

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)

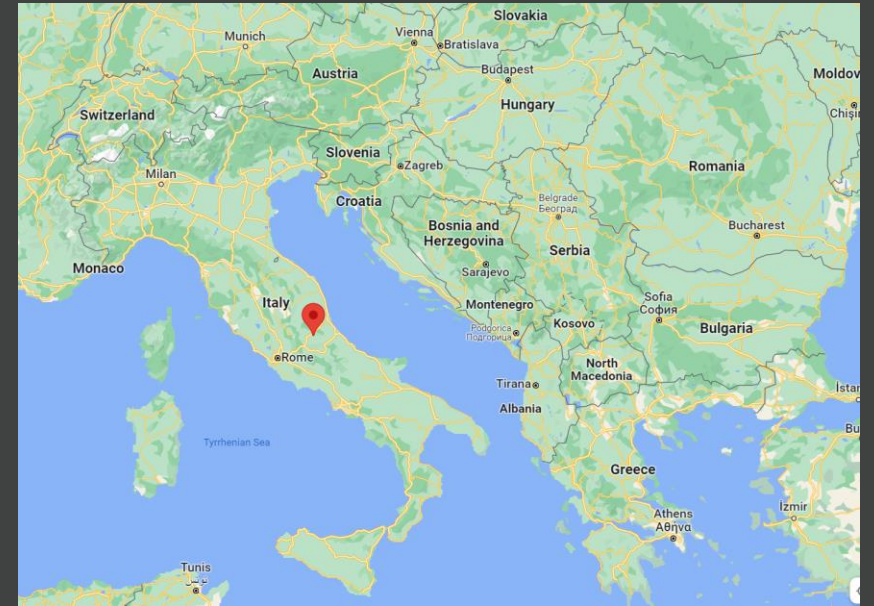
Ferdos Dastgiri (ANU)

Zuzana Slavkowska (ANU)

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



Case 1: Customs



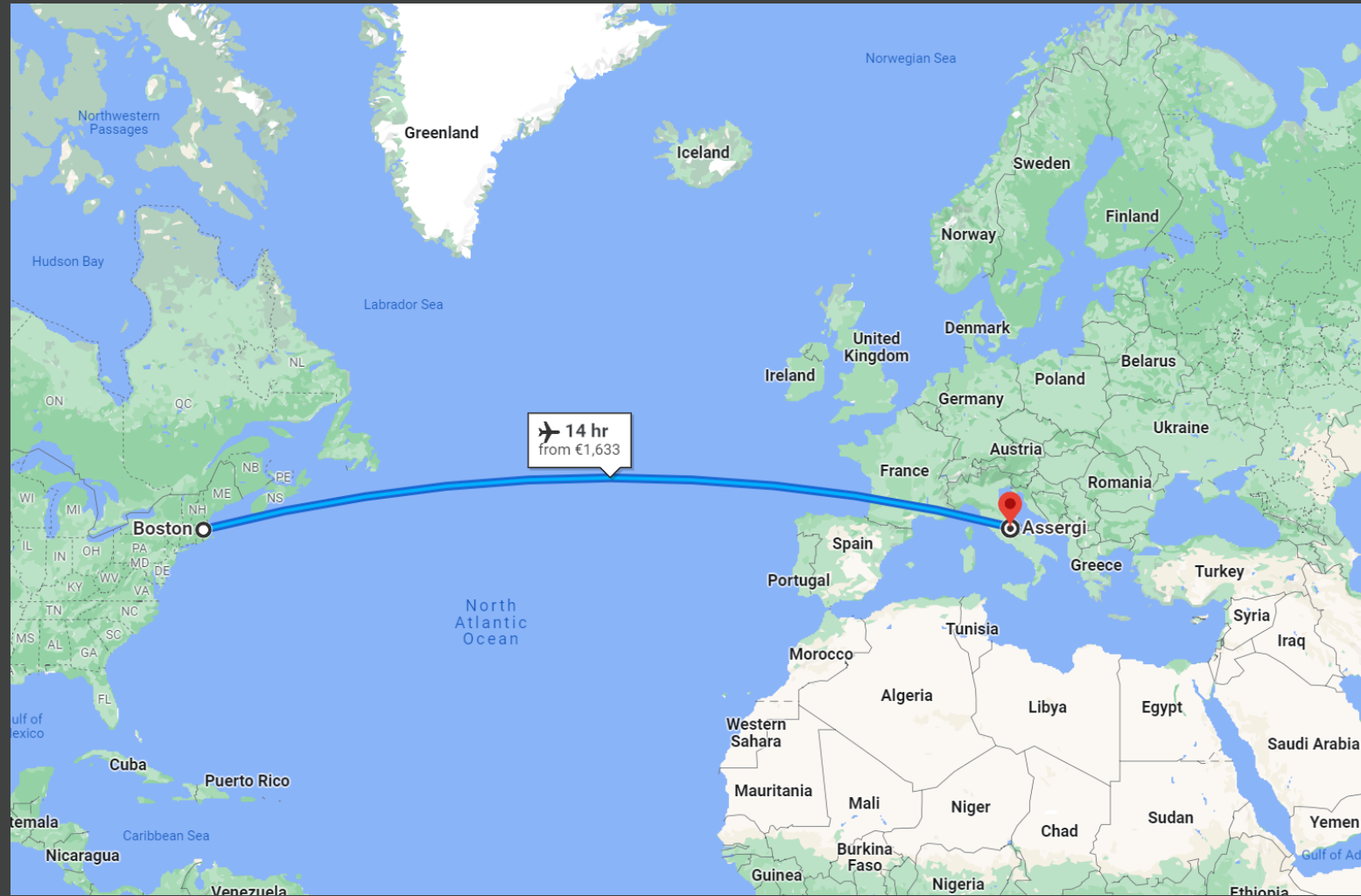
LNGS (Laboratori Nazionali del Gran Sasso), Assergi, Abruzzo, Italy
funded by the **INFN** (Istituto Nazionale di Fisica Nucleare)



Case 1: Customs

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

Shipped on plane with
FedEx Priority



Case 1: Customs

FedEx

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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

Case 1: Customs

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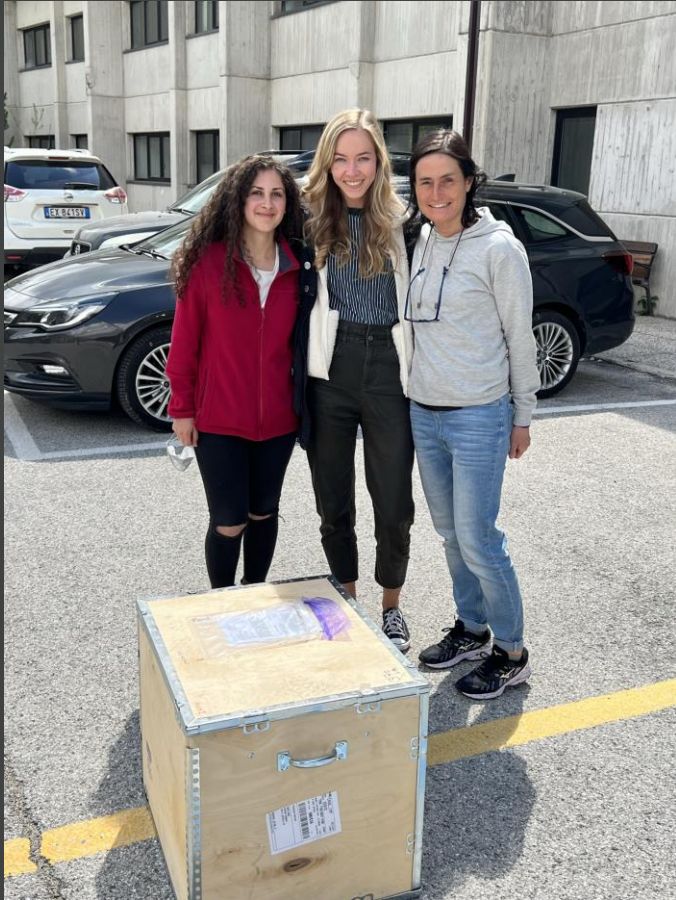
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Case 1: Customs

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:

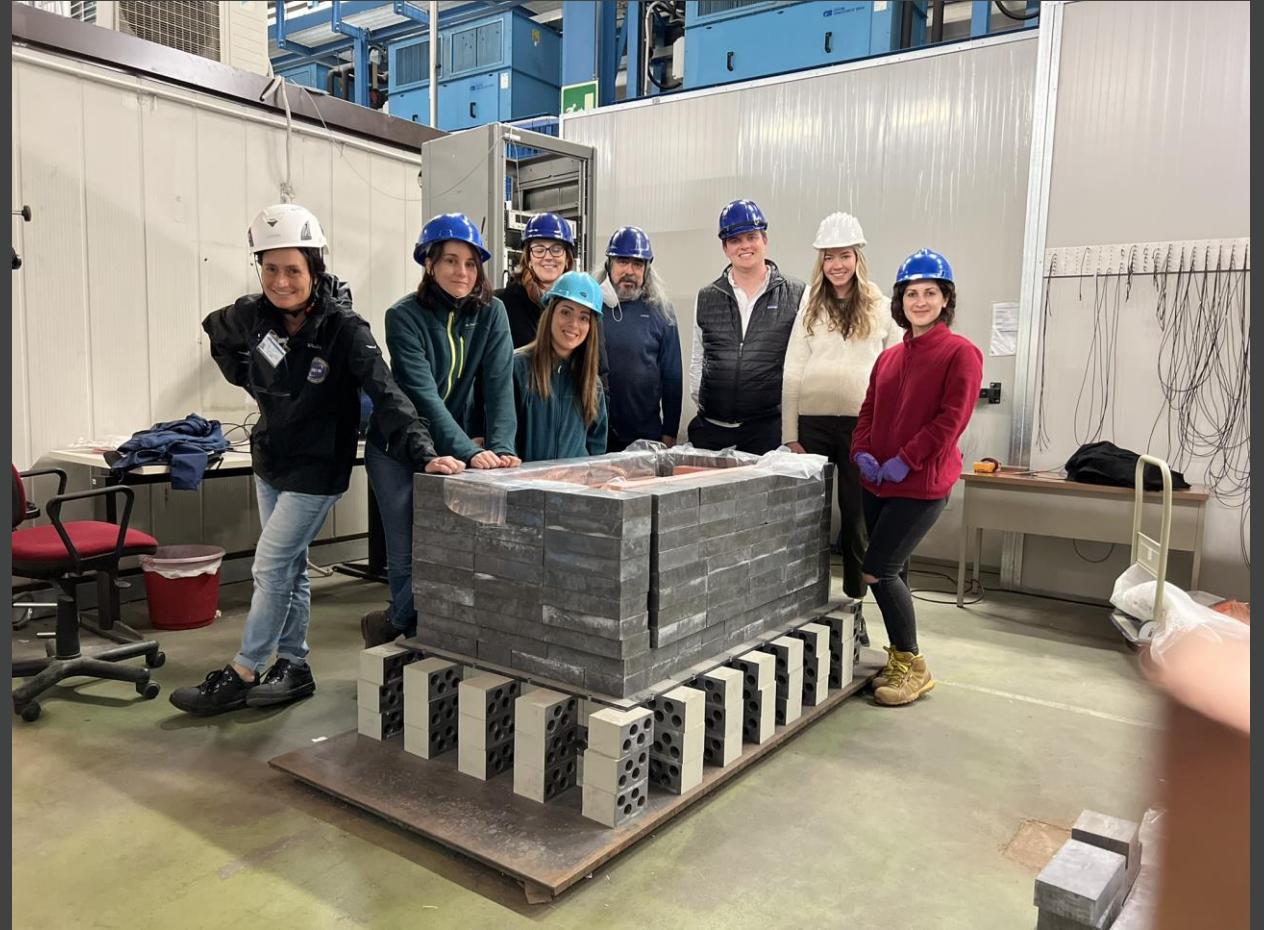
Chiara Vignoli

Giuseppe Dicarlo

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 5×10^{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

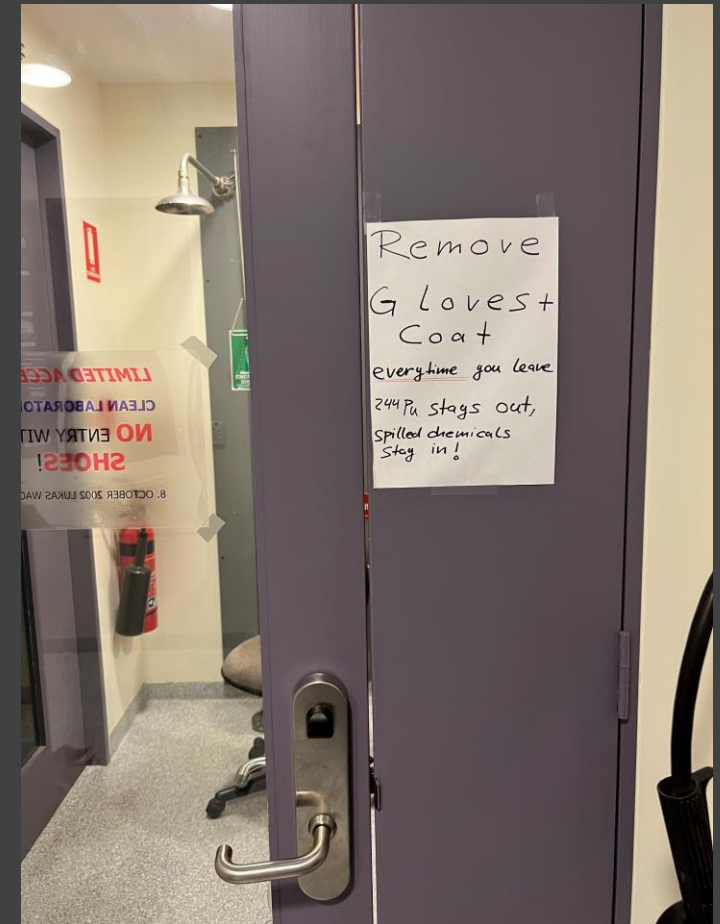
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Our chemistry laboratory (2019):
 $10^3 - 10^4$ Pu-244 atoms

Level in 2021: 10^2 Pu-244 atoms



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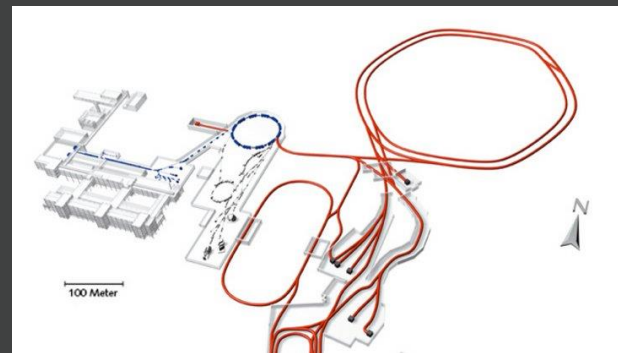
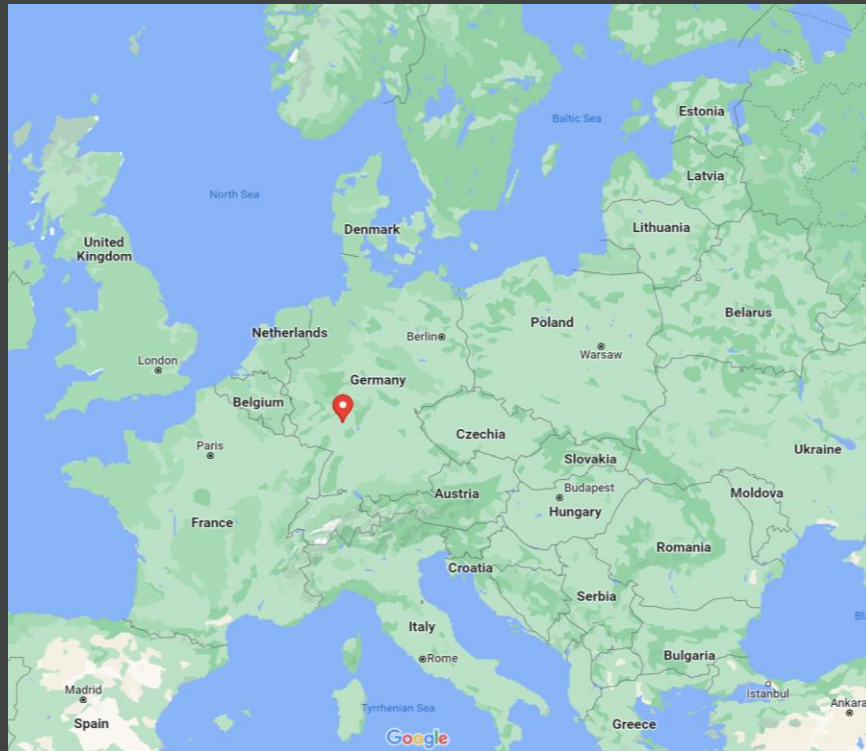
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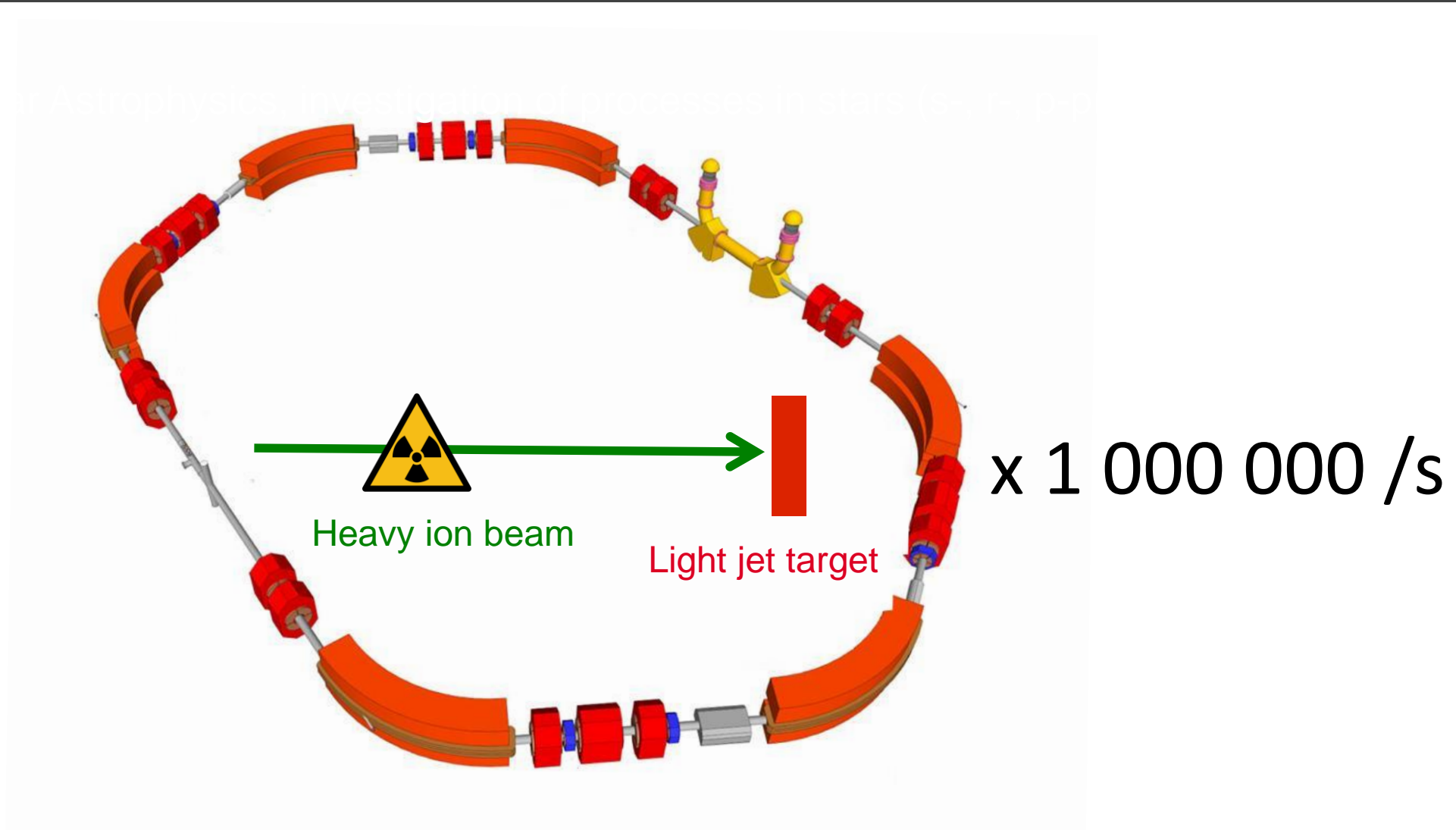
Case 3: Power Outage

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



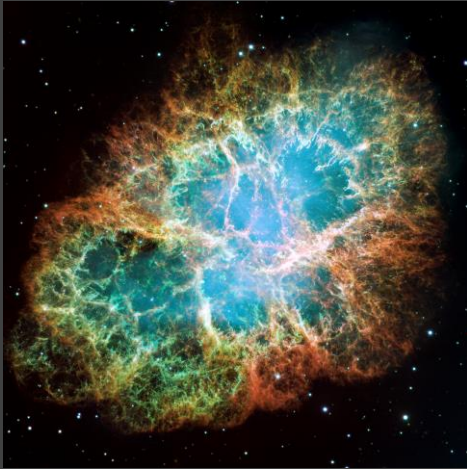
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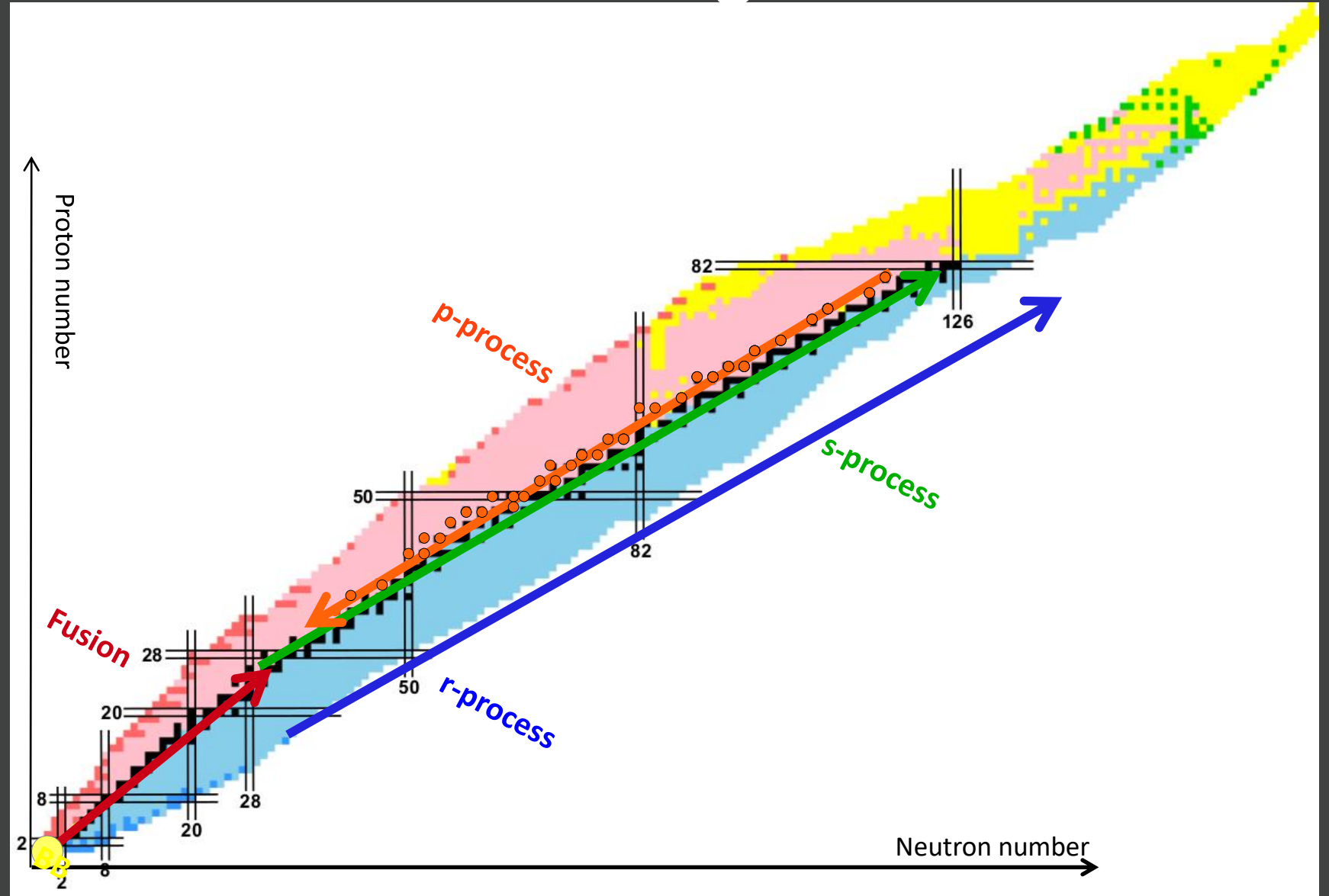


Case 3: Power Outage

Nuclear Astrophysics

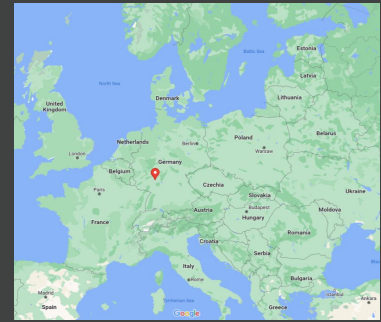


Supernova



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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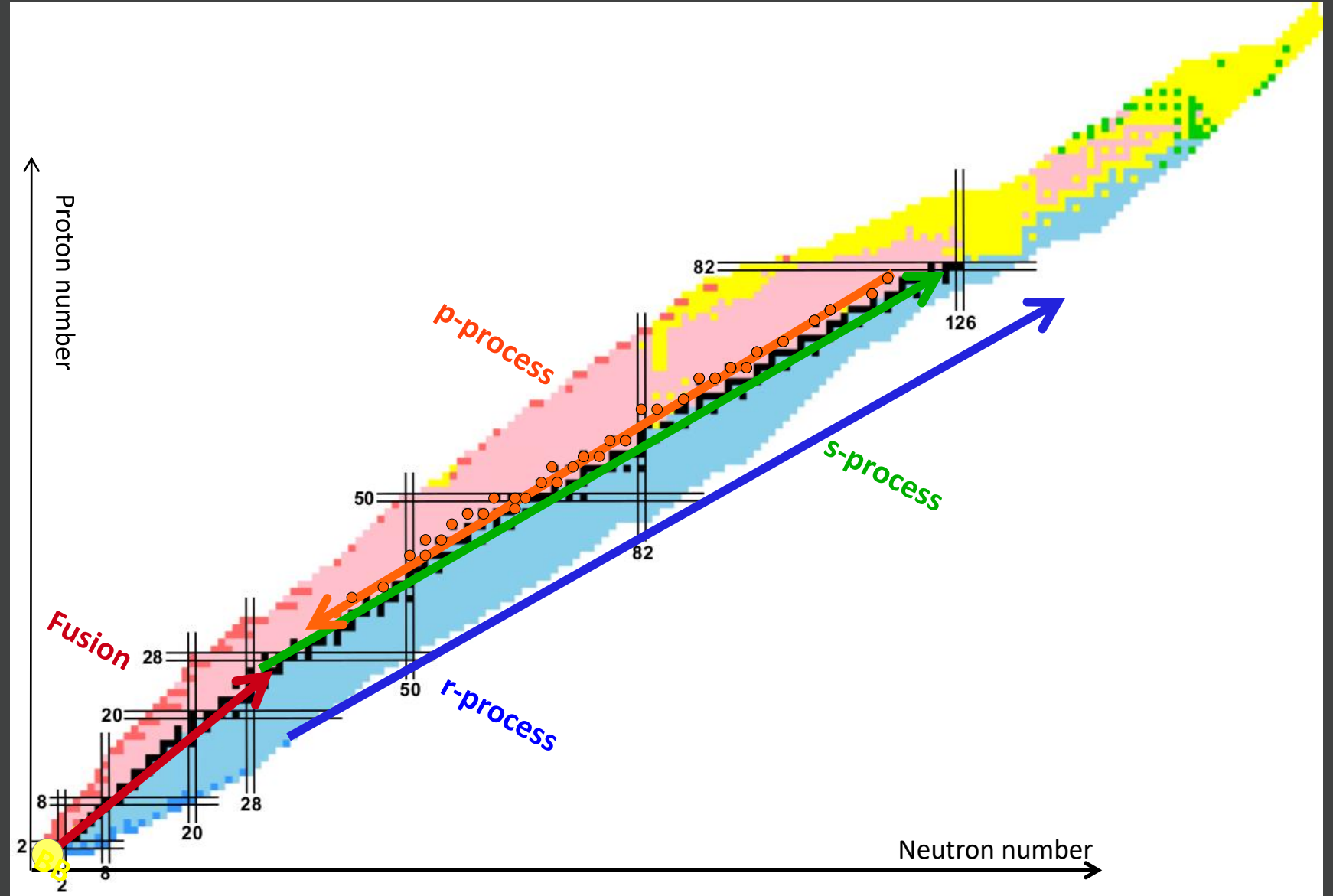
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Case 3: Disappearing samples

Experimental Nuclear
Astrophysics Group at
Goethe University
Frankfurt, Germany

Kr-85(n,g)Kr-86



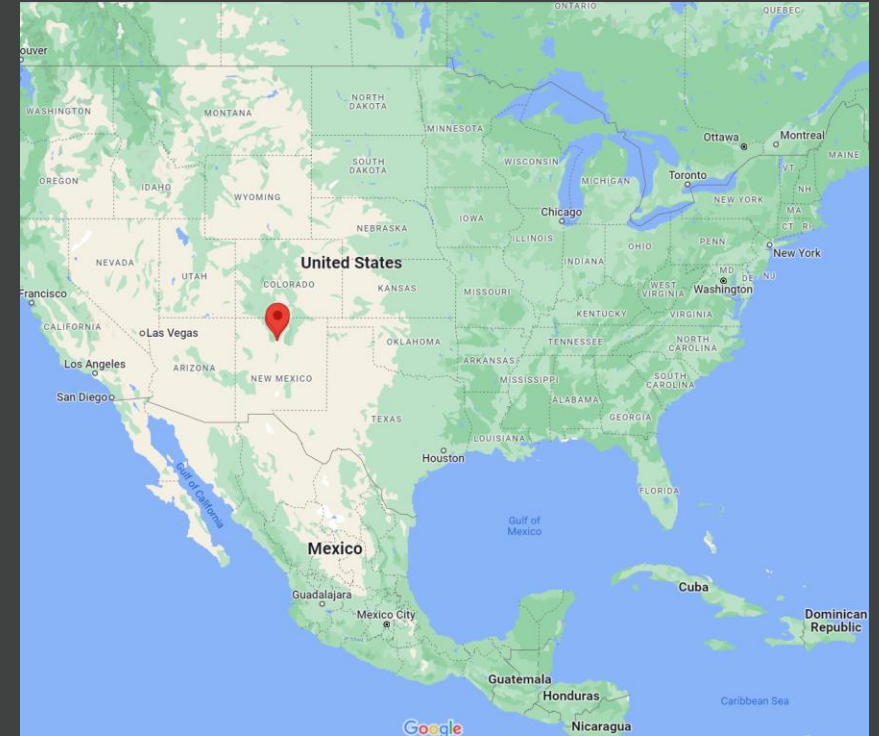
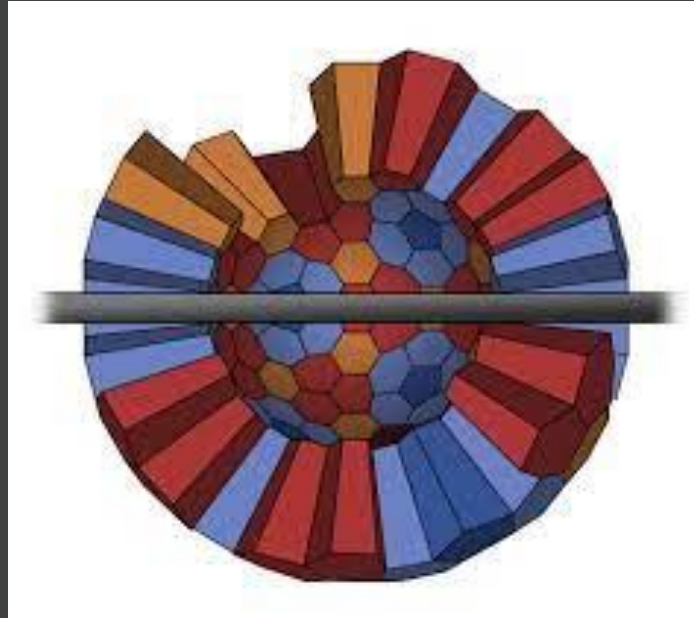
Case 3: Disappearing samples

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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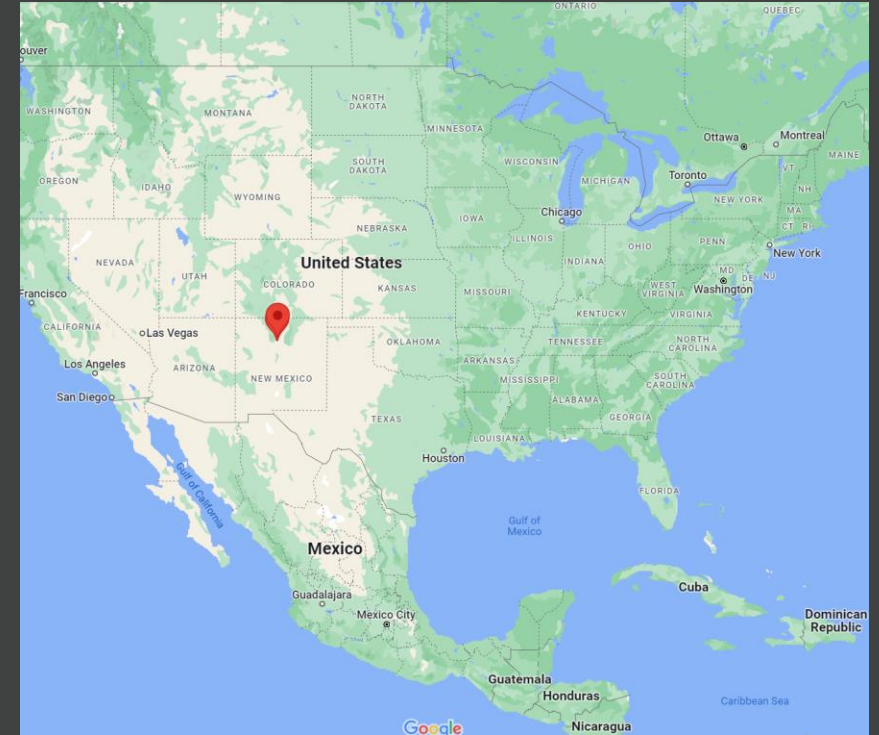
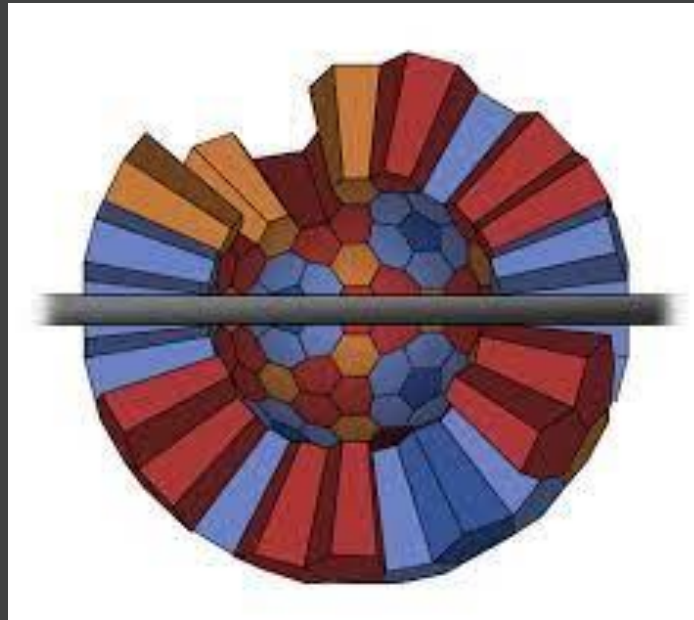
Case 3: Disappearing samples

FedEx International

Sample arrived at Los Alamos Airport

Never delivered to the laboratory

Stefan measured another
reaction





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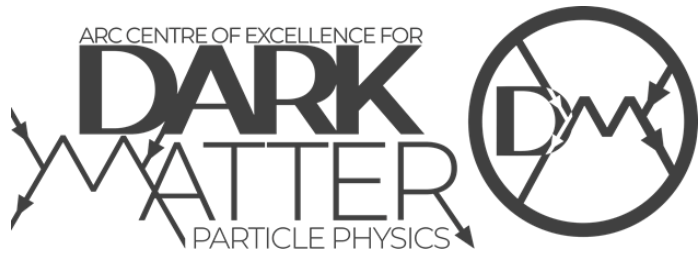
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INTERNATIONAL PARTNER ORGANISATIONS:



The University of Sheffield.

