ATF IC-CoP

Monday 17 October 2022 - Wednesday 19 October 2022

ANU

Book of Abstracts

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14UD Column Structure, A new Understanding.

Alan Cooper[1]

[1] *NPAA ANU*

Corresponding Author(s): alan.cooper@anu.edu.au

The 14 UD will soon receive new Column Posts. We will move to a new low stress assembly technique.

ATF / **10**

14UD SF6 Plant, Concerns and Action.

Alan Cooper[1] ; Alan Cooper[None]

[1] *NPAA ANU*

Corresponding Author(s): alan.cooper@anu.edu.au

Describes the plant and the concerns with age.
Actions underway to mitigate the risks.

IC-CoP / **14**

2.3m Automation - Redesign a control system without changing any (bespoke) hardware

Ian Price[1]

[1] *ANU*

Corresponding Author(s): ian.price@anu.edu.au

The ANU 2.3m telescope was originally built in the early 80's. Usage has evolved from observers on-site pushing buttons to remote operation with GUI interfaces for plant and instrument control, and now fully autonomous operation. The hardware of the telescope and instrument control systems has remained largely unchanged but software control systems have changed substantially. This is a brief overview of the automated observing control system, which pulls various bespoke components into a consolidated distributed control system. The primary objective of the project is to extend the working life of a useful, but aging facility, by 10 years.

General / **22**

AITC

Celine D'Orgeville[1]

[1] *ANU*

Corresponding Author(s): u5090939@anu.edu.au

An introduction to the Advanced Instrumentation Technology forum and also diversity in STEM facilities.

General / **23**

AITC Detector Program

Annino Vaccarella[1]

[1] *ANU*

Corresponding Author(s): annino.vaccarella@anu.edu.au

This talk will outline the detector technology program at the ANU RSAA Advanced Instrumentation Technology Centre.

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ANTARES AMS Data Acquisition System - Current Status and Future Upgrade

JIAN WANG[1] ; Matthew Rees[1] ; David Button[2]

[1] *ANSTO*

[2] *ANSTO, New Illawarra Rd*

Corresponding Author(s): reesm@ansto.gov.au, dbu@ansto.gov.au, jian.wang@ansto.gov.au

ANTARES AMS Data Acquisition System (DAQ) is built up in the early time of 90's. The system includes detector, pre-Amplify, CAMAC electronics system, and VME frame with Motorola MVME CPU processor plus CEAN scaler board and ADC pulse process board. The system employs OS/9 operator system that were developed by Microware for MVME CPU processor. A Linux machine is connected to MVME CPU board via ethernet for the experimental data process and graphic display. A special C program package SOAP plays strong function for above data process and display. With such aged DAQ system, it is quite difficult for maintenance and development. There are also many system issues and hardware shortage that cannot be fixed easily. Upgrade of ANTARES AMS DAQ system is necessary.
Several options have been proposed. What we considered is to apply for latest data process technology instead of Motorola CPU board and VME signal process crate. One portable solution of new DAQ system can be applied for CAEN Digitizer desktop box DT5742, 16+1 Channel 12 bit 5 GS/s Switched Capacitor Digitizer. The CAEN Digitizer DT5742 has strong function combined scaler process and ADC process for the pulse. We can therefore not rely on the VME chases with MVME CPU boards, CEAN scaler board, and CEAN pulse process boards. Furthermore, Digitizer desktop box DT5742 carries built-in DRS4 chip mobile processor with a lot of strong functions. CEAN also provides software package CoMPASS for multiparametric DAQ software for Physics Applications and communication sockets that can be accessed by other user's applications. A Linux DAQ system contains local data analysis and visualised data processor that can connect CEAN software package and "Digitizer Desktop Box" through special socks and optical cable. A new "SOAP" package will be developed depend on QT GUI application and Digitizer desktop box DT5742.

General / **17**

Accelerator Capabilities and Upgrade Projects at the Australian Synchrotron

Rohan Dowd[1]

[1] *Australian Synchrotron*

Corresponding Author(s): rohan.dowd@ansto.gov.au

this talk will give an introduction to the Australian synchrotron accelerator facilities and a summary of current key accelerator upgrade projects we are undertaking and their technical challenges. Current major upgrades include the booster and storage ring RF amplifiers, electron gun and storage ring injection system.

General / **31**

Advanced Composites Manufacturing

Paul Compston[1] ; Chris Stokes-Griffin[1]

[1] *ANU*

Corresponding Author(s): chris.stokes-griffin@anu.edu.au, paul.compston@anu.edu.au

This talk will provide a description of the Advanced Composites Manufacturing facility and recent demonstration projects.

General / **24**

An Overview of Optical Engineering

Israel Vaughn[1]

[1] *AITC at the Australian National University*

Corresponding Author(s): israel.vaughn@anu.edu.au

Optical engineering combines the disciplines of physics, electrical engineering, and mechanical engineering. At AITC we design and integrate optical systems. This talk gives an overview of optical engineering techniques, some tools of the trade, and some tips and tricks that we have learned through building optical systems.

General / **12**

Applications of Compliant Mechanisms

Warrick Schofield[1]

[1] *Australian National University*

Every day we interact with compliant mechanisms (CMs), whether you realise it or not. They are present in light switches, zippers, and even your plastic takeaway container. A compliant mechanism is a mechanism that uses one or more flexing features to achieve a mechanical outcome. We use them frequently at the AITC as substitutes for traditional mechanisms, such as bearings, slides, and hinges, which often don't meet the design requirements associated with high accuracy, repeatability, sensitivity, and especially cryogenic environments.
CMs have many benefits such as being backlash-free, oil-free, small in size, low maintenance, and cheap. They really tick many boxes and can be implemented in almost any engineering design requiring moving components. The challenge I found, when starting to use CMs, was determining when to implement them and being able to imagine all the ways a CM could be designed and used to suit many applications. But with more exposure to CMs, this became easier and creative solutions started to flow.
This presentation is a show and tells of the many applications of CMs designed at the AITC, with the hope that it may inspire others during their design process.

IC-CoP / **19**

Australian Synchrotron's motion architecture EtherCat extension

Nader Afshar[None]

Corresponding Author(s): nadera@ansto.gov.au

Australian Synchrotron has a standardised motion system architecture based on pmac motion controllers and epics pmac support software stack, which is developed based on dls pmac driver.

To address current and future expansion requirements, we have drawn a concept to extend our existing platform to connect Motor Drivers, Encoders and IO terminals to the pmac controllers using CAN Over EtherCat and specifically using DS402 and DS406 profiles.

This architecture enables AS to use a broad variety of low-level motion devices using the existing software stack, with all of the developed features including special equipment protection functions, coordinated motion capabilities and templating toolsets.

Also, this architecture provides the necessary scalability without significant new developments nor change/configuration management.

General / **13**

Bearings in cryogenic environments

Nick Herrald[1] ; David Chandler[1] ; Price Ian[1] ; David Broderick[1]

[1] *AITC*

Corresponding Author(s): nick.herrald@anu.edu.au, david.broderick@anu.edu.au, ian.price@anu.edu.au, david.chandler@anu.edu.a

Bearings present engineering challenges in a cryogenic environment, both from geometric control and tribology points of view. Differential thermal strains, resulting from non-similar materials, thermal gradients, differential cooling rates or a lack of suitable lubrication can cause bearing degradation or malfunction. Thermal strain issues can be overcome using by exploiting specific design geometries, whilst tribology problems can be mitigated with dry lubrication and cryogenic compatible surface treatments. We show how these challenges were overcome in a cryogenic mechanism prototype which was recently built at the AITC.

General / **33**

Bringing custom and precsion optics to Australian industry and researchers - OptoFab ACT

Steve Madden[1]

[1] *OptoFab ACT, ANU*

Corresponding Author(s): stephen.madden@anu.edu.au

In this presetation I will introduce the Australian National Nanofabrication Facility on a general level, and then more specifically OptoFab ACT which is a recent new node formed around optical coatings,precision custom optical fabriction, and ultimately optical chips. I will present the current and upcoming capabilties and some exaamples of components and systems we have built.

General / **4**

Characterising the Pelletron at the University of Melbourne

Author(s): Adam Steinberg[1]

Co-author(s): Jacinta Yap [2] ; Suzie Sheehy [2] ; Robert Appleby [3]

[1] *University of Melbourne / University of Melbourne / Cockcroft Institute*

[2] *University of Melbourne*

[3] *University of Manchester*

Corresponding Author(s): jacinta.yap@unimelb.edu.au, suzie.sheehy@unimelb.edu.au, robert.appleby@manchester.ac.uk, adam.steinberg@manchester.ac.uk

The Pelletron at the University of Melbourne has been used for materials analysis and ion implantation since its installation in the 1970s. Today, it is primarily used to produce proton and helium beams up to 3.5 and 1.5MeV respectively, serving three beamlines via a rotating spectrometer magnet. Although the approximate beam current and transverse profile can be measured using the in-built rotating wire scanners and Faraday Cups, neither the beam stability nor transverse distributions have been previously investigated or measured in detail. Using only the diagnostics already installed in the beamlines, we have performed systematic measurements to determine the beam current variation over timescales ranging from milliseconds to hours, leading to increased beam stability with changes to the operating Pelletron settings. In addition, we have performed initial beam distribution measurements using a custom-built slit-grid apparatus. Our beam characterisation techniques could provide a low-cost method to probe parameters of the beam for improvements in the operation and efficiency of similar accelerators.

General / **32**

Cutting Through Time

Stephen Battisson[1]

[1] *ANU*

Corresponding Author(s): stephen.battisson@anu.edu.au

The preparation of Ferromanganese crust samples for AMS studies.

IC-CoP / **7**

Development of 4-Way Slits Control System for the ANTARES accelerator

This talk will describe the design and development of a control system for precise positioning of 4-way slits to be installed at the low energy end of the ANTARES accelerator at the ASTO Centre for Accelerator Science (CAS). The talk will cover the rationale, process and challenges faced in creating and implementing this in house design exercise. Topics covered include Stepper motors, drive selection, EtherCat communications and Beckhoff TwinCAT development software.

General / **3**

Developments at the ANU Heavy Ion Accelerator Facility

Author(s): Peter Linardakis[1]

Co-author(s): Nikolai Lobanov [2] ; Christian Notthoff [3] ; Thomas Tunningley [2] ; Justin Heighway ; Daniel Tempra ; Ross Tranter ; Chris Kafer ; Thomas Kitchen

[1] *Australian National University*

[2] *ANU*

[3] *The Australian National University*

Corresponding Author(s): thomas.tunningley@anu.edu.au, peter.linardakis@anu.edu.au, nikolai.lobanov@anu.edu.au, christian.notthoff@anu.edu.au

The Heavy Ion Accelerator Facility (HIAF) at the Australian National University is reaching a series 50-year milestones in its operation of the 14UD tandem pelletron particle accelerator. Far from fading into the dying light, the accelerator and facility are instead pushing toward the future with an array of major infrastructure initiatives and an expanded range of industry relevant applications. Major capability upgrade projects include construction of a space radiation testing beam line as a component of Australia's National Space Qualification Network (NSQN) and an upgrade of ion beam injection with an additional alpha ion source and beam analysis hardware. Fundamental systems too are undergoing upgrades, with an extensive renewal of control hardware and underlying EPICS software and a replacement of an aging radiation protection system. Perhaps the biggest indicator of the optimism at HIAF amongst the current, shared challenges of the world is the replacement of all ceramic acceleration tubes and posts within the 14UD to increase stability and restore the peak achievable voltage to its historical maximums.

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Easy Build System

Andrew Starritt[1]

[1] *Australian Synchrotron*

Corresponding Author(s): andrews@ansto.gov.au

The accelerator and support infra-structure at the Australian Synchrotron has over 220 different EPICS IOCs, gateways, archivers and operator interfaces items
that need to be built and maintained.
This presentation will give an over view of the tools involved, the methodology,
and the advantages and disadvantages of the system.

General / **27**

HIAF

Mahananda Dasgupta[1]

[1] *ANU*

Corresponding Author(s): mahananda.dasgupta@anu.edu.au

An overview of the ANU Heavy Ion Accelerator Facility.

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Installation of a PLC in the ANTARES accelerator terminal

Andrew Downes[1]

[1] *ANSTO*

Corresponding Author(s): adw@ansto.gov.au

The ANTARES 10MV accelerator at ANSTO was originally built in the 1960's. The terminal was upgraded in the 1990s and early 2000s. It was very basic in operation due to the harsh operating environment and technological limitations at the time. Technology and user requirements have changed significantly since then and a need was identified to increase the capabilities. This presentation discusses the installation and testing of a PLC in the terminal and the challenges of protecting it from the effects of high voltages.

ATF / **9**

Is there potential for a flatter potential?

David Button[1]

[1] *ANSTO, New Illawarra Rd*

Corresponding Author(s): dbu@ansto.gov.au

The Centre for Accelerator Science (CAS) operate four tandem accelerators featuring 3 different charging and terminal potential stabilising systems. This presentation is a discussion about the current methods used to stabilise the terminal potential and inviting other delegates to contribute their knowledge surrounding the limitations of the existing systems and discuss some ideas that might offer further improvements to existing systems and methods. It is hoped to gain insights from other delegates on potential technological enablers.

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Powerbrick Field Automatic Test System

Simin Chen[1]

[1] *ANSTO*

Corresponding Author(s): simin.chen@synchrotron.org.au

Powerbrick has been selected as the preferred motion controller at Austraian Synchrotron. However it has become mandatory to apply site acceptance test (SAT) due to the quality issues found on received units. System level automatic testing significantly reduced the time consumption from hours to minutes. It is also ideal for field testing on the deployed units.

ATF / 16

Radiation Simulation and Beam Dump design for High Energy Electrons at the Australian Synchroron

Eugene Tan[1] ; Rohan Dowd[1] ; David Zhu[1]

[1] *Australian Synchrotron*

Corresponding Author(s): david.zhu@ansto.gov.au, rohan.dowd@ansto.gov.au, eugene.tan@ansto.gov.au

To support growing interest of the use of high energy electrons (40-200 MeV) for detector and medical therapy investigations, we are developing an electron extraction line at the end of the Australian Synchrotron's 100 MeV linear accelerator. While it is within a shielded area, it is desirable to reduce as much as possible the scattered radiation from the beam dump. We have investigated the use of different materials to reduce backscatter through the use of FLUKA modelling and direct measurements and found the addition of Low Z material to the front of the beam dump gives significantly reduced neutron backscatter. Ideas for how this can be implemented in other areas will also be discussed.

IC-CoP / 8

Renewal of Computer Systems at ANSTO Centre for Accelerator Science

Corresponding Author(s): reesm@ansto.gov.au

This talk will outline steps that are being taken at the ANSTO Centre for Accelerator Science (CAS) to renew and restructure our ageing network and computer systems assets. This process is aimed at modernisation of CAS IT and OT infrastructure to facilitate more efficient collection, storage and processing of electronic data, providing staff and customers with greater overall system visibility and reinforcing a positive user experience.

General / 2

SPACE RADIATION TESTING, DOSIMETRY SLITS

Thomas Tunningley[1]

[1] *ANU*

Corresponding Author(s): thomas.tunningley@anu.edu.au

The ANU has been awarded funding to develop a simulated space radiation testing facility. The facility is aimed at qualifying electronic components for use in space projects. Radiation will be produced and targeted at electronic equipment to measure the effects at a component level. Two of the parts required in this system are: slits for defining the area of irradiation, and dosimetry to provide measurement of radiation. The system must be capable of handling a large range of fluxes, with real-time measurement at low-levels. At ANU, a system has been designed to meet all these requirements in a compact and novel way. This presentation will detail the design requirements and the development of the system from concept to reality.

ATF / **21**

Simulations and design of a compact beamline at the University of Melbourne X-lab

Scott Williams[1] ; Rohan Dowd[2] ; Matteo Volpi[1] ; Geoffrey Taylor[3]

[1] *The University of Melbourne*

[2] *Australian Synchrotron*

[3] *University of Melbourne*

Corresponding Author(s): m.volpi@unimelb.edu.au, gntaylor@unimelb.edu.au, rohan.dowd@ansto.gov.au, scottdw@student.unimelb.edu.au

As part of the development of the University of Melbourne X-band Laboratory for Accelerators and Beams (X-LAB) we have been advancing the conceptual design and simulations of a compact low emittance beamline to be based in the newly re-developed beam hall.
Proposed applications of the beamline include radiation dosimetry, as well as the electron source for an Inverse Compton Scattering (ICS) X-ray light source.

As part of commissioning, it is expected to use a DC photogun plus an additional bunching section for acceptance into the main accelerating section.
The main accelerating section itself is composed of two high gradient X-band linear accelerating structures operating at an expected average gradient of 70MV/m.
For the ICS X-ray source, a quadrupole focusing array is used to focus the beam to a small spot size for interaction with a laser pulse.

For this talk we shall comment on the simulation process of the beamline which utilises multiple simulation codes at various stages of the beamline, the proposed use of a DC gun and S-band accelerating segment for initial commissioning, the conceptual design of the quadrupole focusing array, and expected photon yields.

General / **30**

Software/Firmware/Hardware testing and verification flows in SKAO

Malte Marquarding[1]

[1] *CSIRO*

Corresponding Author(s): malte.marquarding@csiro.au

From requirements to execution of test on hardware and then back using JAMA, JIRA, CICD, tango, k8s and hardware.

General / **29**

Space Projects

Alexey Grigoriev[1]

[1] *ANU*

Corresponding Author(s): alexey.grigoriev@anu.edu.au

Alexey will present on some of the spacecraft missions he has been involved in.

General / **25**

The National Space Test Facility

Eduardo Trifoni[1]

[1] *ANU*

Corresponding Author(s): eduardo.trifoni@anu.edu.au

This talk will outline the Space Test Facility run by the Advanced Instrumentation Technology Centre at the ANU Mount Stromlo Observatory.

General / **15**

The southern hemisphere's first X-band radio-frequency test facility at the University of Melbourne.

Matteo Volpi[1]

[1] *The University of Melbourne*

Corresponding Author(s): m.volpi@unimelb.edu.au

The first Southern Hemisphere X-band Laboratory for Accelerators and Beams (X-LAB) is under construction at the University of Melbourne, and it will operate CERN X-band test stand containing two 12GHz 6MW klystron amplifiers. By power combination through hybrid couplers and the use of pulse compressors, up to 50 MW of peak power can be sent to any of 2 test slots at pulse repetition rates up to 400 Hz. The test stand is dedicated to RF conditioning and testing CLIC's high gradient accelerating structures beyond 100 MV/m. It will also form the basis for developing a compact accelerator for medical applications, such as radiotherapy and compact light sources. Australian researchers working as part of a collaboration between the University of Melbourne, international universities, national industries, the Australian Synchrotron -ANSTO, Canadian Light Source and the CERN believe that creating a laboratory for novel accelerator research in Australia could drive technological and medical innovation.

IC-CoP / **5**

Updating the 14UD control system at HIAF (ANU)

Author(s): Christian Notthoff[1]

Co-author(s): Peter Linardakis [2] ; Daniel Tempra [2] ; Stephen Battison [2]

[1] *The Australian National University*

[2] *Australian National University*

Corresponding Author(s): christian.notthoff@anu.edu.au, peter.linardakis@anu.edu.au

The current control system is based on an Ubuntu 12 (32 bit) server and EPICS version 3.14.11-dirty. The server provides EPICS IOC's to four VME crates and a few arm based IOC's via tftp boot. All IOC's run the same iocApp with different st.cmd and data base files to form the accelerator control system. In addition all control terminals are thick clients booting from the Ubuntu 12 server, which provide a python based control screen to operate the accelerator.
In this contribution I will present our ideas for restructuring/reprogramming the control system and operator screens.
We are planing to update EPICS to R7 where possible, program a new operator screen based on qeframework and alpine Linux, and restructure the overall architecture utilising docker and Gitlab. The aim is to make the system independent of the underlying operating system and partially decentralised (using three servers), so that a single server failure can be compensated by redistributing the services to the remaining servers. Gitlab's CI/CD tools seem to be a promising path to automate some of the maintenance and deployment tasks using git repositories to keep track of changes.

General / **1**

What is Model Based Systems Engineering?

David Brodrick[1]

[1] *ANU*

Corresponding Author(s): david.brodrick@anu.edu.au

Model Based Systems Engineering is something I wish I had discovered much earlier in my career. It is an effective way to help manage the architecture, interfaces and requirements of complex instrumentation projects. I will use this opportunity to provide a brief introduction and reflect on some of the ways we have used MBSE for our projects at AITC.

ATF / **18**

X-ray Beam Position Monitor Development at the Australian Synchrotron.

Eugene Tan[1] ; Lin Rebecca[None] ; Porsa Sina [None] ; Jonathan McKinlay[None]

[1] *Australian Synchrotron*

Corresponding Author(s): eugene.tan@ansto.gov.au

A prototype X-ray Beam Position Monitor (XBPM) has been developed and tested at the Australian Synchrotron. This talk will outline the design consideration, fabrication and initial results for the XBPM. A review of the lessons learned and changes being made of the second iteration will be presented.