UCSC Electron-Ion Collider plans

Simone M. Mazza on behalf of SCIPP UCSC group

Simone Michele Mazza – UCSC EIC plans

02/03/2021

Physics interests

- Exploring simulation topics, in conversation with LANL EIC group
  - Simulations to identify detector demands
  - Geared towards the definition of detector requirements and the motivation for increased 4D precision
- Development of detector reconstruction techniques
  - e.g.: c-tagging algorithms
- Particle Physics topics such as Heavy Flavor Physics are a natural fit
  - D*-meson CP violation
  - BSM searches (e.g.: leptoquarks)
- Also interest in nuclear structure & behavior

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Activities - Sensors

- Sensors (A. Seiden, H. Sadrozinski, B. Schumm, 1 FTE post-doc(me), ½ FTE tech, students)
- Testing FBK AC-LGAD with IR laser with the goal to define a design of a baseline detector
  - Sensor characterization, hit reconstruction algorithms.
  - Front and back IR laser study on etched AC-LGADs (Also prospect of etching at BNL)
  - Geometry optimization (pad pitch/size) and parameter optimization (N+ layer resistivity, Oxide thickness...)
- AC-LGAD simulation with TCAD softwares Sentaurus and Silvaco
- Support to TB runs (at FNAL)
- Prepare a submission with FBK to manufacture thin AC-LGAD (35-20um thickness)
- Started collaboration with KEK for AC-LGAD production at HPK

Fractional charge for Ch1
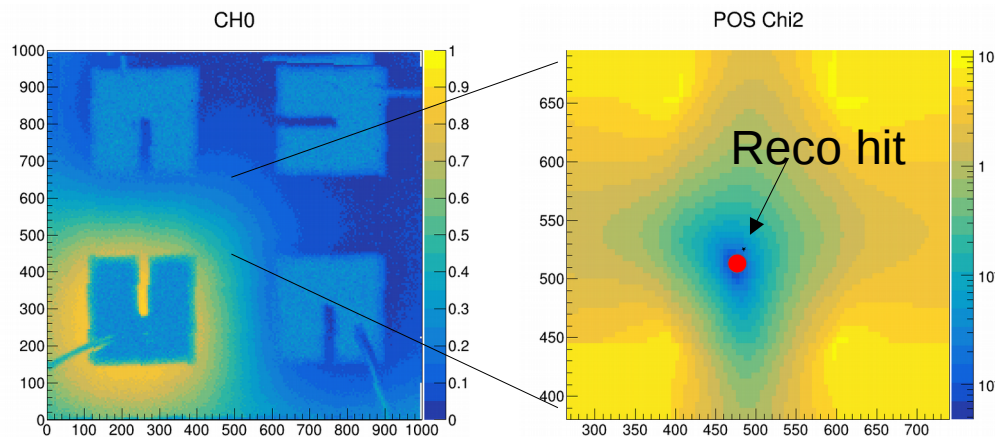
Fractional charge sharing based event reconstruction

Activities - Readout

- ASICs (R. Johnson, 1/2 FTE designer, students)
  - In recognition of the need for a low-noise, ultra-fast readout ASIC with pitch < 500um with acceptable power dissipation
- Work on specifications and simulations
  - Including definition of front-end
- Support two SBIR proposals for ASIC development
  - One for SiGe front-end
  - The other for 65 nm CMOS readout including back-end
- Assembly and test of resulting 16ch chip (sensor plus readout)

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Infrastructures at UCSC

- Clean room with automatic wire-bonders
- Sensor-board assembly capabilities
- Probe stations with possibility of cold measurements
- Power supply, parameter analyzer, LCR meter
- 2,4,13 Ghz Oscilloscopes for readout
- Setup for testing fast readout electronics
- Several single and multi-channel general purpose amplifier boards for single a array dices
- Laser TCT (200ps width) with cold chuck
- Beta source charge collection setup in climate chamber with fast time reference
- TCAD, Silvaco, Sentaurus and Cadence software

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