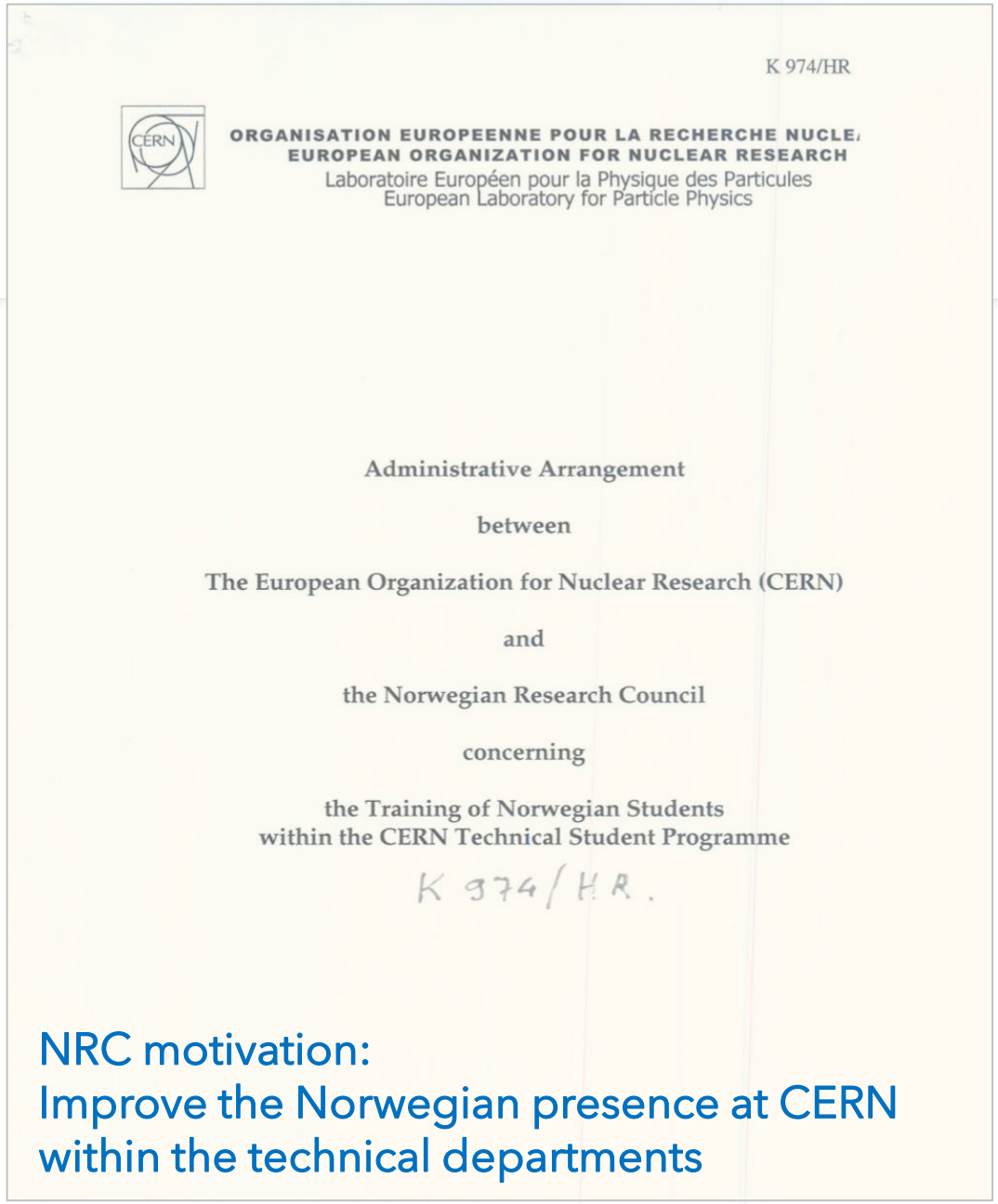
Technical students at CERN, including PhD opportunities– Norwegian initiatives

NorCC Workshop

14–15 September 2022

Session: Application & Exploitation

Jens Vigen, CERN



K 974/HR

ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLE/
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
Laboratoire Européen pour la Physique des Particules
European Laboratory for Particle Physics

Administrative Arrangement

between

The European Organization for Nuclear Research (CERN)

and

the Norwegian Research Council

concerning

the Training of Norwegian Students
within the CERN Technical Student Programme

K 974/HR.

NRC motivation:
Improve the Norwegian presence at CERN within the technical departments

Norwegian technical students at CERN

- Norway has a long tradition of sending technical students to CERN
- Additional Norwegian funding of the programme was introduced in 2003 (ref. K 974/HR)
  - 1 000 000 NOK/year
  - Could fund up to 10 students at 50% per year, CERN topping up the remaining 50%
  - Very advantagous at the time as CERN groups depended on quotas to get students
  - The strong CHF and the abolishment of quotas have changed the situation

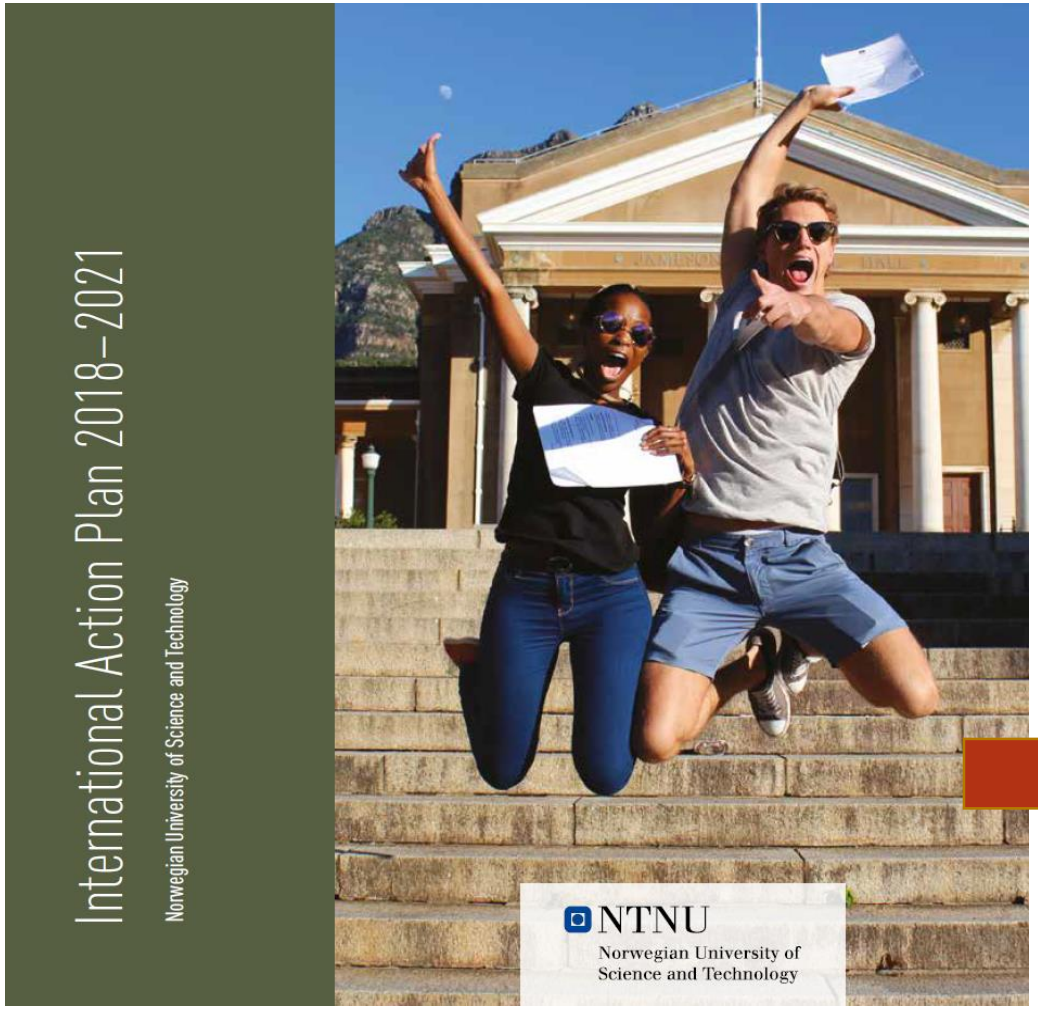
Today: Bachelor, master and PhD students

- CERN hosts typically 10 norwegian bachelor/master students per year
  - NTNU (often from Gjøvik) is the main recruitment pool
  - UiA and HVL have been deeply involved for years, while limited interest is observed at other instituations
- 11 engineers are currently pursuing a PhD
  - 8 of these are NTNU students on a special programme

“Random” examples of technical thesis

- TwinEBIS Control - Development of a LabVIEW Based Control System for Particle Ionisation and Measurement / Steen, Jørgen (2019)
- Development of a Power Quality Conditioning System for Particle Accelerators / Slettbakk, Tony Endre (2018)
- Determination of AC Characteristics of Superconducting Dipole Magnets in the Large Hadron Collider Based on Experimental Results and Simulations / Ambjørndalen, Sara (2017)
- GPU-powered modelling of nonlinear effects due to head-on beam-beam interactions in high- energy hadron colliders / Furuseth, Sondre (2017)

CERN – NTNU longterm, robust partnerships



Assignment given by rector Bovim in 2016

- Strengthen the professional collaboration with CERN
- Establish collaboration across CERN's research areas

Results

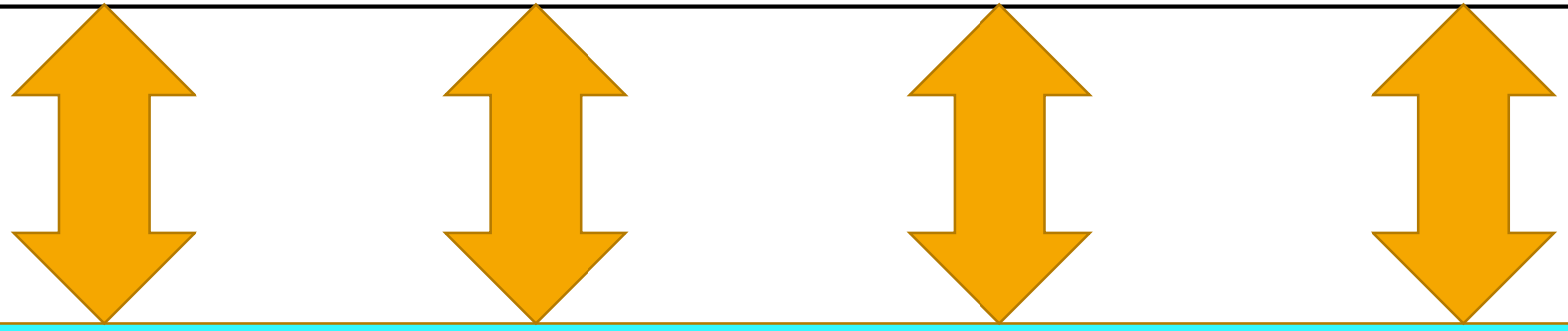
- Framework collaboration agreement signed in 2017
- Particular emphasis on joint publications
- Agreement on PhD collaboration signed in 2019
- Announcement of joint PhD positions in 2019 and 2020

Call for joint PhD projects NTNU - CERN

- Joint application for Ph.D.-projects
- Joint supervision
- 1 ½ year at NTNU and 1 ½ year at CERN

NTNU and CERN has engaged in long-standing cooperation in a number of scientific areas. To strengthen the cooperation, NTNU and CERN have decided to allocate funding for joint PhD-project.

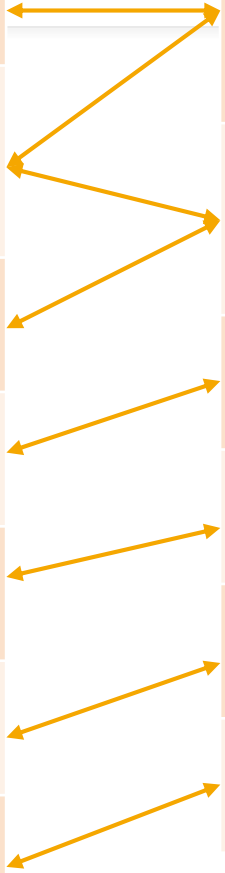
NTNU and CERN researchers are hereby invited to submit applications for joint PhD-projects.
The deadline for submitting applications is 1 October 2019.



Long-term impact: Joint publications, Funded projects from Horizon Europe, Researcher mobility, Student projects and mobility, Infrastructure cooperation

Collaboration between CERN and NTNU

CERN Departments	NTNU Departments
Engineering - Mario Di Castro	**Engineering Cybernetics** - Kristin Y. Pettersen - Morten Hovd
Beams - Walter Wuensch - Brad Schofield	**Physics** - Irina Sorokina - Morten Kildemo
Experimental Physics - Michael Doser	**Electric Power Engineering** - Dimosthenis Peftitsis
Electric Power Converters - Konstantinos Papastergiou	**Ind. Eco. and Tech. Managem** - Øystein Widding
Industry, Procurement and Knowledge Transfer - Giovanni Anelli	**Energy and Process Engineering** - Armin Hafner
Technology - Bart Verlaat	**Mechanical and Industrial Engineering** - Filippo Berto
Targets and Interactions - Marco Calviani	



PhD projects within the NTNU-CERN Collaboration

Hyper-redundant robots for maintenance in Big Science Facilities
Project leaders: Kristin Y. Pettersen, Dept. of Engineering Cybernetics and Mario Di Castro, Dept. of Engineering

Chirped optical laser cooling of positronium
Project leaders: Irina Sorokina, Dept. of Physics and Michael Doser, Dept. of Experimental Physics

Surface plasmons and their role in field emission and breakdown in high-field accelerating structures
Project leaders: Morten Kildemo, Dept. of Physics and Walter Wuensch, Beams Dept.

Energy-optimal control of cooling systems
Project leaders: Morten Hovd, Dept. of Engineering Cybernetics and Brad Schofield, Beams Dept.

Diagnostics and prognostics for power electronics converters in large-scale accelerator facilities
Project leaders: Dimosthenis Peftitsis, Dept. of Electric Power Engineering and Konstantinos Papastergiou, Dept. of Electric Power Converters

The social impact of CERN's technological, human, and branding capital
Project leaders: Øystein Widding, Dept. of Ind. Eco. and Tech. Managem. and Giovanni Anelli, Industry, Procurement and Knowledge Transfer

Large Hadron Collider detector cooling with R744 refrigeration technology (CoolCERN)
Project leaders: Armin Hafner, Dept. of Energy and Process Engineering and Bart Verlaat, Dept. Technology

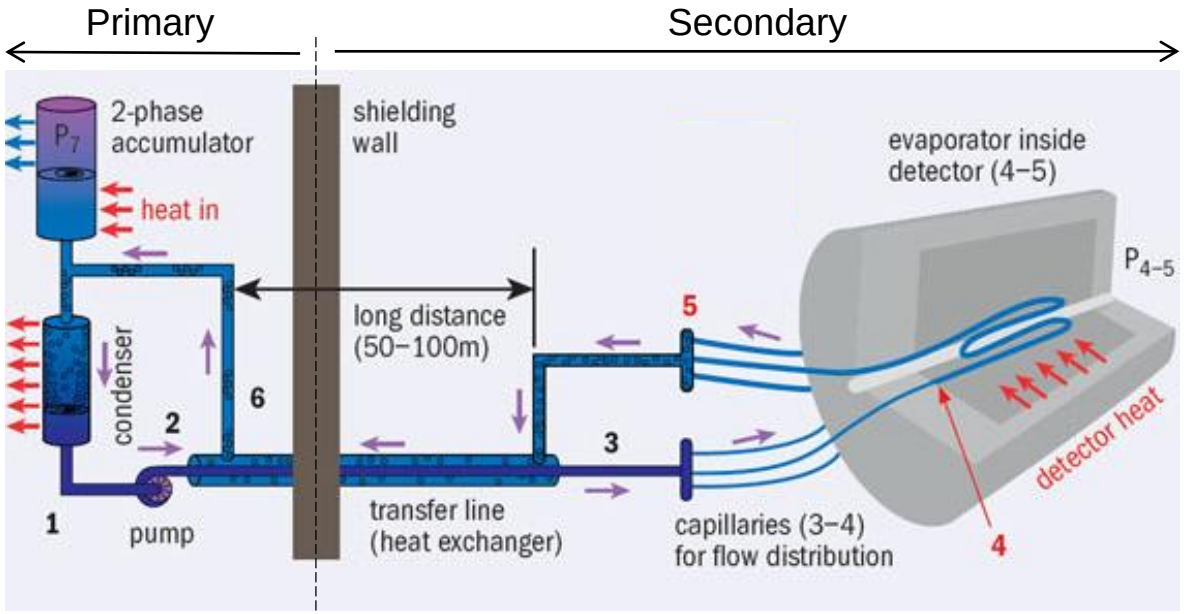
Mechanical and thermo-physical characterization
Project leaders: Filippo Berto, Dept. of Mechanical and Industrial Engineering and Marco Calviani, Targets and Interactions

Agder@CMS: CFD Collaboration Project

The project goal is to use CO2 cooling instead of water, which is currently in use at CMS

The project is split into two parts:

- Building a computational fluid dynamics model that accurately predicts the behavior of two-phase CO2 flows
- Building a benchmarking setup that will allow the validation of the CFD model



International Collaboration

Technical support

Benchmarking setup

CFD model

DESMOD: Detector System Monitoring and Diagnostics

AI for Particle Detector Monitoring, Collaboration between UiA and CMS/CERN (UiA: Mulugeta W. Asres and Christian W. Omlin)

DESMOD

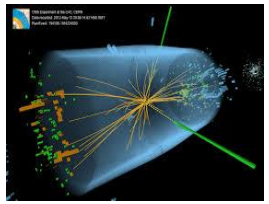
- Rapid identification and resolution of anomalies at the CMS Experiment at CERN
- Contextual time-aware anomaly detection models for detector monitoring
  - A. ML for Diagnostics (Circuit) Sensors
  - B. ML for Data Quality Monitoring (ML4DQM)
  - C. Root Cause Analysis (Causation of Backend Circuit Faults on DQM Anomalies)

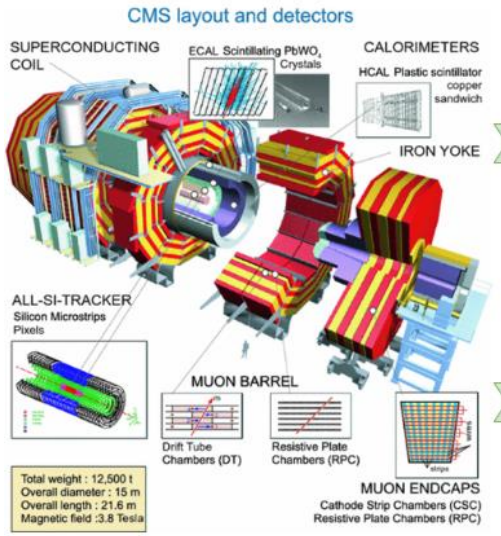
Research Use-case

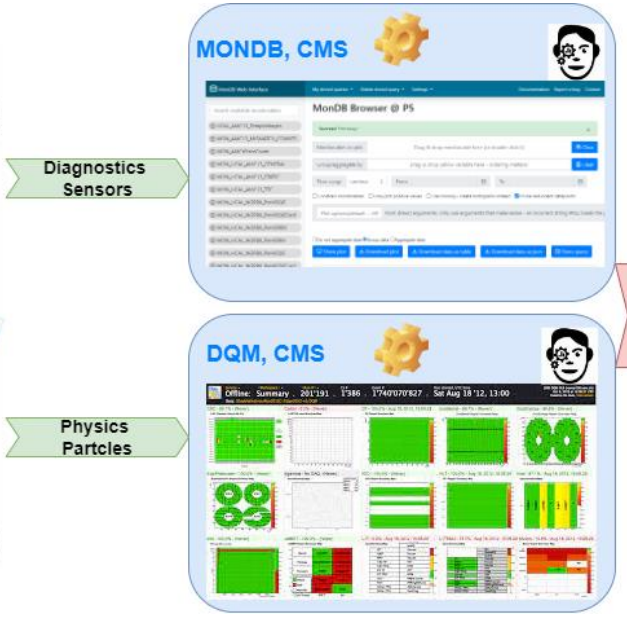
- The Hadron Calorimeter (HCAL) of the CMS Detector

Research Challenges

- Large, heterogeneous, and high dimensional data set
- Lack of annotated data sets
- Data cleaning
- Temporal modeling
- Scalable modeling approach







http://www.desmod.cern.ch:8501

How do we attract/find the candidates?

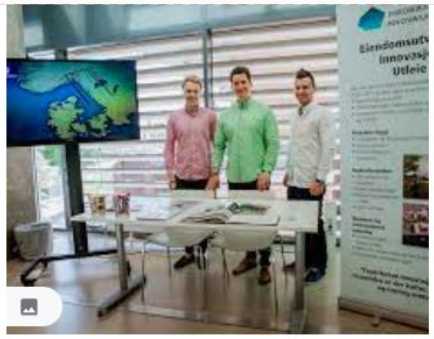
- Regular promotional visits to Norwegian universities
  - Town-hall meetings with students
  - One-to-one discussions with faculty members
- Receiving student groups and schools at CERN
  - Nabla (NTNU) organises a visit to CERN every year
- Sporadic feature articles in the academic Norwegian press

High school visits and teacher schools

- About 1200 Norwegian high school students visit CERN every year
  - CERN only offers a standard half day program—while the schools' expectation is a full day programme
  - We need more speakers and guides!
- Norwegian High School Teacher Program
  - Typically organized every two years

Important recruitment pool

- High schools use the trip to CERN as a "carrot" to get science/physics students
- Most university students coming to CERN came for the first time on a day's visit



Expo 2015: Eksamensutstilling for ...
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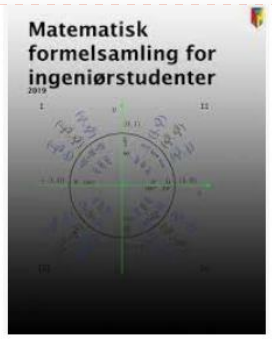

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youtube.com

siden 2002 har flere ...

Universitetet i Sørøst-Norge

NTNU vil ta opp 300 f

Conclusions

- The “technical links” between CERN and Norway are better organized than ever before
- The potential to expand further remains tremendous
  - More students on all levels
  - More CERN staff
  - Closer collaboration with Norwegian technical research groups
- Norway is well represented in the CERN Technician Training Experience (TTE)–not covered in this presentation