

# What can go wrong in experimental physics?

*Zuzana Slavkovská*

*SABRE ECR Workshop, 22 Nov 2022*



# What can go wrong in experimental physics?

Four cases:

1. Customs

2. Contamination

3. Power outage

4. Disappearing sample

+ Your examples

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# Case 1: Customs



<https://easyfreight.co.nz/blog/why-customs-is-holding-your-parcel/>

# Case 1: Customs

19 April – 05 May 2022

## SABRE South team:

Bill Melbourne (Uni Melbourne)

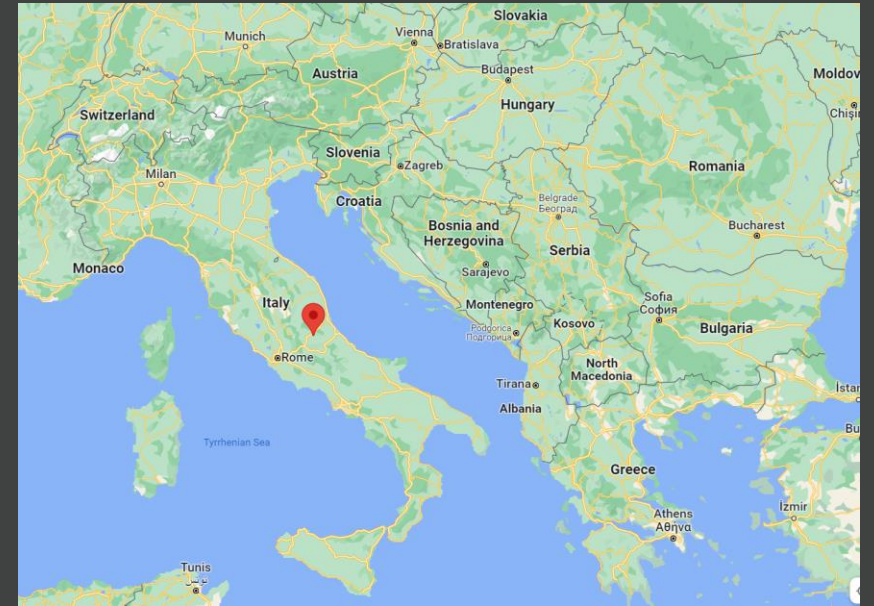
Ferdos Dastgiri (ANU)

Zuzana Slavkovska (ANU)

Travel to Italy to perform characterisation  
measurements of NaI-035 crystal for  
SABRE South dark matter project



# Case 1: Customs



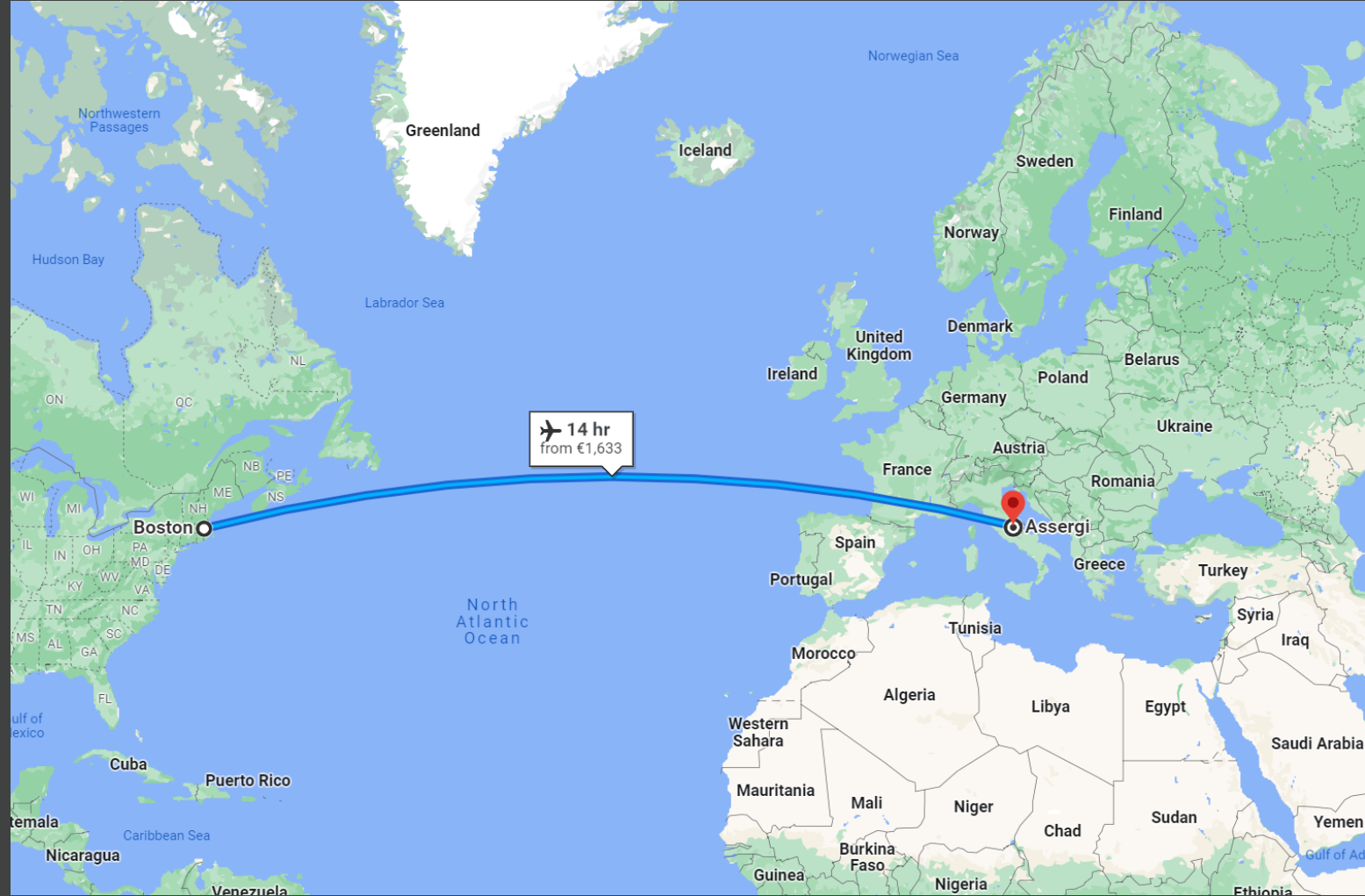
**LNGS** (Laboratori Nazionali del Gran Sasso), Assergi, Abruzzo, Italy  
funded by the **INFN** (Istituto Nazionale di Fisica Nucleare)



# Case 1: Customs

**NaI-035** produced by **RMD**  
(**R**adiation **M**onitoring  
**D**evelopments, Boston, MA, US)

Shipped on plane with  
**FedEx Priority**



# Case 1: Customs

FedEx

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Looking for a solution to ship both individual pieces and bulk packages?

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## Times & Coverage

- Typically 1 to 3 business days worldwide.

\*Terms and conditions may apply for imports to Australia.



## Service Days

- Every business day.
- Monday to Friday.
- Saturday service available in some markets upon request.



# Case 1: Customs

**NaI-035** produced by **RMD** (**R**adiation **M**onitoring **D**evelopments, Boston, MA, US)

Shipped on plane with **FedEx Priority**

1. Package randomly chosen for a check
2. INFN Rome staff contacted first
3. Customs clearance documents needed
4. FedEx disturbances due to global events

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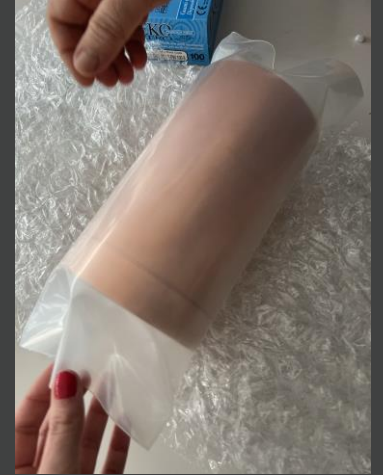
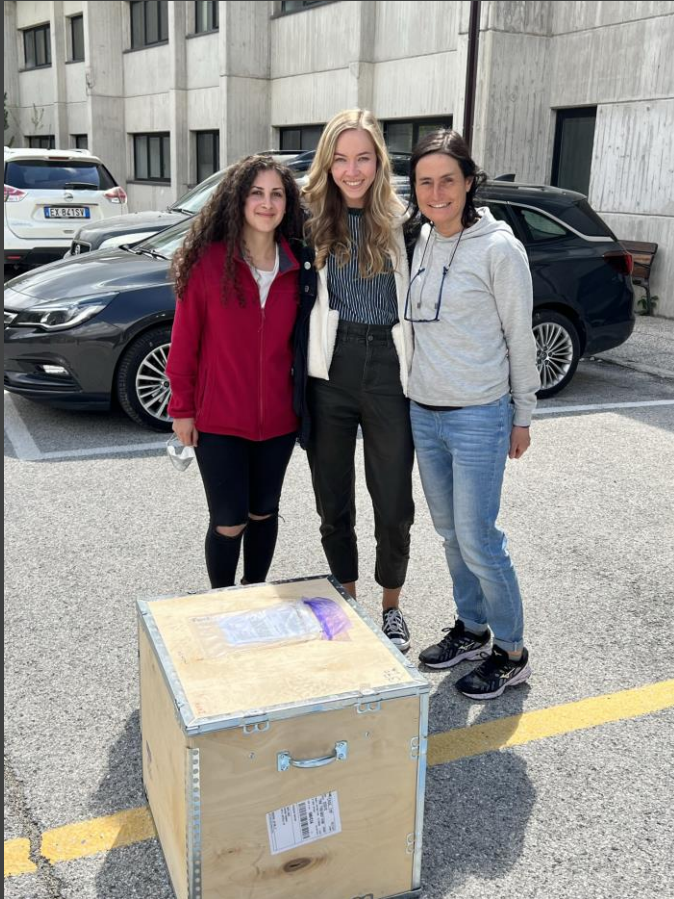
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# Case 1: Customs

Hard time eating Italian food and drinking Limoncello



# Case 1: Customs



# NaI-035 Performance Measurements

## Performed measurements:

- **PMT noise run studies**
- **Series of energy calibration source runs**  
(Am-241 source on different positions) to study spatial effects from the crystal growth
- Several **gamma-ray source measurements**
- **Alpha rate measurements**

# NaI-035 Performance Measurements

## LNGS team:

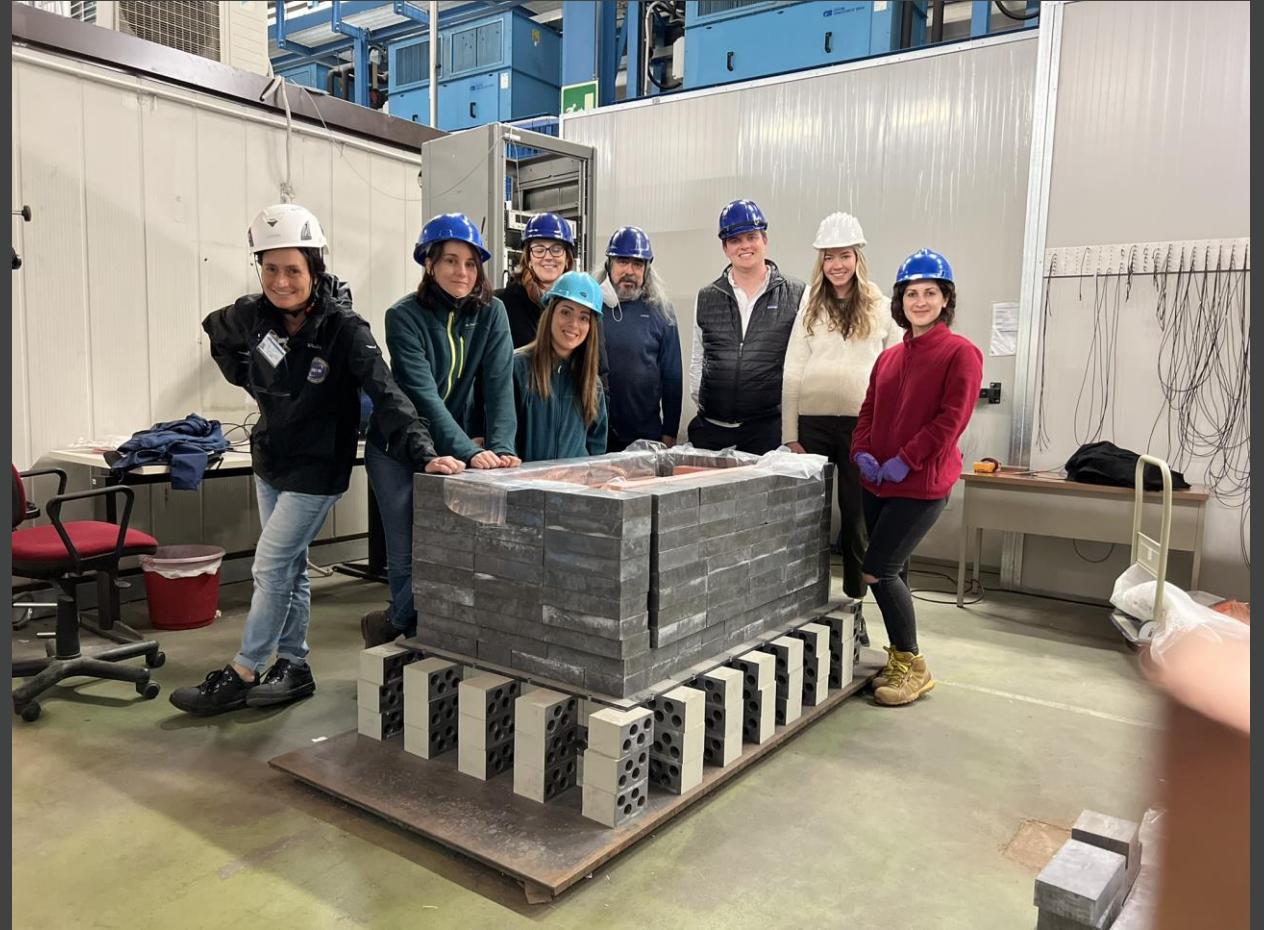
Chiara Vignoli

Giuseppe Dicarolo

Ambra Mariani

Claudia Tomei

Giulia D'Imperio



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# Case 2: Contamination

PhD Project of Dominik Koll at The Australian National University:



Interstellar influx on Earth mapped through Supernova Fe-60 and r-process Pu-244

10 Myr time profile of Fe-60 and Pu-244

3.7 kg crust from Pacific ocean

Drill cores investigated for Pu-244 with Accelerator Mass Spectrometry (AMS)





# Case 2: Contamination

Desired background level:  $10^2$  atoms of Pu-244

Another research group at the facility had Pu-244 targets with  $5 \times 10^{16}$  atoms of Pu-244

-> contamination all across the facility  $10^4 - 10^6$  Pu-244 atoms

Our chemistry laboratory (2019):

$10^3 - 10^4$  Pu-244 atoms



# Case 2: Contamination

We developed decontamination protocols, deep cleaning of laboratory, new labware, continuous monitoring and awareness



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We developed decontamination protocols, deep cleaning of laboratory, new labware, continuous monitoring and awareness



Pressing lab



“Red” lab



“Blue” lab

# Case 2: Contamination

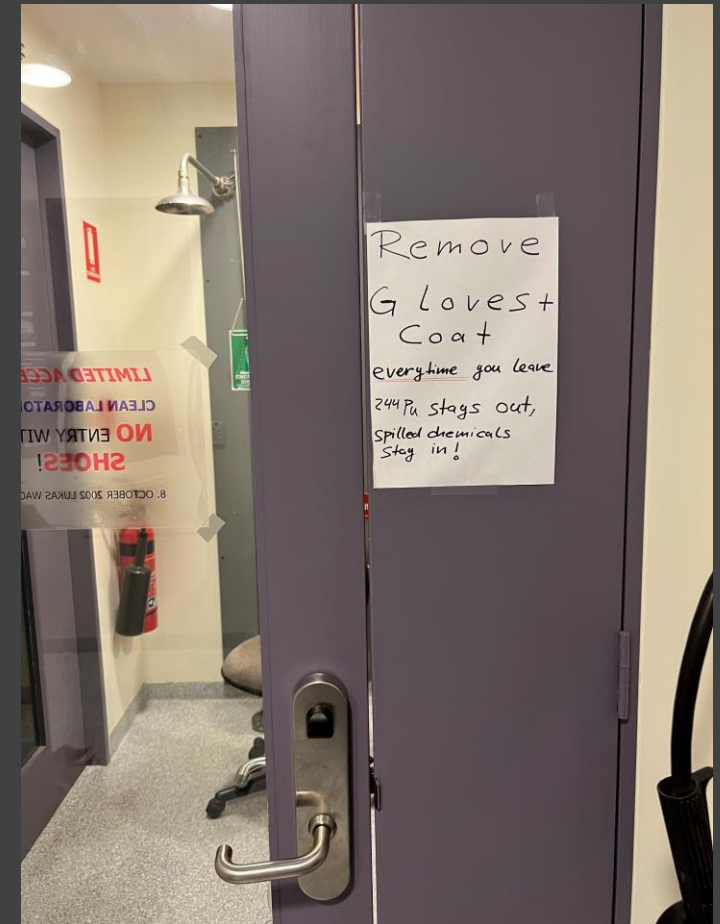
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Our chemistry laboratory (2019):  
 $10^3 - 10^4$  Pu-244 atoms

Level in 2021:  $10^2$  Pu-244 atoms



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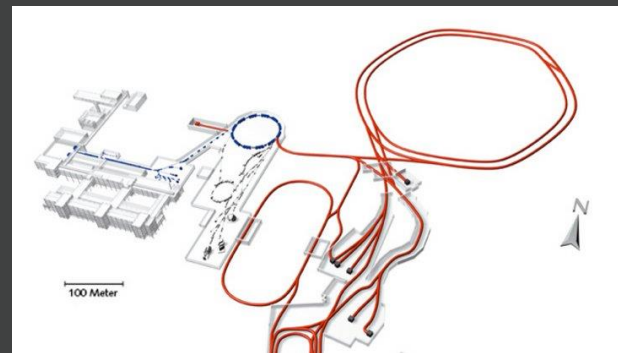
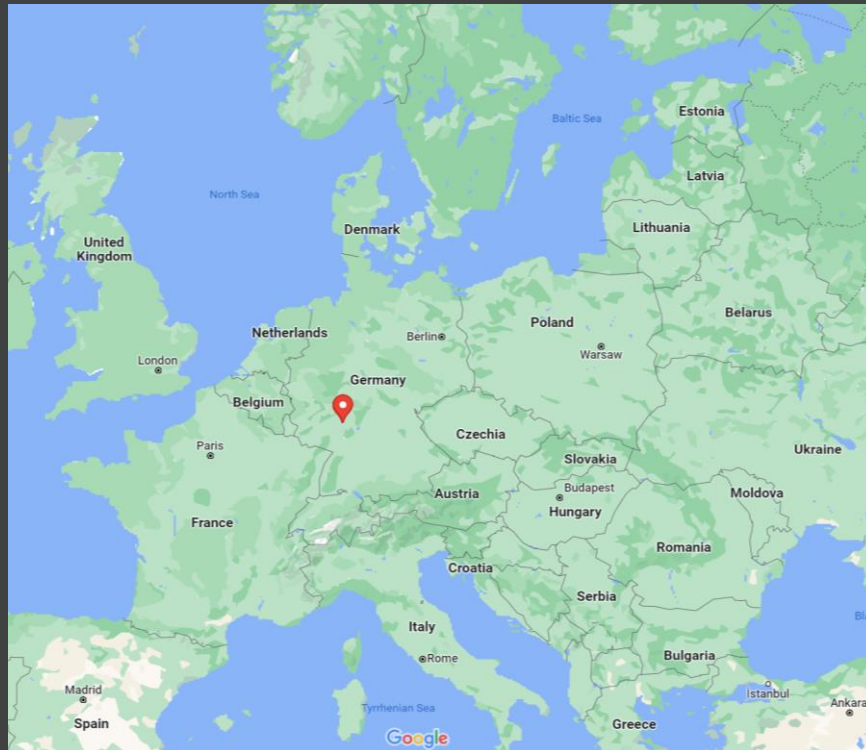
3. Power outage

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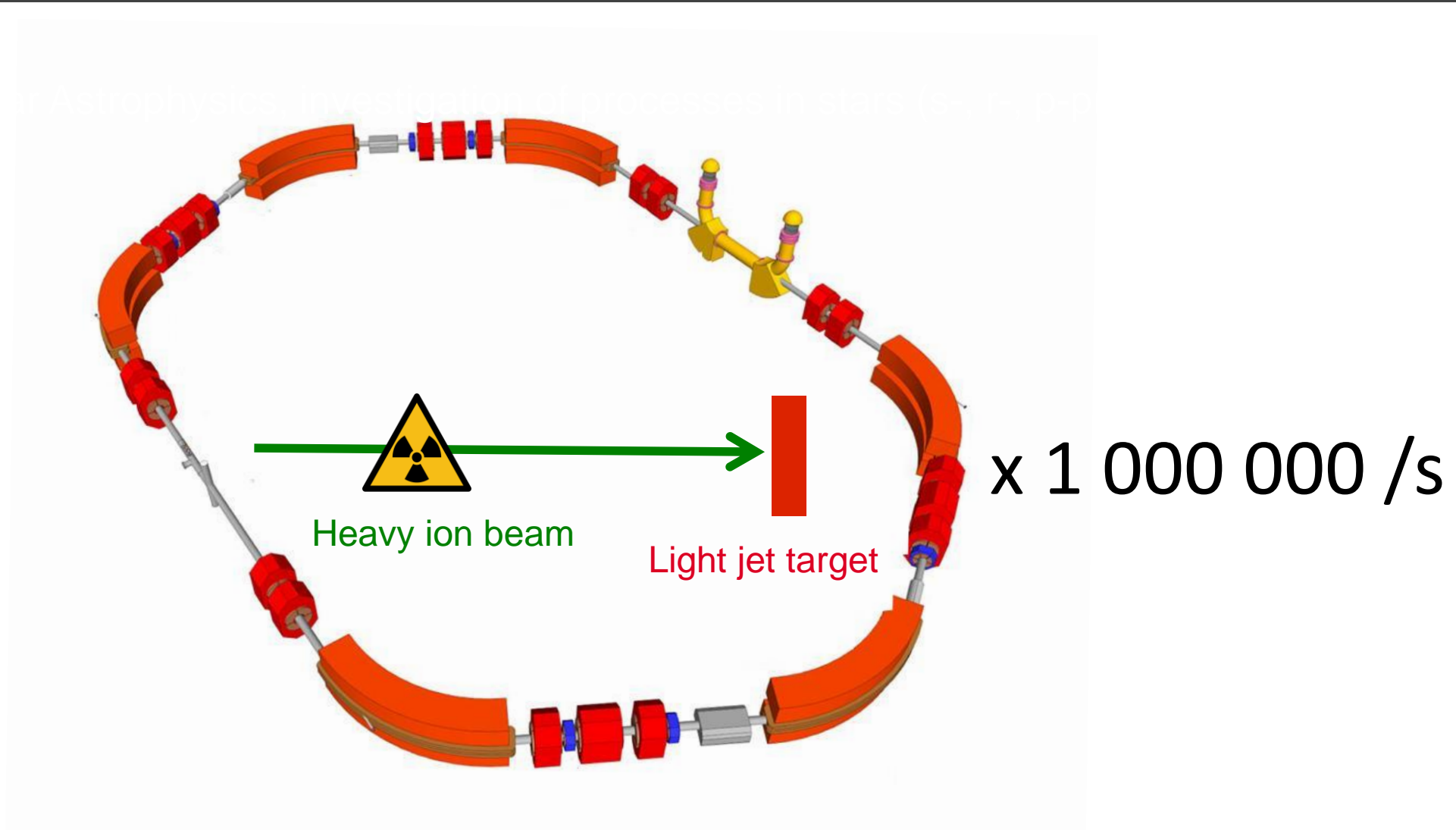
# Case 3: Power Outage

Helmholtz Centre for Heavy Ion Research (GSI) in Darmstadt, Germany



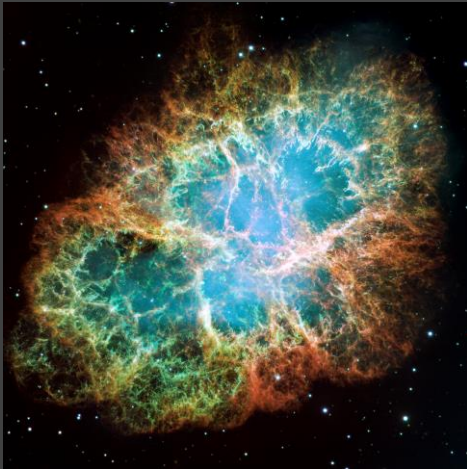
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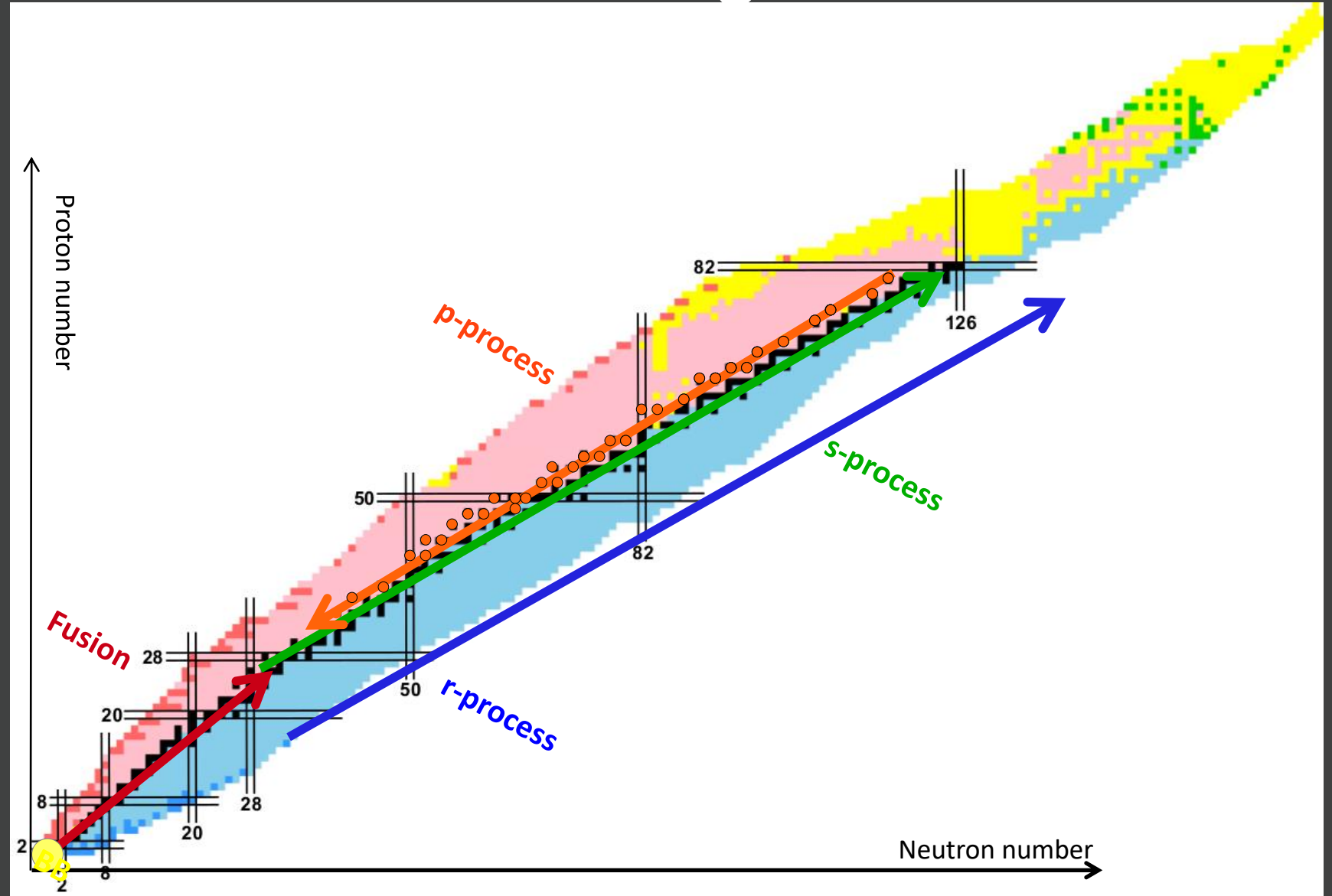


# Case 3: Power Outage

Nuclear Astrophysics



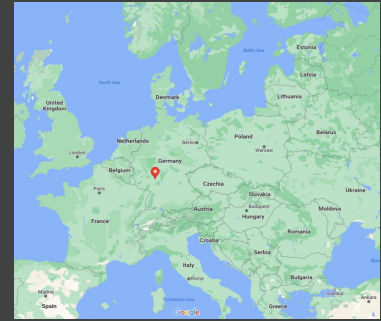
Supernova





# Case 3: Power Outage

Helmholtz Centre for Heavy Ion Research (GSI) in Darmstadt, Germany



Nuclear Astrophysics, investigation of processes in stars (s-, r-, p-process)

Experiment beamtime 2014: Reaction  $\text{Xe-124}(p,g)\text{Xe-125}$

**Storm over night** -> power outage

All machines switched off, the experiment stopped

It took two years to get another beamtime approved

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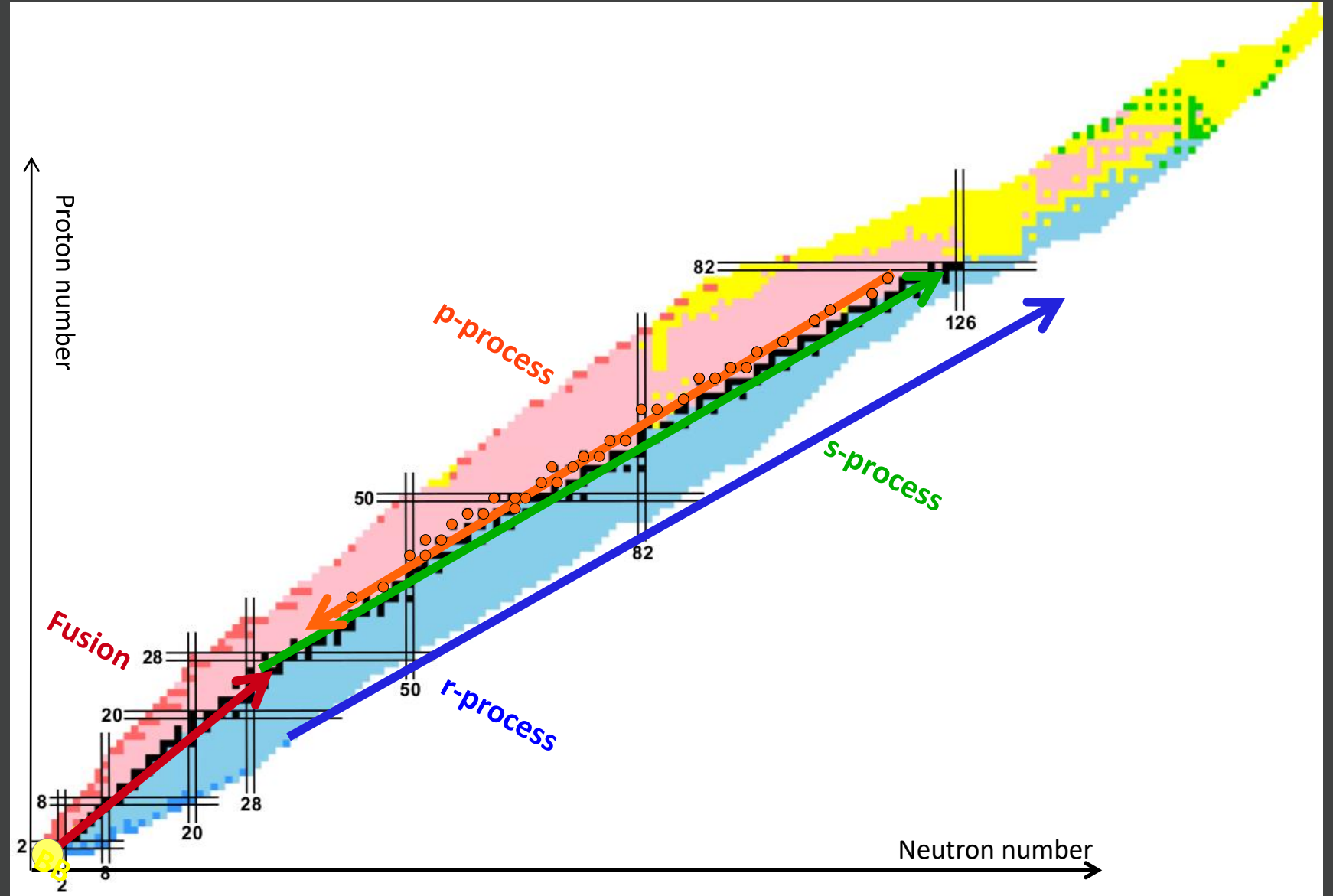
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# Case 3: Disappearing samples

Experimental Nuclear  
Astrophysics Group at  
Goethe University  
Frankfurt, Germany

Kr-85(n,g)Kr-86



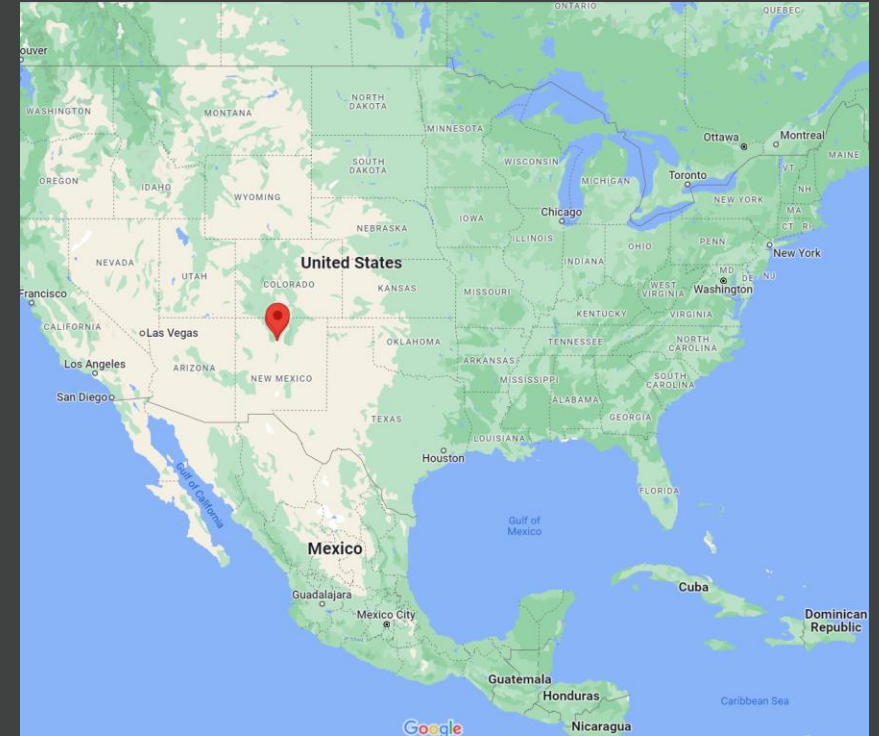
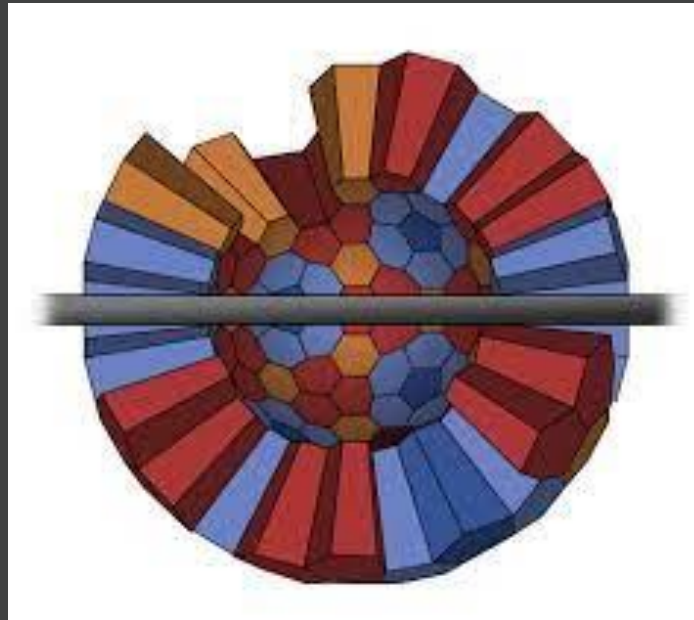
# Case 3: Disappearing samples

Detector for Advanced Neutron Capture Experiments (DANCE) at Los Alamos Neutron Science Centre(LANL)

4 Pi detector array from 160 crystals designed to capture small quantities of radioactive isotopes

PhD Thesis of Stefan Fiebiger

FedEx International



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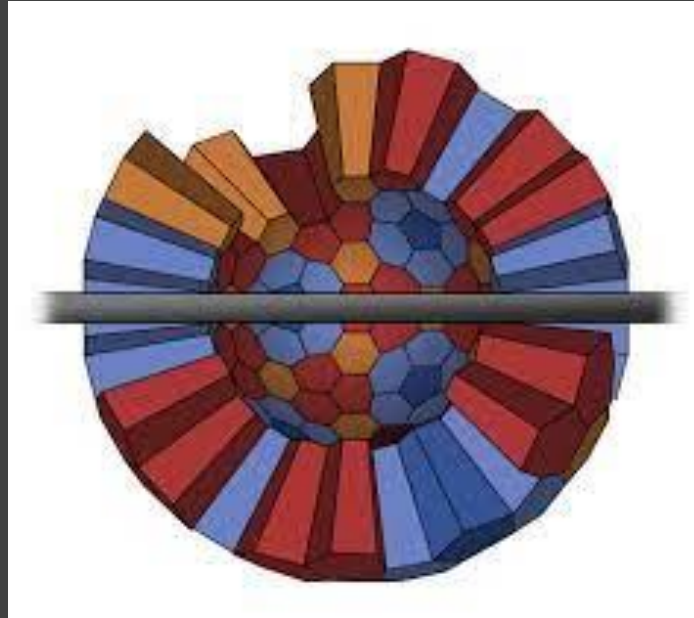
# Case 3: Disappearing samples

FedEx International

Sample arrived at Los Alamos Airport

Never delivered to the laboratory

Stefan measured another  
reaction





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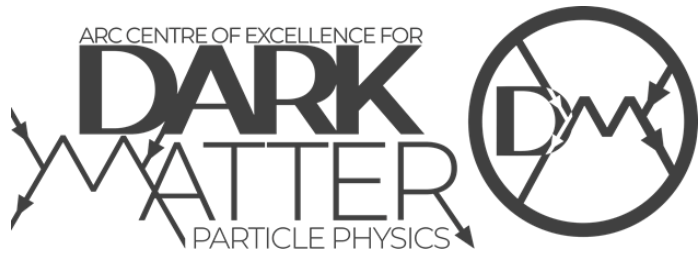
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## INTERNATIONAL PARTNER ORGANISATIONS:



The University Of Sheffield.

