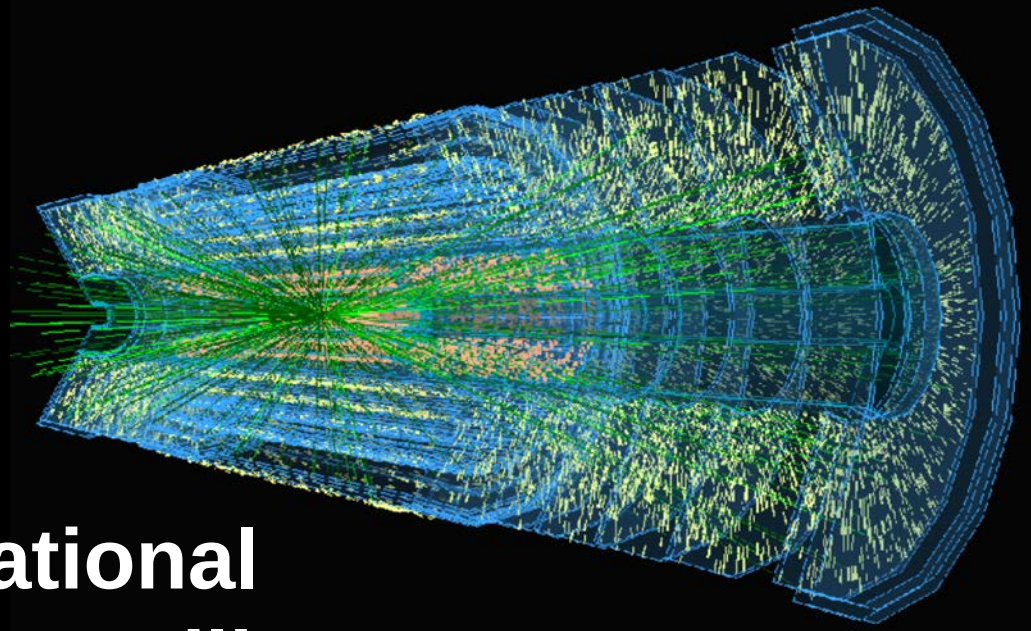
Birmingham Instrumentation Laboratory for Particle physics and Applications

BILPA

UNIVERSITY OF BIRMINGHAM



- **Welcome**
- **Personnel**
- **Programmes**
- **AIDA-2020: Transnational Access Facility**
- **Clean-rooms and Equipment**

Welcome to Birmingham

UK HEP Community Meeting
CMOS Sensors for Future Applications

10th March 2016

The Cosener's House, Abingdon

A meeting to learn about the potential of CMOS technology in our field and discuss how best to exploit it

Registration and more info: https://indico.cern.ch/event/477242/

Organising Committee:
- Phil Allport
- Daniela Bortoletto
- Joost Vossebeld
- Fergus Wilson

Topics:
- CMOS Technology in HEP
- Future Activities and Opportunities
- CMOS and the wider community
- Strategy and Planning

Advances in Radiation-Hard Monolithic Pixel Detectors

IoP HEPP Half-day Meeting

Wednesday 19th of July
School of Physics and Astronomy
University of Birmingham

Register at:
https://indico.cern.ch/e/DMAPS2017

Depleted Monolithic Active Pixel Sensor (DMAPS) technologies present an opportunity for game-changing developments in tracking detectors for particle, nuclear and medical physics applications. Monolithic pixel detectors (combining sensor and electronics) are the subject of a major international research programme to define process variants which can deliver high levels of radiation hardness while meeting stringent requirements in spatial resolution, low material budget and cost effectiveness.

Organising committee:

Phil Allport (Birmingham), Daniela Bortoletto (Oxford), Laura Gonella (Birmingham), Peter Jones (Birmingham), Joost Vossebeld (Liverpool), Nigel Watson (Birmingham), Fergus Wilson (RAL), Steve Worm (Birmingham)

IOP Institute of Physics
High Energy Particle Physics Group

UNIVERSITY OF BIRMINGHAM

Particle Physics
Rutherford Appleton Laboratory

Birmingham Instrumentation Laboratory for Particle physics and Applications

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- **Academics and Research Staff linked with BILPA activities**
  - Phil Allport, Laura Gonella, Stuart Green*, Paul Newman, Kostas Nikolopoulos, Peter Jones†, David Parker†*, Juergen Thomas, Nigel Watson, Steve Worm, New Lecturer*
- **Post-doctoral Staff linked with BILPA**
  - Sam Bailey†, Jacob Kempster, Ben Phoenix*, Tony Price
- **Technical Staff linked with BILPA**
  - Imran Iqbal, Simon Pyatt
- **Current Students linked with BILPA**
  - Matt Baca, Daniel Briglin, James Broughton, John Cotterill*, Jack Lindon, Alasdair Winter
- **Students from September 2017**
  - Robert Bosley, Sam Flynn*, Patrick Freeman, Wennlöf Håkan†

* Medical Applications
†With Nuclear Physics

(The Birmingham HEP Group has 36 Academic, Research, Post-doctoral and Technical staff along with 21 current PhD students in total)

HEP Group Programmes

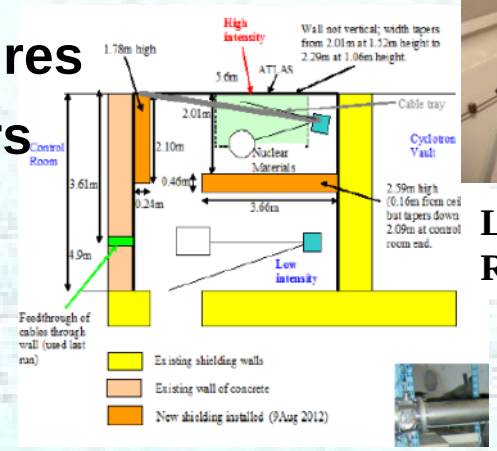
- **Energy Frontier Programmes**
  - **ATLAS (incl HL-LHC)**
  - **ILC: Digital Calorimetry**
  - **FCC-hh: Digital Calorimetry**
  - **LHeC**
- **Intensity Frontier Programmes**
  - **LHCb (incl Upgrades)**
  - **NA62**
- **Neutrino Programmes**
  - **DUNE**
- **Programmes with Nuclear Physics**
  - **EIC**

HEP Group Programmes

- **Generic R&D**
  - RD50
  - AIDA-2020
  - DECAL
- **Medical Applications**
  - Proton Radiotherapy Verification and Dosimetry Applications
  - ENLIGHT
  - Global Challenge Advanced Radiotherapy Network+
  - Enhancement of the UK Primary Standard for Absorbed Dose for Proton Radiotherapy (with NPL)
  - Advanced Instrumentation for Radiotherapy (with University Hospitals Birmingham NHS Foundation Trust)

AIDA-2020 UoB MC40

- The MC40 cyclotron at the University of Birmingham is primarily used for radio-isotope production for mainly medical applications
- However, these are typically produced in overnight runs and the MC40 is now also used to irradiate materials and sensors for particle physics
- Joint activity initiated by the Universities of Sheffield, Liverpool and Birmingham through STFC support for UK ATLAS Upgrade
- Irradiation facility was commissioned in early 2013 and has irradiated several hundred samples in total (including those for 12 AIDA Transnational Access Programmes since 2015)
  - ✓ Composites, carbon fibre support structures
  - ✓ Pixel (hybrid and CMOS) and strip sensors
  - ✓ ASICs. microelectronics, optical fibres
  - ✓ Hybrid and PCB materials
  - ✓ JFETs, HV-switches, …

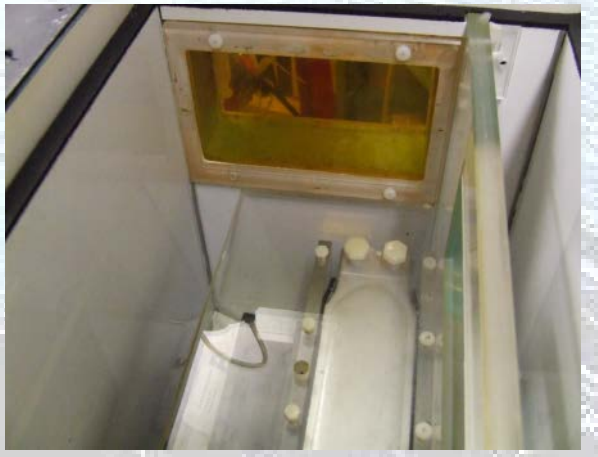


Layout of Radiation Zone

- 27 MeV continuous 1cm^2 proton beam can achieve HL-LHC fluences of ATLAS inner layer strip system (10^{15} 1 MeV n_{eq} cm^{-2}) in 80 s with 1 μA beam current (max energy of 40 MeV, max current of ~2 μA)

MC40 Facility

- **XY-axis (45cm×40cm) scanning system installed in the irradiation area to allow areas of 15cm×15cm (orthogonal) to be uniformly irradiated at low temperatures**
- **Samples are suspended from the lid in the thermal chamber which is mounted on the scanning system**
- **Sealed feed-throughs allow external read-out and monitoring to be connected or space in the box can house shielded electronics**
- **Similar arrangement provided for use at CERN PS by UK irradiation groups**
- **Operating temperature down to -50^{o}C using evaporative liquid N_2 system**
- **Internationally led bids should apply through http://aida2020.web.cern.ch/content/uob**
- **Major upgrade of facility for ATLAS UK ITk Irradiation Programme (device qualification and quality assurance during production) underway with Sheffield**



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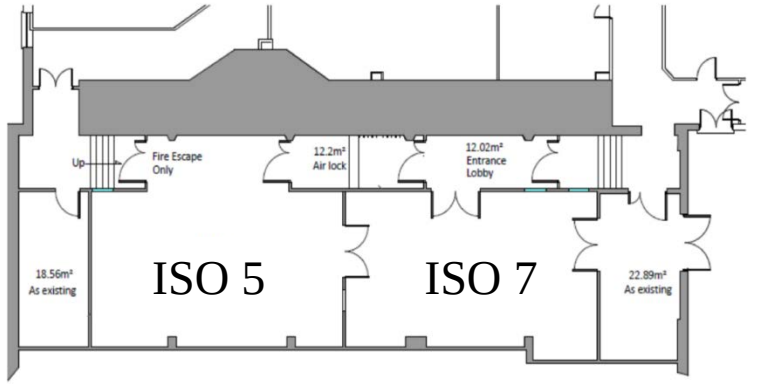
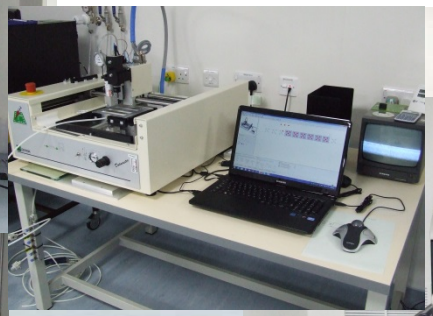
- **~ 200m^2 of new and reconditioned cleanroom laboratory space for both ITk strip module production and R&D on novel radiation-hard detectors**





12:00

Welcome and buffet lunch

Watson LT B, School of Physics and Astronomy, University of Birmingham 12:00 - 12:40

Welcome

Watson LT B, School of Physics and Astronomy, University of Birmingham 12:45 - 12:55

13:00

Technology Overview *Daniel Muenstermann*

Watson LT B, School of Physics and Astronomy, University of Birmingham 13:00 - 13:15

General HV-CMOS *Eva Vilella Figueras*

Watson LT B, School of Physics and Astronomy, University of Birmingham 13:20 - 13:35

Rad-hard MAPS for LHCb Upgrades *Marco Gersabeck*

Watson LT B, School of Physics and Astronomy, University of Birmingham 13:40 - 13:55

14:00

DMAPS for ATLAS Upgrade *Dr. Dima Maneuski*

Watson LT B, School of Physics and Astronomy, University of Birmingham 14:00 - 14:15

ALPIDE and DMAPS Developments *Walter Snoeys*

Watson LT B, School of Physics and Astronomy, University of Birmingham 14:20 - 14:45

15:00

Tea

Watson LT B, School of Physics and Astronomy, University of Birmingham 15:00 - 15:30

CMOS Sensors for ILC/CLIC Vertex Detectors *Joel Goldstein*

Watson LT B, School of Physics and Astronomy, University of Birmingham 15:30 - 15:45

ILC, LHC and FCC MAPS Designs at RAL *Jens Dopke*

16:00

Watson LT B, School of Physics and Astronomy, University of Birmingham 15:50 - 16:05

Large Format MAPS for Medical (IMRT) Linacs *Richard Hugtenburg*

Watson LT B, School of Physics and Astronomy, University of Birmingham 16:10 - 16:25

Silicon Sensors for Proton Therapy *Nigel Allinson*

Watson LT B, School of Physics and Astronomy, University of Birmingham 16:30 - 16:45

EIC Vertex Detector *Laura Gonella*

17:00

Watson LT B, School of Physics and Astronomy, University of Birmingham 16:50 - 17:05

Discussion on Next Steps for UK Programme *Daniela Bortoletto*

Watson LT B, School of Physics and Astronomy, University of Birmingham 17:10 - 17:25