ANEXA 1.A

Call:FAIR-RO 2024 **Project acronym: SISTINA**

FAIR Research Programme / Experiment: PANDA

Annual Summary Document[1]

Year: 2024

Months: 6

Project Title: Strong interaction studies in antiproton annihilation

Project Work Plan (according to the contract)

Stage: I. Design and production of hardware services and software tools needed for the commissioning of the 86 straw module

Activities:

I. 1.HV/LV/Readout partition boards for the 86-straw module;

I. 2. Gas system for the 86-straw module;

I.3 PASTTREC configuration via EPICS;

I.4 PandaROOT, Magboltz and Garfield acquaintance.

Allocated budget: 436,700.00

Realized budget: 436,700.00

[1] Please fill in all the required items and do not alter the template

1. **Cover Page** (max 1 page)

- Group list (physicists, staff, postdocs, students):

Name	**Position**
Petre-Constantin BOBOC	Physicist (Research Assistant) – IFIN-HH, PhD *Student*
Alexandru-Mario BRAGADIREANU	Physicist (CS III) – IFIN-HH
Stefan-Alexandru GHINESCU	Physicist (CS) – IFIN-HH
Ovidiu-Emanuel HUTANU	Engineer - IFIN-HH
Alina MOTORGA	Project accountant - IFIN-HH
Ionel NEAGU	Engineer - IFIN-HH

- Specific scientific focus of group (state physics of subfield of focus and group's role);

Physics subfields: QCD bound states, Hypernuclear Physics.

Taking into account the expertise of our group (ATLAS, EXCHARM, FOCUS, DEAR and SIDDHARTA experiments) we expressed our interest in the measurements dedicated to charmonium and exotic states and in the Hypernuclear Physics with emphasis on Ξ^- atoms were our experience in detecting X-rays coming from transitions in Kaonic exotic atoms would be beneficial for PANDA Collaboration.

- Summary of accomplishments during the reporting period (09.07.2024- 29.11.2024)

Since PANDA experiment is now in Construction phase our short-term objectives, for 2024, were focused on research and development activities for PANDA STT sub-detector and its integration in the PANDA control system.

Accomplishments (to be confirmed at the end of 2024):

-. Prototype for HV/LV/Readout partition boards for the 86-straw module;

- Gas system for the 86-straw module – designed, components acquired, planned to be ready at the end if December;

-PASTTREC configuration via EPICS - ready;

- PandaROOT, Magboltz and Garfield acquaintance - ongoing

2. Scientific accomplishments (max 3 pages)

PASTTREC configuration via EPICS

At the core of our setup is the use of EPICS Channel Access, facilitated by the python SoftIOC module. The libtrbnet library ensures efficient communication with the TRB3 and PASTTREC ASICs.

The PVs are categorized into those that can be set (writeable) and those that provide read-only status information. A Redis database is employed to store the values of all PVs, providing a fast and reliable way to manage real-time state information. Every time a writable PV is updated, the Redis database is synchronized to reflect the change, ensuring consistency across the system.

An EPICS Archiver Appliance is deployed in a Docker container. It has its own Redis database for settings management and it is used to capture historical data about PV changes. In addition to the archival appliance, a specialized PV Logger script is used to push selected PV values into an InfluxDB database, this script focusing on logging only the most critical PVs. The data stored in InfluxDB is visualized using Grafana. Grafana provides an intuitive interface for real-time monitoring of the system's performance and for reviewing historical data trends.

The overall workflow (workflow.PNG) begins with commands issued through EPICS Channel Access, which are processed by pythonSoftIOC and relayed to the TRB3 board and PASTTREC ASICs via the libtrbnet library. Any changes to PVs are recorded in the Redis database in real time. Simultaneously, the EPICS Archiver captures a complete record of user defined PVs, while the PV Logger selectively transfers critical data to InfluxDB. Grafana then retrieves this data from InfluxDB to provide a visual representation of system metrics.

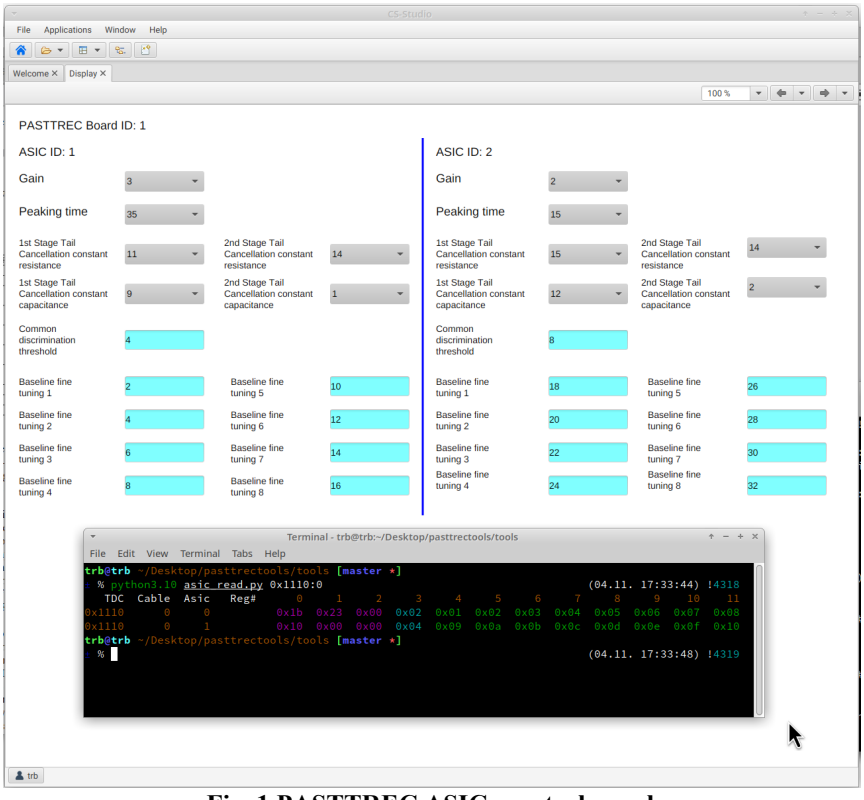

Fig. 1 PASTTREC ASICs control panel

An interface has been created to control the PASTTREC ASICs (fig. 1), making it easy to manage their settings. Each panel in the interface is designed to control two ASICs, which corresponds to one PASTTREC board. This setup allows users to adjust and monitor the settings of a complete board from a single panel, ensuring ease of use and efficient operation.

HV/LV/Readout partition boards for the 86-straw module

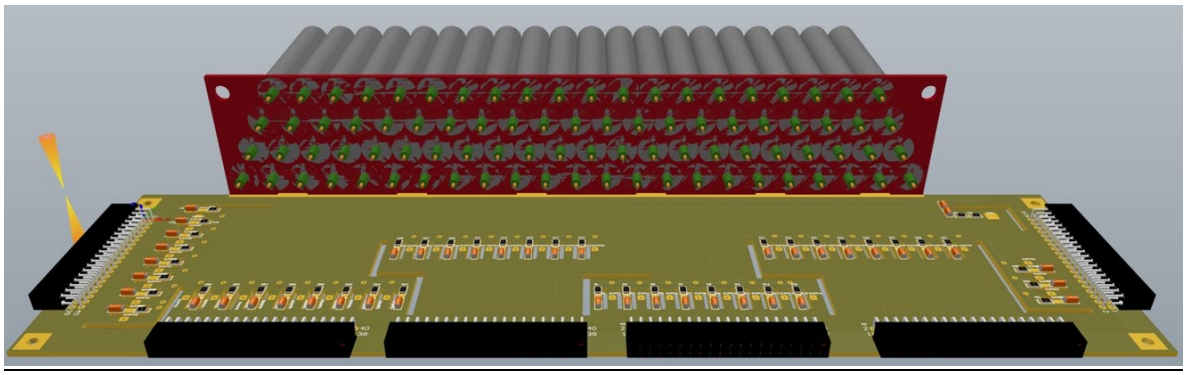

Fig. 2 HV and FEE coupling PCB

The design of HV and FEE coupling PCB was completed. The PCBs were produced in our lab. Corrective design will follow after we get some experience with the detector.

PandaRoot, Magboltz and Garfield simulations

In the final months of 2024, we began familiarizing ourselves with PandaRoot, the event generation, particle transport, detector digitization, reconstruction, and analysis framework of the PANDA experiment. During preliminary tests, we cloned the PandaRoot repository, installed the required dependencies, and completed several tutorials. The next step involves installing the framework on a dedicated server to support the long-term reconstruction and analysis of data from the STT prototype that will be constructed in the IFIN-HH laboratory. The server will also be used for simulations of the prototype resp.

The simulation of the STT is already integrated into the PandaRoot framework. However, to simulate our prototype using the Virtual Monte Carlo (VMC) framework within PandaRoot, we plan to adapt specific classes responsible for constructing the prototype's geometry.

- Describe the progress in achieving the project goals

  -.Prototype for HV/LV/Readout partition boards for the 86-straw module – designed and produced;
  - Gas system for the 86-straw module – designed, components acquired, planned to be ready at the end of December 2024;
  -PASTTREC configuration via EPICS – ready to be tested with the 86 straw module;
  - PandaROOT, Magboltz and Garfield acquaintance - ongoing

3. Group members (table)

No.	Name	Role	FTE[2]	PhD/Master students
1	Petre-Constantin BOBOC	Software development	0.12	PhD student
2	Alexandru-Mario BRAGADIREANU	Controls Software development, Hardware integration	0.2	
3	Stefan-Alexandru GHINESCU	Software development	0.13	
4	Ovidiu-Emanuel HUTANU	Electronics hardware design, assembly and testing	0.16	
5	Alina MOTORGA	Accounting	0.16	
6	Ionel NEAGU	Hardware integration	0.12	

4. Deliverables

Update on TRB3 (PASTTREC) control, PANDA Collaboration Meeting 4-6 November 2024 GSI (https://indico.gsi.de/event/19307/contributions/83679/attachments/49233/71796/panda_col_meeting_2024.pdf)

5. Further group activities (max 1 page)

In 2023 our team joined DRD1 Collaboration – aimed for the development and application of gaseous detectors. We participated at the elaboration of the proposal for "Straw chamber technologies for hadron physics applications" work package. Currently the proposal is submitted for evaluation.

6. Financial report (budged usage) for the reporting period (Annex)

		lei
Type of expenditures		**2024**
1	**PERSONNEL EXPENDITURES, from which:**	**232,247.00**
	1.1. wages and similar income, according to the law	227,136.00
	1.2. contributions related to salaries and assimilated incomes	5,111.00
2	**LOGISTICS EXPENDITURES, from which:**	**82,855.36**
	2.1. capital expenditures	71,909.16
	2.2. stocks expenditures	10,946.20
	2.3. expenditure on services performed by third parties (including the contribution to FAIR)	0.00
3	**TRAVEL EXPENDITURES**	**0.00**
4	**INDIRECT EXPENDITURES – (OVERHEADS) ***	**121,597.64**
TOTAL EXPENDITURES (1+2+3+4)		**436,700.00**

[2] Total number of hours (for a certain period) = 170 average monthly hours x number of months (e.g., for a full year: 170 hours/month x 12 months = 2040 hours)

Indirect Expenditures = General IFIN-HH Overheads (35% from 1+ 2.2 +3) + Particle Physics Department Overheads (15,00043% from 1 + 2.2 +3)

7. Research plan and goals for the next year (max 1 page)

Year	2024		2025				2026			
Quarter	3	4	1	2	3	4	1	2	3	4
HV/LV/Readout partition boards for the 86 straw module										
Study mechanical and electrical coupling of tubes to board										
Prototype PCB design and production (v2 might be needed)										
Prototype PCB test (v2 might be needed)										
PANDA STT HV/LV/Readout partition boards										
Optimize the geometrical configuration of boards										
Prototype PCB design and production										
Prototype PCB test										
Gas system for the 86-straw module										
Design, construction and commissioning										
Commissioning of 86 straw module with cosmic and X rays										
Readout of tubes; parameter tuning (gas mix, pressure, HV, ASIC)										
PASTTREC configuration via EPICS										
Process variables definition and generation; IOC code										
Grafana monitoring and OPI build										
Straw Monte Carlo simulations and data analysis										
PandaROOT, Magboltz and Garfield acquaintance										
Digitization and pattern recognition algorithms development										
Simulations and experimental data analysis										

Date: 29.11.2024