

Nuclear Physics Graduate School: Nuclear Instrumentation Module Specification

The aims of this module are:

To give a practical and theoretical knowledge of the basic electronics and electronic instrumentation used in nuclear measurements. This will cover both analogue and digital systems.

The learning outcomes are:

- Knowledge of the principles of the use of electronic instrumentation for spectroscopic, count rate and timing measurements
- The ability to set up and use NIM electronics and digital systems for spectroscopic, count rate and timing measurements

On completion of this module, students should be able to:

- Know the characteristics of pulses produced from fast-pulse processing units
- Set an energy threshold using a discriminator
- Understand the influence of differentiation and integration time constants
- Setup a TAC in a coincidence circuit
- Acquire and time-calibrate TAC spectra
- Setup and operate a multichannel digital system
- Understand the basic operation of a trapezoidal energy filter
- Merge and analyse digital time-stamped data
- Identify the components of a detector scanning system.
- Understand features of the AGATA segmented detectors.
- Sort digital detector data

Syllabus:

This module, which will be delivered at the University of Liverpool, will include lectures on the following topics:

- Fast timing using analogue electronics
- Digital spectroscopy and coincidence timing
- High Purity Germanium Detector characterisation and analysis

The module will have three lectures; all presented by experts in nuclear instrumentation. The module has an extensive practical component, which allows the key aspects of analogue, digital and multichannel digital systems to be covered.

Lecture 1 will cover:

- Components of an analogue pulse height analysis system
- Components of an analogue fast timing setup (TFA, CDF, LED)
- Jitter, walk and drift
- Attenuation in cables
- TAC measurements and time resolution

Lecture 2 will cover:

- Comparison of analogue and digital PHA (an overview)
- Why digitise detector signals?
- Signal digitisation
- Digitiser types
- Energy filter (MWD)
- Timing filter
- Multichannel digital systems
- Digital coincidence / TAC measurements

Lecture 3 will cover:

- Identify the components of a detector scanning system.
- Understand features of the AGATA segmented detectors.
- Sort digital detector data utilising the MTSort package.
- Identify key features for detector characterisation