SIAP Report

AIDAinnova 3rd Annual meeting

Catania, Italy

21 March 2024

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Scientific and Industrial Advisory Panel

What are we?

The **Scientific and Industrial Advisory Panel** is an external advisory body, whose members are proposed by the Management Team and nominated by the Governing Board, based on their expertise in the activity areas of AIDAinnova. It will include at least one industrial representative. The SIAP has the mandate **to advise the GB on technical and strategic matters related to the scientific programme of the project and the relations with European industry**. The SIAP will provide an internal assessment to the Project Management as regards the status of the project and industrial collaborations on occasion of the Annual meetings.

Scientific and Industrial Advisory Panel

Who are we?

Daniel Fournier, IJCLab

Ingrid Jonak-Auer, ams OSRAM

Matthias Kasemann, DESY

Pier Simone Marrocchesi, Univ. Siena

Petra Merkel, FNAL

Jim Strait, LBNL, Chair

Intro

AIDAinnova has two complementary goals.
From the Abstract of the proposal:

> AIDAinnova **provides state-of-the-art upgrades of research infrastructure** such as test beam and irradiation facilities, and it **covers all key technologies for future detectors**.
>
> AIDAinnova advances the **European detector development infrastructures** through fostering an **intensified co-innovation with industry**. … **Knowledge transfer** will be catalysed through co-innovative work in common detector projects, and it will **strengthen the competence and competitiveness of the industrial partners in other markets.**

Much of emphasis in this meeting has (correctly) been on the first goal of advancing detector technologies in support of science, especially particle physics.

Attention to the second goal of knowledge transfer and strengthening industrial partners has also appeared in some places but was not often emphasized.

WP1: PROJECT MANAGEMENT AND COORDINATION

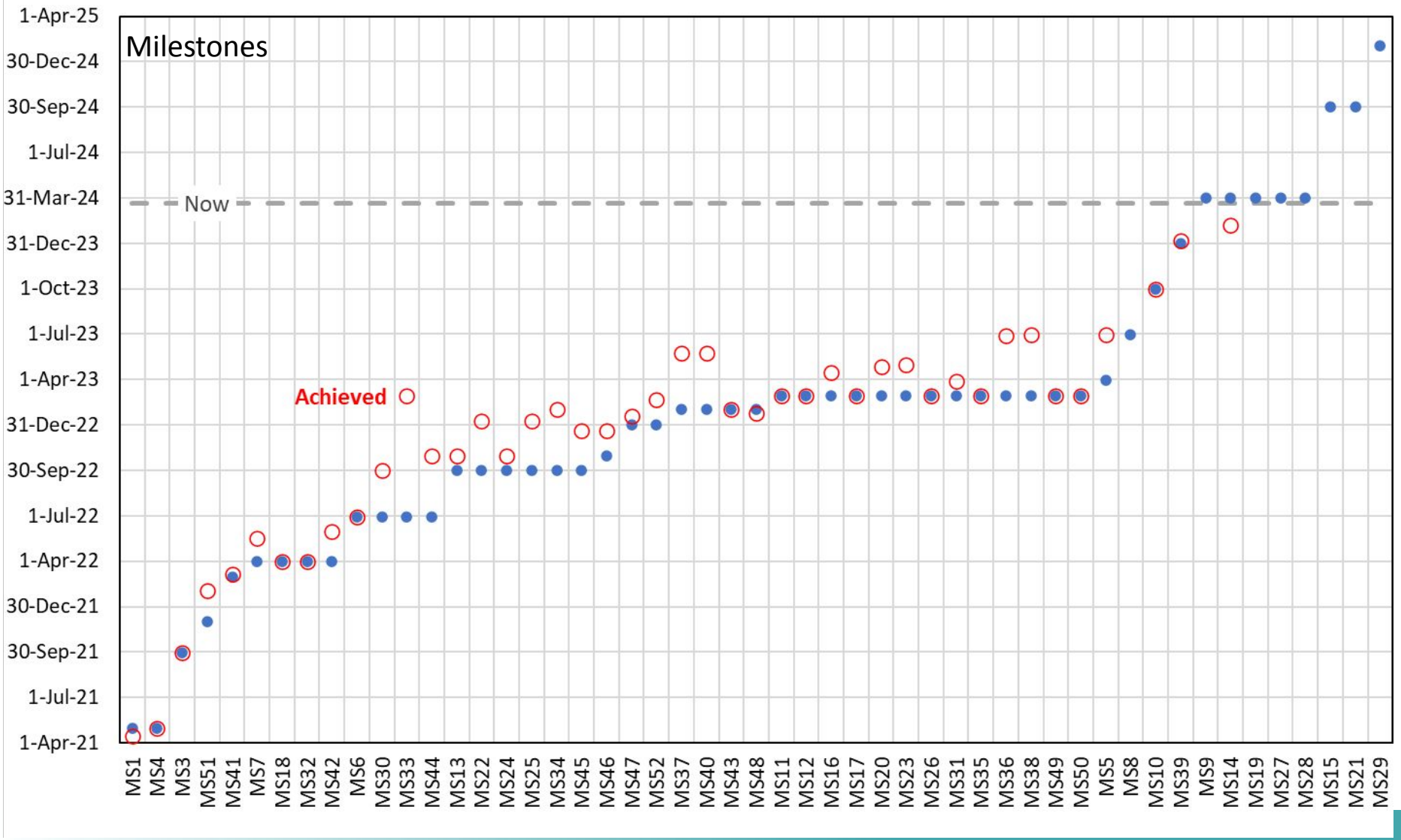
The job of the Project Management Team per the proposal:

> The overall scientific and administrative management and steering of the project will be implemented in this WP by the Project Management Team and the Steering Committee. It includes the preparation of technical and financial reports and the communication with the EC.

Among the most important jobs of the Management Team is to ensure that the (contractually required) Deliverables are successfully delivered by the end of the AIDAinnova Project.

Milestones track the progress toward the deliverables.

WP1: PROJECT MANAGEMENT AND COORDINATION



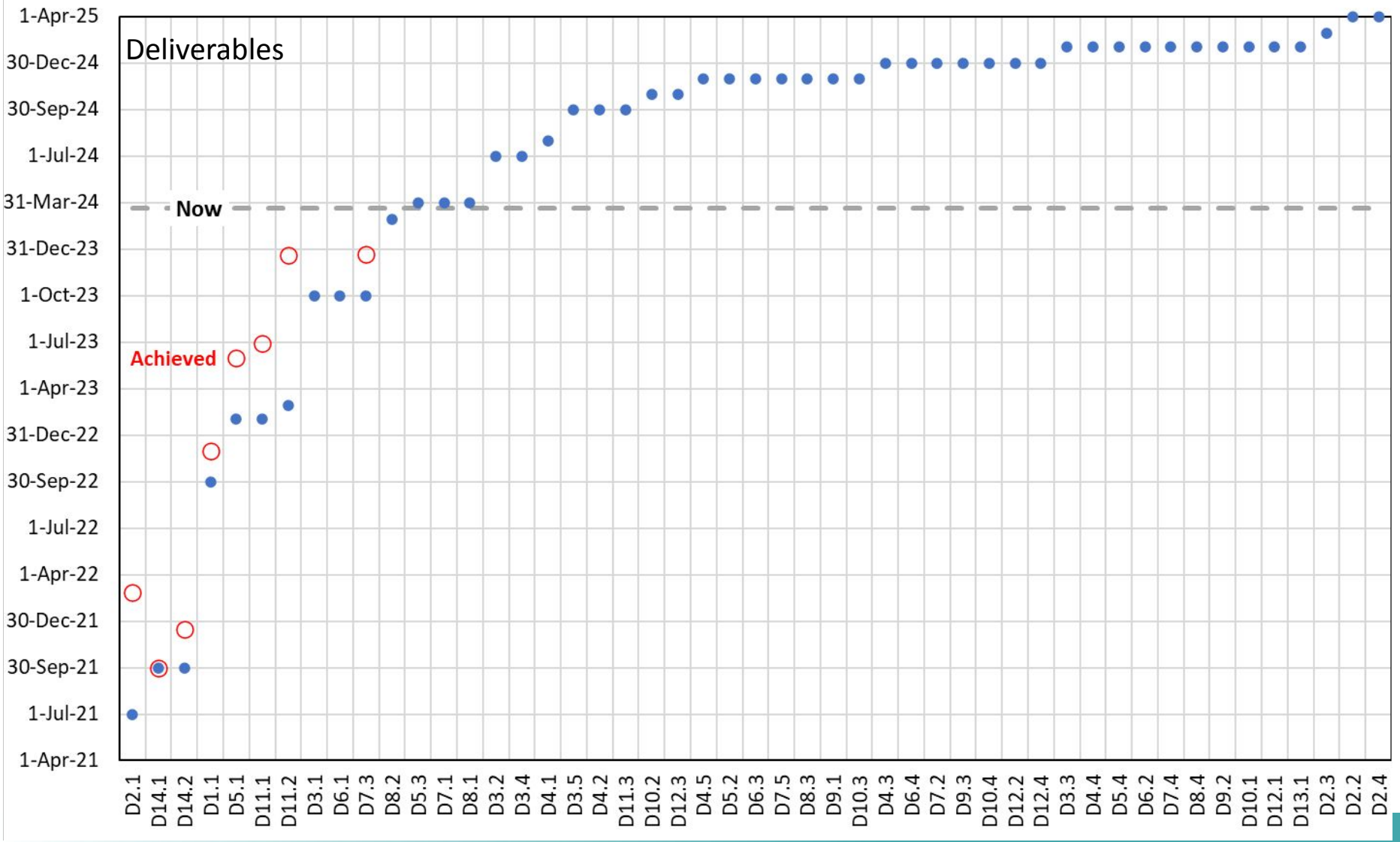
WP1: PROJECT MANAGEMENT AND COORDINATION

Generally achieving the planned milestones with reasonable or no delay.

51 Milestones, of which

- 43 of 44 planned milestones (98%)
- 17 Achieved on-time (39%)
- Average delay relative to planned dates is 2.5 months
- 1 Past due by almost 9 months from its originally planned date
- 4 planned by the end of this month
  - At least one is essentially done.
- 3 planned for year 4

WP1: PROJECT MANAGEMENT AND COORDINATION



WP1: PROJECT MANAGEMENT AND COORDINATION

Generally the deliverables are being achieved, but 1 or 2 may be at risk.

49 Deliverables

- 8 of 11 planned deliverables achieved (73%)
  - 1 Achieved on-time
  - Average delay relative to planned dates is 4.2 months
  - 3 are past due with potential delays of 9 months (or more)
    - A deliverable report has been submitted for one and is awaiting approval.
    - A report justifying the delay has been posted for one of them but the forecast date in it is already passed
    - One the agreement to delay it is noted in a slide this week
- 3 are planned to be completed by the end of this month.
  - One appears to be close. One delayed by 6 months.
- 35 are planned for year 4 of which 29 are in the last 6 months

Focus will be required to ensure that all deliverables, which are contractually required, are achieved before the end of the program 1 year from now.

WP2: COMMUNICATION, OUTREACH AND KNOWLEDGE TRANSFER

WP2: Communication, Outreach and Knowledge Transfer

This WP will implement and coordinate the **communication, dissemination and outreach**, and **support the relations with industry and the knowledge transfer activities** of the project. It will provide website, newsletter and communication support as well as organise “Academia meets Industry events” and special measures to support young researchers. A KT network between participants and the connection with the KT activities of the other innovation pilots will be established, and support in management of intellectual property be provided.

WP2: COMMUNICATION, OUTREACH AND KNOWLEDGE TRANSFER

Brainstorming session during this week. Good ideas were proposed and they should be pursued:

- **Detector related seminars at CERN: try to organize open spots, especially for junior colleagues**
- **Survey about interest for training (patents, IP, outreach, dissemination)**
- **Reach out to DRD outreach contacts to see if they want to organize training, or pursue other ideas together**
- **Tech transfer: advice for future AIDA-like efforts: make sure to allocate funds for actual tech transfer to other fields or industry**

Greater interaction between WP2 and the other WPs would substantially strengthen the work of WP2, especially regarding interactions with industry and knowledge transfer and regarding dissemination of scientific and technical results through journal articles as well as less formal means.

This is not just another equivalent work package, but it affects everyone. The other WPs should make better use of WP2's resources.

WP3: TEST BEAM AND DAQ INFRASTRUCTURE

3.1 Coordination and Communication
3.2 Upgrading the EUDET-style telescopes
3.3 Sub-ns timing capabilities for the EUDET-style telescopes
3.4 Development of DAQ software for next generation beam tests
3.5 Development of common DAQ hardware

Milestones and deliverables (m25-m36)

MS8 (M27): Telescopes upgraded with ALPIDE sensor
- delayed to M33 - still too optmisstic
- delays because “doing the right thing”. (-> scope extension)
- New estimate: this summer

MS9 (M36): Timepix-4 timing layer in deployed telescopes
- delayed, to be approved

MS10 (M30): Monitoring software developed - accomplished in time

WP3: TEST BEAM AND DAQ INFRASTRUCTURE

Deliverables:

D3.1 (M30) Common cold box delivered - 6m delay approved

- Pressure to be used in testbeam by June 2024

Outlook

D3.2 (M39): New TLU produced - delay of 6m expected - to be confirmed
D3.4 (M39): New software developments available for use
D3.3 (M46): Telescopes upgraded with new layers
D3.5 (M46): Common readout boards delivered

Publications on file: only 2
This leaves room for improvement, to support junior colleagues

The project is in the endgame.
Delays need to be considered carefully.

Overall good progress and deliverables on track.
There is a risk of missing or descoping deliverables.

WP4: UPGRADE OF IRRADIATION AND CHARACTERISATION FACILITIES

WP4 has five deliverables, all planned for the 4th year of AIDAinnova:

- D4.1 (31-Jul-24) Integrate the data acquisition and control system at RBI- AF
- D4.2 (30-Sep-24) Evaluate Non-Ionizing Energy Loss (NIEL) of irradiation facilities with dedicated dosimeter structures
- D4.3 (31-Dec-24) Deploy full prototype for irradiation facilities data man- agement including sample tagging and spectrometry features
- D4.4 (31-Jan-25) Offer support towards the implementation of TPA-TCT systems and contribute to the evaluation of newly developed sensors technologies
- D4.5 (30-Nov-24) Develop a conductive noise test bench for irradiation facilities

The teams developing these tools have all the expertise needed for these tasks.

Four milestones have been achieved so far,
on-time or with modest delays, so WP4 is currently on track.

Joint development between the facilities is of great value in streamlining support and making it easier for customers to use.

It should be continued in next (or outside) "AIDA" if possible.

WP5: DEPLETED MONOLITHIC ACTIVE PIXEL SENSORS

Milestones and Deliverables:

MS18 High granularity prototype fabrication1	M12	Achieved
MS20 Radiation hard prototype fabrication	M23	Achieved
MS19 High granularity prototype fabrication2	M36	On track
D5.1: Report on performance of high granularity DMAPS Version1	M22	Achieved
D5.3: Report on performance of radiation-hard DMPAS	M36	On track

Comments:

- In total 7 project teams worked very successfully on 4 different processes at 2 CMOS Foundries;
- Development, processing and characterization has been done on high granularity DMAPS as well as improved radiation hard DMAPS;
- Foundry submissions were done at TowerJazz/TPSCo and LFoundry on Process Nodes TJ180nm, TJ65nm and LF150nm and LF110nm employing a variety of different Si starting materials.
- Very good results have been achieved with respect to position resolution, radiation hardness and timing: Excellent position resolution of down to 1,3µm for 15µm pixels, radiation hardness up to 2E15$n_{eq}cm^{-2}$ and timing resolution of ~60ps could be proven for the individual DMAP chips. Especially worth mentioning is the fact that even high granularity DMAP sensors with small collection electrodes show excellent radiation hardness up to 2E15$n_{eq}cm^{-2}$.
- As AIDAinnova offers a platform for participating project teams to share information on various process options' pros and cons, it would be desirable to work out a comparison table of the used process including achieved parameters in different projects. The above mentioned fact, that high granularity DMAPs show excellent radiation hardness could be a first step towards reducing the number of process/material options for future use. This would lead to more cost efficiency and will enable easier access CMOS foundries.

WP6: HYBRID PIXEL SENSORS FOR 4D TRACKING & INTERCONNECTION TECHNOLOGIES

Milestones and Deliverables:

MS22 Wafer layout	M18	Achieved
MS24 Completion of planar sensor production for ACF	M18	Achieved
MS25 Availability of parts and definition of the technologies for wafer to wafer	M18	Achieved
MS23 Preliminary characterisation of 3D and LGAD prototypes. Test set-up	M23	Achieved
D6.1 Completion of common productions	M30	Delayed to 05/24

Comments:

- Sensor process developments @ FBK cover small pitch Trench-isolated LGADs and 3D-sensors; Trench-isolated LGADs samples were delivered in October 2023 with good yield; 3D-sensor process is not yet finalized, first samples are expected in May 2023. Timeline of these samples is critical for D6.1.
- Sensor process developments @ CNM cover inverse LGADs (iLGAD) and and 3D-sensors; iLGADs on Epi substrate were not functional due to non-optimized doping of the multiplication layer, the Si-Si alternative (substitution of n-Epi substrate by wafer-to-wafer bonded n-FZ wafer) looks promising; also here the timeline is critical, as Test beam is planned for June 2024. Timepix sensor production and characterization will take at least 6 months from now. Planned process transfer from current 4” to 6” wafers @ CNM is currently not taken into account, as CNM has no experience on 6” wafers and confidence to succeed is low.
- TCAD Simulation Model has been improved for LGADs and simulated data fit measurements quite well. The Model for 3D sensor simulations still needs improvements, especially regarding distinction between surface and bulk radiation defects. More measurement data for good statistics are planned as well. Timing simulations have not been done yet.
- Development of interconnection technologies employing Die-to-Die attachment by Anisotropic Conductive Films R&D purpose as well as Wafer-to-Wafer bonding is running according plan. Wafer-to-Wafer Timepix3 on DMAPs is expected in Q3/2024.

WP7: GASEOUS DETECTORS

Deliverables accomplished and reported:

D7.3 Production with industry of small-size prototypes of μ-RWELLs (M33)

Deliverables: planned within the next 12 months

D7.1 (M36) Characterisation of small size MRPC prototypes for fast timing and high rates
D7.2 (M45) Validation of the eco-friendly gas mixtures for RPCs at GIF++.
D7.4 (M46) A small-scale TPC prototype (#10 l) with hybrid charge/optical readout and a hydrogen rich gas mixture with high scintillation yield
D7.5 (M44) Small-size prototype of a MPGD single photon detector for compact RICHs

Milestone 28: delayed by 3 months to M39

Identification of a gas mixture for neutrino physics in an optical TPC

Good progress in all areas, no critical issue observed.

Good example of co-innovation with industry and knowledge transfer.

All four subtasks involve industrial beneficiaries or partners who are working closely with the research community.

WP8: CALORIMETERS AND PARTICLE IDENTIFICATION DETECTORS

DRD Collaborations are now in place under the umbrella of CERN, including DRD4 for Particle ID and DRD6 for calorimetry. **This can only be positive for the advancement of related AIDA activities.**

-----8.3.1-------- Crystal and Innovative materials

E.Auffray Crystal and Innovative materials; picosecond timing developments

- PbWO-UF (Vilnius), Garnet (GAGG) and nano-composite (Glass2power) studied
- Materials exposed to test beams
- **Very active community - many publications (~10) already**

C.Cecchi Si-PM for the Belle-2 EM calorimeter Upgrade in 2030

- An option is to keep CsI(Tl) crystals, readout with PIN diodes, adding SiPM readout for timing (main bkg is <100 MeV). Another option is to replace CsI by Lyso or LaBr3.
- Today with CsI(Tl) timing resol is 7ns; 1ns would be OK; seems doable with SiPM and present Crystals. LYso and LaBr3 could do better. Still some time left before deciding

-----8.3.2---large area Scintillators

A.Montanari reporting for INFN , Mainz+MPI and others.

- Milestone M-33 already met in 2023
- Efficiency to neutrons studied with an AmBe source which emits neutrons and photons in coincidence.
- Large size devices split in strips, another one split in pads, studied in terms of energy resolution and timing resolution. Possible applications in Ship/Shadows and Hike in CERN/EHN3

WP8: CALORIMETERS AND PARTICLE IDENTIFICATION DETECTORS

-----8.4.1---SiPM developments for PID

Rob Pestotnik: reported on radiation resistance of SiPM irradiated (at JSI) by neutrons, in view of application to Rich detectors.

- MS-33 reached.
- Deliverable D-8.3 by end 2024
- Single photon separated at LN2 temperature, but 10^13 n/cm2 is too high (dark counts).
- Timing not too much affected. LHCb prototypes reach 25 ps
- New layout of SiPM, more radiation resistant (trenches), submitted by FBK

Jakub Kandra: similar studies with Hamamatsu components, up to 10^11 only, for Belle2

Ivo Polak: reported on developments of Si-PM arrays by Hamamatsu for the Atlas Tile upgrade

---8.4.2---Highly granular Dual Readout

Report by Romualdo Santoro.

- Deliverable=Large prototype (EM+Had)
- Parts still being delivered; Si PM not delivered so far
- Central part readout by Si-PM coupled to scintillating fibers. In total 10^4 channels
- **The device Is going to be late wrt Milestones.**

---8.2.1---Integration aspects of highly granular Calorimeters

Katja Kruger:

Reported on data Concentration to readout EM and hadronic together, with ILD, and LUXE as targets.

- Si-W EM and Hadronic (AHCal) prototypes were already tested at DESY and CERN
- EM suffers from gluing problems between sensors and PCBs (report by R.Poeschl)
- AHCal readout being updated to match EM readout
- **D8.1 is due now (M36). It is delayed by 6 months.**

WP8: CALORIMETERS AND PARTICLE IDENTIFICATION DETECTORS

R.Poeschl : elaborated about the Si-W ASU

- **Several planes of the EM prototype are affected by delamination between sensors and PCB.** The Epotek conductive glue used has poor mechanical properties. PCB deformation is sizeable. Related to humidity? A solution is still sought for.

Y.Benhammou :Tests of Si Wafers for LUXE

- 90 sensors with Calice specs (90x90 mm). Probe station from DESY with updated electronics IV and CV measurements done, and are OK on all wafers.

---8.2.2--- High granularity Noble Liquid Calorimeters developments

N.Morange reported on the Allegro EM Calorimeter developments.

- Specific to AIDA, the Milestone related to production and measurement of dedicated PCBs was already met in 2023.
- Further prototypes were produced and are used to better assess granularity, noise and Cross-talk, in comparison with detailed simulations.

WP9: CRYOGENIC NEUTRINO DETECTORS

Excellent progress on cold liquid neutrino detectors largely in support of DUNE, both current and potential future detectors.

- All 5 milestones have been achieved
- 3 deliverables are due between November 2024 and January 2025
  - Work appears on track to achieve these deliverables
- Excellent progress on light collection.
  - Recent breakthrough doubles the PDE of the X-ARAPUCA design
  - Good progress in developing large-area wavelength shifter planes
  - Possible application in LEGEND-1000 neutrinoless double beta decay experiment
- Excellent on charge readout plane, cold electronics, digitization hardware for vertical drift TPC.
- Systematic R&D and prototyping of started on combined pixels and SiPM (VUV sensitive) readout planes. Long term aim is to make future DUNE detectors able to study supernova burst neutrinos, solar neutrinos, and even the diffuse supernova background!

WP10: ADVANCED MECHANICS FOR TRACKING AND VERTEX DETECTORS

LPNHE Paris A 3D printed Ceramic solution is followed for joints between micropipes after that a PEEK solution failed.

INFN Pisa light weight structures are investigated

- a 1.3 m long Carbon fiber support, engineered by water jet, intended for CEPC
- a structure (with 50 cm long supports) for the Belle-2 upgrade (2028) consisting of 5 layers of CMOS pixels

CSIC Valencia and CNM Barcelona integrated support and cooling.

- A gas cooling option is evaluated for the Belle-2 upgrade, and micro channels in CMOS sensors are investigated.
- Close relationship with several companies.
- A full demonstrator with micro-channel cooling will fall beyond the end of AIDAinnova.

MPG

- A new clean room with 200 mm wafer post-processing capacity was just made available.
- They work on low temperature bonding.
- Several other developments will follow, including ion etching.
- Related to Belle-2 and other projects.

WP10: ADVANCED MECHANICS FOR TRACKING AND VERTEX DETECTORS

University of Oxford

- Activity on FSI (frequency scan interferometry) was interrupted because the person in charge left.
- Some results obtained, with a vibration table previously used for ATLAS.

CERN

- Regarding ultralight support structures with integrated cooling, they investigated thin foils with polyimide pipes (follow-up of work for Alice).
- The production of pipes and joints with 3D printing using ceramics was tested at Lithoz (mainly with Al2O3) and using metal printing.
- Cooling with supercritical fluids, a new avenue, is being assessed in collaboration with Norway/NTNU.
  - A test-setup is being assembled at CERN to evaluate the performance using CO2 above the critical point. First tests in Spring.
  - Later on Krypton, which allows to work at lower temperature, will be investigated.

WP11: MICROELECTRONICS

Microelectronics is a key technology enabler for novel detectors. Most participating groups of WP11 have reported on their activities and achievements, except DESY, INFN-BA and INFN/BO/LNF.

WP 11 has two main pillars:

(i) Explore 28 nm technology performance for HEP
(ii) Provide readout ASICs in 130 nm for other WPs

The milestones and deliverables for WP11 each concern Multi-Project Wafer (MPW) production:

1) MS11.1: Design review of 28 nm MPW
2) MS11.2: Design review of 65/130 nm run

   MS11.1 and MS11.2 have been achieved in December 2022. (*But only 1 is documented*.)

3) D11.1: MPW 28 nm: The deliverable is a multi-project wafer fabrication with the different test ASICs in CMOS 28 nm

   Updates on fabrication deliverables (D11.1 and D11.2):

   - **CPPM update on 28nm**: prototype test boards received beginning 2024. First tests are encouraging. Functional tests in Q2 2024;
   - **BG/PV update on 28nm**: Analog FE for hybrid pixels - excellent radiation hardness on single MOS devices - Radiation campaign on CSA - Design of ToT-based FE in Q3 2024;

WP11: MICROELECTRONICS

- **AGH update on 28nm:** Fast ultra-low power 10-bit SAR ADC in 28nm - Integration of 4-channel ADC ASIC in progress - Should be ready for submission in 1-2 months;
- **BONN update on 28nm:** no fabrication deliverables yet.

4) D11.2: MPW 65/130 nm: The deliverable is a multi-project wafer fabrication with ASICs in CMOS 65 and/or 130 nm that can be used to readout detectors from the other WPs and in particular WP8
   - **AGH update on 130nm**: 10 bit SAR ADC submission in 1-2 months;
   - **CNRS update on 130nm**: TSMC 130 nm submitted in April 2023, Wafers received last month, presently in packaging;
   - **INFN/TO:** no strong motivations to migrate to 130 nm; 110nm ALCOR ASIC; multi-purpose waveform sampling ASIC in 65 nm (design in final verification phase)
   - **WEEROC**: 5 new ASICs taped, all with time-of-flight capabilities

Comments: Deliverables D11.1 and D11.2 are said to be completed (6 and 9 months late) *but this is not documented yet.*

5) D11.3: Measurement reports: Each of the ASIC fabricated in the two previous deliverables will have its design and performance documented in a report

Also achieved: 1) Networking activity and sharing of expertise among participants. Several ASICs have been developed in co-design; 2) Working with one industrial partner for technology transfer and spinoff.

The group should make sure that the different efforts and ASICs result in a coherent set of results and outputs. The innovative aspects of the newly designed chips should be communicated effectively to the community with the help of WP.

WP12: SOFTWARE FOR FUTURE DETECTORS

12.2: Turnkey software

- Lots of progress in the various packages observed
- Integration of novel and existing methods
- Some packages stable or even final, others just starting
- Progress on tutorials and documentation

12.3: Simulation

- Lots of work on fast simulation, especially of calorimeter

12.4: Tracking

- Organized workshop
- Expanded from silicon tracking to wire chamber support
- Made code more efficient, faster, generic

12.5: Particle Flow

- Rescoping for dual readout calorimeters: use traditional, physics based reco methods, followed by AI/ML to improve performance
- Lots of new code development for ILC specific (APRIL) and DUNE near detector PF reconstruction

Organized Hackathon this week to tackle a few specific challenges and developments. This might be useful more than once per year to take advantage of synergies and compensate for some person power erosion in some areas.

WP13: PROSPECTIVE AND TECHNOLOGY-DRIVEN DETECTOR R&D

- The **eXFlu-innova** activities pursue the development of LGADs with a compensated gain layer.
  - Deliverable 1 (p^+ – n^+ design) was completed;
  - Production of p–n compensated sensors (M12) has been carried out (part of D2); Characterization and testing almost completed;
  - Co-implantation of Carbon ⟶ reduction by a factor of ~ 3 of the acceptor removal;
  - Difficulty in controlling the shape and the peak concentration of two different elements ⟶ Tuning of all process parameters is needed;
  - The n-doped LGAD batch is about to start. Oxygen expected to work well for donor removal.

Observations: the development of compensated LGADs for extreme fluences is strongly innovative and challenging. The WG is actively pursuing several alternatives to improve their present results. The expertise of the WG members and their effort are well adequate to address the challenges of the project.

WP13: PROSPECTIVE AND TECHNOLOGY-DRIVEN DETECTOR R&D

- The **NanoCal** project pursues the development of Nanomaterial Composite (NC) scintillators for fine-sampling calorimetry.
  - Beam tests were carried out in June 2023 at PS T9, Oct 23 (CERN), and Nov. 9 (BTF);
  - Several NC scintillators were used, including CsPbBr3. However the problem persists of a significantly reduced light-yield (of the order of 50%) w.r.t. conventional scintillators;
  - Improvement is pursued by testing different samples of NC scintillators;
  - New tests are scheduled at BTF (April 2024) and CERN(Sept 2024).

Observations: the development of innovative NC scintillators is valuable but challenging. The WG expertise and the work plan of the project are focused to improve the present achievements.

WP13: PROSPECTIVE AND TECHNOLOGY-DRIVEN DETECTOR R&D

- **The Silicon Electron Multiplier** concept aims to achieve charge multiplication with metal electrodes embedded in the Si bulk. Gain mechanism is expected to be intrinsically radiation hard.
  - CNM DRIE demonstrator production is ongoing, first samples expected in few months. Simulations are being adapted to the produced geometry;
  - MacEtch process investigated as a possible alternative approach to the DRIE process;
  - Characterization setup used for the MactEtch structure is being extended to test the DRIE demonstrator.

Observations: the development of the Silicon Electron Multiplier is promising but challenging. It is important to demonstrate the feasibility to achieve a high electric field at the pillars and to achieve charge multiplication. The expertise of the WG members and their effort seem well adequate to address the challenges of the project.

WP13: PROSPECTIVE AND TECHNOLOGY-DRIVEN DETECTOR R&D

- **The Wireless Data Transfer** project pursues the development of wireless links that would be beneficial to HEP applications.
  - The first full link demonstrator at 1 Gbps per layer was tested;
  - Power measurements of the SK202 board were carried out at different distances up to 20 cm;
  - Pursuing the integration of a Low Noise Amplifier (LNA) between the 60 GHz transceiver chip and the antenna/antenna array.

Observations: This is a technological project aiming to provide new user communities with an access to this novel technology. The timeline of the new developments should be monitored.

Summary / Conclusions

AIDAinnova is an important program that appears to be proceeding well, with only a few glitches.

Most tasks are proceeding as planned with only modest delays.

However, there are a few deliverables that are quite late and may be at risk for not being achieved with full scope. Focus will be required to ensure that all deliverables are achieved.

Overall, AIDAinnova is well on track to achieve the goal to **provide state-of-the-art upgrades of research infrastructure** and **cover all key technologies for future detectors**.

AIDAinnova includes examples of **intensified co-innovation with industry** that can foster **Knowledge transfer.**

It is less clear the extent to which AIDAinova is **strengthening the competence and competitiveness of the industrial partners in other markets.**

Keep up the good work!

The Future

AIDAinnova is approaching the end, with one year left.

- A six month, no-cost extension may be appropriate to allow a number of deliverables to be fully achieved without compromising on scope.

The AIDA series of projects has been extremely successful and valuable to the particle physics community in developing new technologies that help push the science forward. Developing a follow-on program is important.

- We look forward to the community developing a new proposal and work on that will need to start as soon as the next call is issued, expected in the coming months.

Thank You

This has been another productive, interesting and enjoyable workshop.

We appreciate the high quality of the presentations and the openness of the discussion … and the kind hospitality of our local hosts!

We hope that the SIAP has been helpful, both through these comments and the discussions during this week.

We look forward to seeing the progress at the final annual meeting.