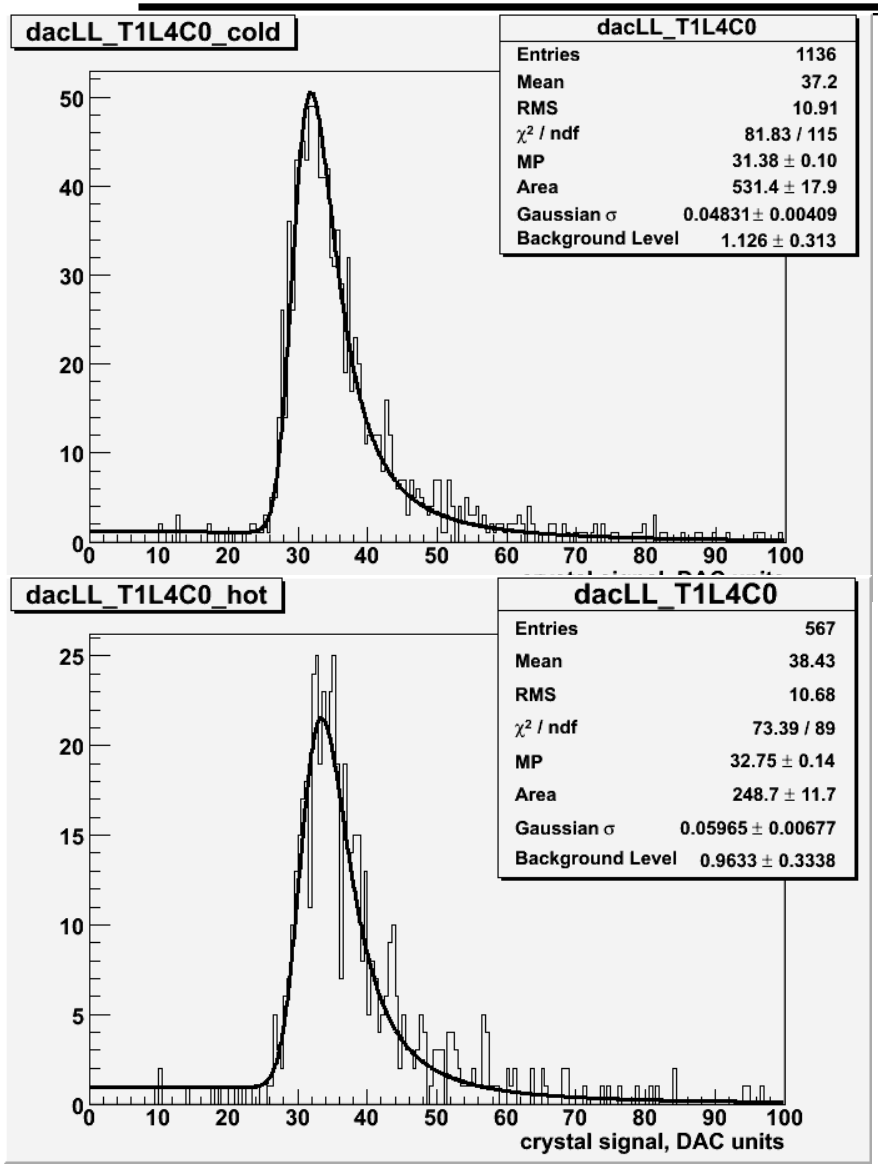
CsI light yield variation with temperature.

Alexandre Chekhtman
NRL/GMU

LAT TVAC muon runs

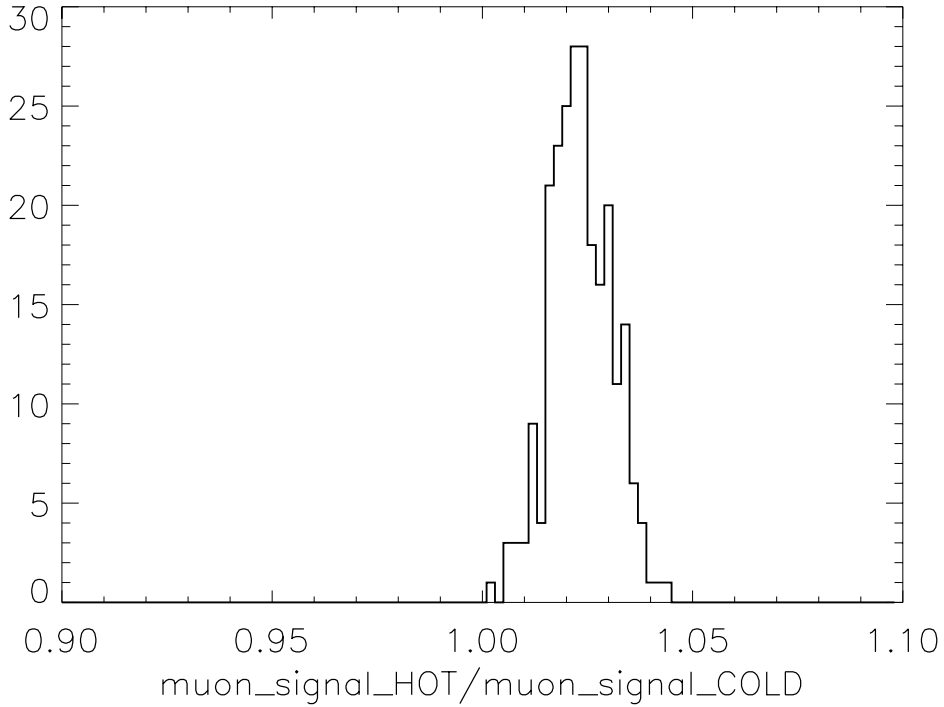
- hot LAT-71x runs at T~20 C, Jan 11, 2008 :
  - 11 runs (16651-16667) x 0.5 hour (7M events)
- cold LAT-71x runs at T~10C, Jan 21, 2008 :
  - 34 runs (16882-16905, 16914-16923) x 0.5 hour (14M events)
- To see just light yield changes, both data sets were processed by calibgenCAL using the same charge injection calibration
  - ADC to DAC conversion is identical for cold and hot data sets
- pedestals were defined individually for each data set

Fit of muon signal spectrum



- Landau function convolved with gaussian used for fit
- Landau sigma/MP ratio was fixed
  - Gaussian sigma was free parameter
- The asymmetric background was added to take into account the low energy tail due to residual muons with small pathlength

Hot/Cold muon signal ratio



- The mean hot/cold muon signal ratio is 1.024
  - This means 0.24% per degree C
  - This is consistent with BaBar paper, giving for CsI crystal with photodiode readout 0.29% per degree in the region between +10C and +30C

- G.Dahlinger,J.Brose, Temperature Dependence and Radiation Hardness of CsI(Tl) Crystals. BABAR Note#35, February 14,1997
  - http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.34.4553

Conclusion

- The effect is there, it is not negligible and has the correct sign (!), capable to explain some part of Data/MC discrepancy
  - To estimate we need to know what was the temperature when CU muon calibration data were collected (runs 276-285, July 14, 2006 - no temperature information for the moment).
    - Could be determined from pedestal drift with respect to a run with known temperature.