AKPIK 1: AKPIK I: Data Science & Analytics

Time: Tuesday 16:00–18:15 Location: AKPIKa

AKPIK 1.1 Tue 16:00 AKPIKa

The PUNCH4NFDI consortium with the "Nationale Forschungsdateninfrastruktur" (NFDI) — •Thomas Schörner-Sadenius — DESY, Hamburg, Germany

With the "Nationale Forschungsdateninfrastruktur" (NFDI, national research data infrastructure), a massive effort is undertaken in Germany to provide a coherent research data management and make research data useable according to the FAIR data principles.

PUNCH4NFDI is the consortium of particle, astro- and astroparticle, and hadron&nuclear physics within the NFDI. It aims for a FAIR future of the data management of its community and at harnessing its massive experience particularly in "big data" and "open data" for the benefit of "PUNCH" sciences (Particles, Universe, NuClei and Hadrons) as well as for the entire NFDI.

In this presentation, we will address the needs for FAIR and open data management and the plans of the PUNCH4NFDI consortium to address this needs.

AKPIK 1.2 Tue 16:15 AKPIKa

German-Russian Astroparticle Data Life Cycle Initiative: results and perspectives — •Victoria Tokareva, Andreas Haungs, Donghwa Kang, Frank Polgart, Doris Wochele, and Jürgen Wochele for the GRADLCI-Collaboration — Institute for Astroparticle Physics, Karlsruhe Institute of Technology, Germany

Distributed data processing in astroparticle physics experiments is mostly discussed in the context of large experiments (e.g. CTA, IceCube). On the other hand, small and medium-sized experiments often employ specialized historically developed data-processing methods and specific software. This may complicate effective usage of solutions, developed for handling large-scale homogeneous data, and impede collaborations between scientific groups in joint analysis, in particular in the highly relevant field of multimessenger astroparticle physics.

To address such challenges, the international project German-Russian Data Life Cycle Initiative (GRADLCI) was established with its main goal of supporting the processing of data from astroparticle physics experiments throughout the entire data processing cycle, from collection and storage to preparation of data analysis results for publication as well as data archiving and open access.

This talk will outline the results achieved in all major areas of the project, such as: extension of KASCADE Cosmic-ray Data Center (KCDC), development of distributed data aggregation platform and software for multimessenger analysis, publication of scientific data as well as outreach activities.

AKPIK 1.3 Tue 16:30 AKPIKa

Status of Beam-Based Feedback Development for Superconducting Electron Linear Accelerator ELBE — •Andrei Maalberg[1,2], Michael Kuntzsch[1], and Eduard Petlenkov[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf, 01328 Dresden, Germany — [2]Department of Computer Systems, Tallinn University of Technology, 19086 Tallinn, Estonia

The superconducting electron linear accelerator ELBE at Helmholtz-Zentrum Dresden-Rossendorf represents a versatile light source operated in continuous wave mode. As new experiments and beam modes place a higher demand on the beam stability, it becomes critical to investigate new ways of improving the existing beam control schemes. Following this, the current control system is planned to be upgraded by a beam-based feedback, and in this contribution we summarize the work in progress.

In essence, the work status can be outlined as follows. First, a plant model has been developed that demonstrated how RF noise translates into electron beam instabilities. Based on this modelling, an optimal H2 controller has then been designed to reduce the impact of RF noise on electron beam properties. As a last step, the designed controller is currently being transferred into VHDL code to be executed on fast FPGA hardware. The resulting beam-based feedback system will be evaluated at ELBE in dedicated machine development shifts.

AKPIK 1.4 Tue 16:45 AKPIKa

Imaging in space, time and frequency: M87* as movie — Philipp Arras[1,2], Philipp Frank[1], •Jakob Knollmüller[2,1], Reimar Leike[1], Philipp Haim[1], Martin Reinecke[1], and Torsten Ensslin[1] — [1]Max-Planck Institute for Astrophysics — [2]Technical University Munich

The recent observations of the black hole shadow of M87* with Very Long Baseline Interferometry (VLBI) by the Event Horizon Telescope (EHT) open the possibility to investigate the dynamical processes right at the edge of black holes. In this regime, traditional radio-astronomical imaging algorithms are brought to their limits. Compared to regular radio interferometers, VLBI networks have fewer antennas. The resulting sparser sampling of the Fourier sky can only be partly compensated by co-adding observations from different days, as the source changes. Here, we present an imaging algorithm that copes with the data scarcity and the source's temporal evolution, while simultaneously providing uncertainty quantification on all results. Our algorithm views the imaging task as a Bayesian inference problem of a time-varying flux density, exploits the correlation structure between time frames, and reconstructs a whole, 2+1+1 dimensional time-variable and spectral-resolved image at once. (https://arxiv.org/abs/2002.05218)

AKPIK 1.5 Tue 17:00 AKPIKa

Adaptive predictor as trigger mechanism for cosmic rays radio signals corrupted by noise — •Clara Watanabe[1,2,3], Paulo Diniz[2], Joao de Mello Neto[1], and Tim Huege[3,4] — [1]Physics Institute, Federal University of Rio de Janeiro (UFRJ) — [2]Multimedia and Telecommunications Laboratory (SMT), The Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering (COPPE), Federal University of Rio de Janeiro (UFRJ) — [3]Institute for Astroparticle Physics (IAP), Karlsruhe Institute of Technology (KIT) — [4]Astrophysical Institute, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium

Adaptive filtering belongs to the realm of learning algorithms, so widely used in our daily life when we hear about machine learning, artificial intelligence, pattern recognition, etc. It is formally defined as a self-designing device with time-varying parameters that are adjusted recursively in accordance with the input data.

The trigger mechanism is known to be a central task in radio detection experiments as it selects among all the voltages traces events that reach the antennas, a cosmic ray induced signal.

In this work, it is presented the efficiency of a trigger mechanism developed using the adaptive predictor filter technique, since its capability is well known in the usage for time series prediction. It is also independent from an external detector, considering only the online temporal series that arrives in the antennas in a simulated data set and noise.

AKPIK 1.6 Tue 17:15 AKPIKa

Classification of respiratory-related RNA virus sequences using Machine Learning — Louis Oberer, •Angel Diaz Carral, and Maria Fyta — Institute for Computational Physics, Universität Stuttgart, Allmandring 3, 70569 Stuttgart, Germany

A very simple and efficient approach to analyze and identify respiratory related virus sequences based on Machine Learning is proposed. The method is based on RNA sequence comparison and the open reading frame (ORF). Data from the respiratory related corona viruses are collected and features are extracted based on reoccurring nucleobase tuples in the RNA. These are further used for classification purposes. Well separated clusters for the respiratory related corona viruses were found in the feature space. The relevant features are the natural nucleobase triplets used in protein biosynthesis. Accordingly, our methodology is simply based on counting nucleobase triplets, normalizing the count to the length of the sequence and applying PCA techniques. Our very simple and very efficient approach was also validated by including more RNA sequences from the herpes virus family. We discuss the relevance of this scheme in identifying differences in similar viruses and its impact in bioanalysis.

AKPIK 1.7 Tue 17:30 AKPIKa

FlashCam 2.0 Prototype: New DAQ system with Xilinx Zynq-Devices — •Mario Schütt — Max-Planck-Institut für Kernphysik, Heidelberg, Deutschland

FlashCam, a FlashADC system, has been developed and built at Max-Planck-Institut für Kernphysik in Heidelberg (MPIK). FlashCam is

used in a variety of experimental setups based on different detectors like photo multipliers (PMTs) and germanium ionization detectors. For the germanium detector readout in the LEGEND 1000 experiment, the MPIK wants to develop a new Flash ADC system which is called FlashCam 2.0. The system needs a flexible design because it has to handle different pulses on different times scales like PMT pulses (ns time range) and Ge-detector pulses (mus time range). The latter also requires high precision, i.e. a 16bit resolution. Modern experiments like LEGEND are often based on single or multiple detector arrays. Thus, effective DAQ systems have to be scalable. Ease of usage and cost per channel are further crucial factors.

The talk starts with a recap of the FlashCam characteristics. The second part is a summary of the FlashCam 2.0 Prototype setup and its technical innovations. In the conclusion first application results are shown.

AKPIK 1.8 Tue 17:45 AKPIKa

Interessante digitale Wissenschaftskommunikationsformate (Outreach) — •Marcus Mikorski für die Netzwerk Teilchenwelt-Kollaboration — Institut für Kernphsyik, Frankfurt am Main, Deutschland

Mit Lego das ALICE Experiment virtuell konstruieren, eine Echt oder Fake Wissenschaftsshow als virtuelles Meeting, eine Masterclass digital durchführen... . Solche Formate hätte es wohl ohne die Pandemiesituation so nicht gegeben.

Outreach Methoden sind bisher zum Großteil auf Events, Podien, Zuschauende, die mitmachen oder zumindest mitklatschen und ähnliches angewiesen gewesen. Die Pandemie zwingt zum Umdenken.

Berichte aus der Praxis zu einzelnen Formaten sollen in diesem Vortrag als Anreiz dienen, die eigene Kommunikationsstrategie in der Pandemie, aber eben auch darüber hinaus anzureichern. Die Beispiele stammen aus dem ALICE Forschungsschwerpunkt und der Tätigkeit des Vereins BesserWissen e.V. .

AKPIK 1.9 Tue 18:00 AKPIKa

Minianalyse zum Test des 97.1% Klima-Konsens-Claim — •Philipp Lengsfeld, Adedamola Adedokun, Andreas Glassl und Margarita Grabert — re:look climate gGmbH Berlin

Im Geist der Methodik der Technikfolgenabschätzung haben wir den sogenannten 97.1% Klimaforschungskonsens einer Prüfung unterzogen. Wir postulieren, dass die von Cook et al. (2013) [1] durchgeführte Abstraktanalyse von über 11.000 wissenschaftlichen Publikationen als crowd based science analysis auf Grund falscher Klassifizierung zu nicht belastbaren und irreführenden Ergebnissen geführt hat. Wir schlagen eine neue Klassifzierung der untersuchten Arbeiten vor: Nicht Einteilung basierend auf der Positionierung bezüglich der AGW (anthropogenic global warming)-Hypothese durch die Autoren im Abstrakt, sondern Einteilung der zu Grunde liegenden Daten und Untersuchungen: Für AGW relevant oder nicht, wenn relevant: Wird AGW-Hypothese gestützt, geschwächt oder sind die Ergebnisse uneindeutig.

Diese Hypothese unterziehen wir einem Test ('Minianalyse') durch Analyse zweier Publikationsmonate (2019, 2009) unter Nutzung der von Cook et al. genutzen search strings (EBSCO Datenbank) (ca. 2000 Arbeiten 2019, 800 Arbeiten 2009). Dabei wird klar belegt, dass die Missqualifikationen in beiden Jahrzehnten erheblich sind. Statt über 90% Unterstützung des AGW ist der Anteil der AGW-stützenden relevaten Untersuchungen deutlich unter 10%.

[1] Cook et al. Quantifying the consensus on anthropogenic global warming in the scientific literature, 2013 Environ. Res. Lett. 8 024024