Preview of laser data analysis

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Brief introduction to the laser system

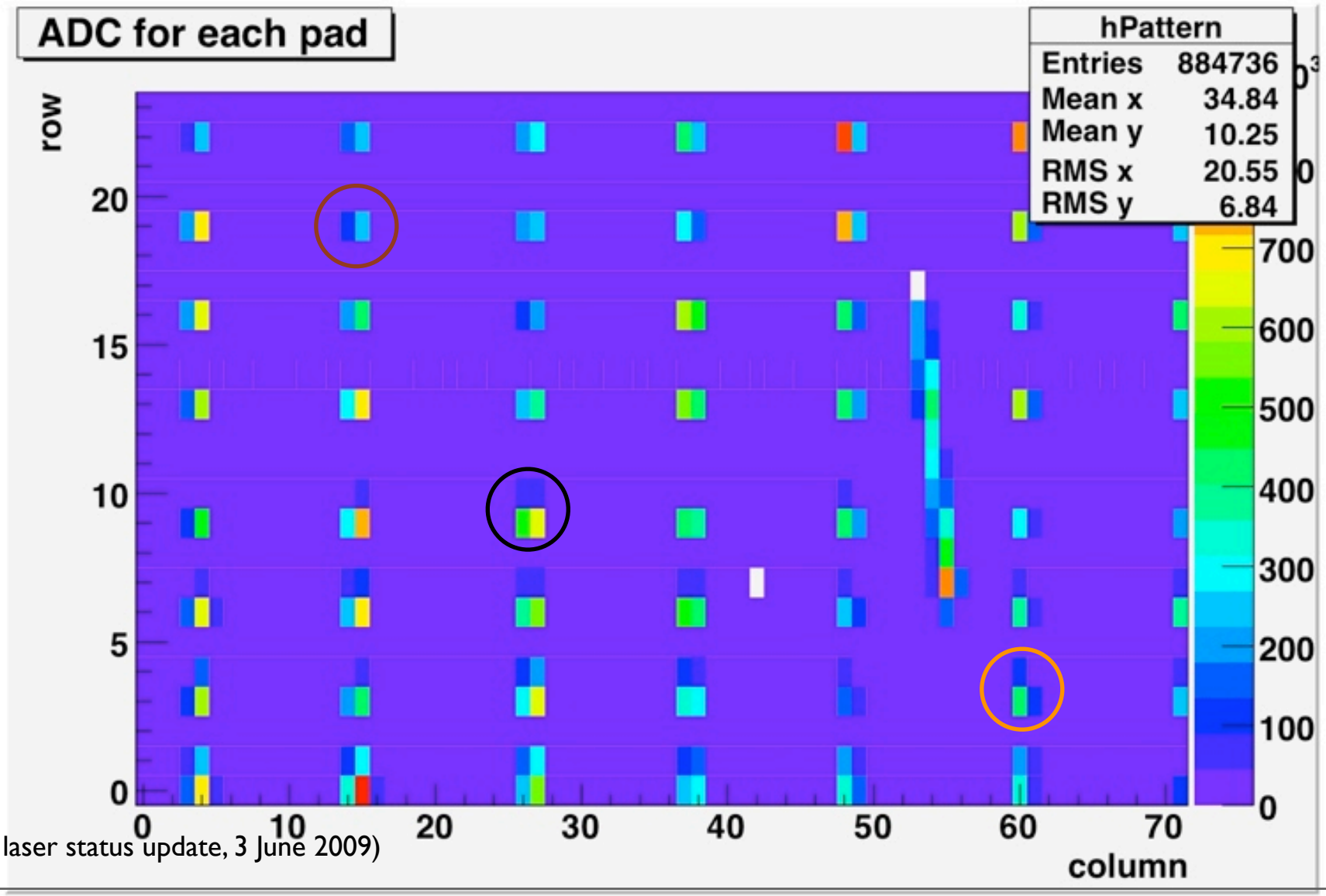
- Pulses UV laser shines diffuse light into the TPC drift volume from the anode
- Light pulses create photoelectrons on the aluminum cathode pattern
- Photoelectron clouds are recorded by detectors; locations of clouds give a 2D image of magnetic field distortions, plus other information

Status of analysis code

- Only recently reached a usable point
- Cannot yet perform full analysis of laser data
  - No transverse diffusion
  - Cannot separate overlapping hits
  - Results must be manually interpreted if strong distortions exist

Observing distortions from B inhomogeneities

- z=15cm position (homogeneous field) (total of 500 events)

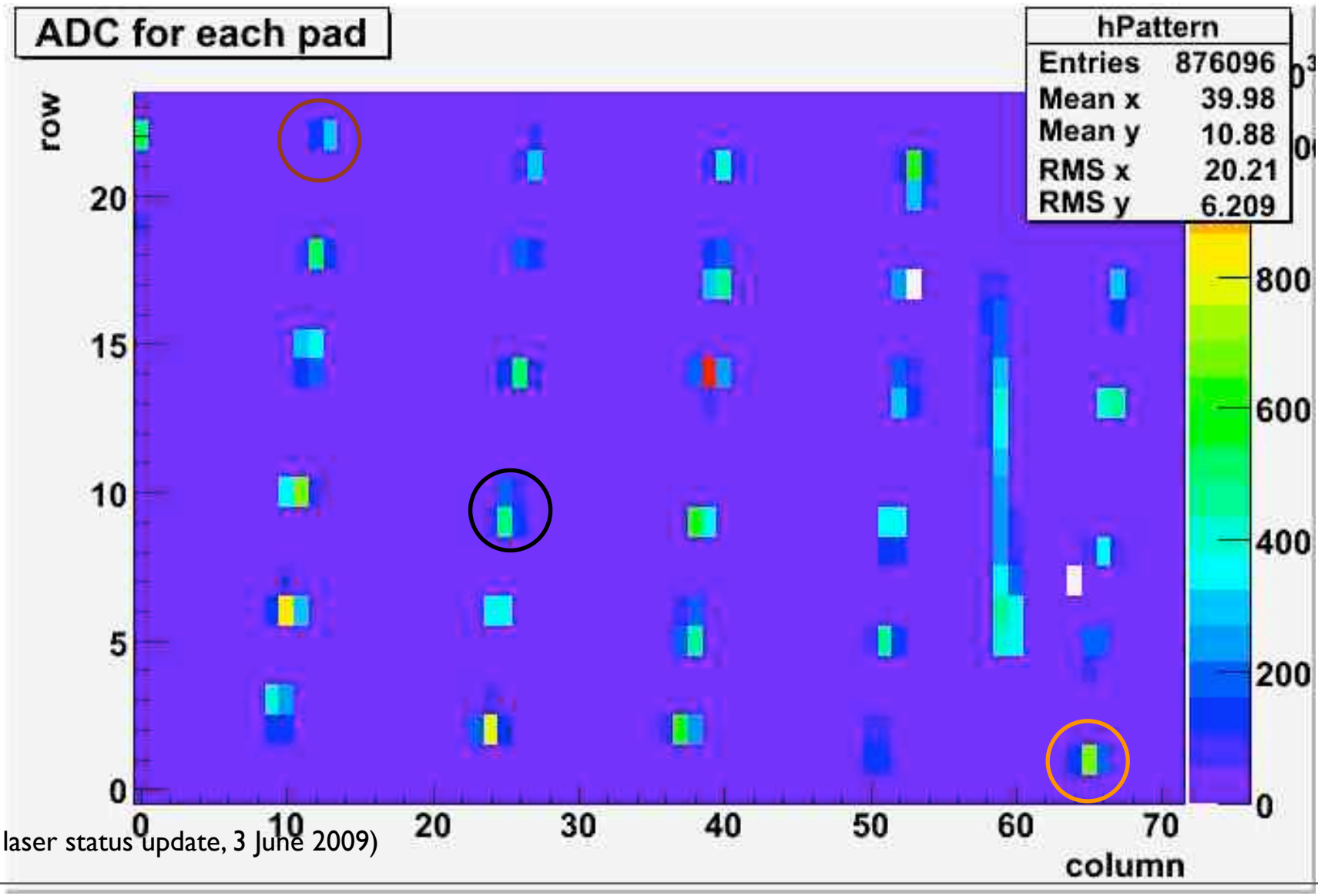


(Taken from laser status update, 3 June 2009)

Run 638

Observing distortions from B inhomogeneities

- z=50cm position (inhomogeneous field) (total of 500 events)



(Taken from laser status update, 3 June 2009)

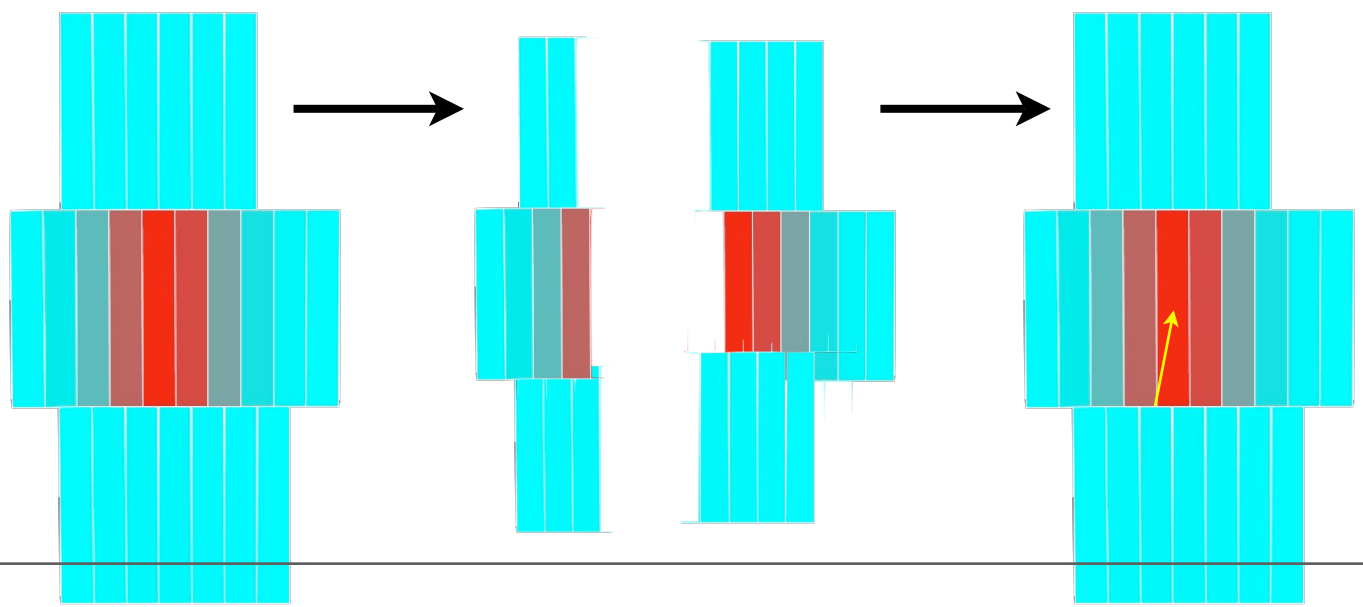
Run 636

Methods for calculating centre of photodot images

- Centre-of-mass calculation
  - Calculates hit centre using a weighted mean of charges and pad coordinates
  - Advantages: simple, does not require knowledge of transverse

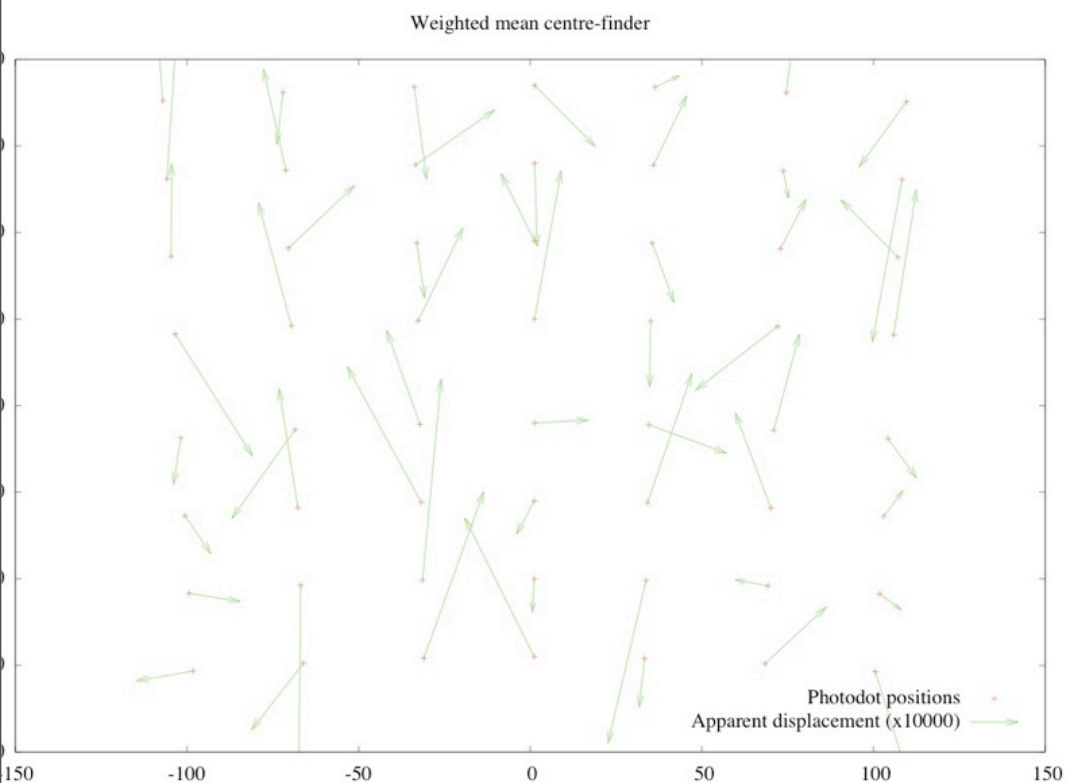
Methods for calculating centre of photodot images

- Error function calculation
  - Hit is divided into quadrants around an approximate centre
  - Fraction of charge on each side of intersection of quadrants gives a displacement from the approximate centre to the real centre
  - Advantage: high accuracy

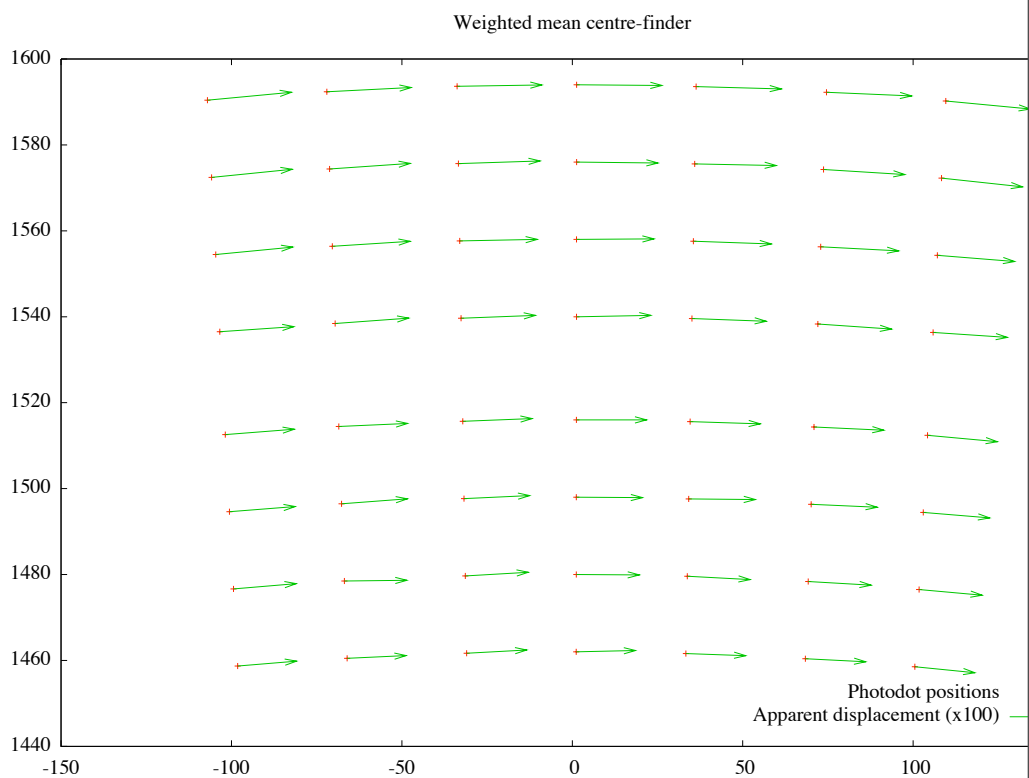


Precision: weighted mean

Ideal magnetic field
(no x- or y- distortion)
•Precision after 500 events: 39μm



Non-ideal magnetic field
(All dots shifted 1/2 pad clockwise)
•Precision after 500 events: 200μm

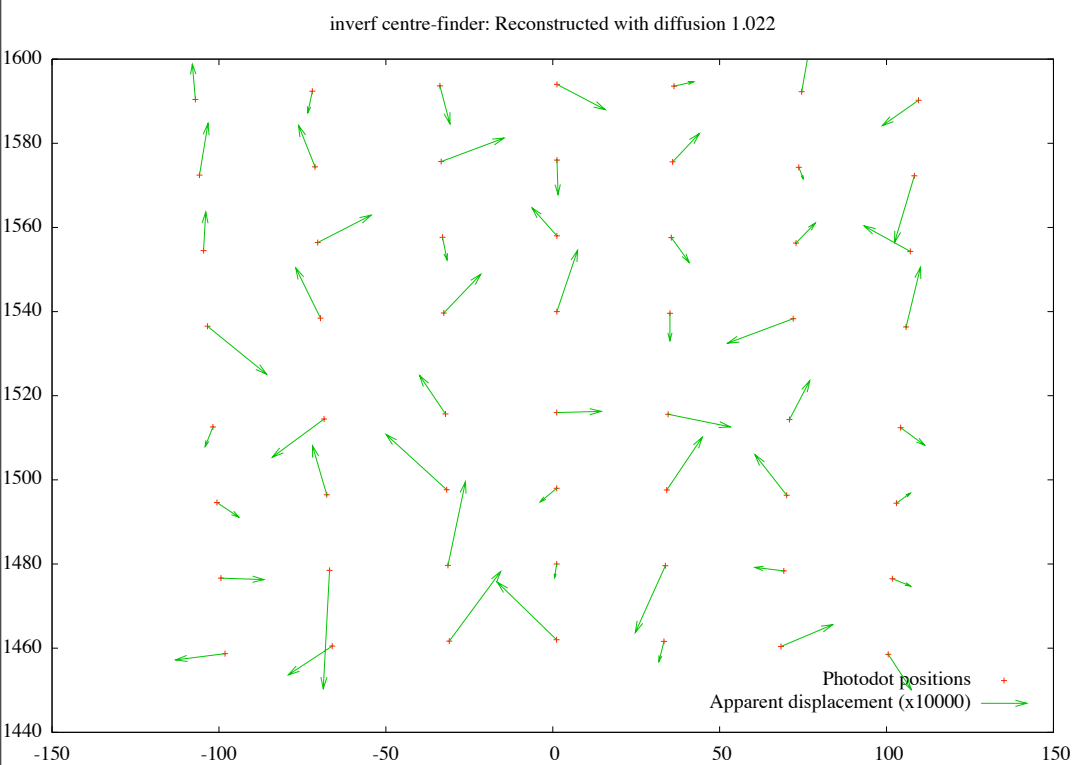


Hit appearance:

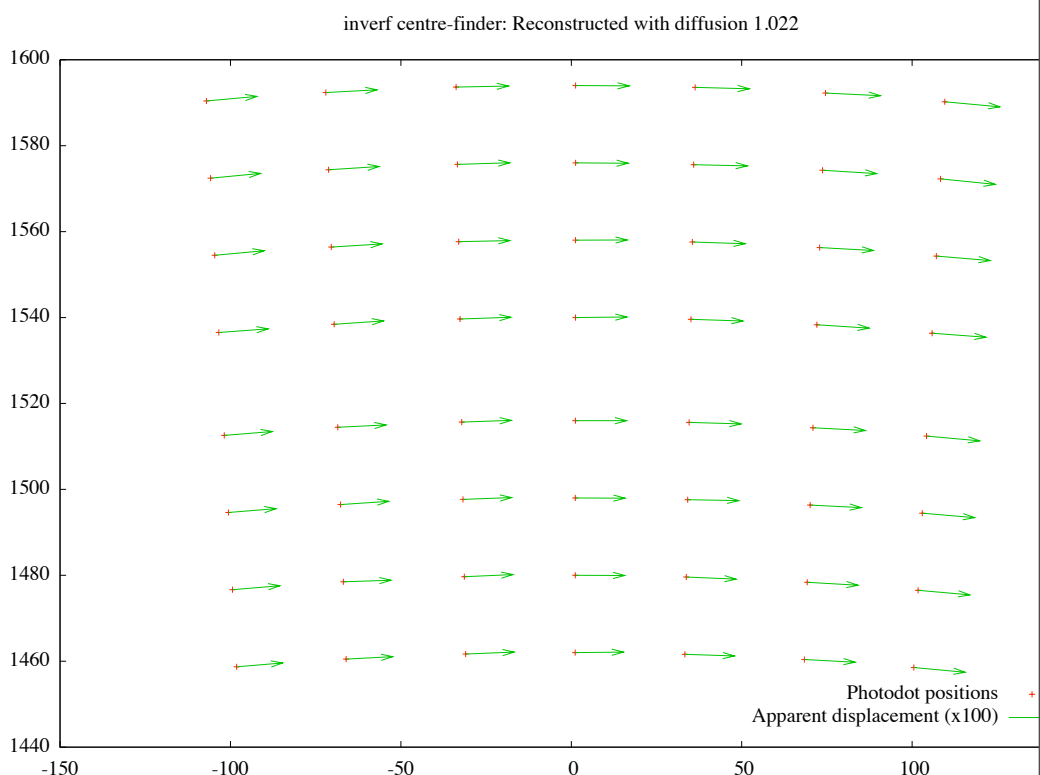
- In larger hits (for example, in a 0T field) precision can be expected to be higher

Precision: Error function

Ideal magnetic field
(no x- or y- distortion)
•Precision after 500 events: 22µm



Non-ideal magnetic field
(All dots shifted 1/2 pad clockwise)
•Precision after 500 events: 150µm



- In larger hits (especially in 0T field) precision can be expected to be higher

Summary

- Analysis code will soon be tested with data from the Saclay micromegas detector in May.
- Improvements to the code will allow for calculation of drift velocity, diffusion, and matching of cathode dots to images in strongly-distorting fields.
- Changes to the laser system will hopefully create higher electron counts, allowing better precision.