



**MU days 2022**  
**20-21 October 2022 @GSI**

## **ADC-MAPP**

**Analysis- and Data Centre for  
Multimessenger AstroParticle Physics**



**Innovationpool BMBF 2019/20(21)**

**Innovationpool BMBF 2021-23**

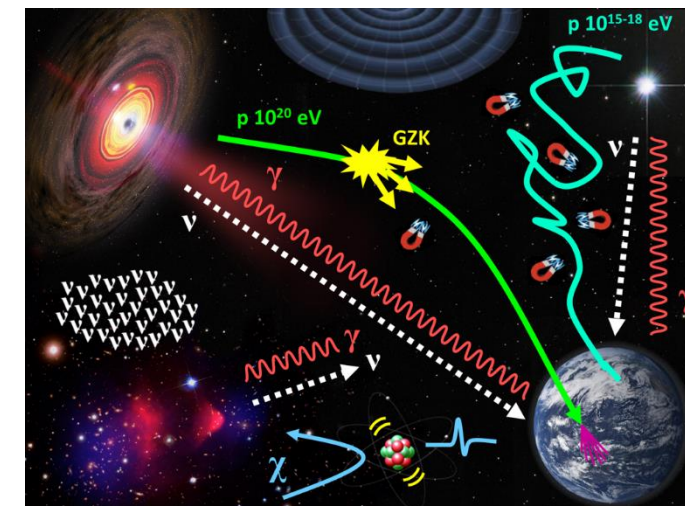
Research Area **Matter**

Program **Matter and the Universe**

Topic **Matter and Radiation from the Universe**

Cooperation with **GridKa (LKII) / MT-DMA / FB Information**

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**ADC-MAPP is dedicated to building a demonstrator that will transition into a sustainable astroparticle physics infrastructure during PoF-IV**

### **Goals:**

- **Sustainable, FAIR access to scientific data**
- **FAIR archiving of data and metadata**
- **Provision of tools (esp. for real-time analyses)**
- **Training in Big Data Science**
- **Method development for MM analyses (AI)**
- **Platform for communication and exchange within astroparticle physics**

# ADC-MAPP 1 (1/2019 - 12/2021)

## ➤ Work Programme ADC-MAPP 1

### ➤ Data Management –

Create concepts for comparable FAIR data cycles at CTA, Auger, IceCube.

Generalisation and opening of the KCDC portal for data from other experiments

### ➤ Big Data Multi-Messenger Analyses –

Enhancements CORSIKA, Gammapy;

Deep learning analyses; application of AMPEL

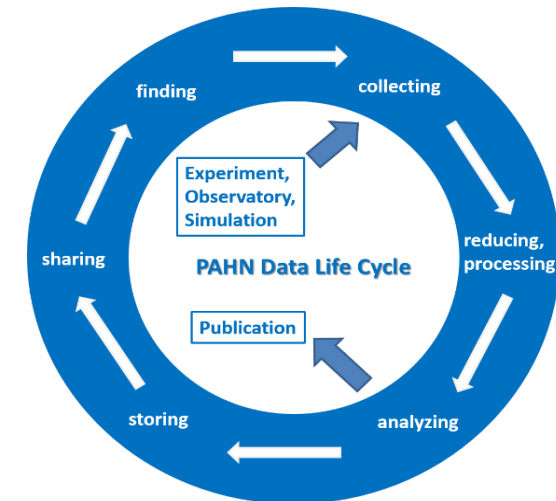
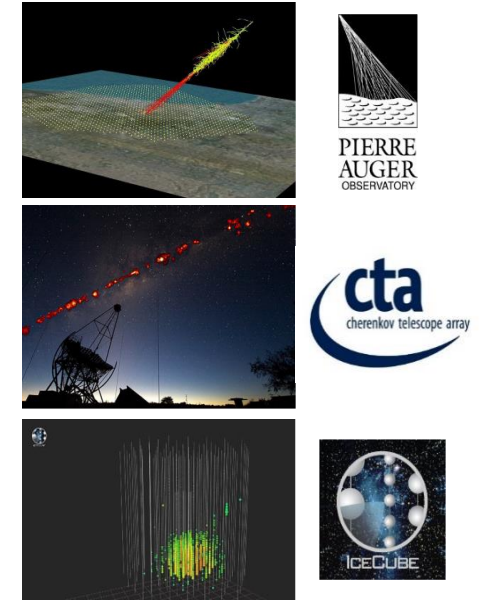
### ➤ Hardware and Services –

Use of local HPC clusters, containers & docker

Joint IceCube Tier1 incl. GridKa as blueprint for future resource use

### ➤ Networking –

Work for NDFI proposal (PUNCH), ESCAPE, ErUM-Data, HMC, HAICU, HIFIS



(from NDFI Proposal,  
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# ADC-MAPP 2 (1/2021 - 12/2023)

## ➤ Work Programme ADC-MAPP 2

### ➤ ADC-MAPP 2019/20 cont'd –

Continuation or deepening of the previous wp; e.g. deep learning analyses.

Preparation of the demonstrator of a FAIR Astroparticle Physics Data Lake

Networking: cooperation with ErUM-Data, PUNCH4NFDI

### ➤ Community Software –

Integral part of the FAIR data cycle for Gammapy and CORSIKA.

Development of the software especially for (open data) data formats and metadata

### ➤ Long-Term Data Archive –

Concept for FAIR data archiving and reproducibility of papers / theses / analyses

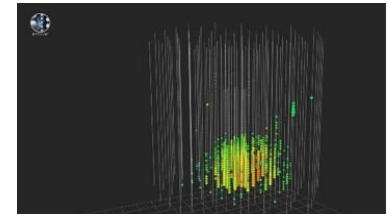
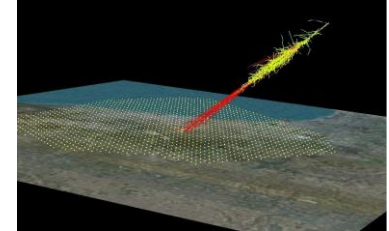
### ➤ Realtime Services –

Integration of LSST, IceCube, CTA and ET in 'AMPEL'

### ➤ Integration of the Einstein Telescope in ADC-MAPP –

Advanced real-time services

Git server (software) and low-latency (monitoring data) service centre for Virgo/LIGO



# Flash of (some) achievements in ADC-MAPP



- Contributions to development of open data format for gamma observatories (prototype for CTA & development of long-term public archives for current instruments; expansion to particle detectors)

## Data formats for gamma-ray astronomy



The *Data formats for gamma-ray astronomy* is a community-driven initiative for the definition of a common and open high-level data format for gamma-ray instruments.

- Repository: <https://github.com/open-gamma-ray-astro/gamma-astro-data-formats>
- Docs: <https://gamma-astro-data-formats.readthedocs.io/>
- Mailing list: <https://lists.nasa.gov/mailman/listinfo/open-gamma-ray-astro>

- Generalisation and opening of the KCDC portal for data from other experiments



<https://kcdc.iap.kit.edu/>

### ▼ Data Shops

KASCADE

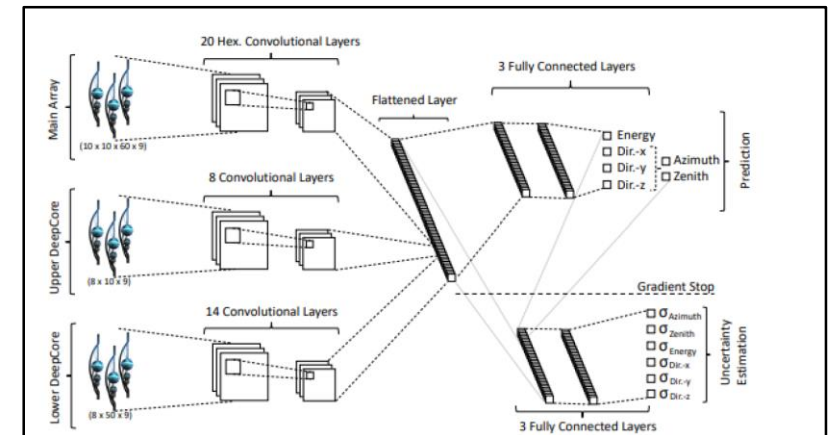
COMBINED

Maket-Ani

Review Requests

### ► Simulations

- Application of Graph Neural Networks (GNN) for analyses in astroparticle physics (IceCube); Application of Sequential Recurrent Neural Networks for shower simulations.

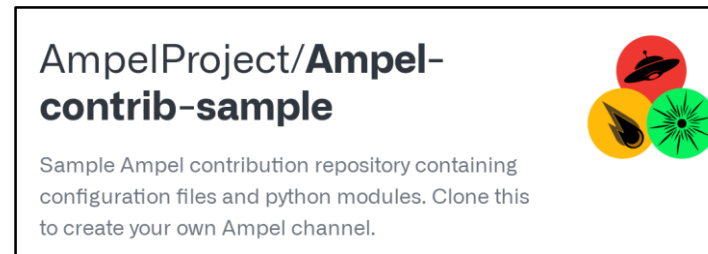
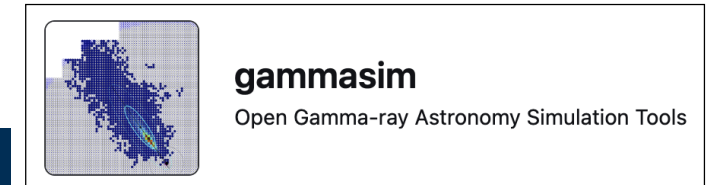
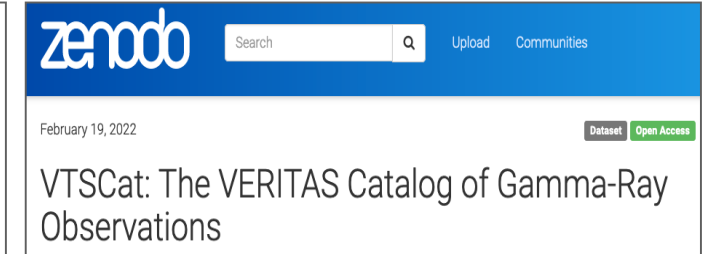
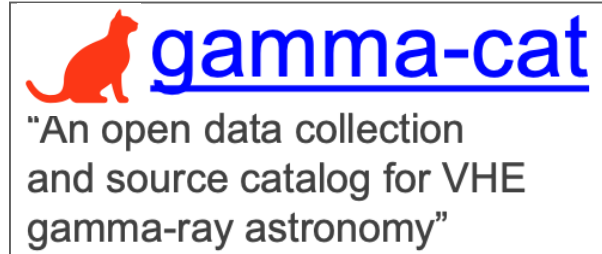




# Flash of (some) achievements in ADC-MAPP



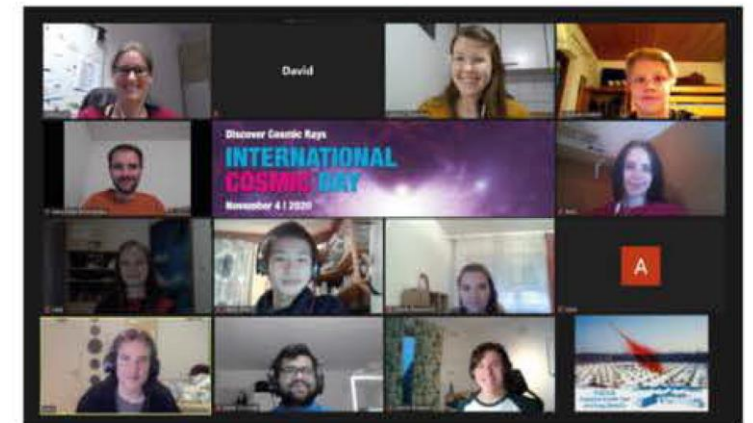
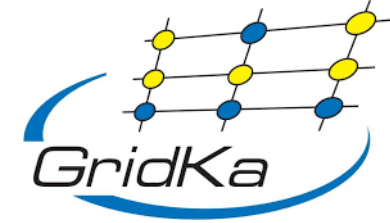
- Machine-readable catalogue for physics results from gamma-ray observatories (complete for VERITAS; in progress for HESS/MAGIC)
- Development of open simulations (CORSIKA8), simulation workflows (gammasil-tools), and analysis (gammapi) software for astroparticle physics
- Further development of real-time analysis software (AMPEL), photometric classification for LSST



# Flash of (some) achievements in ADC-MAPP



- DESY+KIT jointly operate an IceCube Tier1 and use GridKa as a Virtual Organisation
- Significant participation and representation of astroparticle physics from DESY and KIT in the NFDI consortium PUNCH4NFDI
  - Reproducible workflows for simulations
  - KCDC as use case for the PUNCH Data Portal
  - Metadata schemata for Astroparticle Physics
- Initiation of an advanced training series "Data Science Seminar" at DESY in Zeuthen
- Development of a KCDC-based master class and applications, e.g. at the International Cosmic Day



# ADC-MAPP

## ➤ ADC-MAPP 1

Successful project with far-reaching course-setting for the FAIR Data Life Cycle in astroparticle physics.

ADC-MAPP 1 Ressources per Center and year (flat over 2y, partly BMBF, partly MU)		
DESY	KIT	Gesamt
352 k€	496 k€	848 k€

## ➤ ADC-MAPP 2

The preparatory work in the previous ADC-MAPP was useful and necessary; Good progress in the work packages

ADC-MAPP 2 Ressources per Center and year (flat over 3y, partly BMBF, partly MU)		
DESY	KIT	Gesamt
332 k€	371 k€	703 k€

