



# Growing skills for **R**eliable **E**conomic **E**nergy for **N**uclear

## The **GREEN** Centre for Doctoral Training

Professor Colin Boxall, Lancaster University  
Standing in for: Professor Scott Heath, University of Manchester



Engineering and  
Physical Sciences  
Research Council



The University of Manchester



The  
University  
Of  
Sheffield.

# Overview



Building on the success of predecessor CDTs Nuclear FIRST and NGN, the mission of GREEN is, in collaboration with industry, to provide high quality research training in the science and engineering underpinning nuclear technologies (primarily TRLs 1-3), developing the subject matter experts of tomorrow

2019-2027: target of 90 PhD students – has hit 115  
£6M from EPSRC, £4.1M from Industry, £2.8M from HEIs



16 Industry partners



# Model



## Three submission rounds for project proposals

- Based on half studentships
- Halves funded by UKRI/EPSCRC, industry partners or Universities
- Driven by project needs, halves are matched to make whole studentships
- **Resulting in leverage of 2:1 with respect to EPSRC funded studentships**

## Management structure

- **GREEN Strategy via Industrial Advisory Board:** Meetings of all HEI & non-HEI partners as required and annually at Winter School
- **GREEN Management via GREEN Management Board:** Meetings of 5 HEIs every 6 weeks by conference call and face-to-face every quarter
- **Oversight of GREEN student experience:** panel of 3 externals (B'Ham, Strathclyde, NNL)



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# Structure



**Full time and part time routes available**

**University & Industry-based projects (“EngD” route) available**

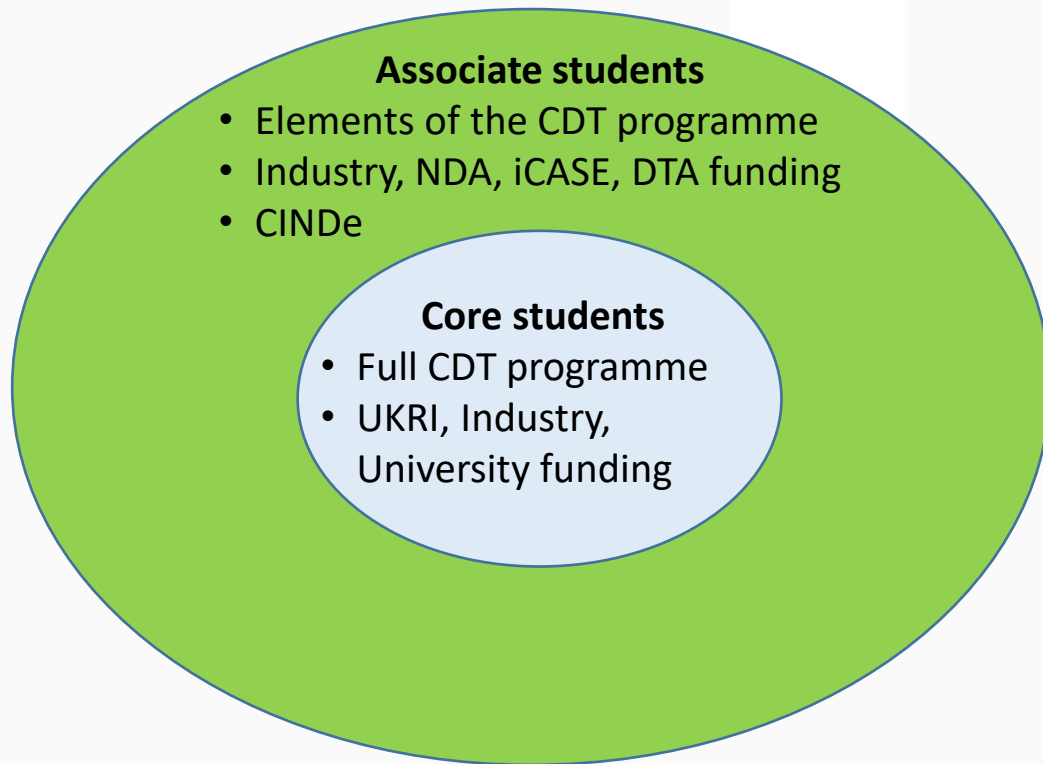
**Timetable:**

**4 Months Bespoke Taught Programme, Sept-Dec**

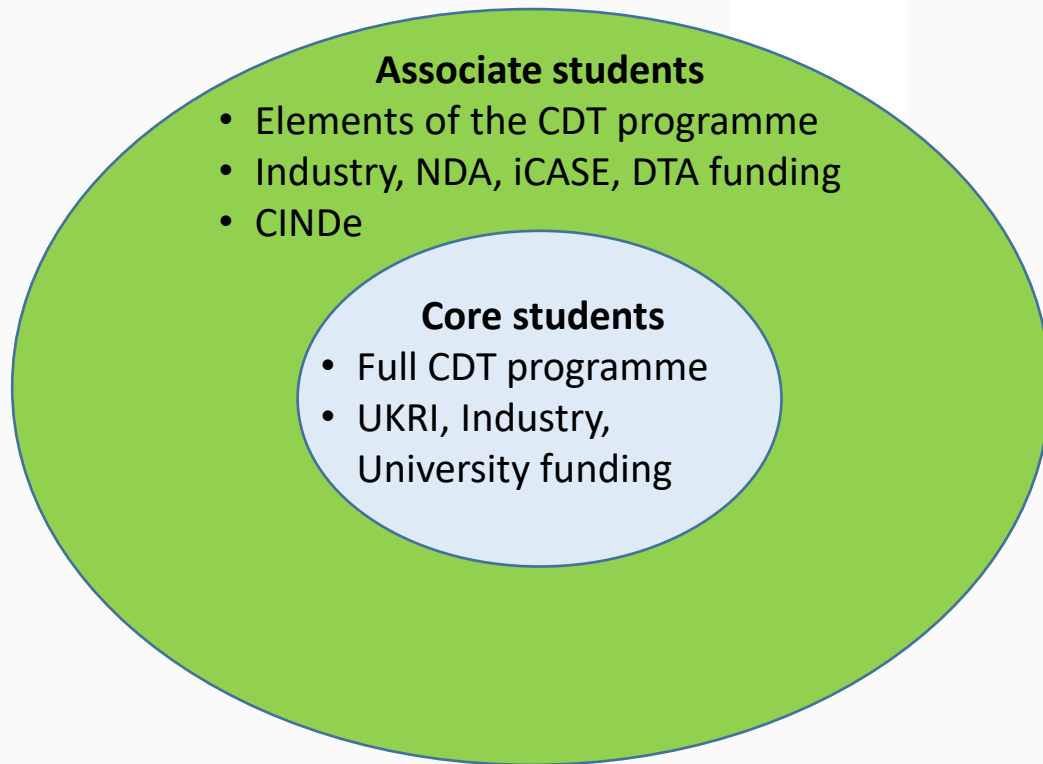
- 12 week ‘Introduction to Nuclear Energy’
- No specific nuclear background required
- Business Games, Exercises, Case Studies
- Strong ‘real life’ contribution
- Site visits – Sellafield, Springfields, Heysham
- **2022/3 – visit to Research Reactor, Taiwan – more anon**

**Winter School, January**

- 3 day residential, >200 attendees



# Structure



## 6 Months Student Specific Training (SST) – Feb-Jul

- SST1 – Literature review and report
- SST2 - Project specific training and report
- Presentation and poster days
- End-of-year student conference

## 36 Months PhD Research

- Host HEI PGR QA system
- Co-supervision
- **EngD Route**
- Ongoing CPD and steps towards SQEP status
- Training - Responsible Research and Innovation; Risk awareness; International Nuclear Law; Careers

## Throughout - Outreach

- Public engagement training and events – MOSI, Jodrell Bank, Bluedot, ScienceX at Trafford Centre, Schools

# Student numbers: Cohorts 1-4 – 79 FTE

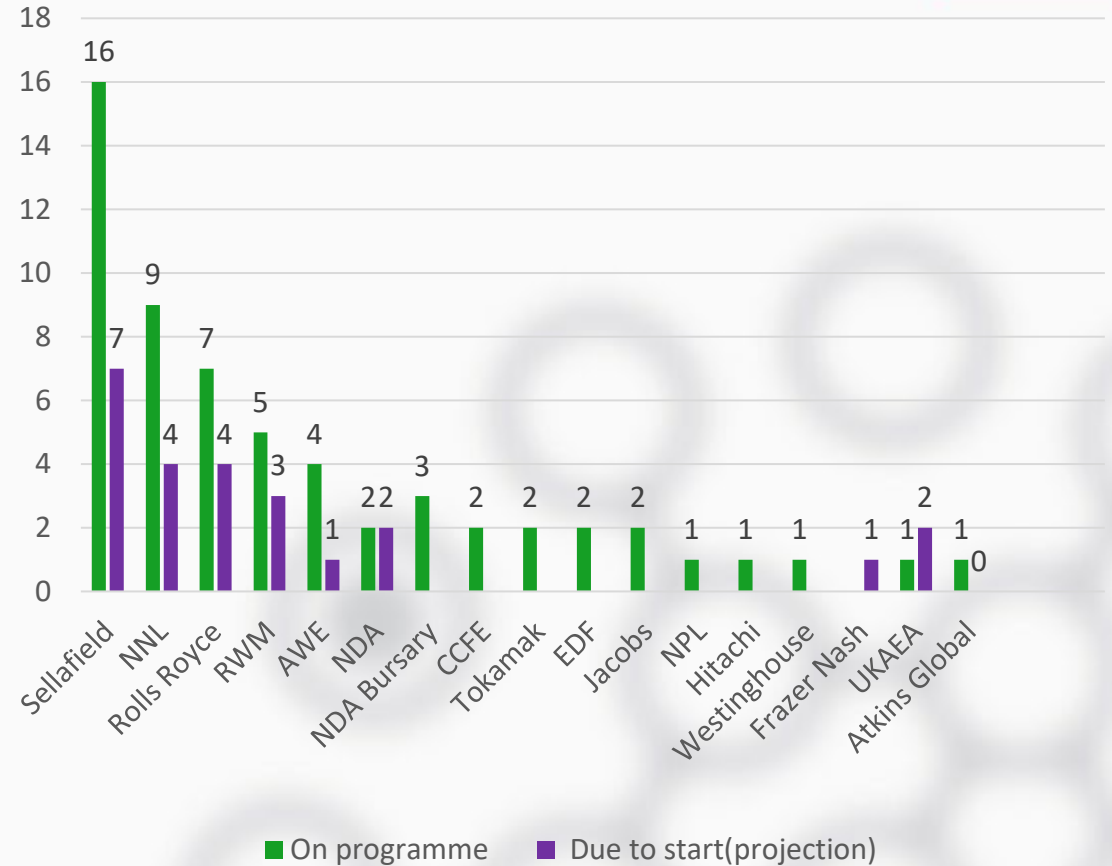
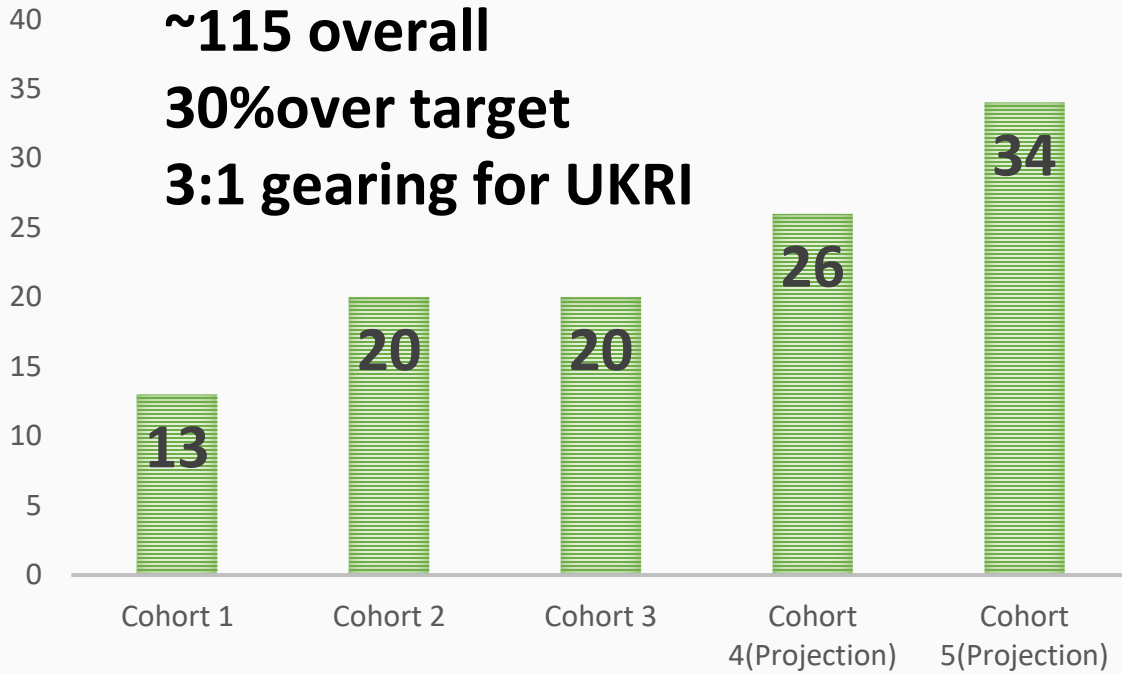


Current Nuclear Programmes	• Spent Nuclear Fuel and Nuclear Materials Management	11
	• Decommissioning and Clean-Up	11
	• Geological Disposal	5
	• Current Operating Reactors	8
	• New Build Reactors	10
	• Nuclear Security	2
Future Nuclear Energy	• Fusion	8
	• Future Fuel Cycles	7
	• Advanced Reactors: Liquid Metal, Molten Salt, Gas Cooled	12
	• Co-generation	
Nuclear Energy in a Wider Context	• Regulation	2
	• Manufacturing	2
	• Interaction of Infrastructure and Environment	4
	• Societal Issues including Economic & Finance	8
	• Management	4

# GREEN Cohorts 5...in partnership



**~115 overall**  
**30% over target**  
**3:1 gearing for UKRI**



# Use of National Facilities



Manchester

- RADioactive waste management & Environmental Remediation (RADER), CRR, DCF; NFCE

Lancaster

- ADRIANA; Lancaster Accelerator Mass Spectrometer; UTGARD Phase I & 2

Leeds

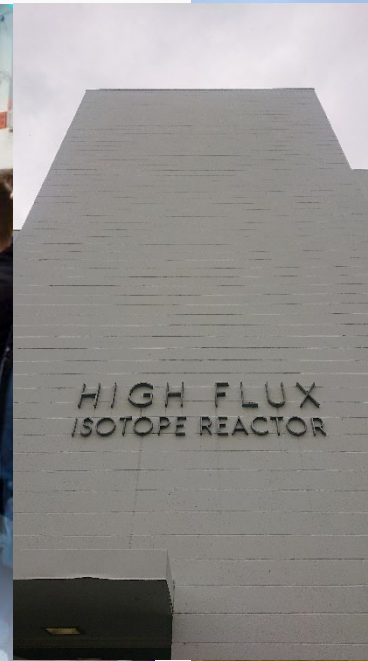
- MUFFIN (MULTiphase Fluid Flow In Nuclear systems)

Sheffield

- MIDAS, HADES (High Activity Decommissioning Engineering Science)



# Visits to Overseas Facilities



**Tsing Hua, Taiwan**

**INL, ORNL, USA**



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# Cohorts 1-4: EDIA & COVID impacts



Gender	All Cohorts
Male	47
Female	31
Non-Binary	6 or less
Transgender	6 or less
Home International	
Home	67
EU/International	12
Age	
21-24	49
25-29	19
30-39	9
40+	6 or less

## 2019 Intake – Cohort 1

Winter School held, then COVID. CDT office operating remotely; Redesign of SST2 and PhD phase; UKRI extensions managed by home HEIs

## 2020 Intake – Cohort 2

Winter School cancelled, replaced with virtual sessions. Taught programme & SST1 on-line; SST2 socially distanced; Poster session by Mozilla Hubs

## 2021 Intake – Cohort 3

In person teaching resumed – but no site visits. Winter School returned; Summer School created



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# Alumni and The Future



## The Future

- Cohort 5 – recruitment near completion
- Taught course refresh – inclusion of fusion module?
- National Lab tour, USA, incl ORNL and INL
- NTHU Taiwan, political situation permitting
- SATURN!

## Finally – Key Output - Alumni

- 70% of Nuclear FIRST and NGN graduates in nuclear
- 92% first destination in nuclear