Photosensors and Electronics

Goals:

- To evaluate commercial photosensors for EIC PID detectors and to develop alternative, cost-effective photosensors (LAPPDs).
- To develop readout electronics for PID detector prototypes.

Activities:

- Evaluation of photosensors in high-B fields at JLab.
- Adaptation of LAPPDs to EIC requirements at ANL.
- Adaptation of readout electronics (U. Hawaii and INFN-Ferrara) to detector PID prototypes.

Sensors in High-B Fields

Goals

- Identify the limitations of current MCP-PMTs and provide guidance for development of new photosensors
- Find the optimal location and orientation of sensors in the EIC detector
  - Example: tilt angle with respect to the local B-field different sensor options
- Investigate suitable parameters for operations in high magnetic fields

FY18 progress

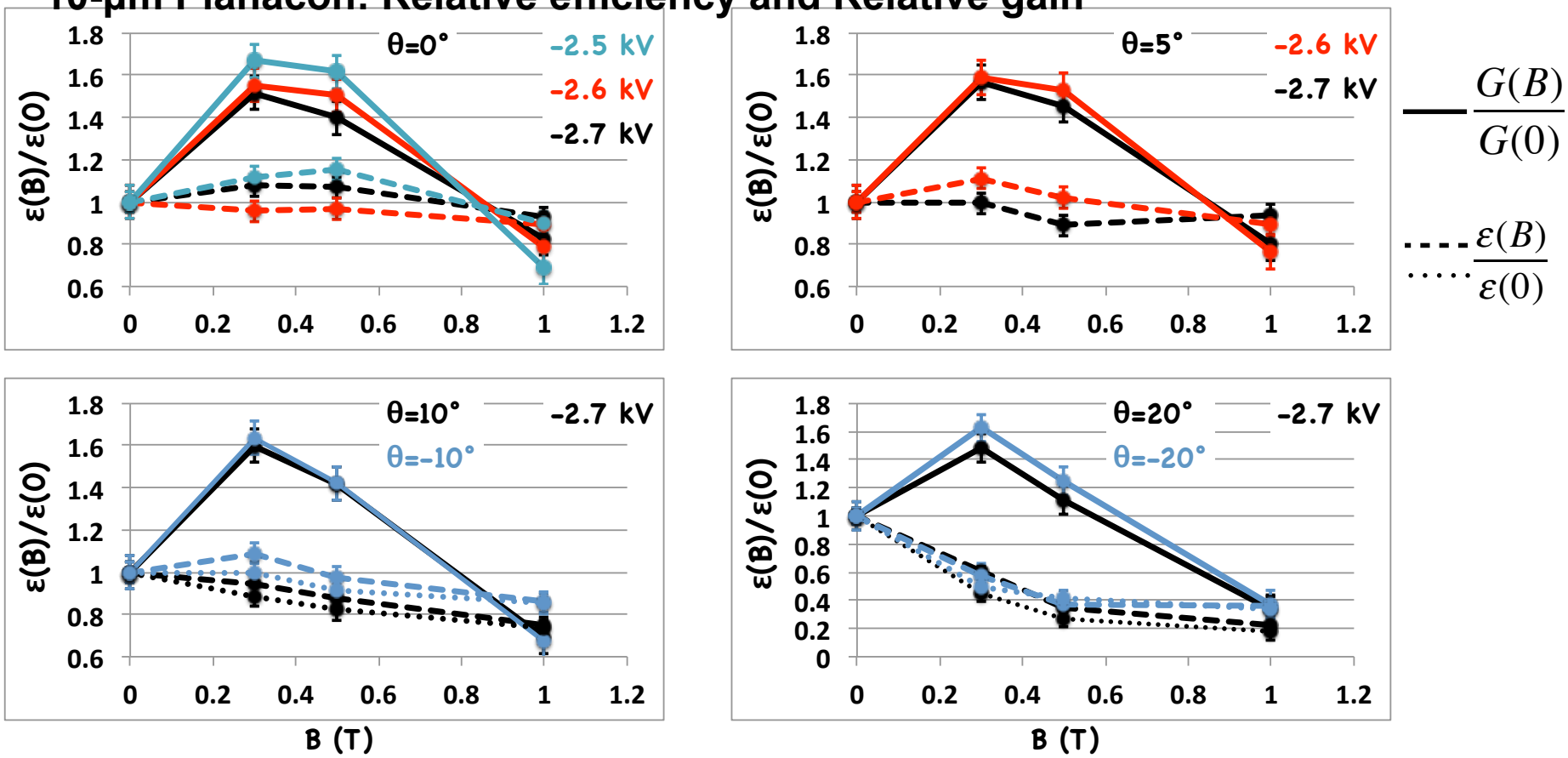
- Construction, installation, and commissioning of a timing upgrade for timing measurements (fast laser system, electronics).
- Efficiency evaluation of a 10-μm Planacon MCP-PMTs as a function of field, orientation, and $HV_{photocathode\text{-}MCP1}$.
- Ion feedback measurement as a function of HV and B-field magnitude.

Planned FY19 activities

- Timing measurements of a 10-μm Planacon.
- Some gain and efficiency measurements to understand trends observed in 2017-2018.
- Work on a simulation for optimization of MCP–PMT design parameters as time permits.

Results from Summer 2018 Efficiency Studies

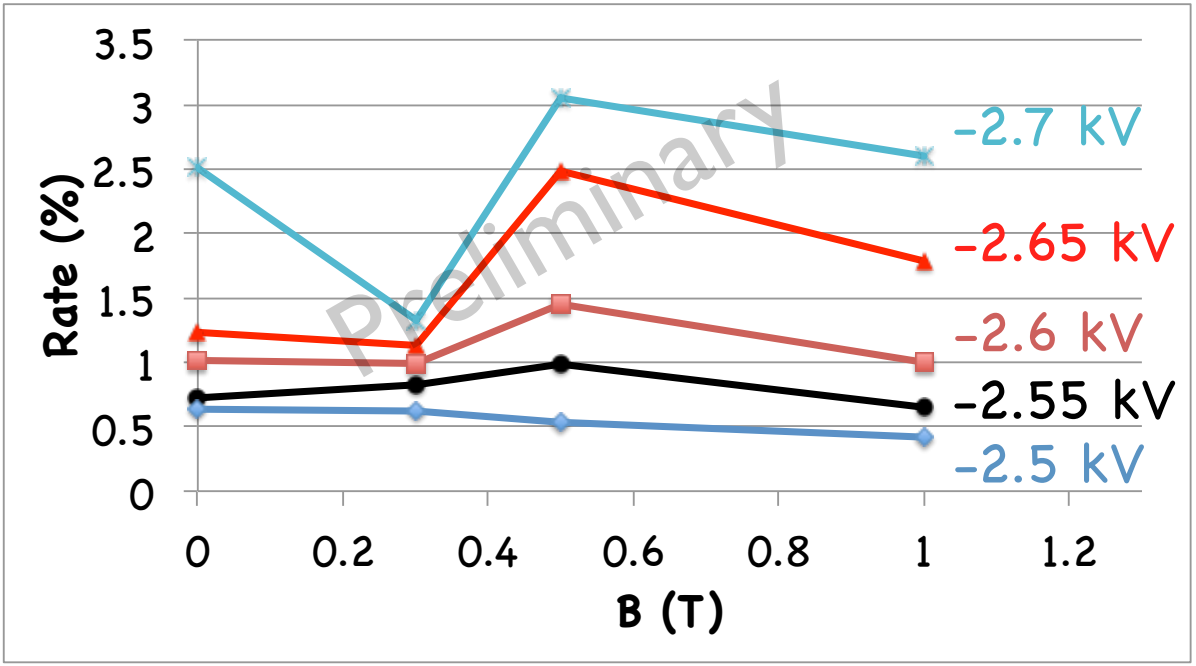
10-μm Planacon: Relative efficiency and Relative gain

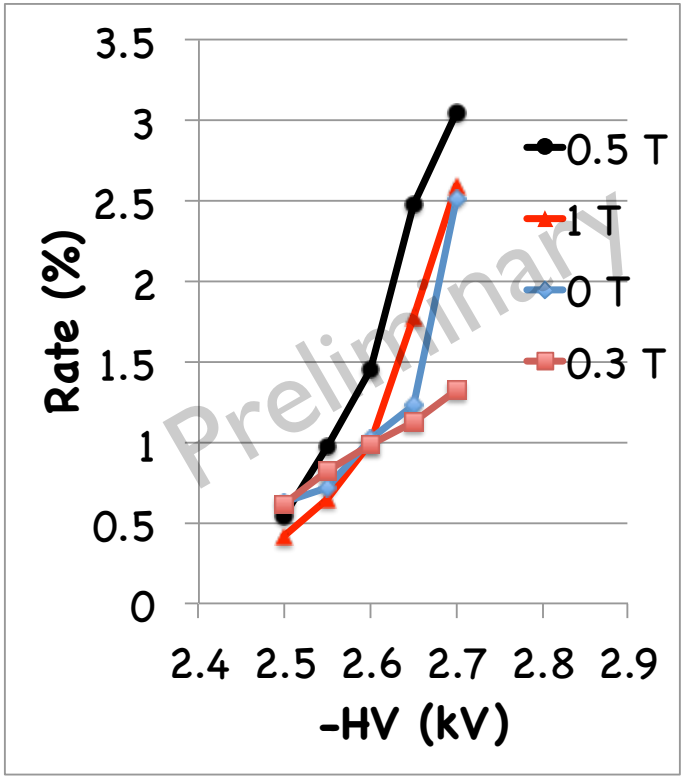


- Efficiency: $\varepsilon = N_{1phe}/N_{ped.}$
- At θ=20° between the sensor and the B-field axes, the efficiency drops continuosly as B increases even though the gain shows a maximum at 0.3 T.
- An increase of $HV_{photocathode\text{-}MCP1}$ by 200 V (close to maximum allowed) recovers only about 13% of the efficiency (θ=20°).

Results from Summer 2018 Ion-Feedback Studies

10-μm Planacon: Ion Feedback





- The accuracy of the extracted ion-feedback rate strongly depends on the noise of the signal line (pick-up noise and ringing need to be properly accounted for, waveform-by-waveform analysis is critical for accurate estimates).
- Ion-feedback seems to be driven by HV rather than B-field magnitude.