Dress Rehearsal Review: FAIR Perspective
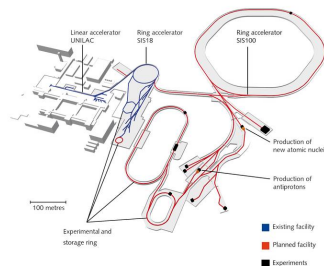
Marek Szuba / GSI

2020-12-09, 2nd ESCAPE WP2/DIOS Workshop

Outline

1. FAIR and Its Pillars

2. FAIR Data-lake Work Flows

3. November Dress Rehearsal

4. Summary

Introduction to FAIR

- **F**acility for **A**ntiproton and **I**on **R**esearch
- Upcoming international accelerator centre in Darmstadt, Germany
- Extension of acceleration facilities of GSI Helmholtz Centre for Heavy-ion Research
- Four experimental pillars:
  - PANDA — antimatter studies
  - CBM — heavy-ion physics
  - NUSTAR — rare/exotic beams for astrophysics
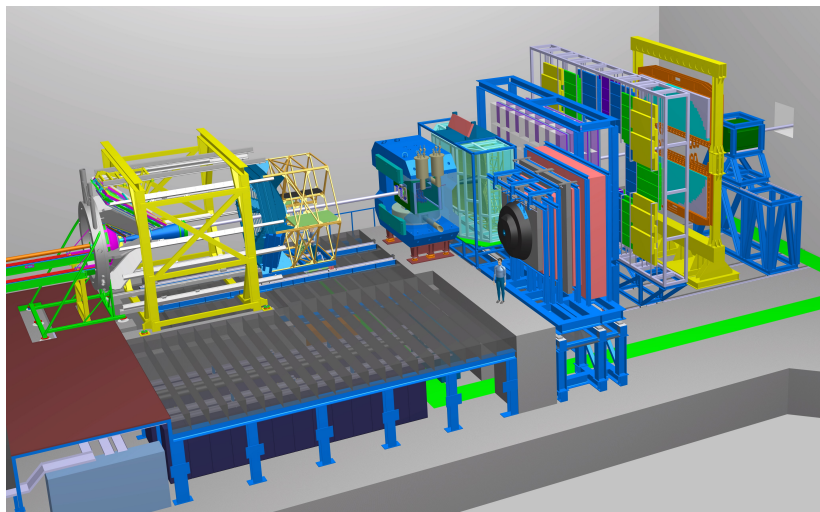 - APPA — Atomic, Plasma Physics and Applications

$\bar{P}ANDA$
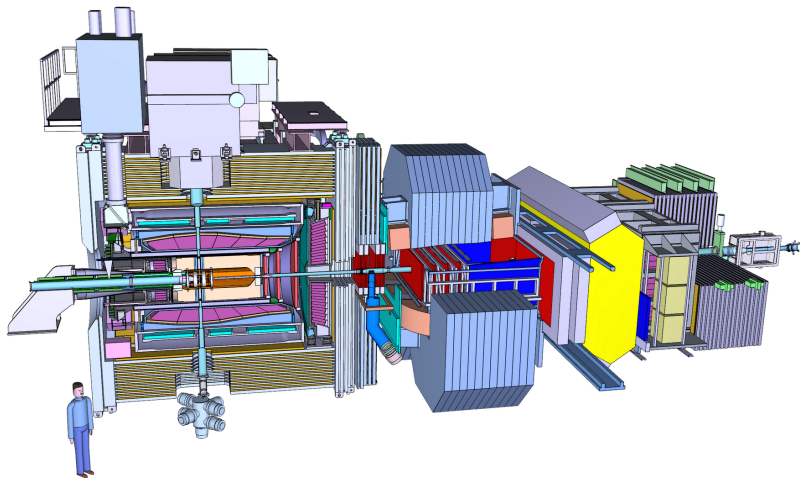
$\bar{P}ANDA$

- **anti**-**P**roton **AN**nihilations at **DA**rmstadt
- General-purpose detector with large acceptance
- First fixed-target, later collider mode
- Hadron spectroscopy, hadrons in matter, nucleon structure, hypernuclei
- Collisions: $\bar{p} - p(A)$
    - *high event rates but relatively low event size*

CBM

CBM

- **C**ompressed **B**aryonic **M**atter
- Modular detector — different configurations for different runs
- Fixed-target
- Phase diagram of strongly interacting matter, phase transitions, quark-gluon plasma, neutron stars
- Collisions: up to and including heavy-ion $A - A$
  - *high event rates AND large events*

FAIR Data-lake Work Flows
Current State

- None yet!
    - still a few years till FAIR Phase 1 launch
    - work ongoing on experiments' computing models
    - hardware not ready for target requirements
- Likely first candidate: Monte-Carlo reconstruction for CBM
    - January 2021???
- Meanwhile, we can approximate

FAIR Data-lake Work Flows
Operational Assumptions

With CBM raw-data ingestion as upper bounds:

- 3-month runs every year
- $\sim$18 PB/run -> $\sim$200 TB/day
- ROOT files — binary, possibly compressed data
- file size: $\sim$1 GB
- near real-time reconstruction — no ESD, no persistent AOD
  — raw data as analysis input
- QoS classes:
  - RAW_HOT — reasonably reliable, reasonably fast —
    $\sim$ CHEAP_ANALYSIS
  - RAW_COLD — highly reliable — $\sim$ SAFE

FDR #1 "FAIR" Work Flow

- mock CBM raw-data ingestion at $\sim 1/500$ expected data rate
- randomly generated 1-GB files uploaded every ~ 10 minutes
- source system: workstation on GSI office network (Gigabit Ethernet)
- uploads to "home" RSE (GSI-ROOT; QOS=CHEAP_ANALYSIS)
- QoS tagging: 1x CHEAP_ANALYSIS (FTS no-op) + 2x SAFE
- steering: Rucio CLI client + bash scripts
- authentication: long-lived X.509 proxy cert with periodic keyless renewal of VOMS extension

Run Progress

- before 12:30 UTC: all uploads failed due to GSI-ROOT problems
- afterwards: nearly 100 % success for both uploads and replication
    - 7 uploads failed when the Rucio server had to be restarted
    - replication of last few uploads delayed due to FTS issues, eventually succeeded
- upload frequency doubled around 13:30 UTC, no problems

Summary and Outlook

- so far so good ...
    - ...for a mock work flow and $\sim 1/250$ nominal data rate
- next step: continuous uploads over 10GE
    - highest we can go on current hardware
    - theoretical maximum: ~ 105 TB/day
- Rucio server as potential bottleneck
    - local buffer needed to prevent data loss on outages
    - minimise client-server communication: subscriptions for QoS rules, ...
    - asynchroneous renewal of Rucio auth tokens?

THANK YOU