

Welkom in het CERN

6-7 februari 2023



Jorgen D'Hondt



Steven Lowette

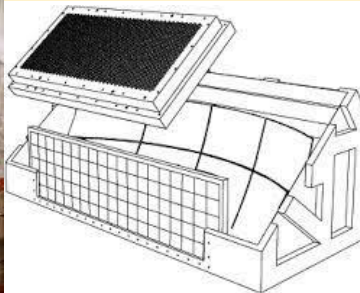


Michael Tytgat

Short CV – Michael Tytgat



Koninklijk Atheneum Kortrijk (math/science)
 1991-1995: Cand/Lic. in Physics
 1995-2001: PhD in Physics (hep-ex)
 2001-2010: FWO Postdoctoral Fellow @ UGent
 2006-2007: Visiting Scientist @ CERN
 2010-2012: Postdoctoral Assistant @ UGent
 2012-2022: Research Engineer @ UGent
 2016-present: Guest Lecturer @ UMons
 2023-present: Guest Professor @ UGent
 2023-present: Professor @ VUB



Main research topics @ VUB

- ❑ **CMS @CERN**
 - Phase-2 upgrades (Tracker, Muon-RPC/GEM)
 - Searches for BSM through flavor physics studies
- ❑ **Future Colliders (FCC/ILC)**
 - Detector R&D (e.g. gaseous for muons, calorimeters)
 - Heavy flavor physics studies
- ❑ **Non-HEP applications of Muon Radiography**
 - Main interest in geoscience & archaeology



Research History

- ❑ **Virtual Compton Scattering below π -threshold @MAMI: 1994-1997**
- ❑ **HERMES @HERA: 1995-2007**
 - Exclusive vector meson production
 - Ring Imaging Cherenkov detector
 - Recoil detector, including project management
- ❑ **CMS @CERN: 2006-present**
 - Established CMS@UGent in 2007 and co-leading team since then
 - Muon-RPC since 2007
 - Muon-GEM since 2009 (co-founder of CMS-GEM project)
 - BSM physics searches
 - Numerous level-1 & 2 management positions within CMS Muons
- ❑ **RD51 R&D on Micro-Pattern Gaseous Detectors: 2009-present**
 - GEMs, Thick-GEMs, Fast Timing Micropattern Gaseous detectors
- ❑ **CALICE R&D on Calorimetry for Future Colliders: 2009-present**
 - Semi-Digital Hadron Calorimeter development
- ❑ **Muon Radiography: 2017-present**
 - Muraves @ Vesuvius volcano
 - SciDEP @ Egyptian Pyramids
 - Belgian Portable Muoscope project

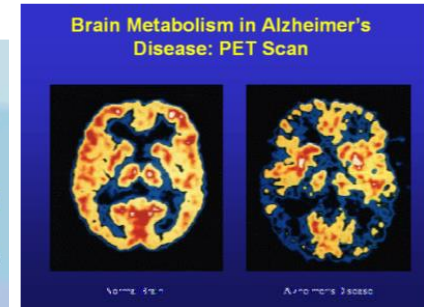
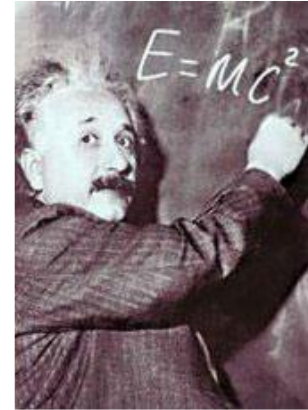
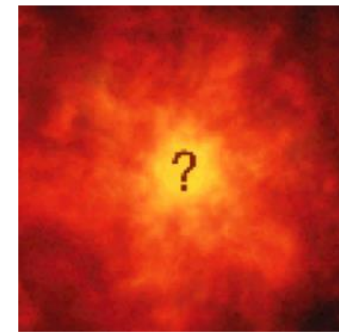
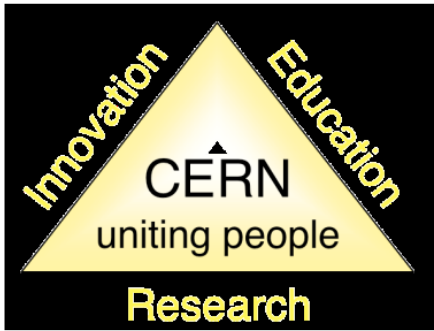


What is CERN about ?

- CERN
 - Original meaning: Conseil Européen pour la Recherche Nucléaire
 - Current meaning: European Organization for Nuclear Research

- CERN's mission

- **C** → International **C**ollaboration, i.e. unite people from different countries and cultures
- **E** → **E**ducation and knowledge sharing, i.e. train scientists and engineers of tomorrow
- **R** → Fundamental **R**esearch, i.e. push back the frontiers of knowledge, e.g. secrets of the Big Bang, what was matter like within the first moments of the Universe's existence ?
- **N** → **N**ew technologies for accelerators and detectors; information technology (the Web and the GRID); medicine diagnosis and therapy

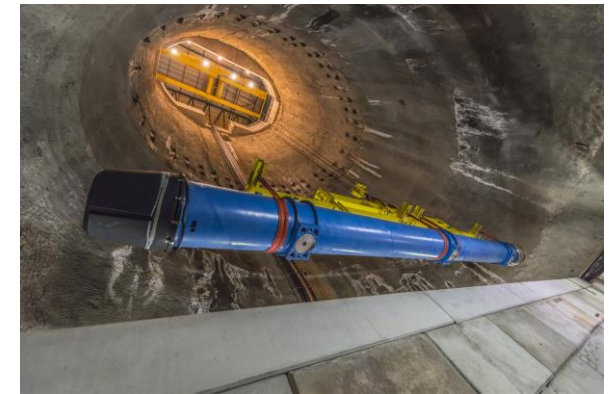
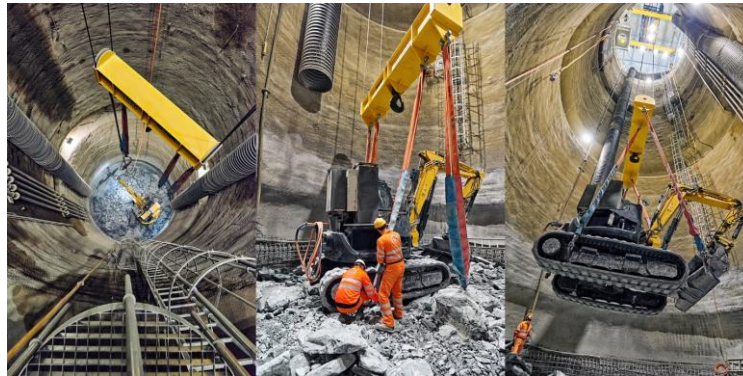


- CERN has particle accelerators and many experiments to discover and study the **building blocks of the universe**
- CERN is an **open laboratory**, with certain constraints and regulations
- Every year, ~ **130 000** people visit CERN



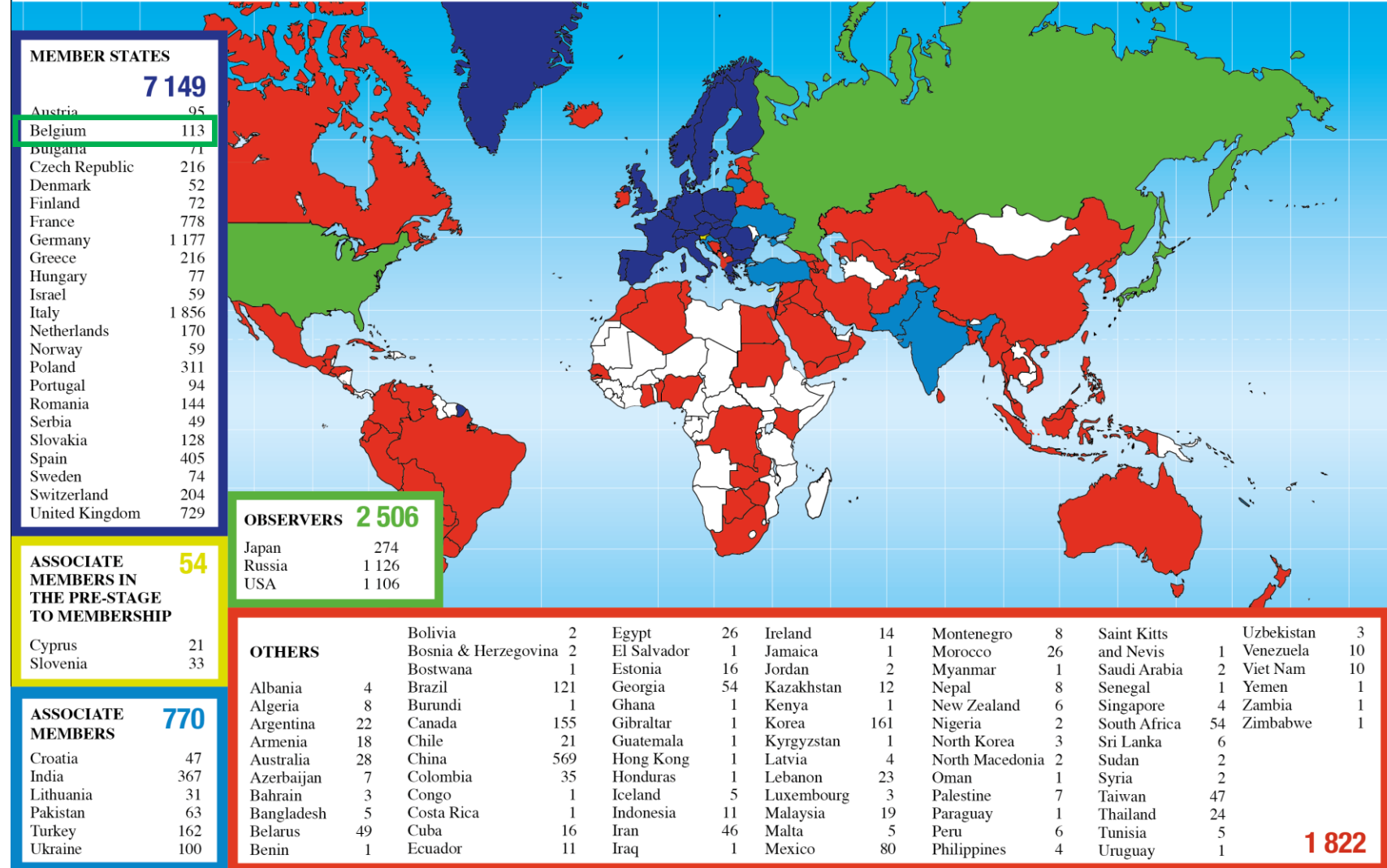
Short History of CERN

- 1949: first steps towards civilian research in nuclear technology; CERN origins: putting Europe back on the research map in the post-WOII era
- 1952: foundation of CERN under auspices of UNESCO
- 1953: CERN charter is signed
- 1954: completion of the ratification by 12 founding states (including Belgium); start of the construction: CERN began to materialize
- 1957: CERN's first accelerator: the synchrocyclotron
- 1959: the Proton Synchrotron (PS) starts up
- 1971: first proton collisions: Intersecting Storage Rings
- 1976: Super Proton Synchrotron (SPS) starts up
- 1983: W and Z bosons are discovered
- 1989: first injection in the Large Electron Positron collider (LEP)
- 1990: first web site and server are up
- 2008: Large Hadron Collider (LHC) starts up
- 2012: ATLAS&CMS experiments observe a particle consistent with the Brout-Englert-Higgs boson



- ~3000 people employed by CERN: physicists, engineers, computer scientists, mathematicians, technicians, secretaries, fire brigade, health & safety experts, security, etc
- >10000 physicists from all over the world associated with CERN

Distribution of All CERN Users by Nationality on 27 January 2020



Belgium in CERN

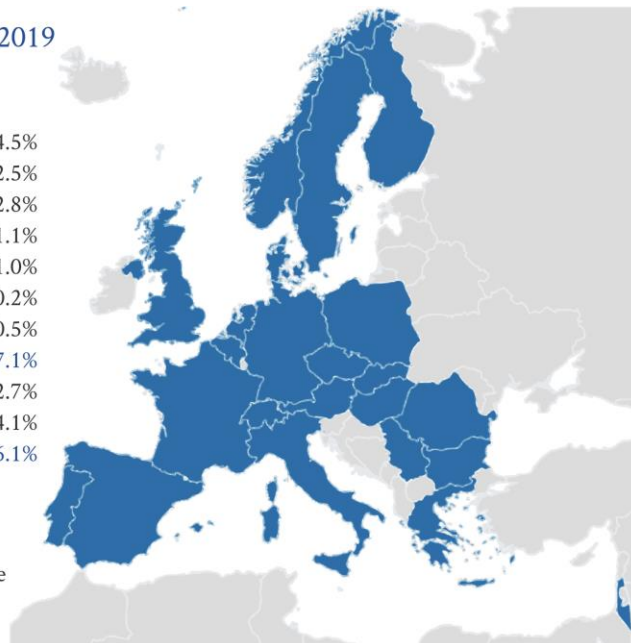
Contributions from Member States in 2019

Annual budget: 1.17 billion CHF

Austria	2.1%	Netherlands	4.5%
Belgium	2.7%	Norway	2.5%
Bulgaria	0.3%	Poland	2.8%
Czech Republic	0.9%	Portugal	1.1%
Denmark	1.8%	Romania	1.0%
Finland	1.3%	Serbia	0.2%
France	14.0%	Slovakia	0.5%
Germany	20.6%	Spain	7.1%
Greece	1.0%	Sweden	2.7%
Hungary	0.6%	Switzerland	4.1%
Israel	1.7%	United Kingdom	16.1%
Italy	10.4%		

Associate Member States (~25 MCHF)

India, Lithuania, Pakistan, Turkey, Ukraine
Cyprus, Slovenia



Experiments

CMS

Participating Belgian Institutes

Ghent University
KU Leuven
Université catholique de Louvain (UCL)
Université Libre de Bruxelles (ULB)
Université de Mons
Universiteit Antwerpen
Vrije Universiteit Brussel (VUB)

ISOLDE Facility (multiple experiments)

Ghent University
KU Leuven
Belgian Nuclear Research Center (SCK-CEN)
Université Libre de Bruxelles (ULB)

nTOF Collaboration

Joint Research Center (JRC) (IRMM)

NA62

Université catholique de Louvain (UCL)

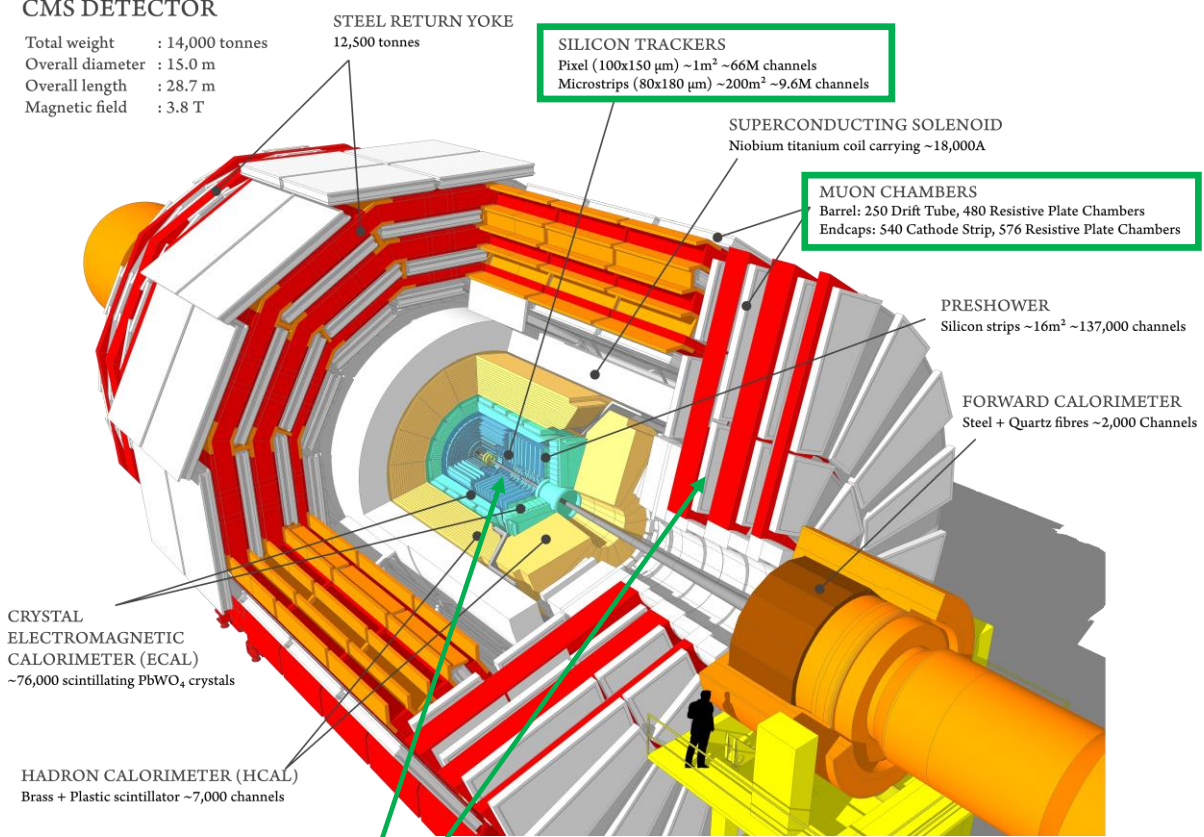
- Belgium as founding member of CERN
- Belgian physicist Léon van Hove as Director-General of CERN (1976-1980)
- Main past/present experimental contributions include experiments with neutrino beams, the electron-positron collider, the large hadron collider and nuclear physics experiments at ISOLDE facility
- Today's main focus of HEP Belgium at CERN on CMS@LHC: construction of forward silicon tracker, forward RPC and GEM muon systems & CASTOR forward calorimeter; CMS Tier-2 center @ VUB/UCLouvain; numerous data reconstruction algorithms and physics analyses

CMS Experiment



CMS DETECTOR

Total weight : 14,000 tonnes
 Overall diameter : 15.0 m
 Overall length : 28.7 m
 Magnetic field : 3.8 T



Belgian main contributions

3394 PHYSICISTS (1228 STUDENTS)
 1102 ENGINEERS
 282 TECHNICIANS
 247 INSTITUTES
 57 COUNTRIES & REGIONS



Now Go and Explore !

Taking photographs is allowed everywhere, i.e. at any place where you are allowed to go 😊

Social media: #CERN, #CMSExperiment, #WeAreVUB ...

Don't hesitate to ask questions !

CERN Information: www.cern.ch

CERN TV: www.youtube.com/cern

CMS Information: cms.cern

CMS Social Media:

www.facebook.com/CMSExperiment

twitter.com/CMSExperiment

www.youtube.com/watch?v=S99d9BQmGBO

www.instagram.com/cmsexperiment/

«Magic does not happen here, magic is being explained» (Tom Hanks, during his visit to CERN in 2009 for the *Angels and Demons* movie)

