UJ @ ATLAS : History, Analysis, Operations, Computing, Tech transfer, Outreach

S Ballestrero[1,2], G Bentum[1], M Bhamjee[1], T Brooks[1], T Chirwa[1], M Connell[1], S H Connell[1], GC Daniels[4], C Harley[1], J Hartman[1], N Govender[1], L Leeu[1,4], PT Mafe[1,3], K Maluleka[1], X Mapekula[1], B Maqabuka[1], RD Mavunda[1], T Mpai[1], P Ntsoele[1], M Phiri[1,] F Pieterse[1], L Truong[1]

1. University of Johannesburg, Johannesburg, South Africa.
2. Proton Mail, Geneva
3. UNISA, Johannesburg, South Africa
4. University of the Western Cape, South Africa
5. Necsa, South Africa

History

3 Students learn Grid Computing in USA

UJ organises 1st Grid School in SA

SA-CERN launched

UNISA partner with UJ in ATLAS Astro + HEP

2005 2010 2015

Prof Assamagan (UJ)

Physics + Outreach + MinPET and Reactor Physics Tech Transfer

Grid Computing Tech Transfer

Staff members in TDAQ HPC / Engineering

K Assamagan (BNL) visits SA to arrange entry into ATLAS

UJ 1st SA entity in ATLAS as a Sub-Institute of BNL

Necsa partner with UJ in ATLAS

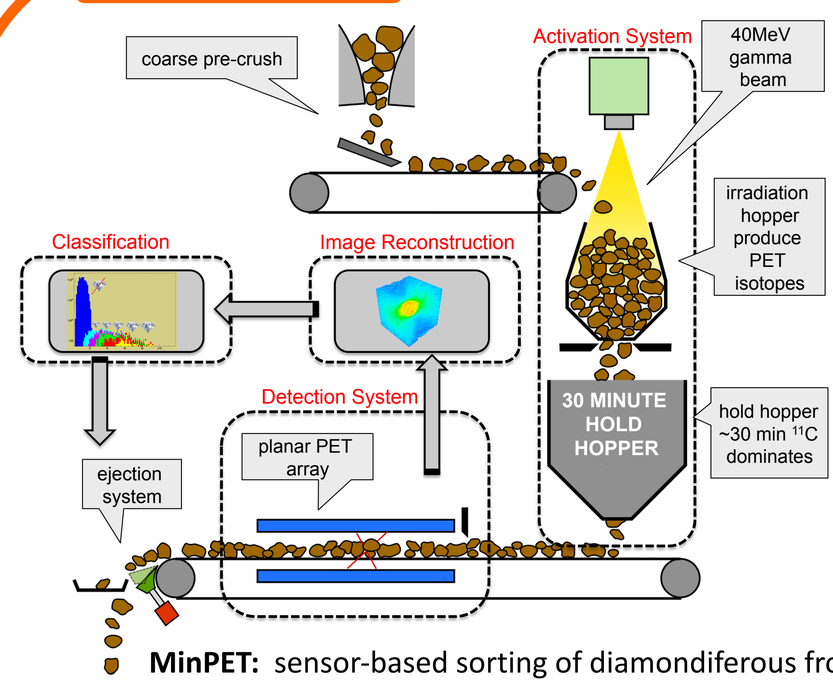
SA-ATLAS launched

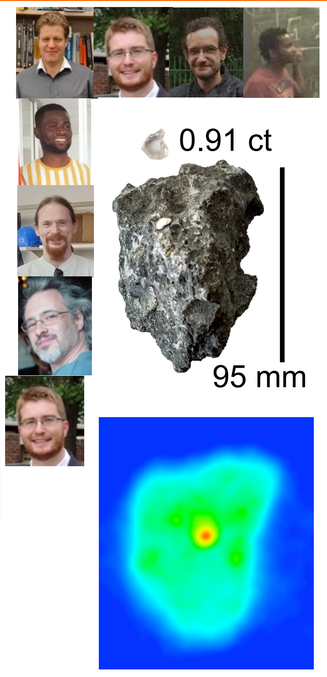
Commercialisation in progress

Sensors for extremes

SME and ESKOM / Koeberg (in progress)

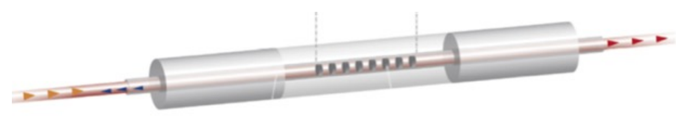
Tech-transfer

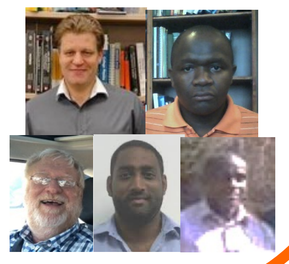




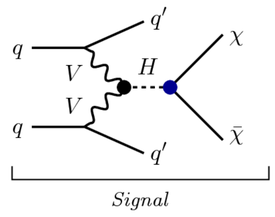
MinPET: sensor-based sorting of diamondiferous from barren kimberlite.
→Comercialisation in progress

Radiation Hard Humidity and Strain Sensors in the ATLAS ITK
→ Sensors in Extreme Environments → SEE
→ Commercialisation in progress

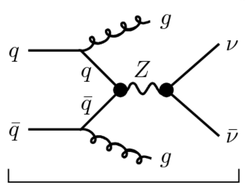




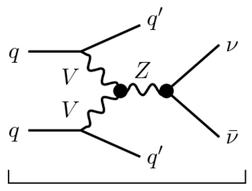
Analyses 1



Signal

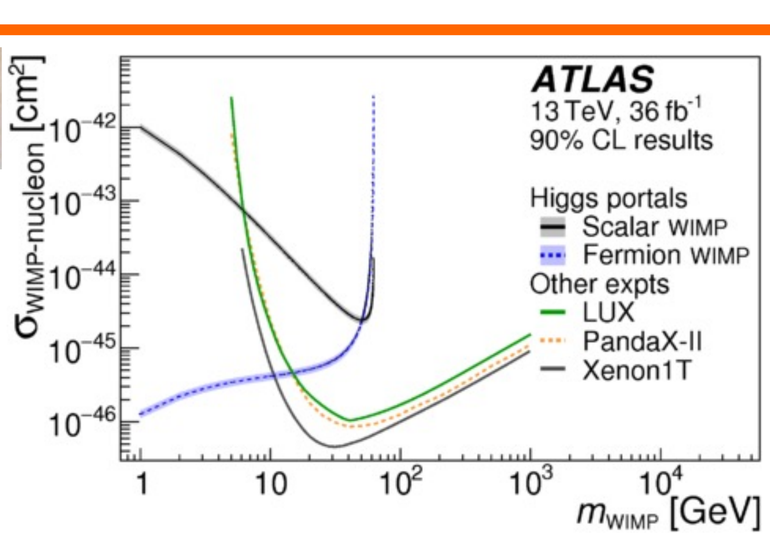


$Z+2j$ *via strong process*



$Z+2j$ *via weak process*

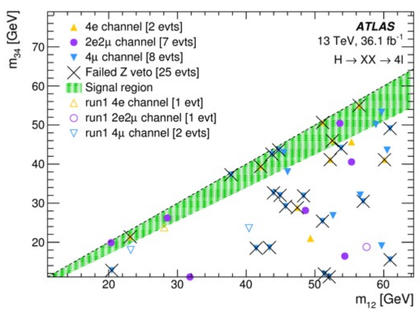
- **Search for invisible Higgs boson decays in vector boson fusion (VBF)** at √s=13 TeV arXiv:1809.06682 (Submitted to PLB). **Combination of searches for invisible Higgs boson decays Run 1 + Run 2** (in ATLAS internal circulation)
- **Motivation:** Higgs Portal to Dark Matter where mDM < mH/2
- **Signatures:** large missing transverse momentum + 2 well separated high transverse momentum jets (VBF topology)
- **Results:** Observed (expected) upper limit at 95%CL of BR(H→inv) = 0.37 (0.28)



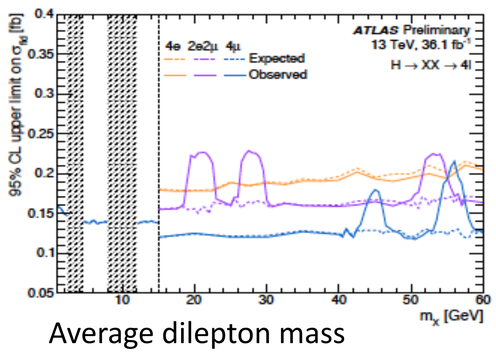
Analyses 2

Search for physics beyond SM → Dark Matter (HAHM and beyond)

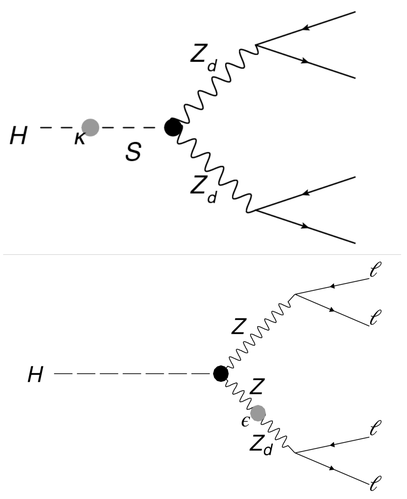
1. Introducing new mass states **dark Z-boson** Z_d and **dark Higgs S**.



Observed events in Run 1 + Run 2

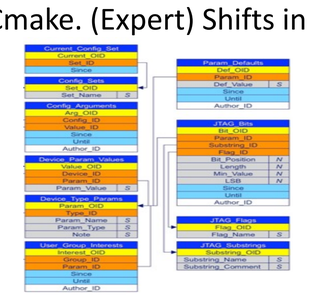


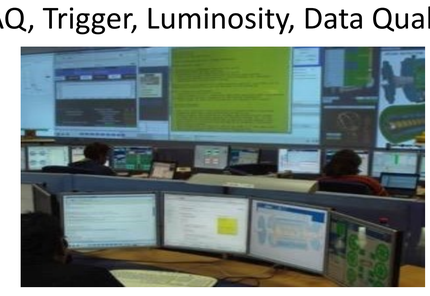
Average dilepton mass
Upper limits at 95% Confidence Level



Computing + ML

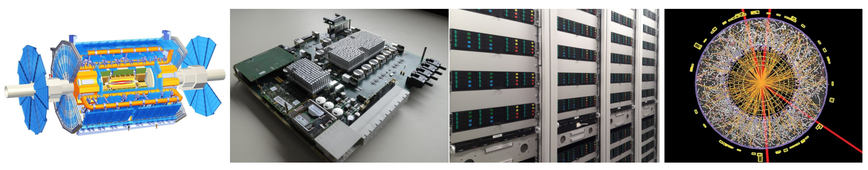
Operations :
Muon ConfigDB in the Control Room
Developed for Point 1. Contributions to the port from CMT to Cmake. (Expert) Shifts in TDAQ, Trigger, Luminosity, Data Quality





The TDAQ (trigger and data acquisition) and Network

- Manage the computer and network infrastructure, preparing for the LS2 upgrades.
- Development of automation tools to optimise operations, and research into vitualisation & containerisation within the HLT.
- Design, implement, and integrate a new high-speed network infrastructure for the High-Lumi LHC.

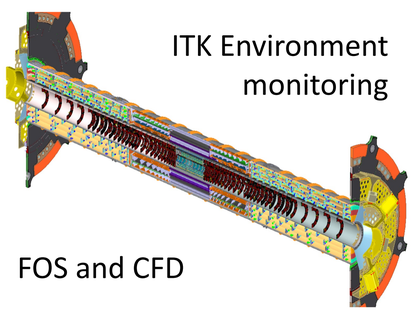


ATLAS → L1 Trigger → HLT Farm → Storage

AI and ML

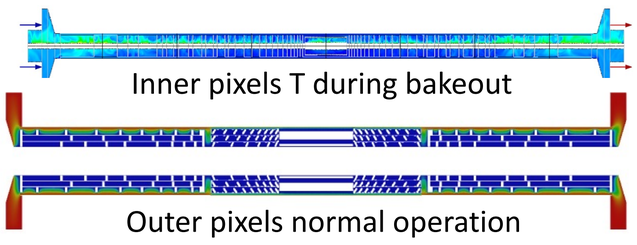
- In ATLAS data analysis
- Anomaly detection in the TDAQ
- AI in Medical Applications

Engineering CFD



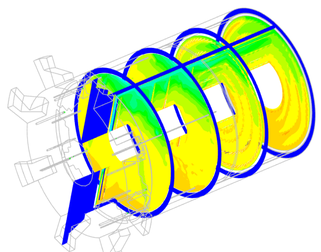
ITK Environment monitoring

FOS and CFD



Inner pixels T during bakeout

Outer pixels normal operation



Rel. Humidity in Strips under leak conditions

Outreach

Public talks

National tour

CERN Beam Line for Science

All media