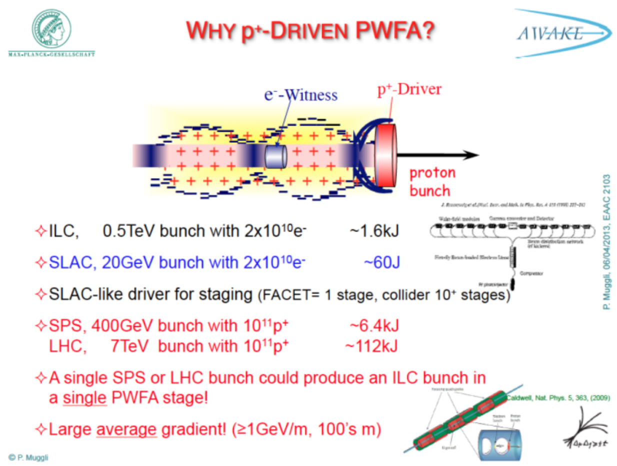
# Lecture topics

## Week 1

- Introduction to: RF, Beam instrumentation, Optics
- Optics, Lattice cells, Insertion and dispersion suppression
- Longitudinal beam dynamics
- Space charge
- Beam loading, RF feedback
- Wakefields and impedances, WFA
- Beam instabilities, Electron cloud effects
- Low emittance lattices
- Timing and synchronization



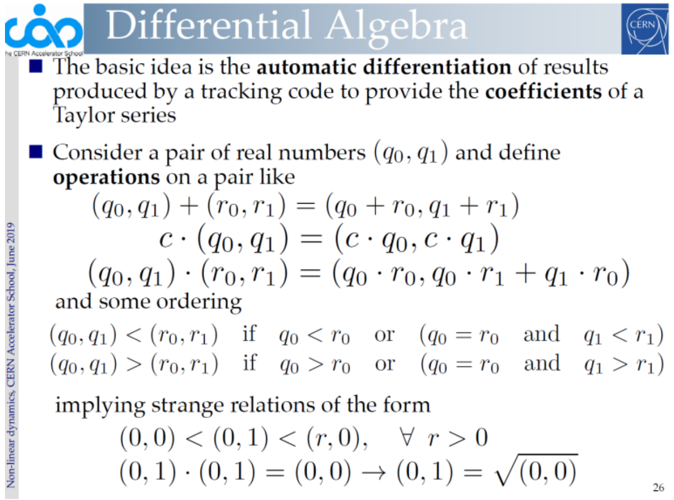



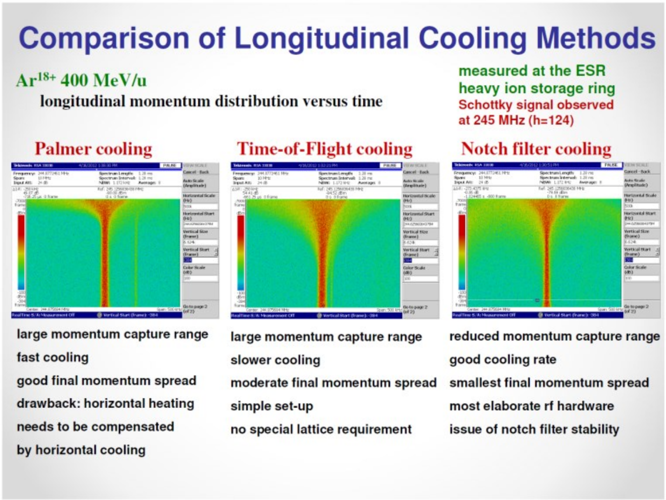



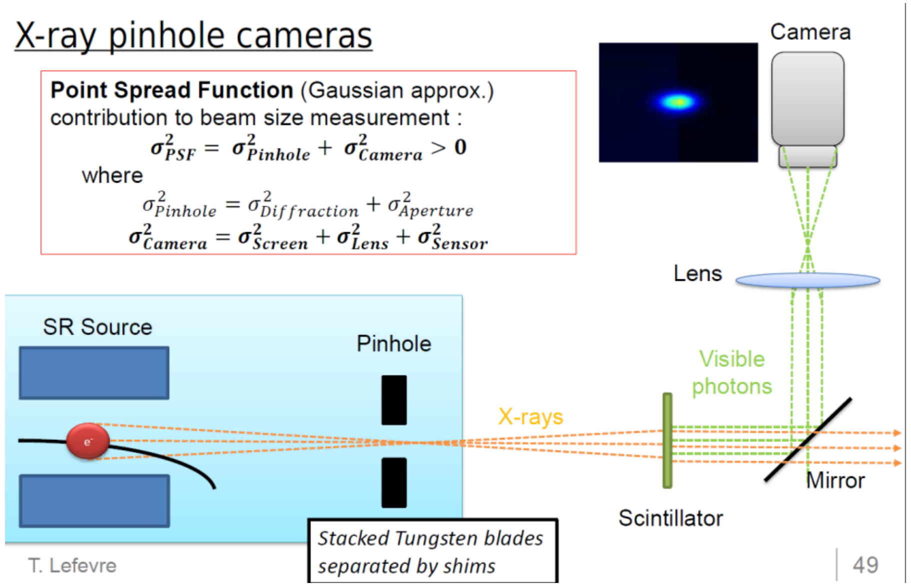
# Lecture topics

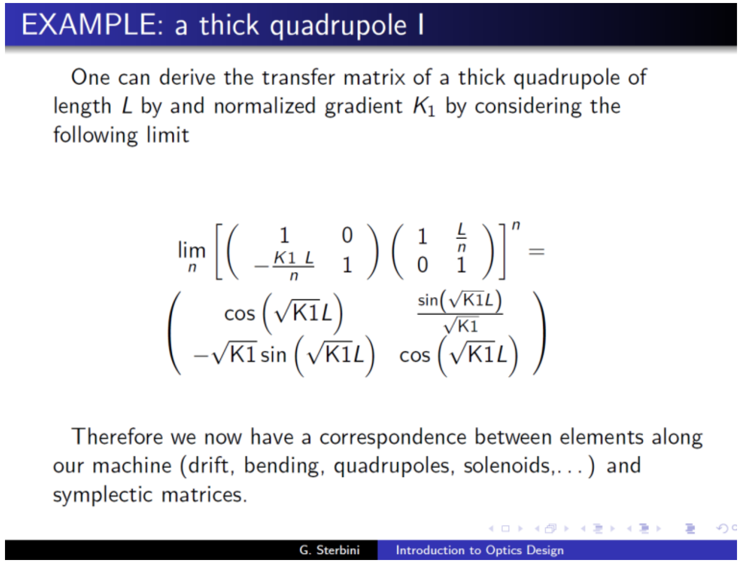
## Week 2

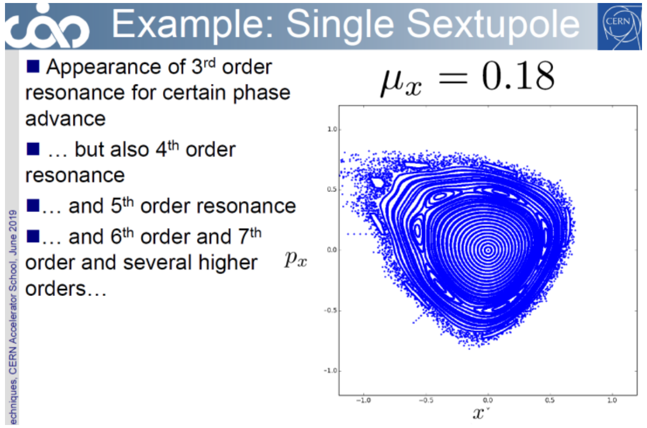
- Beam cooling, Stochastic cooling, Landau damping
- Polarisation (spin), Beam-beam effects
- Non-linear dynamics, Truncated power series algebra
- High brightness and longitudinal beam diagnostics



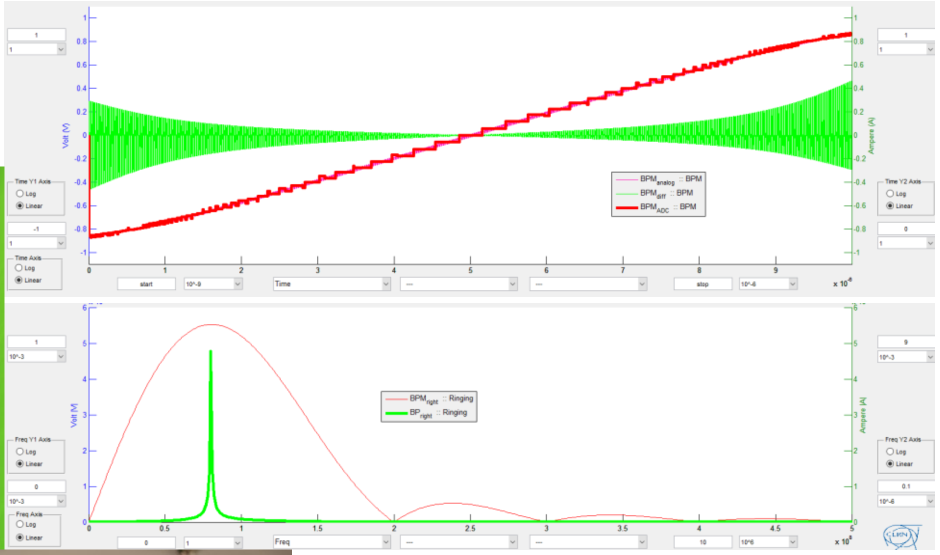



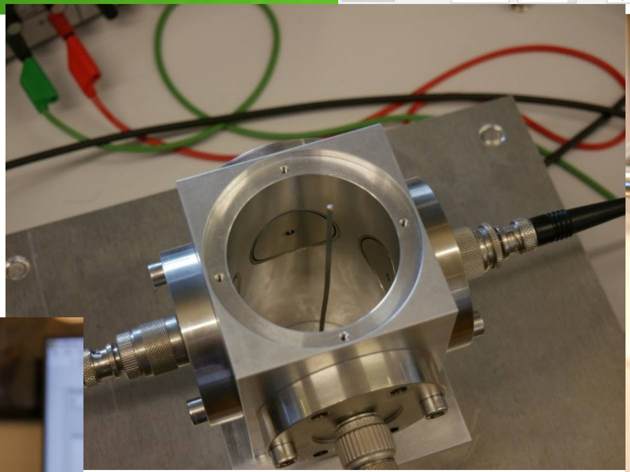



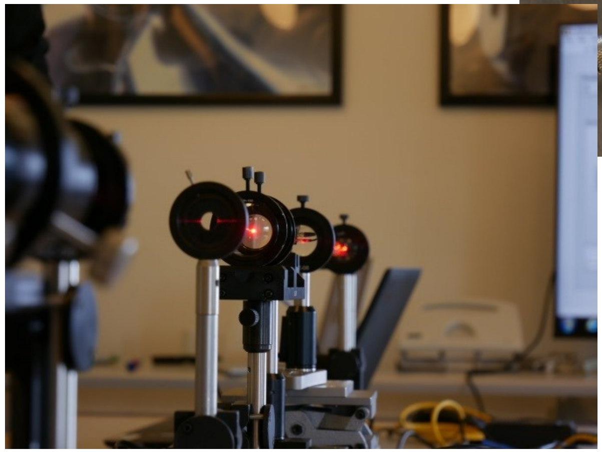
# Afternoon exercises

## Beam instrumentation and diagnostics

- Design of a BPM electronics
  - Drag and drop style
  - LTspice
- BPM laboratory exercises
  - Button BPM
  - RF BPM
- Beam size and emittance measurements
  - Laser beam
  - Pinhole, scraper, pepper-pot, quad scan, multiple screens
  - Electro-optic modulator



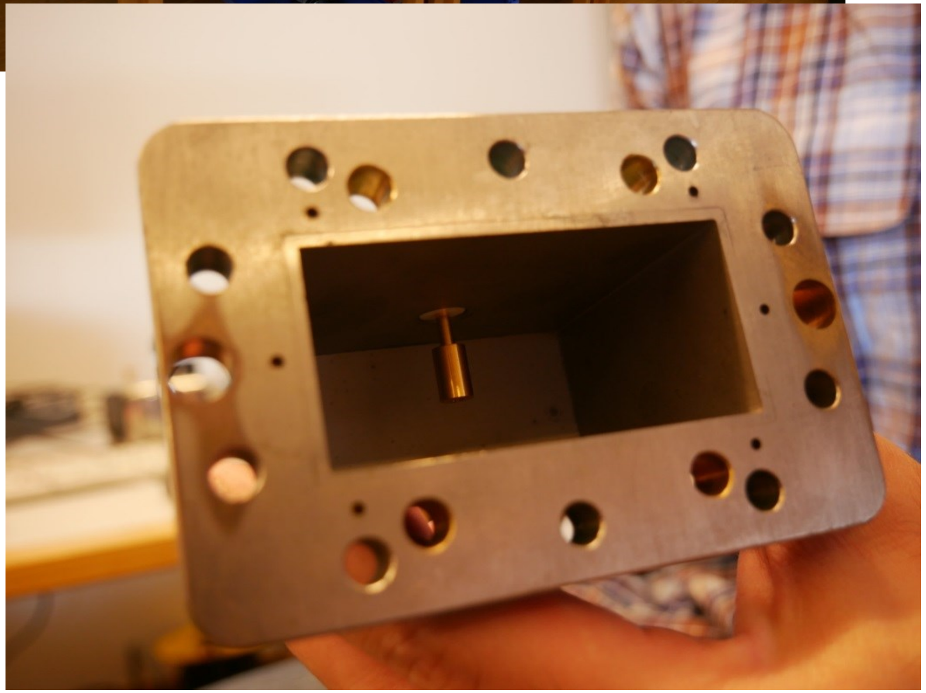





# Afternoon exercises

## RF lab and optics

- RF lab
  - Vector network analyzer
  - AM/FM modulation, Coupling impedance
  - RF characteristics, Pill-box cavity
  - Coupling impedance
  - CST simulations
- Optical design
  - MAD-X, Python
  - Lattices
  - ???

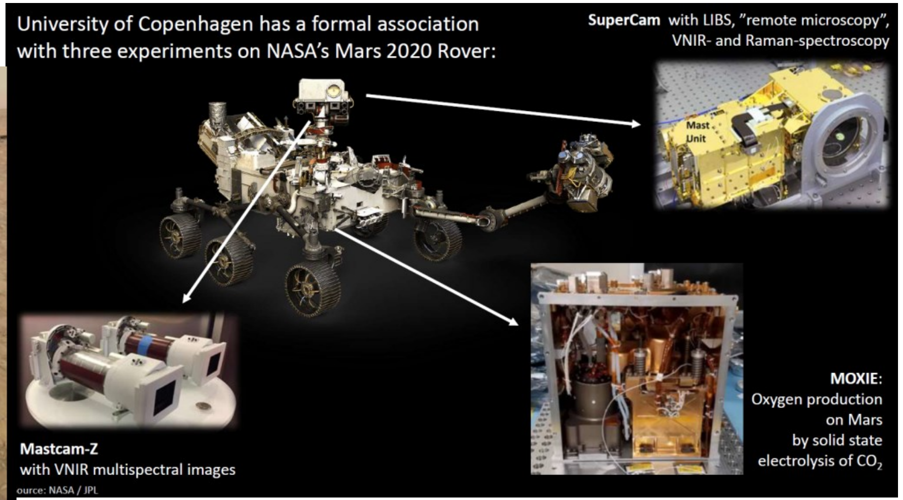


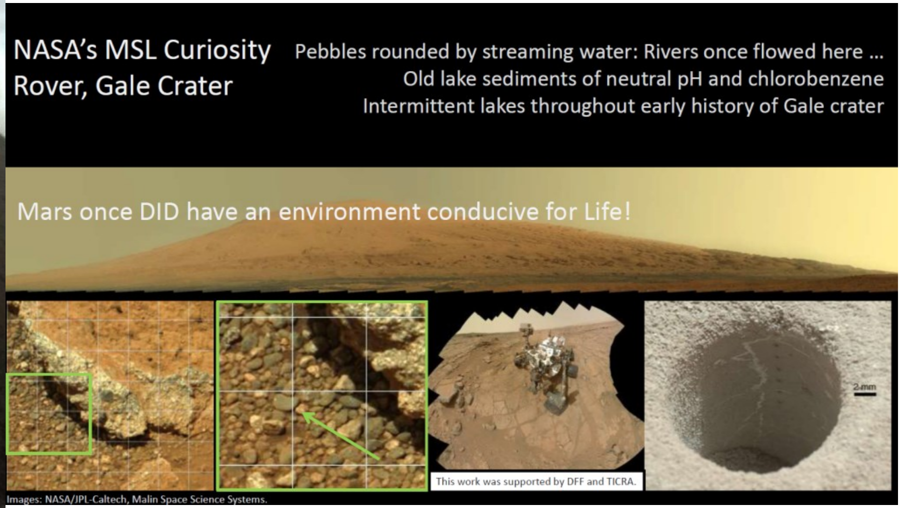
# Seminars

- Non-accelerator scientific topics
- Exploration of Mars
  - Landers
  - Search for evidence of water
  - Measurement instruments
  - Human voyage to Mars
- Deep Greenland ice core and climate
  - Deep ice elemental contents
  - Evidence of past global warming
  - Ice flow in Greenland and dating
  - North vs south ice caps
  - Sea level rise by source


Curiosity “selfie” recorded on sol 177 by MAHLI


First images of a cloudy sky



# Evenings





# Excursion

## Secret underground military base

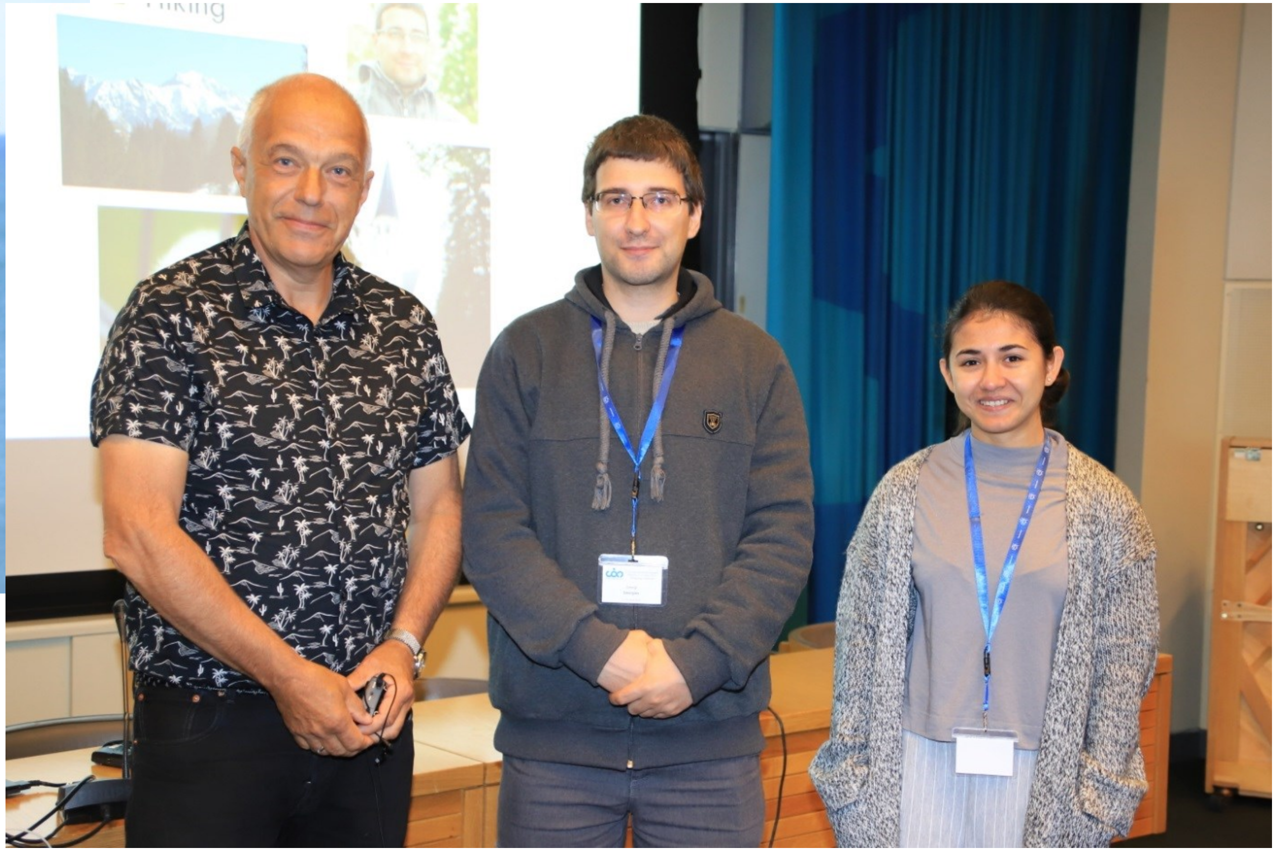




# Excursion

## Viking ships and 50 My old fossils

# Thank you!



# Backup slide

Sorry, if someone did not have lunch yet!