Welcome and introduction

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WORKSHOP ON FAST REALTIME SYSTEMS AND REALTIME MACHINE LEARNING
Justus–Liebig–Universität Giessen
08.04.–11.04.2024

Welcome

- We appreciate that you are here (in person or remote)
  although there have been many constraints: Ramadan, last week before semester (in
  some federal states), first week of semester (in other federal states), data taking
  (LHC, Hades and Belle II)

- This workshop is hybrid (in order to support sustainability and to enable
  participation to interested persons with limited funding)

- The topic of this workshop is REALTIME systems, conventional and novel.

- Approach: not only benchmark results,
  but also "real life" experiences with the systems (joy and frustration),
  and all related side aspects (e.g. monitoring),
  and ample time for questions and discussion.

- The classic definition of realtime (around 1990) was:
  a system which replies to an interrupt within a fixed interval
  of e.g. 10 us.

- Nowadays, the timescale changed.
  Question to be discussed: is it possible to have a neural network decision within
  100 ns (answer is yes, see talks on Wednesday), 10 ns?, 1 ns?

Welcome

- Part I, supported by Jennifer2 project

  **Realtime data acquisition (DAQ) systems with high bandwidth
  (from GB/s to TB/s)
  Realtime trigger systems with high trigger rates
  (from kHz to MHz)**

  - Monday: triggerless readout, neutrino experiments, GPU-based systems

  - Tuesday: FPGA*–based systems

- Part II, supported by ErUM Data Hub
  Realtime Machine Learning

  - Wednesday: neutrotrigger, anomaly detection, earthquake realtime analysis

  - Thursday: FPGA*-based systems (incl. newest generation platform)

* many XILINX platforms (Virtex, Kintex, - UltraScale and UltraScale+ -, Zynq, Versal)

Justus–Liebig–University Giessen

- founded 1607

- about 25.700 students

- II. Physics Institute (Subatomic Physics):
  involvement in FAIR (hadron and nuclear physics,
  both high and low energy, also atomic physics),
  ATLAS, Belle II, and other projects,
  former involvement in BESIII

- Bachelor and master courses besides physics:
  physics and technology for space travel applications,
  data science, applied informatics

- Famous physicists:

  - Wilhelm Conrad Röntgen, 1879–1888

  - Alfred Clebsch met Paul Gordan, ~1864
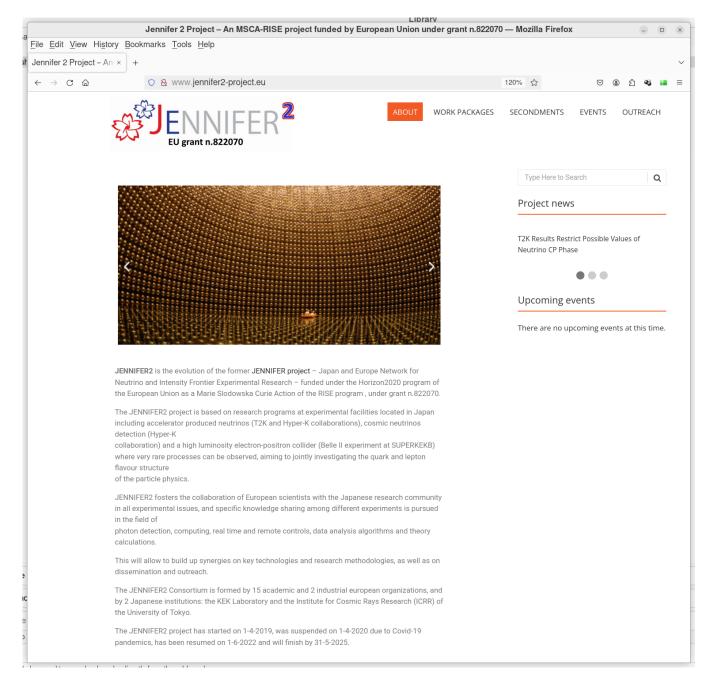
Stratoballoon, 2020

Physics Building, Photo: Klaus Foehl

Jennifer2 project

Jennifer2 project

- Japan and Europe Network for Neutrino and Intensity Frontier Experimental Research

  - 15 academic + 2 industrial beneficiaries, 2 Japanese partners

  - more than 200 researchers

- European Commission, Horizon 2020 Framework
  Marie Skłodowska-Curie Actions
  MSCA-RISE-2018 - Research and Innovation Staff Exchange

- Funding for "secondments", i.e. travel to and research in Japan
  (for foreign researchers), in total 533 secondments months

- Funding period 1.04.2019 – 31.05.2024

- This workshop is a deliverable for workpackage 5.2

ErUM Data Hub and DIG-UM

The ErUM Data Hub is the central networking and transfer office for the digital transformation in the exploration of universe and matter, funded by the German Federal Ministry of Education and Research (BMBF) and involves stakeholders from all ErUM thematic areas.

The ErUM Self-Organization for Digital Transformation DIG-UM was launched at the same time as the ErUM-Data-Hub. Within the self-organization, the needs and requirements of the eight ErUM communities are combined, scientific strategies are developed and overview documents are written in different topic groups.

https://erumdatahub.de/dig-um/

ErUM-Communities

The ErUM-Data-Hub implements the measures of the ErUM-Data Action Plan. In doing so, the Hub maintains close contact with the German ErUM communities:

KAT
Astroparticle Physics
The Committee for Astroparticle Physics represents all German physicists in the field of astroparticle physics.
More →

KET
Elementary Particles Physics
The Committee for Elementary Particle Physics is the elected representation of the German particle physicists.
More →

KfB
Accelerator Physics
The Accelerator Physics Committee represents the interests of accelerator physics employees and students.
More →

KFN
Research with neutrons
The KFN is an independent interest group with the aim to promote research with neutrons in Germany.
More →

KFS
Research with synchrotron radiation
The KFS represents all researchers working with synchrotron radiation in Germany.
More →

KFSI
Research with nuclear probes and ion beams
The KFSI represents and promotes research with nuclear probes and ion beams in Germany.
More →

KHuK
Hadron and nuclear physics
The Hadron and Nuclear Physics Committee coordinates and represents the interests of German hadron and nuclear physicists.
More →

RDS
German Observatory Council
The Council of German Observatories represents the interests of the institutes active in astronomical research in Germany.
More →

Organisatorial remarks

- **LUNCH 11:30–13:15**
  - We will walk together to the mensa (~10 min walking distance), no reserved seats, but there will be sufficient availability (semester did not start yet).
  - Please pick up tickets from me (based upon your indico registration).
- **WORKSHOP DINNER, Tuesday 9.04. @ 19:00**
  - Restaurant Bootshaus, located at the Lahn river, walking distance to recommened hotel, special Menu: please select one of 5 dishes (see pdf in indico).
- All plastic nametags are recycled from former conferences (sustainability).
- **COFFEE BREAKS**: afternoon, **14:45-15:30**, in the cafeteria opposite ("CaRe"), payments with my card, please bring a cup and tea (if you like) from this room. Bottled water, coke, apple juice: in this room. IMPORTANT: Please don't drink water from the tap.
- Restrooms, ground floor, in the center of this building, (turn left when exit this room, then turn right behind the glass and iron doors).

Thanks for listening.

Thanks to Jennifer2 and ErUM-Data-Hub

for the kind support.

We hope you enjoy the workshop