NEXT STEPS

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Requirements

From the physics objects jets and requirements are basically the same for all energies

- B-Physics and τ lifetime requires the most stringent performance on material budget and point resolution
- Charm jets (for Higgs-charm couplings) mostly influenced by material budget, point resolution and 1st measurement layer position

From the machine, Z physics run is particularly different from the other energies, at least from Higgs in terms of expected backgrounds, which are mostly related to the collision scheme (11200 bunches vs 440).

- Expected data rate in L1 from IPC per module (6.4 x 32 mm) at the Z is ~20 Gb/s (or ~120 Gb/s per ladder) compared to “only” ~3 Gb/s at the ZH, if no mitigation is applied
    - 250 MHz/cm2 hit rate at the Z
- The machine current for ZH is lower, so expect smaller background anyway
- Different vertex detectors (and maybe beam-pipe?) between the two energies?

Systematics effects

From the systematics point of view

- Systematics errors to cope with the statistical precision
  - Becomes a new specification to design vertex detector

  - Very large data rates:
    - 1 LEP experiment every couple of minutes could solve alignment issues?

  - Need to evaluate requirements on alignment from some selected physics channels

  - Design with physics impact due to systematics in mind.

Sensors aspects

Technology

- MAPS technology relies on access to Foundry and discuss with them
  - Our “mass” production is infinitely smaller wrt commercial volume
    - Need to secure at least 2 foundries to guarantee success (remind the TSI story)

  - ALICE ITS3/ALICE3, EIC and Belle-II upgrade will provide state of the art MAPS
    - Keep the community focused on existing projects but projected towards future
      - Create collaborations, keep alive similarities and differences

Sensor aspects

Resolution and efficiency

- One crucial aspect is point resolution
  - What is the ultimate one?
    - going to 3 µm seems difficult, what about the idea of 2 close-by detectors or charge sharing by increasing the epitaxial layer?
- Possible increase of the matrix active area (currently 95%)?
  - Larger tiles area (defects removed)?
  - Back side power distribution and 3D stacking?
- Redundancy is a must to compensate coverage problems

Data handling

- ALICE hit density ~100 MHz/cm^2 – FCC-ee ~400 MHz/cm^2 but smaller length of data transmission → they become comparable or not 'that much different'
- Power drops needs to be handled!
- Pushing data off w/o trigger seems to be viable and preferable from power point of view
- Silicon Photonics offers to reach 100 Gb/s per fibre
  - Real problem is integration
    - Need specs and co-integrated design between sensors and data links (avoid intermediate ASICs)

Mechanics and integration

- Take into account integration from the beginning
    - Interplay with the sensors and data readout
    - Minimize material budget
    - Routing of the services
    - Cooling
    - …

Not at the stage of ‘final’ detector layout, though investigating some of the problems right now

How to move on?

- Lot of interest in moving on towards FCC-ee focused design starting from the current R&D from the community
  - ALICE, EIC, Belle-II upgrade, Mu3e but also other experiments
- Becomes important the interplay between detector and machine experts
- Need a way to collaborate also taking advantage of the DRD and CPAD efforts.
  - Possibly to contribute not only to the Feasibility study but also to the ESPP?

Another workshop in the fall is foreseen, stay tuned!

Thanks to everybody and have a safe trip back!