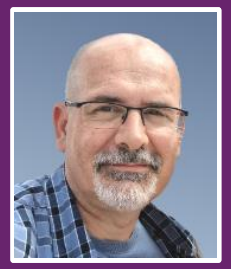
# Durham Practical Course




Presented by:

**Dr Mark J Raine**
m.j.raine@durham.ac.uk

Chief Experimental Officer
Physics Department, Durham University
Superconductivity Group (DUSG)

and Prof. Damian P. Hampshire


January 2025

# OVERVIEW



1. 

**Course Team Members**
and other business

2. 
**RISK & COSHH Forms**

3. 

**Responsibility**

4. 
**In the Event of Fire**

5. 

**Staying Safe in the Laboratory**

6. 
**Using Liquid Nitrogen**

# Course Team Members/Demonstrators



## Course Leader

Prof. Damian Hampshire

## Course Demonstrators

### Computational

Prof. Rifa El-Khozondar

Charles Haddon

Yahya Nasir

### Experimental

Dr. Mark J. Raine

Daniel Scobbie

Rollo Hudson

Emma Gillard

# Lunch Break

**Today lunch is 13:00 to 14:00 hrs**

**One of the course team will show you the way to the Palatine Centre.**

# Cathedral Tour

Tomorrow starting 18:30 hrs

Meet inside the Cathedral's main entrance near the font

# CDT Dinner - Uno Momento Italian Restaurant




**Tomorrow evening at 20:00 hrs**

**One of the course team will show you the way to the restaurant.**

**Meal choices form**

# RISK & COSHH Forms



- The risks for the practical tasks are contained in the course **RISK Assessment** and **COSHH forms** and **you all should have read** those forms.

- At coffee this morning you must all **sign** the H&S form to say you have read and understood the **RISK** and **COSHH** assessments.

**RISK**

Durham University — Inspiring the extraordinary

**Icy Durham Practical Course: 6th - 8th January 2025 – 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.*<br>*The practical workshop sessions include:*<br>1. *The mounting of a high temperature superconducting (HTS) sample to a brass sample platform using Pb-Sn solder.*<br>2. *Attaching the mounted sample to the measurement probe.*<br>3. *Positioning the measurement probe into the iron core magnet apparatus.*<br>4. *Electrically connecting the power and control cabling from the data acquisition instrumentation setup to the measurement probe.*<br>5. *Cooling and maintaining the test temperature of ~196 °C using liquid nitrogen in the sample Dewar.*<br>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.*<br>7. *Once the measurements are completed, the above process is then reversed, ready for the next practical session.*<br>*The project will include the use of:*<br>1. *Soldering at temperatures up to 250 °C using lead-tin solder, solder flux, filtered fume extractor and a hot plate.*<br>2. *The solvent Isopropanol to clean surfaces and solder flux from soldered parts.*<br>3. *Cryogenic liquids (nitrogen @ ~196 °C)*<br>4. *High magnetic fields up to 0.7 T using an iron core electromagnet.*<br>5. *High current (low voltage – 10 V max) power supply (up to 120 A)*<br>6. *Computer and instrumentation equipment such as multimeters.* | ***Lectures and briefings**: The Sir James Knott library (Ph132).*<br>***Practical sessions**: In the Superconductivity Group's laboratories, Ph 42, 44, 48, and 72.*<br>***Coffee and lunch breaks**: In the Bransdon room (Ph221).* | *From: 06/01/2025*<br>*To: 08/01/2025* |
| **Most significant risk(s):** | | **Required equipment:** *(including PPE, tools, chemicals etc.)* |
| 1. *Medical emergencies.*<br>2. *Hot burns from soldering equipment.*<br>3. *Cold burns from cryogenic liquids.*<br>4. *Asphyxiation from cryogenic liquid boil-off gas.*<br>5. *Fire.*<br>6. *Electric shock from electrical equipment.*<br>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.* |

Health and Safety Service — Form F2 (V2.0 October 2019) — 1

**COSHH**

Durham University | Responsible Safety … together we can stay safe & healthy.

**COSHH Assessment Form [02]**

| **Name of Substance:** | LIQUID NITROGEN | **Reference:** | CAS No. 7727-37-9 | |
|---|---|---|---|---|
| 1. Eliminating the hazardous substances: Is it possible to avoid the need to use the hazardous substance and safely dispose of existing quantities? | | | ~~Yes~~ | No |
| 2. Substitution: Is it possible to use a less harmful substance to do the work? | | | ~~Yes~~ | No |

**Before beginning work on the COSHH assessment process ensure you have a copy of the latest Manufacturers Safety Data Sheet (MSDS) for the substance. MSDS's are available from suppliers and manufacturers of products.**

| 3. Describe the activity or work process. Note: Include how long the task will take, how often it will be repeated and how much of the substance is used . | **TRANSFERRING or DECANTING**<br>Description of use:<br>Liquid nitrogen (-196 °C) is used to cool high-temperatrure superconducting samples below their transition temperatures.<br>Process and exposure duration:<br>The process consists of a trained person decanting from a 200 L liquid nitrogen Dewar into a 4 L hand-held plastic laboratory Dewar (this should take no more than 1.5 minutes) for either direct use at that location or manual transport to another nearby location by a course attendee from which it is then poured into the final sample Dewar. This process might need to be repeated multiple times.<br>Substance amount and handling:<br>When decanting from the 200 L Dewar into a smaller laboratory Dewar, no more than 4 L of liquid nitrogen will be transferred in one continuous period.<br>**INITIAL WARNINGS**:<br>Do not use liquid cryogens unless you have been adequately trained and you feel competent to do so. Always wear personal protective equipment and employ all good practices at all times. | **How long?** | **How often?** | **How much?** |
|---|---|---|---|---|
| | | Explicit exposure to cold liquid <3 min | As often as required | <4 L at a time. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Location of work:** | Laboratory | | | | | | | | |
| **Persons at risk:** | Employees | ✓ | Students | ✓ | Others | ✓ | Vulnerable persons | ✗ | |

Health and Safety Service — Forms F4 — V1.4

**SIGN**

1

CDT Practical Course 6th to 8th January 20[illegible]
RISK & COSHH Assessments

By signing this form, I confirm that I have read the RISK and COSHH assessments, I understand the risks and hazards, and I will follow all safety procedures.

| | NAME | SIGNATURE | DATE |
|---|---|---|---|
| Lab 42 | Armitage, Lucy | | |
| | Bader, Amro | | |
| | Beggan, Sean | | |
| | Bundschuh, Noé | | |
| | Butterworth, Leon | | |
| | Christon, Conor | | |
| | Daniels, Freddie | | |
| | Edmunds, Ethan | | |
| Lab 44 | Edwards, Charles | | |
| | Elliot, Ryan | | |
| | Hashemi, Bardia | | |
| | Kosimov, Dalir | | |
| | McCabe, Ruairi | | |
| | McGlothlen, Greg | | |

**COSHH**:
**C**are **O**f **S**ubstances **H**azardous to **H**ealth

# RESPONSIBILITY

**ALWAYS REMEMBER**:

- **You** are ***responsible*** for your *own safety*, and also for the *safety of those around you*.
- You must take **reasonable care** for the health and safety ***of anyone who may be affected by what you do or fail to do***.


IN THE
EVENT OF
FIRE!

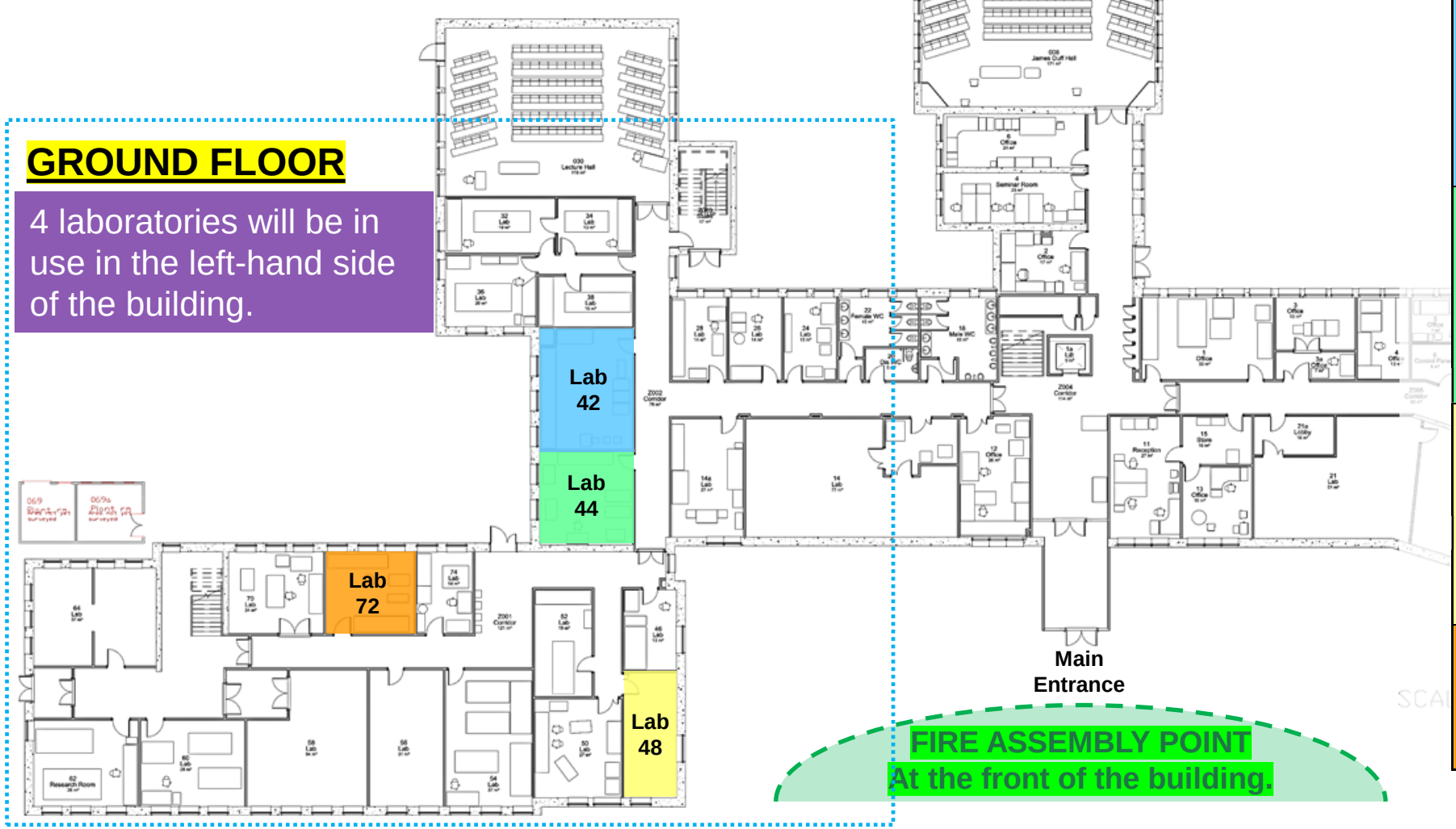
# In the Event of a Fire



Demonstrators will guide you to the **Fire Assembly Point**

## GROUND FLOOR

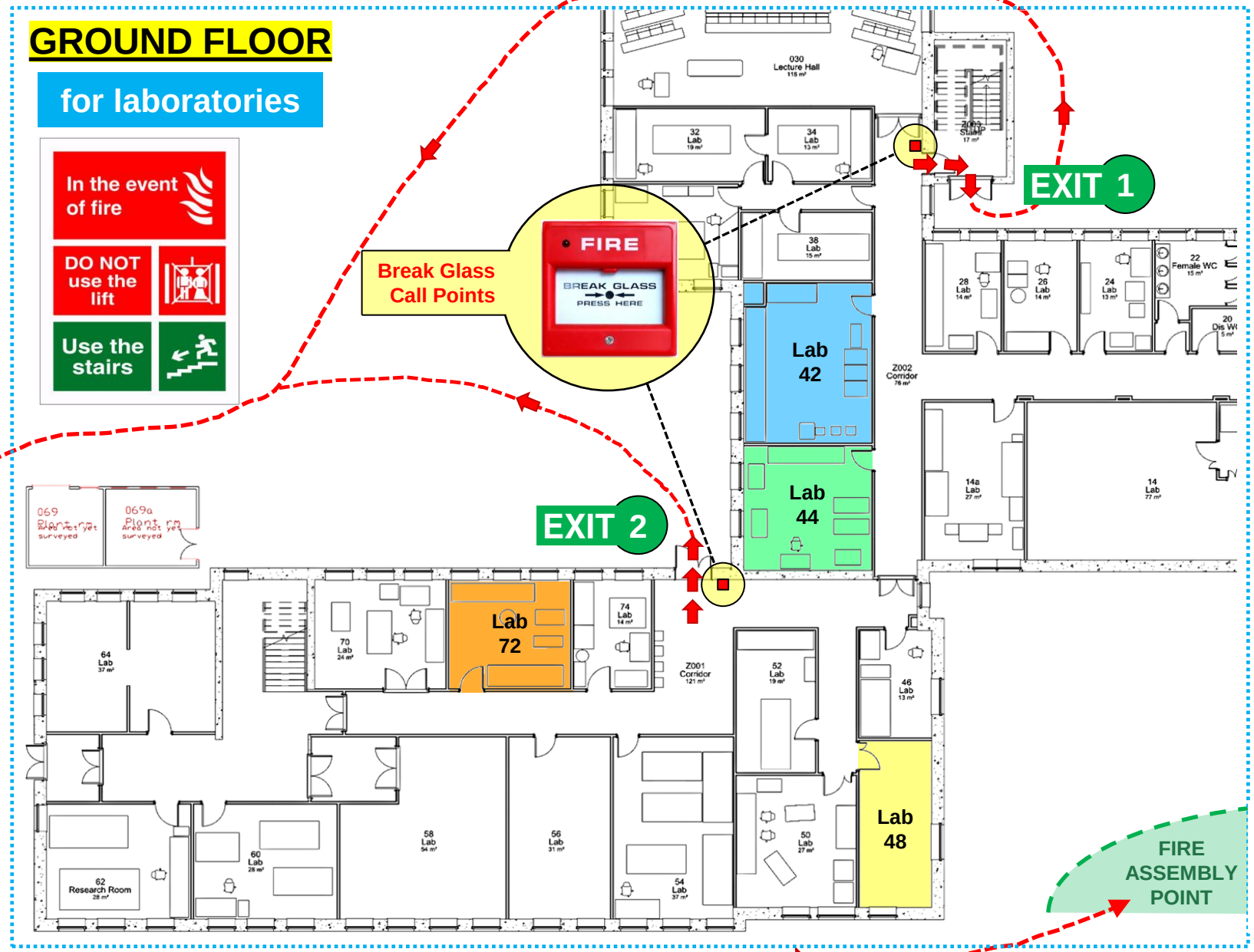
4 laboratories will be in use in the left-hand side of the building.




| LABORATORY | NAME |
|---|---|
| Lab 42 | Armitage, Lucy |
| | Bader, Amro |
| | Beggan, Sean |
| | Bundschuh, Noé |
| | Butterworth, Leon |
| | Christon, Conor |
| | Daniels, Freddie |
| | Edmunds, Ethan |
| | Reddy, Sanjana |
| Lab 44 | Edwards, Charles |
| | Elliot, Ryan |
| | Hashemi, Bardia |
| | Kosimov, Dalir |
| | McCabe, Ruairi |
| | McGlothlen, Greg |
| Lab 48 | Oxley, Matthew |
| | Pinto, Emir |
| | Robertson, Oliver |
| | Rolph, Brodie |
| | Saputil, Ryan |
| | Shih, Lin |
| Lab 72 | Stuart Parry, Chris |
| | Verheul, Elsa |
| | Warner, Matthew |
| | Watts, Felix |

# In the Event of a Fire






## ACTIONS to be TAKEN

**1. If you discover a fire…**

a) Sound the alarm using the nearest **Break Glass Call Point**.

a) Leave the building via the nearest **EXIT**.

b) Move to the **Fire Assembly Point**

c) Let a Demonstrator know where the fire is.

**2. If you hear the fire alarm…**

a) Leave the building via the nearest **EXIT**.

b) Move to the **Fire Assembly Point**

Course Demonstrators will guide you to the **Fire Assembly Point**

# In the Event of a Fire



**1st FLOOR**

**for lectures**

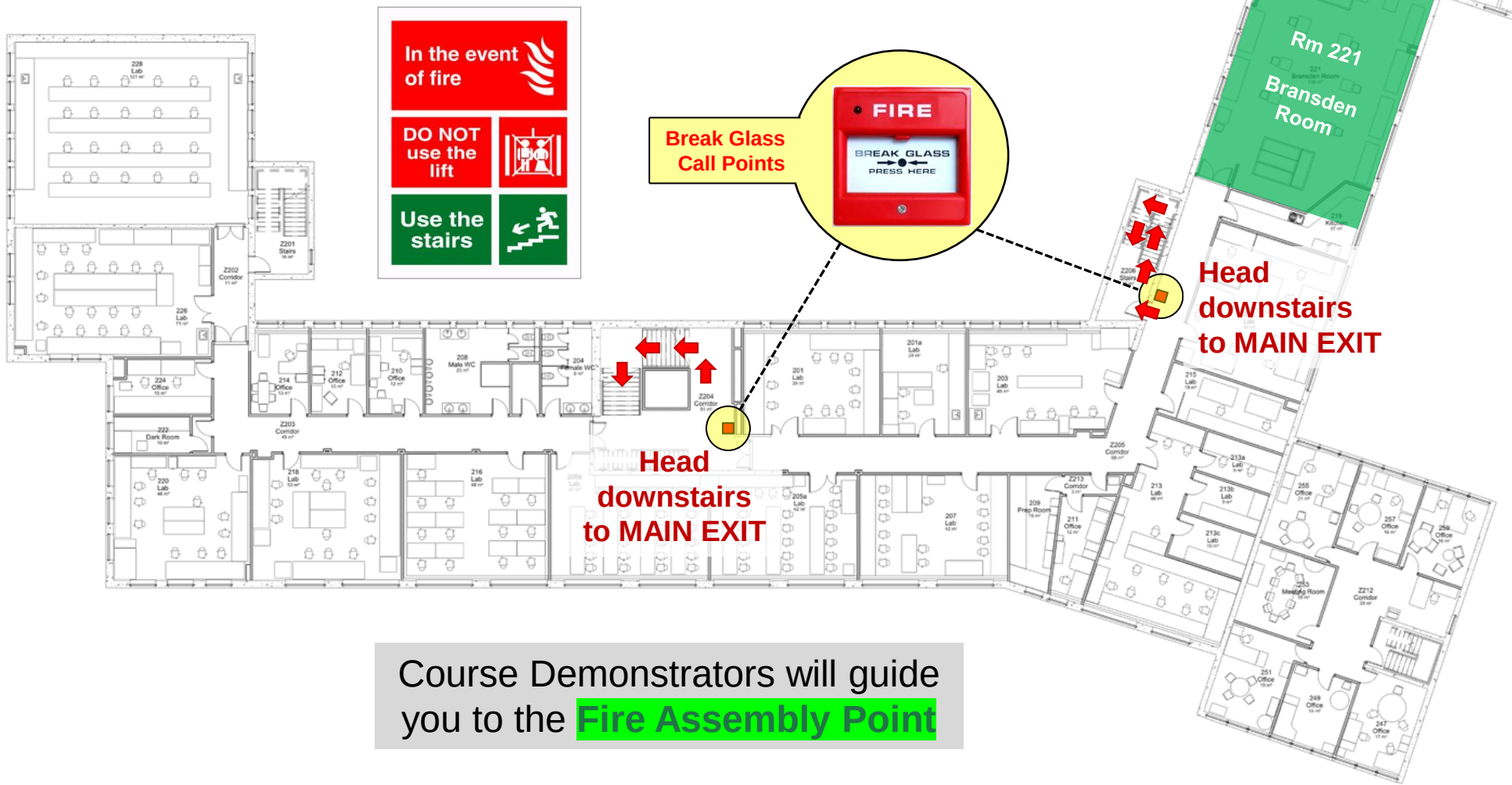

Course Demonstrators will guide you to the **Fire Assembly Point**

# In the Event of a Fire



**2nd FLOOR**

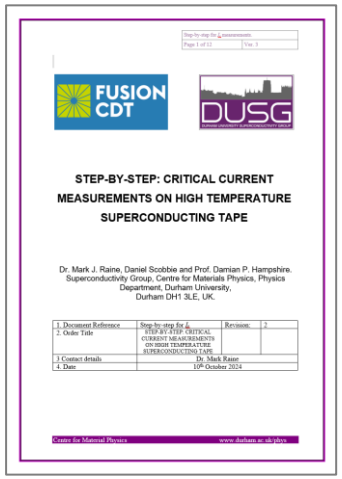
**for breaks**




Course Demonstrators will guide you to the **Fire Assembly Point**

# Staying Safe in the Laboratory



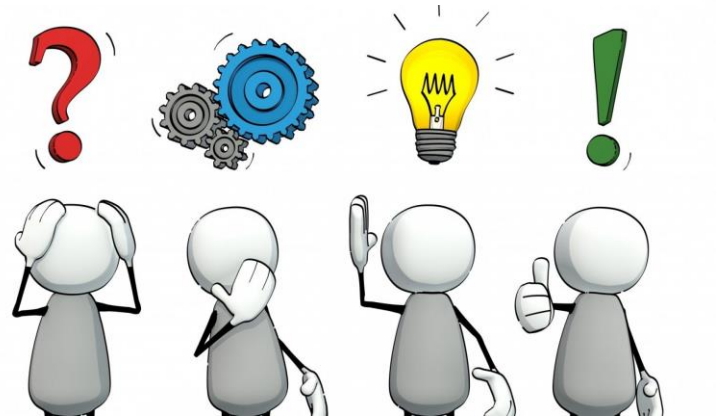


STEP-BY-STEP: CRITICAL CURRENT MEASUREMENTS ON HIGH TEMPERATURE SUPERCONDUCTING TAPE

Dr. Mark J. Raine, Daniel Scobbie and Prof. Damian P. Hampshire.
Superconductivity Group, Centre for Materials Physics, Physics Department, Durham University, Durham DH1 3LE, UK.

**Carefully follow the step-by-step for the practical work in the laboratory.**

**Think about what you are going to do before doing it and discuss it with other members of your team.**



**Dispose of contaminated items in yellow waste bins provided.**

Lab gloves

Cotton buds

Blue roll

**If in doubt, ask a Demonstrator.**

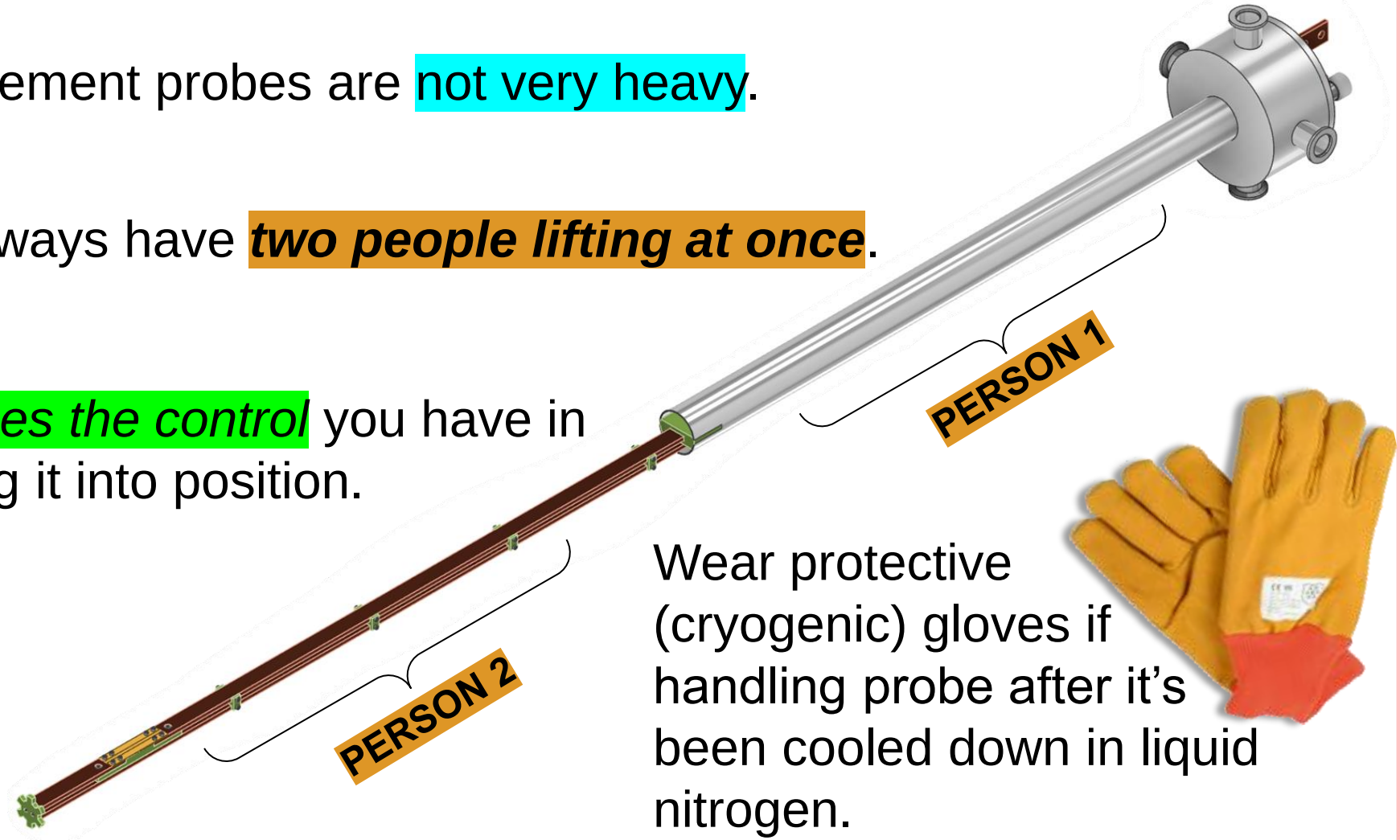
# Staying Safe in the Laboratory

## Positioning the Measurement Probe in the Magnet Dewar

The measurement probes are not very heavy.

However, always have ***two people lifting at once***.

This *increases the control* you have in manoeuvring it into position.



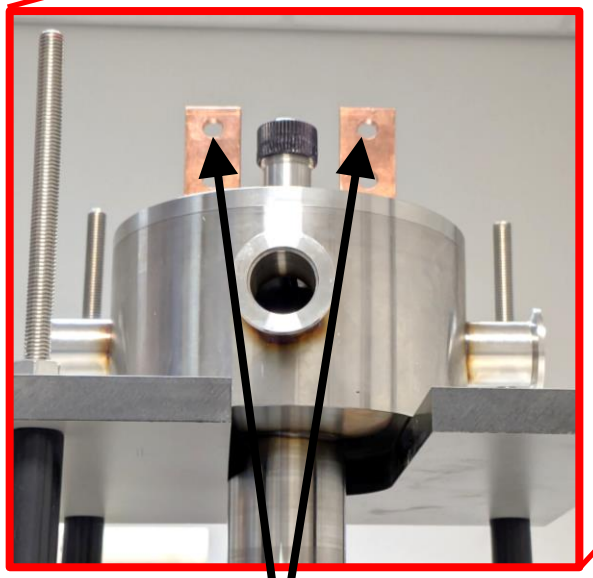



Wear protective (cryogenic) gloves if handling probe after it's been cooled down in liquid nitrogen.

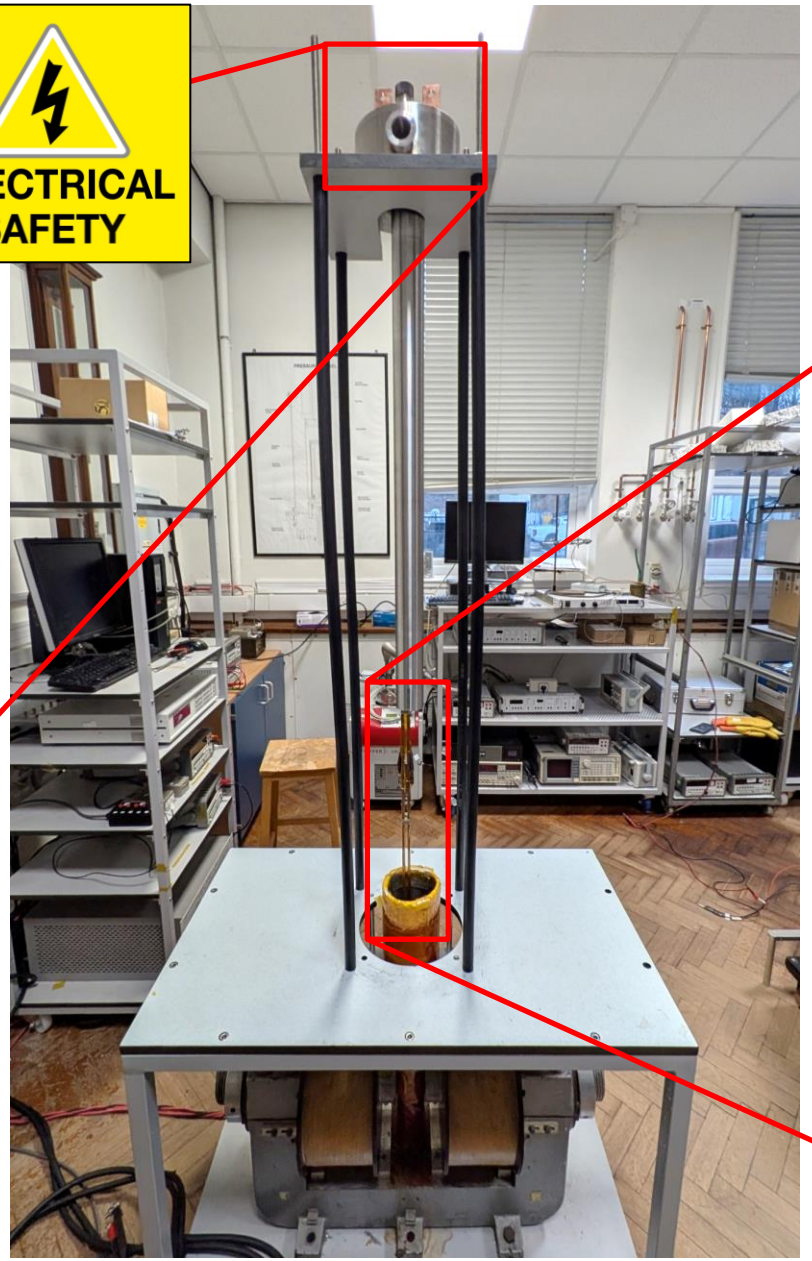
# Staying Safe in the Laboratory



**WARNING**
**HIGH CURRENTS**



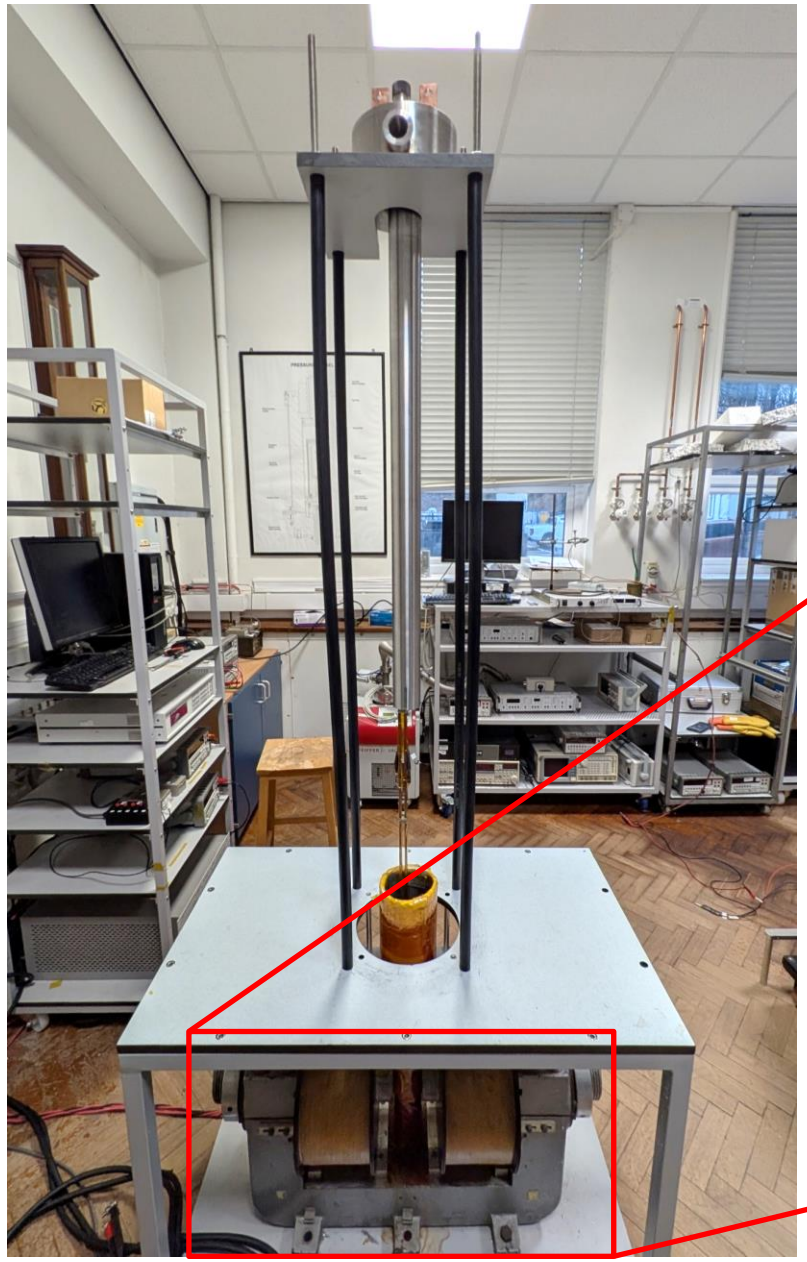
Once set up,
**DO NOT TOUCH**
the bus bar
**terminals**




Once set up,
**DO NOT TOUCH**
the **bus bars**

# Staying Safe in the Laboratory

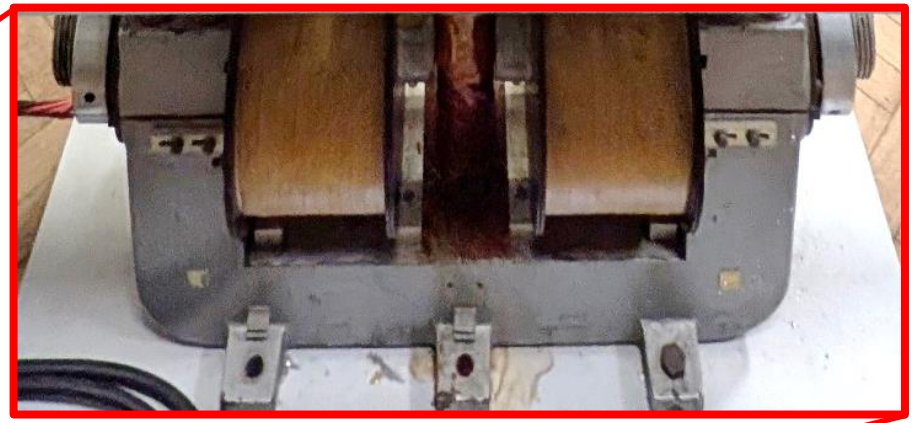




**WARNING**
**HIGH MAGNETIC FIELDS**



Iron core magnet up to 0.7 T



Speak with Dr. Raine if you have any medical implants.

# Using Liquid Nitrogen

# Using Liquid Nitrogen





- Liquid Nitrogen ($LN_2$) has a temperature of **-196℃** at atmospheric pressure.
- It can cause **severe frostbite and/or eye damage** upon contact.
- Objects might become *brittle upon contact and shatter*.
- During vaporisation, it expands by a factor of 700 and can displace the oxygen in the air with the **possibility of causing asphyxiation**.
- It should always be *used in well ventilated spaces*.

# Using Liquid Nitrogen

## Correct Clothing and Personal Protective Equipment (PPE)



- Must wear a **full face visor**.
- Wear *long sleeve tops* and *long trousers* (no bare legs).
- Wear *fully enclosed shoes*. No open-toes, canvas shoes or sandals.
- Wear the supplied **cryogenic safety gloves**.


# Using Liquid Nitrogen

## General Safe Use

- Wear appropriate **PPE.**
- Use only in *well ventilated and low traffic areas.*
- *Avoid breathing* $LN_2$ vapors.
- Carry containers away from body and face.
- *Do not leave open containers unattended.*
- Leave to ventilate in a corner on completion (*do not throw on floor or pour down sink*)


If in doubt, ask a **Demonstrator**!

# Using Liquid Nitrogen

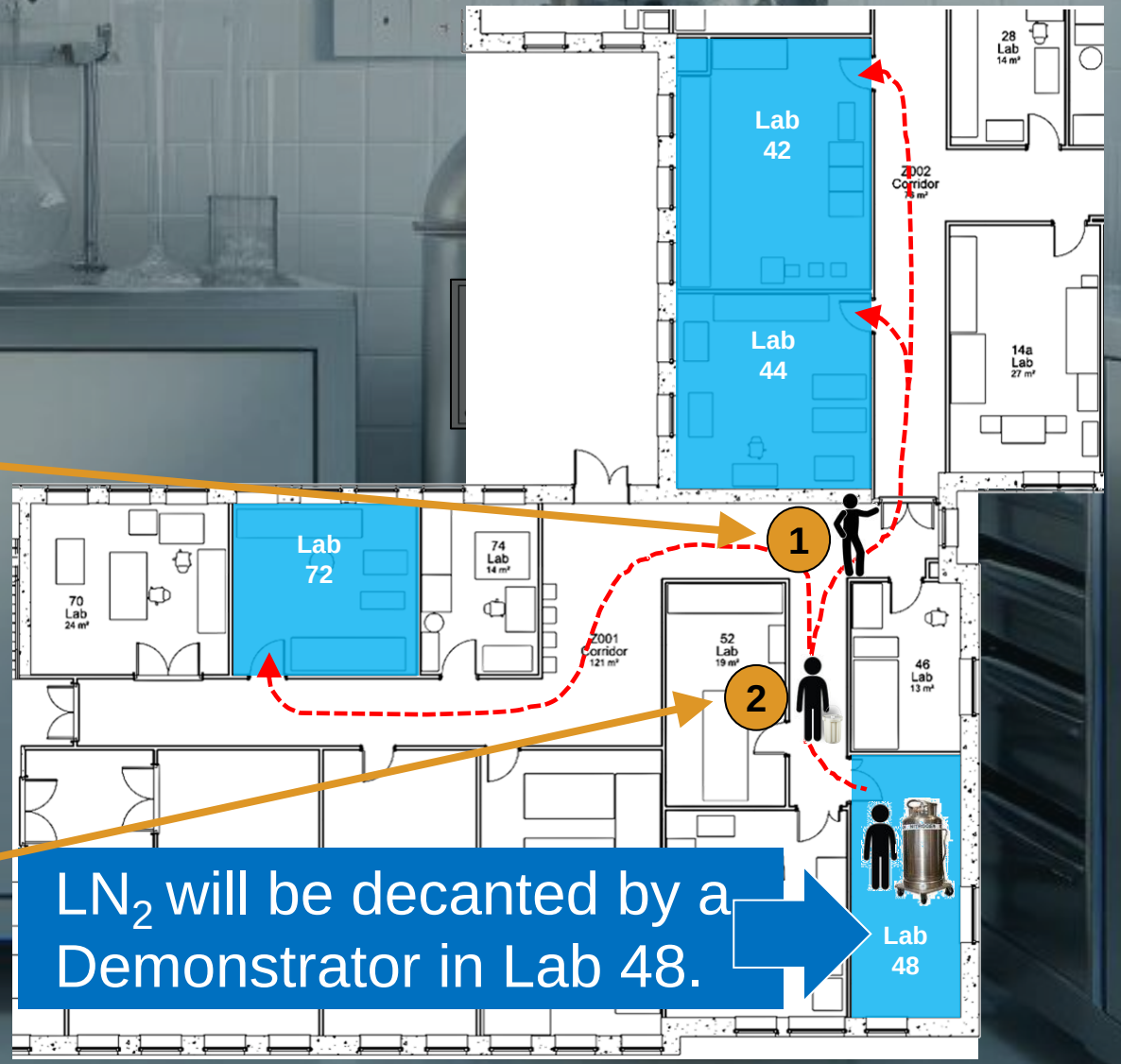
## Procedure for Collecting Liquid Nitrogen

Laboratory partners will work in pairs to collect $LN_2$ from a Demonstrator in Lab 48

**Two people for each collection**:

**Person [1]**: is there to *make sure the corridors are safe*, and to *open doors*, *clearing a safe path for Person [2]*.

**Person [2]**: ***wears full PPE*** and will collect a full 4 L plastic Dewar from Lab 48.



# A Quiet Place




If you need a quite space, we have a multi-use EDI room where you can go.

Room **PH119C** (1st floor) – ask a demonstrator.

# CONCLUSIONS

1. The course team has assessed the risks associated with you being in this building and working in the laboratories:
   - These risks are contained in the course **RISK** and **COSHH** assessments.
   - Make sure you ***follow all guidance***.
   - ***Be vigilant***.
   - ***Think about*** the ***safety*** of what you're doing ***before doing it***!
2. You also have a ***responsibility*** to *help manage your health and safety and of those around you*.
3. Follow a ***common sense*** approach to keeping yourself and your workplace safe.

DUSG
DURHAM UNIVERSITY SUPERCONDUCTIVITY GROUP

**Thank You**

Presented by:

Chief Experimental Officer
Physics Department, Durham University
Superconductivity Group (DUSG)

**Dr Mark J Raine**
m.j.raine@durham.ac.uk

and Prof. Damian P. Hampshire