

Signature pages for the HADES member institute IJCLab (to be completed and signed)

| Intended commitment in the period 2023 - 2030 | Resources |
|---|---|
| Participation in data analysis (describe which contribution) | 3 FTE. <ul style="list-style-type: none">• pp@4.5 GeV: dilepton and K+K channels-• pi+C@0.7 GeV/c: hadronic channels• heavy-ion experiments: dilepton channels and phenomenology of thermal models |
| Participation in detector maintenance and commissioning activities (describe which contribution) | Pion beam optics |
| Contribution to common fund | 3 k€ / year |
| Contribution to detector upgrades (included in the HADES RRB10/11 cost matrix) (describe which contribution) | 40 k€ |
| Contribution to detector upgrades (<u>not</u> included in the HADES RRB10/11 cost matrix) (describe which contribution) | 0 |

(date)

(signature and name of Head of Department, Institute, Dean or Director)

Signature pages for the HADES member institute IFJ PAN (to be completed and signed)

| Intended commitment in the period 2023 - 2030 | Resources |
|---|----------------------------|
| Participation in data analysis (pp @ 4.5 GeV, pion beam) | 2 [FTE] |
| Participation in detector maintenance and commissioning activities (describe which contribution) | 0 [FTE] |
| Contribution to common fund | 1 kEuro [EURO/year] |
| Contribution to detector upgrades (included in the HADES RRB10/11 cost matrix) (describe which contribution) | 0 [EURO] |
| Contribution to detector upgrades (<u>not</u> included in the HADES RRB10/11 cost matrix) (describe which contribution) | 0 [EURO] |

(date)

(signature and name of Head of Department, Institute, Dean or Director)

GSI Helmholtzzentrum für Schwerionenforschung GmbH (GSI) Darmstadt

Current members: T. Galatyuk, M. Gumberidze, T. Heinz, J. Markert, J. Pietraszko, A. Rustamov, E. Schwab, S. Spies, J. Stroth, C. Wendisch, HADES department; J. Adamczewski-Musch, S. Linev, M. Traxler, P. Zumbach (Experiment Electronics)

GSI is also a member institution and agrees to meet the obligations defined below **as a Member of the Collaboration**. The interest of the GSI HADES group is to develop further the spectrometer and to participate in the analysis, presentation and publication of the physics results. GSI will also be fully committed to the physics program with HADES at SIS-100. The HADES group at GSI has/takes over responsibility for the following activities/projects:

- Development, M&O of beam-line detectors,
- Design, M&O of the HADES LVL1 trigger,
- M&O and low-level data analysis for MDC
- M&O of the superconducting magnet incl. cryogenics
- Design, installation, M&O of the IT infrastructure for event building and mass storage,
- Development, M&O and management of the HADES experiment database,
- Development, M&O and management of the analysis and simulation frame work,
For event reconstruction,
- Management of the slow-control platform EPICS.

The group also participates in:

- FEE and Read-out of new detector systems
- Installation of new detector systems

| Task, component | Allocated funds or personnel | Comments |
|--|-------------------------------------|------------------------------------|
| Integration/maintenance/operation of detector system | 2.5 FTE | In particular t0 detectors and MDC |
| DAQ/FEE upgrade for high rates | 0.5 FTE | Mainly MDC and DAQ |
| Trigger electronics, beam detectors, target assemblies, magnet, gas systems, etc. | 2 FTE, 80 k€/a | |
| Management and maintenance of the DAQ, EDS, DB and analysis environment | 3 FTE, 50 k€/a | Event building, HPC, Database |
| Data analysis | 1 FTE | w/o PhD students |
| HADES management | 1 FTE | Technical coordination |

GSI as the host is not participating to the common funds. The annual expenses for maintaining the basic infrastructure as detailed in paragraph 4, not included in the table above, amount to approximately 50 k€ w/o personnel. This commitment might be subject to changes only in case of unexpected reductions in allocated funding resources or severe rises in costs. Any change will be communicated to the Collaboration Board.

Joachim Stroth
Collaboration Board member

Thomas Nilsson
Scientific Director of GSI

Katharina Stummeyer
Administrative Director of GSI/FAIR

Signature pages for the HADES member

Nuclear Physics Institute, Czech Academy of Sciences, Rez, Czech Republic

and Faculty of Science, Palacky University, Olomouc, Czech Republic

(to be completed and signed)

Members of the group

NPI: Andrej Kugler, Ondrej Svoboda, Pavel Tlustý, Vladimír Wagner (perm.); Kyrylo Merkotan (Postdoc), Antonín Opíchal (PhDs)

PU: Luboš Krupa, Pavel Kohout (perm.); Alena Kohoutová (PhDs)

The party will contribute to all types of experiments performed with HADES. The analysis activities will be focused on heavy-ion and cold-matter physics addressing collective effects (flow), dileptons and hadron (strangeness) production with the aim to study hadron properties in medium.

The Party takes the responsibility of contributing to software implementation of analysis algorithms for the ECAL detector and corresponding data analysis, and to simulation of ECAL as well as simulation and design studies of whole HADES setup performance for heavy ion beam energies up to 8 AGeV.

The Party takes on the responsibility for following detectors:

- TOF scintillator wall maintenance and related analysis framework (NPI)
- FW scintillator wall maintenance and related analysis framework (PU)
- ECAL detector build up, maintenance and related analysis framework(NPI)

| Intended commitment in the period 2023 - 2026 | Resources | |
|--|--|-----------------------|
| Participation in data analysis Physics analysis (Flow, pions, dilepton, strangeness) | 1 [FTE] | |
| Participation in detector maintenance and commissioning activities ECAL, FW and TOF detectors | 2 [FTE] | |
| Contribution to common fund | 1000 [EURO/year] | |
| Contribution to detector upgrades (included in the HADES RRB10/11 cost matrix) (describe which contribution) | In 2005 prices | |
| | Infrastructure | 293 000 [EURO] |
| | ECAL detector | 390 000 [EURO] |
| Contribution to detector upgrades (not included in the HADES RRB10/11 cost matrix) (describe which contribution) | funds spent before 2016 in 2005 prices | |
| | ECAL HV system, LED system, mechanics | |
| | | 174 000 [EURO] |
| | FW detector | 230 000 [EURO] |
| | TOF detector | 216 000 [EURO] |

(date)

(Ing. Ondřej Svoboda Ph.D., Director)

Signature pages for the HADES member institute Ruhr U. Bochum (to be completed and signed)

| Intended commitment in the period 2023 - 2030 | Resources |
|---|---|
| Participation in data analysis (describe which contribution) | 2 senior scientists (part-time on HADES), 3-4 postdocs 3 PhD students currently analyzing the pp 4.5 GeV data.: pp Elastics, ppKK, PKOS Lambda pi, p n pi+, Xsi & developing a PWA tool set We will shift our focus more to the pion induced data in the future |
| Participation in detector maintenance and commissioning activities (describe which contribution) | STS1, iTOF 0.5 [FTE] |
| Contribution to common fund | 5,000 [EURO/year] |
| Contribution to detector upgrades (included in the HADES RRB10/11 cost matrix) (describe which contribution) | PSP 1.1.2.7.4 25,000 [EURO] |
| Contribution to detector upgrades (<u>not</u> included in the HADES RRB10/11 cost matrix) (describe which contribution) | Pion beam modifications 20,000 [EURO] |

(date)

(signature and name of Head of Department, Institute, Dean or Director)

Signature pages for the HADES member institute AGH University of Krakow, Faculty of Physics and Applied Computer Science, Cracow, POLAND

| Intended commitment in the period 2023 - 2030 | Resources |
|---|---|
| Participation in data analysis (describe which contribution) | 0 [FTE] |
| Participation in detector maintenance and commissioning activities (describe which contribution) | 3 [FTE] Front-end electronics for STS, contribution to front-end for MDC |
| Contribution to common fund | 3kE [EURO/year] |
| Contribution to detector upgrades (included in the HADES RRB10/11 cost matrix) (describe which contribution) | 0 [EURO] |
| Contribution to detector upgrades (<u>not</u> included in the HADES RRB10/11 cost matrix) (describe which contribution) | 0 [EURO] |

(date)

(signature and name of Head of Department, Institute, Dean or Director)

Addendum 2 to the "Update of the HADES Memorandum Of Understanding
for the execution of the HADES experiment during FAIR Phase-0"

Signature pages for the HADES member institute xxxxxx (to be completed and signed)

| Intended commitment in the period 2023 - 2030 | Resources |
|---|--|
| Participation in data analysis (describe which contribution) | ? [FTE] 2 FTE elementary and A+A collisions: dileptons, strangeness |
| Participation in detector maintenance and commissioning activities (describe which contribution) | ? [FTE] 2 FTE RICH detector |
| Contribution to common fund | ? [EURO/year] 8000 €/year |
| Contribution to detector upgrades (included in the HADES RRB10/11 cost matrix) (describe which contribution) | ? [EURO] RICH detector (cost matrix ?) |
| Contribution to detector upgrades (<u>not</u> included in the HADES RRB10/11 cost matrix) (describe which contribution) | ? [EURO] RICH detector |

(date)

(signature and name of Head of Department, Institute, Dean or Director)

Signature pages for the HADES member institute WUT (to be completed and signed)

| Intended commitment in the period 2023 - 2030 | Resources |
|---|-------------------------|
| Participation in data analysis Two-particle correlations | 3.5 [FTE] |
| Participation in detector maintenance and commissioning activities (describe which contribution) | |
| Contribution to common fund | 2000 [EURO/year] |
| Contribution to detector upgrades (included in the HADES RRB10/11 cost matrix) (describe which contribution) | |
| Contribution to detector upgrades (<u>not</u> included in the HADES RRB10/11 cost matrix) (describe which contribution) | |

(date)

(signature and name of Head of Department, Institute, Dean or Director)

Addendum 2 to the “Update of the HADES Memorandum Of Understanding
for the execution of the HADES experiment during FAIR Phase-0”

Frederick University, Nicosia, Cyprus

| Intended commitment in the period 2023 - 2030 | Resources |
|---|------------------|
| Participation in data analysis Heavy-ion reactions: collective effects (flow) and strange hadrons production | 2 [FTE] |
| Participation in detector maintenance and commissioning activities | [FTE] |
| Contribution to common fund | 1000 [EURO/year] |
| Contribution to detector upgrades (included in the HADES RRB10/11 cost matrix) | [EURO] |
| Contribution to detector upgrades (<u>not</u> included in the HADES RRB10/11 cost matrix) | [EURO] |

Date: 19/2/2025



Alexis Onoufriou
Director of Research & Interconnection Service

Addendum 2 to the “Update of the HADES Memorandum Of Understanding
for the execution of the HADES experiment during FAIR Phase-0”

Signature pages for the HADES member institute xxxxxx (to be completed and signed)

| Intended commitment in the period 2023 - 2030 | Resources |
|---|--|
| Participation in data analysis (describe which contribution) | ? [FTE] 3 FTE medium (dielectrons, strangeness, flow) |
| Participation in detector maintenance and commissioning activities (describe which contribution) | ? [FTE] 0.5 FTE MDC maintenance |
| Contribution to common fund | ? [EURO/year] 8000 Euro/year |
| Contribution to detector upgrades (included in the HADES RRB10/11 cost matrix) (describe which contribution) | ? [EURO] |
| Contribution to detector upgrades (<u>not</u> included in the HADES RRB10/11 cost matrix) (describe which contribution) | ? [EURO] Contribution to upgrade MDC layers III and IV. No invest. |

(date)

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Signature pages for the HADES member institute BUW Wuppertal (to be completed and signed)

| Intended commitment in the period 2023 - 2030 | Resources |
|---|--|
| Participation in data analysis (describe which contribution) | 1,5 FTE Pi0 / Eta analysis via double photon conversion technique. |
| Participation in detector maintenance and commissioning activities (describe which contribution) | 1,5 FTE operation, maintenance and performance tuning of HADES RICH detector. |
| Contribution to common fund | 4 k€ / year |
| Contribution to detector upgrades (included in the HADES RRB10/11 cost matrix) (describe which contribution) | - |
| Contribution to detector upgrades (<u>not</u> included in the HADES RRB10/11 cost matrix) (describe which contribution) | - |

(date)

(signature and name of Head of Department, Institute, Dean or Director)

Signature pages for the HADES member institute JU (to be completed and signed)

Jagiellonian University

| Intended commitment in the period 2023 - 2030 | Resources |
|---|--|
| Participation in data analysis (describe which contribution) | 4 [FTE] till 2027 (complete pp analysis) After 2027 depending on pion-beam availability |
| Participation in detector maintenance and commissioning activities (describe which contribution) | 2 [FTE] till 2028 (later depending on HADES beam times) Forward Tracker |
| Contribution to common fund | 1500 kEuro [EURO/year] +15000 |
| Contribution to detector upgrades (included in the HADES RRB10/11 cost matrix) (describe which contribution) | 440 kiloEuro [EURO] Ecal, Forward Tracker |
| Contribution to detector upgrades (<u>not</u> included in the HADES RRB10/11 cost matrix) (describe which contribution) | 0 [EURO] |

(date)

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