Light collection non-uniformity near the end of crystal
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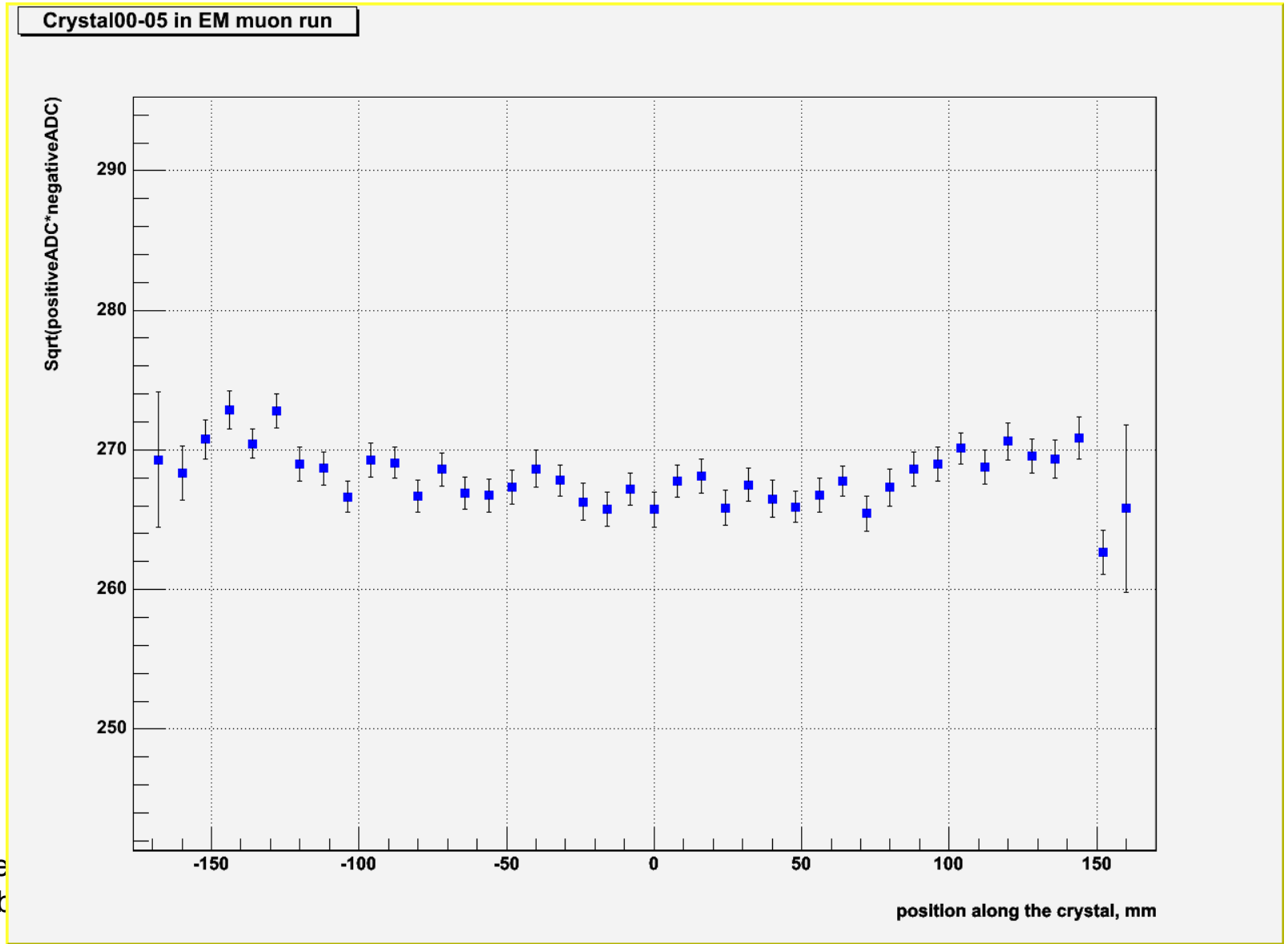
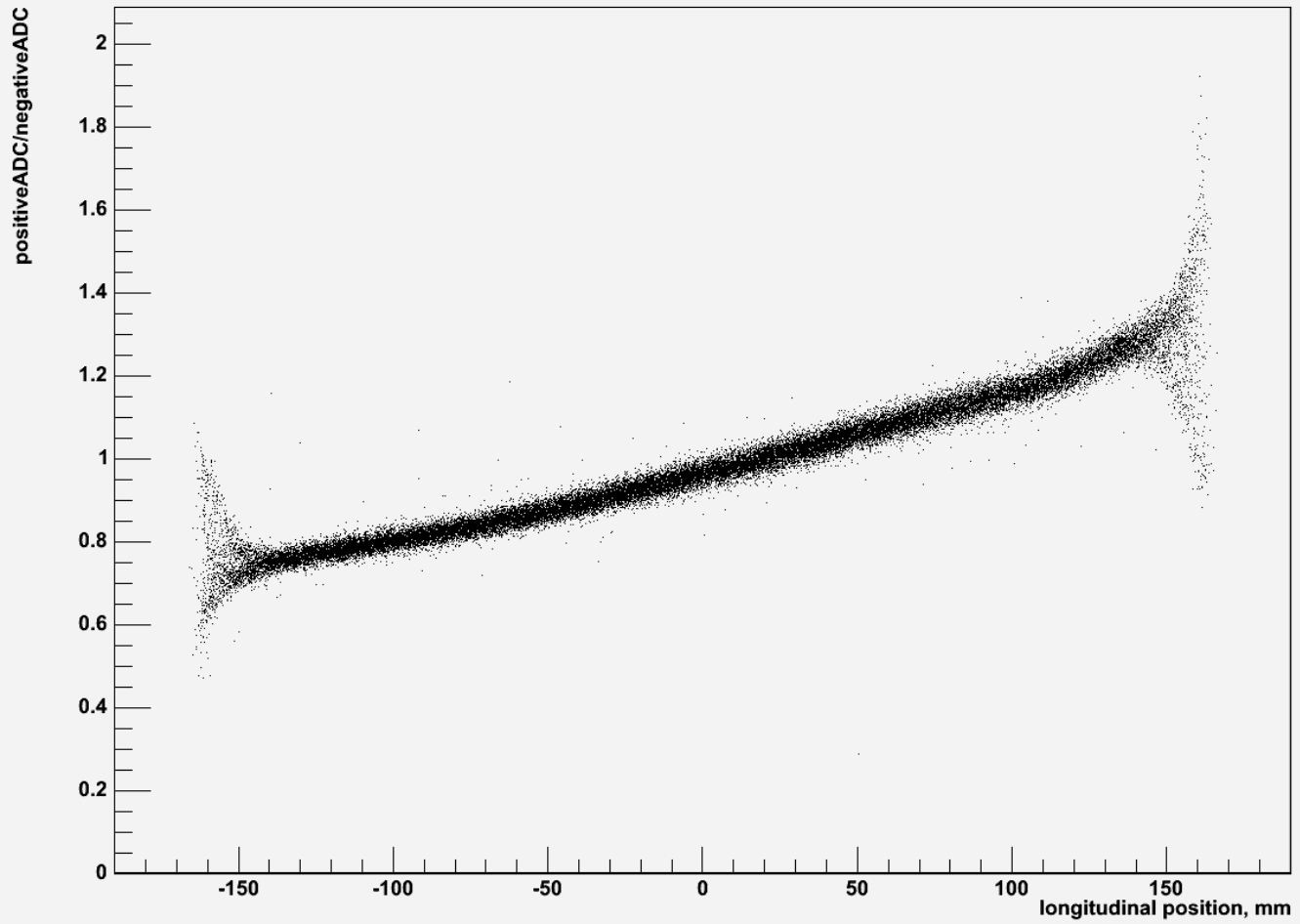
- **Task:** to investigate light attenuation/propagation in CAL crystals using TKR+CAL information
- **Data:** EM cosmic muons runs from SLAC (70 fits files). These have been converted to ROOT digi format, and then reconstructed using EM v2r0402p5
- **Code:** Xin's lightTaperCalib from calibGenCAL package
- **Approach:** one of the ways to parameterize the asymmetry and attenuation is to take a look at the product and the ratio of the signals from crystal's ends
  - if light in the crystal attenuates according to the exponential law then the product of the signals from the two ends should be a constant; the ratio of the two signals has small uncertainty (takes out Landau fluctuations). Combining the ratio and the product we can have tapering and asymmetry curves.
- **Event selection:**
  - $\cos(\theta) <= -0.95$ ($\theta <= 18.2$ deg)
  - only events with the signal higher than <pedestal>+10σ, plus the requirement that signals in 2 adjacent crystals are smaller than <pedestal>+4σ were considered, to cut off clipping events
  - pedestal subtracted, path length corrected
  - data from crystals 0-9 in layer 0 were studied in order to have accurate TKR data (crystals 10 and 11 have no statistics because of unconnected TKR strips).

Product of ADC signals from crystal's ends

- deviation from a constant reflexes the fact that the light taper curves are not perfectly exponential

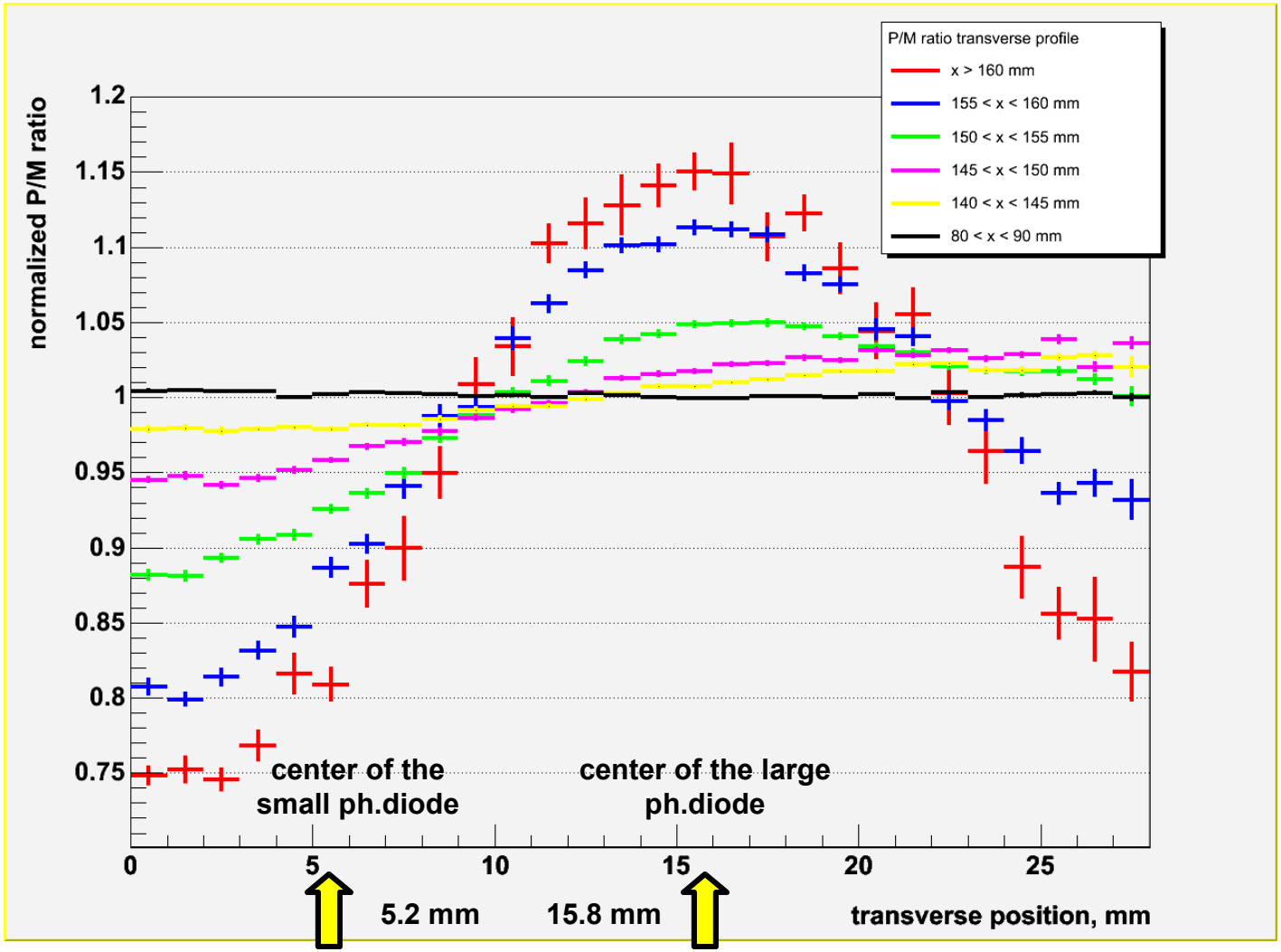


Ratio of ADC signals



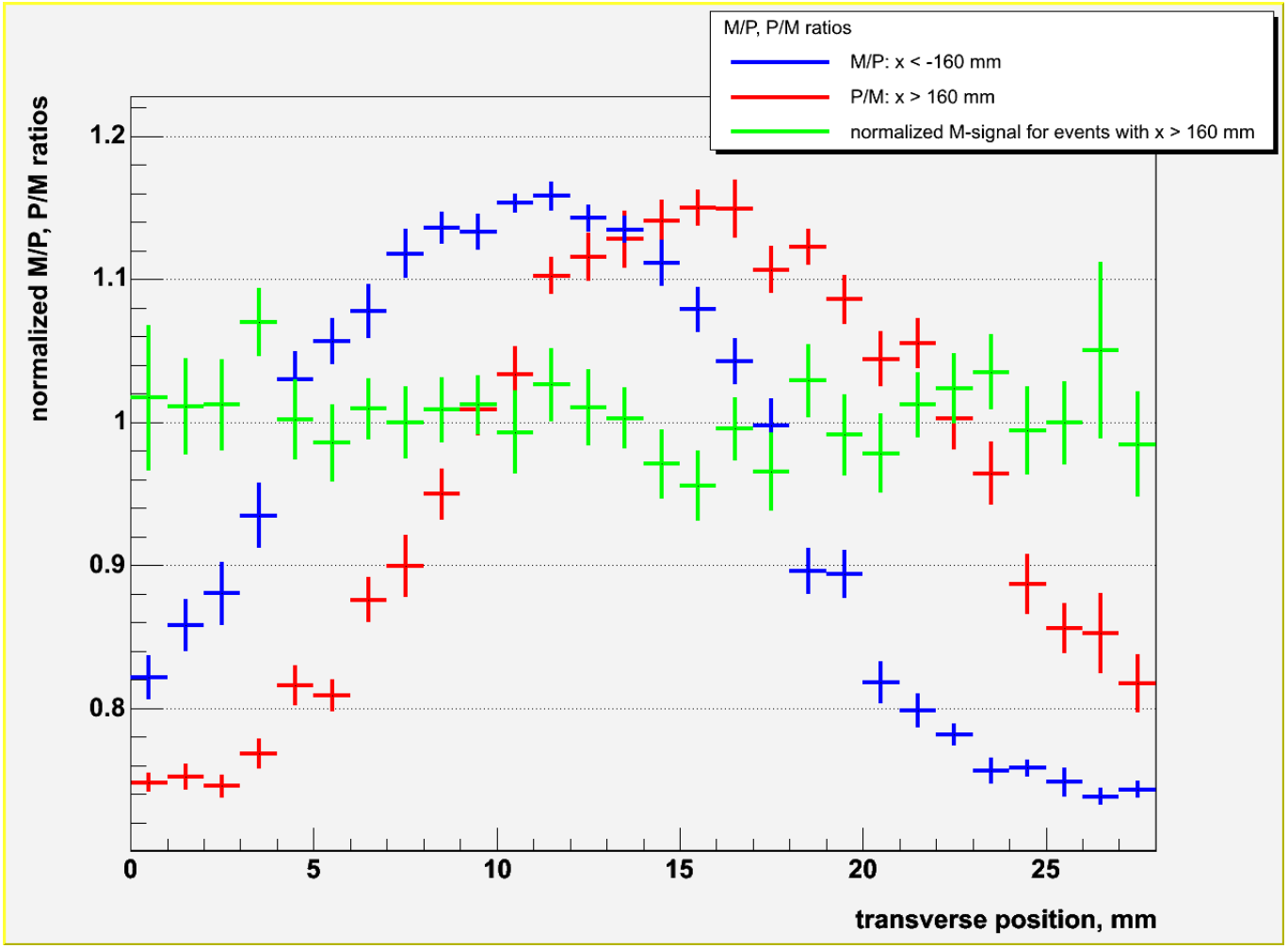
Transverse distribution of the signals ratio near the end

- looking at the signal from the large photodiode



Looking at the two ends:

- ratio NEG/POS near the negative end; POS/NEG near the positive end
- far end signal does not vary much (~2%) with the transverse position – light gets diffused on its way



Conclusion

- Strong non-uniformity of light collection near the diode does not allow to use the diode for precision measurement if scintillation is closer than 2 cm from crystal end;
  - it is better in this case to use only signals from the opposite crystal end.
- Non-uniformity also makes rather difficult the study of the signal from direct energy deposition to the diode,
  - this direct signal is difficult to distinguish from the scintillation signal modified by the non-uniformity of light collection.