



A prelude to a long journey: from Big Data to Scientific Wisdom

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EaPEC 2022, Baku
29th of September 2022

An aerial photograph of the LHC tunnel in the Swiss Alps, showing the circular path of the tunnel and the surrounding landscape. The tunnel is highlighted by a white line that forms a large circle, with a smaller circle indicating a specific section of the tunnel. The landscape is a mix of green fields and brown patches, with some buildings and roads visible. The sky is blue with some clouds.

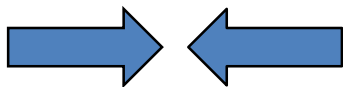
Research and
Development

Technology

Education

International
Collaboration



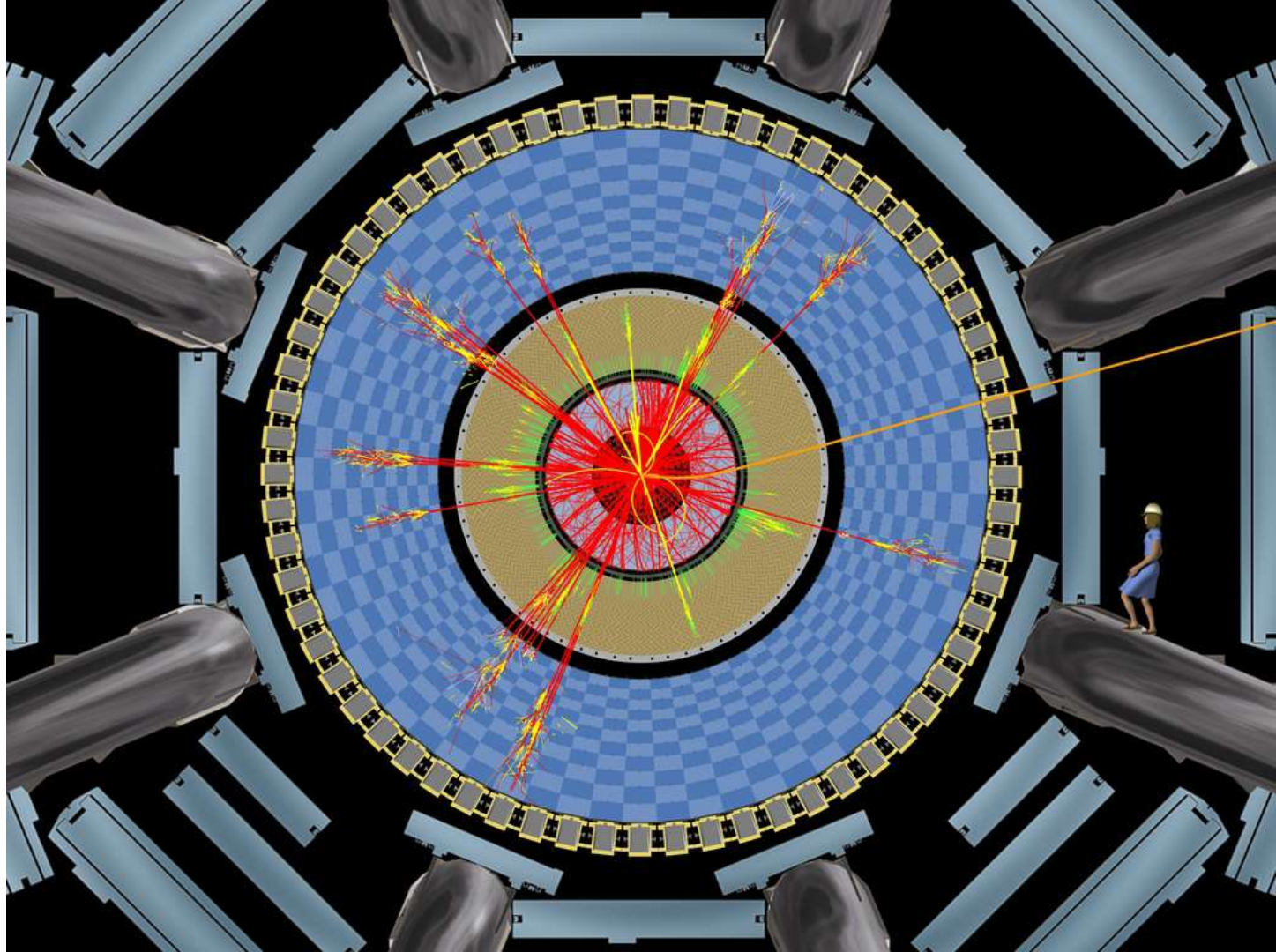


7 TeV +

7 TeV

1 GeV ~ Mass of 1 proton





DATA PRODUCED:

150 million channels

X

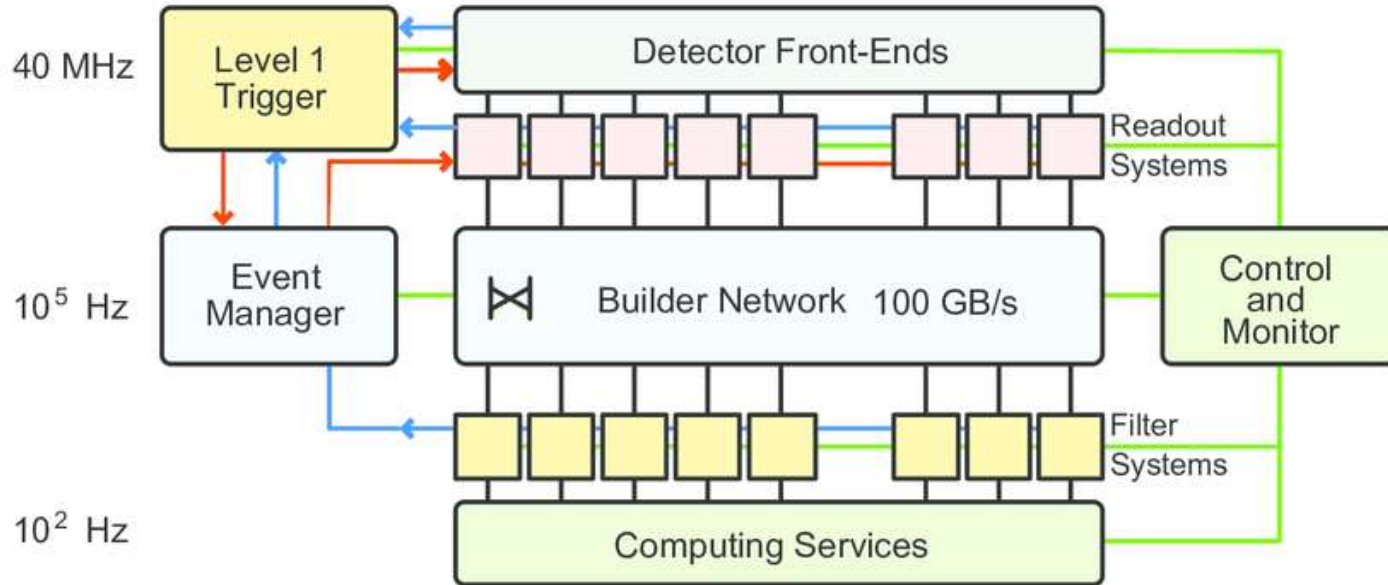
40 million bunch crossings per second

= ~ 1petabyte/second

(information on the front ends of the detectors)

TRIGGER:

Do you know what you are looking for?



Data written to disk: 1 GB/s → results in PBs/year

DATA DISPLAY

26 September 2022 - 11:00

Average number of cores used by LHC VOs: 1153948

Power delivered to LHC VOs: 1339.817 H506

LHC VO transfer throughput: 16.21 GB/s

VOLUME TRANSFERS VOLUME FILES VOLUME DATA



CURRENTLY DISPLAYING

FROM: 26 September 2022 - 11:00
TO: 26 September 2022 - 13:59

LAST DATA UPDATE

LOADING 100 %

File Specified downloaded on Monday, 26 September 2022
Last transfer was on Monday, 26 September 2022

DATA TRANSFER CONSOLE

Logfile for Volume Transfer and Files: 2022-09-26 11:00:00
Logfile for Volume Transfer and Files: 2022-09-26 11:00:00
Logfile for Volume Transfer and Files: 2022-09-26 11:00:00
Logfile for Volume Transfer and Files: 2022-09-26 11:00:00
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GLOBE VIEW

MAP VIEW

EXPERIMENTS SELECTION

Click on experiment names to filter tracks

Alice

ATLAS

CM5

LHCb

TIER5 SELECTION

ENABLED

Click on tier buttons to filter data

TIER 0

TIER 1

TIER 2

TIER 3

DATES SELECTION

ACTIVE

Use calendar to filter a period of time

SELECT DATES

TIME SCALE

100 sec/hour

COUNTRIES SELECTION

LIST

Select name from list to filter by country

NO COUNTRY SELECTED

Afghanistan
Aland
Albania
Algeria
American Samoa
Andorra
Angola

WLCG Support in Türkiye

TÜBİTAK ULAKBİM has conducted to set up and operate national Grid, HPC and federated cloud infrastructures and mandated related initiatives for 20 years.

2003-TR-Grid National Grid Initiative

2004-First TR-Grid test-bed for SEE-Grid Project

2005-National HEP community awareness (workshop and trainings)

2006-EU funded grid projects (EUMEDGRID, SEE-GRID-2, EGEE-II)

2007-HEP@TR-Grid WG, TR-Grid Advisory Board, 7 TR-Grid Sites

2008-Tier-2 Center CERN MoU (CMS & ATLAS) and CERN visit

2009-Tier-2 Centers resource planning & commitment

2010-CERN visit to TR-Grid Tier-2 Centers

2011-2012-Tier-2 Centers resource planning & commitment

2013 - Support to BELLE-II

2014-2015- Tier-2 Centers resource planning & commitment

WLCG Support in Türkiye - current

Tier-2 Sites CPU and storage capacity (2009-2022)

| Tier-2 | Tier-2 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|--------|-----------------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| ATLAS | CPU(HEP-Spec06) | 2800 | 5100 | 5100 | 5100 | 5100 | 5100 | 5100 | 5100 | 5180 | 5180 | 7508 | 7508 | 9384 | 9384 |
| | Disk (Tbytes) | 340 | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 750 | 750 | 750 | 1300 | 1300 |
| | Nominal WAN | 1000 | 1000 | 1000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| | (Mbits/sec) | | | | | | | | | | | | | | |
| CMS | CPU(HEP-Spec06) | 2600 | 4700 | 4700 | 4700 | 4700 | 4700 | 4700 | 4700 | 4700 | 4700 | 5160 | 5160 | 9384 | 9384 |
| | Disk (Tbytes) | 210 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 350 | 550 | 550 | 550 | 1100 | 1100 |
| | Nominal WAN | 1000 | 1000 | 1000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| | (Mbits/sec) | | | | | | | | | | | | | | |

TRUBA Overview

TRUBA - National center providing high performance computing and data storage for all researchers in Türkiye.



❑ Funding

- ✓ Presidency of Strategy and Budget – TRUBA 2023 Project
- ✓ 16M Euro

❑ Resource

- ✓ 25.000 CPUs & 216 GPUs
- ✓ 14 PB storage

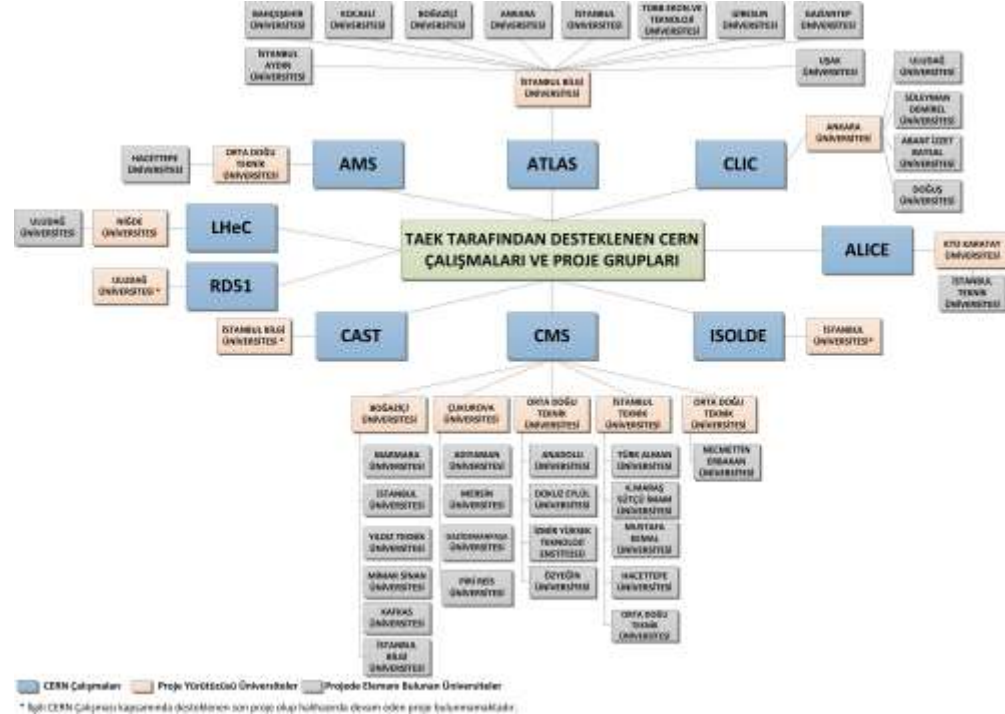
❑ Usage

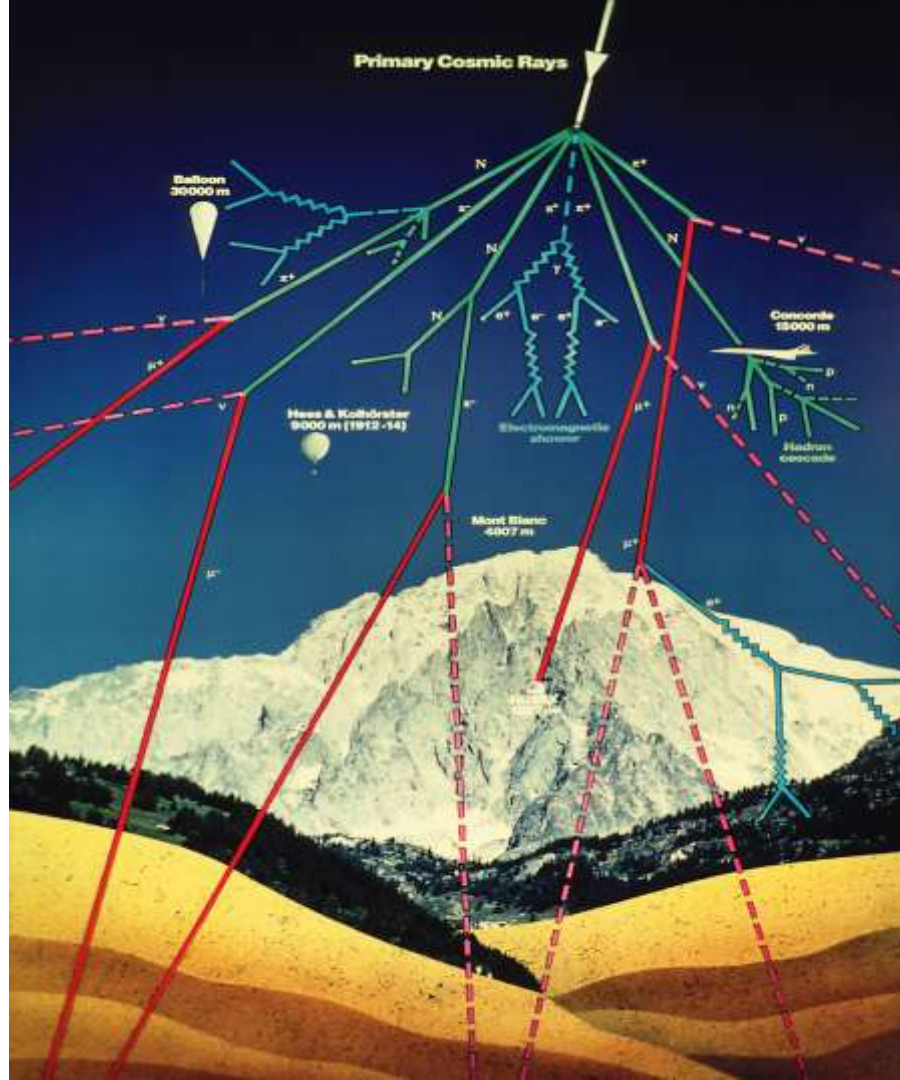
- ✓ 16M CPU hours/month
- ✓ > 4500 Registered users
- ✓ > 150 Research project support
- ✓ 6 National and 15 EU projects and 3 memberships

Associate Membership of Turkey to CERN



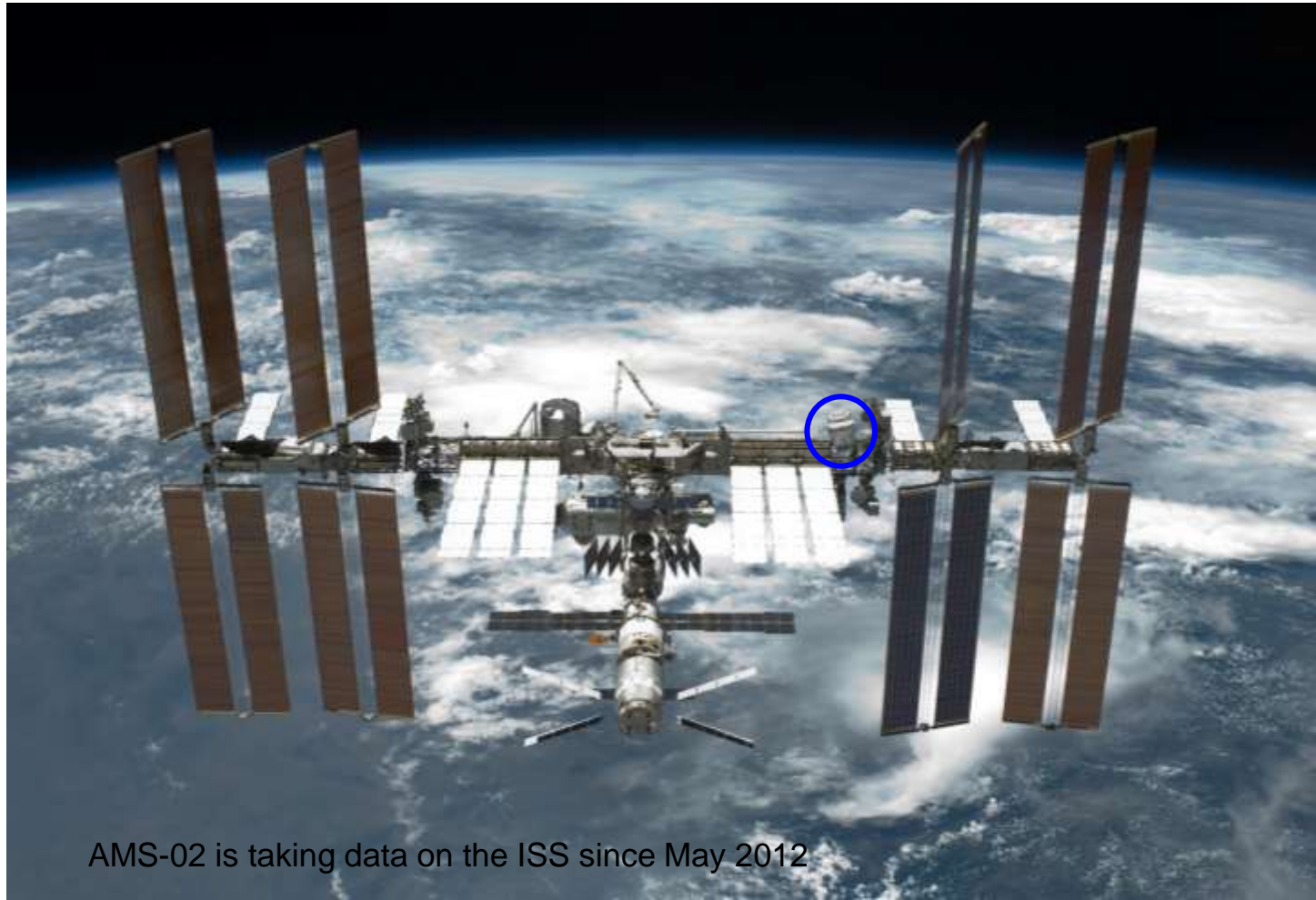
12th of May 2014, CERN





- Cosmic Rays
- Primaries:
- Mostly protons close to the speed of light.

Alpha Magnetic Spectrometer (AMS-02)



AMS-02 is taking data on the ISS since May 2012



**300,000 electronic channels
650 processors**

**15ft x 12ft x 9ft
7.5 tons**



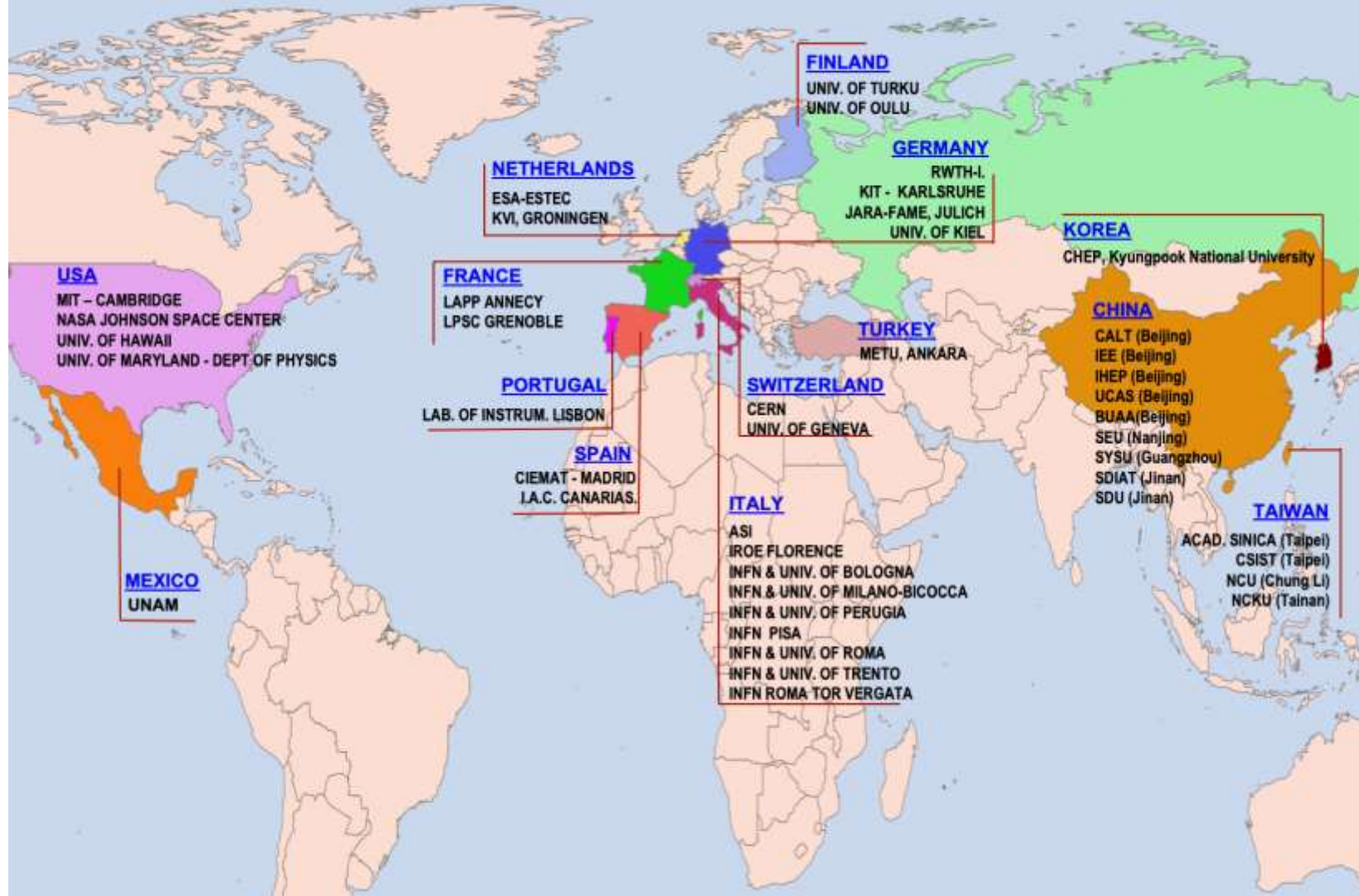
STS-134 launch May 16, 2011 @ 08:56 AM



May 19, 2011: AMS is installed on the International Space Station.

AMS is controlled from the CERN POCC since June 2011.





AMS: A TeV precision, multipurpose spectrometer

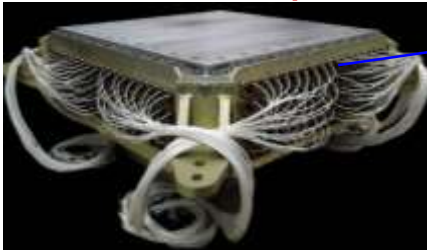
TRD
Identify e^+ , e^-



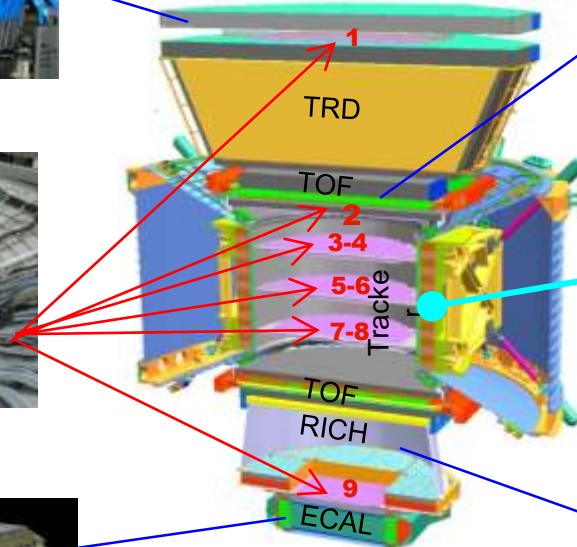
Silicon Tracker
 Z, P



ECAL
 E of e^+ , e^- , γ



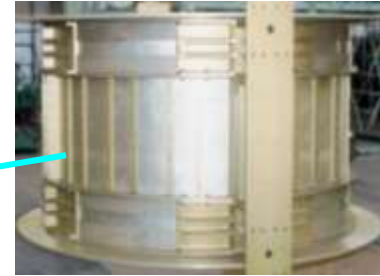
Particles and nuclei are defined by their charge (Z) and energy ($E \sim P$)



TOF
 Z, E



Magnet
 $\pm Z$

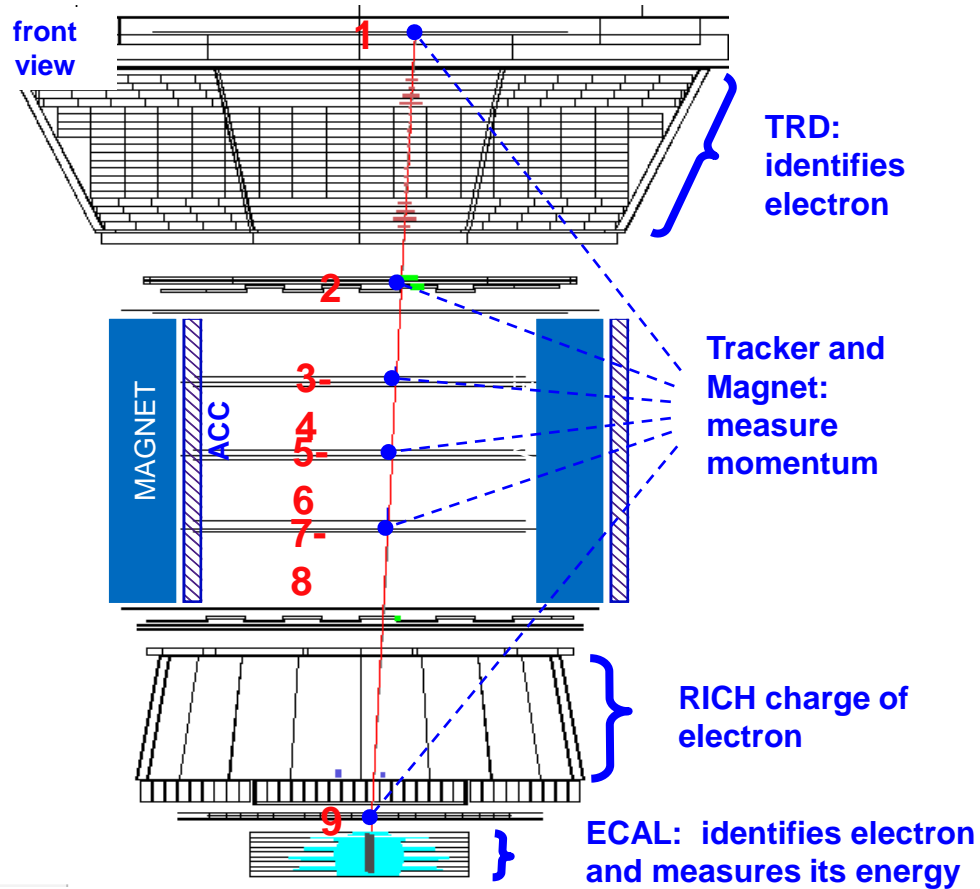


RICH
 Z, E

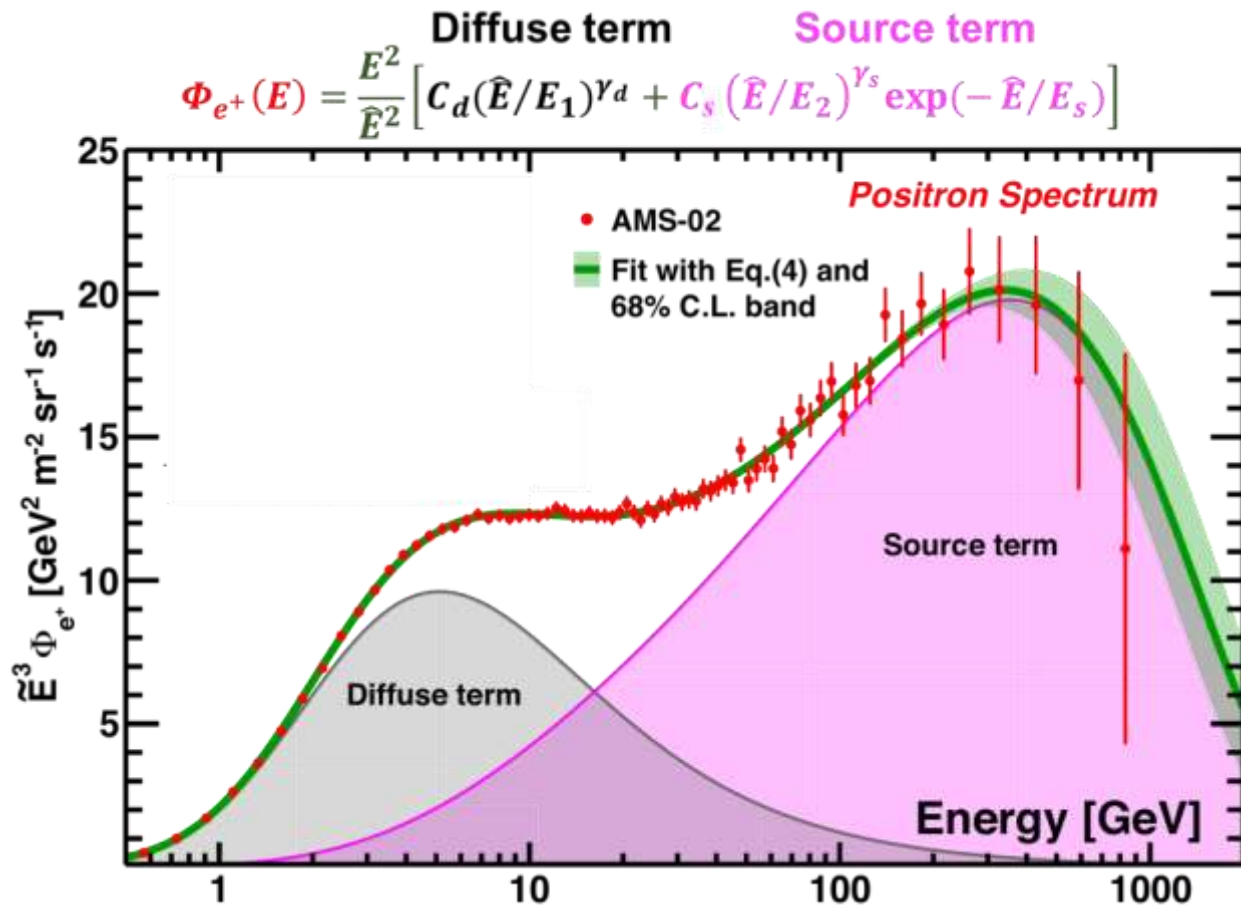


Z, P are measured independently by the Tracker, RICH, TOF and ECAL

Recorded
209,769,925,558
events in space
As of 14:25 today 😊



AMS data on ISS: 424 GeV positron

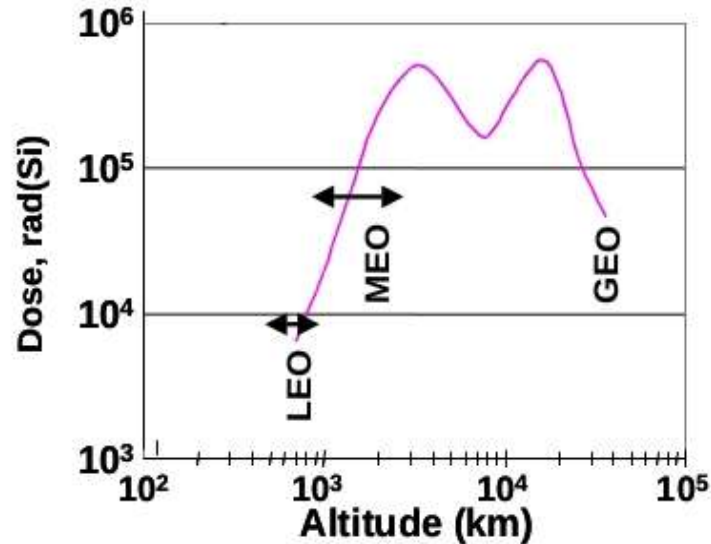
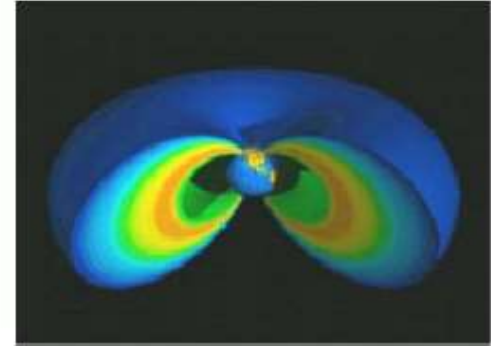


Space Radiation Environment

LEO (550 – 1000 km) \sim 1-10 krad (Si) / y1

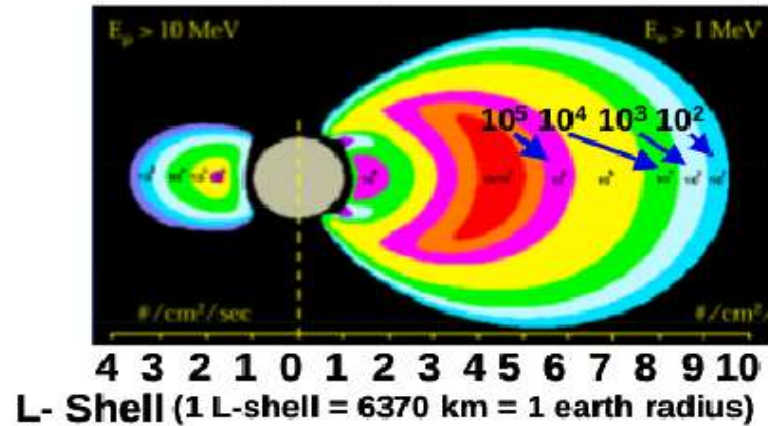
MEO (1000 – 3000 km) \sim 100-1000 krad (Si) / y1

GEO (36,000 km) \sim 10-100 krad (Si) / y1



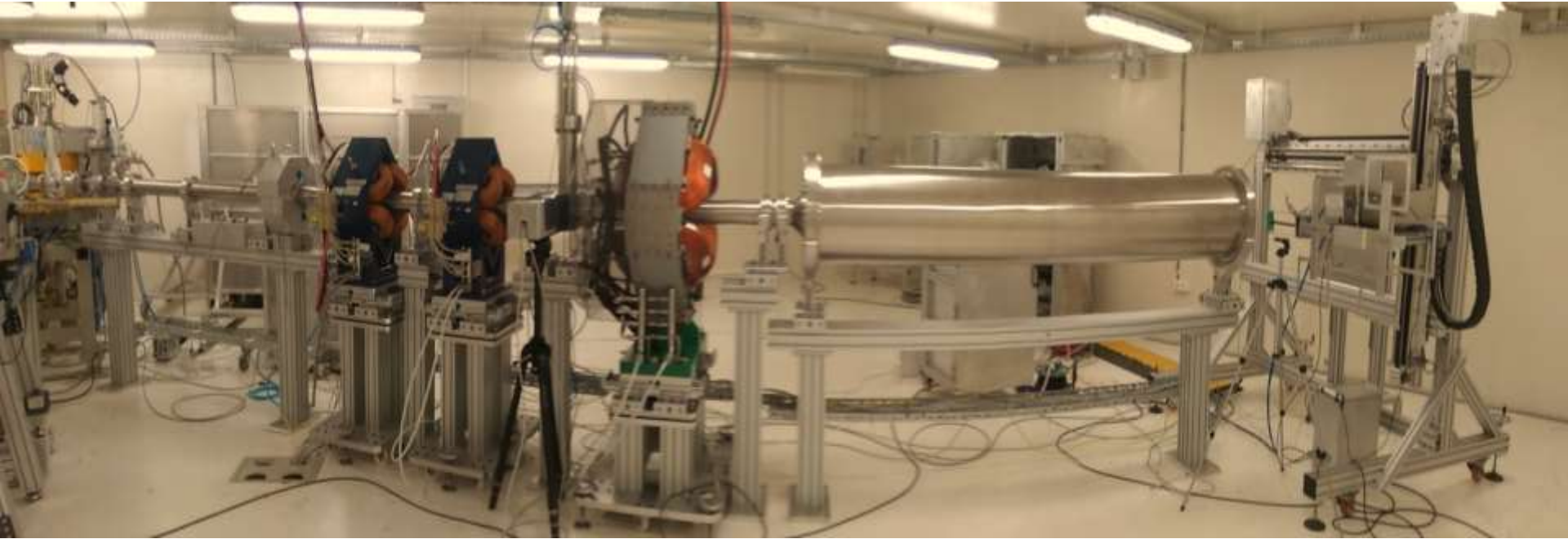
Protons (AP-8)

Electrons (AE-8)

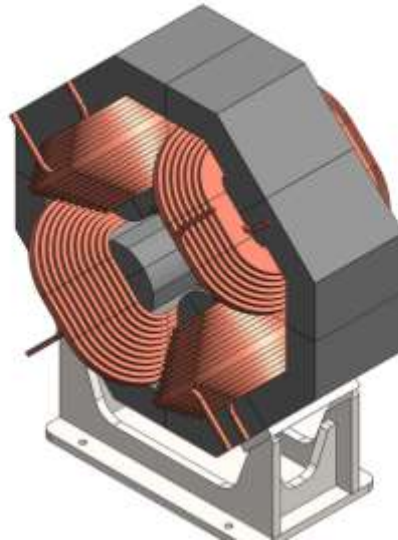
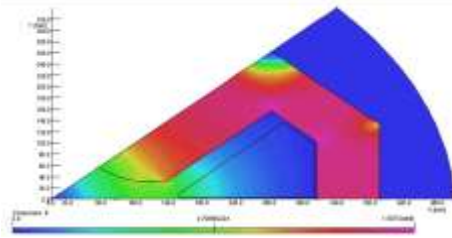


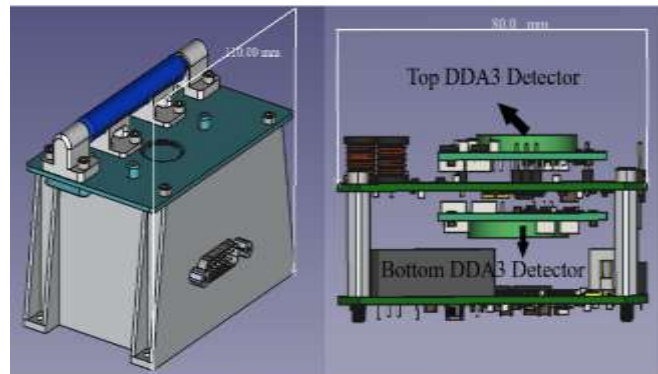
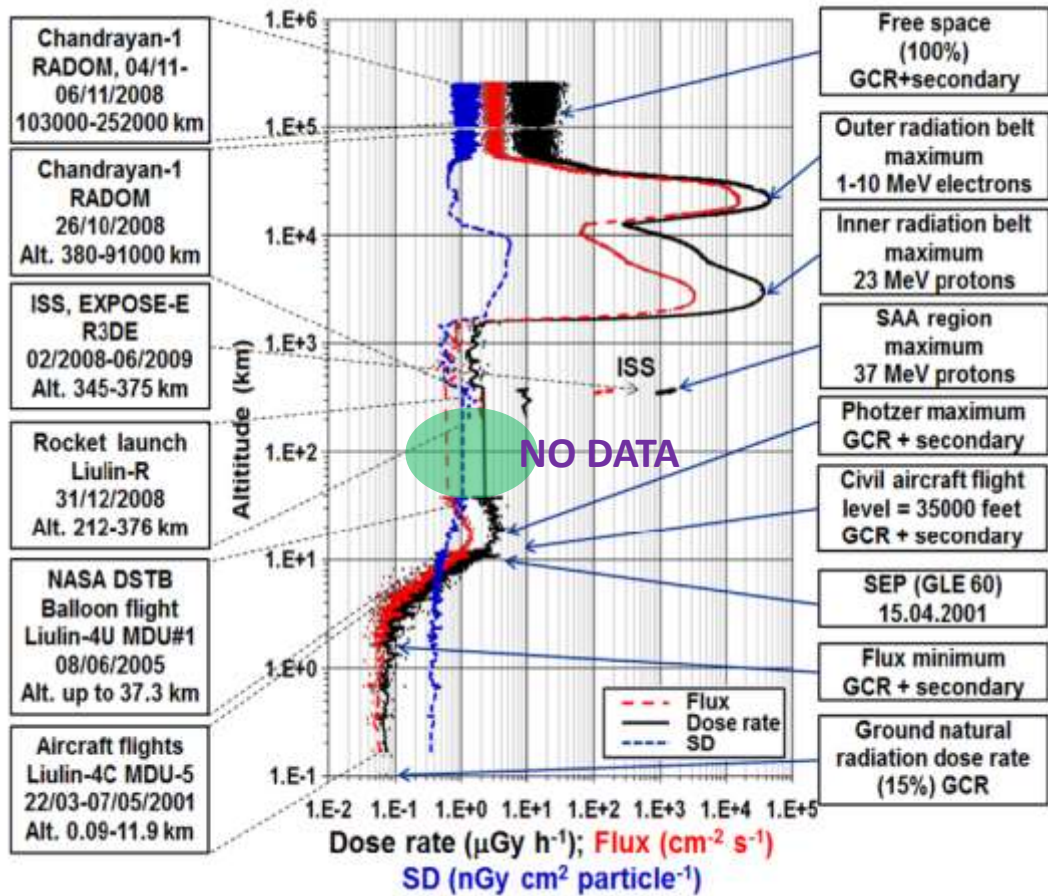
METU-DBL : An Irradiation Facility in Ankara for Space Research

since November 2019



15 – 30 MeV protons, delivered to an area of an A4 paper size for testing electronics, materials, ... built by CERN knowledge transfer...





**Prototype
Radiation
Monitor (SB)
and Readout
Electronics**



What about wisdom?

An answer in 3 parts:

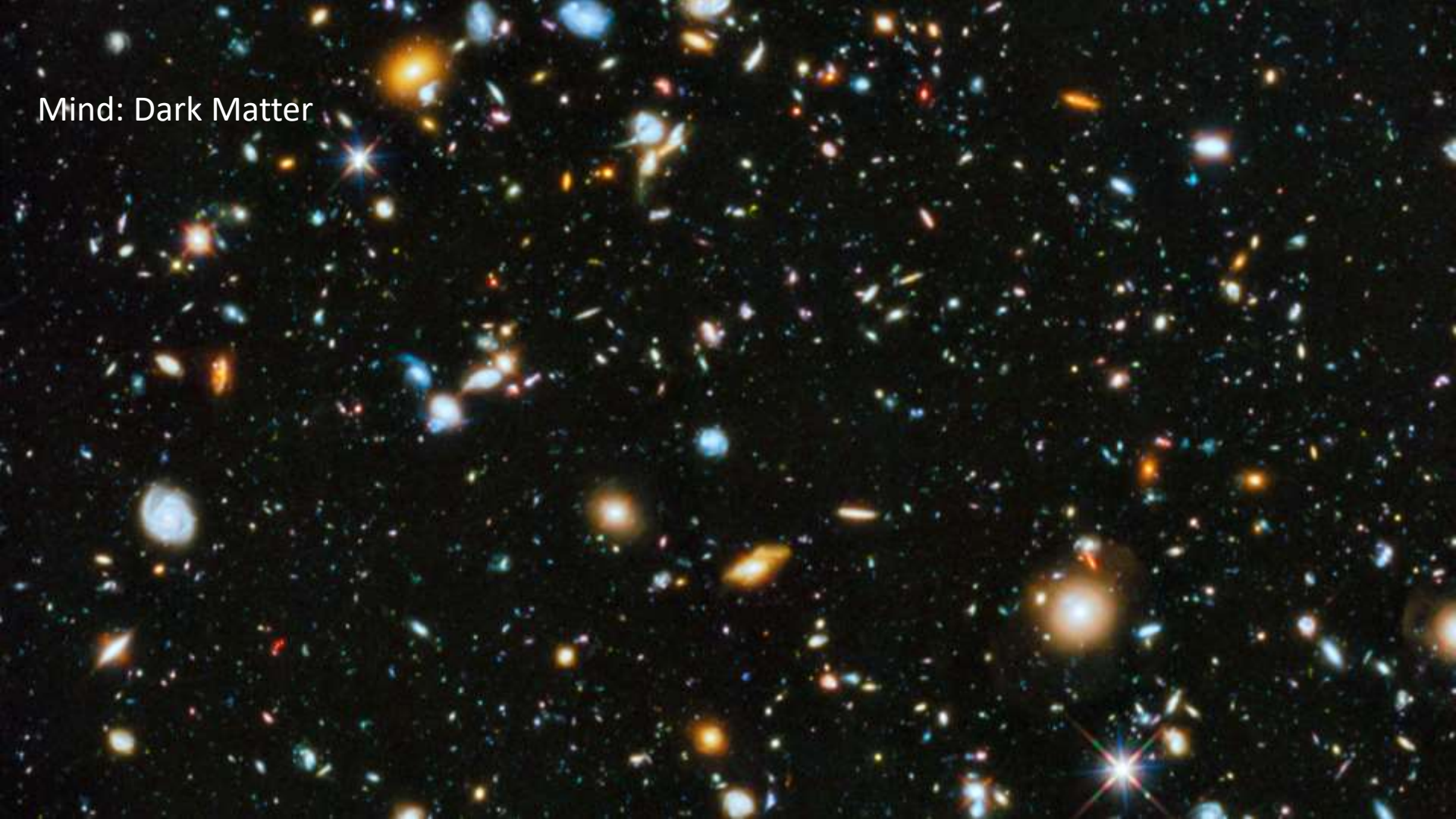
Mind

Heart

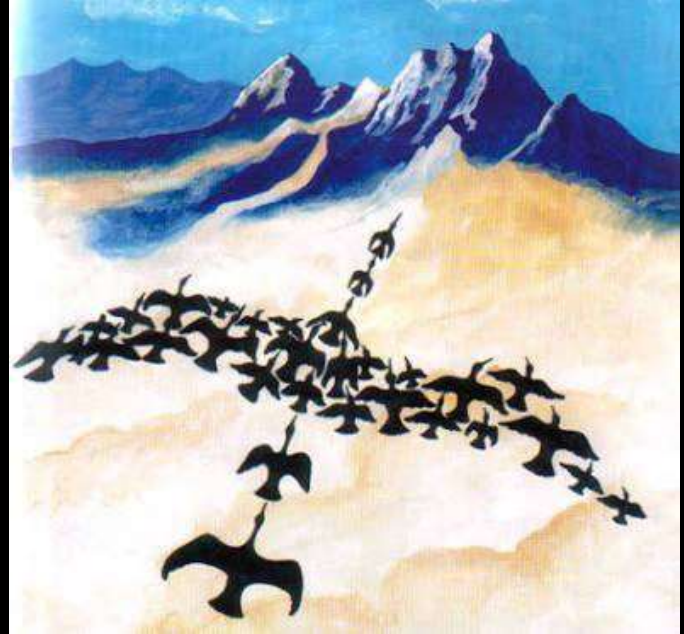
Soul

Mind:

Mind: Dark Matter



*Mantiku't-Tayr by
Farid ud-Din Attar*

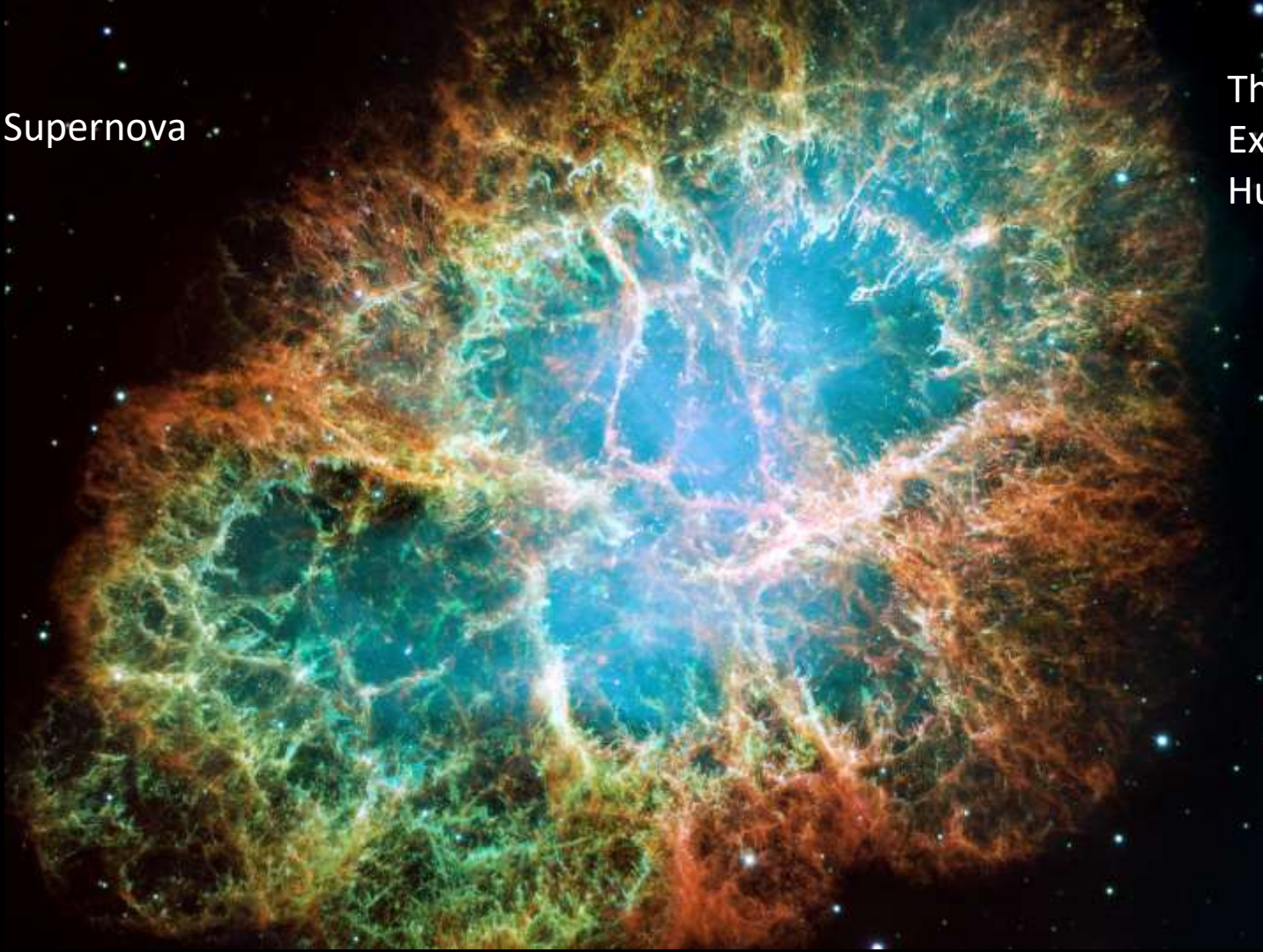


Simurg = 30 birds

Heart:

Heart: Supernova

The Crab Nebula
Exploded in 1054
Hubble Telescope





Zümrüd-ü Anka

Soul:

From Apollo 8
Earth-rise from the Moon
1968

