Karlsruhe Institute of Technology

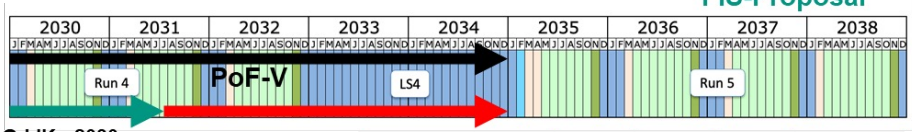
GridKa LK-II Facility

MU Days 2023, Outlook to PoF V

Max Fischer, Andreas Petzold, Achim Streit

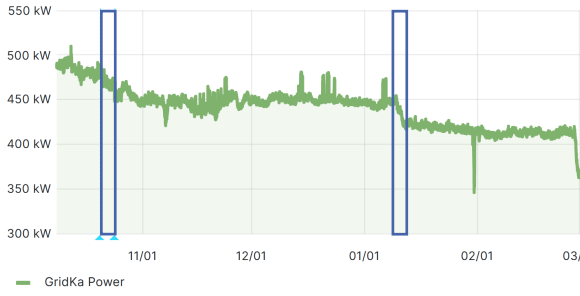
PoF-V scope for GridKa

- PoF-V covers operations & personnel
- Start of LHC Run 4 in 2029
  - GridKa ramp-up from 2027 onwards
  - Hardware funding from FIS-entry „**Upgrade TIER-Centers for HL_LHC**“ needed from 2027
- Full support for DARWIN
- Accommodate University Tier-2 storage from 2025
  - Just ATLAS and CMS, small w.r.t. Tier-1 storage
- Detailed energy-monitoring & -analyses of potential savings, testing other CPU architectures and GPUs
- Monitoring of sustainability discussions in RF and KIT



GridKa 2030
(projections from 11/2021):
- CPU: 350 k log. Cores
- DISK: 350 PB
- TAPE: 1 EB
- ~1.1 MW

FIS [M€]	2027	2028	2029	2030	Total
KIT	1	7	7	6	21
Total	3	11	13	6	33



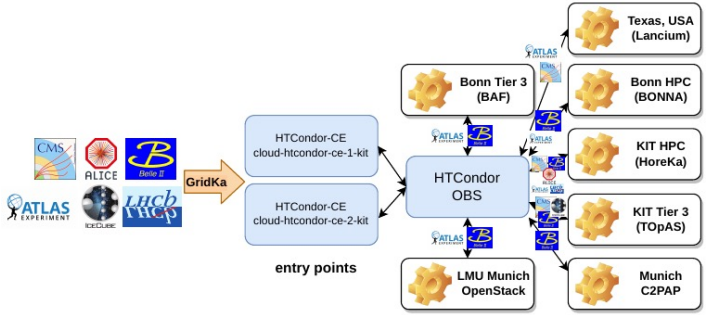
Upgrade TIER-Centers for HL-LHC

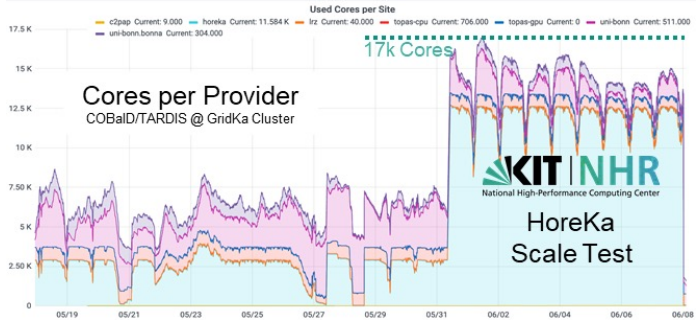
- HL-LHC generates **new challenges** for data management and analytics – addressing them properly enables new scientific discovery
- Without alternatives, **Germany needs** powerful data and analysis centers so that the German physics community can participate in the scientific discovery at HL-LHC
- "**Upgrade TIER-Centers for HL-LHC**"
  joint proposal of KIT, DESY, GSI and part of the **Helmholtz FIS roadmap** 2021, page 53

	2027	2028	2029	2030	Total
DESY [Mio. €]	1	3	4	0	8
GSI [Mio. €]	1	1	2	0	4
KIT [Mio. €]	1	7	7	6	21
Total [Mio. €]	3	11	13	6	33

Opportunistic Compute @ GridKa

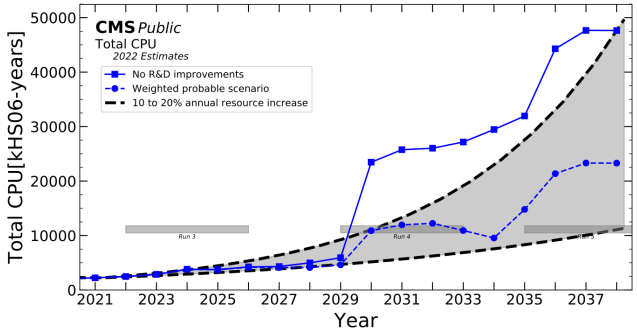
- Long term community cooperation on R&D
  - Joint development of the open-source software COBalD/TARDIS for **transparent, on-demand integration of remote computing resources**
  - Close collaboration with several physics groups
- Prepared for changes in computing landscape
  - Leverage COBalD/TARDIS to adjust scope of GridKa for resources and expertise
  - Provide experimental compute environments without long-term commitment for Tier 1 itself
  - Retain flexibility to integrate with possibly more distributed and heterogeneous future landscape

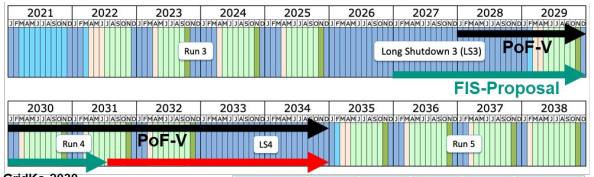




LK-II GridKa in PoF-V

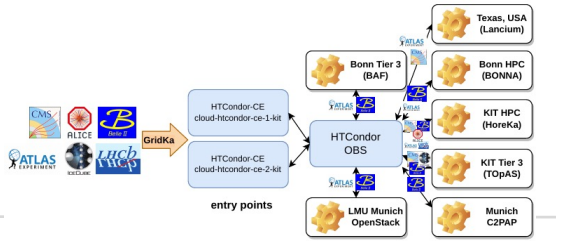
- Increasing resource demand during PoF-V
  - Provide better performance for better physics
  - Planned hardware rampup from 2027 onwards
- New sustainability opportunities/challenges
  - Improve physics output and reduce resource needs
  - Already looking at power, architecture, … options
- Promote technology for opportunistic resources
  - Access to experimental setups from broad landscape
  - Allow large compute centers to retain flexibility





GridKa 2030
(projections from 11/2021):
- CPU: 350 k log. Cores
- DISK: 350 PB
- TAPE: 1 EB
- ~1.1 MW

FIS [M€]	2027	2028	2029	2030	Total
KIT	1	7	7	6	21
Total	3	11	13	6	33



GridKa – Resources

- Compute
  - 217 active nodes – reduced to **110% plege** to safe power
  - 42500 active cores – **>97% efficiency**
  - Purchase **ARM nodes** for testing at scale
- Online Storage
  - **99 PB usable** storage + 15 PB being migrated
  - dCache + xrootd on IBM Storage Scale
- Offline Storage
  - Ongoing migration to **HPSS**
  - Development for **recall optimization**
  - **Flash** based disk buffers
  - **85 PB used**,123PB (135PB) pledged
- WAN
  - **200 Gb/s to CERN**/LHCOPN
  - **200 Gb/s to DFN**/LHCONE