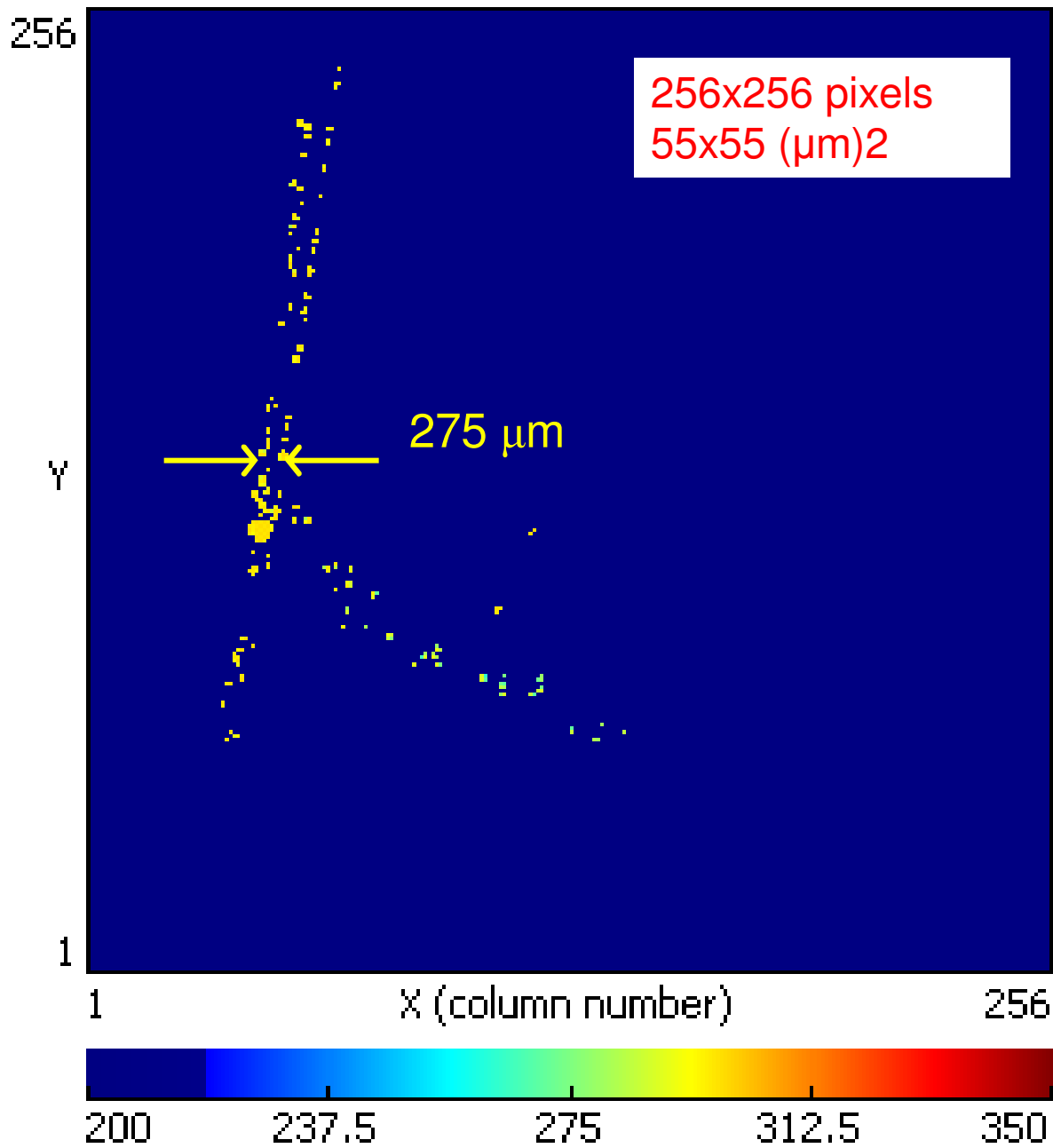# Compare TPC performance of pad with pixel readout at ILC and CLIC

Introduction
TPC simulation discussion
Bonn, 12 February 2010

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Pad readout vs. Pixel readout

- Pad size ~1x5 mm^2 or ~3x7 mm^2
- Timepix pixel size 55x55 (μm)^2

- Pad TPC ~ 10^6 pads; several 10^9 3D-voxels
- CMOS pixel readout ~ 2.10^9 'pads' (but 'only' ~ 4.10^4 chips); ~ 10^{12} 3D voxels

\# pads/pixels might be problem for software, but occupancy rather low

256

256x256 pixels
55x55 (μm)2

275 μm

Y

1

1   X (column number)   256

200   237.5   275   312.5   350

Two-track separation:

•Will be diffusion limited

•In this example:

5 pixels = 275 μm

Diffusion at 4T in

Ar/CF4/iC$_4$H$_{10}$ is

~ 20√200 = 300 μm

My 'dream' plans are:

- Compare pads with pixels for ILC/CLIC TPC
  - Single point resolution (RΦ (and z?)); also track angle dependence!
  - Corresponding momentum resolution, for single (muon) tracks and tracks in e.g. ttbar evts.
  - 2-track separation (definition?) and tracking efficiency in ttbar events
  - dE/dx (pulse heights truncated mean vs. cluster counting

Several questions already (probably many to follow)

- What tools exist already (in MarlinTPC)?
- Role MarlinTPC ↔ full ILD simulation?
- Should one start with simplified geometry (in case of single muon tracks)?
- Who has done something similar already in the (recent) past? Are these tools/codes properly archived?
- Contact other LCTPC/ILD groups who may be interested to join in?
- In particular other FLC people interested?

Questions cont'd

- Once implemented could be 'simply' extended to CLIC energy? But large 2-photon event overlap!

  (CLIC CDR machine + detector due ~Apr.2011)

- Ultimately (>2012) comparison using data from LP possible?

- Comparison TPC vs SiD-like tracker?

"Summary"

- Pixel readout very promising technique
- Issues are (still) robustness, large(r) detectors. Work going on.

  My guess is still that pixel readout:

- Should lead to improved RΦ resolution
- Better two-track separation (< 1 mm possible)
- Possibility of cluster counting (dE/dx)