**Benchmark Performance & Analysis**

Sub Detector – level:

// Differential: Performance as a function of object (track, jet, etc) Polar angle & Energy

**Vertex:**

Differential Efficiency.

Requirement: ~ 100%; dead channel number < o(0.1)%

Intrinsic spatial & time (optional) resolution.

Requirement: 5 micro-meter spatial resolution

Ref: CDR baseline design

Timing: shall be addressed from DAQ + Online system study

Differential Occupancy (with beam background + MDI studies).

Requirement: ~o(0.1)%

shall be addressed from DAQ + Online system study

**Tracker:**

Differential Eff.

Requirement: Pt threshold ~ o(100) MeV, |cos(theta)| < 0.99

Ref: CDR baseline design

Differential Material Budget.

Requirement: < 10%/50% X0 in Barrel/endcap

Ref: CDR baseline design + BMR & Material Dependence

Differential Resolution of 5 track parameters.

Requirement: In the barrel

delta(D0/Z0) ~ < 3 micro meter at 20 GeV

delta(Pt)/Pt ~ o(0.1%)

Ref: CDR baseline performance

Differential Pid Capability: eff\*purity of Kaon id @ Z pole.

Requirement: eff\*purity > 90% for all charged Kaon with E > 2 GeV (@ Z pole)

~ relative resolution of dE/dx (or dN/dx) be better than 3%

ToF of 50 ps

Ref: Nuclear Inst. and Methods in Physics Research, A 1047 (2023) 167835

Sep. power: On 3 prong tau decay @ Z pole.

Requirement: efficiency > 99% at 3-prong tau

Ref: CDR baseline performance

**Calorimeter:**

**Intrinsic energy resolution:** wi/wo Clustering – Hit/Energy collection efficiency.

Requirement:

EM resolution: ~ 3%/sqrt(E) \conv 0.5%

Ref: JHEP12(2022)135

Had resolution: ~ 50%/sqrt(E) \conv 2%

Ref: CDR baseline performance

**Di-particle separation power.**

Di photon; requirement: ~ 1.5 cm. eff. ~ 50%

Pion + Photon; requirement: ~ 1.5 cm. eff. ~ 50%

Pion + Neutral Hadron; ~ ? cm. (TBD)

Ref: 2018 JINST 13 P03010

Ref: CDR baseline performance

Shower Profile -> Pid potential (e, mu, hadron).

Requirement:

eff ~ 99% & mis-id ~ 1% for isolated charged particle with E > 2 GeV

Ref: Eur. Phys. J. C (2017) 77:591

Ref: 2021 JINST 16 P06013

Ref: CALICE TB data analyses

Differential Eff (long-term).

Requirement: Energy threshold ~ o(50) MeV, |cos(theta)| < 0.995

Ref: CDR baseline performance

**ToF: Time resolution & Efficiency.**

requirement: 50 ps @ Cluster level

Ref: Eur. Phys. J. C (2018) 78:464

Ref: Nuclear Inst. and Methods in Physics Research, A 1047 (2023) 167835

Dedicated:

LGAD,

Multi-RPC. Ref: Nuclear Instruments and Methods in Physics Research A 1056 (2023) 168656

Integrated with Calo (as CMS HGC). Ref: Eur. Phys. J. C (2023) 83:93

**Muon: Efficiency, Volume & Cost.**

**Global:**

**BMR:** depends mainly on **Calo, Tracker** (Tracker Material)

**Jet Origin id:** depends on all **sub-detector**

**Particle identification (**optional**):** Differential Efficiency & Mis-id (Purity): depends on **Calorimeter, Tracker, ToF.**

**Physics Analysis Benchmarks.**

1, H->SS @ 240 GeV

relies on **BMR, Jet origin id**

2, Vcb from W decay @ 240 GeV and W threshold (optional)

relies on **BMR, jet origin id**

3, alpha-s from Z->Tautau @ 91.2 GeV

relies on **PFA Separation, Pid**

4, vvH, H->bb @ 360 GeV relies on **BMR, jet origin id**

5, Bs->DK @ 91.2 GeV, for CKM angle measurements (Gamma\_s, Gamma\_sb, etc)

**relies on Jet Origin id, Pid, Tracking.**