

# Muon Detectives: Empowering Educators & Engaging Students in Dark Matter Science

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# Inspiration from Existing Programs

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## Regional Partner Schools

- Opportunities for underserved schools
- Lessons linking contemporary physics and science investigation with the secondary curriculum
- Scientists engaging with students in classrooms

# Inspiration from Existing Programs

**Regional  
Partner  
Schools**

## **Node-Led Outreach Support**

- **Building capacity for PhD students to host and support events in their cities**
- **Creating the materials and activities (kits) to assist local programs**
- **Outreach leadership training**

# Inspiration from Existing Programs

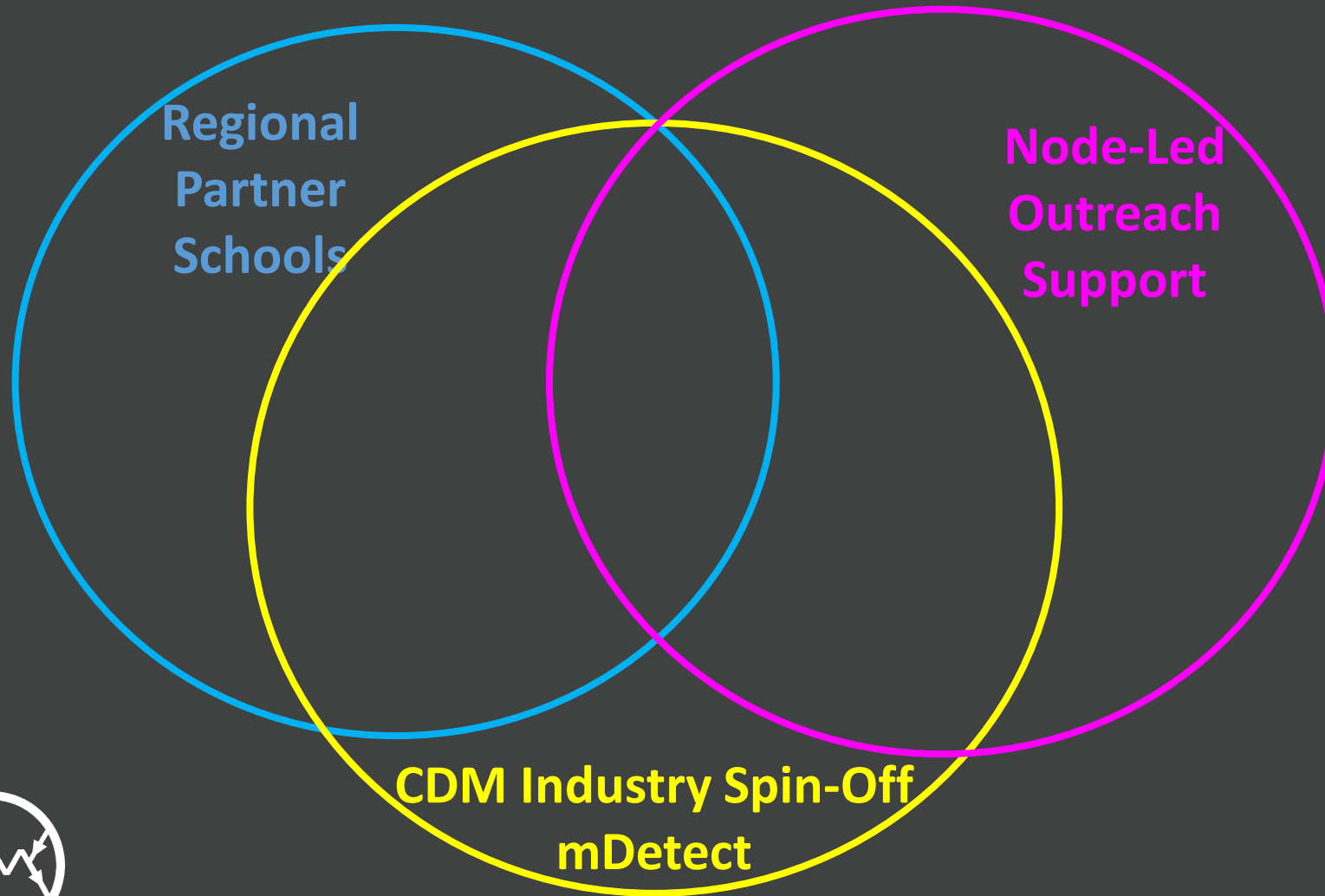
**Regional  
Partner  
Schools**

## **CDM Industry Spin-Off mDetect**

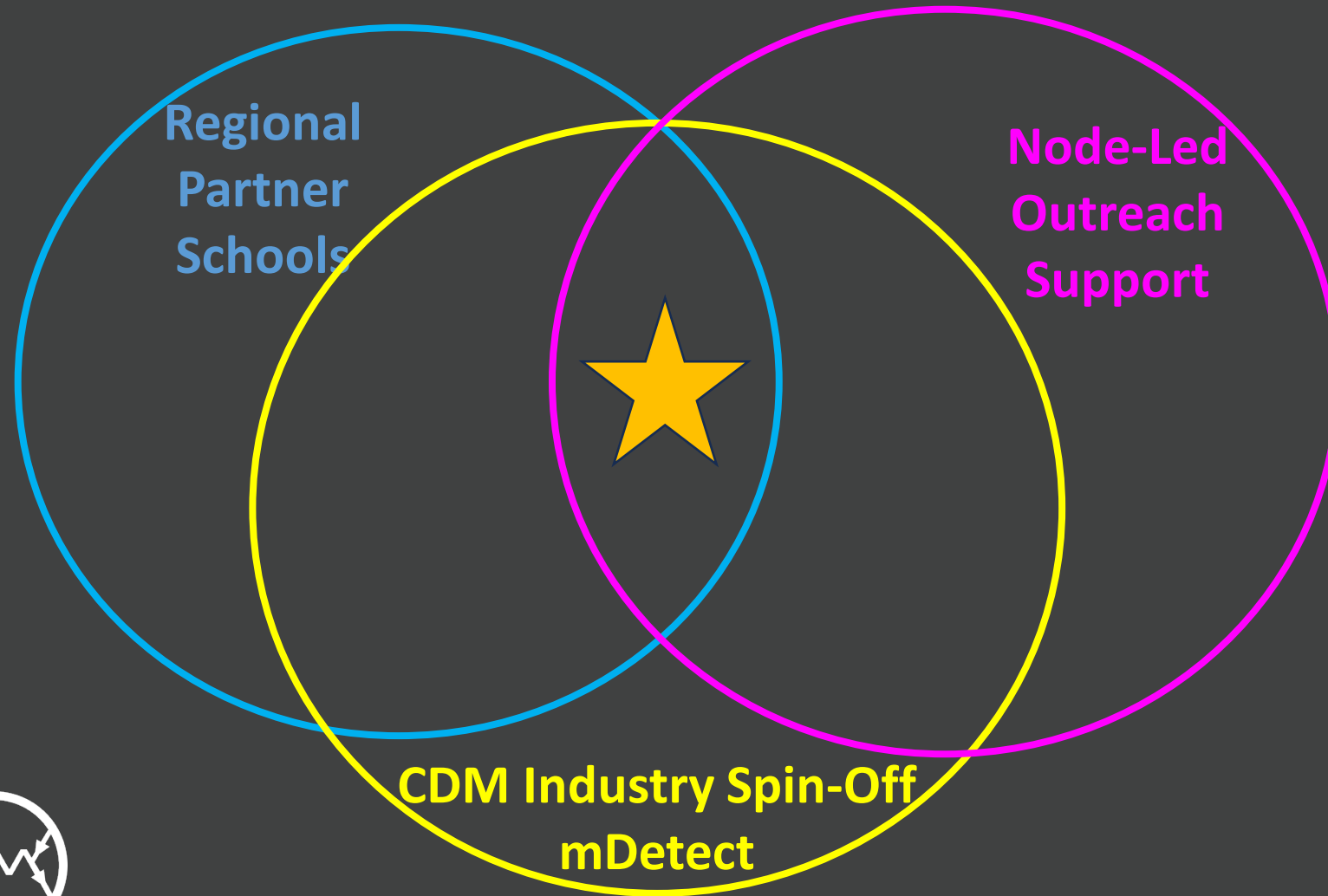
- **Development of portable and robust muon detectors for applications such as mining**
- **Further iteration of device for use in tertiary education**
- **Development of EduMod for classrooms**

**Node-Led  
Outreach  
Support**

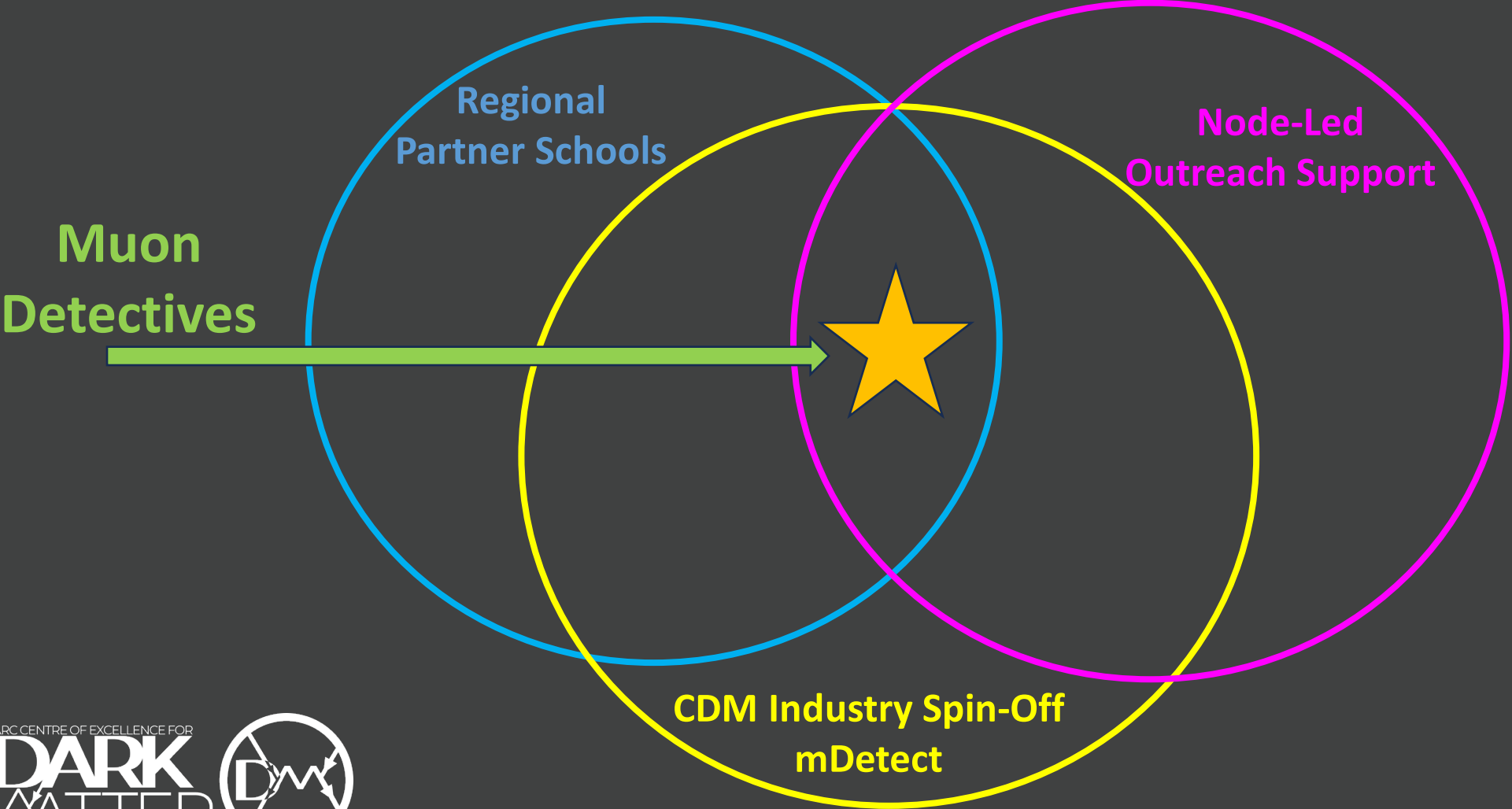
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# Muon Detectives: Initiative Goals

- Source mDetect muon detectors (EduMODs) to Nodes for local outreach and as class sets
- Develop new curriculum-aligned lessons for piloting in our partner schools with secondary teachers and the Melbourne Graduate Schools of Education (MGSE).
- Incorporate this pilot into the existing study on the efficacy of the partner schools program on science belonging for regional students
- Designation of Outreach Ambassadors for each node to lead outreach initiatives at their respective universities
- Joint professional development workshop with PhD Outreach leaders and partner school teachers to co-develop new lessons and activities for use in both classes and with the public

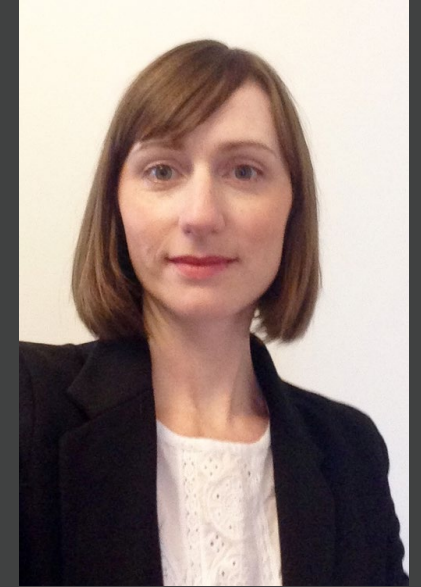


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# Project Team



# Project Status / Timeline

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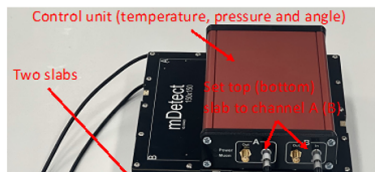
## Muons and Relativity

### Activity A: Detection of Muons - ANSWERS

#### Setup

The correct setup of the detectors is simple:

1. The scintillators must be plugged into the control unit, generally the top one is plugged into A for consistency (however which is plugged into A or B isn't important).
2. The control unit is then plugged into the computer. The other 2 ports are for an oscilloscope, this is optional.
3. The executable (".exe") file is put into a folder by itself.
4. A file name for the data (".csv") file is chosen.
5. A logging mode is chosen (continuous logging is suggested). Don't tell the students yet, but at least 20 minutes of data should be collected in one session for effective data analysis.
6. Begin logging data.



## Muons and Relativity

### Activity B: Analysis of Muon Detection Data

Key Question: How can we visualise and conclude how many muons have been detected on the Earth's surface?

<p>Approx Duration: 30 minutes</p> <p>In this activity, you will create a histogram that shows the number of muons detected every 10 seconds and use this to conclude the average 'per second' detection rate of muons.</p>	<p><b>Learning Intentions</b></p> <ul style="list-style-type: none"> <li>To analyse the muon detection data and state the muon detection rate.</li> </ul>
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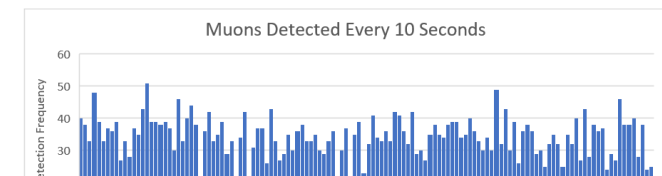
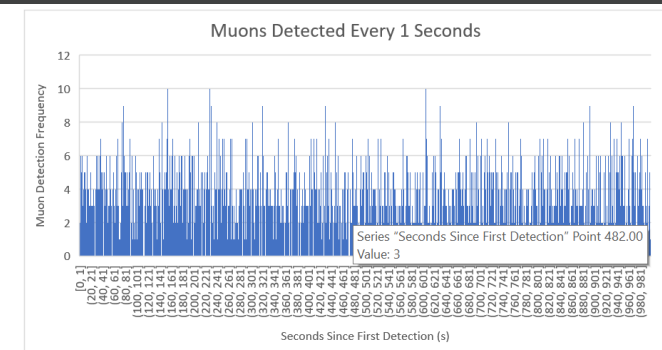
#### Aim

To graphically represent and analyse the muon detection data and conclude the average 'per second' detection rate of muons.

#### Manipulation of Data

Open the saved '.csv' file from your experiment. Each row gives the date, time, temperature, pressure, and detector angle for each muon detection event. Save it as an Excel Workbook '.xlsx'.

	A	B	C	D	E	F	G	H
1	Date	Time	Seconds	A_amp	B_amp	Temperat	Pressure hPa	Angle degrees
2	31/12/2023	14:15	30.63707	89	77	21.81	1018.05	20.16



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## Instruction for setting up the EduMOD

- To start, place the two scintillators on top of each other, just as illustrated in the image.
- Position the electronic box flat on top of the scintillators to measure the scintillators' angle accurately.



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- August-October 2024: First trials of lessons with senior physics classes at partner schools
- Early 2025: PD for teachers and outreach ambassadors

# Results in time for IPPOG 2025?

