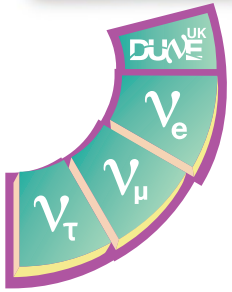
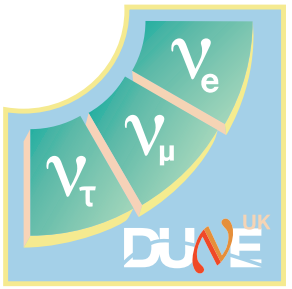
DUNE RS EXHIBITION

TSHIRTS, WATERBOTTLES, POSTCARDS PINS





Brochure (Draft!)

IMPACT OF DUNE ON THE UK ECONOMY

DUNE UK is having a positive impact on the British economy, both in terms of contracts with local companies and the creation of new technical jobs. Thanks to the great expertise of British industry, numerous UK companies are engaged in providing crucial advanced components to the experiment, including contracts in excess of £1M in the north of England.

DUNE UK has adapted and developed new technologies, such as the 'wire-winding robot' that is used to accurately position approximately 4000 copper wires, each not much thicker than a human hair, into huge, 6 metre long, 2.3 metre wide planes that will collect the data from the neutrino detector. DUNE UK is building 137 of these planes, which will eventually be installed in a 17,000 tonne liquid-argon cryostat a mile underground at the SURF lab in South Dakota.

At the Daresbury Laboratory, where the APAs are assembled, more than 20 new high-skill jobs have been created, ranging from technicians through to mechanical engineers. The people taking up these jobs are gaining valuable skills in cutting-edge techniques and technologies.

The DUNE detectors will produce enormous amounts of data, equivalent to 1,600 high-definition movies per second. DUNE UK is leading the development of the data-acquisition system, which ensures that this vast stream of data is captured, requiring cutting-edge computing engineering, supported by engineers at the Rutherford Appleton Laboratory, and DUNE researchers must reconstruct the particle interactions to analyse which rely on the latest computational techniques, data science, and machine learning.

A rapidly growing number of new PhD students are joining DUNE to learn the skills of world-class research in particle physics, ensuring that the next generation of scientists is trained and ready to enhance innovation, maintaining the leading role that the UK has in science and innovation.

Since the start of the UK involvement in DUNE

63 academics
48 postdoctoral researchers
48 PhD students
29 engineers
60 technicians

have worked on DUNE in British institutions, cementing our prominent position in particle physics.

FINAL WORD

Prof. Gary Barker

LBNF/DUNE-UK Spokesperson

"The LBNF/DUNE-UK project, funded by DSIT/UKRI-STFC, is delivering key components of the international project including elements of the proton LINAC, the neutrino beam target, the majority of the charge collection planes of the DUNE horizontal drift detector, the data acquisition system for first stage of the project and major computing/software contributions. We are the largest international partner and central to its success."

Prof. Morgan Wascko

"Neutrinos play a key role in the origin and development of our universe. The major responsibilities that the UK neutrino community have taken within the Long Baseline Neutrino Facility (LBNF) / DUNE project puts our scientists at the forefront of the global effort to measure the properties of neutrinos and hence finally understand the way that nature works at the most fundamental level."

DUNE UK Projects:

The DUNE-UK project is funded by the Science and Technology Facilities Council (STFC), part of the United Kingdom Research and Innovation.

Anode Plane Assemblies construction - Prof. Justin Evans (University of Manchester)
Reconstruction Software and Distributed Computing - Dr Andy Blake (Lancaster University)
Data Acquisition System - Dr Jim Brook (University of Bristol)

LBNF UK project
High Power Neutrino production Target- Dr Chris Densham (STFC - Rutherford Appleton Laboratory)
Superconducting RF Cryomodule for PIP-II - Dr Peter McIntosh (STFC/ASTeC, Daresbury Labs.

UKRI Science and Technology Facilities Council

CONTACT

https://www.dunescience.org/

A DUNE Anode plane Assembly (APA) under construction on an automated wire winding machine at STFC Daresbury Laboratory

CAPTURING NATURE'S GHOSTS

DUNE UK DEEP UNDERGROUND NEUTRINO EXPERIMENT

WHAT IS DUNE?

Karolina Wresilo

PhD student in High Energy Physics at the University of Cambridge

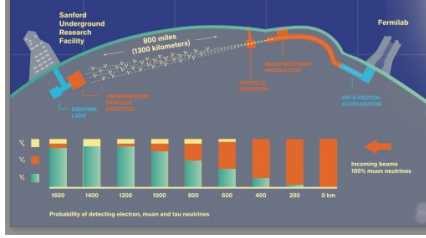
DUNE is a next-generation neutrino experiment utilising the world's most intense neutrino beam and an ambitious human endeavour with more than 1400 collaborators worldwide!

"I became fascinated with neutrinos when I learned about how different they are from other particles that make up all the matter in the Universe. The Standard Model describes 3 neutrino types with an associated probability that any type can change identity into one of the other two - a phenomenon called neutrino oscillation. This means that they must have a mass, which surprisingly disagrees with our best theories up to date, and therefore indicates new physics is out there! Due to the elusive nature of neutrinos, they remain the least understood particle. This makes them exciting to study, with decades-old questions still to be answered."

DUNE will be a key player in neutrino physics in the years to come. Its main physics goals include:

- Measurement of neutrino oscillations with unprecedented precision.
- Measuring the CP violating phase – a parameter that is crucial to explain the dominance of matter over antimatter in the early Universe, and hence why we exist.
- Detection of neutrinos originating in the Sun and supernova explosions.
- Searches for exotic physics that may potentially challenge our understanding of the world at a fundamental level.

Deep Underground Neutrino Experiment



WHO IS DUNE UK?

The DUNE UK collaboration is a leading force in developing, integrating and testing the Data Acquisition (DAQ) and Anode Plane Assembly (APA) technologies, therefore playing a crucial role in the experiment's operation.

Prof. Jaroslaw Nowak

(Lancaster University)
LBNF/DUNE UK Institutions Boards Chair

"Since neutrinos cannot be observed directly, their presence is inferred through the detection of particles produced in their interactions with the liquid Argon. These particles leave trails of electrons as they pass through the detector and are collected by the wires of the APA.

Each APA is connected to the DAQ system, which then evaluates and selects interesting data for storage and further analysis. This data is then used to create a 3-D snapshot of the neutrino event, that can be then studied."

HOW DOES DUNE WORK?

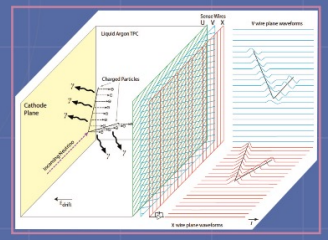
Tiago Alves

PhD student in High Energy Physics at Imperial College

The DUNE UK collaboration is a leading force in developing, integrating, and testing the Data Acquisition (DAQ) and Anode Plane Assembly (APA) technologies, therefore playing a crucial role in the construction of the experiment.

"Since neutrinos cannot be observed directly, their presence is inferred through the detection of particles produced in their interactions with the liquid argon. These particles ionise the argon, which produces electrons (and photons). These electrons are detected by the wires of the APAs.

Each APA is connected to the DAQ system, which then evaluates and selects interesting data for storage and further analysis. This data is then used to create a 3-D snapshot of the neutrino event, that can be then studied."



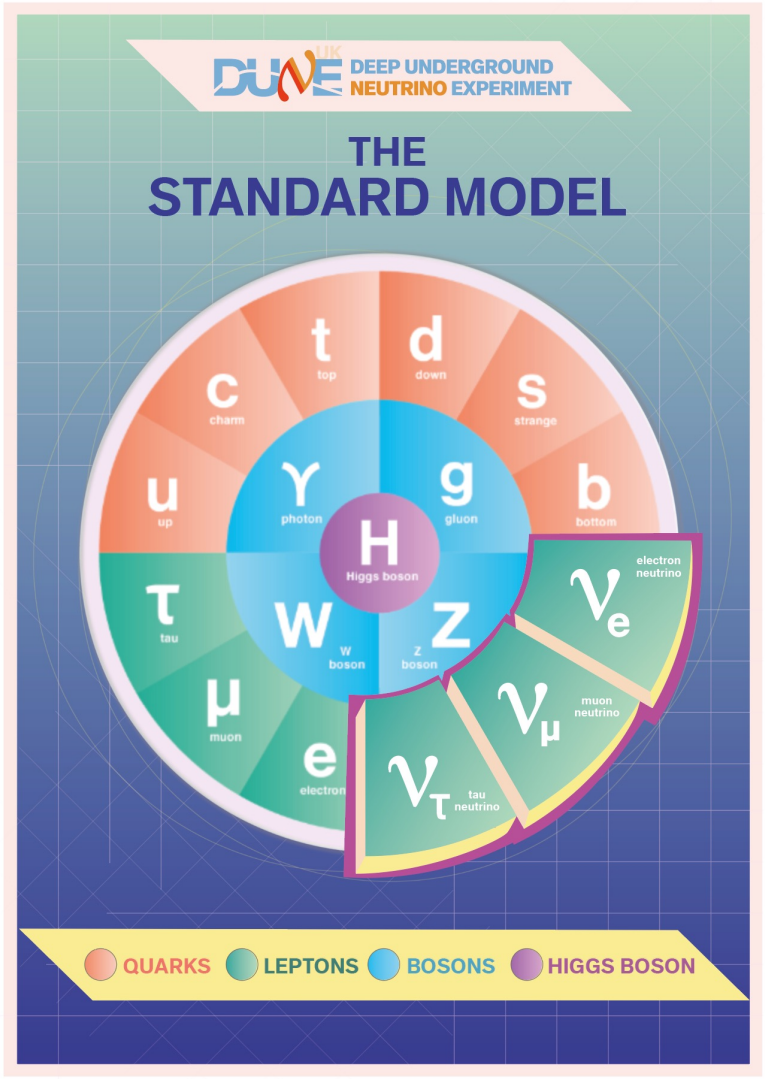
"This figure shows an incoming neutrino interacting with an argon nucleus. Particles produced from this interaction continue to travel through the liquid argon, ionising atoms along the way. The ionisation produces free electrons and photons. Due to an electric field inside the detector, the electrons move towards the APA. The electrons induce electrical signals on the wires of the APA. The photons are detected by light detectors, which tells us when the electrons started to move. Altogether, this information allows us to create a 3D image of the trajectories of the particles produced by the incoming neutrino. From this, we can infer the properties of this neutrino to recreate the 3-D image of the event."

Banner & Posters

1 OFF A1 POSTER MOUNTED ON 3mm FOAMEX

564

841

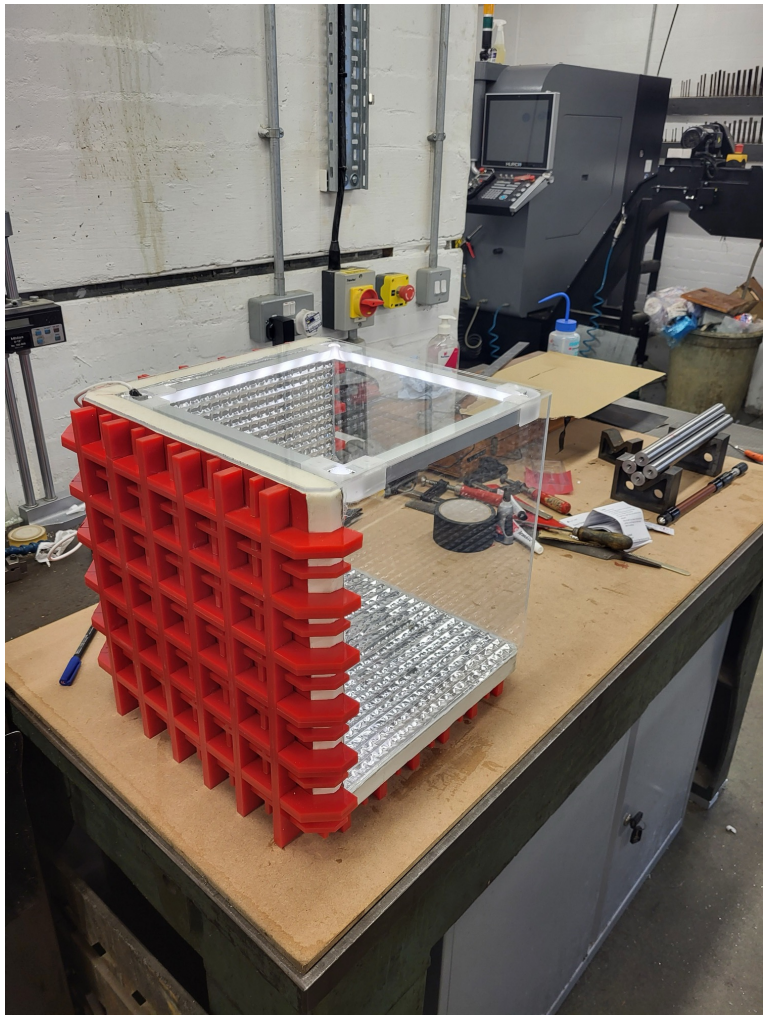


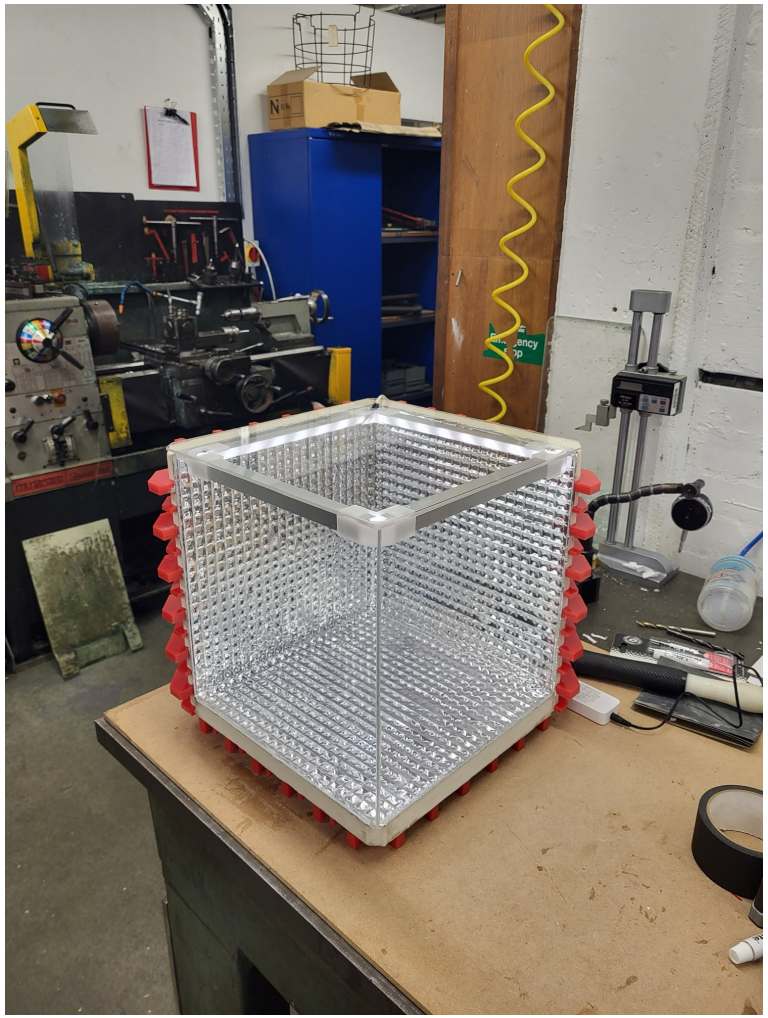
3 OFF BANNER - 1900 X 250 mm

1900

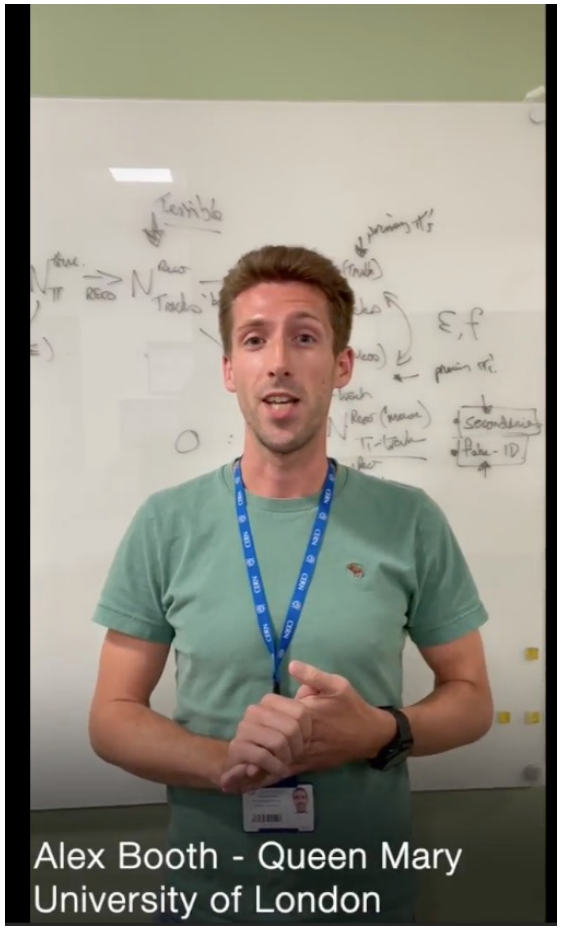
250

ProtoDUNE!





VIDEOS!


Alex Booth - Queen Mary
University of London


particles, makes this a very
interesting field to be in!


In fact, around 500,000 billion
of them will pass through


Neutrinos are created by the weak interaction and can be produced
naturally in processes like in active stars or supernovas, in
radioactive processes happening in nature like inside our planet
earth.

HOW MANY NEUTRINOS?

RS DUNE STORY BOARD FOR IPAD INTERACTIVE NEUTRINO COUNTER

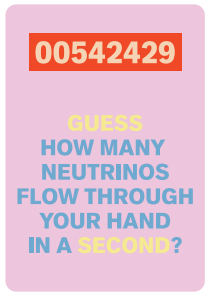
1

2

ANIMATE BACKGROUND NEUTRINOS RANDOMLY MOVING AROUND THE SCREEN

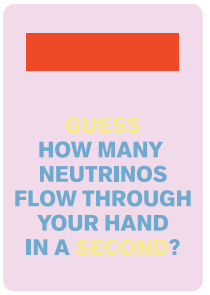
3

4



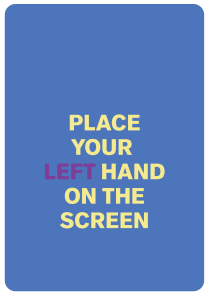
TEXT APPEARS AND NUMBERS GO UP QUICKLY TO 1 BILLION

5



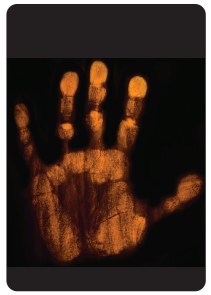
NUMBERS DISAPPEAR

6



NEW MEASSAGE

7



DIGITAL HANDPRINT APPEARS

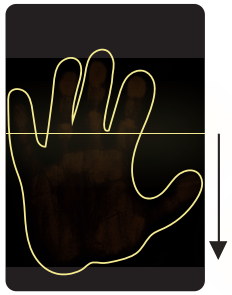
8

PULSE OF LIGHT TRACES HANDPRINT

9

SCANNER MOVES DOWNWARDS OVER HANDPRINT

10

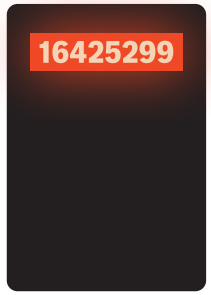


11

12

HAND DISAPPEARS NUMBERS COUNT UPWARDS REALLY FAST

13



COUNTER FLASHES NUMBERS STOP TO A PARTICULAR NUMBER

14

MESSAGE APPEARS