Welcome!

A short Introduction and Overview

Philip King
ISIS Muons
Outline

A bit about ISIS
- how ISIS works

Muons at ISIS
- history, usage

Overview of the Training Course
ISIS

- 28 Neutron and muon instruments (soon to be 35)
- 700 Experiments per year
- 3000 Instrument-days per year
- 500 Publications per year
- 2000-strong user base
- 360 staff
- £2-3M electricity bill
Science at ISIS

- Archeometry
- Bio-molecular Science
- Earth / Planetary Science
- Engineering
- Hydrogen Storage
- Surfaces & Interfaces
- Superconductivity / Magnetism
- Environmental Science
The ISIS Pulsed Neutron and Muon Source

A World Centre for Condensed Matter Science with Neutrons and Muons
The ISIS Accelerators

- Ion source
- Linear accelerator
- Synchrotron accelerator
- Extracted proton beam (to targets)
- 800 MeV proton beam
- 800 MeV synchrotron
- 70 MeV H⁻ Linac
- HEP Test Beam

Science & Technology Facilities Council
The ISIS Accelerators

The beginning - the Ion Source

Produces H⁻ ions and accelerates them to 665 keV.
The ISIS Accelerators

The middle - the Linear Accelerator

Accelerates the H⁻ ions to 70 MeV.
The ISIS Accelerators

The final stage - the Synchrotron Accelerator

H⁻ ions stripped to protons
Protons travel ~10,000 times round
Accelerated to 800 MeV (84% light speed)
The ISIS Targets

The Neutron Target

Tantalum target
Neutrons produced by ‘spallation’
Heat dissipation is 160 kW
The ISIS Targets

The **Muon Target**

Carbon target, 10 mm thick
Takes 2-3% of the proton beam
The Second Target Station Project

- £150M project
- Designed to meet future scientific needs in the key areas of:
  - Soft Matter
  - Advanced Materials
  - Bio-molecular Science
- First proton beam to target area: Dec 2007
- First measured neutrons: Spring 2008
- Start of experimental programme: Oct 2008
The ISIS Pulsed Neutron and Muon Source

• ISIS runs ~180 days per year
• It runs in ‘cycles’ of 30-40 days each
• ISIS is controlled from the Main Control Room - which is always staffed
Muons at ISIS
A Brief History of EC ISIS Muons

1985: Construction - EC, UK, Italy, France, Germany, Sweden

1987: First muons - single beamline (MuSR)

1991: Construction of beamline upgrade - EC-funded

1993: 3 beamlines operational (MuSR, EMU, DEVA)

1996 - 2008: €3.9M in EC Access funding

1998-2000: DEVA RF-spectrometer built (EPSRC)

2005-2009: HiFi constructed (£2.1M)

2007: 20th birthday!
Usage of EC ISIS Muons

The last 3 ISIS proposal rounds (June 2006 - December 2007):

Applications from

19 different countries (UK + 11 European + 7 outside Europe)
67 separate research groups have made applications
738 days applied for: 417 available (1.8 oversubscription)
~35% of applicants are regular neutron users
Average of 50 publications per year over the past 8 years

Usage of EC ISIS Muons

Chemistry and molecular studies

Hydrogen studies
- Other H studies
  - H in other semiconductors
  - H in II-VIs and oxides
- Light particle diffusion
- Polymer charge transport
- Ion/proton transport

Charge transport and diffusion

Inorganic magnetism and superconductivity
- Organic magnetism and supercond.
- Inorg. magnetism
- Inorg. supercond.
- Spintronics

Organic magnetism and superconductivity
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<thead>
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The lectures take place in the conference room on the first floor of R78.
## Experiment Timetable

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**AFM = Observation of an antiferromagnetic phase transition.**

**CdS = Muonium in CdS.**

**Cu = Muon diffusion in copper.**

**F-μ-F = Observation of the F-μ-F state in a fluorinated polymer.**

**High $T_c$ = Measurement of the London penetration depth in a high-$T_c$ superconductor.**
Muon People!

Steve Cottrell

Sean Giblin

Francis Pratt

James Lord

Iain McKenzie

Steve Cox

Adrian Hillier

Zaher Salman