eIC Silicon R&D at LBNL

Nikki Apadula for LBNL

eIC Silicon Consortium Meeting

May 5, 2022

eRD111: Milestones

New milestone dates (to be verified, estimates are my own)
Based on start date of June 1, 2022

Milestone Description	**Date**
Report on baseline stave designs	10/2022
Report on baseline disc designs	12/2022
Report on simple disc & stave models	06/2023
Up-to-date silicon tracking CAD models	12/2022
Report on mechanics conceptual design	01/2023
FY22 R&D report	03/2023

- LBNL is planning to work on stave/disc construction & additional infrastructure (mechanics & cooling) from the eRD111 plan
  - Previous experience with STAR HFT, ALICE ITS2, ATLAS iTK (engineers)

eRD111: Time

- To meet these milestones, LBNL has requested money to cover engineer & technician time, as well as for materials

	Engineer	**Technician**	**Staff**	**Postdoc**	**Student**
Hours	480	220	800	780	200

- Time split between ~2 staff, ~2 postdocs
- New engineer starting now, good timing to work through the project

eRD111: Stave Designs

Milestone Description	Date
Report on baseline stave designs • Stiffness & vibrational requirements for staves & discs • Examine stave options (ITS like, I-beam, etc.) • Develop options based on potential reticle sizes	10/2022

- Stiffness & vibrational requirements
  - What has been studied by ITS3 already? What do we know from our own simulations ?
- Stave options
  - ITS-like (truss), I-beam (ATLAS), something else?
    - Benefits & drawbacks (material budget, stiffness, etc.). Information gathering
- Stave configurations based on likely reticle size
  - Layout options to meet the lengths (~34 & 47 cm)

eRD111: Disc Designs

Milestone Description	Date
Report on baseline stave designs	10/2022
Report on baseline disc designs • Stiffness & vibrational requirements for staves & discs • Examine disc options (stave based, plate based, etc.) • Develop options based on potential reticle sizes	12/2022

- Disc options
  - Stave based, plate based, etc.
    - Benefits & drawbacks (material budget, stiffness, etc.)
    - Cooling?
  - Some layout options have already been attempted (e.g. Ernst's presentation 2 weeks ago)
    - Further optimizations, simulations to study dead area/overlap

eRD111: Mechanical/Cooling

Milestone Description	Date
Report on baseline stave designs	10/2022
Report on baseline disc designs	12/2022
Report on simple disc & stave models • FEA analysis of stave & disc designs • Fabricate & test simple disc & stave mechanical models (mechanical properties, cooling)	06/2023
Up-to-date silicon tracking CAD models	01/2023
Report on mechanics conceptual design • Review carbon foam studies for cooling options • Integrate cooling options into stave/disc prototype designs • Develop conceptual designs other mechanical structure/support pieces • FEA analysis of shells & cones	03/2023

eRD111: Mechanical/Cooling

Milestone Description	Date
Report on mechanics conceptual design • Review carbon foam studies for cooling options • Integrate cooling options into stave/disc prototype designs • Develop conceptual designs other mechanical structure/support pieces • FEA analysis of shells & cones	03/2023

- Previous LBNL LDRD on air cooling with carbon foam
  - Structure still exists, needs some technician time for set-up
  - Planned as a summer project using ITS3 power estimates & carbon foam selection

Involvement with ITS3

- Chip testing
  - 88” cyclotron for radiation effects, other test beams in the US (FNAL, SLAC, JLAB)?
- UC Berkeley Postdoc at CERN starting on DPTS test beam analysis
- Possibility for LBNL Postdoc to work on WP1, physics/simulations

- 2 UC Berkeley people at CERN
  - Currently sitting in on DPTS test beam

Summary

- eRD111
  - Stave/Disc concepts, mechanics/cooling
  - Conversations with engineers
    - New hire will start work with us
  - Some cooling test setups exist and can be re-used
  - Some initial work has already started
    - Information gathering, stave/disc layout options
- ITS3
  - Chip testing, test beam analysis, physics/simulations?
  - Members at CERN provide good opportunity for LBNL involvement