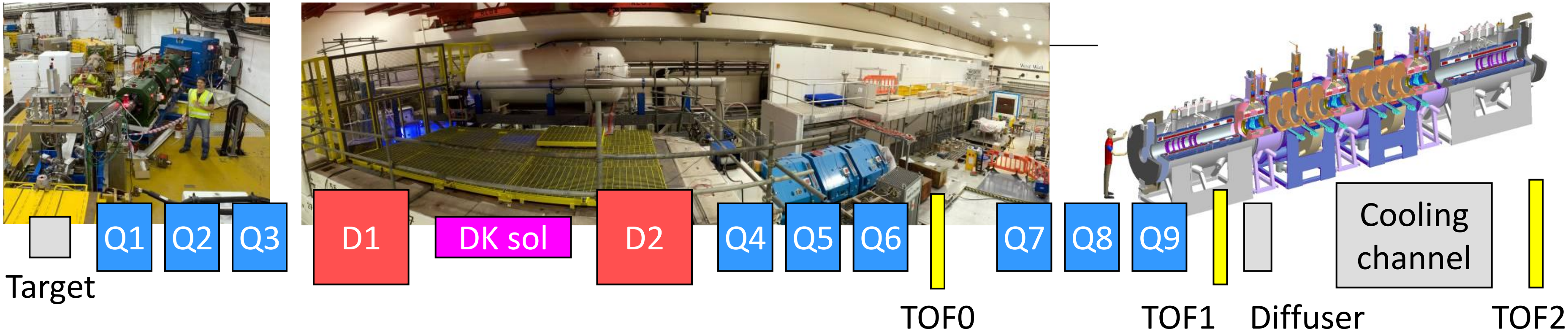
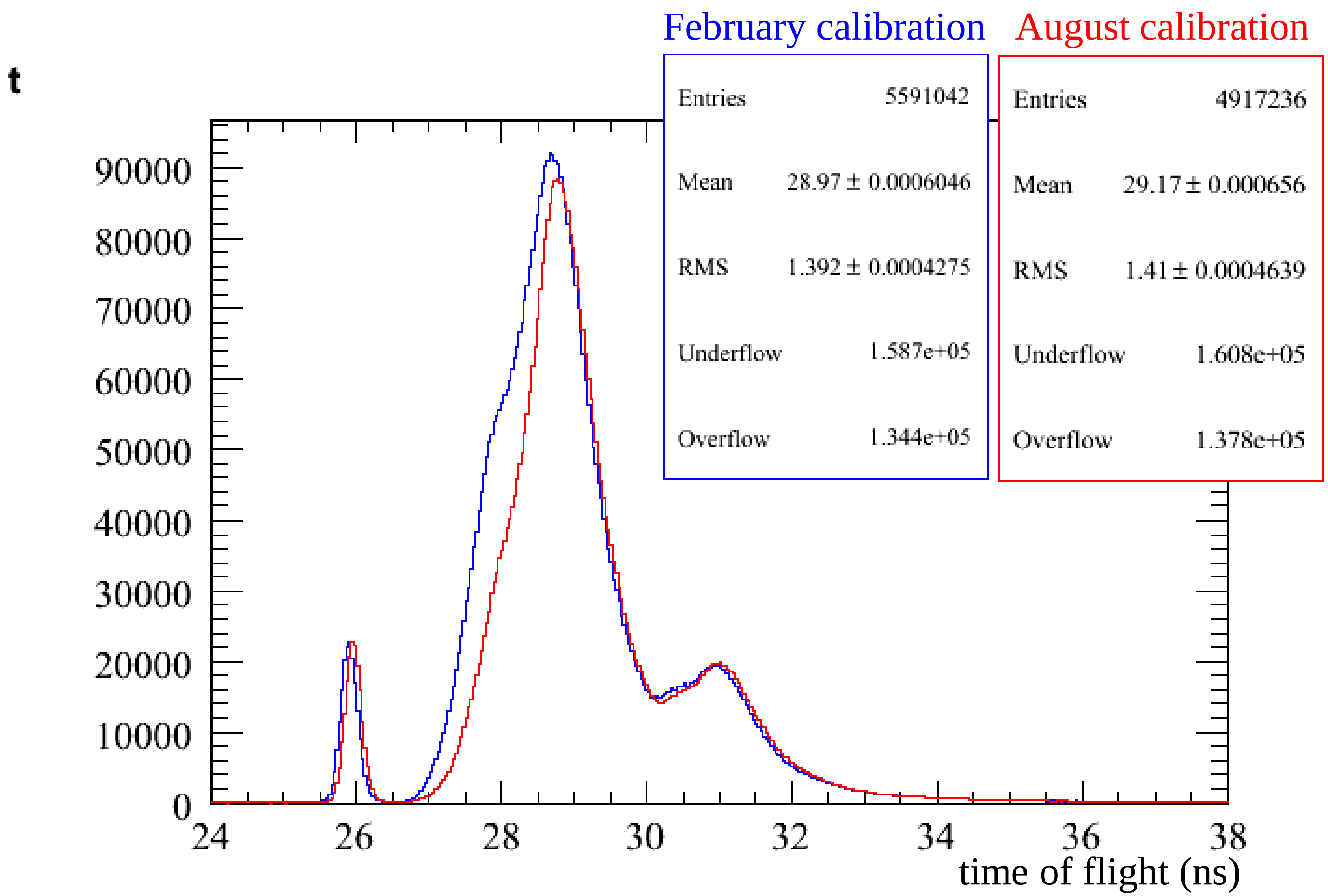


Stability of the TOF calibration and the effect on phase space reconstruction

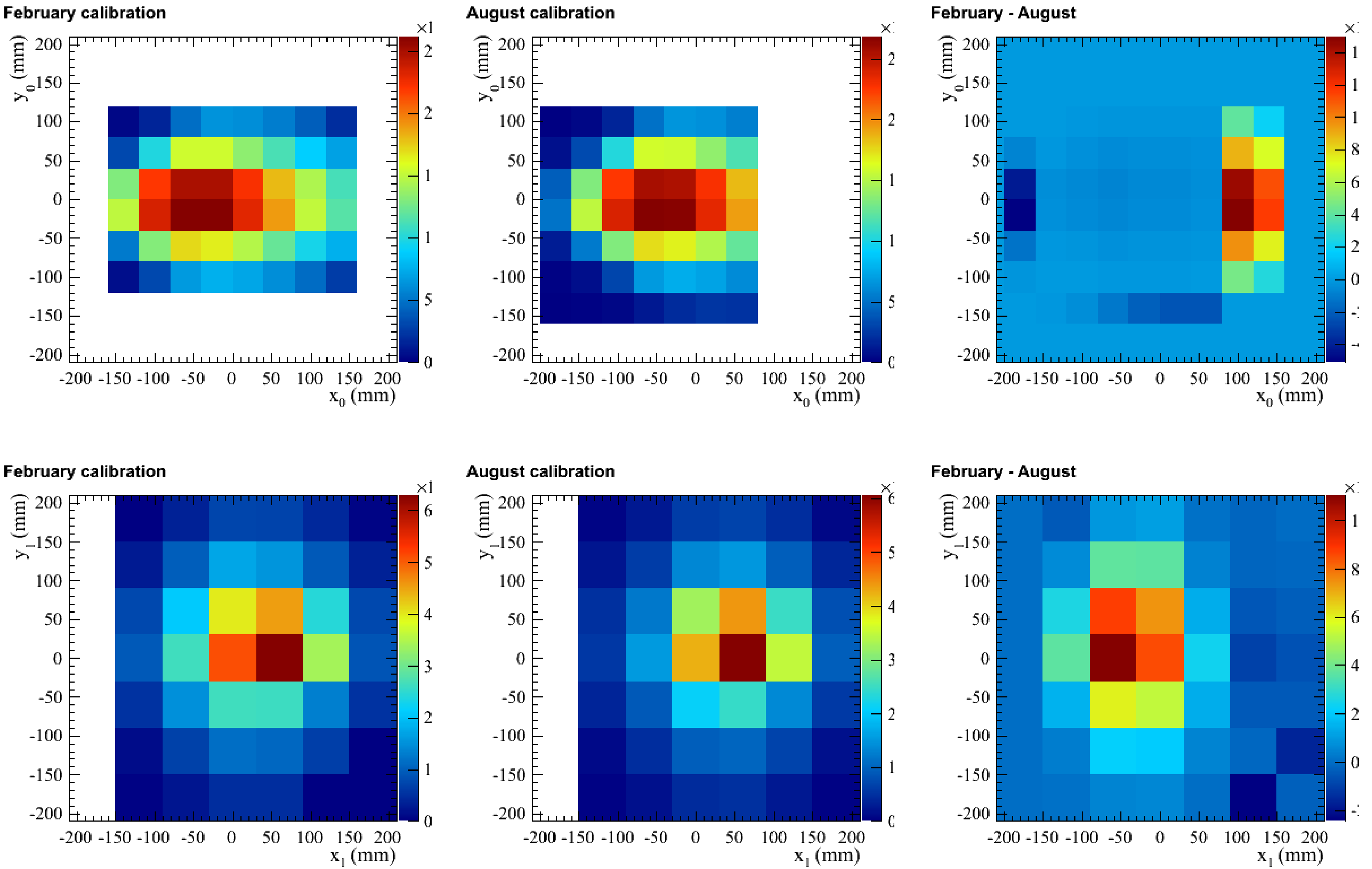
MICE CM28, 5th October 2010

Mark Rayner, University of Oxford

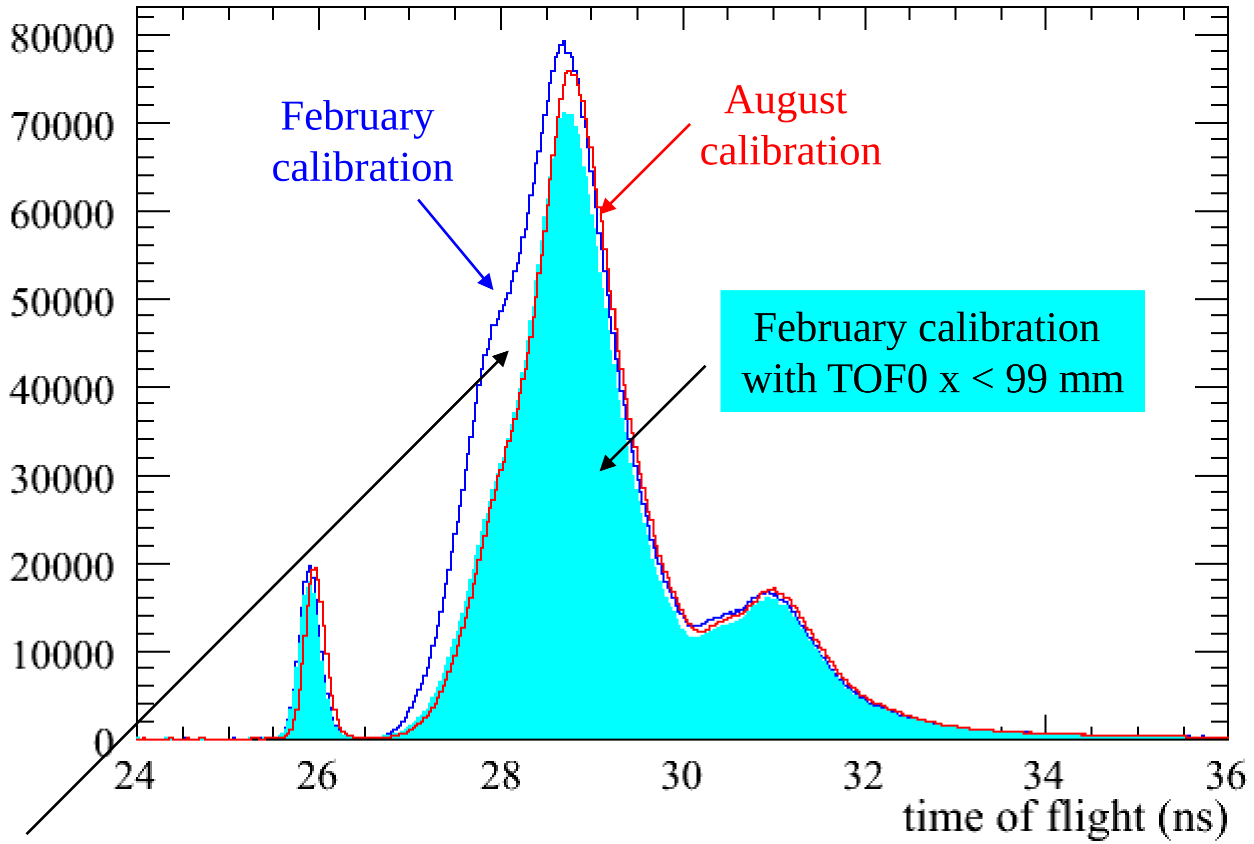
Calibrated time of flight, runs 1590 - 2896



Pixel coverage of the two calibrations

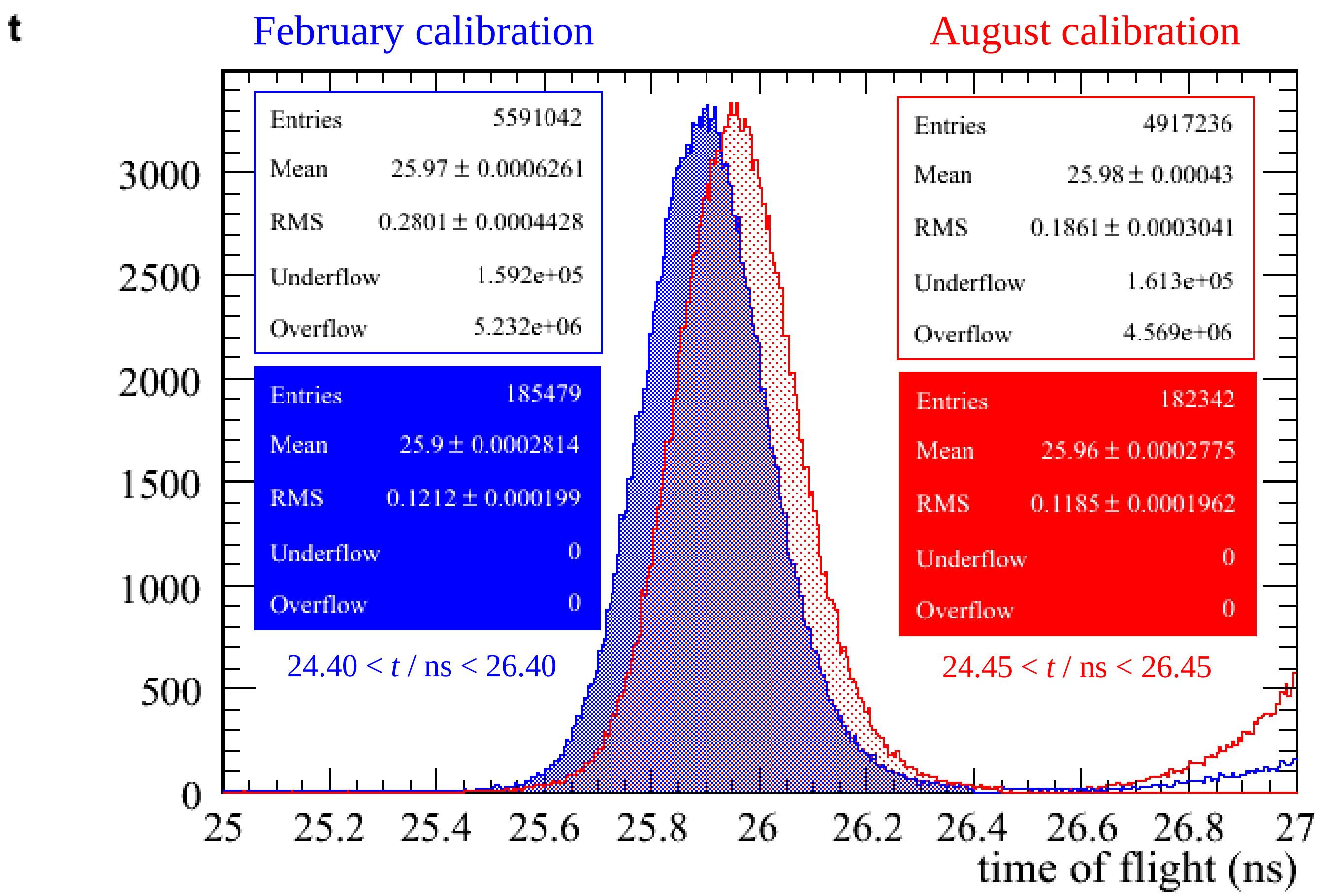


Dispersion leads to the fast muon depletion in August

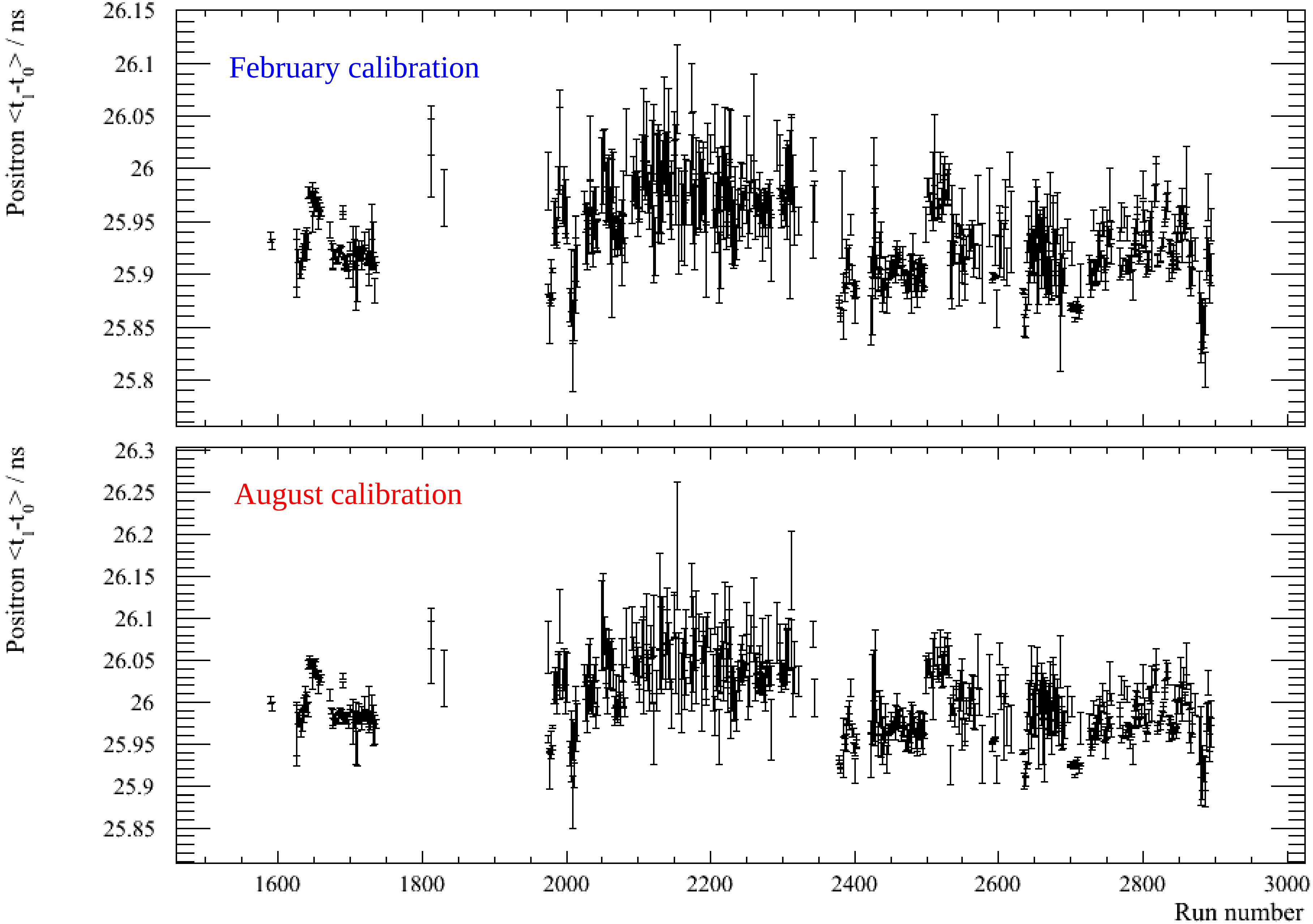


Dispersive beam line:
High p_z muons have TOF0 x >= 100 mm
Not yet included in the August calibration

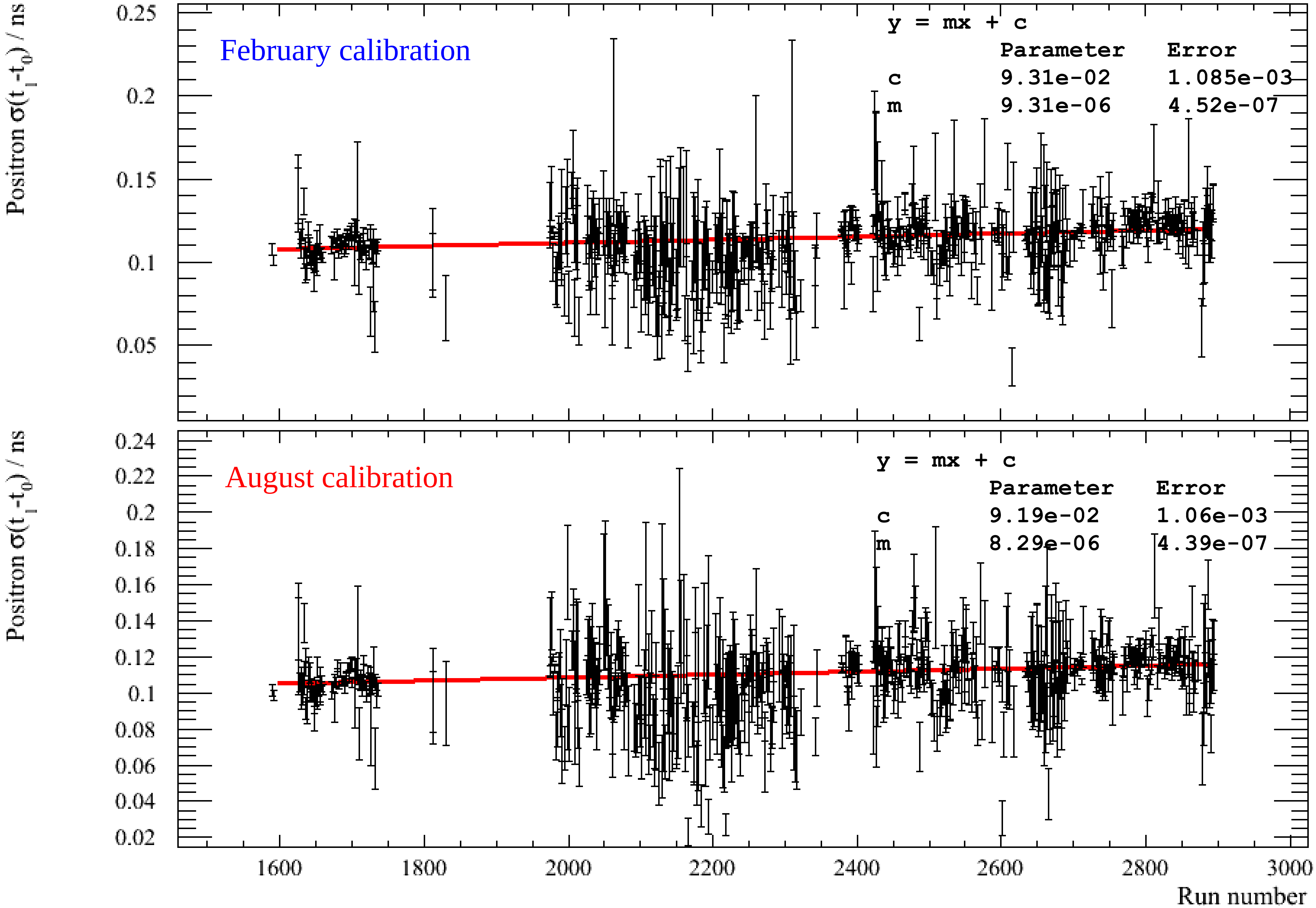
Calibrated e^+/e^- peak, runs 1590 - 2896



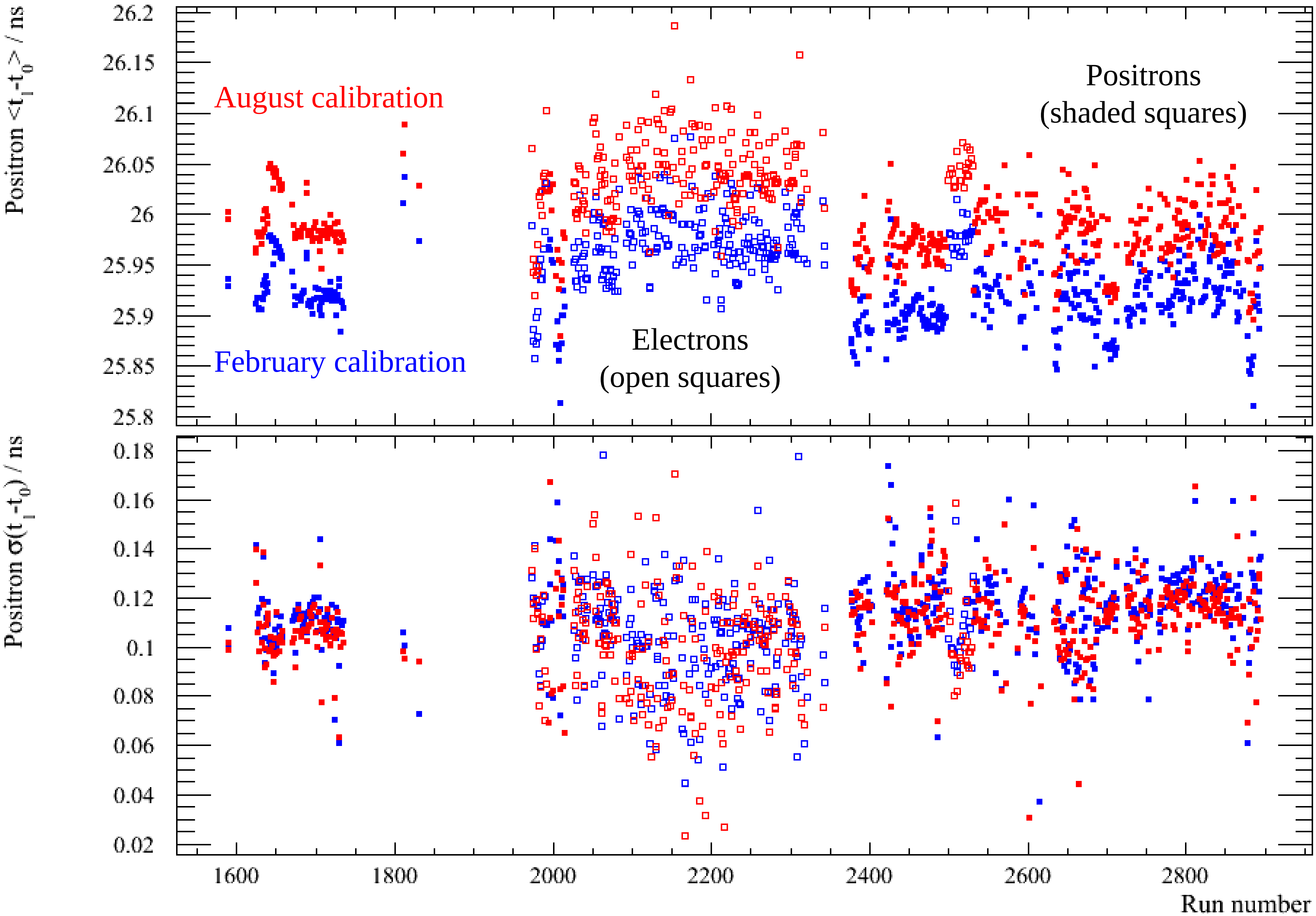
Mean calibrated e^+/e^- time of flight



RMS e^+/e^- time of flight

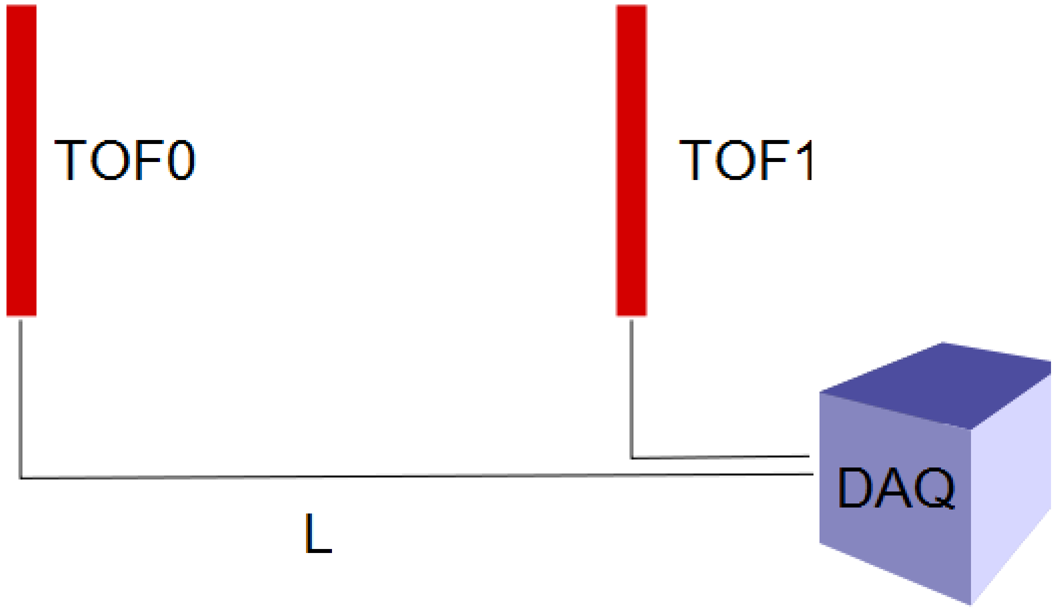


February/August comparison



Temperature variation?

- L ~ 8m?
- 1 ns = 30 cm / c (rather a handily round number)



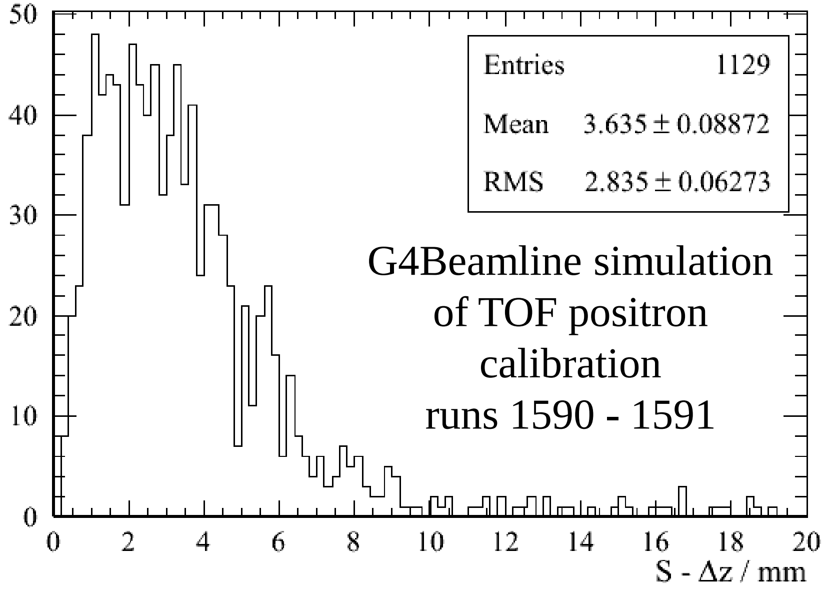
- Expansion coefficient of copper $\alpha = 16.5 \times 10^{-6}\ K^{-1}$
- Expansion governed by $\Delta L/L \sim \alpha\ \Delta T$
- Assuming L = 1 ns, $\Delta t / \Delta T \sim 0.0165$ ps/K
- 50 ps cannot be explained by temperature variation

Conclusion

- Bias on p given by bias on time of flight and path length

$$\frac{\Delta p}{p} = \frac{E^2}{m_0^2}\left(\frac{\Delta s}{s} - \frac{\Delta t}{t}\right)$$

  – Possible calibration drift of order 50 ps * c = 15 mm
  – G4Beamline simulation of positron path length = 4 mm + Δz



- Can we explain the positron time of flight width?
  – (TOF resolution of 70 ps)^2 + (MC path length width of 10 ps)^2 != (Observed 100 ps)^2
  – Tilt ➔ 6 mm ➔ 20 ps
- 0.5 ns shift in muon peak ➔ 12% momentum shift at 250 MeV/c