

# VENu

The Virtual Environment for Neutrinos

**Marco Del Tutto**

2<sup>nd</sup> August 2017  
DPF Meeting



UNIVERSITY OF  
**OXFORD**

# What is?

VENu is an event display for the MicroBooNE experiment

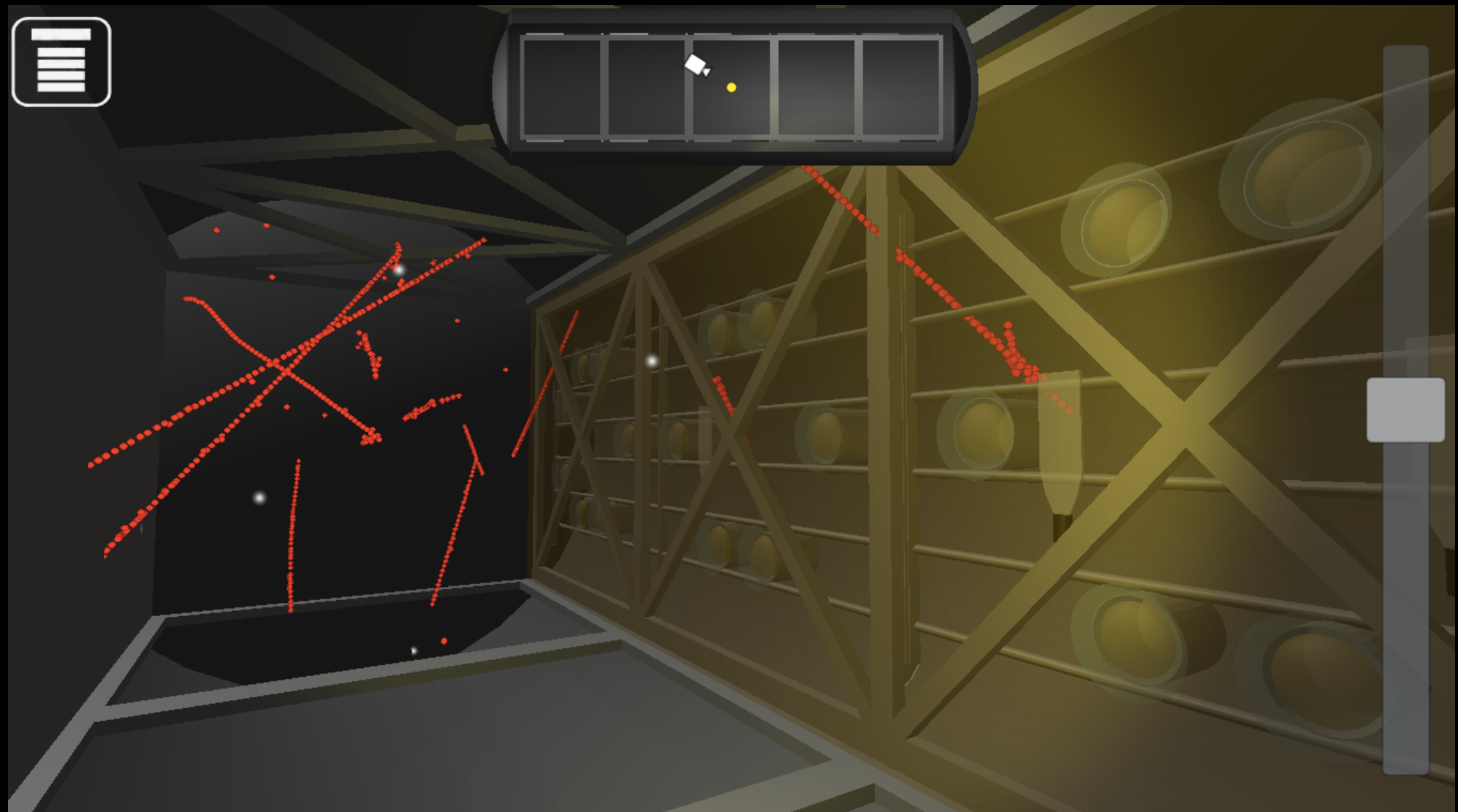
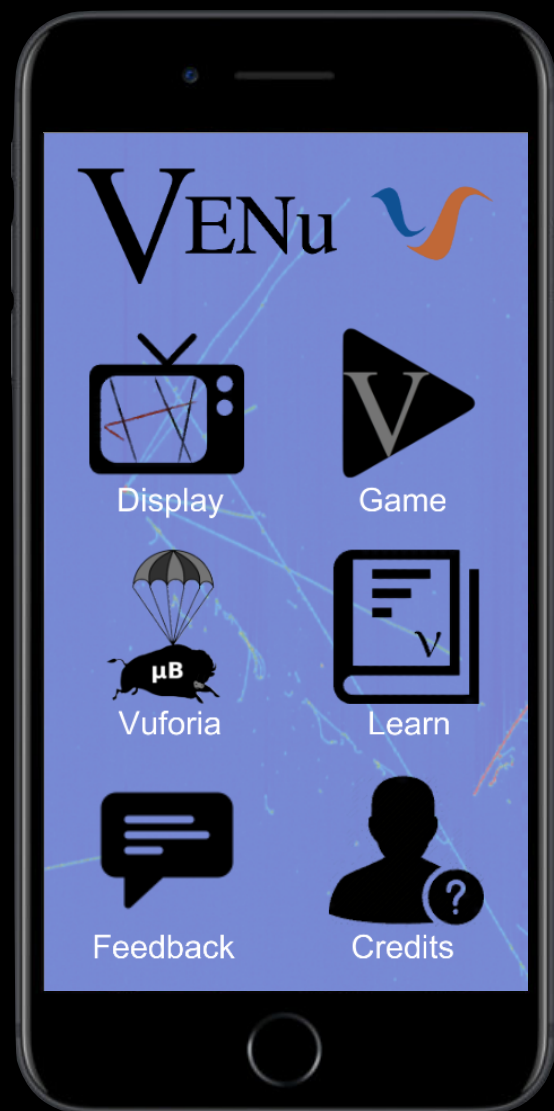


- ▶ MicroBooNE is a neutrino experiment at Fermilab
- ▶ The neutrino detector is a Liquid Argon Time Projection Chamber
- ▶ VENu allows to virtually go inside the detector

μBooNE

# What is?

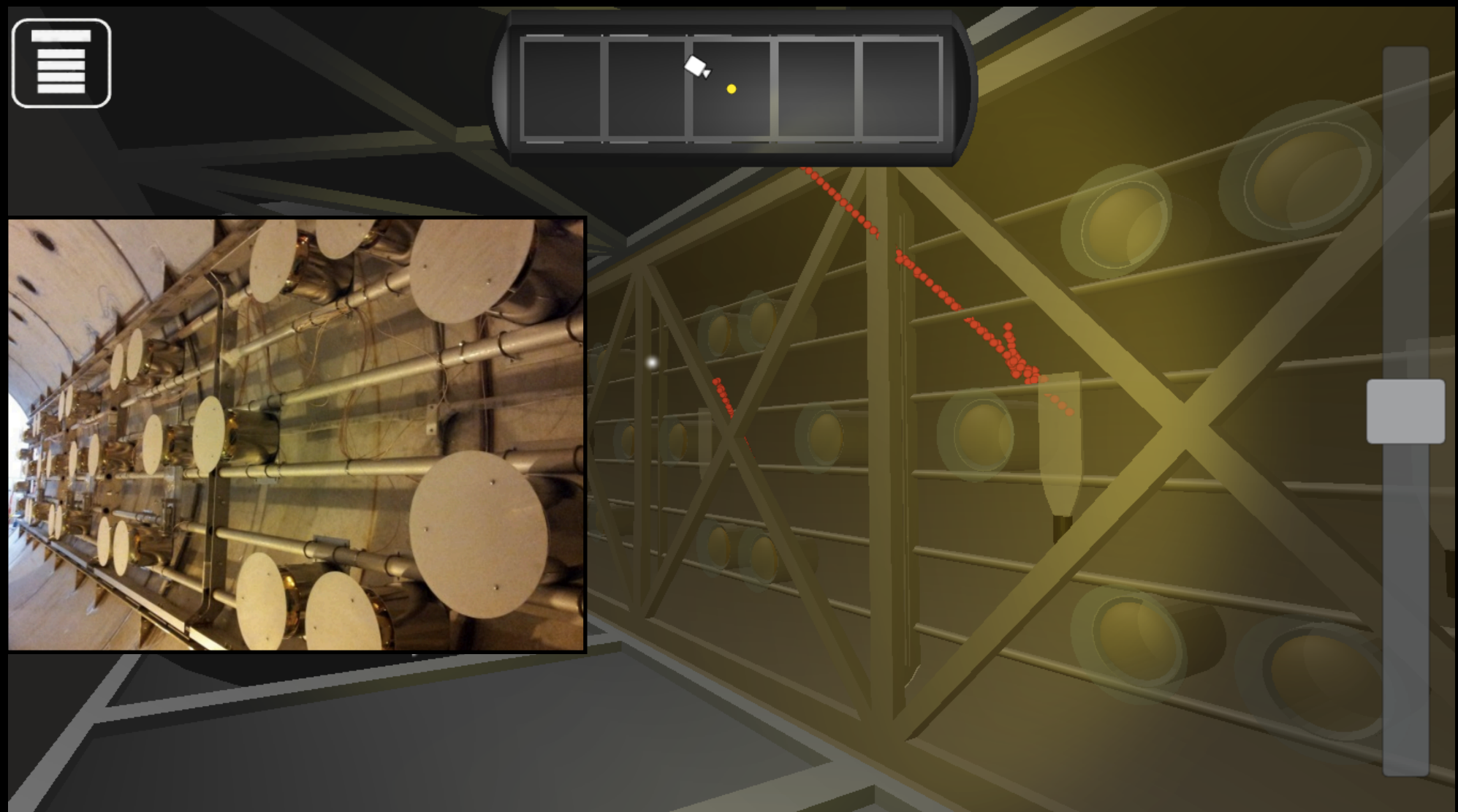
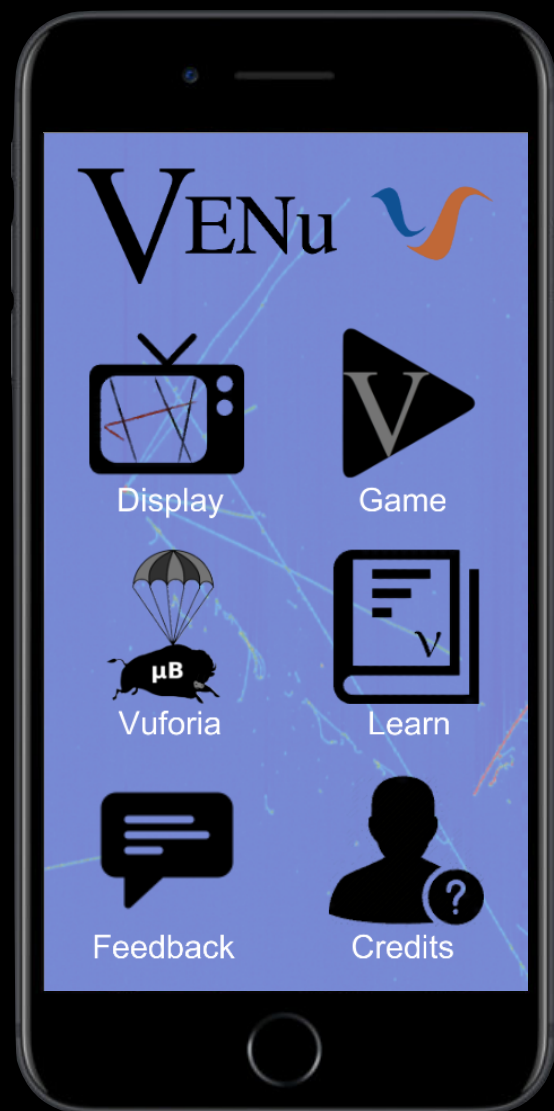
VENu is an event display for the MicroBooNE experiment





# What is?

VENu is an event display for the MicroBooNE experiment





“We had been thinking about new ways to show off the MicroBooNE experiment. MicroBooNE is an innovative technology, and we wanted an innovative way to show it off”

**Sam Zeller**

MicroBooNE co-spokeperson

# Why?

50%

Characterise  
scientists as  
secretive

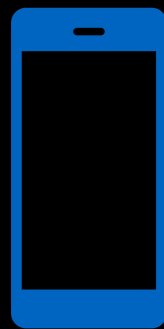
55%

Believe science is  
too specialised for  
them to understand

# Why?

50%

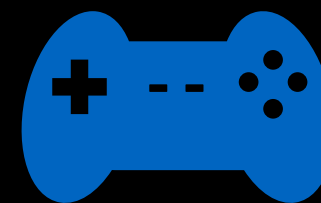
Characterise  
scientists as  
secretive



Mobile App

55%

Believe science is  
too specialised for  
them to understand



Game



Learning sections



- Connections with the **general public**;
- The **educational game** included in the application will allow young people to hunt neutrinos and to learn more about them in a **fun environment**;
- To offer a tool for neutrino physicists to **interact with the public** while describing their research.

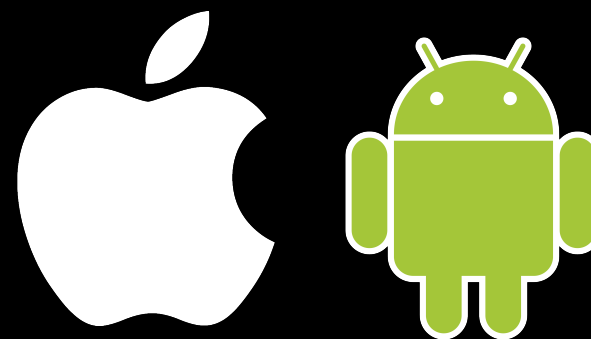
# What is it?



VENu... ..is a multi-platform **event display**



Desktops



Smartphones



Web

...and many more...

# What is it?



VENu... ..is a mobile app



iOS

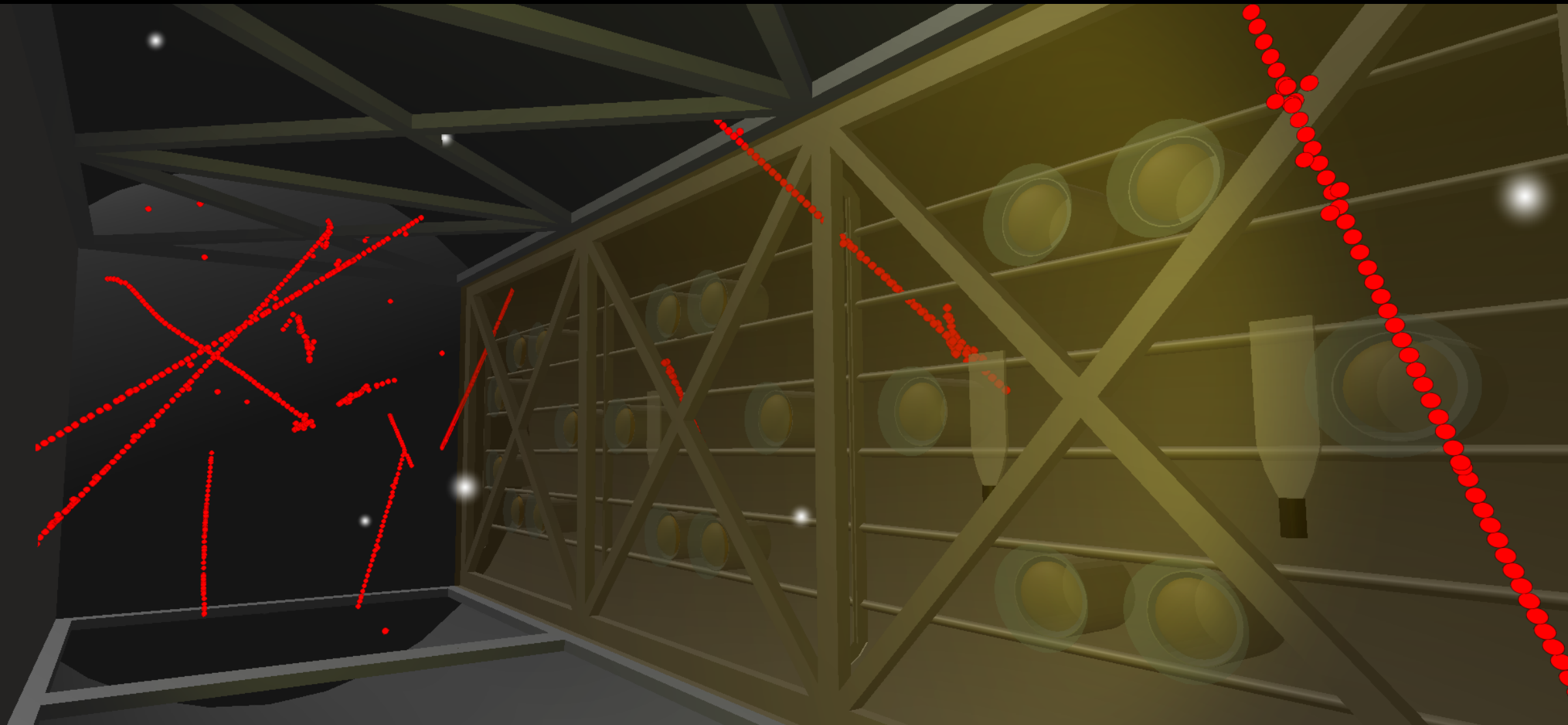


Android



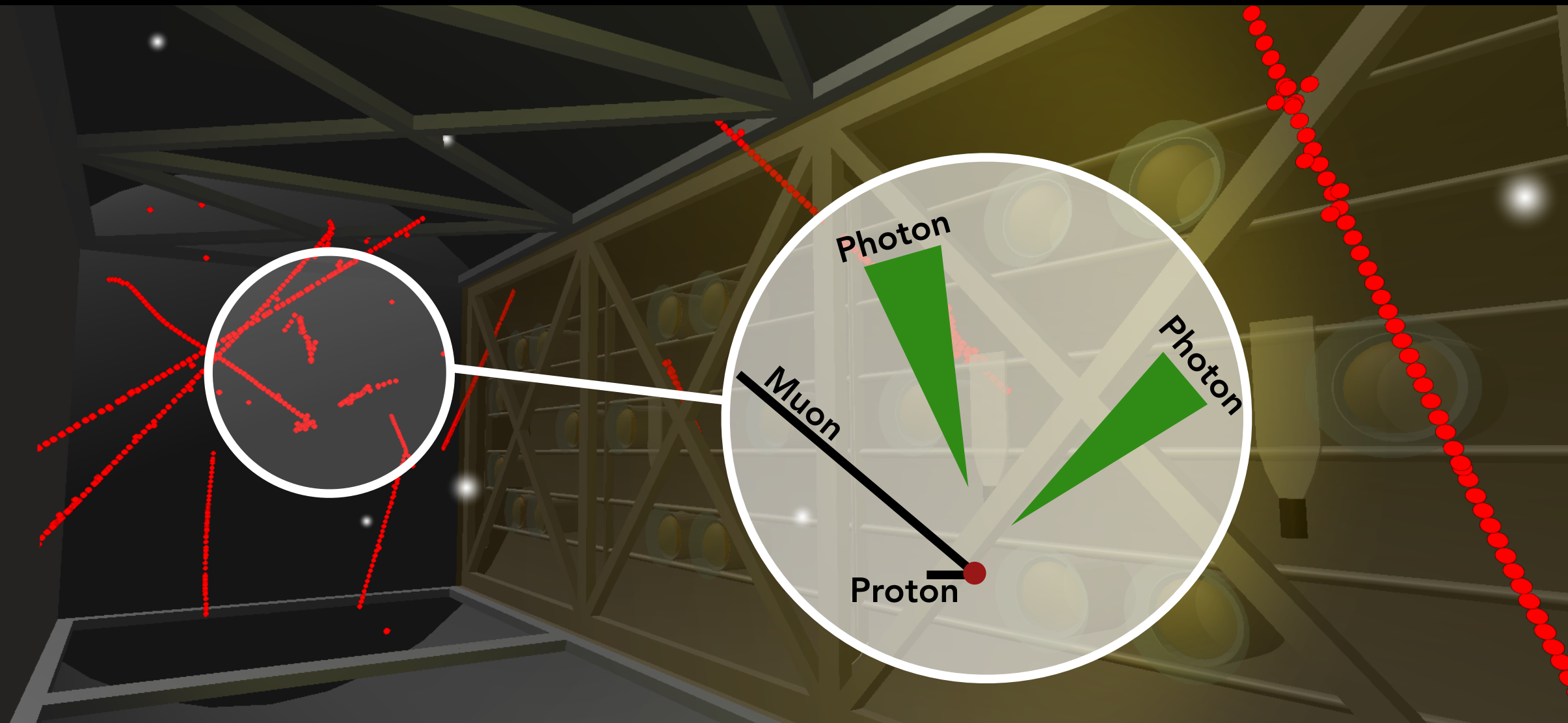
# What is it?

VENu... ..is built and rendered in a 3D environment



# What is it?

VENu... ..displays actual neutrino interactions  
from the **MicroBooNE** detector





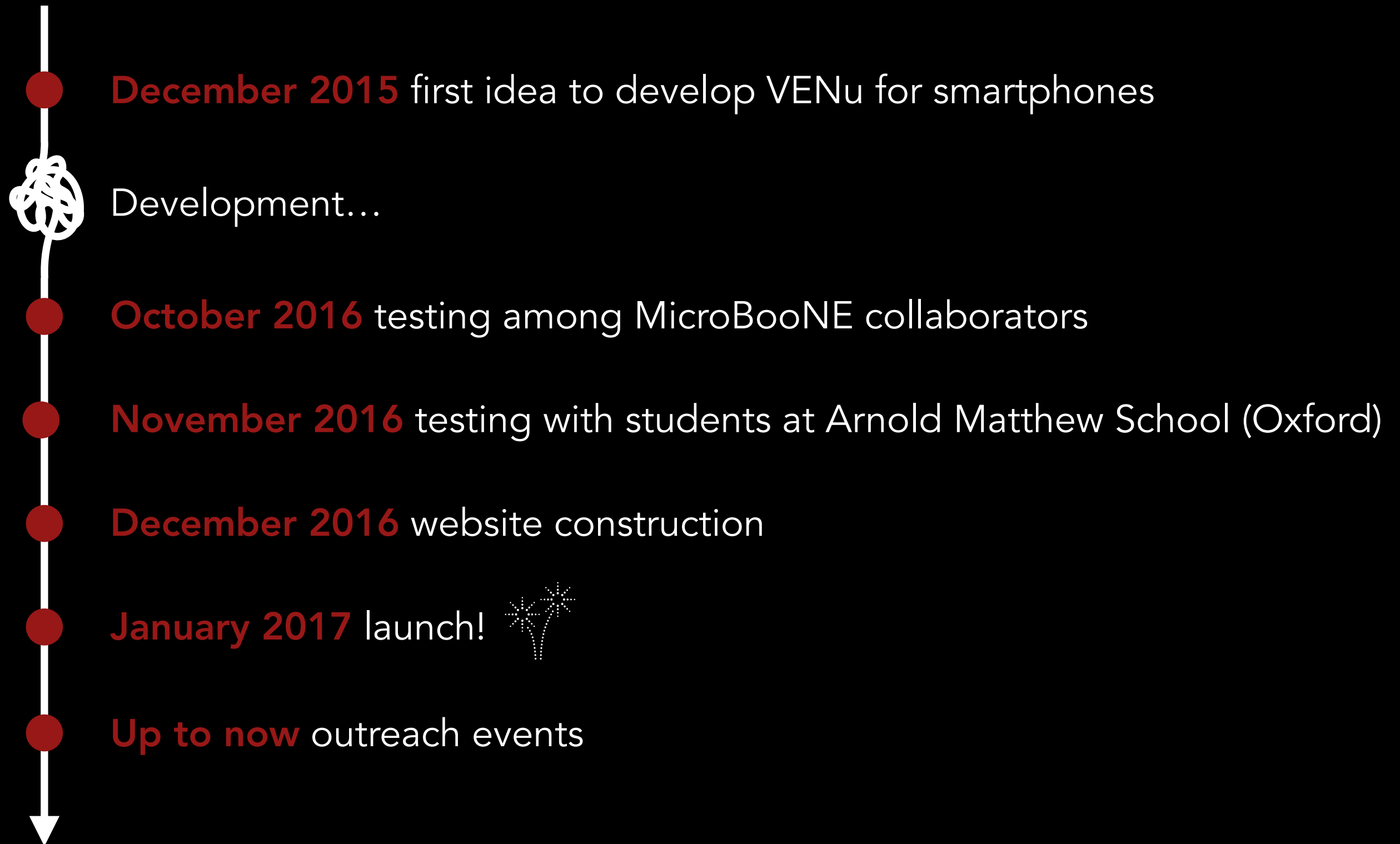
# What is it?

VENu... ..is designed to exhibit both **virtual** and **augmented reality** features



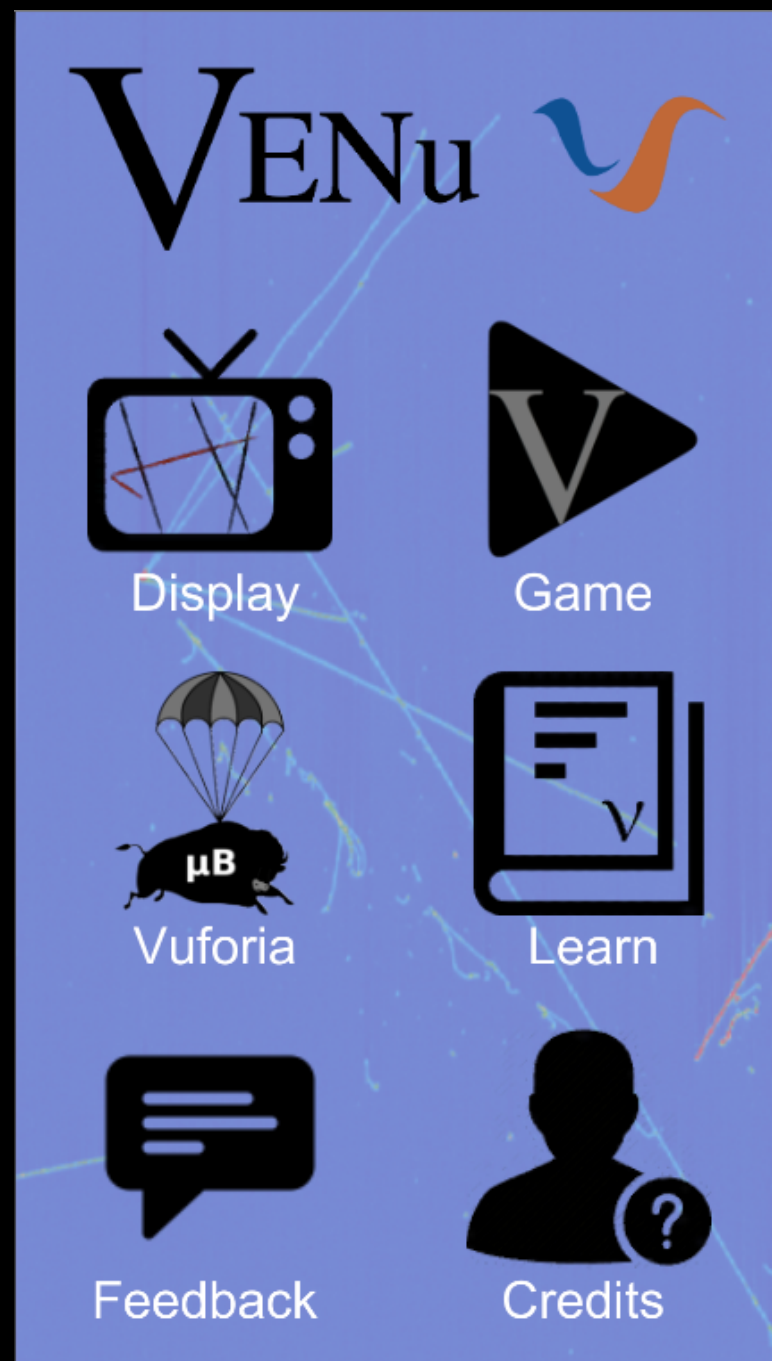


# History



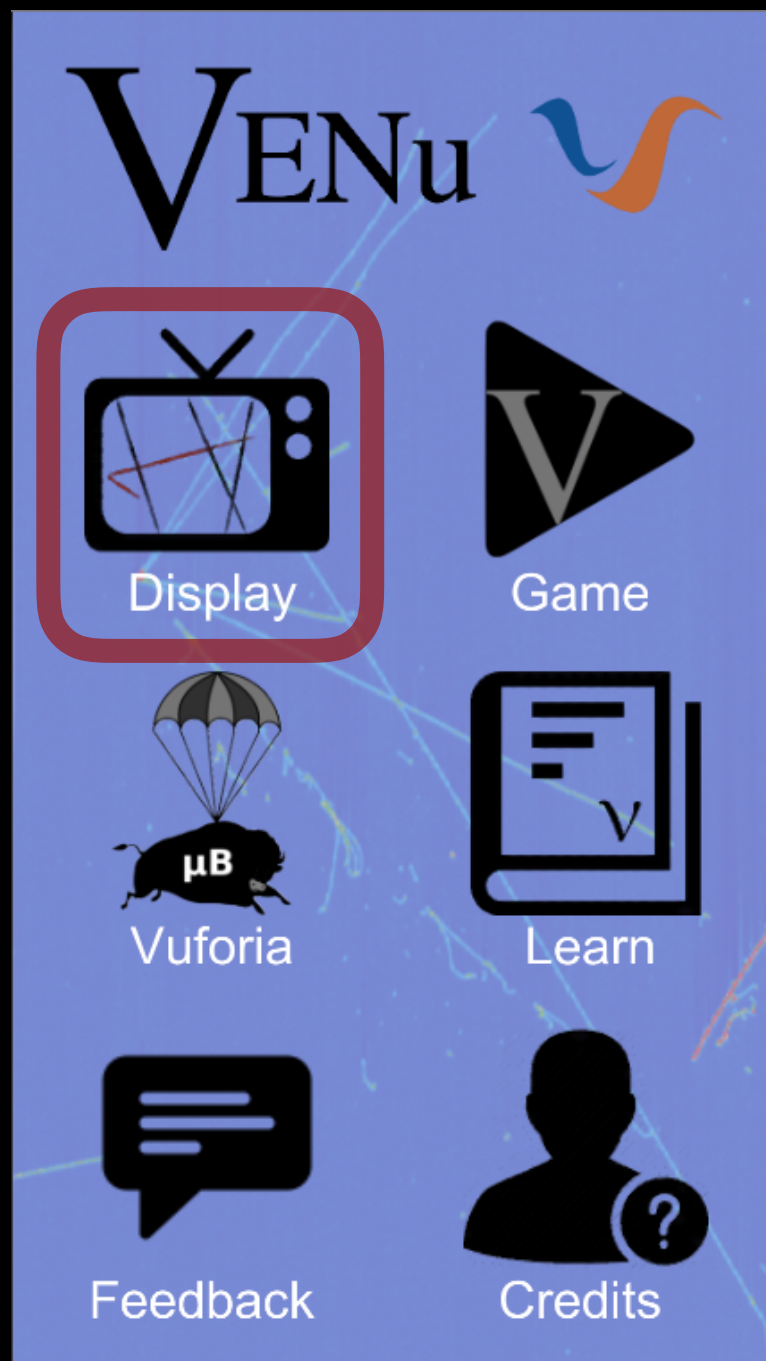
# The Menu

## Main Menu

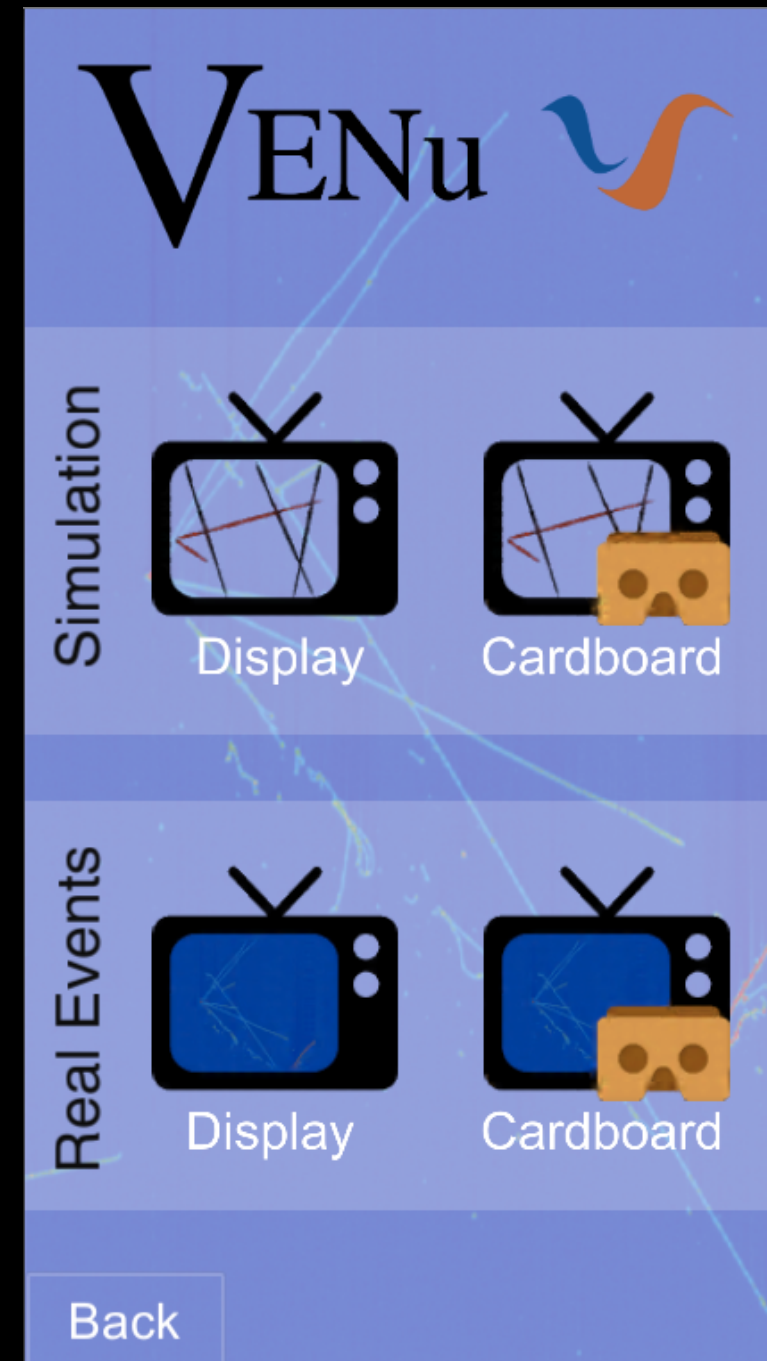


# The Menu

## Main Menu

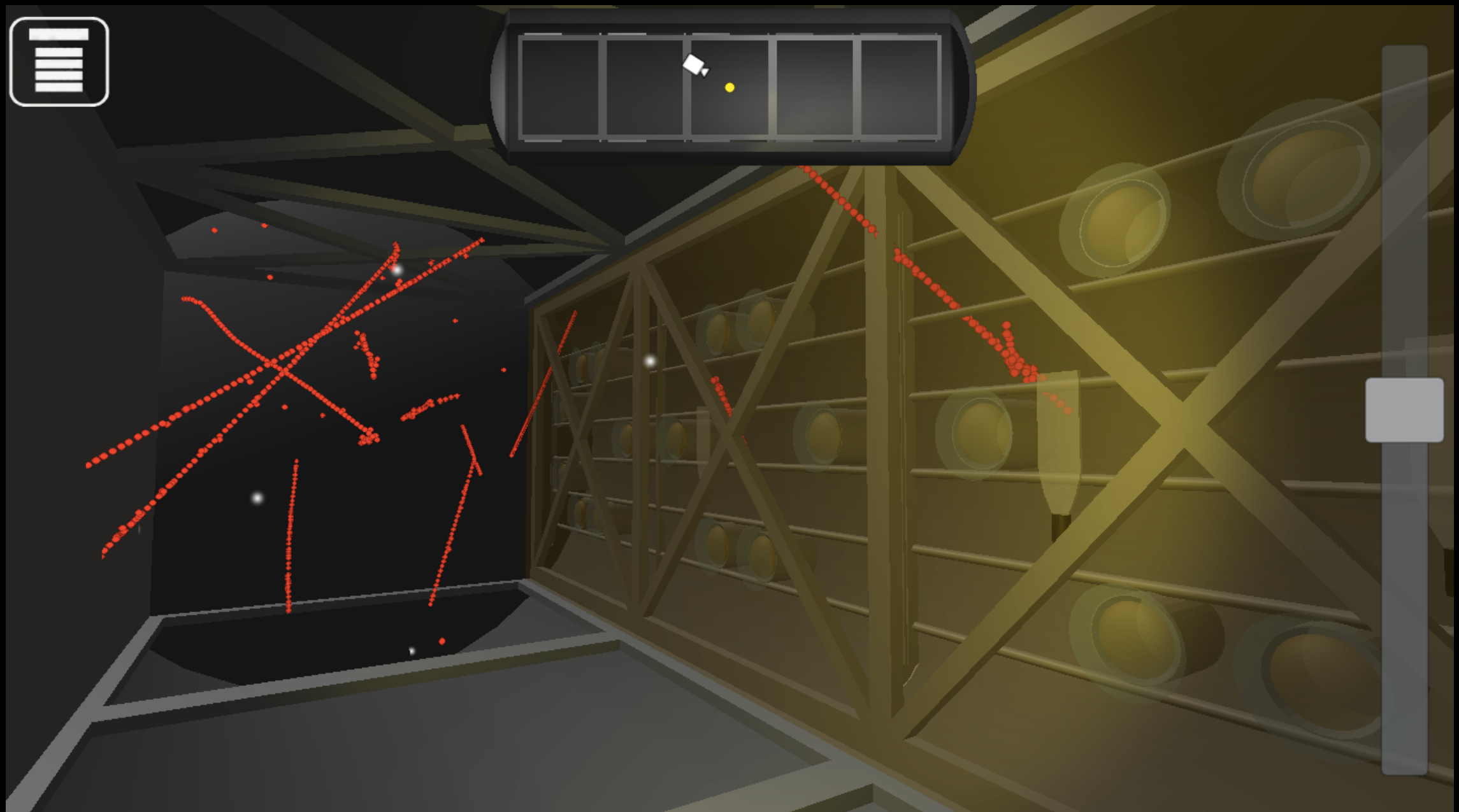


## Display Menu






# The Display



# The Learning Sections **V**ENu

## Learn Menu

**V**ENu  
Learn 

What are neutrinos?

Where do neutrinos come from?

How to make a neutrino beam

Neutrino interactions

What is a cross-section?

Cosmic rays

Main Menu

## Learn Section

**V**ENu  
Learn 

**Where do neutrinos come from?**

Neutrinos were first produced in the universe some 14 billion years ago, 10 to the -43 seconds after the Big Bang. A mere second later, they were already rapidly moving away from the rest of the hot and dense primary particle soup; scientists are still seeking to detect these neutrinos that survive from the Big Bang. So far, only two sources of extraterrestrial neutrinos have been observed: the sun and supernovae.

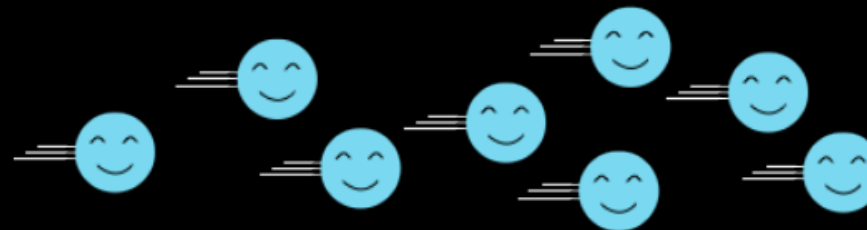


Main Menu Learn Menu

# The Tutorial

1/5

All starts with a neutrino beam produced at Fermilab...

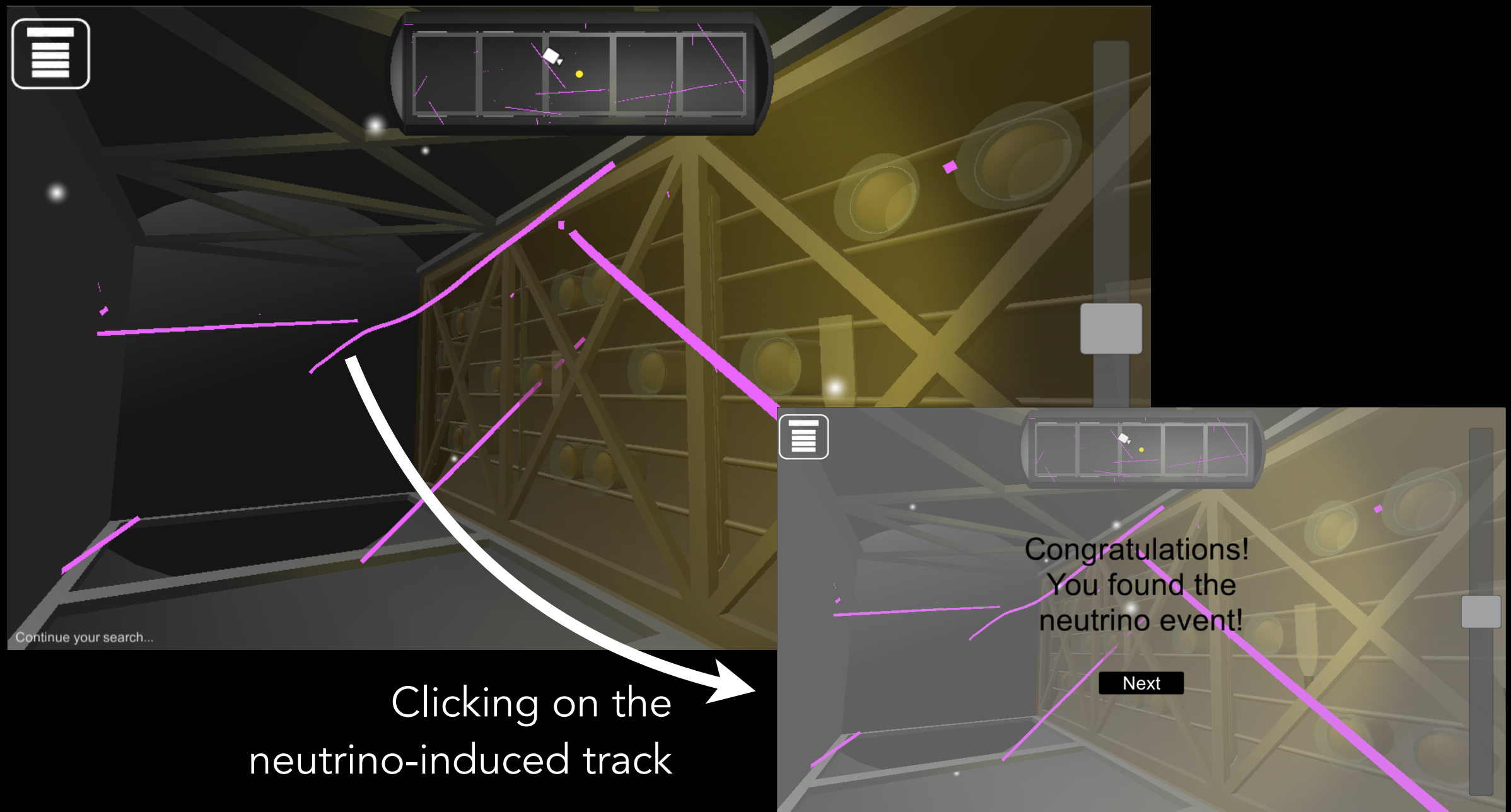


Learn how to make  
a neutrino beam

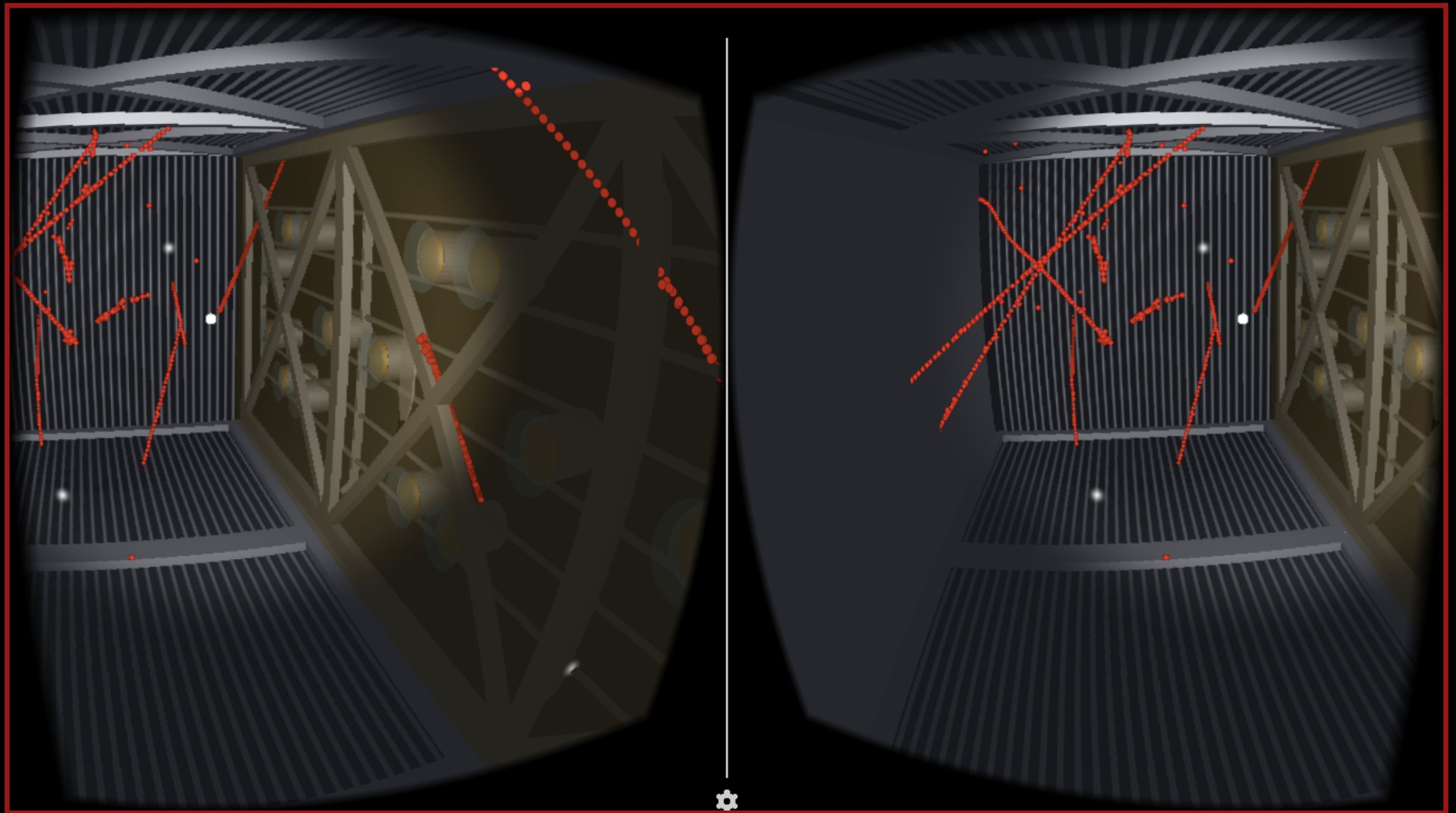
Back

Next

# The Game



# The VR Mode





# Who was engaged?



Other than UK and USA, we have downloads  
mainly from Canada, Italy, Germany,  
Australia, Switzerland, France and India.



More than 1000 downloads up to now!

# Who was engaged?



## Stargazing

When 28 January 2017

Where Physics Dep. University of Oxford

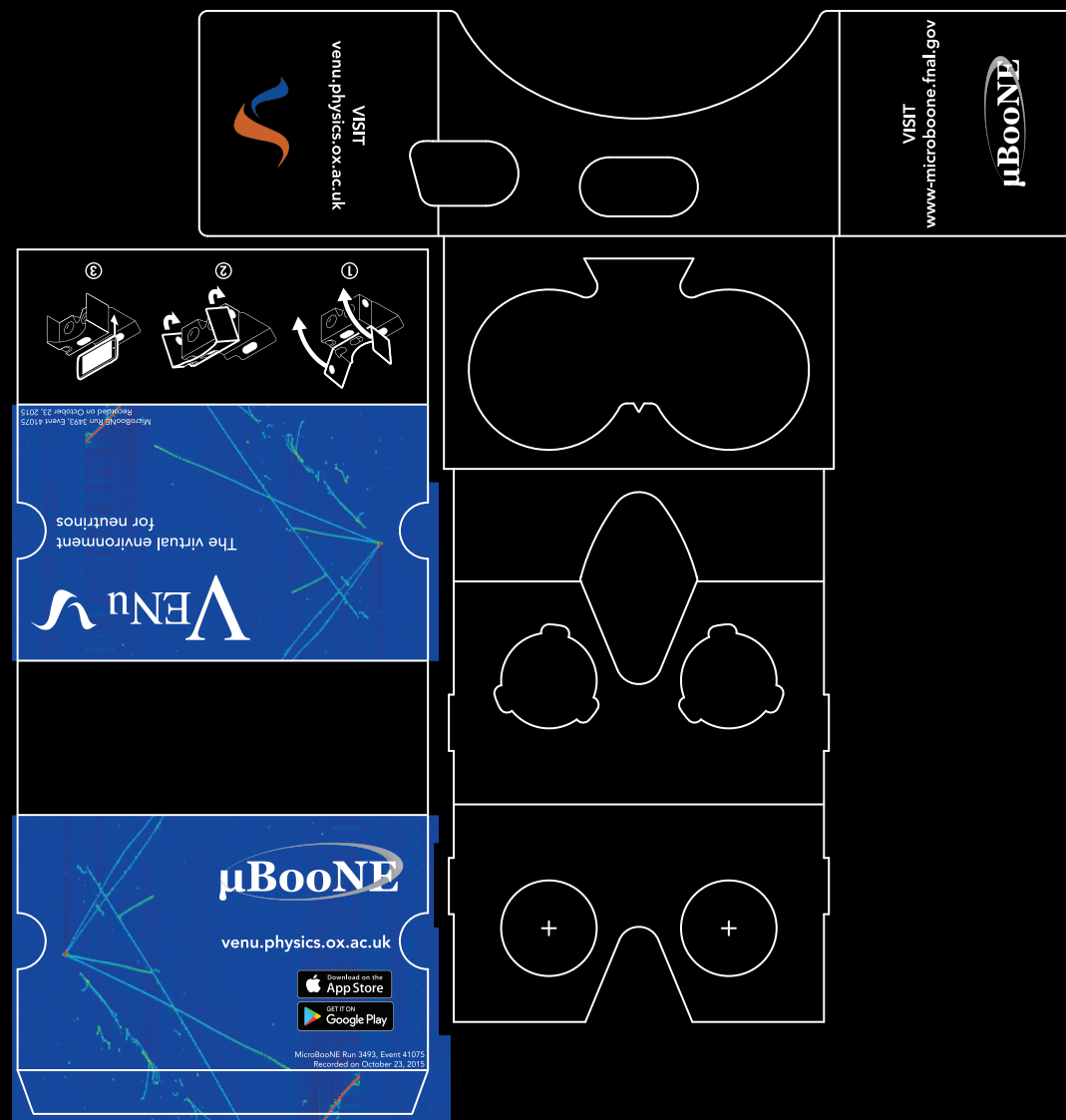
Link <https://www2.physics.ox.ac.uk/events/2017/01/28/stargazing-oxford-2017>



# Who was engaged?

VENu 

We designed custom  
Google Cardboards



Credit: Wouter van de Pontseele







Stargazing, Oxford University, 28 January 2017



Credit: Wouter van de Pontseele



Stargazing, Oxford University, 28 January 2017



Credit: Wouter van de Pontseele



Stargazing, Oxford University, 28 January 2017



# Who was engaged?



## Chicago Science Festival

When 20 May 2017

Where Chicago Merchandise Mart

Link <http://www.illinoisscience.org/chiscifest2017/>





Chicago Science Festival, 20 May 2017



# Who was engaged?



## Oxford Garden Party

When 25 June 2017

Where Rhodes House, Oxford

Link [physics.ox.ac.uk/events/2017/06/25/2017-physics-alumni-garden-party](https://physics.ox.ac.uk/events/2017/06/25/2017-physics-alumni-garden-party)





Oxford Garden Party, Rhodes House, 25 June 2017

Credit: Junior Williamson



## Add new features:

- ▶ 3D introductory video;
- ▶ allow users to perform simple analyses;
- ▶ stream live data;
- ▶ add other detectors (ICARUS just arrived at Fermilab!)



# Conclusions

The app is available for free: [venu.physics.ox.ac.uk](http://venu.physics.ox.ac.uk)



Contact us: [venu.developers@physics.ox.ac.uk](mailto:venu.developers@physics.ox.ac.uk)



[facebook.com/venuneutrinos](https://facebook.com/venuneutrinos)

## MOBILE APP, CARDBOARD VERSION AND GAME

Marco Del Tutto University of Oxford

### CORE DEVELOPMENT

Alistair McLean New Mexico State University

Marco Del Tutto University of Oxford

Matt Bass University of Oxford

Owen Crawford Bradley University

Thomas Wester University of Chicago

Ben Carls Fermilab

Ariana Hackenburg Yale University

Gene Kim Illinois Math and Science Academy

Tia Miceli New Mexico State University

Sean Ngo Illinois Math and Science Academy

Steve Pate New Mexico State University

Jen Raaf Fermilab

Sam Zeller Fermilab

### LEARN SECTIONS

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### GRAPHICS AND DESIGN

Marco Del Tutto University of Oxford

### SPECIAL THANKS TO

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Roxanne Guenette University of Oxford