Status of IBF detector module with UV-light

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Manpower and activities of TPC module R&D

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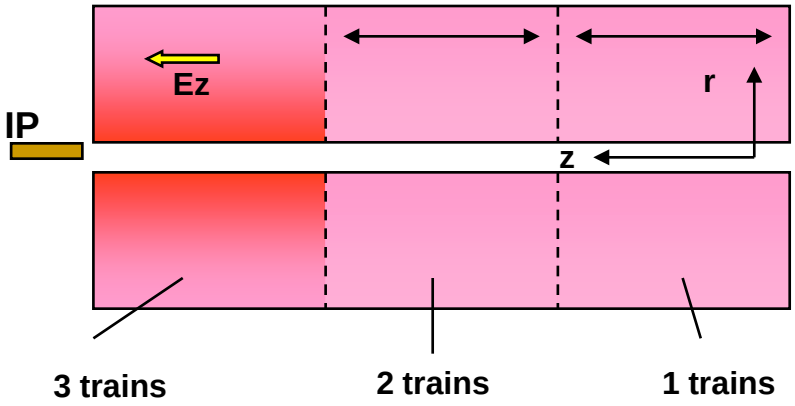
Critical challenge: Ion Back Flow and Distortion

In the case of ILD-TPC

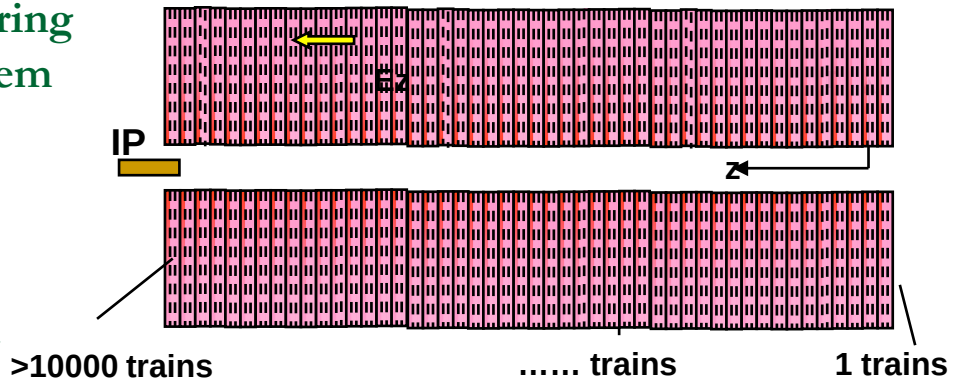
- Distortions by the primary ions at ILD are negligible
- Ions from the amplification will be concentrated in discs of about 1 cm thickness near the readout, and then drift back into the drift volume Shorter working time
- 3 discs co-exist and distorted the path of seed electron
- The ions have to be neutralized during the 200 ms period used gating system



Amplification ions@ILC

In the case of CEPC-TPC

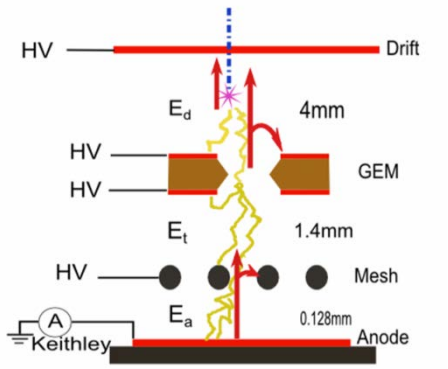
- Distortions by the primary ions at CEPC are negligible too
- More than 10000 discs co-exist and distorted the path of seed electron
- The ions have to be neutralized during the ~4us period continuously

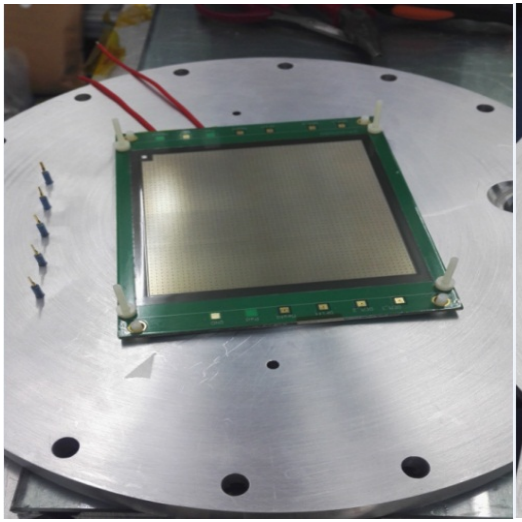


Amplification ions@CEPC

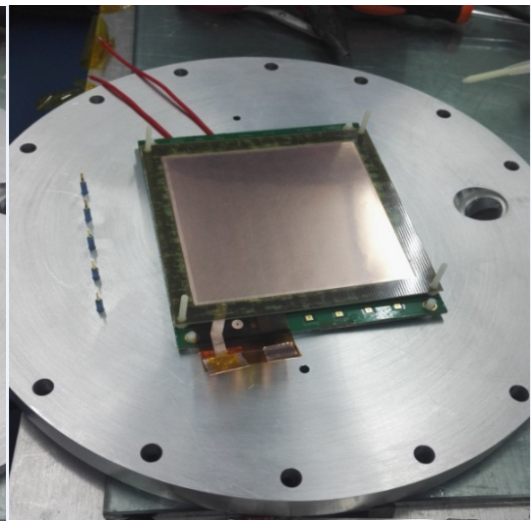
Test of the new module

- Test with GEM-MM module
  - New assembled module
  - Active area: 100mm×100mm
  - X-tube ray and 55Fe source
  - Bulk-Micromegas from Saclay
  - Standard GEM from CERN
  - Additional UV light device
  - Avalanche gap of MM:128μm
  - Transfer gap: 2mm
  - Drift length:2mm~200mm
  - Mesh: 400LPI

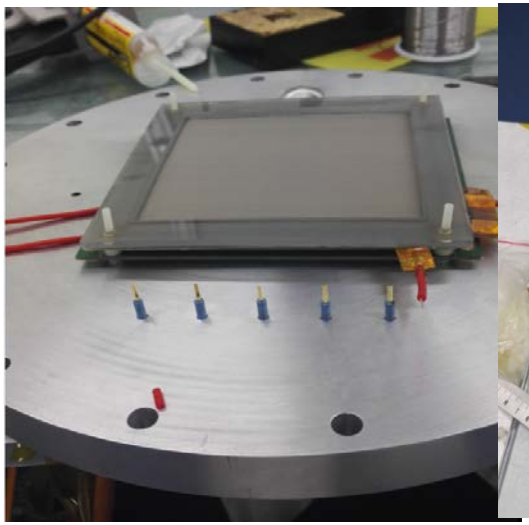




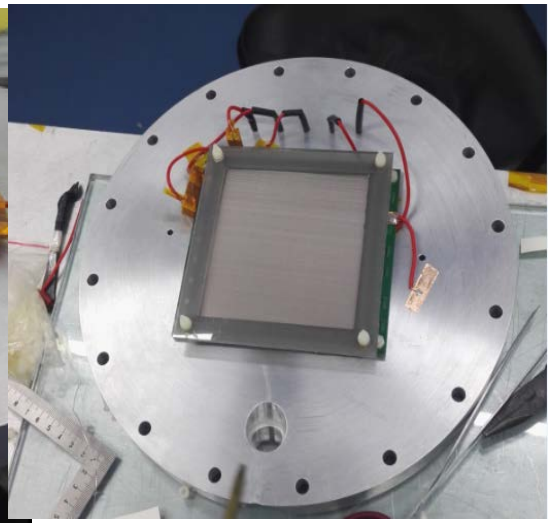
Micromegas(Saclay)



GEM(CERN)



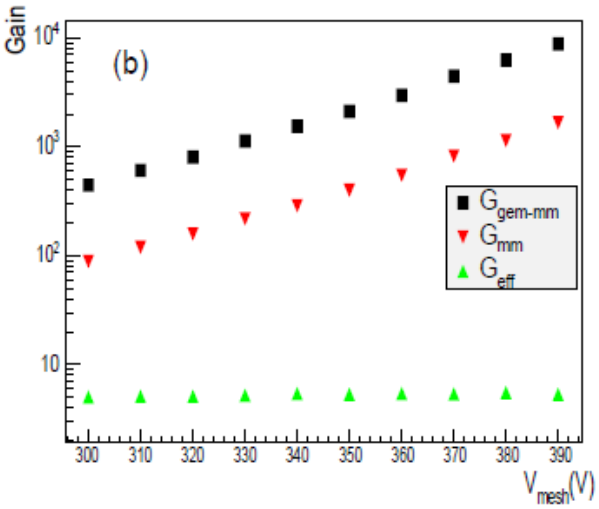
Cathode with mesh



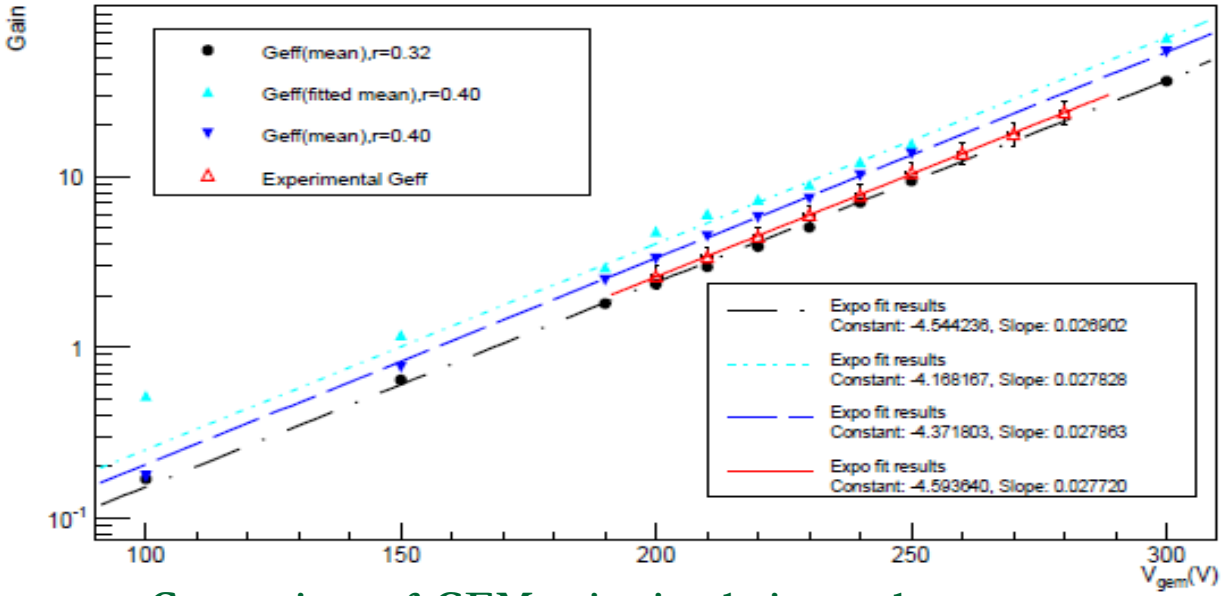
GEM-MM Detector

Gain of GEM-MM module

- Gain of the GEM-MM
  - Gain simulation by Garfield++
  - Gain test with GEM-MM detector
  - Optimization operation high voltage
  - V_{GEM}=240V/V_{MM} from 300V to 400V
  - Good fit the value with simulation and measurement
  - Gain of GEM: 3~23
  - Gain of GEM-MM: 100~10000



Gain with MM at VGEM=240V

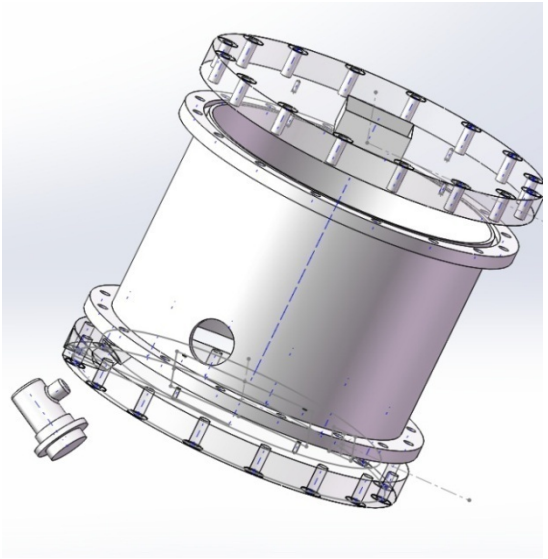


Comparison of GEM gain simulation and measurement

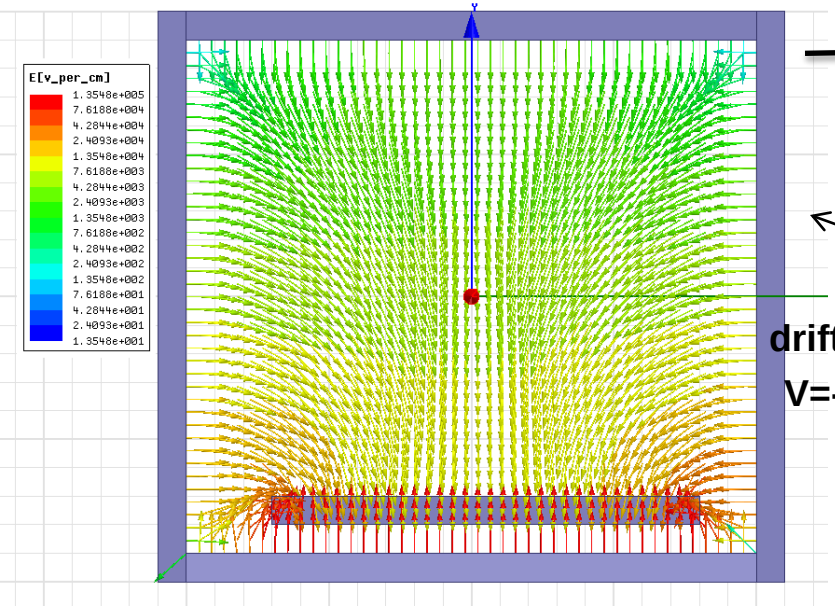
UV test of the new module

- UV lamp measurement
  - New designed and assembled UV test chamber
  - Active area: 100mm×100mm
  - Deuterium lamp and aluminum film
  - Principle of photoelectric effect
  - Wave length: 160nm~400nm
  - Fused silica: 99% light trans.@266nm

Deuterium lamp
X2D2 lamp



UV test geometry with GEM-MM



Electric filed map in module

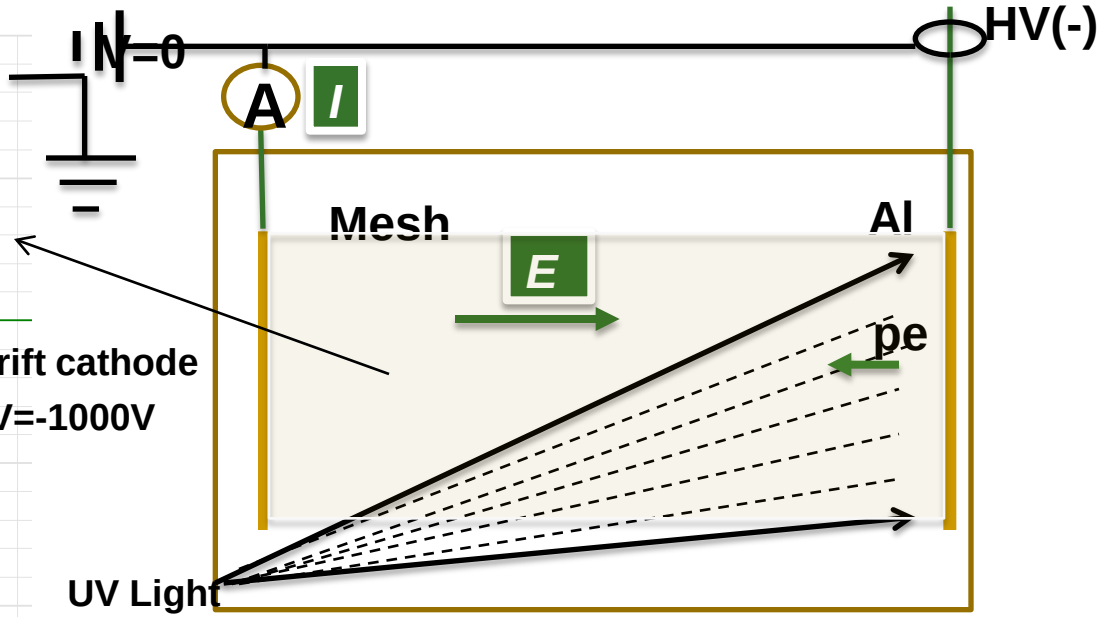
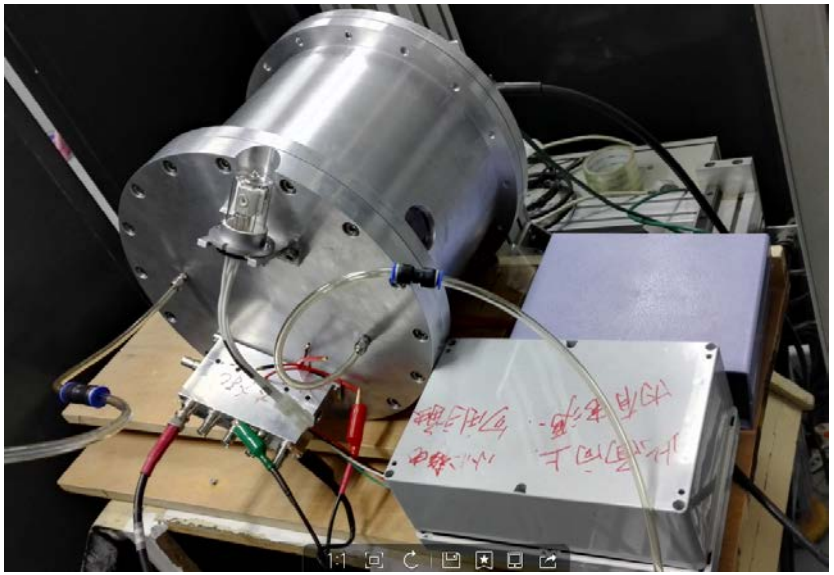
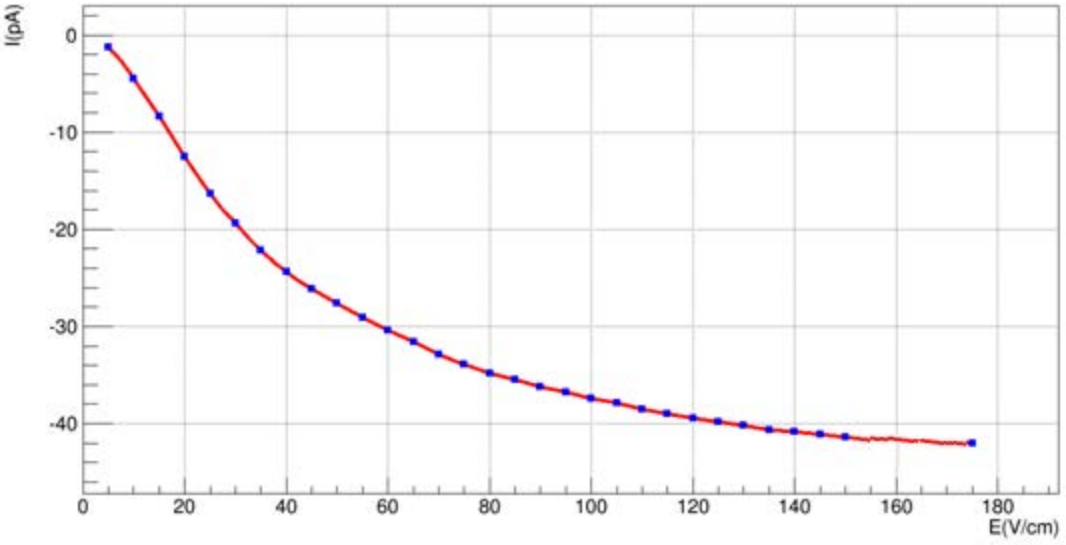


Diagram of the UV test with new module.

UV test -first step

- UV lamp measurement
  - pA current meter from Keithley
  - First step test about the current in mesh
  - E_drift: 10~175V/cm
  - ~43pA@175V/cm
  - Stable current with UV light
  - ~200V/cm@T2K operation gas





Electrons by photoelectric effect with Edrift

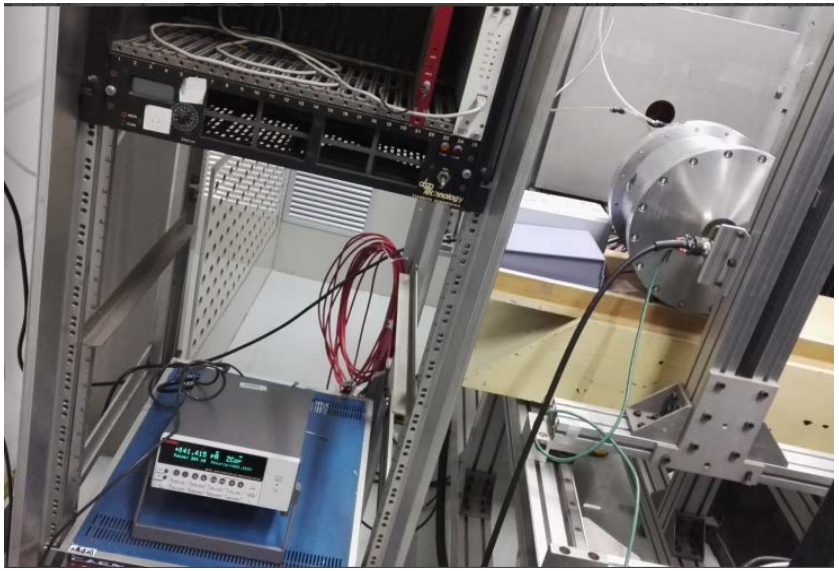
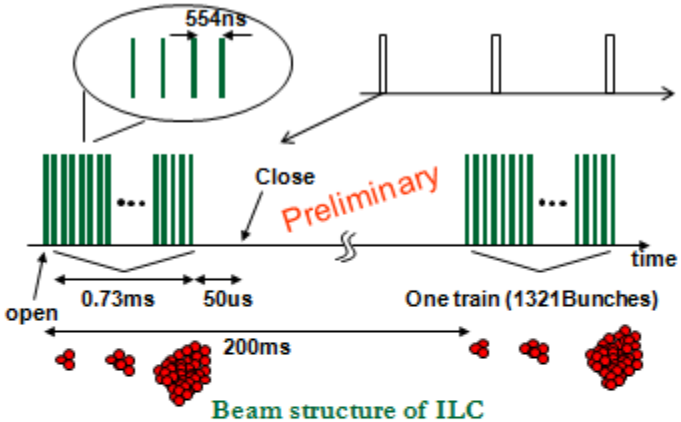


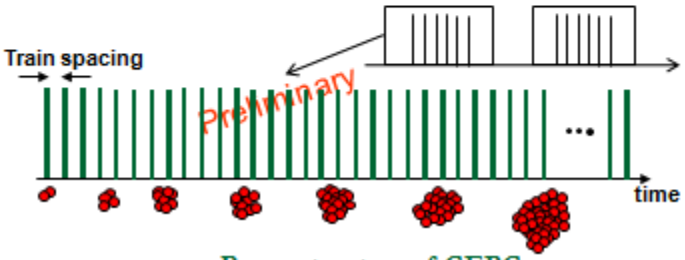
Photo of the new module in lab

UV test - next step

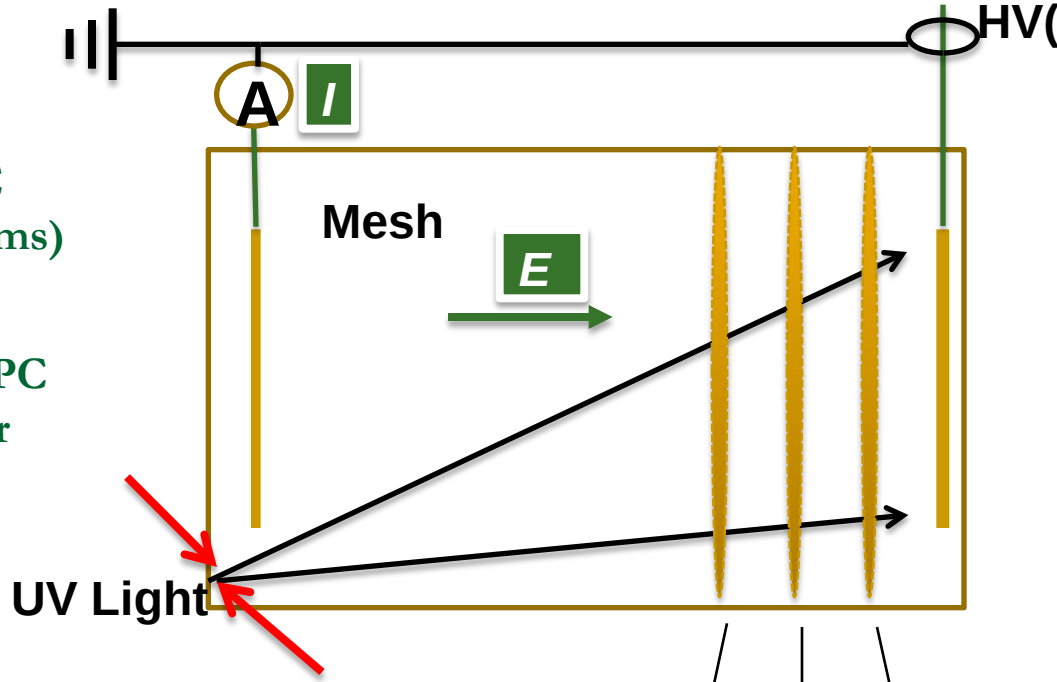
- In the case of ILD-TPC
  - Bunch-train structure of the ILC beam (one ~1ms train every 200 ms)
- In the case of CEPC-TPC
  - Bunch-train structure of the CEPC beam (one bunch every ~90μs) or partial double ring
- Gating and IBF test

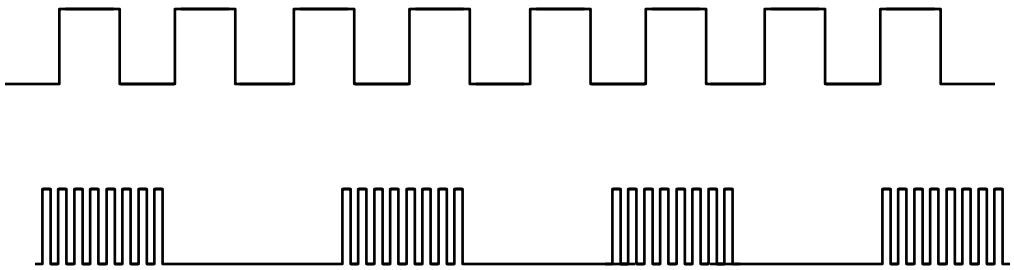


Beam structure of ILC



Beam structure of CEPC





Shutter time similar to ILC and CEPC beam structure

Summary

- Critical requirements for CEPC TPC modules
  - Beam structure
  - Obvious distortion
  - Continuous Ion Back Flow
- Some activities for the module
  - Assembled detector module
  - First results from the new detector module
  - Some plans for the module

Thanks very much for your attention !