MSc project Physics & Astronomy
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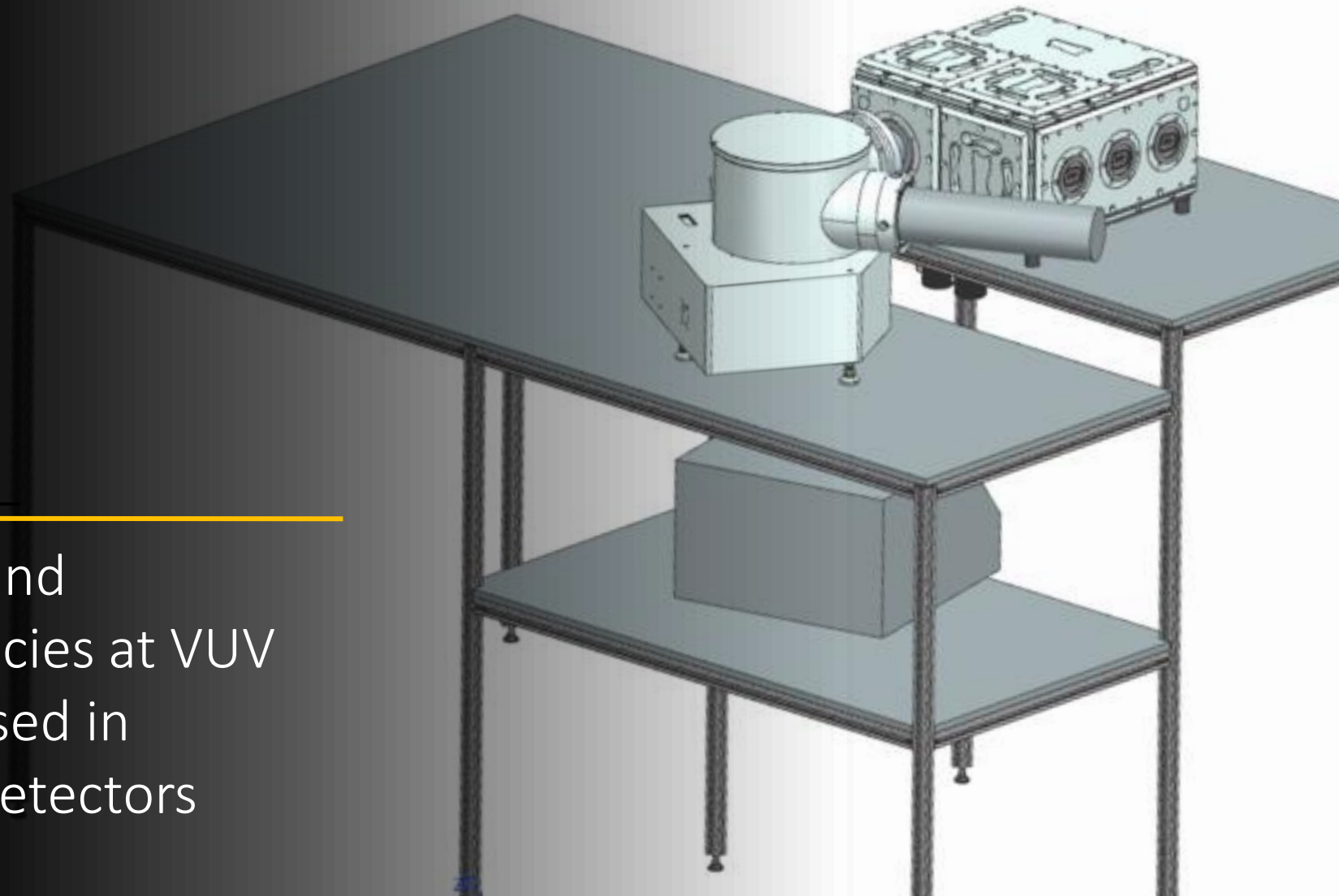
Nikhef

VUV Experiment

Measuring the reflectivity and wavelength shifting efficiencies at VUV wavelengths of materials used in neutrino and dark matter detectors

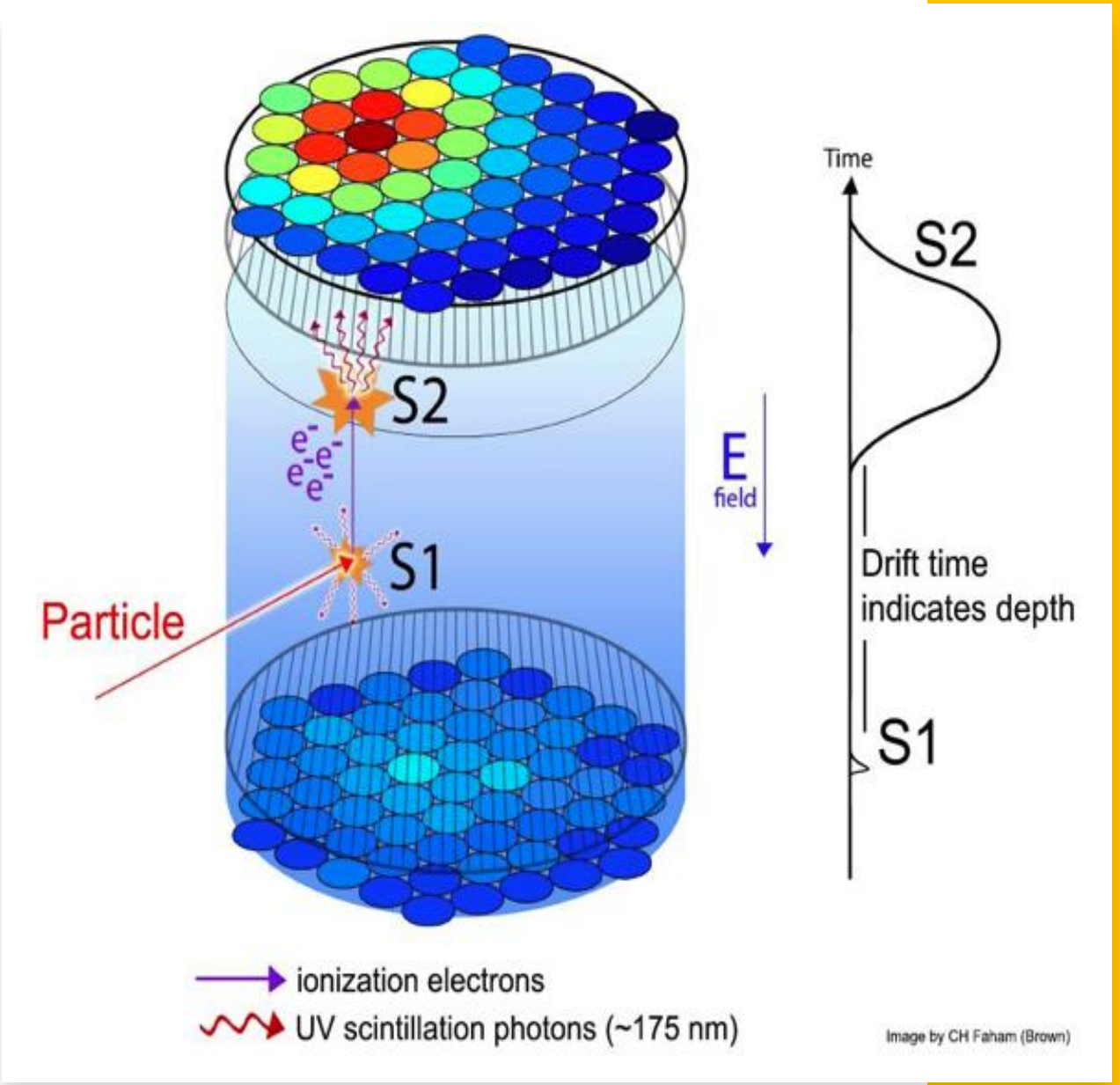


Contents

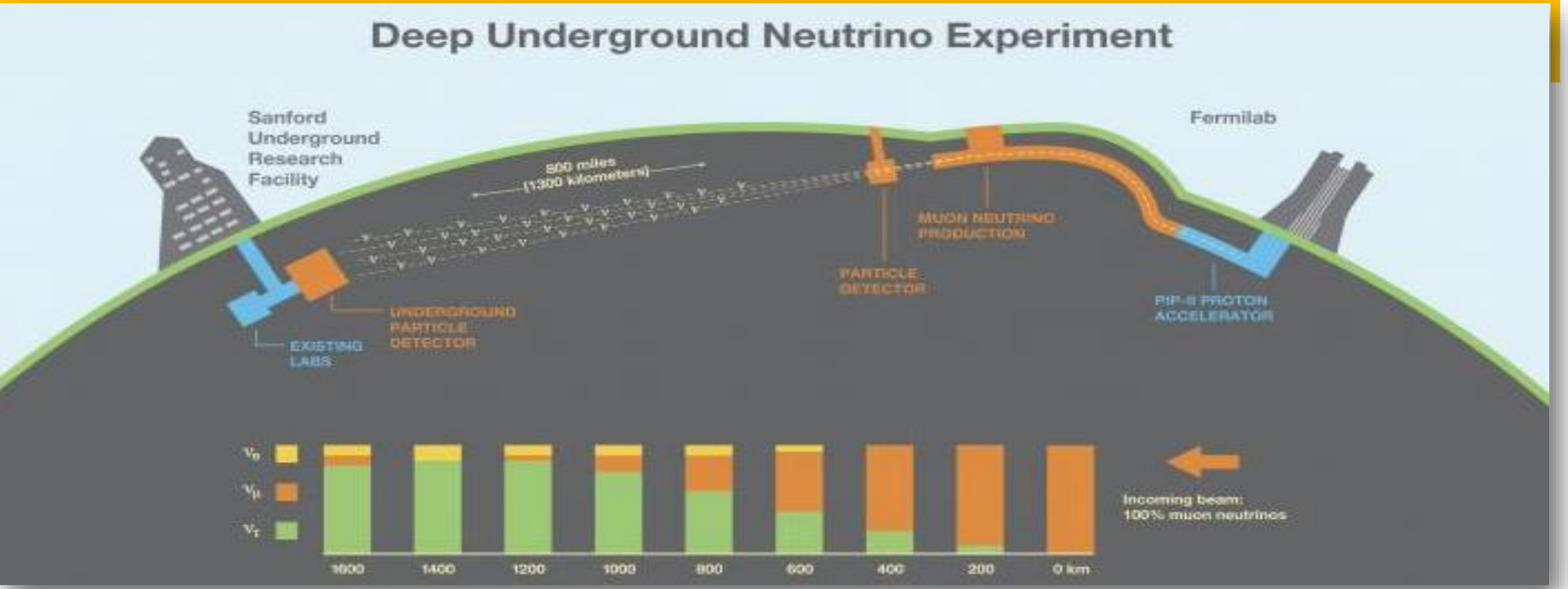
1. Background
2. DUNE
3. VULCAN
4. My project
5. Progress

Background

- Standard model of elementary particles
- Dark matter
- Neutrino's
  - ν_μ , ν_τ , ν_e
  - Oscillations
- Neutrino and DM detection
  - Weakly interacting
  - Time projection chambers (TPC's)



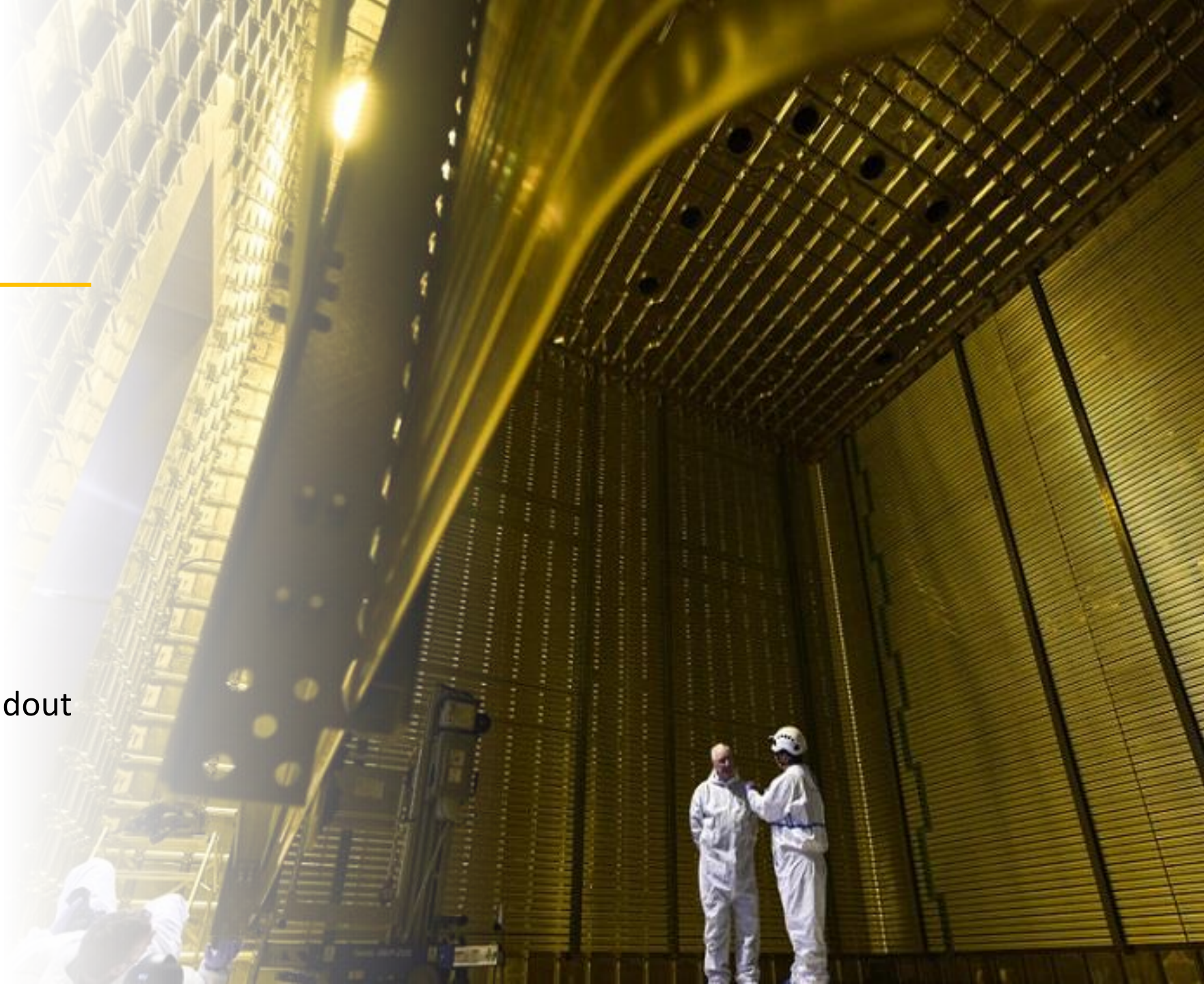
DUNE

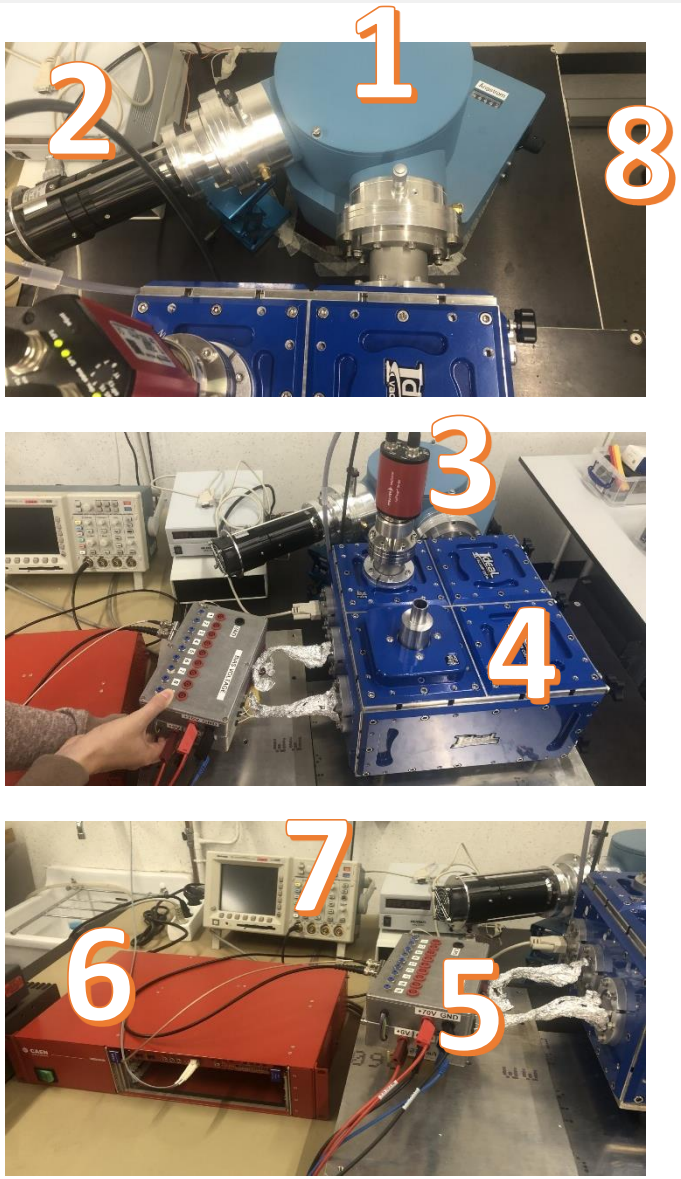

Deep Underground Neutrino Experiment
Sanford Underground Research Facility
Fermilab
800 miles (1300 kilometers)
MUON NEUTRINO PRODUCTION
PARTICLE DETECTOR
PIP-II PROTON ACCELERATOR
UNDERGROUND PARTICLE DETECTOR
EXISTING LABS
Incoming beam: 100% muon neutrinos
1600
1400
1200
1000
800
600
400
200
0 km

DUNE

- Liquid argon scintillation
  - +/- 127 nm
  - Interaction with DUNE materials

- Samples from DUNE
  - Copper from charge readout plane
  - Aluminium from crystat
  - ???





VULCAN experiment

1. Monochromator
2. Deuterium lamp
3. Pressure sensor
4. Vacuum chamber
5. Amplifier
6. Digitizer
7. Oscilloscope
8. Vacuum pump (under table)

My project

I will be Measuring the reflectivity and wavelength shifting efficiencies at 100 – 300 nm (range for liquid argon scintillation light) of materials used in DUNE

My project

Background phase

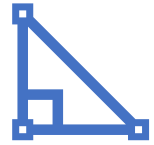
Reading up on theory

Understanding the setup

Commissioning/calibration phase

Making the setup work

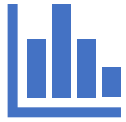
Intensity calibration



Designing sample alignment system

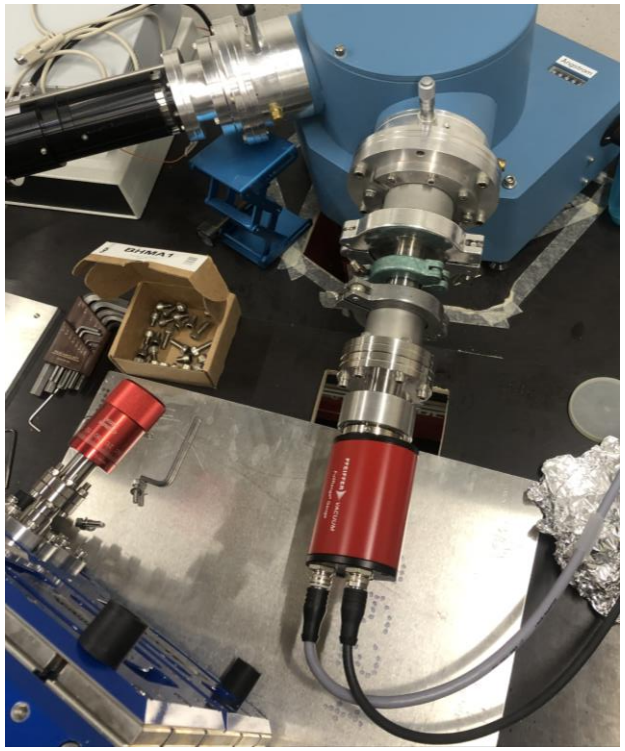
Measurement phase

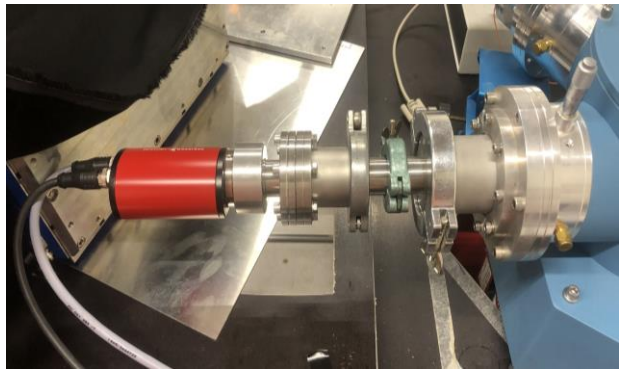
Measuring on DUNE samples

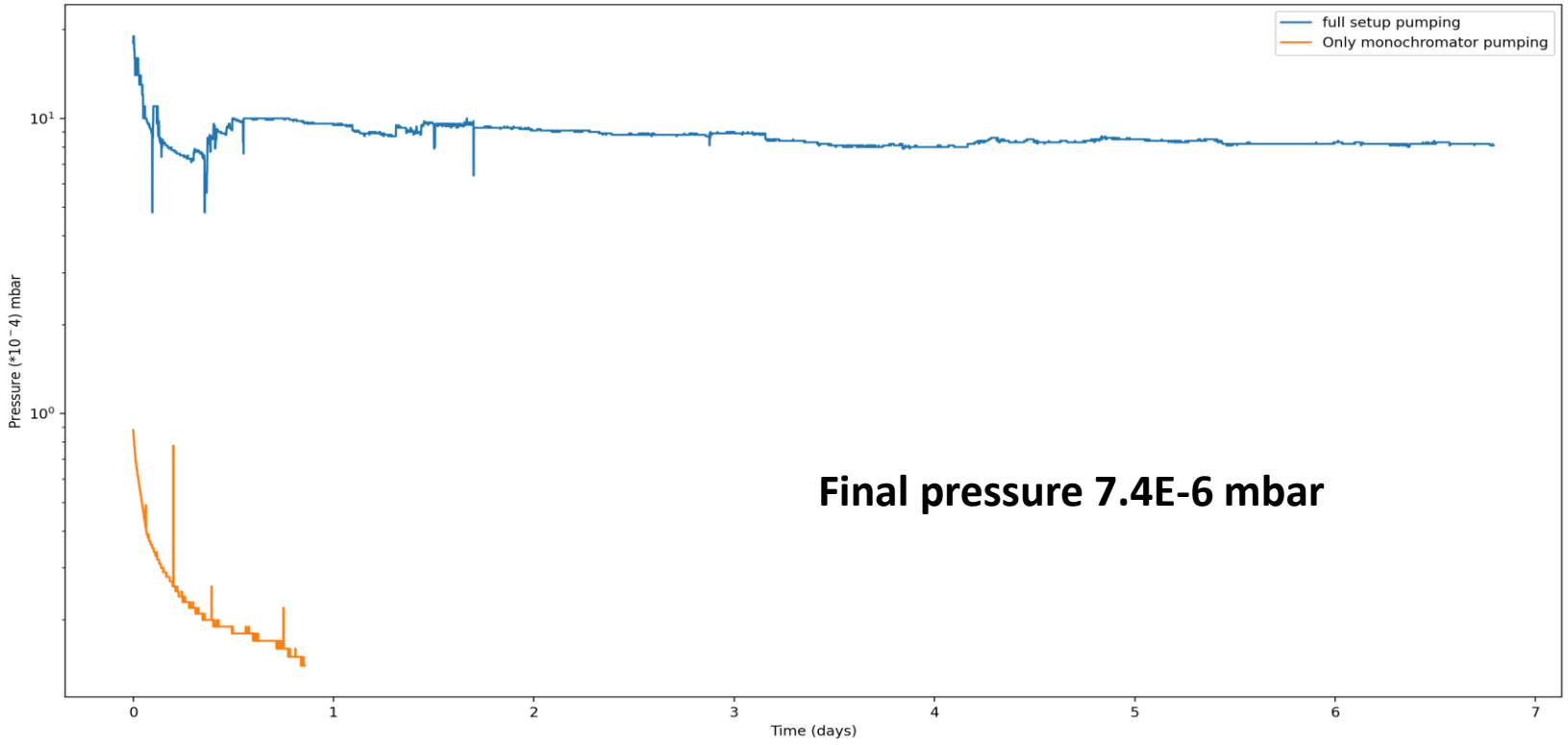


Analyzing data

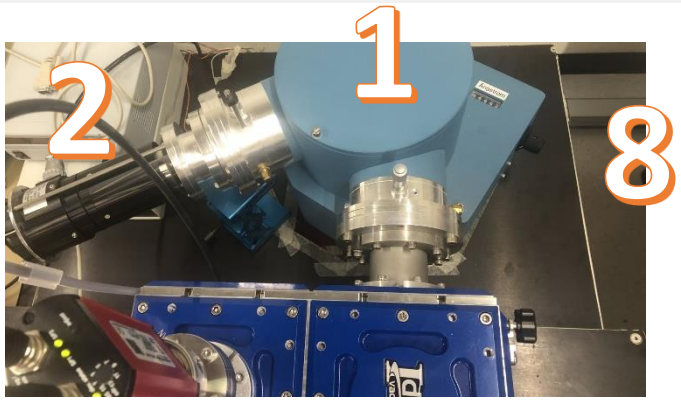
Progress

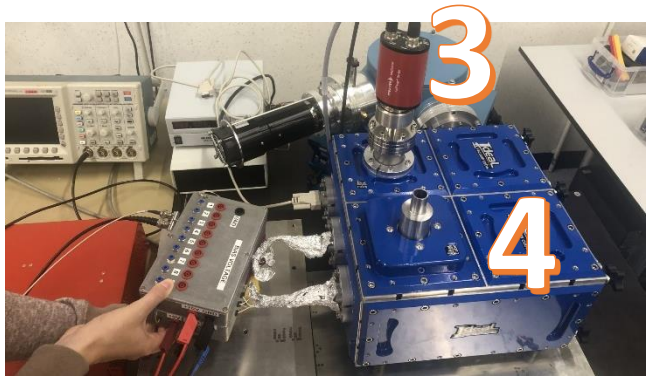


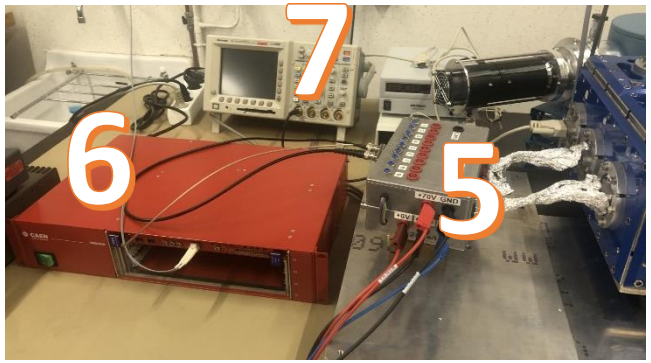




Final pressure 7.4E-6 mbar

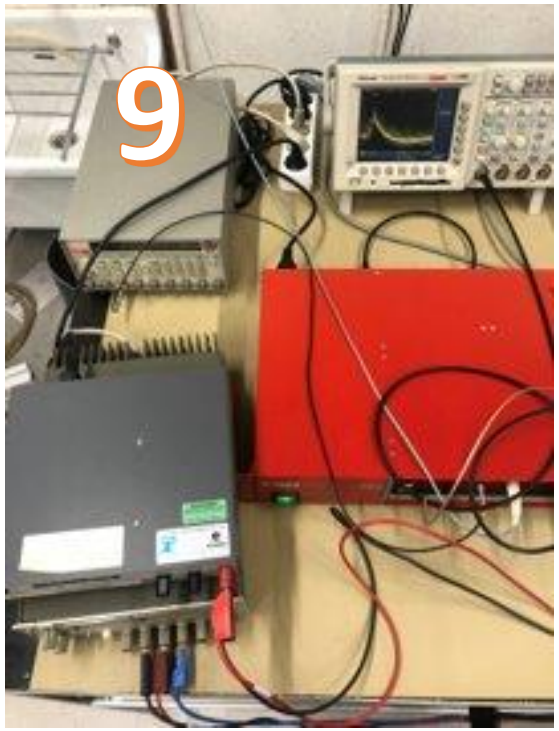




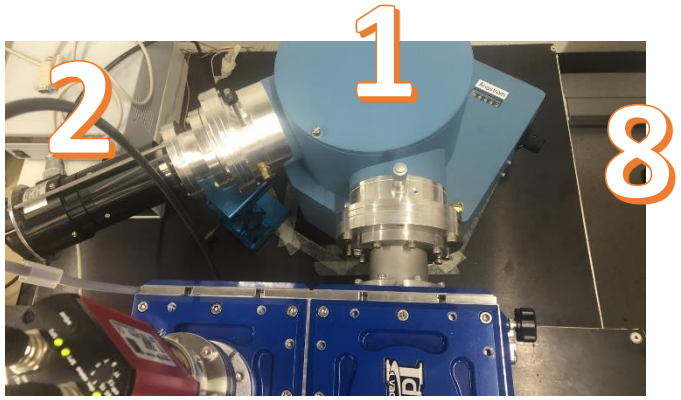


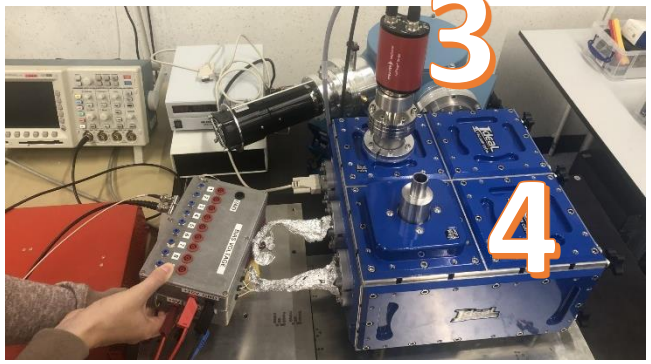
Progress

1. Monochromator
2. Deuterium lamp
3. Pressure sensor
4. Vacuum chamber
5. Amplifier
6. Digitizer
7. Oscilloscope
8. Vacuum pump (under table)
9. External trigger



Progress


1
2
8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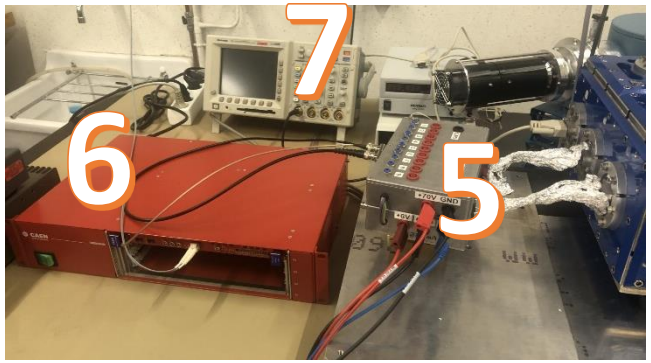
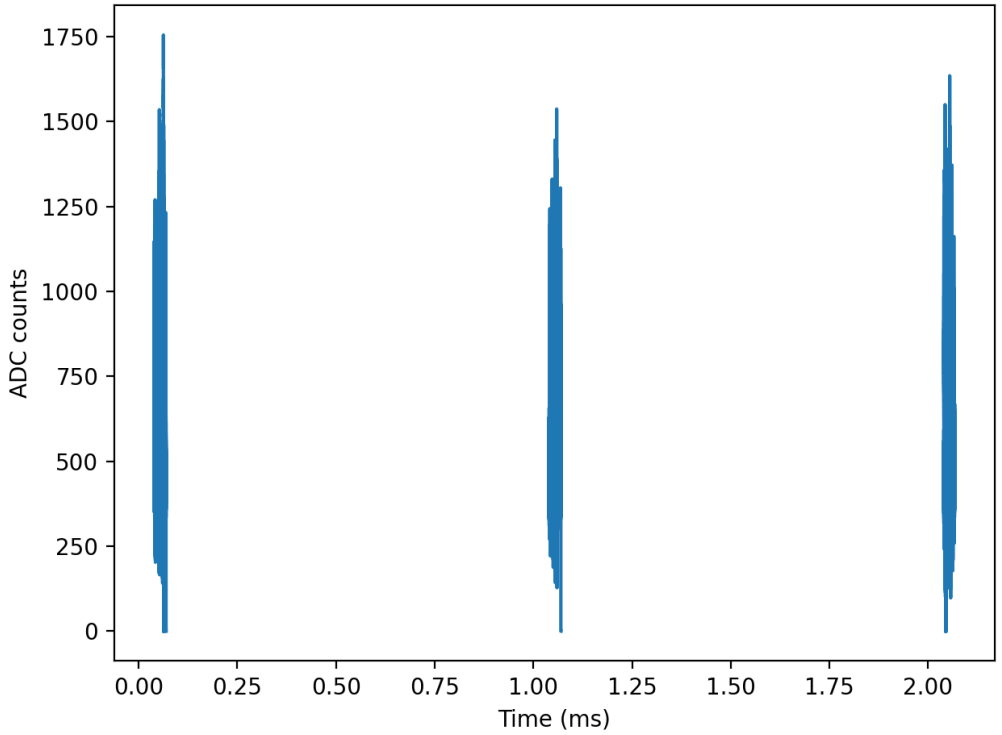
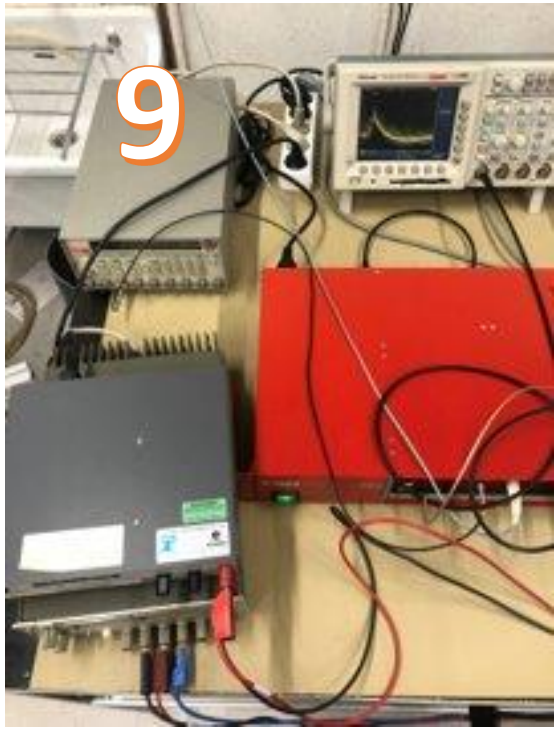

7
6
5


1750
1500
1250
1000
750
500
250
0
ADC counts
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Time (ms)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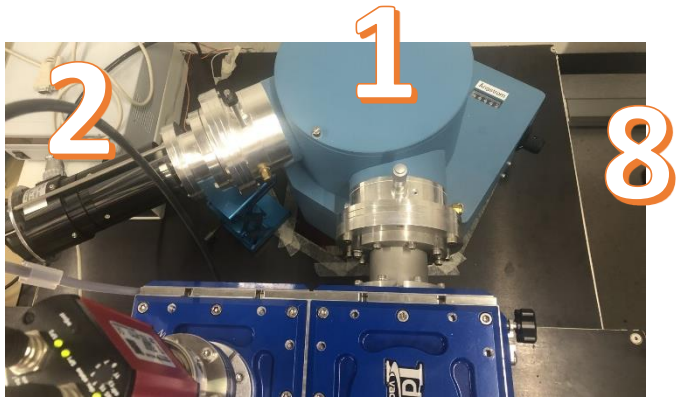
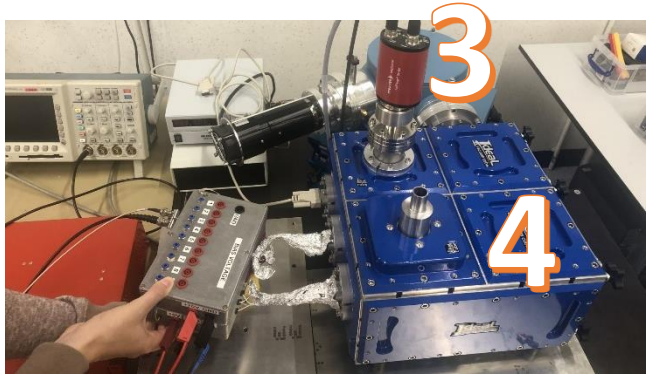
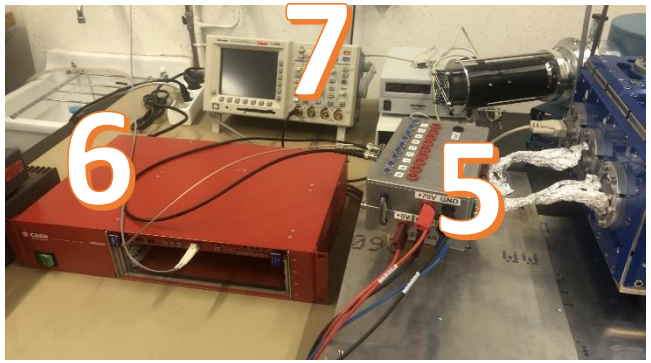
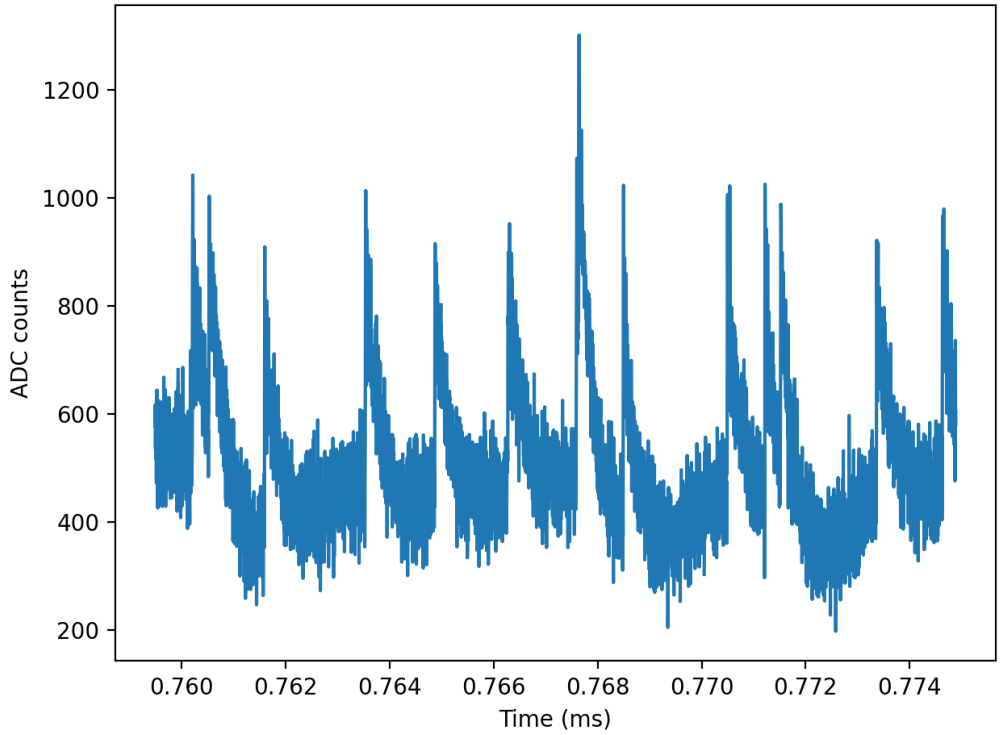
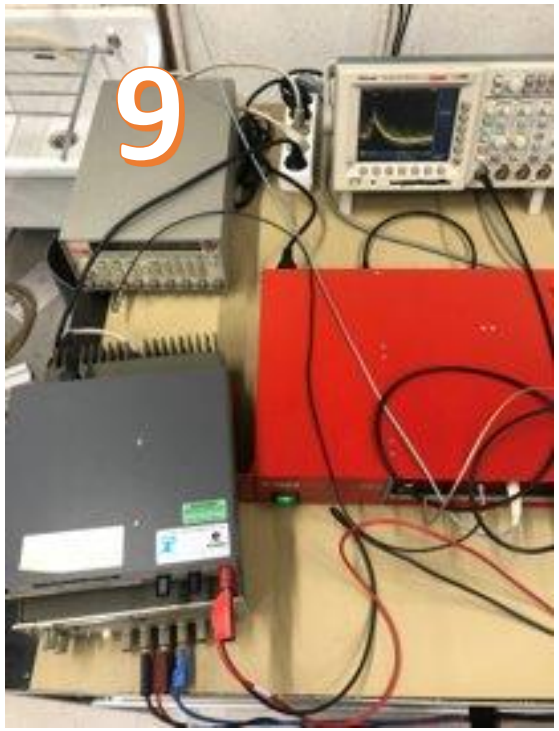
Progress


1
2
8


3
4


7
6
5


ADC counts
1200
1000
800
600
400
200
0.760
0.762
0.764
0.766
0.768
0.770
0.772
0.774
Time (ms)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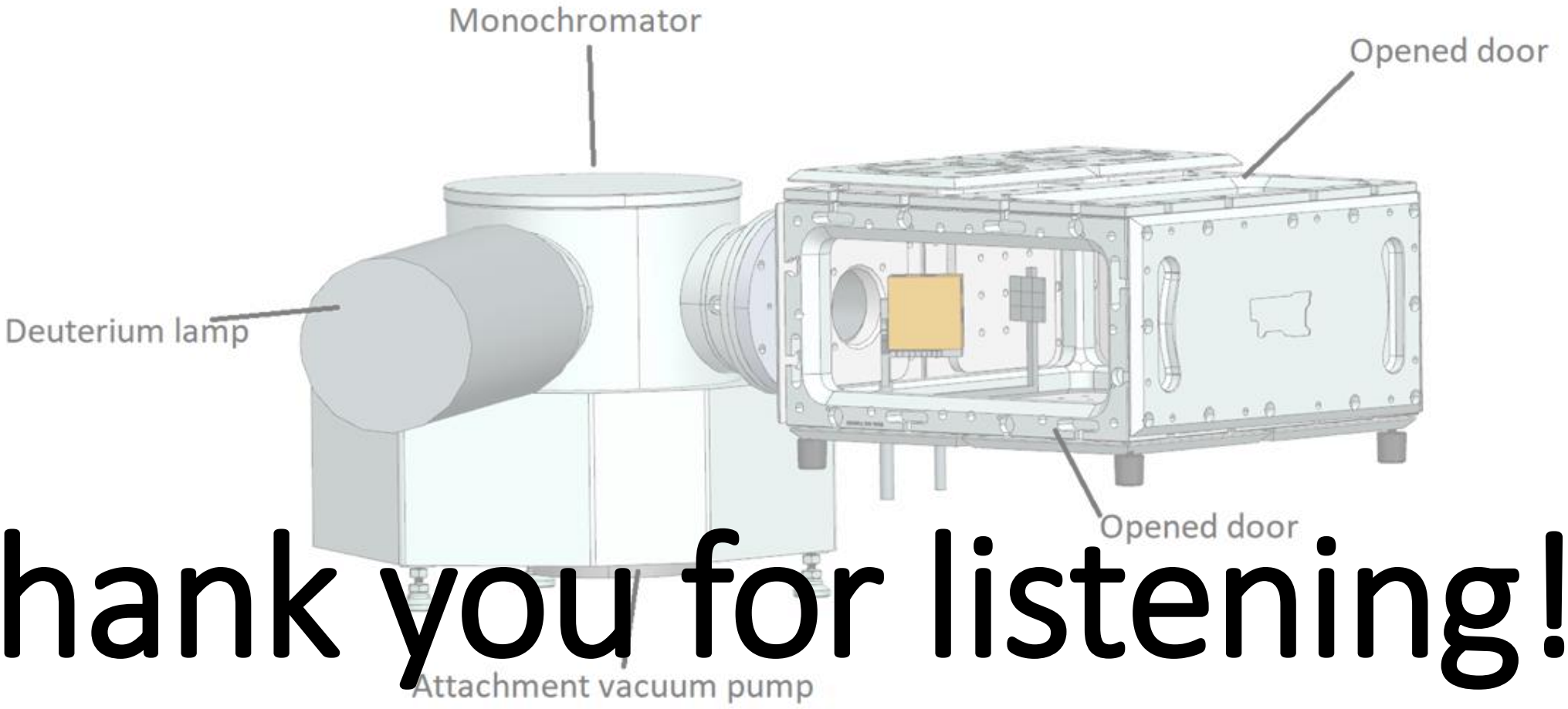

Thank you for listening!