science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

South Africa: Current Status and Future Perspectives

Lerothodi Lapula Leeuw

by invitation, with slide credits and work to all involved

Celebration of the discovery of the Higgs boson anniversary from Africa

4 July 2022

South Africa
SA-CERN programme
ATLAS, ALICE, ISOLDE, THEORY, CERN

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

NRF National Research Foundation | iThemba LABS Laboratory for Accelerator Based Sciences

University of Cape Town · iYunivesithi yaseKapa · Universiteit van Stellenbosch

UNIVERSITY OF JOHANNESBURG

UNIVERSITY OF KWAZULU-NATAL

NELSON MANDELA UNIVERSITY

DUT DURBAN UNIVERSITY OF TECHNOLOGY

UNIVERSITY of the WESTERN CAPE

Cape Peninsula University of Technology

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

UNIVERSITY OF ZULULAND

Participating institutions : 1 National Facility (iThemba LABS) and 10 Universities, **slide credits to them** UNISA university of south africa

	ATLAS	ALICE	ISOLDE	Theory	Total
PhD	6	5	6	8	25
MSc	19	2	7	15	43
Accad Staff	7	6	6	7	26
Tech Staff	3				3
Post Docs	5	2	2	2	8

2017 numbers, increasing trajectory

- SA has a long history in High Energy Physics, eg : 1st neutrino discovered and studied in nature 1965
  - Long history at CERN, BNL, JLAB, JINR, others
  - Also a long history of theoretical contributions
- **SA-CERN Co-operation Agreement 1992**
- Now formal participation at CERN and JINR

Most HEP now in the SA-CERN and JINR Programmes

Decades of "ad hoc" participation

- ALICE since 2001
- ATLAS since 2010
- ISOLDE since 2017
- Theory
- JINR since 2005

The UJ–ATLAS and Associated Innovation Group + UNISA + UWC

Staff
- Simon Connell (Prof)
- Muaaz Bhamjee (Sn Lect)
- Nicolin Govender (Prof)
- Loan Truong (Lecturer, Visiting Prof)
- Francois Pieterse (Sn Lect)

Post Docs
- Bongani Maqabuka
- Emmanuel Igumbor
- Hasina Ralijaona

Students
- PhD: Phineas Ntsoele
- PhD: Thendo Nemakhavhani
- PhD: Matthew Connell
- MSc: Xola Mapekula
- MSc: Mr Mitchell Phiri
- MSc: Gideon Bentum
- MSc Chris Lee

Associate sub-institute
- Lerothodi Leeuw (Prof UWC)
- Pedro Mafa (Dr UNISA)
- Mantile Lekala (Prof UNISA)

Necsa Associates
- Dr Graham Daniels, Dr Dazmen Mavunda, Eric Chinaka, Linina Bedhesi

Research Associates
- Dr Martin Cook (SRA UJ),
- Dr Sergio Ballestrero (SRA UJ)
- Tim Brooks (SRA UJ)

+ many colleagues from ATLAS
Prof Kétévi Assamagan BNL

ATLAS Innovation

2019/2/22 UJ-ATLAS

The Institute for Collider Particle Physics

UNIVERSITY OF ZULULAND
UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
NRF National Research Foundation
iThemba LABS Laboratory for Accelerator Based Sciences
INSTITUTE FOR COLLIDER PARTICLE PHYSICS UNIVERSITY OF THE WITWATERSRAND

First ASFAP Particle Physics Day, 19/11/21

THE ACADEMICS

A SHORT HISTORY OF UCT INVOLVEMENT WITH ATLAS

- Started by Andrew Hamilton in 2011 (no longer an ATLAS member)
- Sahal Yacoob joined in 2015
- James Keaveney joined in 2019 Currently top quark cross-sections group co-convenor

A relatively small group


Andrew

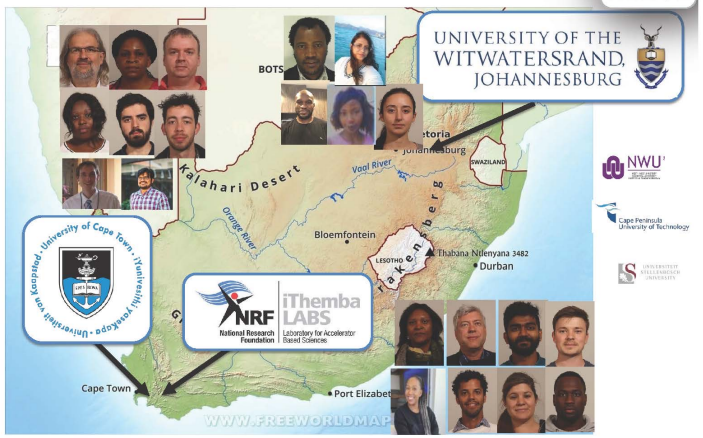

Sahal


James

ATLAS EXPERIMENT

ALICE in South Africa

ALICE



HUMAN CAPACITY DEVELOPMENT

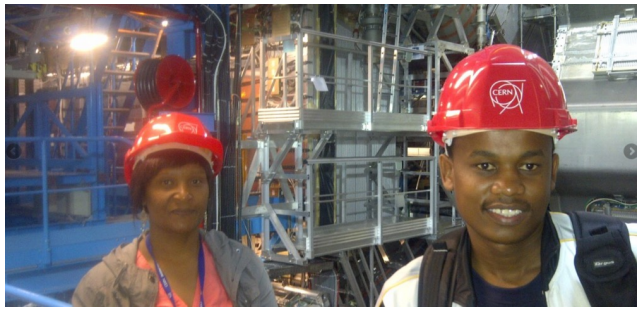
STUDENTS

- Students Graduated:
  - 16 MSc (including engineers)
    - Most continued in academia
  - 1 PhD
    - Currently a post-doc on ATLAS
- Current Students
  - 4 MSc
  - 3 PhD

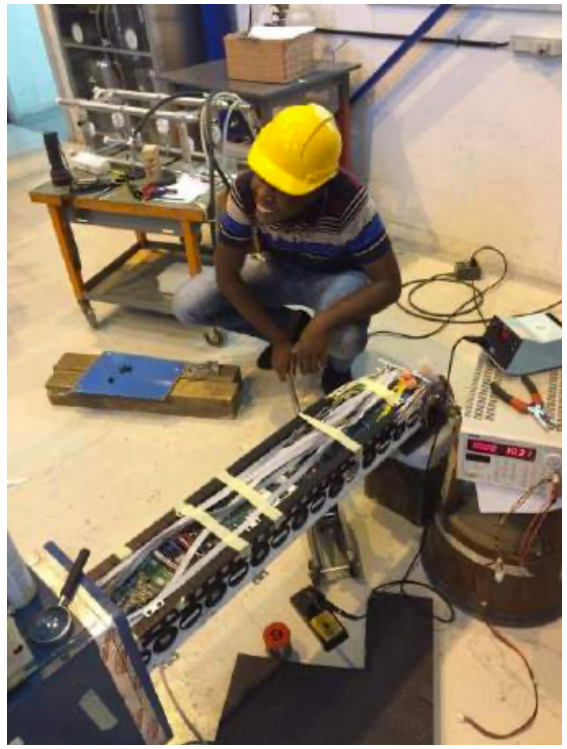
ATLAS EXPERIMENT

SA participates in Physics, Upgrade Activities, Engineering and Outreach, with Human Capacity Building and Technology Transfer

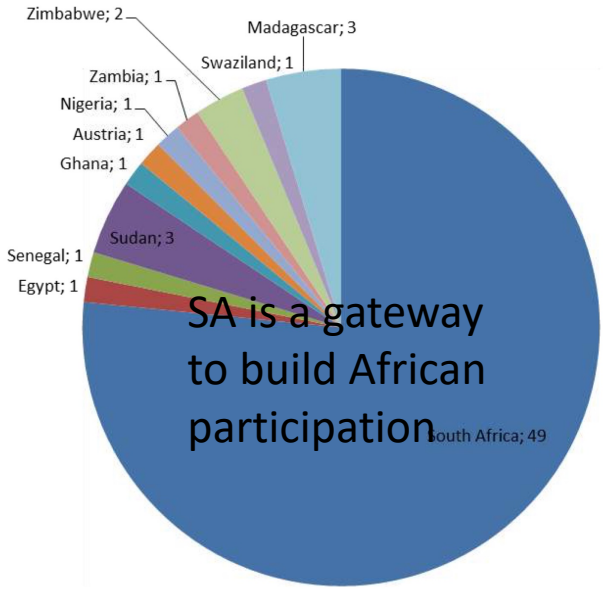
Some of the SA-CERN group



Staff and students at ALICE



Testing modules developed in SA for ATLAS

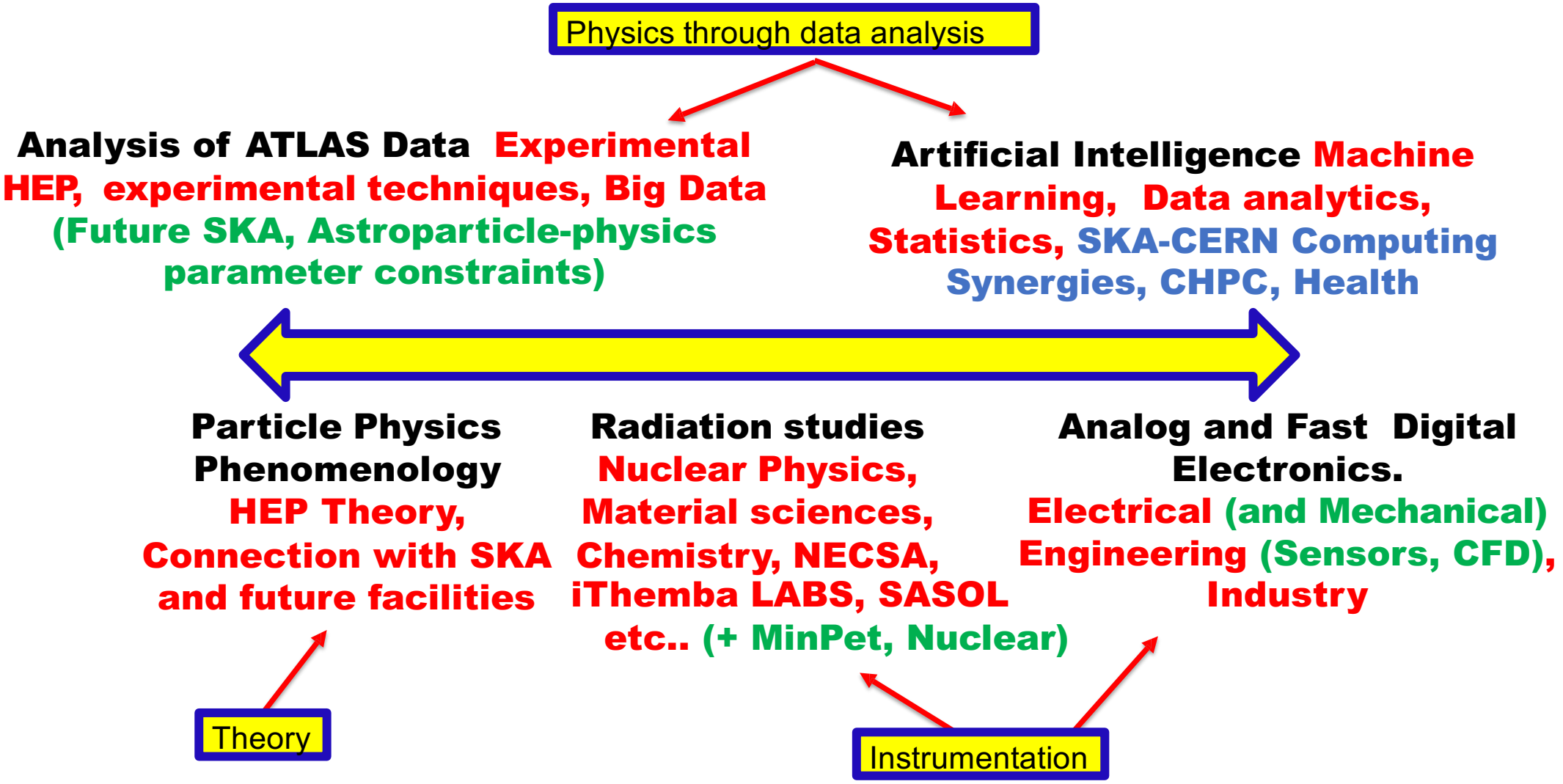


SA is a gateway to build African participation

Staff and students at ISOLDE

Scope of Research + Co-Impact + Future

WITS, UCT+ ALICE + UJ + SKA+SA-CERN + Health



The UJ–ATLAS and Associated Innovation Group + UNISA + UWC

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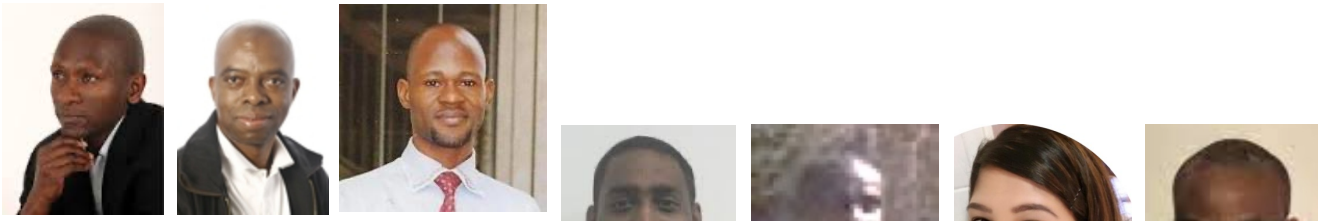
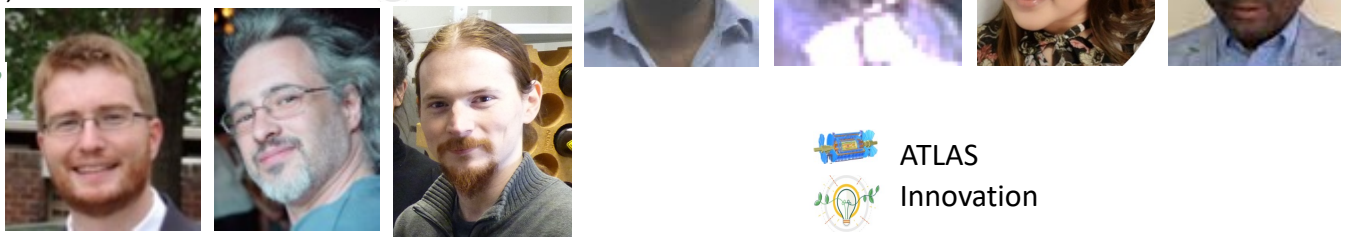
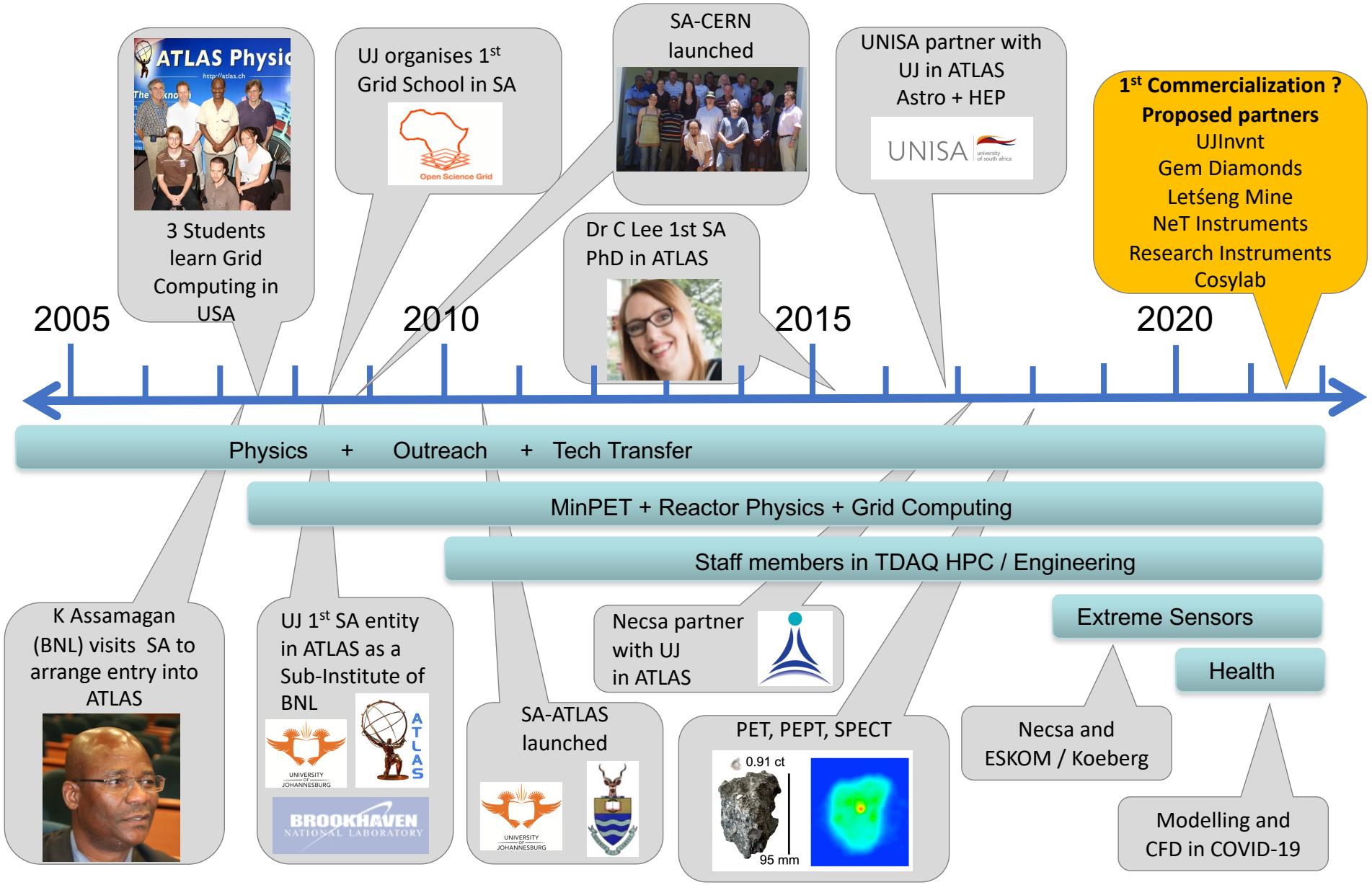



+ many colleagues
from ATLAS
Prof Kétévi Assamagan
BNL

ATLAS
Innovation

UJ in ATLAS Timeline ….. Many 1st achievements



Analysis : Physics motivated by searches for Dark Matter

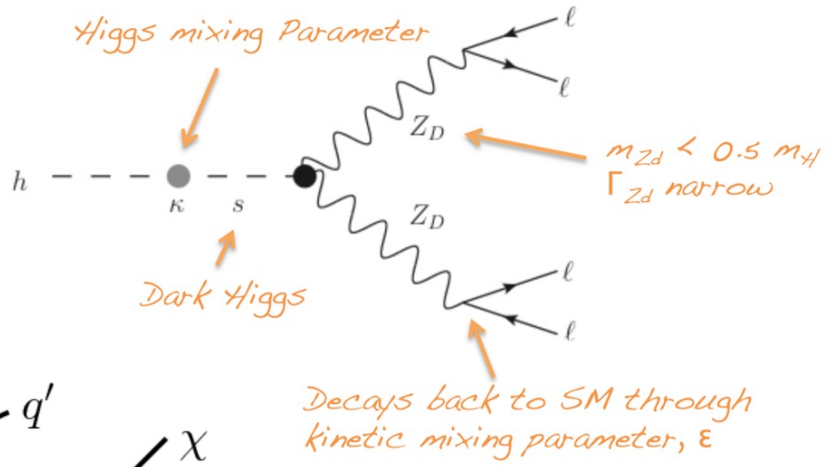
- Standard Model (SM) has deficiencies
  - Many free parameters, no DM or DE, (anti)matter paradox, hierarchy problem, strong CP problem, no gravity …
- Hidden (dark) sector states introduced with an additional $U(1)_d$ dark gauge symmetry appear in many extensions to the SM, the models are capable of
  - providing a candidate for the dark matter (DM) in the universe
  - explain astrophysical “observations” which may have DM interpretation
- This represents an alternative DM scenario to that of Super Symmetry

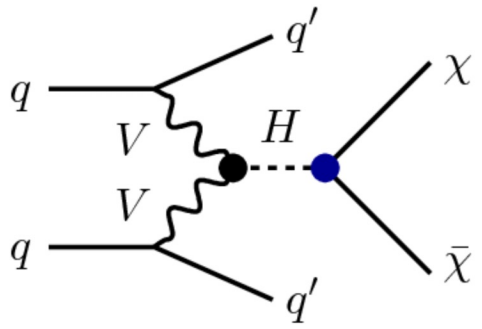
Analysis : The Higgs Portal to the Dark / Hidden sector

Higgs Portal Models for BSM DM

- J.D. Wells, arXiv:0803.1243, 2008
- S. Gopalakrishna, S. Jung and J.D Wells PRD, 78(5):055002, 2008
- Curtin et al, http://arxiv.org/abs/1312.4992

1. H → Z_dZ_d → 4e, 4μ, 2e2μ,
2. H → ZZ_d → 4e, 4μ, 2e2μ
3. S → Z_dZ_d → 4e, 4μ, 2e2μ
4. S → Z_dZ_d → 4e, 4μ, 2e2μ + 2j
5. S → Z_dZ_d → 4e, 4μ, 2e2μ + MET
6. H → invisible (VBF)
7. H → $\gamma\gamma_d$





Analysis : The Higgs Portal to the Hidden sector with Z_d

Latest published result ….. Just gone on the arXiv

High Energy Physics – Experiment

[Submitted on 26 Oct 2021]

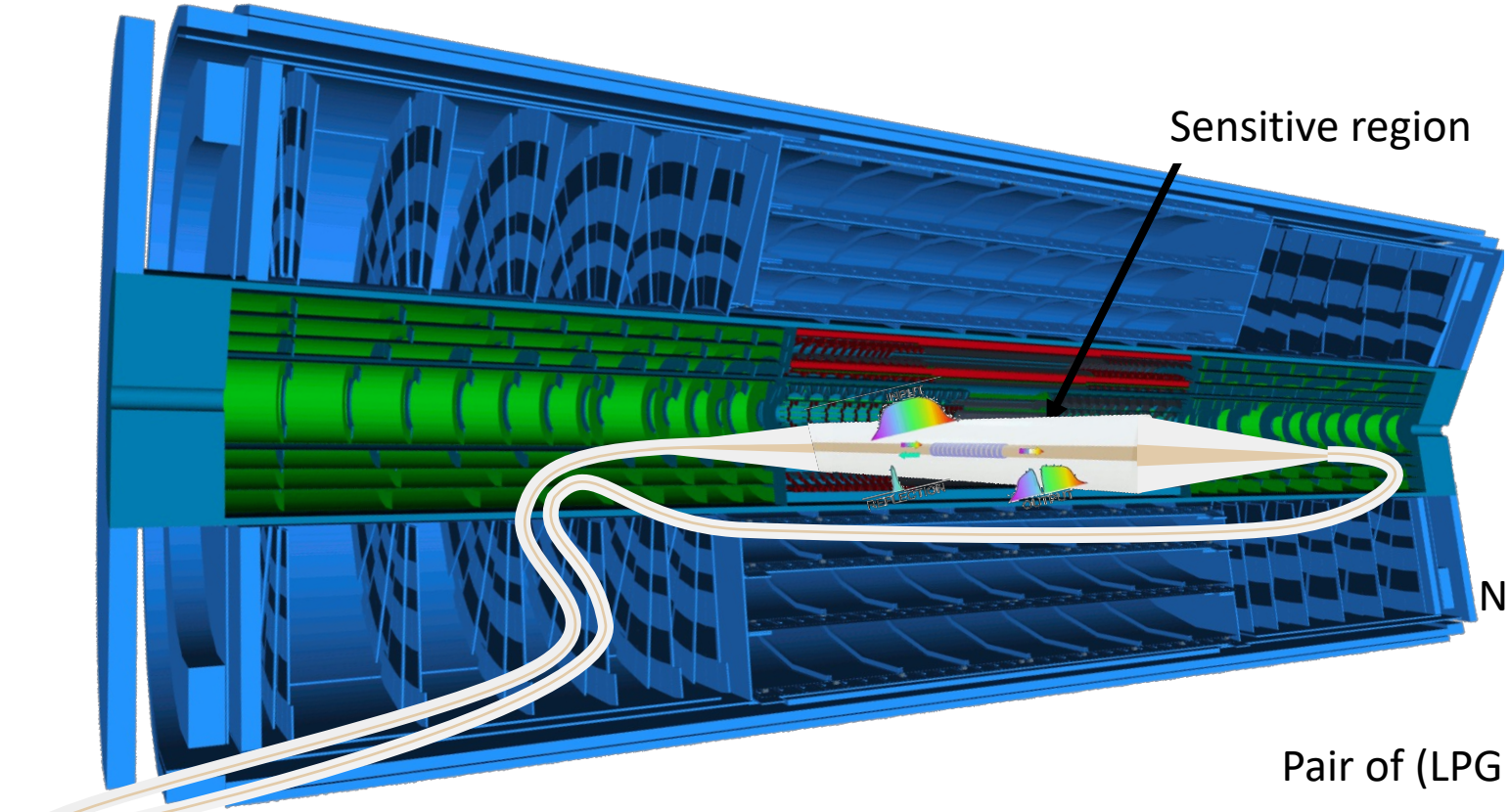
Search for Higgs bosons decaying into new spin-0 or spin-1 particles in four-lepton final states with the ATLAS detector with 139 fb^{-1} of pp collision data at $\sqrt{s} = 13$ TeV

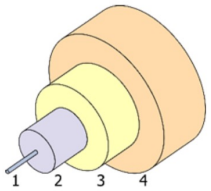
ATLAS Collaboration

Searches are conducted for new spin-0 or spin-1 bosons using events where a Higgs boson with mass 125 GeV decays into four leptons ($\ell = e,\mu$). This decay is presumed to occur via an intermediate state which contains two on-shell, promptly decaying bosons: $H \to XX/ZX \to 4\ell$, where the new boson X has a mass between 1 and 60 GeV. The search uses pp collision data collected with the ATLAS detector at the LHC with an integrated luminosity of 139 fb^{-1} at a centre-of-mass energy $\sqrt{s} = 13$ TeV. The data are found to be consistent with Standard Model expectations. Limits are set on fiducial cross sections and on the branching ratio of the Higgs boson to decay into XX/ZX, improving those from previous publications by a factor between two and four. Limits are also set on mixing parameters relevant in extensions of the Standard Model containing a dark sector where X is interpreted to be a dark boson.

Comments: 65 pages in total, author list starting page 49, 20 figures, 6 tables, submitted to JHEP. All figures including auxiliary figures are available at this http URL
Subjects: **High Energy Physics – Experiment (hep-ex)**
Report number: CERN-EP-2021-193
Cite as: arXiv:2110.13673 **[hep-ex]**
(or arXiv:2110.13673v1 **[hep-ex]** for this version)

Upgrade: Keeping the ITk dry. (Humidity / Temperature)





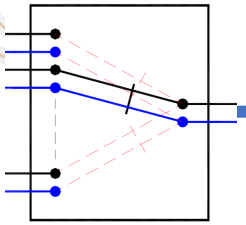
Typical structure of a single mode optical fiber *(not to scale)*

1. Core 8 - 9 µm diameter
2. Cladding 125 µm dia.
3. Buffer 250 µm dia.
4. Jacket 900 µm dia

ATLAS ITK

New radiation hard fibre optic humidity sensors

Pair of (LPG for RH, FBG for T)



DAQ PC

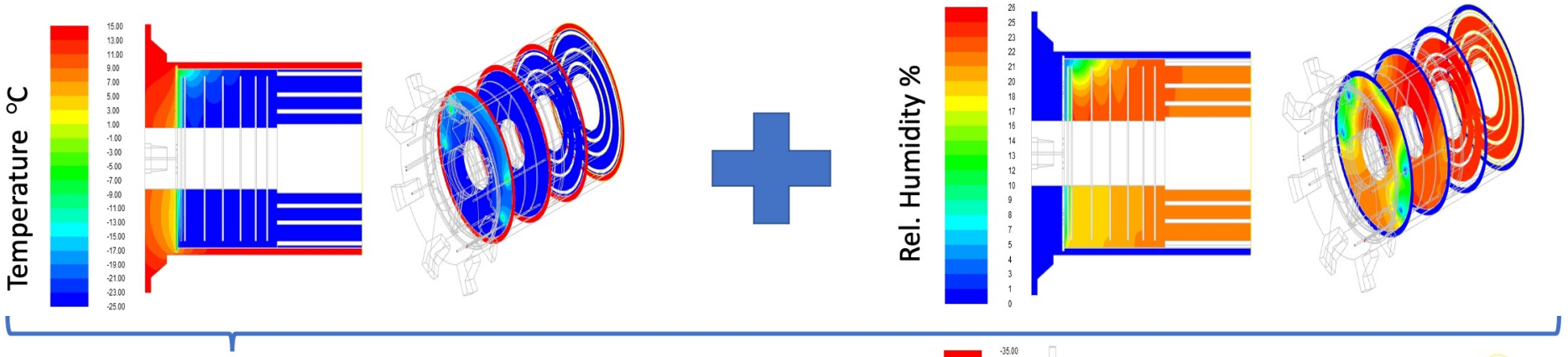
OPC UA Server

ATLAS P1

Upgrade: Keeping the ITk dry. (Humidity / Temperature)

CFD simulations for temperature and humidity distribution inside the detector volume … lead by Dr Muaaz Bhamjee

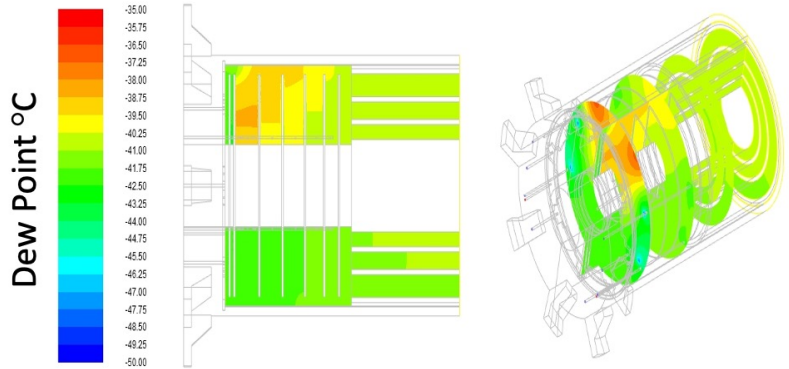
ATLAS ITK Upgrade – N_2 Purging and Humidity Simulations



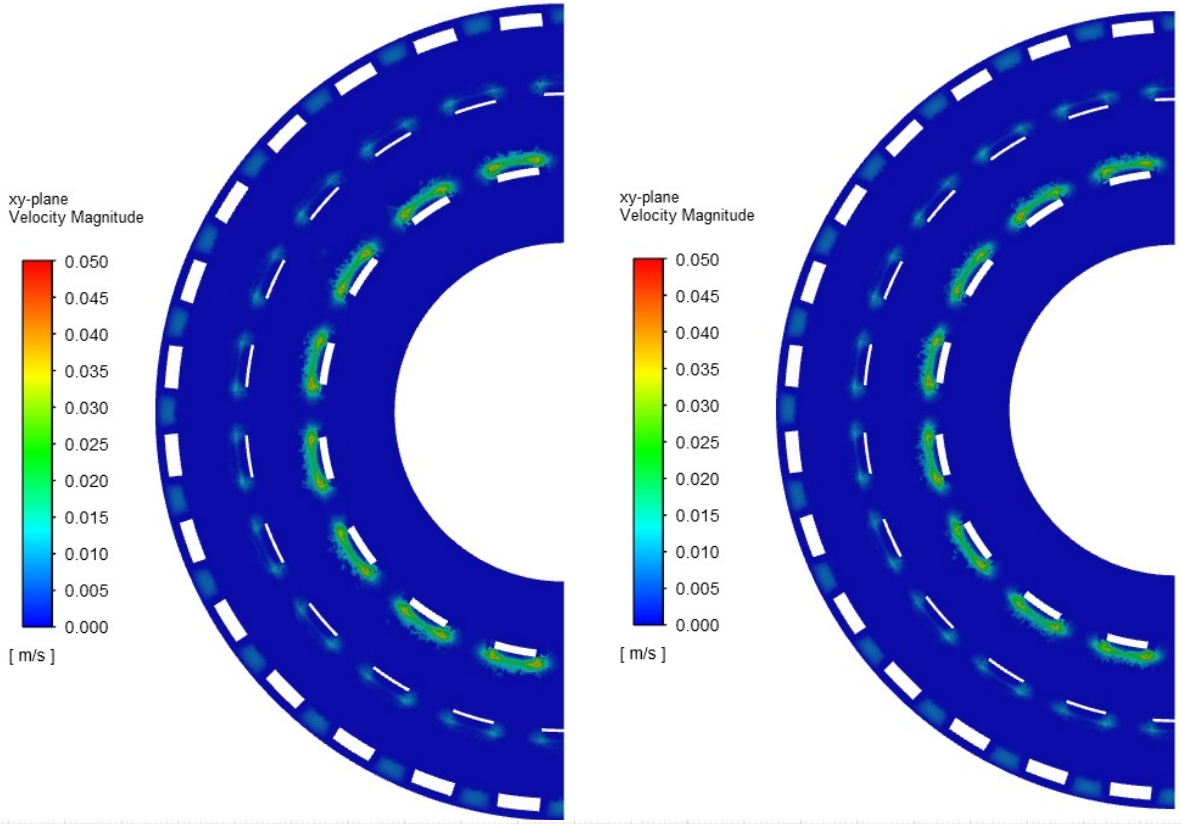
The Dew point was calculated using a the Bögel modification of the Magnus formula:

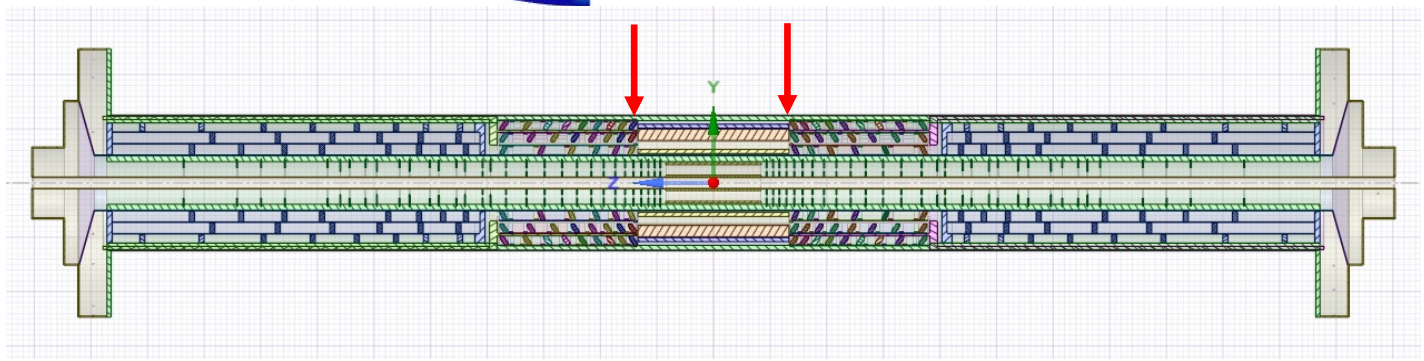
$$\gamma_m(T, RH) = ln\left(\frac{RH}{100} e^{\left(b-\frac{T}{d}\right)\left(\frac{T}{c+T}\right)}\right)$$

$$T_{dp} = \frac{c\gamma_m(T, RH)}{b - \gamma_m(T, RH)}$$



Upgrade: Keeping the ITk dry. (Humidity / Temperature)





Outer Pixels
CFD simulations for temperature and humidity distribution inside the detector volume

Z +-375mm: 0.05 scale

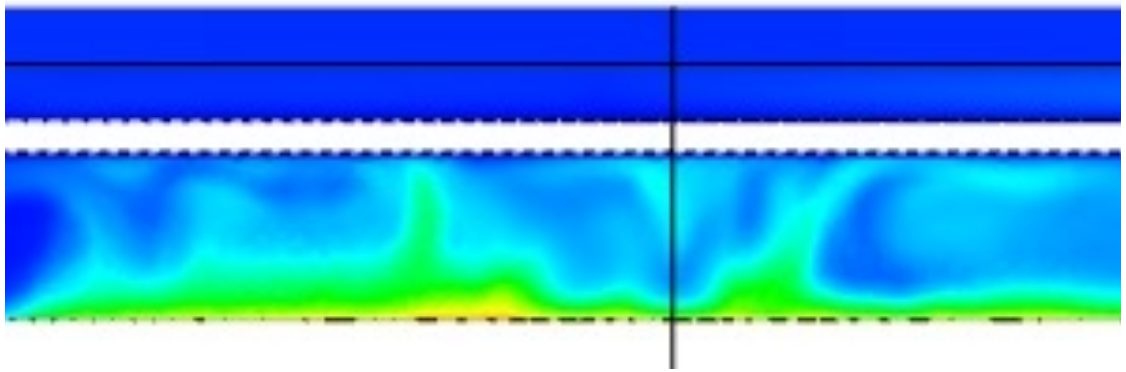
- **Border between longerons and conical disc sections.**
- **Flow much faster towards the centre.**

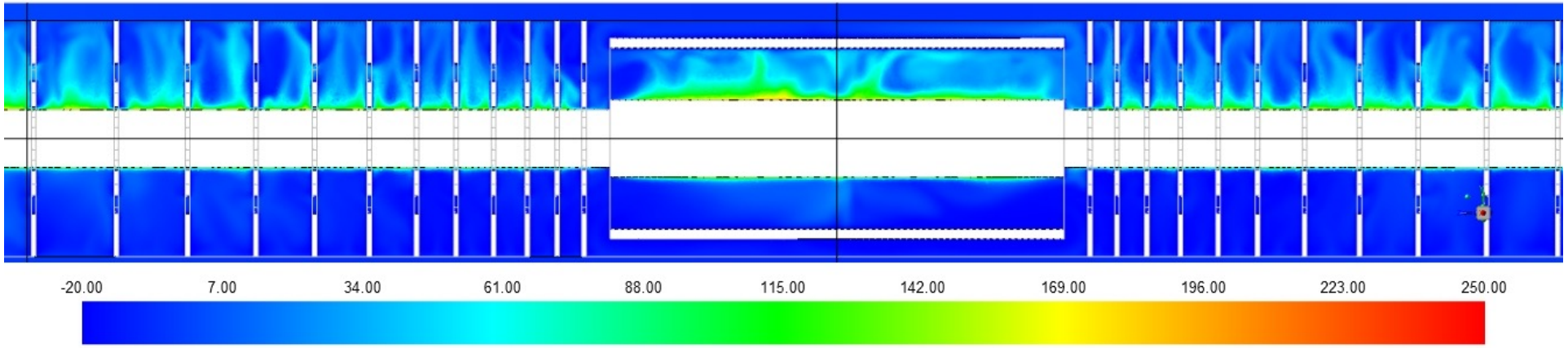
Upgrade: Keeping the ITk dry. (Humidity / Temperature)

Inner Pixels

CFD simulations for temperature flow during bakeout …

This version, thermals w/o radiation. Homogeneity improves slightly with radiation





Temperature

Towards Innovation

Research at ATLAS

1. Physics Discovery searches
2. Upgrade
3. Operation
4. Detector Development

Knowledge Hub, Networking and then Technology Transfer

1. Modern, pre-commercial high-performance sensors (detectors)
2. High throughput electronics
3. Intelligent DAQ
4. Big data
5. Data visualisation, reconstruction
6. High Performance Computing, Multi-CPU, GPU, AI, ML
7. Full Physics Modelling
8. Full Dress Rehearsal Experiments and Simulation
9. Digital Twins
10. Innovation, IP Protection, Commercialisation

(9 Patents filed in last 3 years)
(Many patentable disclosures pending decision)

Commercial Programmes

1. MinPET (discovery of diamond in Kimberlite)
2. Medial PET, PEPT for Mining, Poly PET, SPECT for Security
3. FOS in reactors, real-time, on-line, in-core
4. Public Health - CFD, Wearables AI, Epidemiology
5. Blaze-DEM
6. Ubuntu Reactors (Geant4)

2. Patents

1. MinPET : Detection of Diamonds, 2005/03/14, SA Patent Application 2006/08025, ARIPO Patent Application AP/P/2006/003753 and AP 1986, Canadian Patent Application 2,559,516, Australian Patent Application 2005220403 Russia Patent Application 2006135960 and 2334974, China Patent application 200580011607.9, India Patent Application 5365/DELNP/2006 Patentscope
2. MGRT : Method of Multiple Source and Detector Gamma Ray Tomographic Radiography, 2018/10/19, PCT INTERNATIONAL APPLICATION (253LPS) PCT/IB2018/058162, Patentscope
3. MinPET 1 : Method and System for High Speed Detection of Diamonds, 2018/9/8, PCT INTERNATIONAL APPLICATION P82286PC00,Patentscope
4. MinPET 2 : Detector Arrangement, Detection System and Method of Processing Data from a Detector Arrangement for High Throughput Data Handling, 2019/11/12, PCT INTERNATIONAL APPLICATION P82287PC00m Patentscope
5. MinPET 3 : Method and System for Irradiating and Activating an Object, 2020/01/23, PCT INTERNATIONAL APPLICATION P82288PC00, Patentscope
6. MinPET 4 : Reducing Artefacts in Positron Emission Tomography Image Reconstruction, 2020/06/24, PCT INTERNATIONAL APPLICATION P82289ZP00, Patentscope
7. MinPET 5 : Detector Arrangement, Detection System and Method of Positioning a Detector Arrangement to Reduce Imaging Artefacts, 2020/07/30, PCT INTERNATIONAL APPLICATION P82290PC00, Patentscope

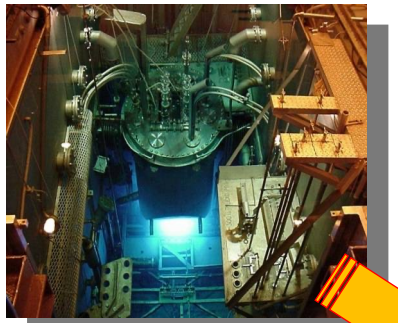
Tech Transfer : Fibre Optic Sensors (from ATLAS ITk → Reactors)

Nuclear Energy

Radiation Hard, Moderate Temperature (300°C - 400°C)

- Koeberg (ESKOM) : Monitoring of temperature, neutron flux (power)
- Sense Temp, Dose, Water-level etc – in-core, on-line, real-time
- Fiber survival beyond 1 x 10^{21} n/cm^2 (epi-thermal) in SAFARI tests.
- R&D in progress.

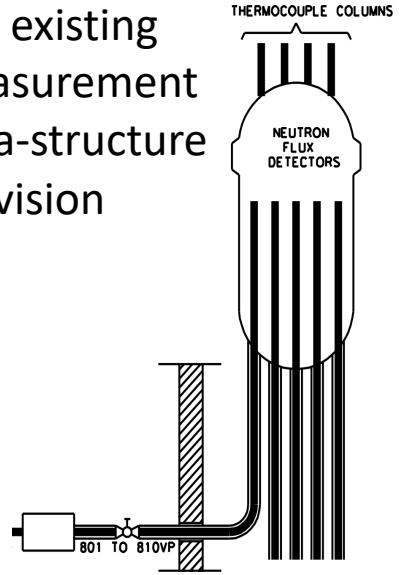
+ other colleagues



Tests so far equivalent to at least 2 G Gray, or two weeks in a 1GW PWR.

Improved reactor efficiency and safety.

Use existing measurement infra-structure provision



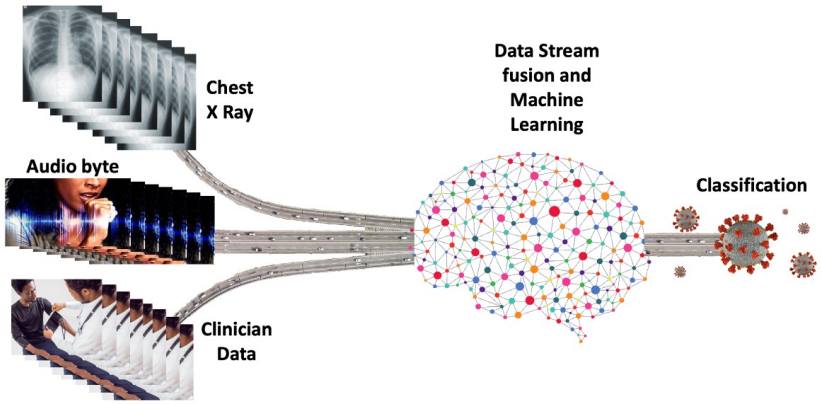
Public health

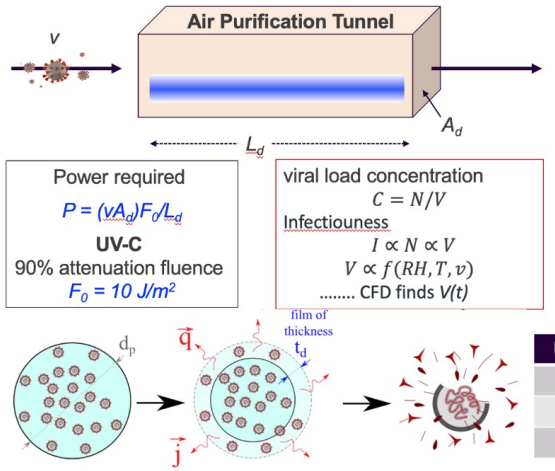
Preventing COVID-19 with Mathematical Modelling, Digital twins, AI and 4IR Engineered solutions

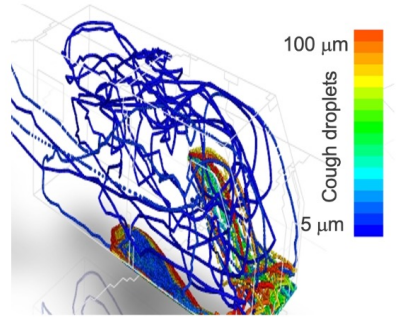
PI: Dr. Muaaz Bhamjee
Co-PIs: Prof. Charis Harley and Prof. Simon H. Connell
Faculty: Faculty of Engineering and the Built Environment

Project Description:

1. The use of mathematical modelling (CFD + algorithms),digital twins and optimising 4IR engineered solutions to make public spaces safer. Novel feature is augmentation of CFD with two droplet infectiousness models.
2. Public Health, Artificial Intelligence and Diagnosis based on Multiple Data Sources - Chest X-rays, Audio Bytes, Clinician data, data processing and data fusion, longitudinal studies, develop machine learning augmentation of clinician diagnoses.







UV-C (nm)	Pathogen	F_0 (J/m²)
222	H1B1	15
254	MHV	6.6
254	RNA-DNA viruses	3 - 12

Timeline: Two years

The Institute for Collider Particle Physics

First ASFAP Particle Physics Day, 19/11/21

Outline of their recent talk and work

- **Overview**
  - **Current membership and scope**
- **Data analysis and Phenomenology**
  - **The world of anomalies**
  - **Role of Artificial Intelligence**
- **Instrumentation at ATLAS**
  - **Maintenance, operations, upgrade**
- **Human capacity development**
  - **Pipeline of future academics**
- **Technology transfer**

Current graduate students: (19 PhD + 23 MSc + 6 honors, 48 students)

Lawrence Christopher, PhD
Sukanya Sinha, PhD
Mvelo Dhlamini, MSc
Danielle Wilson, MSc
Karien du Plessis, MSc
Hannah Van Der Schyf, MSc
Roy Gusinow, MSc
Benjamin Lieberman, PhD
Joshua Choma, MSc
Hirmans Tabaharizato, PhD
Thuso Mathaha, MSc
Thabang Lebese, PhD
Phuti Rapheeha, PhD
Gaogalalwe Mokgatitswane, PhD
Edward Nkadimeng, PhD

Ryan McKenzie, MSc ➔ PhD
Nkosiphendule Njara, MSc
Thabo Lepota, MSc
Humphry Tlou, PhD
Abdualazem Fadol, PhD
Onesimo Mtintsilana, PhD
Esra Shrif, PhD
Elias Malwa, MSc
Lerato Baloyi, PhD
Talemwa Kaheru, MSc
Malipalema Khang, MSc
Meghan Malaatjie, MSc
Nidhi Tripathi, PhD
Innocent McHechesi, MSc
Tshegofatso Sekgobela, MSc
Lungisani Phakakthi, MSc

Nathan Boyles, PhD
Kentaro Hayasi, MSc
Finn Stevenson, MSc
Ralekete Temo, MSc
Mpho Gololo, PhD
Ronewa Nemalili, MSc
Ayanda Thwala, MSc
Othmane Mouane, PhD
Tshepo Mahafa, PhD
Nicholas Perikli, MSc
Sanele Gumede, MSc

+ 6 honors students

Over 30 prizes and awards

Post-doctoral fellows:
Tashnuva Choudri, Salah Dahbi, Abhaya Swain + 3 new fellows

Engineers and technical staff: Fernando Carrio, Roger van Rensburg

Academics:
Deepak Kar, Betty Kibirige, Mukesh Kumar, Xifeng Ruan, Bruce Mellado

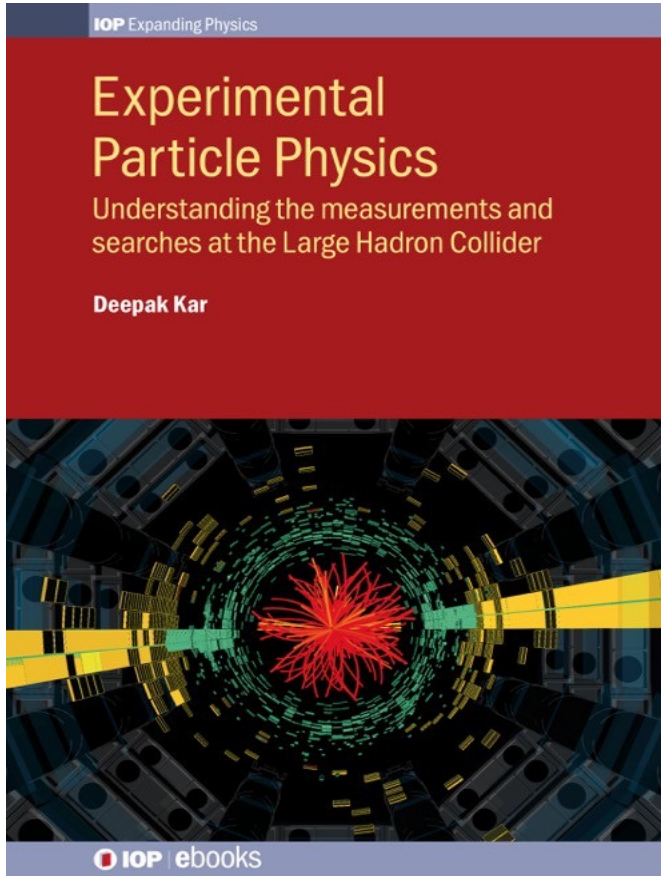
Positions of Leadership at ATLAS
(past two years)

Name	Position	Area
Edward Nkadimeng	Convenor of LVPS working group	Instrumentation
Humphry Tlou	TileCal run coordinator	Instrumentation
Ryan McKenzie	TileCal run coordinator	Instrumentation
Bruce Mellado	Chairperson of the Institutional Board of the Tile Calorimeter, TileCal management	Instrumentation
Bruce Mellado	Level 2 Manager of the TileCal Phase II upgrade	Instrumentation
Xifeng Ruan	Lead contact of analysis group	Data analysis
Sukanya Sinha	Lead contact of analysis group	Data analysis
Yesenia Hernandez	Lead contact of analysis group	Data analysis

Strive at having a strong presence at the ATLAS experiment

The book!

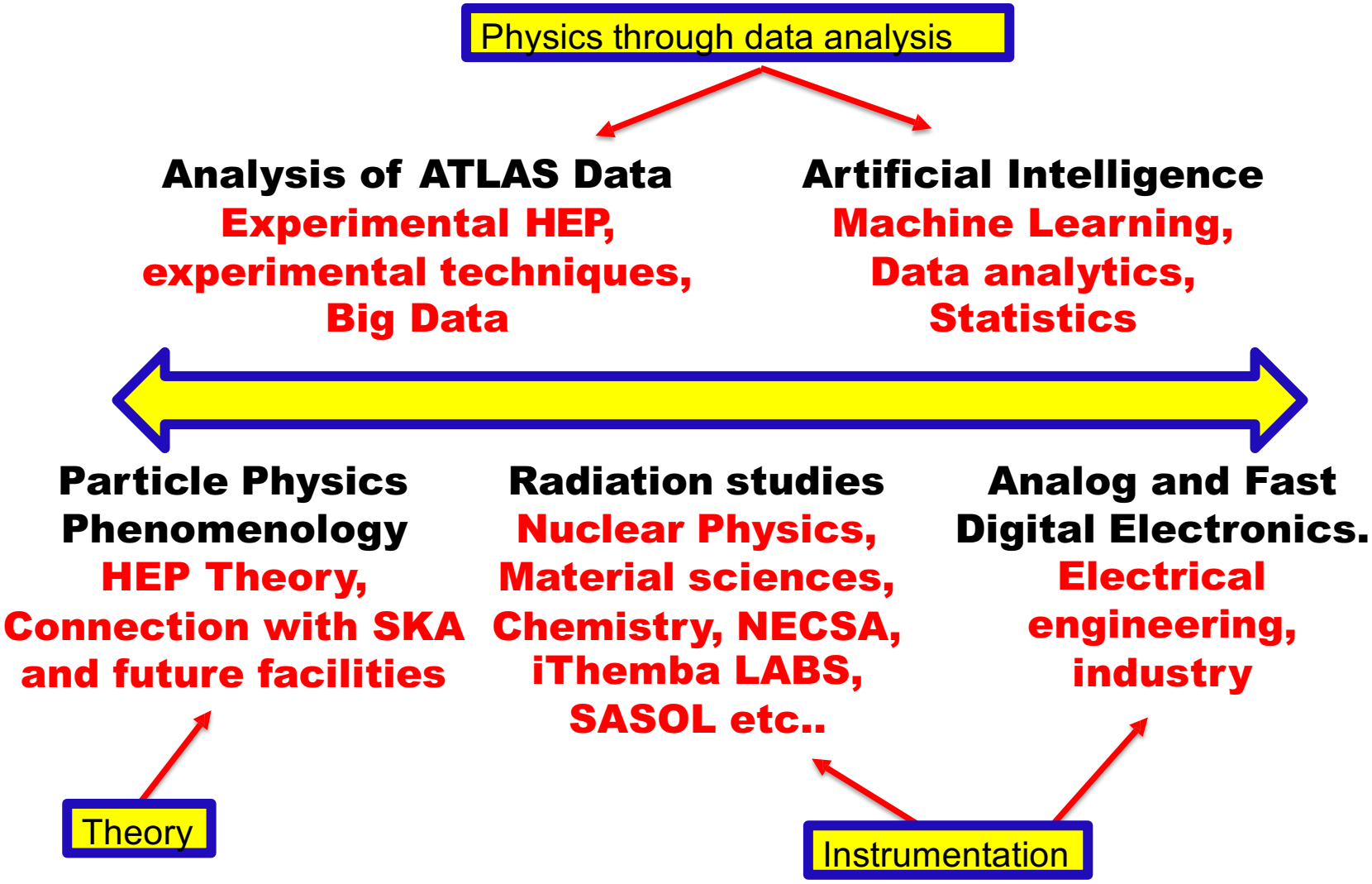
Prof. Deepak Kar



First book to focus on experimental data analysis techniques.

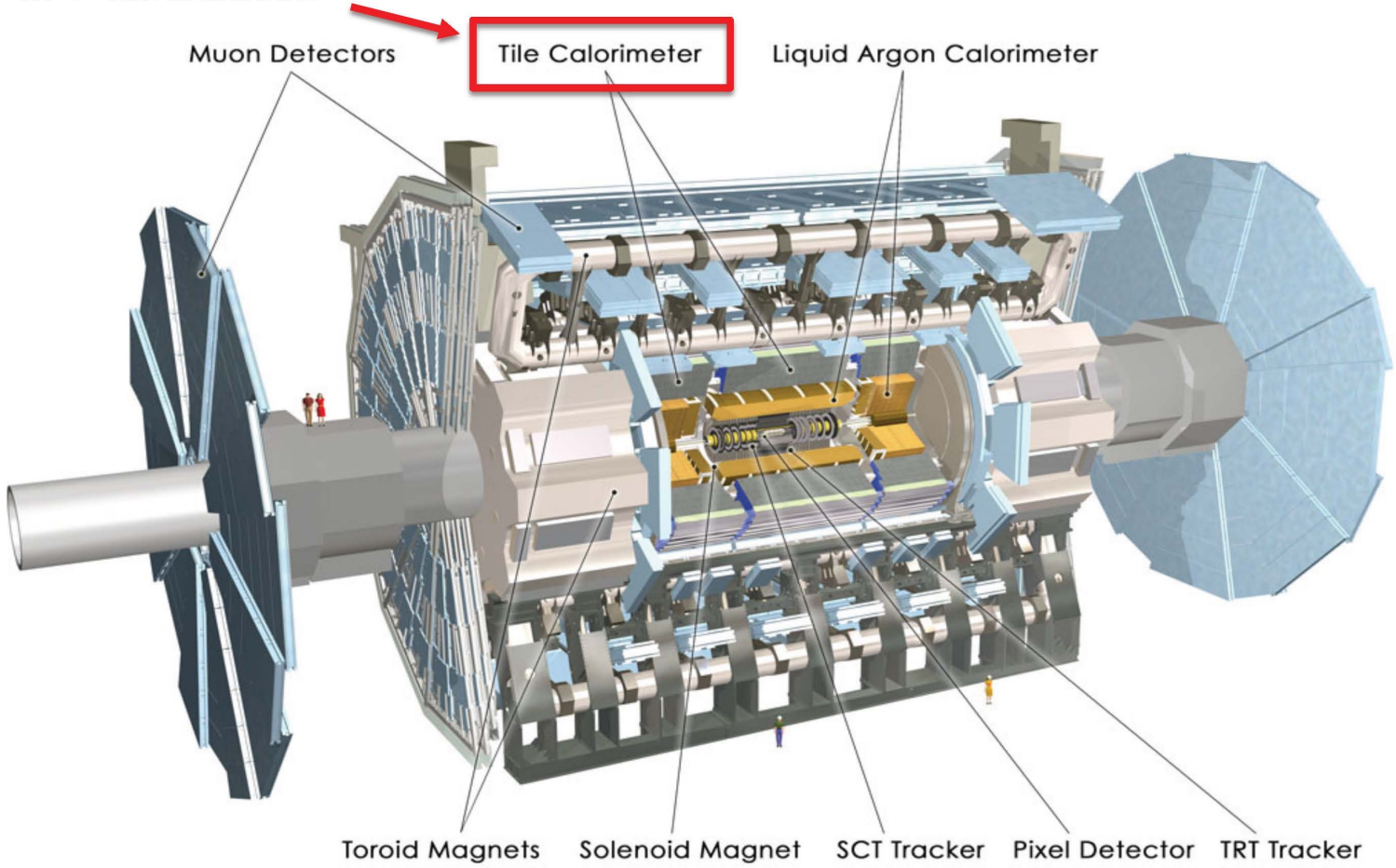
An one stop resource for beginning students in the field, downloaded many times and acclaimed by readers!

Scope of Research

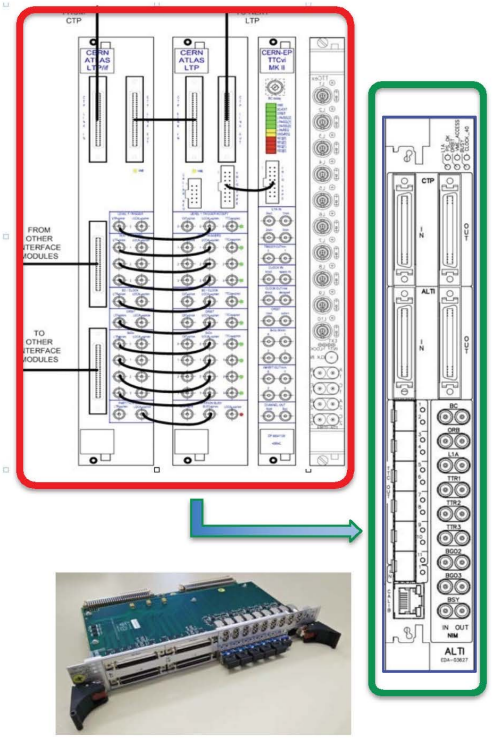


The ATLAS Detector

ICPP contribution



Phase-I upgrade



ATLAS Local Trigger Interface (ALTI)

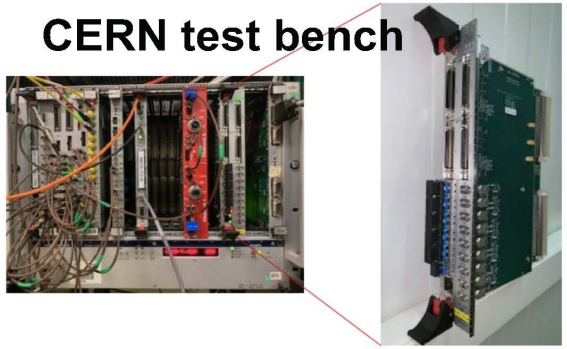
Set of local trigger processor boards (LTPi, LTP, TTCvi, TTCex) replaced by a single ALTI board

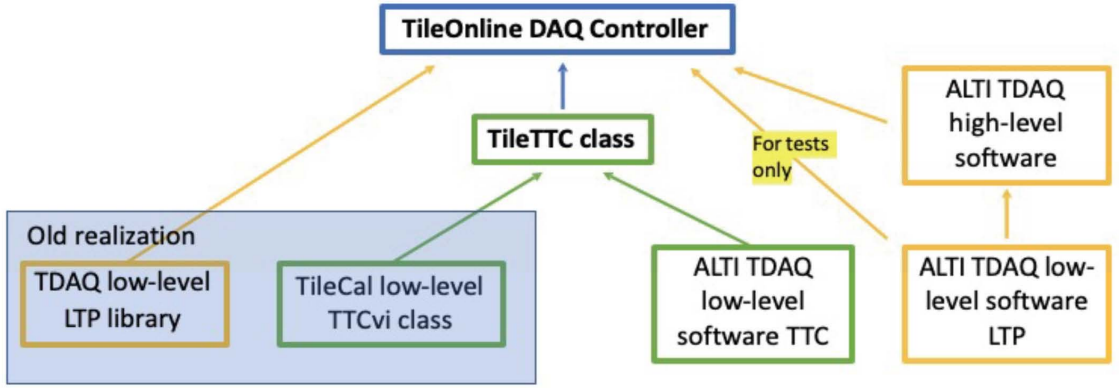
- ❑ Aging legacy modules, spares (obsolete components)
- ❑ New sub-systems in Run-3 need new TTC modules

TileCal Online software now incorporates new TileTTC class functionalities, compatible with the ALTI and TTCvi systems

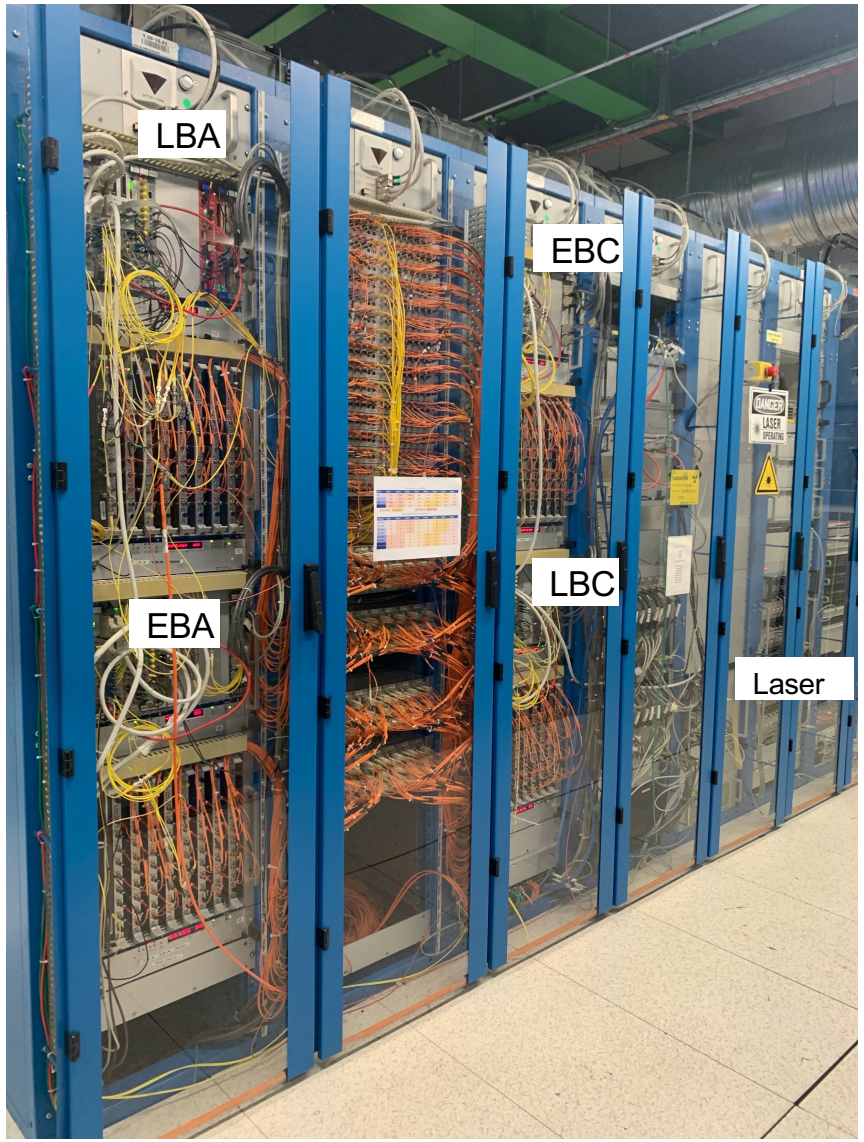
- ❑ Tested and installed in P1 in July 2021

CERN test bench



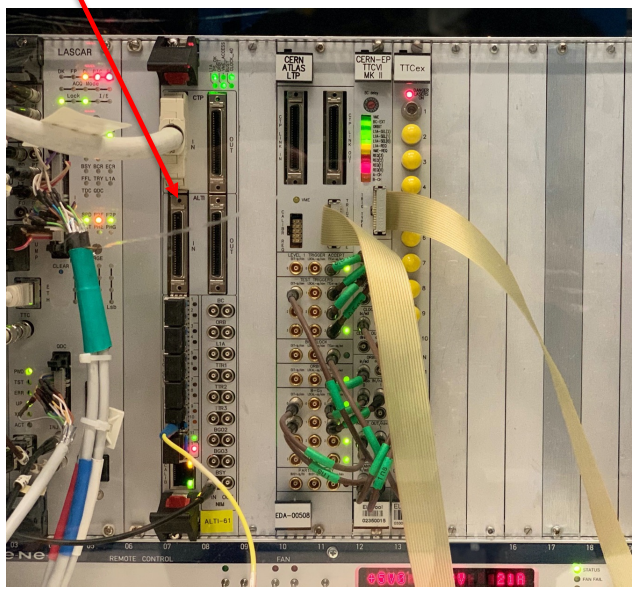


Installation of ALTI boards in the USA15 cavern

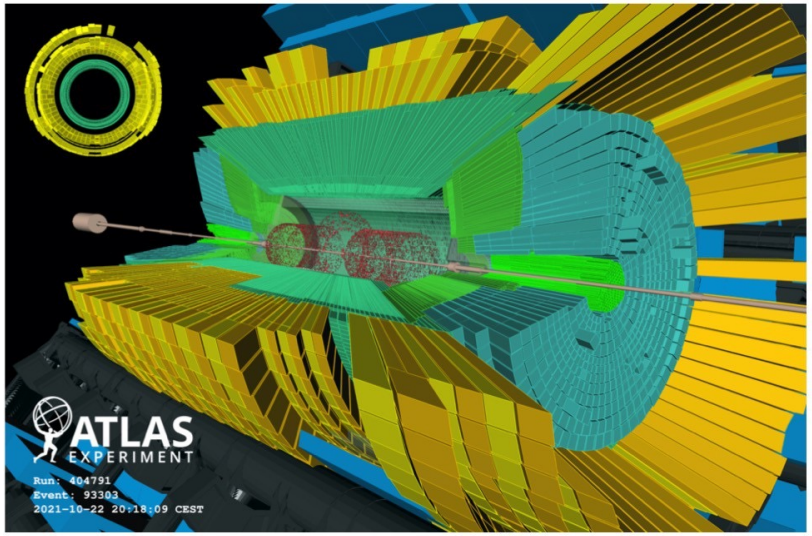


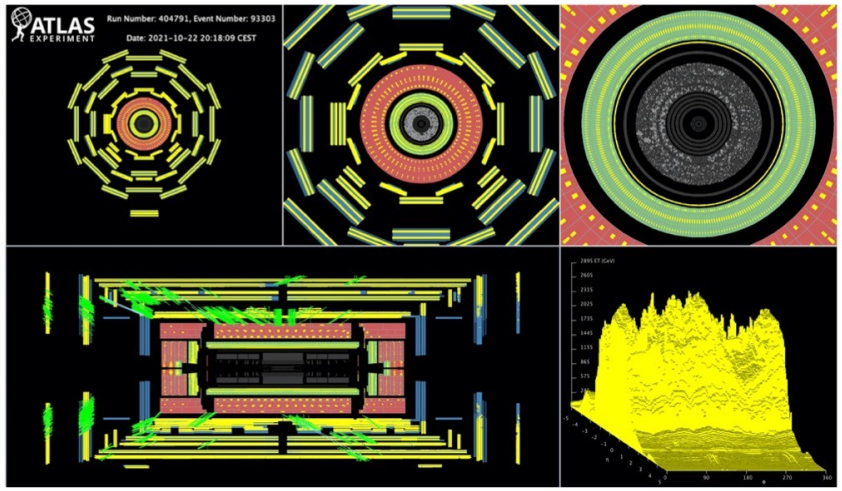
Started on the 29th of July to the end of the first week of August
ALTI boards were installed in the TTC crates of LBA, LBC, EBA, EBC and the Laser crate.

ALTI board in Laser crate



The TileCal ALTI system tested during Run 3 pilot run





- The TileCal subsystem was included in the ATLAS combined run
- ATLAS successfully recorded 25-30 beam splashes from each beam on the 22nd of October 2021
- a view of a few event displays from the run is shown on the ATLANTIS display
- the TileCal ALTI system has been fully validated and is now ready for Run 3 data-taking

Phase-I Upgrade activities: Assembly, quality checks and instalation of the gap scintillator counters on the ATLAS detector

During Run-2 (2015-2018) data-taking period of the LHC, Crack and MBTS scintillators were degraded by radiation and had to be replaced with more radiation-hard scintillators as part of the phase-I upgrade.

Upgrade activities consisted:

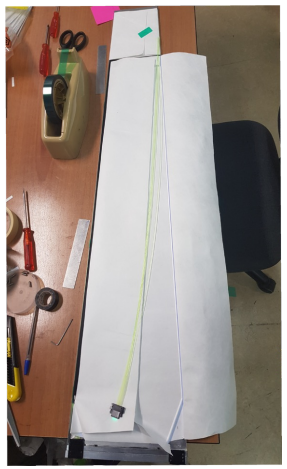
- Re-design of the crack and MBTS counters
- Assembly of detector modules
- Qualification and characterization using radioactive sources (Strontium-90 and Cesium-137)
- Installation on the ATLAS detector

ASSEMBLY (Crack and MBTS)

E3 Scintillator slab

Slab wrapping

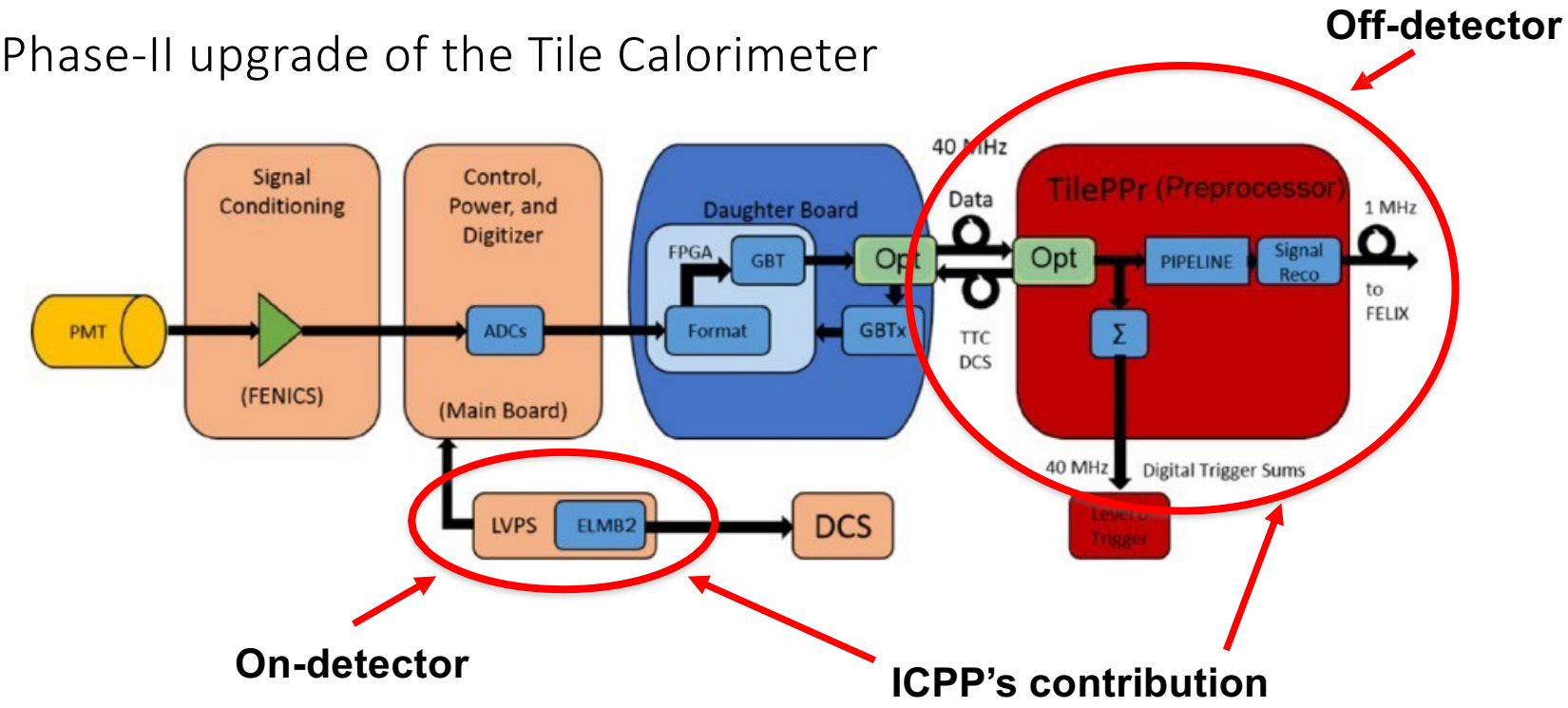
Fibre placement



Encapsulation with Al

Assembled modules

Phase-II upgrade of the Tile Calorimeter

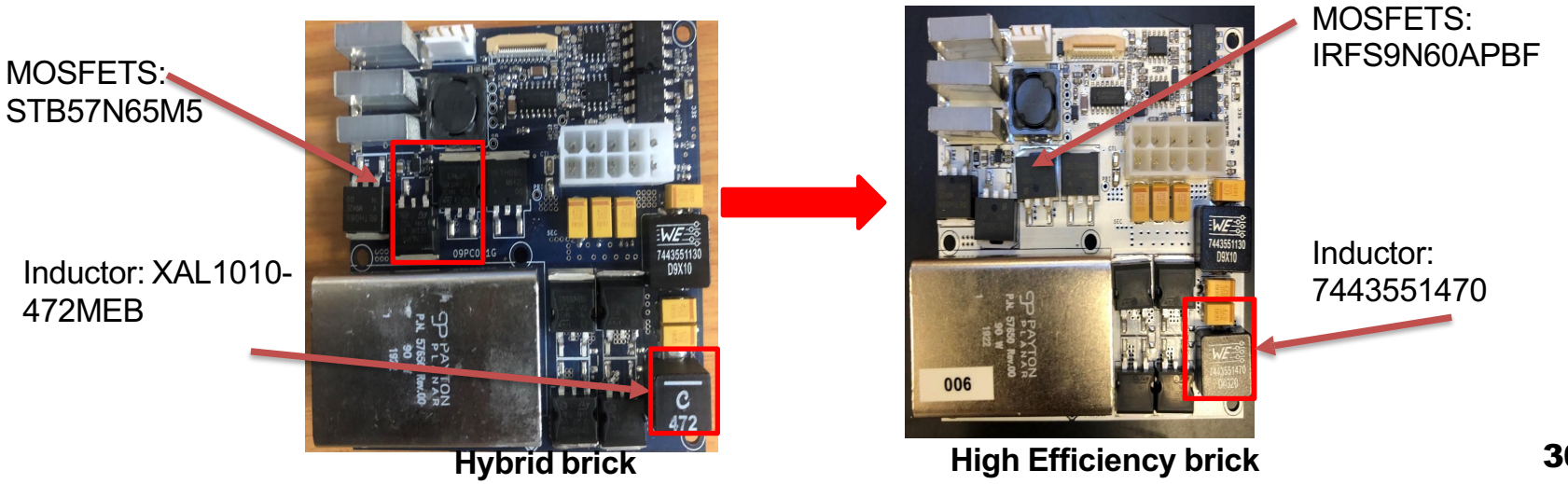


South Africa's contribution to the TileCal Phase-II Upgrade is

1. 50% of the production of the Low Voltage Power Supplies (LVPS)
   - Fully manufactured in South Africa
   - Fully tested in South Africa
2. 24% of the production of the Tile Preprocessor (PPr)
   - Two of the boards within the PPr fully manufactured in SA
   - Contribute to fare-share share of FPGAs and Back-ends

Brick production in South Africa

- Latest round of eight (8) bricks were populated in May 2021
- All 8 of these bricks were shipped to CERN to be used in several vertical slice tests
- Test performed on all bricks showed expected behaviour as per specification requirements
- Changes made on for the hybrid to the latest high efficiency bricks shown on labels

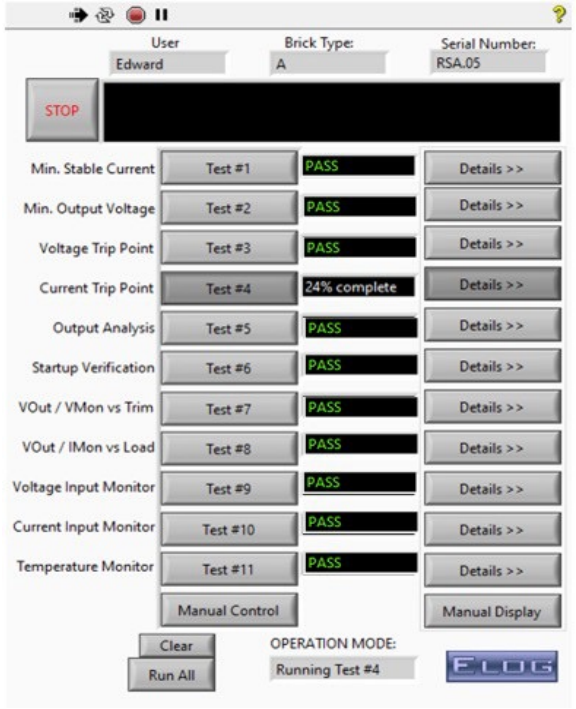


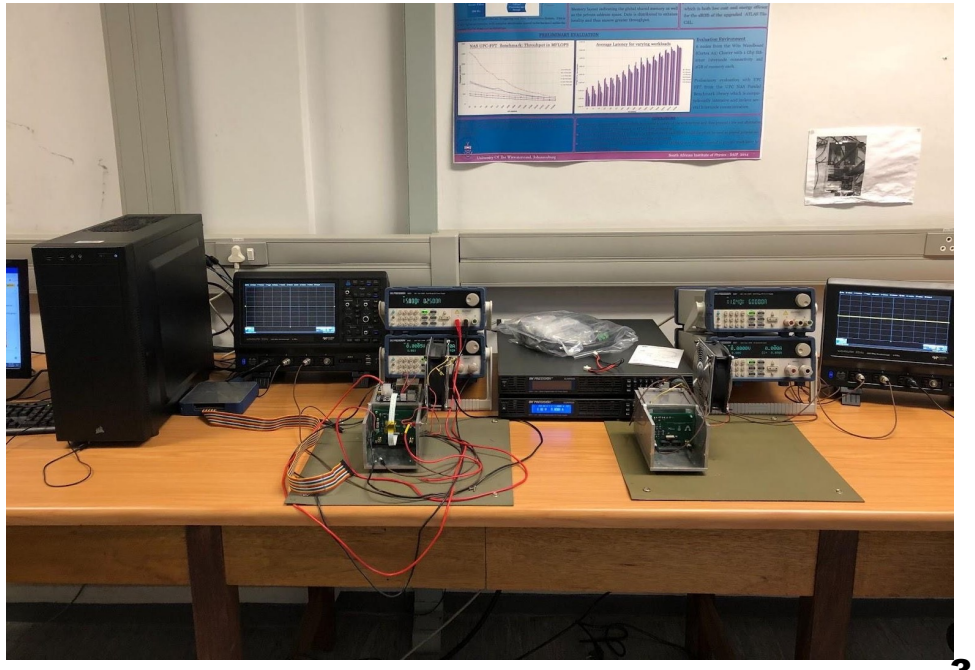
Hybrid brick

High Efficiency brick

Individual brick test bench

- Two test benches are being commissioned with the LabVIEW control software being modified to include some new tests and remove the obsolete tests
- Test setup comprises of a single brick running on a mechanical fixture. Test bench based on computer controlling and reading out equipment which perform the tests in LabVIEW





South Africa:Activities in ALICE

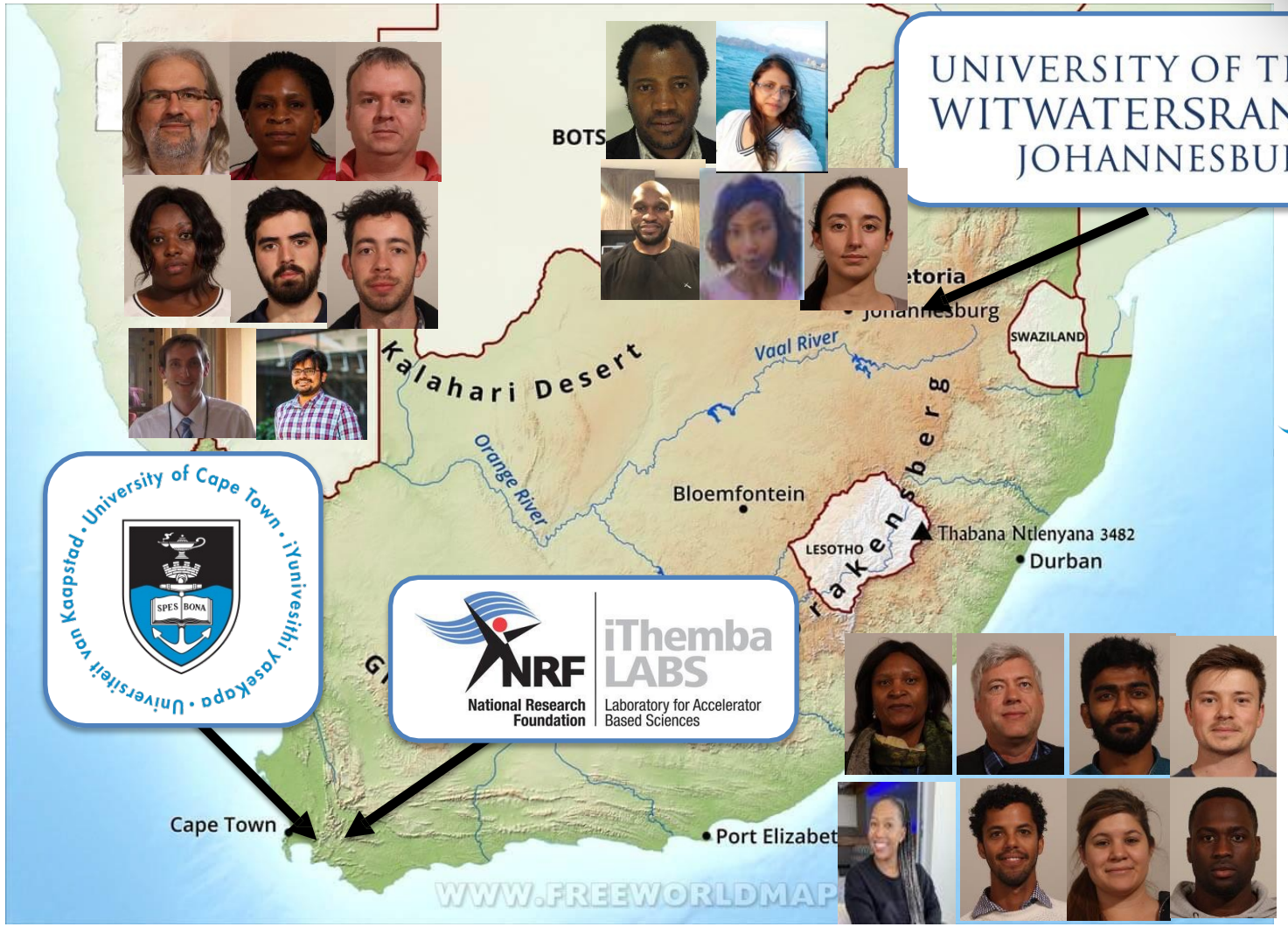
Zinhle Buthelezi,
for SA-ALICE

First ASFAP Particle Physics Day,

African Strategy for Fundamental Physics & Applications

18 November 2021

ALICE in South Africa



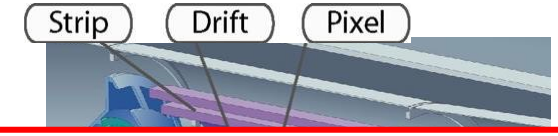
NWU North-West University

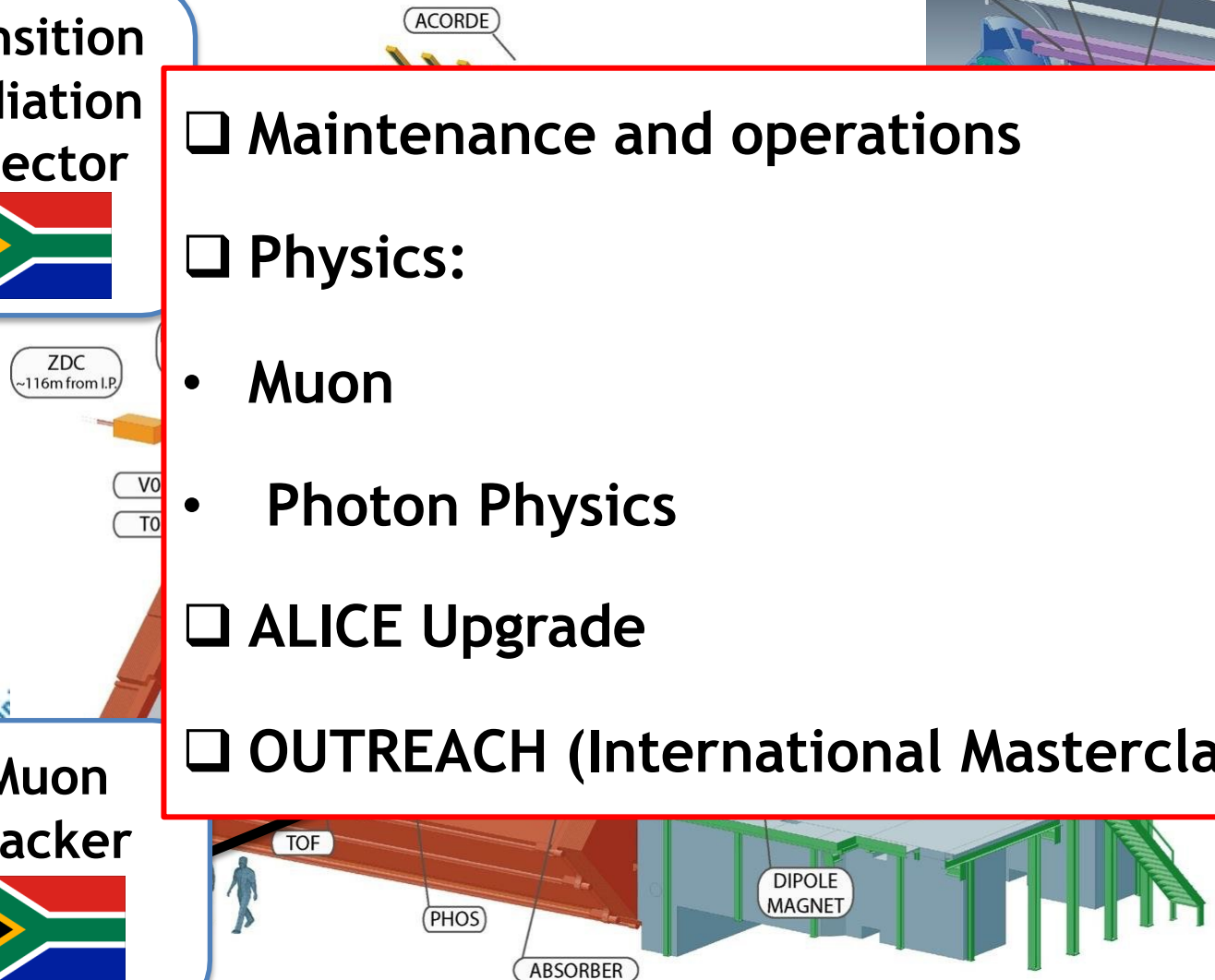
Cape Peninsula University of Technology

Universiteit Stellenbosch University

South Africa and ALICE

Transition Radiation Detector





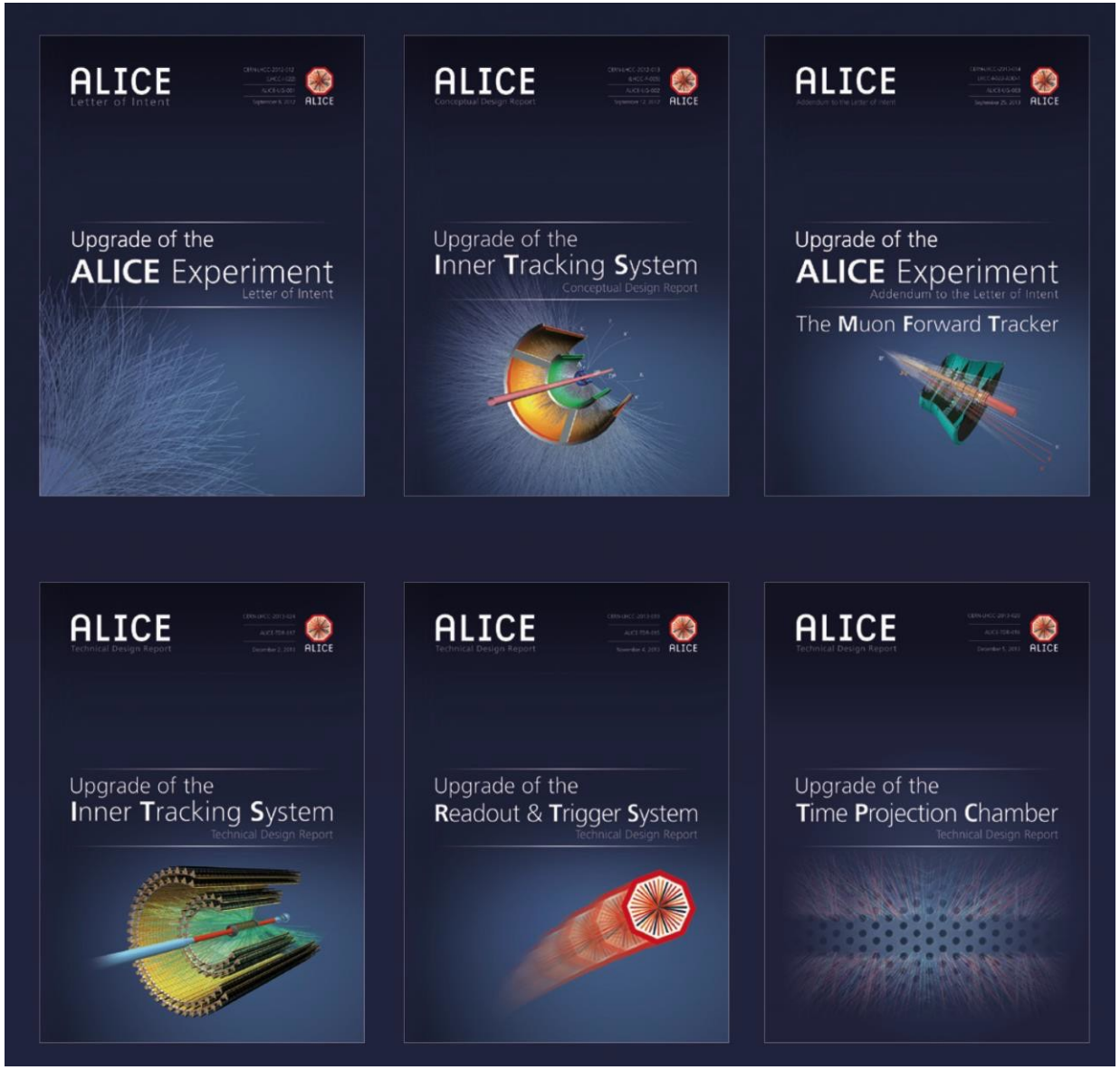
- ❑ Maintenance and operations
- ❑ Physics:
  - Muon
  - Photon Physics
- ❑ ALICE Upgrade
- ❑ OUTREACH (International Masterclasses)

Muon Tracker

Identifier

ALICE Collaboration

ALICE Upgrade



Main Goal:

- 100x more collisions
- 50 kHz event rate
- all events recorded

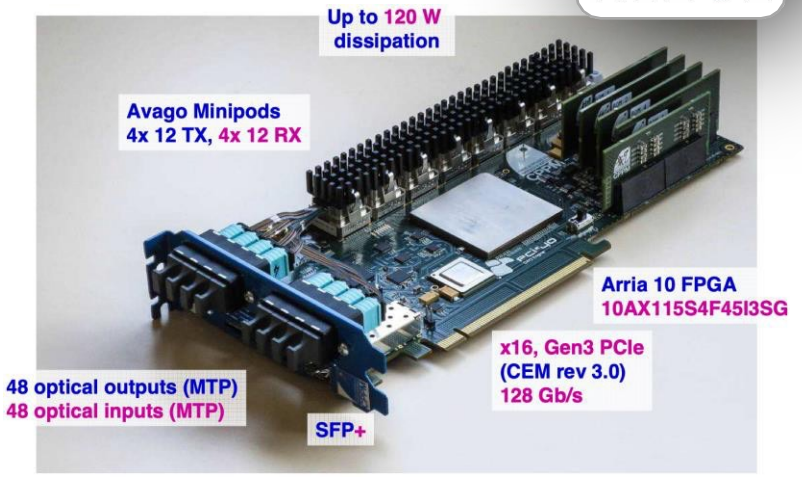
Scheduled for 2019/21

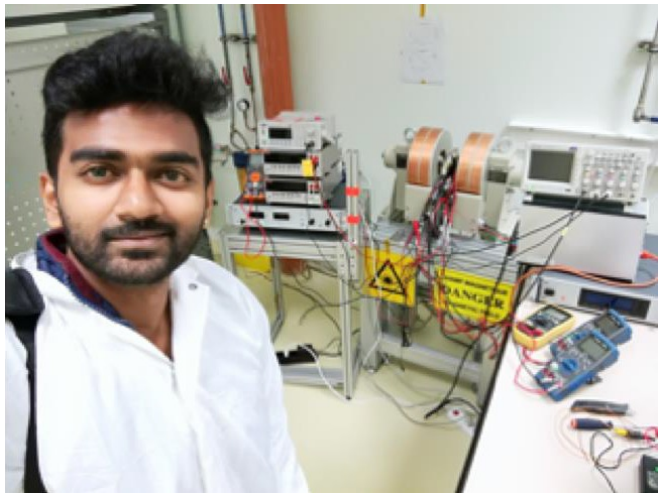
Upgrade Projects

Muon Identifier:
Common Readout Unit
- VHDL firmware development
- Gen3 x16 PCIe card with Arria-10 FPGA and 48 optical inputs/outputs
- on-the-fly data conditioning @ 51.2Gb/s
- **Collaboration with French Labs: Subatech in Nantes & Clermont-Ferrand**

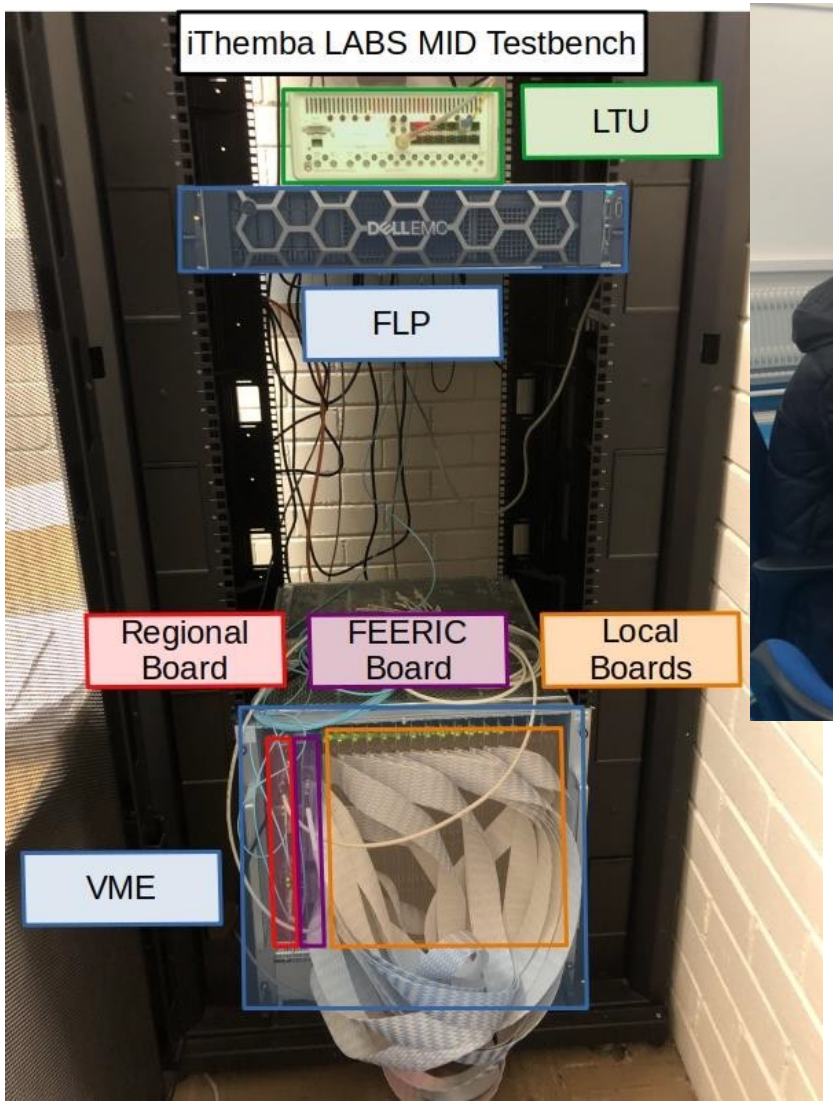
Muon Tracking:
Low-Voltage System
- challenges:high radiation, strong magnetic field
- circuit design, component selection, testing
- control system development
- **Collaboration with Italy (Cagliari) & France (Saclay and Orsay)**

Transition Radiation Detector:
Online Data Processing
- simulation, calibration and reconstruction
- integrated in ALICE Online-Offline (O^2) upgrade
- distributed high-throughput computing @ 5GB/s
- Collaboration with German institutes





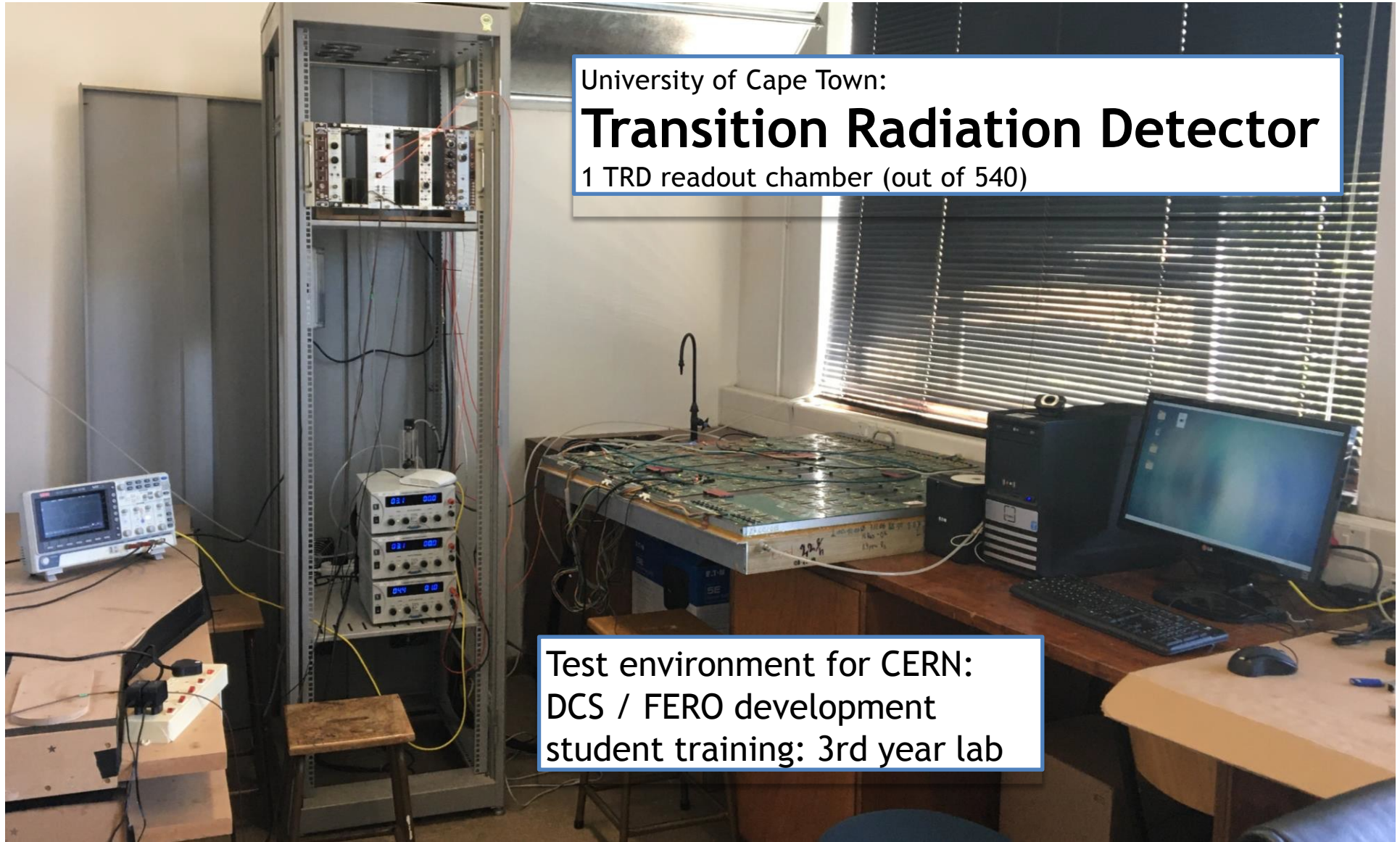
MID Readout Test Stand @ iThemba LABS



Muon Identifier (MID)
Common Readout Unit (CRU)

- FPGA/VHDL CRU firmware development
- High-throughput electronics
- Full setup of MID electronics, trigger, DAQ

TRDlab @ UCT


University of Cape Town:
Transition Radiation Detector
1 TRD readout chamber (out of 540)
Test environment for CERN:
DCS / FERO development
student training: 3rd year lab

Remote Operation Site @ UCT

- Travel restrictions for many countries
- Limited availability of shifters at CERN in 2021
- Fall-back solution for 2022

Outreach: International Masterclasses

International programme led by CERN

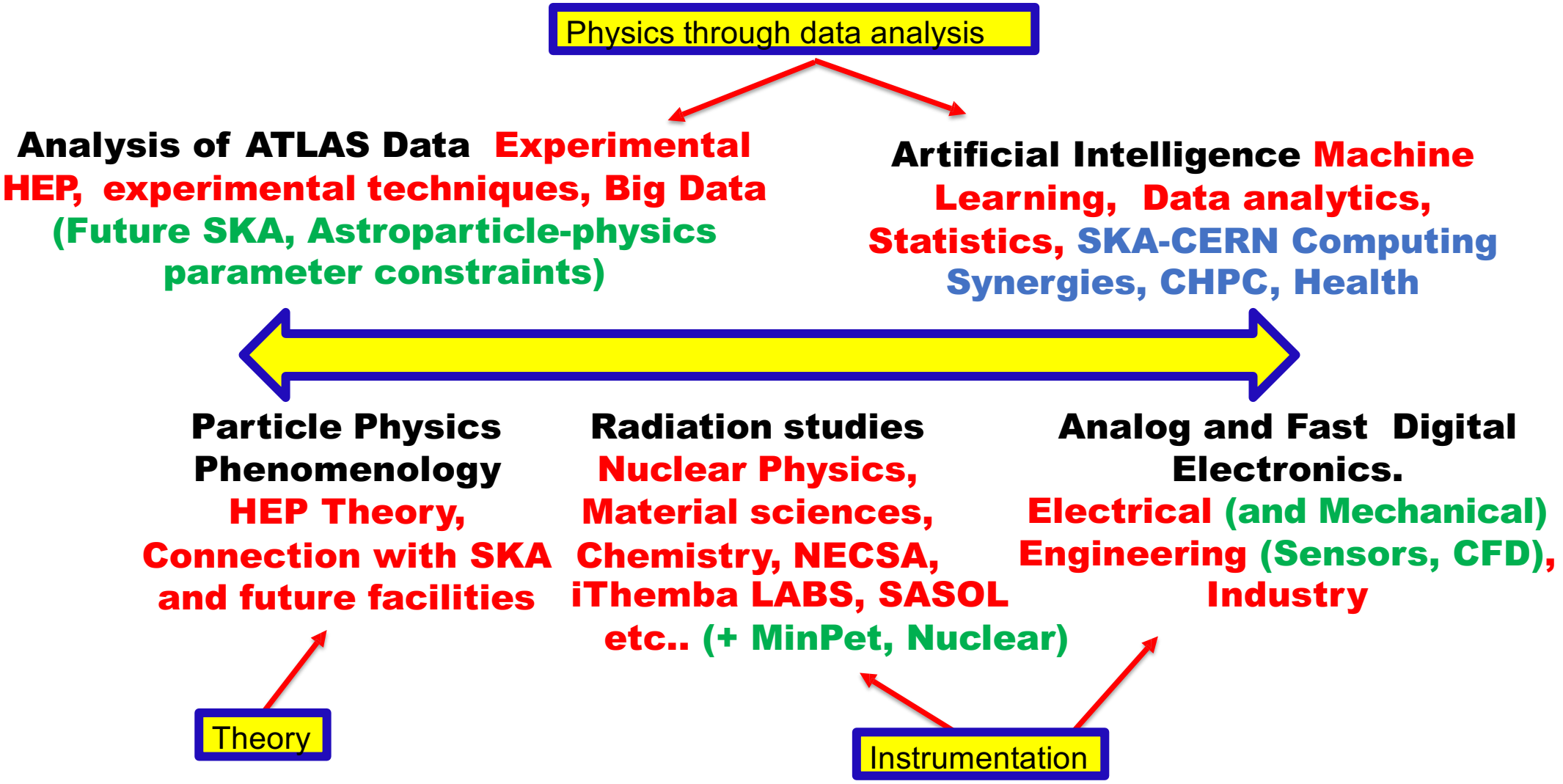
"one day as a physicist"

up to 50 students from 25 schools per year

Pandemic: Online masterclasses??

Scope of Research + Co-Impact + Future

WITS, UCT+ ALICE + UJ + SKA+SA-CERN + Health



The UJ–ATLAS and Associated Innovation Group + UNISA + UWC

Staff
- Simon Connell (Prof)
- Muaaz Bhamjee (Sn Lect)
- Nicolin Govender (Prof)
- Loan Truong (Lecturer, Visiting Prof)
- Francois Pieterse (Sn Lect)

Post Docs
- Bongani Maqabuka
- Emmanuel Igumbor
- Hasina Ralijaona

Students
- PhD: Phineas Ntsoele
- PhD: Thendo Nemakhavhani
- PhD: Matthew Connell
- MSc: Xola Mapekula
- MSc: Mr Mitchell Phiri
- MSc: Gideon Bentum
- MSc Chris Lee

Associate sub-institute
- Lerothodi Leeuw (Prof UWC)
- Pedro Mafa (Dr UNISA)
- Mantile Lekala (Prof UNISA)

Necsa Associates
- Dr Graham Daniels, Dr Dazmen Mavunda, Eric Chinaka, Linina Bedhesi

Research Associates
- Dr Martin Cook (SRA UJ),
- Dr Sergio Ballestrero (SRA UJ)
- Tim Brooks (SRA UJ)

+ many colleagues from ATLAS
Prof Kétévi Assamagan BNL

ATLAS Innovation

2019/2/22 UJ-ATLAS

The Institute for Collider Particle Physics

UNIVERSITY OF ZULULAND
UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
NRF National Research Foundation
iThemba LABS Laboratory for Accelerator Based Sciences
INSTITUTE FOR COLLIDER PARTICLE PHYSICS UNIVERSITY OF THE WITWATERSRAND

First ASFAP Particle Physics Day, 19/11/21

THE ACADEMICS

A SHORT HISTORY OF UCT INVOLVEMENT WITH ATLAS

- Started by Andrew Hamilton in 2011 (no longer an ATLAS member)
- Sahal Yacoob joined in 2015
- James Keaveney joined in 2019 Currently top quark cross-sections group co-convenor

A relatively small group


Andrew

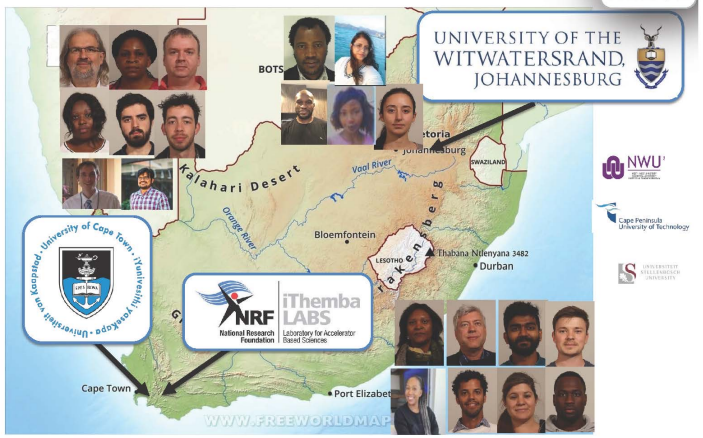

Sahal


James

ATLAS EXPERIMENT

ALICE in South Africa

ALICE



HUMAN CAPACITY DEVELOPMENT

STUDENTS

- Students Graduated:
  - 16 MSc (including engineers)
    - Most continued in academia
  - 1 PhD
    - Currently a post-doc on ATLAS
- Current Students
  - 4 MSc
  - 3 PhD

ATLAS EXPERIMENT