



COLLEGE OF ENGINEERING
UNIVERSITY of HAWAI'I at MĀNOA

Proposal to join ePIC

University of Hawai'i at Mānoa

Jennifer Ott

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ePIC Collaboration Council, April 4, 2025



Honolulu

Background

The University of Hawai'i system encompasses several public university and community college campuses on the Hawaiian islands

- Flagship campus in the **Mānoa** valley: the only R-1 ranked university in the state of Hawai'i
 - Among the most diverse student populations in the US; Minority-Serving Institution
 - Passed 20,000 enrolled students for the first time in AY24/25!

Department of Physics and Astronomy: strong presence in high-energy physics at the Belle II experiment, neutrino physics including protoDUNE and KAMLand-Zen, instrumentation in gaseous detectors and detector readout

- **Instrumentation Development Lab** → **Varner Lab**

Recent collaborative hires in Physics // Electrical & Computer Engineering, with nominal emphasis on ML/AI in front-end electronics: Zepeng Li (Phys) and **Jennifer Ott (ECE)**

Group and prior experience



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- New tenure-track faculty in Electrical & Computer Engineering, cooperating graduate faculty in Physics & Astronomy
- Previously postdoctoral researcher at SCIPP / UC Santa Cruz
- Involvement in ePIC started in 2022/2023 in eRD112 and eRD109, subsequently in TOF: AC-LGAD sensor characterization, evaluation of '3rd-party ASICs' from Nalu Scientific LLC and Anadyne, Inc.
- **Commitment to ePIC according to tasks and need: ~20-30% of eligible time**

Envisioned:

- *Graduate student*
- *0.1-0.2 FTE of a postdoc shared with other projects*
- *'Vertically integrated project': involving undergraduate students at various levels over several years*

Pending EPSCoR proposal:

- *Postdoc with ca. 0.5 FTE*
- *Additional graduate student 'full-time' on ePIC/EIC*

Research interests and contributions to ePIC

Focusing on the Time-of-Flight Particle ID (TOF) system

Barrel TOF: strip AC-LGAD sensors

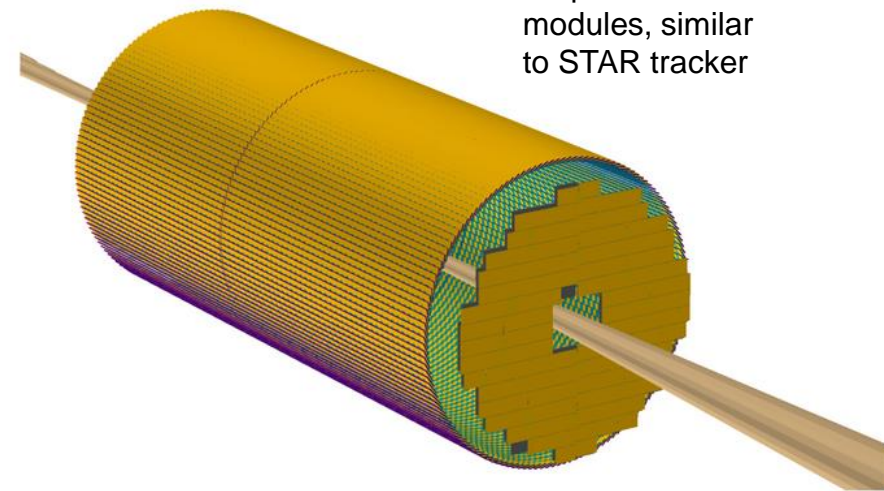
Forward TOF (and Roman Pots): pixelated AC-LGAD sensors

Goal: advance towards full-sized forward-TOF sensors = pixelated sensors in 32x32 geometry to match EICROC readout chip

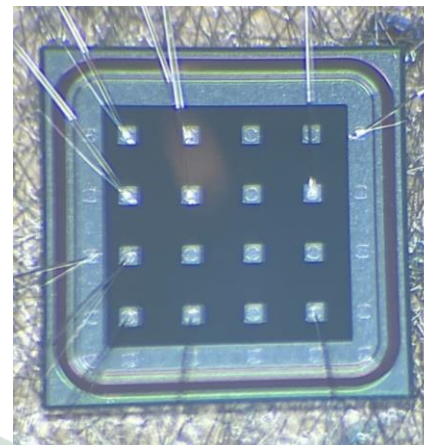
- This could include a role of sensor coordinator for fTOF, similar to Simone Mazza (UCSC) for bTOF: working together with Mathieu Benoit (ORNL)

Finalization of electrode geometry and pitch for fTOF

- Channel count; minimizing metallized area \leftrightarrow sufficient signal-to-noise ratio and rise time between pads
- Sensor thickness, n+ layer resistivity, electrode shape (crosses?)



Barrel TOF
Strip sensor modules, similar to STAR tracker



Forward TOF
Similar to CMS ETL

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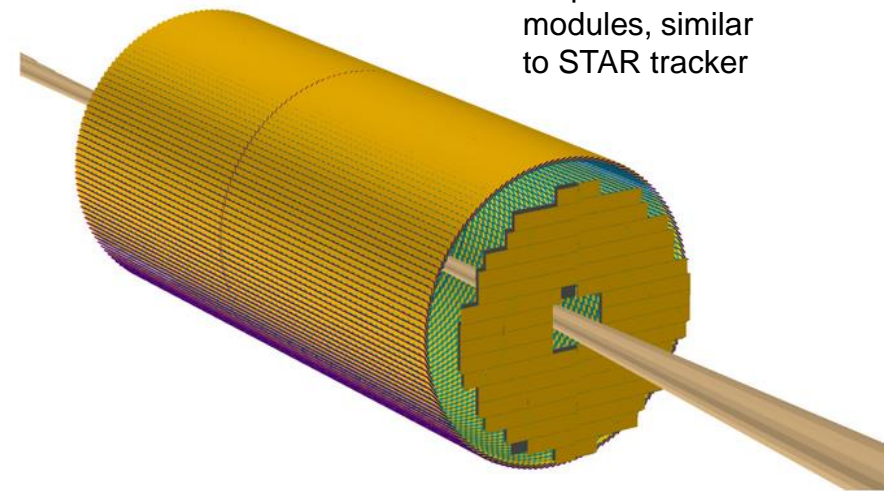
Forward TOF (and Roman Pots): pixelated AC-LGAD sensors

Completion of the Hamamatsu pixel fabrication, expected by the end of 2025:

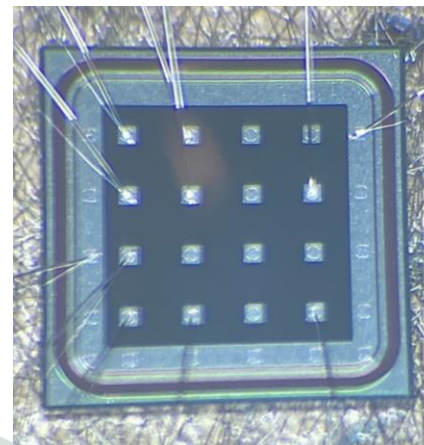
- Testing of sensors
- Hybridization, testing of sensors + EICROC1

Characterization of new sensor productions

- FBK production
- Potential sensor production with a Taiwanese vendor, if this is still being considered



Barrel TOF
Strip sensor
modules, similar
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Forward TOF
Similar to CMS
ETL

Research interests and contributions to ePIC

Contribute to the interfacing of the ASIC, primarily EICROC for fTOF (but possibly also other chips for the barrel-TOF) with the front-end and readout board prototypes

- ASIC control and readout in modules ('module board' prototypes)
- Explore background and zero suppression, as well as hit clustering and e.g. ToA correction on the front-end, potentially by using Machine Learning
- Global integration of the TOF system: extraction of timestamp/t₀, integration of TOF data with Tracking?

Involvement in development of software, firmware, or simulation/reconstruction – also depending on the interests of the postdoc(s) and graduate student(s)

Synergistic research, even though not formally in the scope of ePIC:

- *Characterization of the Nalu HP-SoCv3 chip, which has been funded through JLab/EIC-R&D: completing the deliverables of the previous fiscal year; collaborate on next generation of this chip family*
- *Generic fast-timing sensor and readout ASIC R&D, also for High-Energy Physics*