Physics potential & Physics Requirement

Detector Concept

Hardware study/designs:

TPC,
Silicon,
Calorimeter...

Feasibility & Optimized Parameters

Feasibility analysis: TPC and Passive Cooling Calorimeter is valid for CEPC

	CEPC_v1 (~ ILD)	Optimized (Preliminary)	Comments
Track Radius	1.8 m	>= 1.8 m	Requested by Br(H->di muon) measurement
B Field	**3.5 T**	**3 T**	**Requested by MDI**
ToF	**-**	**50 ps**	**Requested by pi-Kaon separation at Z pole**
ECAL Thickness	84 mm	84(90) mm	84 mm is optimized on Br(H->di photon) at 250 GeV; 90mm for bhabha event at 350 GeV
ECAL Cell Size	5 mm	10 – 20 mm	Passive cooling request ~ 20 mm. 10 mm should be highly appreciated for EW measurements – need further evaluation
ECAL NLayer	30	20 – 30	Depends on the Silicon Sensor thickness
HCAL Thickness	**1.3 m**	**1 m**	-
HCAL NLayer	**48**	**40**	Optimized on Higgs event at 250 GeV; Margin might be reserved for 350 GeV.

PFA Oriented Detector: Performance

- Solid Angle Coverage : $|\cos(\theta)| < 0.99$

- Lepton id : eff > 99.5%, mis id < 1%

- Calorimeter Shower Separation ： 9 – 16 mm

- Tracking: $\delta(1/Pt) \sim$ 2e-5 GeV^{-1}, 1 order of magnitude better than current status

- C-tagging is feasible

- Photon Energy resolution: σ/Mean ~ 1.7 – 2.4% for H->$\gamma\gamma$ events

- Jet Energy resolution: σ/Mean ~ 4% for H->gg events

- Pi-Kaon Separation: at 3-4 sigma level with E < 20 GeV

- Systematic control : ~ 1 order of magnitude better

  – Beam energy monitoring, Calibration, Alignments...

In simu/reco

- Fully implemented into G4 simulation

- Evt display looks healthy

- Validation & Object level Performance study on going

Question towards the sub-detectors:

how to realize the performance:

1, within the constrain of energy, material budget and radiation tolerance?

2, keep the level of monitoring (Calibration, alignment, homogeneity and stability)?

Main Tracker: TPC

- Collision environment & Feasibility
  - Occupancy
  - Charge distortion
  - OK for qqH events at Z pole at 2E34.
- dx = 100 micro meter per point
- Upto 200 points, align to 100 micro meter level
- Power budget (active cooling or not)
- Requested knowledge to E/B field?
- Stability (esp. In terms of dEdx)

Silicon tracking device

- Resolution 5-10 micro meter

- Material budget 1% X0 per layer (in total: 5-10% X0 before Calorimeter)

- Radiation tolerance?
  - Flux map ready
  - Tolerance limit?

- Power budget? Cooling scenario?

- Rate capability & occupancy?

ECAL: Si-W

- Photon resolution: 16%/sqrt(E) + 0.5%

- Requirement on Homogeneity? ~10%

- Power budget?

  - At 10 mm cell size should be OK

  - ToF: ADC + TDC power requirement

HCAL

- MIP efficiency ~ 98%

- MIP Multiplicity < 1.3

- Hadron energy resolution: 60%/sqrt(E) + 2%

- Separation performance & Fake Neutral Hadron (Fragments) Chance?

- Power budget?

LumiCal

- General Layout? (Limited by MDI design)

- Requested position resolution & alignment accuracy?
  - Toward 1E-3;
  - Toward 1E-4!

DAQ, etc

- To valid the trigger-less mode?

- General DAQ framework, Sub-Detector integration time, etc...?

- General cooling (if needed) system design?

- On line monitoring?