The Importance of Tracking: TPC vs. Silicon
— Some considerations for CEPC-TPC

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Tracker detector option

- Options of the tracker detector
  - Main drift chamber (MDC)
  - Silicon tracker detector (SiD)
  - Time projection chamber (TPC)

- TPC detector
  - Detector consists of
    - Chamber of working gas
    - Field Cage for the uniformity electron field
    - MPGD as readout on the two sides
  - Advantage
    - Angle of coverage: \( \sim 4\pi \)
    - dE/dx, Particle identification
    - Multi-hits resolution
    - Low material budget: working gas

TPC Detector overview
(ALICE, STAR, ILD-TPC, etc.)
Beam structure @ CEPC

In the case of ILC-TPC

- Bunch-train structure of the ILC beam (one ~1ms train every 200 ms)
- Bunches time ~554ns
- Duration of train ~0.73ms
- Used Gating device
- Open to close time of Gating: 50µs+0.73ms
- Shorter working time

In the case of CEPC-TPC

- One bunch every 3.63µs or smaller

Primary ions@ILC

3 trains 2 trains 1 trains

Primary ions@CEPC

300 trains ...... trains 1 trains
Estimation of backgrounds at CEPC

- Beamstrahlung
  - Pair production
  - Hadronic background

- Lost Particles
  - Radiative Bhabha
  - Beamstrahlung
  - Beam-Gas Scattering
  - ...

- Synchrotron Radiation
  - More than 100keV of Gamma
  - Just consider at endcap (readout and modules for TPC)

- From Dr. Zhu Hongbo and Xiu Qinglei

- Photon energy due to beamstrahlung at CEPC is smaller than that of ILC
- The pole angle of the photons is below 1 mrad
- Most of photons will leave the IP along the beam pipe
Simulation of occupancy

- Occupancy@250GeV
  - Very good for Silicon pixel tracking
  - Very important parameter for TPC
  - Size of the detector structure used ILD-TPC
  - ADC sampling 40MHz readout
  - Time structure of beam: 4us/Branch
  - Beam Induced Backgrounds at CEPC@250GeV (Beam halo muon/e+e-pairs) + $\gamma\gamma \rightarrow$ hadrons with safe factors ($\times 15$)

CLIC_ILD ~30%@3TeV
1×6mm² Pads
CLIC_ILD ~12%@3TeV
1×1mm² Pads
NO TPC Options!
Occupancy@250GeV

- Voxel occupancy
  - Pad size: 1mm × 6mm
  - No consideration for the beam collimator, the value of occupancy might larger
  - No consideration for Synchrotron Radiation

TPC voxel occupancy simulated in TPC radius
- NO conclusion …
- TPC Detector could be as one option for CEPC …
Thanks!