

Icy Durham Practical Course: Risk Assessment.

Description of event: (to include enough information to establish the foreseeable hazards)	Location(s): (where will the activity or task take place?)	Date:
CDT practical workshop consisting of lectures, hands-on practical sessions, and on-site coffee and lunch breaks. There is expected to be a maximum of 30 students, 5 lecturers, and 6 laboratory demonstrators. <u>The practical workshop sessions include:</u> 1. The mounting of a high temperature superconducting (HTS) sample to a brass sample platform using Pb-Sn solder. 2. Attaching the mounted sample to the measurement probe. 3. Positioning the measurement probe into the iron core magnet apparatus. 4. Electrically connecting the power and control cabling from the data acquisition instrumentation setup to the measurement probe. 5. Cooling and maintaining the test temperature of -196 °C using liquid nitrogen in the sample Dewar. 6. Using a bespoke LabView data acquisition program to measure the critical current of the HTS sample at -196 °C and at different applied magnetic fields up to 0.7 T. 7. Once the measurements are completed, the above process is then reversed, ready for the next practical session. <u>The project will include the use of:</u> 1. Soldering at temperatures up to 250 °C using lead-tin solder, solder flux, filtered fume extractor and a hot plate. 2. The solvent Isopropanol to clean surfaces and solder flux from soldered parts. 3. Cryogenic liquids (nitrogen @ -196 °C) 4. High magnetic fields up to 0.7 T using an iron core electromagnet. 5. High current (low voltage – 10 V max) power supply (up to 120 A) 6. Computer and instrumentation equipment such as multimeters.	Lectures and briefings: The Sir James Knott library (Ph132). Practical sessions: In the Superconductivity Group's laboratories, Ph 42, 44, 48, and 72. Coffee and lunch breaks: In the Bransdon room (Ph221).	From: 07/01/2026 To: 09/01/2026
Most significant risk(s):	Required equipment: (including PPE, tools, chemicals etc.)	
1. Medical emergencies. 2. Hot burns from soldering equipment. 3. Cold burns from cryogenic liquids. 4. Asphyxiation from cryogenic liquid boil-off gas.	5. Fire. 6. Electric shock from electrical equipment. 7. Slips and trips in the laboratories and more generally while moving around the building. See the course booklet, "Step-by-step: Critical Current Measurements on High Temperature Superconducting Tape," page 4 of 12 for a full list of required equipment and personal protective equipment.	

Hazards (things with the potential to cause harm)	Those at risk (people who could be harmed)	How could they be harmed? (nature of injuries, damage that could result)	Uncontrolled risk level (level of risk without control)	Required controls (how the risk can be removed or reduced by for example engineered methods, safe systems of work, training and/ or personal protective equipment)	Controlled risk level (level of risk remaining when controls are in place)
Medical emergencies	Attendees and staff.	Incidents arising from any of the hazards on this form and/or other incidents from pre-existing conditions e.g. diabetic fit, heart attack etc.	5 x 4 High Risk	All departmental first aiders have received appropriate training. In the event of a medical issue the organisers will consult a departmental first aider (for example lab technician). The department maintains suitable first aid provision based on the expected activities and attendee numbers for this event. For minor first aid requirements, individuals will be encouraged to self administer first aid, this may be under the direction of a trained first aider. Where a first aider is required (and not available in the building) Security will be contacted on 0191 3342222. In the event of a serious health concern, the emergency services will be contacted immediately on 999. Security will also be notified to help direct the ambulance to the correct location and to provide additional support. The postcode for the Physics Buildings, should it be required, is DH1 3LE. Additional first aid boxes can be found at Rochester, Ogden Centre (East) and Ogden Centre (West) receptions. Easily accessible Defibrillators are available in wall mounted cases at Rochester, Ogden Centre (East) and Ogden Centre (West) receptions. Guidance on who to contact in the event of an emergency can be found on wall signage throughout the department and on the departmental web pages.	2 x 2 Low Risk
Use of Lifts	Attendees and staff.	Failure of lift resulting in occupant's being trapped.	5 x 4 High Risk	Attendees will be shown and encouraged to use stairs where able, and to limit the use of the lift to persons with mobility or health issues. There is signage inside the lifts indicating passenger limits. Emergency contact is provided in all lifts. Attendees will be reminded not to use lifts during any emergency evacuation of the department.	2 x 2 Low Risk

Violence and aggression, riots and protests	Attendees and staff.	Physical and/or psychological distress.	4 x 3 Medium Risk	The organisers will alert the University Security team as soon as possible in the event of any violence or aggression during the workshop, which cannot be amicably resolved by the organisers. Persons who are deemed a risk (due to their behaviour) will be ejected from the workshop. Attendees will be reminded that they should conduct themselves in a respectable manner and that there is a zero tolerance for violent, abusive, bullying and/or harassing behaviour. In the event that the workshop is disrupted due to any rioting or protests on campus the organisers will seek guidance on safety routes from University security and or police officers in attendance. In such circumstances the organisers will do their utmost to keep attendees informed of developments, should the workshop need to be relocated or cancelled etc.	2 x 2 Low Risk
Slips and trips	Attendees and staff.	Trip over objects or slip on spillages causing sprains or fractures.	4 x 4 High Risk	All attendees will be reminded of good housekeeping practices and common sense whilst in the department e.g. no running, making excessive noise etc. Attendees will be encouraged to keep all power chords off the floor and on their work stations during the practical sessions in Ph42, 44, 48, and 72.	3 x 2 Low Risk
Fire	Attendees and staff.	Fatal injuries from smoke inhalation/burns	5 x 4 High Risk	At the start of the event, all attendees will receive a verbal briefing of what to do in the event of a fire, such as the fire alarm being activated. Attendees will not be familiar with the layout of the building or the evacuation procedure, thus they will be told/shown their nearest fire exit and/or escape route, including where to congregate so a register can be taken. The Department has an evacuation plan that has been tested. Fire alarms are tested regularly. Fire drills are carried out at least 4 times per year. All corridors and stairs must be kept free of combustible items. Equipment should be switched off when not in use for long periods. A Department fire risk assessment has been completed and adequate fire safety measures are in place. Staff are made aware of fire notices, break glasses, fire extinguishers and where to assemble in the event of an evacuation.	2 x 2 Low Risk

Work equipment (mechanical and electrical)	Attendees and staff.	Electrical shocks or burns from using faulty electrical equipment. Staff may also suffer injury from moving parts of equipment or unbalanced equipment.	5 x 3 High Risk	<i>Each laboratory will have at least one supervisor present at all times.</i> All new equipment is checked before first use to ensure there are no obvious accessible dangerous moving parts, and equipment siting does not introduce additional hazards. Course team staff are all trained in the use of the equipment where necessary. Damaged or defective equipment must not be used and a member of staff informed of the problem/danger. Staff will remove the item from use. All electrical equipment is (and should be) PAT tested (see date on PAT test label). All accessible power sockets are UK 240 V AC. Attendees may use these sockets, for example, to power their personal laptops. All attendees are required to use a suitable adaptor if their device does not have a standard UK 3-pin plug. The layout of the work stations with the power sockets minimises the risk of trip hazards with cables running across the floor. All attendees will be instructed on the laboratory rules and best-practices.	2 x 2 Low Risk
Manual handling	Attendees and staff.	Strains or sprains and injuries or back pain from handling heavy/bulky objects, e.g. while positioning the measurement probe into the measurement station.	3 x 2 Low Risk	None of the equipment likely to be moved by attendees is of a weight considered to be physically dangerous. The heaviest item to be moved by attendees (measurement probe) is long enough to be safely and simultaneously handled by multiple people. Attendees will work in Groups of at least two people. No less than two people should attempt to move a probe.	2 x 1 Low Risk
Working at height (use of step ladders)	Attendees and staff.	Bruising and fractures. Falls from height.	4 x 4 High Risk	The only task in this practical course that might require an attendee/staff member to use a ladder, is when attaching current leads and instrumentation plugs to the probe head. This, however, is unlikely to be needed. In the first instance, ask a staff member for help. The staff member will decide if a ladder should be used. 6 Monthly inspections of equipment are undertaken and recorded by a member of the Mechanical Workshop. A ladder register is held by the Health and Safety Coordinator for the department. http://www.hse.gov.uk/work-at-height/stepladders.htm Never use a desk chair or shelf to access items at height. Where defects are identified the ladders should be quarantined and appropriately marked so that they cannot be used. New ladders should be acquired and the damaged equipment suitably disposed of.	4 x 2 Medium Risk

Dangerous substance – Isopropanol (solvent)	Attendees and staff.	- Serious eye damage or irritation. - Can cause drowsiness or dizziness. - May cause breathing difficulties. - May cause central nervous system depression. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting.	3 x 3 Medium Risk	<i>Each laboratory will have at least one supervisor present at all times.</i> This substance is unlikely to be needed, but if needed, only a very small amount will be required. Dedicated dispensing bottles are provided, which restrict spillages if knocked over. Additionally, each dedicated bottle will only contain a small volume of the substance. There will only be one dedicated bottle per laboratory. <i>All staff and course attendees should read the COSHH (Care of Substances Hazardous to Health) form, "COSHH [01] - Isopropanol," prior to commencing the laboratory sessions.</i>	2 x 2 Low Risk
Cryogenic liquids – Liquid Nitrogen (-196°C)	Attendees and staff.	- Liquid gases and their cold vapours can damage the skin, eyes, mucous membranes and lungs with effects similar to a heat burn. They can also cause frostbite or other damage to unprotected parts, especially the lungs and eyes. - The low viscosity of cryogenic liquids means that they will penetrate woven or other porous clothing materials very easily. - Unprotected parts of the body coming into contact with uninsulated, cold equipment, may be freeze-welded to it and be torn upon removal. Because of the speed at which nerves are damaged, there may be little warning that damage is being done i.e. damage occurs before pain is felt. - When cryogens are being dispensed, the effective temperature of visible vapour clouds, caused by the condensation of water vapour in the air, is -40 °C. and it is likely that oxygen concentrations within clouds are significantly reduced. General hypothermia may occur at temperatures up to 10 °C. Transient exposure may cause breathing discomfort and provoke an attack of asthma in susceptible people. The potential of an asthma attack in the context of an already oxygen	5 x 3 High Risk	<i>Each laboratory will have at least one supervisor present at all times.</i> The only cryogen that will be used is liquid nitrogen (-196 °C). The laboratories will be well ventilated. They will have at least one window and door open at all times. Each laboratory is fitted with an oxygen monitor that has an audible alarm if the oxygen level unacceptably reduces. If the oxygen meter alarm goes off, everyone should leave the laboratory immediately and wait for further instructions from the supervising staff member. All liquid nitrogen transfers from the 200 L Dewar to a mobile 4 L bucket, will be carried out by a trained staff member. Everyone who is to transport liquid nitrogen within, or between, laboratories must wear protective goggles and cryogenic gloves, and must be appropriately dressed. They must also be accompanied by another team member to make sure they have a clear route back to their laboratory and to open doors along the way. <i>All staff and course attendees should read the COSHH (Care of Substances Hazardous to Health) form, "COSHH[02] Liquid Nitrogen," prior to commencing the laboratory sessions.</i>	2 x 2 Low Risk

		depleted atmosphere is particularly problematic. • Cryogenic liquids will evaporate and their gases will change the composition of the air they mix with. Small amounts of liquid produces large volumes of gas. With the exception of liquid oxygen, which will create other types of hazard, this will replace some or most of the air in the local environment, reducing local oxygen levels. • Normally oxygen makes up 21% of the air we breathe. However, our senses are not able to detect oxygen levels directly. Hence, we will not become aware of oxygen deficiency within the room. • In general, oxygen deficiency leads to: 1. Loss of mental alertness. Distortion of judgement and reduced performance. 2. Asphyxia due to oxygen deficiency is often rapid with no prior warning to the victim. Risk of fire due to oxygen enrichment: Open vessels of liquid nitrogen are cold enough to condense oxygen from the atmosphere, so be aware of the reactive nature of oxygen or oxygen-enriched liquid nitrogen to organic substances – even when liquid. The low viscosity of cryogenic liquids means that they will penetrate woven or other porous clothing materials much faster than, for example, water. As a result, a small amount of oxygen-enriched cryogenic liquid encountering clothing poses a significant fire hazard.			
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Soldering with a soldering iron and hot plate.	Attendees and staff.	- Fumes emitted during soldering may irritate the eyes, skin, nose, throat and lungs. - May cause damage to organs (Blood, Kidney, Central Nervous system) through prolonged or repeated exposure (inhalation-dust, oral). - May damage fertility. - May damage an unborn child. - May cause harm to breast-fed children. - Burns due to handling accidents with the soldering iron. Burns due to handling accidents with the hot plate.	4 x 3 Medium Risk	<i>Each laboratory will have at least one supervisor present at all times.</i> It is necessary to use Lead-tin solder, as opposed to lead-free solder, due to it having a lower melting point, which subjects the high temperature superconducting tape to less damaging heat. There will be no opportunity for <i>prolonged</i> exposure to solder fumes during the laboratory sessions. Each soldering station has a dedicated, positionable, filtered extractor fan that can be placed in a location most suitable for fume extraction. Each laboratory will be well ventilated with at least one window and entrance door open to ensure fresh air throughput. Each soldering station will have access to protective gloves to guard against burns from hot parts/surfaces. <i>All staff and course attendees should read the COSHH (Care of Substances Hazardous to Health) form, "COSHH[03] PbSn Solder," prior to commencing the laboratory sessions.</i>	2 x 2 Low Risk
Intense magnetic fields	Attendees, staff and passersby.	- Magnetic fields above 0.5 mT can be harmful/dangerous to those with pacemakers. - Very high magnetic fields can cause heating in medical implants.	5 x 3 High Risk	<i>Each laboratory will have at least one supervisor present at all times.</i> The 5 Gauss line, which is the perimeter around the magnet beyond which the magnetic field is less than 0.5 mT) is situated within the laboratory and therefore no special measures need to be taken to restrict corridor access outside the laboratory to passersby. However, there should be restricted access to laboratories to people who are not involved with the workshop. The magnets to be used are iron core magnets that have a maximum magnetic field between their poles of 0.7 T. Anyone with pacemakers or metal implants should consult the course leaders before commencing the laboratory sessions.	1 x 2 Low Risk

Internal Guidance/Linked Documents:		COSHH [01] – Isopropanol COSHH [02] - Liquid Nitrogen COSHH [03] - PbSn Solder	
Competence Requirements:		Supervisory staff will be available in all laboratories during the workshop practical sessions.	
Supervisor/Manager Review and Comment:			
Assessment Prepared by		Supervisor/Manager acceptance	
Name:	Dr. Mark J. Raine	Name:	Prof. Damian Hampshire
Signature:	M. Raine	Signature:	D. Hampshire
Date:	08/10/2025	Date:	08/10/2025
This risk assessment should be read by those performing and supervising the work in conjunction with all relevant documentation including method statements and safe systems of work			

Health and Safety Risk Matrix

			Probability/ likelihood of risk realisation				
			Almost Impossible (1)	Not Likely to occur (2)	Could occur (3)	Known to occur (4)	Common occurrence (5)
			A freak combination of factors would be required for risk to be realised	A rare combination of factors would be required for risk to be realised	Could happen when additional factors are present otherwise unlikely to occur	Not certain to happen but an additional factor may result in risk being realised	Almost inevitable that risk will be realised
Potential Consequences	Severe (5)	One or more fatalities. Irreversible health problems	5	10	15	20	25
	Major (4)	Partial or medium-term, disabilities or major health problems	4	8	12	16	20
	Moderate (3)	Lost-time injuries or potential medium-term health problems	3	6	9	12	15
	Minor (2)	Minor, very short-term health concerns on recordable injury cases.	2	4	6	8	10
	Insignificant (1)	Inherently safe, unlikely to cause health problems or injuries	1	2	3	4	5

Extreme risk	High risk	Medium risk	Low risk