

# B Detectors TDR Preparation Status

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# Outline

- Review status of *both* tracker and calorimeter according to the TDR scheme
  - Using
    - Green – well in hand
    - Orange – in progress
    - Red – just or not started
- Requirements → Design
- (some) Key plots (in draft form)
- Present some of the important open issues

- Requirements
  - From **physics**
  - **Radiation hardness**
  - Expected **data rates**
- Justification
  - Device **concept and justification** for the technological choice
  - **Description**
    - General device description
    - Sensors
    - FEE (for rates with reference to a global table in electronics/DAQ section)
    - Other components (f.i.: radiators in calorimetry and in Cherenkov devices, ...)
  - **Performance** from available input (lab studies, test beam, prototyping, simulation studies)
- Implementation
  - **Services** (cooling, gas system, sensor power supply, FEE power supply, ...)
  - Subdetector **mechanics and integration**
  - **Calibration, alignment and monitoring** strategy and tools
  - **Status and remaining design effort**
    - R&D up to here (and missing, if any); E&D status and outlook
    - Other work needed for design completion
    - Status of maturity (with reference to next slide)
  - **ES&H** (Environmental, Safety & Health) aspects and **QA** (Quality Assessment) planning
  - **Construction and assembly planning**
  - **Collaborators** (=Institutions) and their role, resources and workforce
  - **Risks and mitigation strategy**

# Requirements for Tracker and Calorimeter

- **Requirements**

- From physics
- Radiation hardness
- Expected data rates (some small refining remains, especially for bkg)

# Justification for Tracker and Calorimeter

- Justification

- Device **concept and justification** for the technological choice

- **Description**

- General device description

- **Sensors**

Sensor/Readout  
scheme for  
calorimeter still  
being refined

- FEE (for rates with reference to a global table in electronics/DAQ section)

- **Performance** from available input (**lab studies, test beam, prototyping, simulation studies**)

Simulation studies are  
in good shape but not  
completed

On the TDR time scale we are limited to non-dedicated studies, i.e. AC-LGAD from RP/OMD program and crystal calorimetry with ZDC

# Implementation for Tracker and Calorimeter

- Implementation

- **Services** (cooling, gas system, sensor power supply, FEE power supply, ...)
- **Subdetector mechanics and integration**
- **Calibration, alignment and monitoring** strategy and tools
- **Status and remaining design effort**
- R&D up to here (and missing, if any); E&D status and outlook
- Other work needed for design completion
- Status of maturity (with reference to next slide)
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- **Construction and assembly planning**
- **Collaborators** (=Institutions) and their role, resources and workforce
- **Risks and mitigation strategy**

Installation is **very** tricky and demanding, as we progress on planning this there is feedback to core detector performance

# Requirements → Design: Tracking Detector

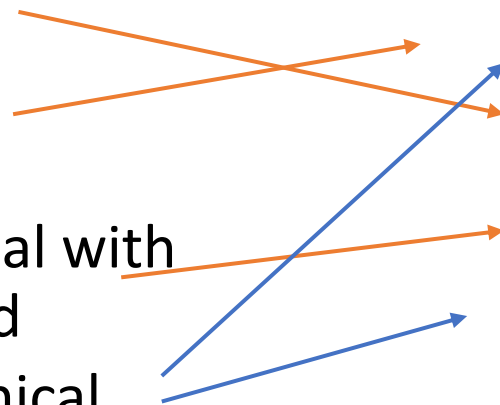
Forward ( $4.6 < \eta < 5.9$ ) charged tracking & proton tagging

- Requirements:

- Momentum resolution  $< 6\%$
- Radiation hard for forward environment
- Timing precision sufficient to deal with vertex smearing and background
- Accommodate available mechanical envelope

- Detector design:

- 4 layers of AC-LGAD
  - Use  $3.2\text{cm}^2$  pixel sensors
  - W/ charge sharing acceptable resolution
  - Fast  $\sim 30$  ps
- $\sim 27$  cm spacing between layers, situated at front (IR side) of B0 magnet



# Requirements → Design: EM Calorimeter

Forward ( $4.6 < \eta < 5.9$ ) photon and  $\pi^0$  measurement

- Requirements:

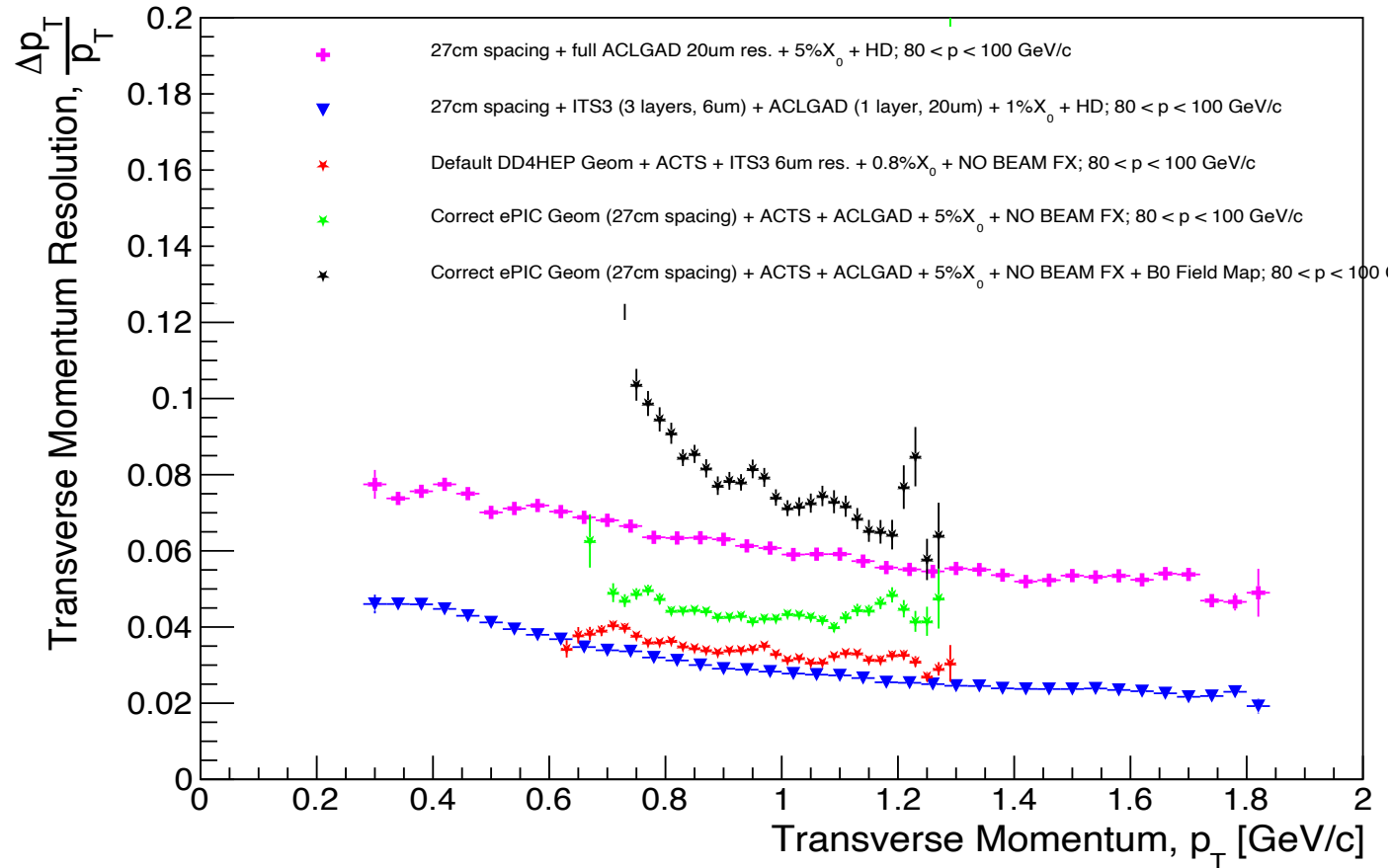
- Energy resolution  $\frac{\sqrt{E}}{E} \leq \frac{8\%}{\sqrt{E}} + 2\%$
- Radiation hard for forward environment
- Sensitive to soft ( $\sim 50$  MeV) and hard ( $\sim 100$  GeV) photons
- Accommodate available mechanical envelope

- Detector design:

- $\sim 135$  Scintillating crystals, each\*  $2 \times 2 \times 20$  cm, situated  $\sim 1$  m into magnet bore
- **Baseline** is  $\text{PbWO}_4$  crystals
  - Soft photon performance challenging
- **LYSO** crystals still being considered for low energy performance
  - CAVEAT: Not clear that LYSO crystals of reasonable size/**cost** can be obtained.

# Some key plots - Tracker

Study by Alex Jentsch



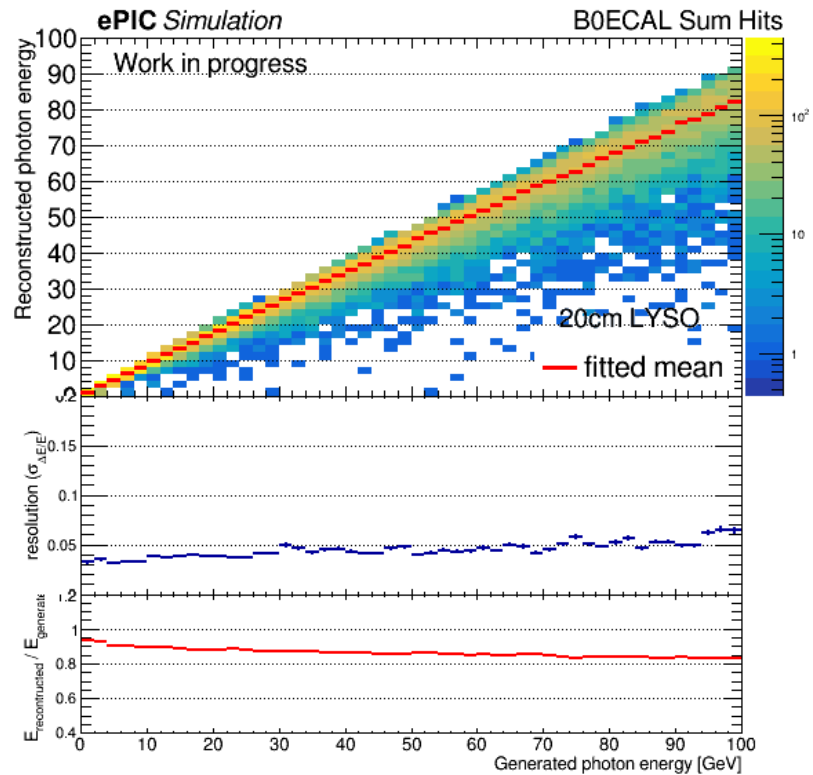
(old version shown)

Acceptance, Efficiency

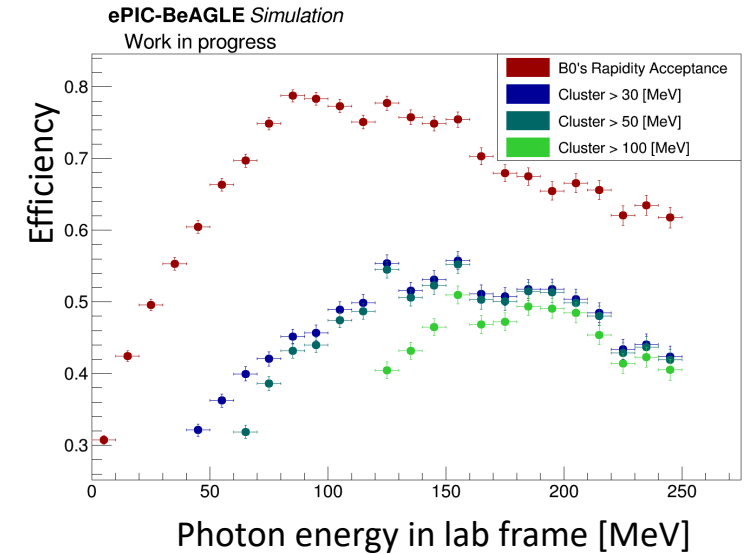
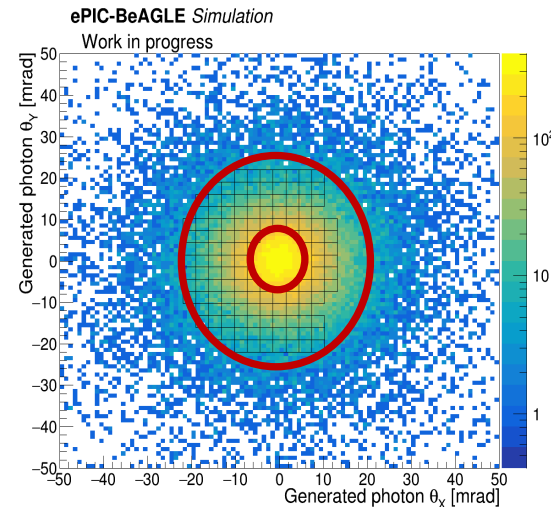


# Some key plots – EM Calorimeter

Study by Michael Pitt



(old version shown)



(old version shown)  
(soft photon version shown)

# Key Open Issues

- Installation and integration
  - Finalizing layout of detectors is top priority (determined by performance *and* installation constraints)
  - Support and installation rail system only roughly implemented
- EMCal crystal baseline is  $\text{PbWO}_4$ , not finalized
- EMCal readout scheme (including channel count) to be finalized
- Tracker resolution relies on charge sharing with AC-LGAD, performance after irradiation needs confirmation

