



# Personal experiences of participating in LHC experiments

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**On behalf of the ALICE Outreach group.**



science & innovation

Department:  
Science and Innovation  
REPUBLIC OF SOUTH AFRICA



# About me



**JOB Title:** Senior Research Scientist and Associate Professor,

**WHERE:** National Research Foundation (NRF) - iThemba Laboratory for Accelerator-Based Science (LABS), Somerset West/School of Physics, University of Witwatersrand (Johannesburg)

**City and Country of Residence:** Cape Town, South Africa

**Collaboration at the CERN LHC:** **ALICE Collaboration**

**Since when:** Active member since 2008

**Research Interest:** heavy-flavour physics and electroweak bosons

**Detector contribution:** Muon Spectrometer



# This talk

- Brief history of South Africa (SA) in HEP
- Profile of SA at CERN/LHC
- My experiences joining the LHC experiment
- Challenges: covering different perspectives from others affected by distance
- Considerations - points to ponder

# History of HEP in South Africa (SA)

- ❑ SA's history in HEP dates back to 1965, e.g. 1<sup>st</sup> neutrino was discovered and studied in nature in 1965
- ❑ Long history at CERN (NA experiments), US facilities (BNL, JLAB) and Russia JINR, etc.
- ❑ Also a long history of theoretical contributions in Heavy-Ion Physics and String Theory
- ❑ **SA-CERN Co-operation Agreement 1992**

*→ Decades of “ad hoc” participation → unsustainable participation*

- ❑ **Formal participation at CERN 2000 and mid-2002 later at JINR**

- ❑ Most HEP now in the

- **SA-CERN**

- **ALICE** since 2001
  - **ATLAS** since 2010
  - ISOLDE since 2017
  - Theory
- Experiments at the CERN Large Hadron Collider (LHC)



# At CERN, SA participates in Physics, Upgrade, Engineering, Outreach



Some members of the SA-CERN group

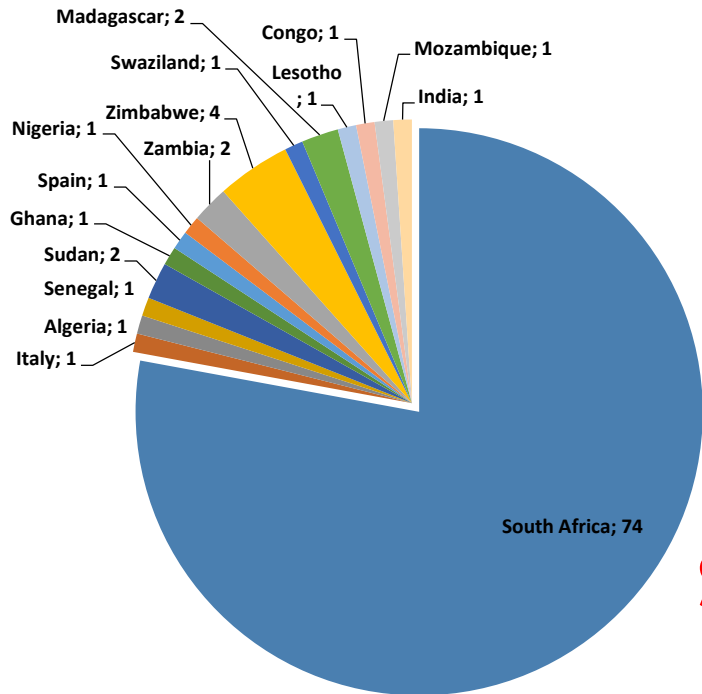


Staff and students at ALICE

Staff and students at ISOLDE



Testing modules developed in SA for ATLAS



**SA is a gateway to building African participation**

# South Africa at CERN, “aka” SA-CERN



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- ❑ 10 universities + national facility: NRF-iThemba LABS
- ❑ Membership (30 November 2022): 47 Researchers/Academics and 7 Postdoctoral Fellows  
6 Engineering/Technical staff and  
62 Ph.D. and MSc students

## ALICE

- heavy-ion physics
- quark-gluon plasma
- 3 institutes



ALICE

## ATLAS

- particle physics
- Higgs physics
- SUSY, BSM
- 4 institutes



## ISOLDE

- rare isotope facility
- nuclear and atomic physics
- 4 institutes



## Theory

- particle, heavy-ion, and nuclear physics
- 3 institutes



## IPPOG

- Representation
- Outreach / Science Engagement





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My contribution



# The ALICE Collaboration

40 Countries, 171 Institutes, 2026 Members



**ALICE**





# ALICE in South Africa



The image features a map of South Africa with several callouts and portraits. At the top right, a callout box for the University of the Witwatersrand, Johannesburg, contains the text "UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG" and the university's crest. A callout box for the University of Cape Town, Cape Town, contains the text "University of Cape Town" and the university's crest. A callout box for NRF iThemba LABS, Laboratory for Accelerator Based Sciences, contains the NRF logo and the text "iThemba LABS Laboratory for Accelerator Based Sciences". Other callouts include "BOTS" (Botswana), "LESOTHO", "SWAZILAND", and "Vaal River". Portraits of researchers are arranged in clusters: one group of four in the top left, one of four in the top center, one of four in the middle left, one of three in the middle right, one of four in the bottom right, and one of four in the bottom center. Logos for NWU (North West University), Cape Peninsula University of Technology, and Universiteit Stellenbosch are also present on the right side of the map.

Transition  
Radiation  
Detector



ZDC  
~116m from I.P.

Maintenance and operations

Physics:

- Muon

- Photon Physics

ALICE Upgrade

OUTREACH (International Masterclasses)

Muon  
Tracker



TOF

PHOS

ABSORBER

DIPOLE  
MAGNET

Identifier



ACORDE



# Participating in LHC experiments: Experiences through my eyes



# Joining the collaboration

Joining big collaborations from a developing country is not trivial due to socio-economic reasons. It required a few initial considerations:

## Identifying the research area of interest

- Experimental (detector) contributions towards the maintenance and operations (M&O)
- Physics topic – Physics Working Group for monitoring and reporting



## Manpower: do we have enough people to form a group?

E.g. in ALICE **full membership** requires a group of **3 full-time staff Physicists with a PhD**



## Funding:

- M&O and Authorship fees
- Travel - participating in the experiment and attending meetings



## Preparedness:

- basic training needs,
- skills and competencies



## Sustainability: training students and mentoring Postdocs





# The fun part of participating in the LHC experiment



❑ International platform - becoming part of a global enterprise through Science has major benefits:

❑ Access to frontier and cutting-edge science and technology

❑ High level of expertise, and competency

❑ Exposure to a diverse and multidisciplinary environment

- Exchange of idea
- Different ways of thinking and doing
- Experience different cultures

❑ Power of teamwork/collaboration





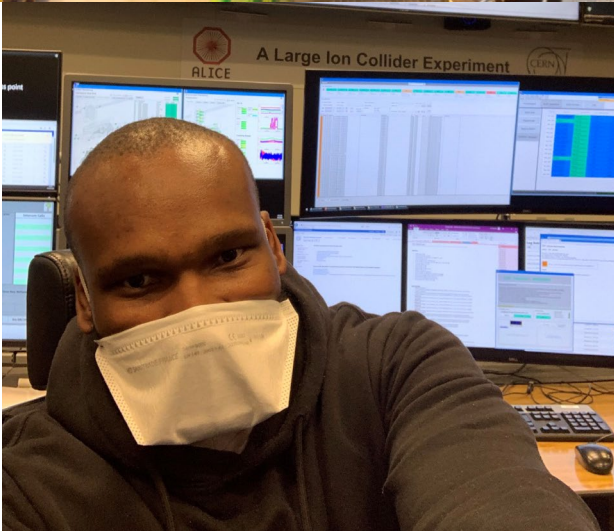
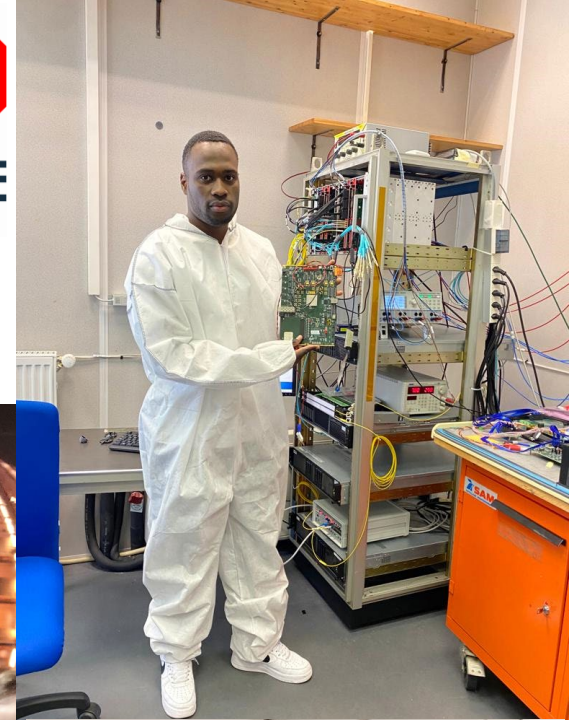
# Training and human capital development



- Exposing students to knowledge and tools is essential to build capacity



- Engineering and technical staff involvement is critical



- Skills and technology transfer back to SA

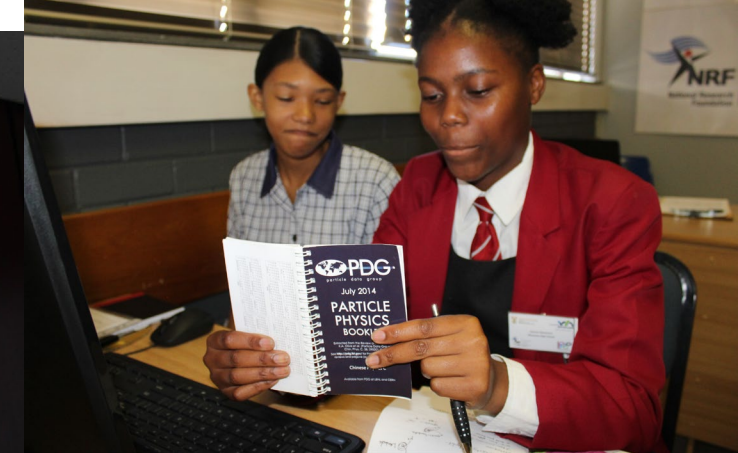
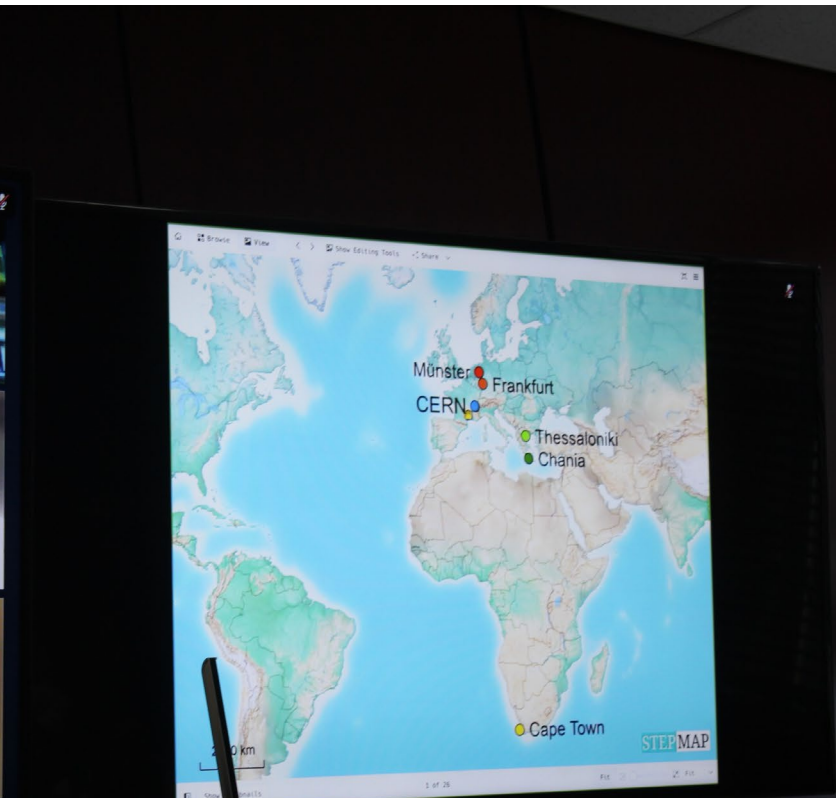
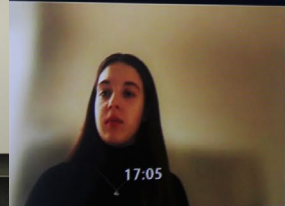
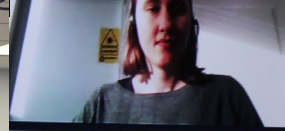
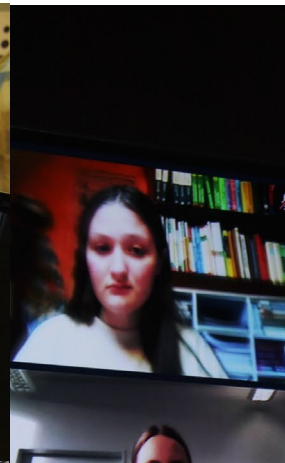




# Outreach / Science Engagement



- ❑ Creating awareness and promoting STEM
- ❑ Exposing high school learners to facilities and tools
- ❑ Providing learners access to international peers
- ❑ Involving postgraduate (senior) students





# Outreach: International Masterclasses



- International program led by CERN
- “One day as HEP physicist”
- Attracts up to 60 students from 25 schools per year



**ALICE**

- Rewards:** former learners who went through our IMC are studying Physics at Universities!



# Bring the “funders” along the journey with you

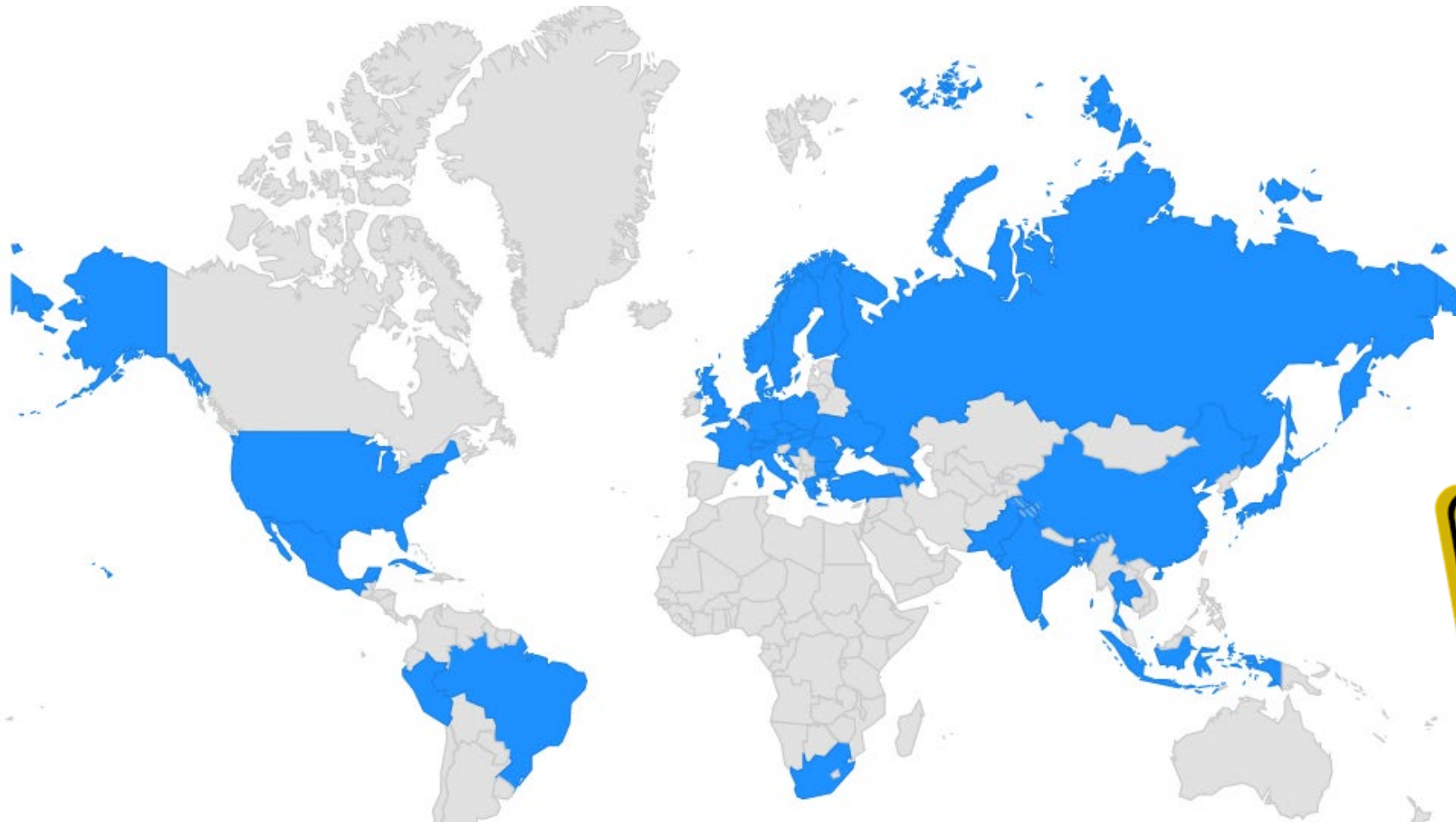
- ❑ Funding plays a major role in the travel to CERN, conferences/workshops
- ❑ Exploiting other possibilities beyond HEP/synergies with other fields
- ❑ Potential for International relations



- ❑ Convince the funding agency of the “value for money”:
  - Skills development,
  - Technology transfer,
  - Spinoff for industry exploits



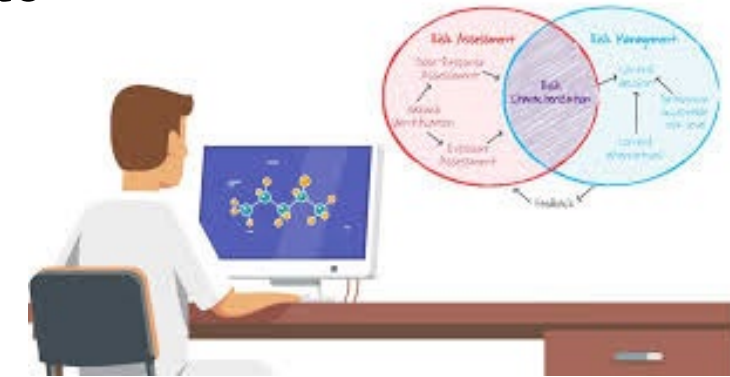
# The challenging part of participating in the LHC experiment



Views expressed include other people's perspectives, especially those also affected by distance from CERN

# Challenges 1

- ❑ Distance - the further away the more effort you have to put in to maintain contact with analysis groups and/or team activities
  - Different time zones affect participation in meetings,
  - Choice and scope of projects
  - Access to peers for stimulating and impromptu discussions, tutorials, and other CERN-organized activities, etc.



- ❑ Network/bandwidth: bad internet connection has a ripple effect on data analysis and meetings → **offline work can become challenging.**

- ❑ Optimization of time spent at CERN: organization of activities to ensure access to people and important events (ALICE meetings, tutorials, etc.) → **timing is everything**



## Challenges 2

### ❑ Isolation from peers:

*“From my experience, while ZOOM meetings are always productive and effective, nothing can **replace** in-person discussions with experts. So, I would say, the problem in traveling remains a major challenge.”*

*“Learning in person is very significant as compared to online learning.”*



- ❑ Financial constraints - availability of funds for regular trips to CERN, conferences/workshops/schools is essential

*“Another very important aspect is the interest of higher-level personnel (decision makers). Lack of their interest also makes it difficult for us to work on the experiment from our location.”*

- ❑ VISA issues: approval and issuance of Visa and/or deputation from the government for travel causes a hindrance

## Considerations



- Alternate meeting time slots to accommodate different time zones
- Record meetings to allow access for those unable to connect during a meeting
- Hosting some meetings/workshops/conferences in a hybrid form
- Local group dynamic critical:- to provide support, e.g. basic training



I'll end my talk with words from Nelson Mandela...

“Education is the most powerful weapon which you can use to change the world.”

and...

“A winner is a dreamer who never gives up.”

**Thank you for listening!**