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**GSI Darmstadt**

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WP19 Status Report

# GSI: a German National Lab for Heavy Ion Research

## FAIR: Facility for Ion and Antiproton Research ~2018

### GSI/FAIR computing

ALICE T2/T3

HADES

CBM

PANDA

NuSTAR

APPA

Theory

LQCD

**today**

~ 14000 cores,

~ 5.5 PB lustre

~ 9 PB archive capacity

~ **2018**

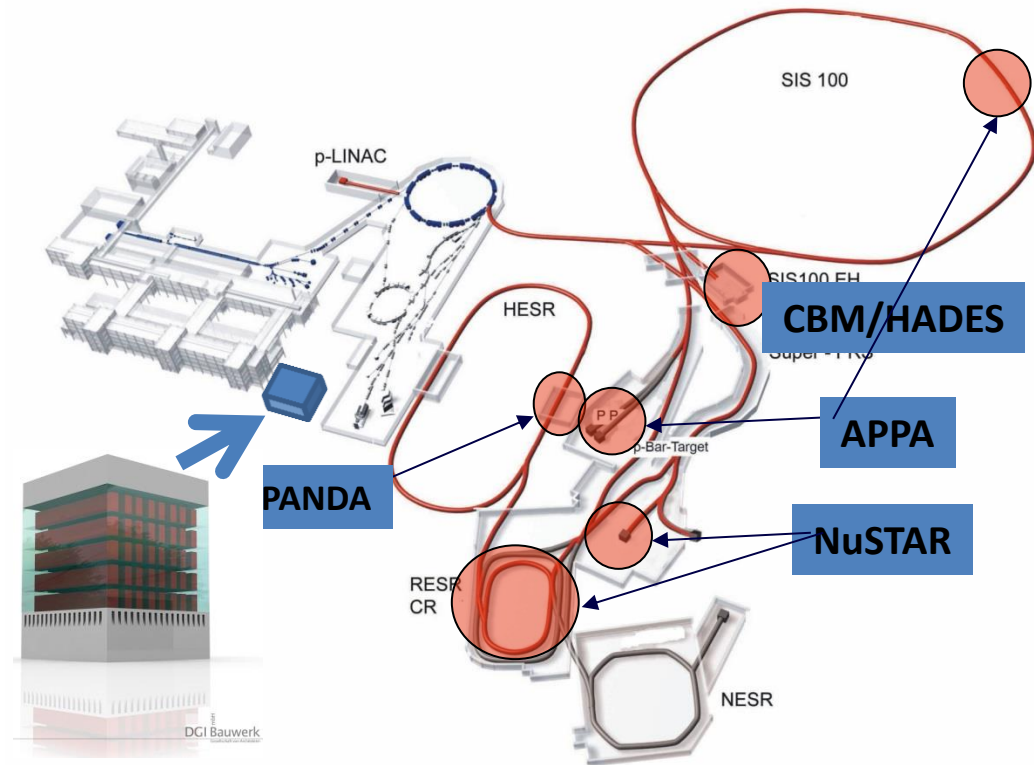
~ 300000 cores

~ 40 PB disk

~ 40 PB archive

& FAIR MAN

& FAIR Grid/Cloud



open source and community software  
commodity hardware  
support different communities  
scarce manpower

## •The four pillars of FAIR:

•Facility for Ion and Antiproton Research ~2018

•Atomic, Plasma Physics and Applications: APPA

•Nuclear Matter Physics: CBM (Compressed Baryonic Matter)

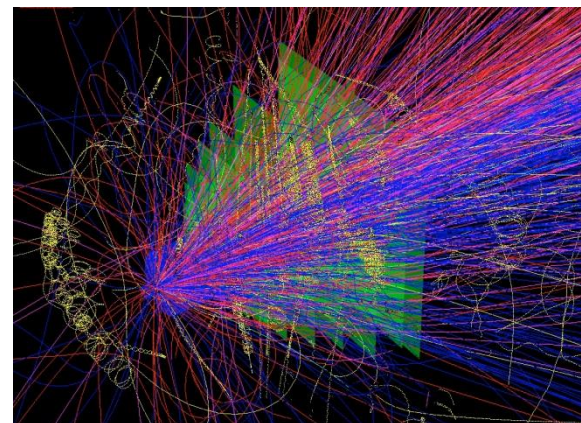
•Nuclear Structure, Astrophysics and Reactions: NUSTAR

•Antiproton Physics: PANDA (Antiproton Anihilation at Darmstadt)

•Two HEP like experiments (CBM & PANDA)

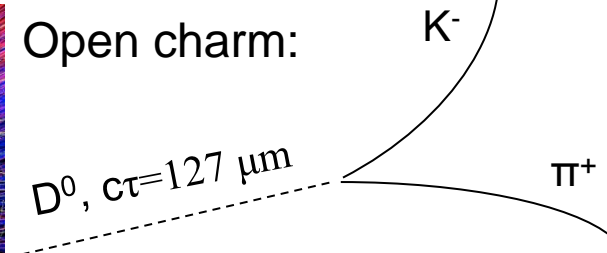
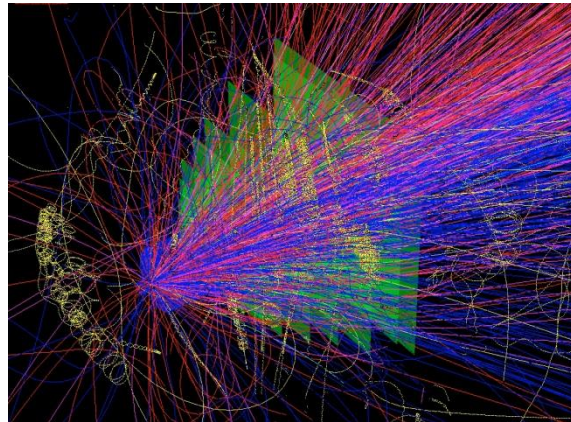
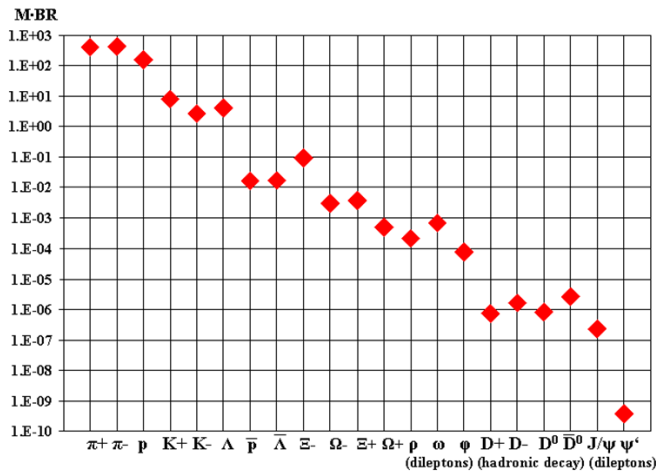
•APPA more like Photon Science

•NUSTAR in between



# Additional challenges for reconstruction

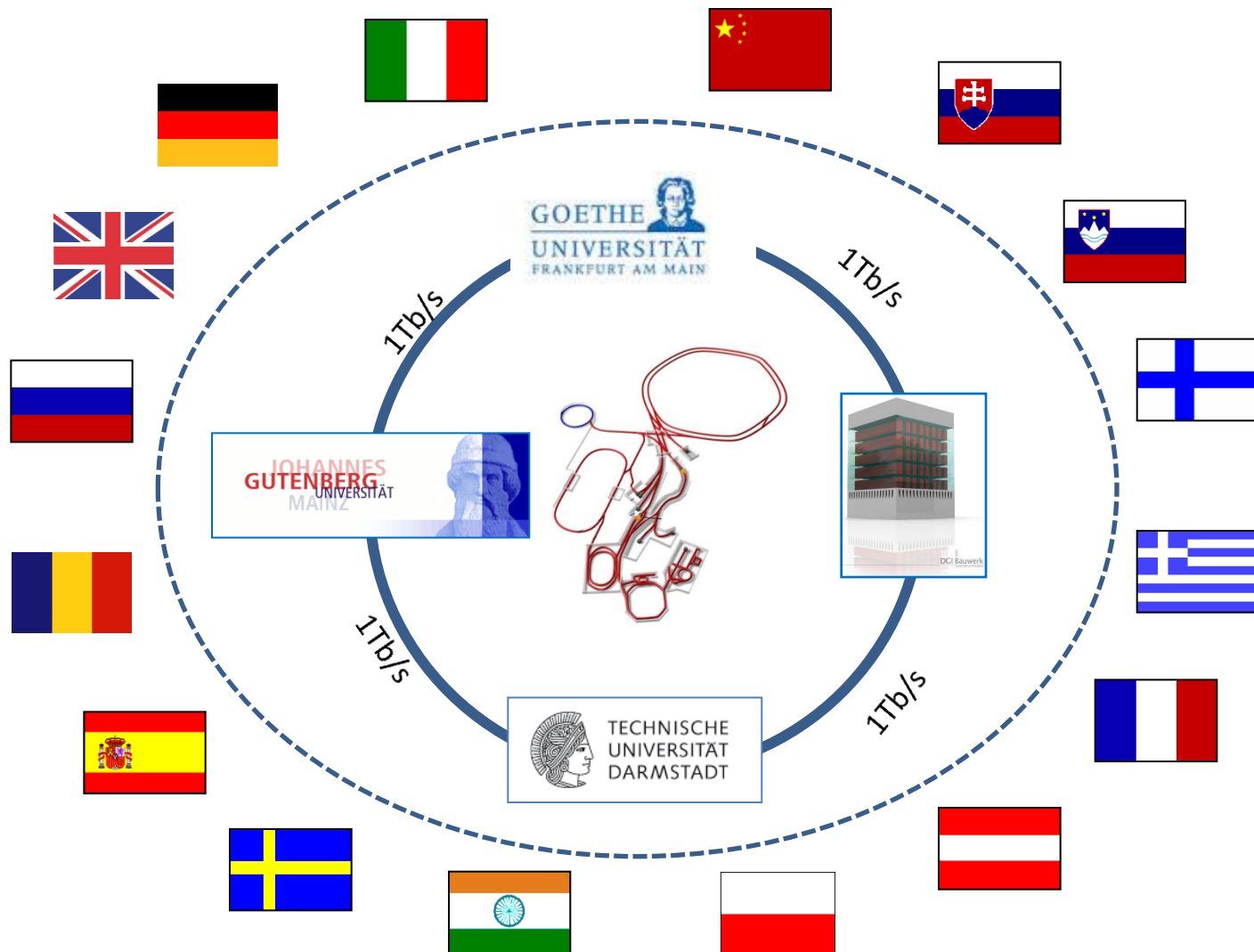
- Fast online event reconstruction, not exclusively via hardware trigger
- time to reconstruct 1-10ms &  $10^7$  collisions/s
- ->  $10^4 - 10^5$  cores



Typical signal multiplicities:  $O(10^{-6})$

No „easy“ trigger signatures

# Infrastructure: T0/T1 MAN & Grid/Cloud



# Storage Interfaces to Metropolitan Area System

- task
  - setup of high performance storage link within federated FAIR T0/T1 centre
- work done
  - design of a high performance LNET router cluster between Ethernet and Infiniband
  - setup of high performance link between GSI and University of Frankfurt
    - currently achieved speed between Frankfurt and GSI Lustre Cluster: 14 GB/s on 120 Gb link
  - secure connection via certificates and high performance firewall
    - status: functioning prototype
- further topics: GID/UID mapping of interconnected sites, cross site accounting, monitoring, anomaly discovery

# Storage Interfaces to Metropolitan Area System (II)

- task
  - integration of FAIR MAN in global Grid/Cloud infrastructure
- main topic
  - development work in the context of data management/interface programming between global Grid file systems and HPC storage systems
    - status: functioning prototype

# Cloud Interfaces to existing environments

- 1 person has been hired and is working on this task
- A tool set has been developed (Dynamic Deployment System (DDS))
  - DDS distributes user defined processes on different resource management systems
  - DDS can run on a local PC, a batch farm and/or with Cloud Systems
  - DDS is an ongoing development which started with PROOF on Demand (PoD)



# Extension of the FairRoot framework

- task: enable FairRoot to do high speed (online) data analysis in real time (expected data rate up to 1 Tb/s)
- main topics:
  - message queue technique enables efficient communication of many processes in heterogeneous computing environment (CPU, GPU, FPGFA, ...)
  - new resources (e.g. GPU) have to be usable just by changing configuration
  - system needs to be monitored and configured in real time without performance loss
    - failure of single nodes and processes needs to be discovered and restarted automatically
  - APIs for communication with various DAQ systems

# Extension of the FairRoot framework - current status

- 1 person has been hired and is working on this task
- see also poster by N. Winckler
- ALFA as a common framework for ALICE and FAIR came into existence
  - works for online/offline/simulation
  - message queue based design
    - currently supported messaging libraries: 0MQ/Nanomsg
  - effective use of all available resources