Minutes: CEPC Reference Detector TDR Meeting in Dec 3, 2024

- Participants Present in the meeting room (M.B. 122): Miao He, Weidong Li, Jingbo Ye, Yong Liu, Feipeng Ning, Sen Qian, Yiming Li, Quan Ji, Huirong Qi, Fei Li, Haoyu Shi, Qi Yan, Wei Wei, Manqi Ruan, Boping Chen, Guang Zhao
- Online at ZOOM: Yifang Wang, Xinchou Lou, Mingshui Chen,ChangJinfan, Fangyi Guo, Gang Li, Haijun Yang, Haoyu Shi, Huaqiao Zhang, Jingzhou ZHAO, Jinyu Fu, Kaili Zhang, Mei Zhao, suen.hou, Sun Shengsen, Tao Lin, Linghui Wu, Xiaolong Wang, Zhang Ying, Zhao Ling, Zhijun Liang

MDI – Haoyu:
- Beam Backgrounds:
  - Higgs/Low-Lumi-Z Baseline(no shielding) finished; pair + single
    - SR needs Geant4 11.2.0 or newer. Testing with CEPCSW based on LCG105.
    - Shielding design on going
    - Writing on going. The results of no shielding will be included in MDI Chapter.
- LumiCal:
  - Design(including mechanical) almost finished; First version finished and merged.

- Yifang:
  - The baseline version of BIB should include the design of shielding, instead of the version with no shielding.
  - clearly define the baseline and its indicators, outlining what has been accomplished, what is still missing, and the expected completion timeline.
  - Introduce the baseline to everyone in next week meeting

Vertex - Zhijun:
- Formal proposal of CEPC vertex at DRD3 meeting, then formal cooperation can start
- TDR wrting is on going ~ 17 pages
- Yifang：Progress of stitching
  - Zhijun: will follow up latest progress

Silicon – Qi Yan:
- The Latest PID Performance of TPC and OTK
- Safe Margins Between OTK Barrel and TPC Endcap
- Remaining Ongoing Tasks for the Silicon Tracker TDR
  - Miao: further optimization of current design?
    - Qi: will summarize the optimization in TDR

TPC - Huirong:
- TDR writing updated
- Updated design of TPC endplate: TPC outer R is changed to 1820, and a connecting ring is made

with ECAL, using the notched part of the ECAL polygon (多边形缺口部分) for cables/cooling….

ECAL - Yong:
- Endcap ECAL: mechanics studies
    - Distributions of deformation and stresses per module
    - Module temperature distribution with active cooling
- Updated performance for BIB (no shielding)
- TDR writing is on going ~ 31 pages

- Yifang: Haoyu no need to release all versions of BIB to sub-detectors. The difference of versions can be recognized at generator level, no need to generate all samples
- Miao: expected crystal hit rates (due to BIB) including shielding?
    - Haoyu: expect to reduce ~ 20%

HCAL -Sen Qian:
- New mechanics design: add boxes of modules
    - Yifang: we need detailed geometry plots, including sizes, connections inside box, between modules…Because the design is related to cost and performance, which needs careful validation.
- Each SiPM in the box shares a power supply to reduce the number of circuits.
    - Miao: Is the power sufficient? → Yes, the power supply is at the rear, can be replaced at any time, and also reduces noise.
    - Yifang: How to shield the power supply lines? → Shielded twisted pair wires with a 1mm thickness, independently controlling the voltage drop.
    - Yifang: Power consumption needs to be considered, quantitative analysis is required to prove feasibility.
    - Miao: What if the 1mm wire is damaged during installation? Detailed installation plans and procedures for replacement after damage are needed.
    - Sen: Will introduce detailed design in next week

Muon - Xiaolong:
- Yifang: [last reminder] more care about engineering, detector full design, electronics and mechanics design, performance estimation... Report the progress in next week.

Magnet - Feipeng:
- Yifang: requirement: the thickness should reduce from 700mm to around 500mm
- Xinchou: Introduce the production timeline, starting from the time required for installation, extrapolating the timeline.   IAC Chair is concerned about this.
    - Yifang: Demonstrate that what you intend to do has already covered all the necessary tasks to complete the construction.

Electronics – Wei Wei：
- Hit rate of BIB for ECAL
    - Issue: electronics is unchangeable from Higgs to High LumiZ
        - The scheme should be design aiming at the highest request - High LumiZ
            - > Main difference from the changeable VTX scheme
        - ~10kHz vs 350kHz vs 3MHz /bar has a dramatical impact on scheme
    - Yifang: need a typical meeting for it in next week.
        - MDI need to provide new BIB including shielding → Hoayu: results for Higgs, Low Z can be finished，using scaling for high Z
        - Xinchou: need to consider the boundary condition for higgs/low Z and High Z before this meeting. Need a scientific plan for upgrade (high Z and top)

TDAQ - Fei:

[Slides]
- Updated rate for BIB
- Trigger & Data Rate for Higgs and Low Z

Software - Weidong:
- Software release tdr24.12.0 published
- Calorimeter: The reconstruction algorithms for end-cap being developed
- OTK: new geometry of barrel and end-cap is being implemented for detector simulation
- Simulation of silicon detectors: simplified passive material
    - Miao/Widong：passive material is more for precision detectors (vertex, silicon detector)

Mechanics – Quan Ji:
- Idea of outline structure of this chapter
- Design of barrel OTK – fixed on TPC
    - Single layer layout
    - Thickness of OTK: 20mm
    - Dimensional boundary: <3640mm
- Pipeline layout of sub-detectors
    - Quan: need clear temperature requirement of sub-detectors (except for vertex – air cooling), consider one unified cooling system
    - Haoyu: no need to consider activation issue of air cooling of vertex, considering enclosing the entire hall
    - Qi Yan: Silicon detector needs detailed design for cable layout

Performance - Mingshui:
- Tracking: the shift of momentum now fixed (with refined magnet field map), issue of tracking resolution at low pT understood
- Vertexing: ACTS package of vertexing fit integrated in CEPCSW, preliminary results look good –

- Jet Performance:
  - Working on performance evaluation: differential JER/JES/JAR/JAS, BMR
    - Latest development of CyberPFA (can reach ~3.8% BMR) now integrated in the CEPCSW release (tdr24.12.0 last mid-night).
    - Next priority for SW group: Geometry/Digi/Reconstruction of Endcap Calo
- PID – Now working on PID performance in physics processes, while dN/dX algorithm optimization ongoing
  - Shanzhen and Xuhao working on evaluation of the impact from different ECAL granularity, PID: lamda_c -> p K pi，boosted tau

AOB:

Miao: Please upload the latest version to Overleaf as soon as possible, should around 500 pages.