Work in Progress

[1] https://wiki.bnl.gov/EPIC/index.php?title=TOFPID
[2] https://wiki.bnl.gov/conferences/index.php/ProjectRandDFY23
[3] https://www.overleaf.com/read/vftxyvjtjrvp

eRD112 [2]

- Sensor (382k$)
  - BNL, HPK/FBK productions
  - Lab/beam test, Irradiation
- Sensor/ASIC integration (45k$)
  - Interposer
- Mechanical structure ($35k)
  - Low-density mechanical structure

eRD109 [2]

- ASIC (148k$)
  - EICROC1, FCFD1, SCIPP
- Frontend electronics (119k$)
  - Timing chips and streaming readout
  - Barrel/Endcap TOF Hybrids

Simulation [1]

- DD4HEP geometry, digitization, reconstruction
- Spatial resolution requirement
- Timing resolution requirement
- Material budget requirement

Project Engineering and Design (PED) [3]

- Mechanical engineering
  - Barrel TOF
  - Endcap TOF
  - Cooling system
- Electric engineering – postponed/DAQ PED
  - Precision clock distribution (<5 ps)
  - Prototype readout board, cables

2022 EIC Detector Advisory Committee Meeting (10/19-21, 2022)

- Status of EIC Project: Overall, appear on-track with planned timeline https://indico.bnl.gov/event/17159/
- eRD112
  - Large effort on many fronts to understand/develop AC-LGADs
  - Successful test beam studies
  - Significant progress in readout electronics development
  - Recommend continued study of sensor production options
  - Recommend study of optimization for ePIC needs: time resolution vs spatial resolution, especially forward vs central regions
  - Continue to study impact of cooling/readout on performance
  - Appears possible to achieve project timeline goals
- eRD109
  - Important for collaboration to focus on details of full readout system (I.e. detector to electronics hut)
  - Overlapping efforts should mitigate risk and lead to synergy in R&D
  - Recommend careful attention to ASIC development cycles with vendors to keep to project timeline, possibly too optimistic. Historically development time has been significantly under-estimated.
- Global Recommendation:
  - At next review important to hear how R&D is being used in development of final design, especially critical design choices
  - Aggressive effort needed to keep to project timeline
  - Important to move from R&D activites to detector specific design
  - Important to expand manpower as soon as possible to keep on track
  - Recommend more direction of effort towards final detector development for CD2/3a

Project Engineering and Design (PED)

Resource	FTE (%)	Budget (k$)
Manufacturing Design of pre-production		
Mechanical Engineer + Technician, Purdue	20	60
UG students, Purdue	20	0 (in-kind)
Postdoc, NCKU	20	0 (in-kind)
G/UG students, NCKU	20	0 (in-kind)
Materials and Supplies (staves, etc.)	-	20
Integration aspects / Services		
Mechanical Engineer, Purdue	10	20
Total	-	100

Table 1: Purdue/NCKU budget request on engineering design for barrel TOF in FY23. All entries in thousands of dollars.

Resource	FTE (%)	Budget (k$)
Mechanics Prototype Engineering		
Mechanical Engineer	20	60
Staff Scientist	5	0 (in-kind)
Postdoc	5	0 (in-kind)
Materials and Supplies	-	5
Cooling System Engineering		
Mechanical Engineer	15	40
Staff Scientist	5	0 (in-kind)
Total	-	105

Table 2: ORNL budget request on engineering design for endcap TOF in FY23. All entries in thousands of dollars.

- The R&D proposal and the resources requested for the PED are highly connected and synergistic. The R&D work will use non-final materials to deliver a first prototype of a stave folded with limited thermal and mechanical FEAs to guide the work. The PED relies on these results and further pushes these to a prel. engineering design with final materials.
- Deliverables for the PED request are a prototype/mock-up of the larger mechanical stave support structure, which allows to test integration of the staves, as well as studying routing for cooling and other services.

- A realistic, validated, mechanical design for TOF endcap discs with partial mechanical mockups. A full, validated implementation of the resulting TOF detector geometry into the EPIC software framework and related studies will be contributed in-kind.

- A realistic, preliminary design for a low material cooling system based on circulating water at close to ambient temperature. The proposed cooling system will be fully integrated into the mechanical design.

TOF Simulation and Reconstruction

- Update TOF geometry in DD4HEP
  - Detailed Barrel and simplified Endcap TOFs (8%X_0 Silicon) by Zhenyu (in main)
  - Detailed Forward TOF done by Nicholas
- Include TOF in tracker assembly in DD4HEP
  - Detailed Barrel and simplified Endcap TOFs by Zhenyu (in main) #154
  - Problem when including the detailed Forward TOF being investigated by Nicholas #191
- Include TOF hits in EICrecon tracking
  - Done with the help of Dmitry Ramonov (in main) #173
- Create TOF PID reconstruction #201
  - Track projection and TOF plugin template with the help of Dmitry (in main) #263
    - include path length and time of flight for TOF hits on track (see next slide)
    - Add path length and time of flight for TOF hits near track projected position

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