ePIC hpDIRC

- Radiator bars:
  - Size: 4580mm x 35mm x 17mm (L x W x T)
  - Barrel: 700mm radius, 12 bar boxes, 10 long bars per bar box

    long bar: 4 bars glued end-to-end, flat mirror on far end

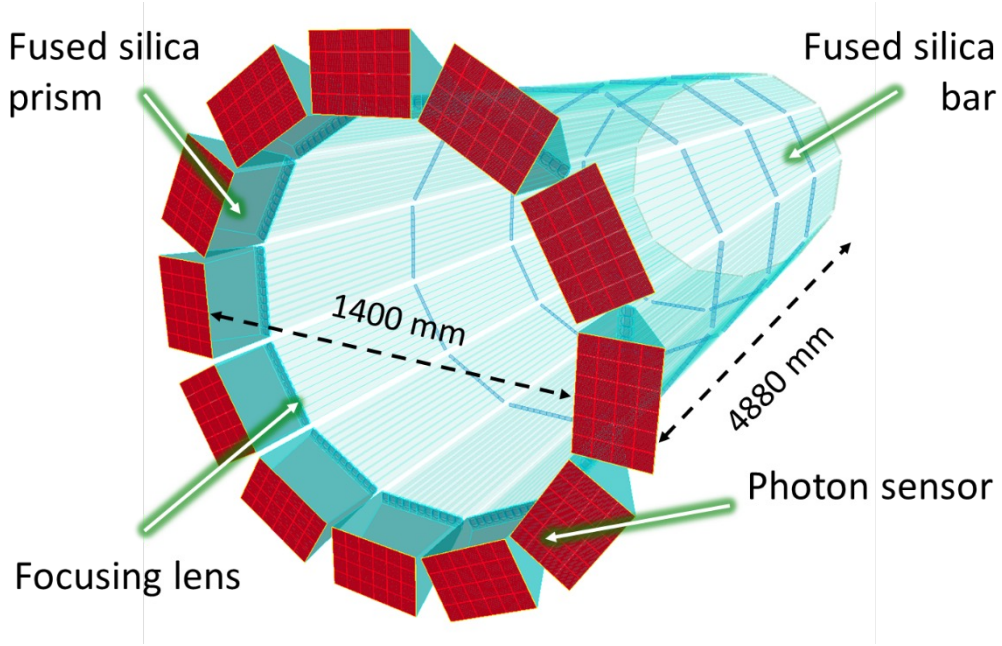
    baseline design: reuse of BaBar DIRC bars (R&D underway)
- Focusing optics:

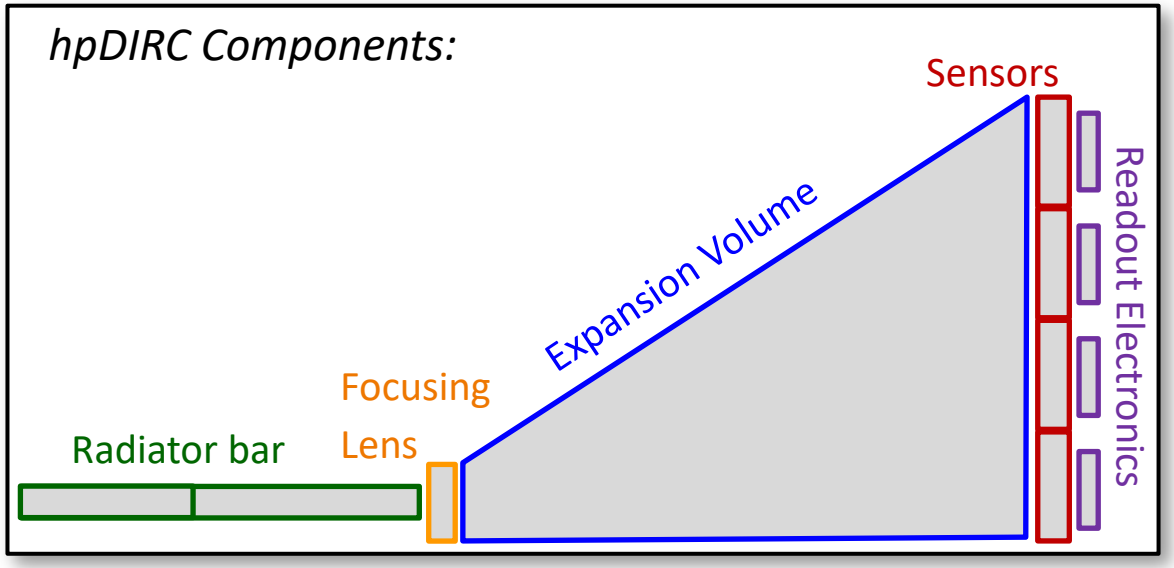
  Radiation-hard 3-layer spherical lens (sapphire or PbF_2)
- Expansion volume:

  Solid fused silica prism: 24 x 36 x 30 cm^3 (H x W x L)
- Readout system:

  MCP-PMT Sensors (~3x3mm^2 pixels)

  ASIC-based Electronics (~74k channels)
- Many core design aspects, as well as detailed Geant simulation, validated in joint beam tests with PANDA Barrel DIRC (prototype tests in cosmic rays and test beams in preparation)





HPDIRC SENSOR/READOUT REQUIREMENTS

Efficient single photon detection: rms timing precision per photon <100 ps

Note: 100 ps for entire chain (sensor ⊕ readout ⊕ sync.), ~10^6 gain, small signals (few mV)

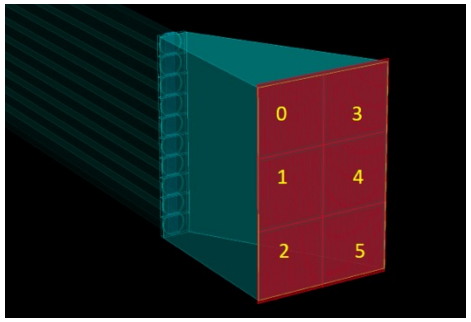
Small pixels: pixel size ~3mmx3mm, sensors tiled, minimize gaps between sensors

Very tight space in readout region: compact card/cable configuration needed

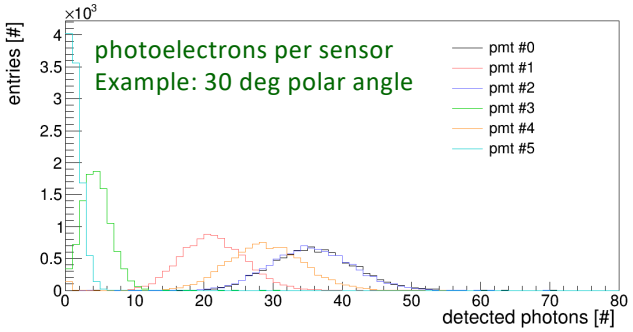
High photon yield: need tolerance for high occupancy per sensor

Long photon propagation paths in bar: need low dark count rates

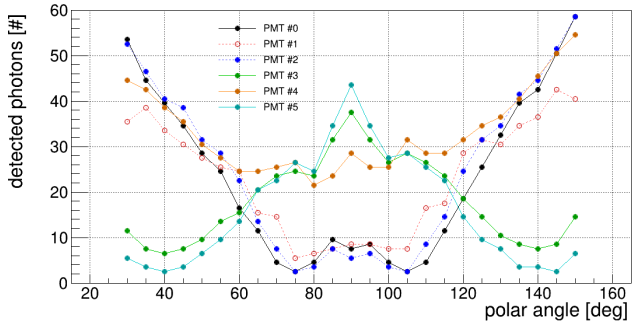
(coincidence timing very difficult/impossible to use)



Geant4, single track particle gun, 2x3 configuration
Uses QE/CE similar to PANDA Barrel DIRC sensors



Maximum number of photoelectrons per sensor



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Geant4, single track particle gun

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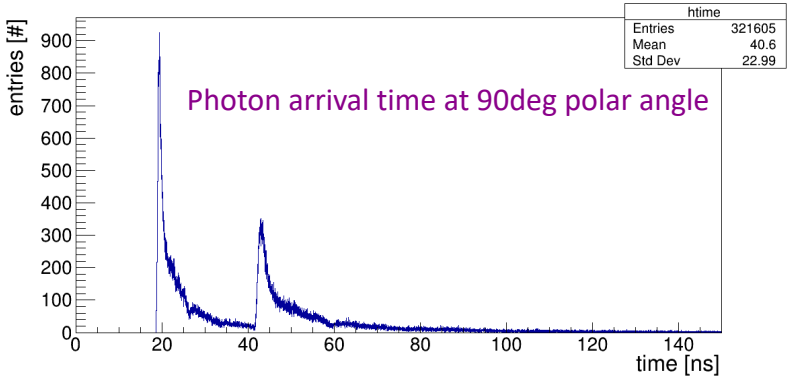

Max – min arrival time difference, different fractions