“Detector requirements” Mini-Workshop (June 2015)

THE UNIVERSITY
of EDINBURGH

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FCC-ee Physics Meeting
4 May 2015

Mini-workshop on Detectors

- Goal: make progress with detector designs
  - Feasibility studies, backgrounds, impact on physics reach

- Organisation
  - Mogens Dam, Gigi Rolandi & CL (overall coordination)
  - Nikiforos Nikiforou & Lucie Linseen (detectors)
  - Colin & Benedikt (software)
  - Emmanuel Perez & CL (online)
  - Nicola Bacchetta/Helmut Burkhardt (MDI)

- Dates (~1.5 days of meetings)
  - Wed 17 – Thu 18 June (during ATLAS week)
  - Have just received room booking confirmation from Patrick

Draft agenda

- Detectors
  - Plans for implementation of additional CLIC detectors in DD4HEP (e.g. SID/SID-like designs)
  - Other detector designs (e.g. ALICE tracker)
  - Performance figures for various options obtained with fast simulation
- Software
  - FCC software overview *(Benedikt Hegner)*
  - Towards an integrated fast / full simulation in the FCC software *(Ana Zaborowska)*
  - DD4HEP in the FCC software *(Julia Hrdinka)*
  - PAPAS: a parametrized particle simulation *(Colin Bernet)*

Draft agenda #2

- Online
  - Background rates using Mokka [ILD full sim] *(Emmanuel Perez)*: $\gamma\gamma \rightarrow$ hadronic backgroung, beamstrahlung photons
    - Potentially: Occupancies and background with different detector configurations
  - Recipe for SLIC [SiD full sim]?
  - Implementation of SimHits in FCCSW *("CL")*
    - Algorithmic development of physics reconstruction, trigger asymmetries
  - "Physics talk" on LEP trigger strategies
    - Precision required, trigger efficiencies, tag-n-probe
  - LHCb upgrade (hardware-less) trigger *(Renaud Le Gac)*
    - Challenges for FCC-ee rates/data volumes

Draft agenda #3

- MDI
  - Original idea: revisit synchrotron radiation issues with crab-waist optics (discussed in Washington DC); Also: SR simulation with "CERN" optics: remedies and/or better simulation
  - Helmet:
    - "On the machine side I doubt we will have news beyond what was discussed in Washington."
    - "We really need a SR friendly design, ie. what can be done to make detectors more SR tolerable."
    - "Expect it will still take a while until we have an acceptable zero order IR layout."
    - Goal: select fellow at next Committee

Backup

A first look at FCC-ee detector requirements (FCC 2015)

- Short Term Strategy (Oct. 2015): Implement in the DELPHES parametrization few designs of known detectors: ALEPH, CMS, ILC/CLIC detectors. Check performance for FCC-ee benchmark physics channels.

A first look at FCC-ee detector requirements (FCC 2015)

WG11 Medium Term

Analyses will be PF based. Layout to be optimized accordingly. Special attention:

- Tracker outer radius vs field strength
- Position of HCAL (inside/outside cryostat)?
- Balance between calorimeter granularity and performance
- Minimization of vertex and tracker material budget
- Assume we can achieve excellent μ and e id independently of the above
- Performance with/without Hadron Id

About tracker:

- How ”intelligent”? - more processing, more power, more cooling
- Follow advanced powering scheme (CMS, Belle2 upgrades and ILC)
- Follow studies on heat management integrated in detector design
- Follow R&D of PLUME Collab. on advanced materials and integration
  - Example: Mu3e vertex studies on HV-MAPS supported by prisms of 25 μm Kapton foil

Keep an eye open on new technology developments