status of the PADME-Target simulation software

Viviana Scherini and the Lecce Team

Outline

Status of

- TargetDigitizer.cc
- TargetGeometry and Messenger
- TargetReconstruction

TargetDigitizer.cc

- TargetDigitizer.cc module for:

  - hit mapping (channel calculation)
  - raw waveform construction (including CCD)
  - signal processing (noise, filter)

- TargetRootIO persistence of TargetDigi in root file
  time, energy, multiplicity, charge, waveforms (filling optional)

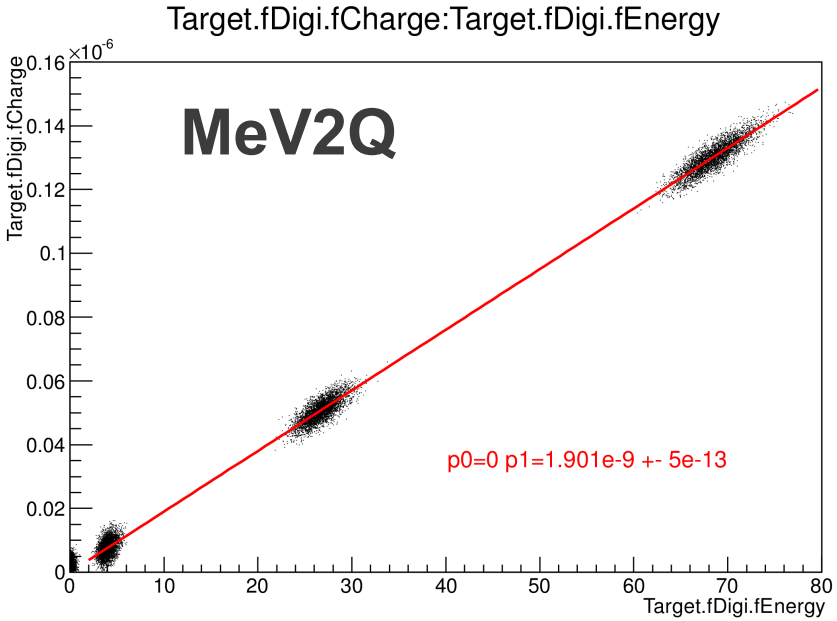
→ handling of parameters via datacard (Geometry-Messenger)
  - fast / full and light modes
  - noiseRMS, threshold ...

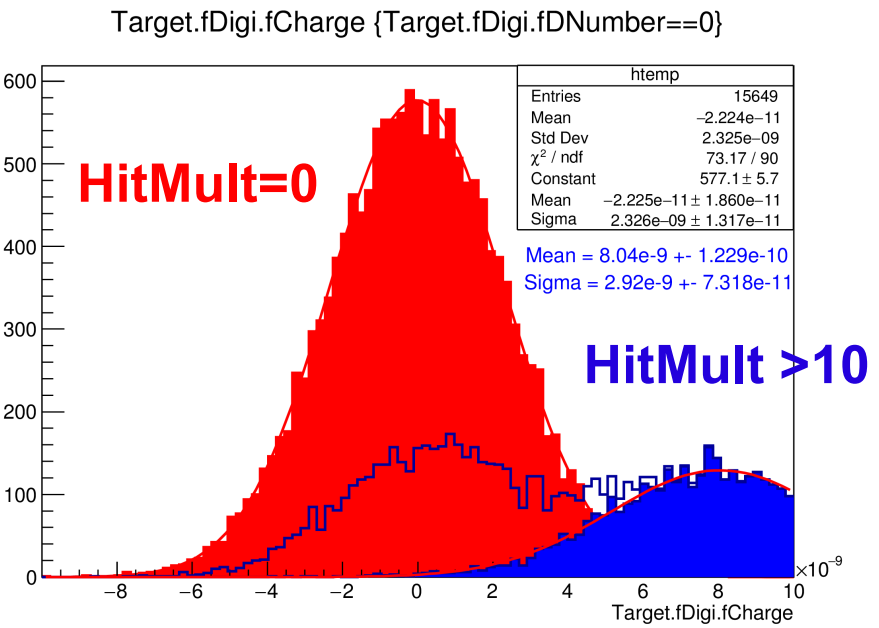
TargetDigitizer: Fast

`/Detector/Target/EnableFastDigitization  (default)`

- Charge from conversion of G4 dEdX → **calib factor MeV2Q**

- Noise: random charge RMS from full MC study (parameter variation as a function of noise RMS)





noiseRMS = 0.87 uA

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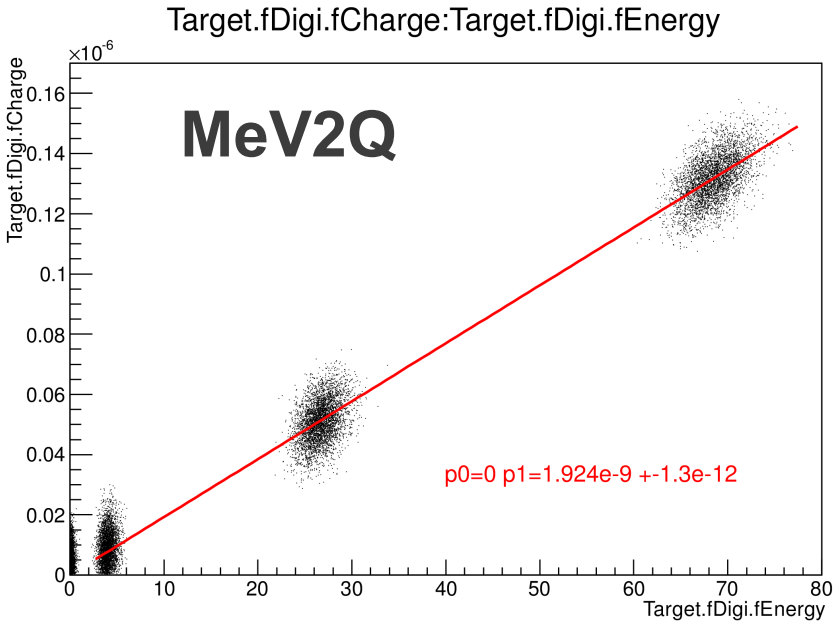
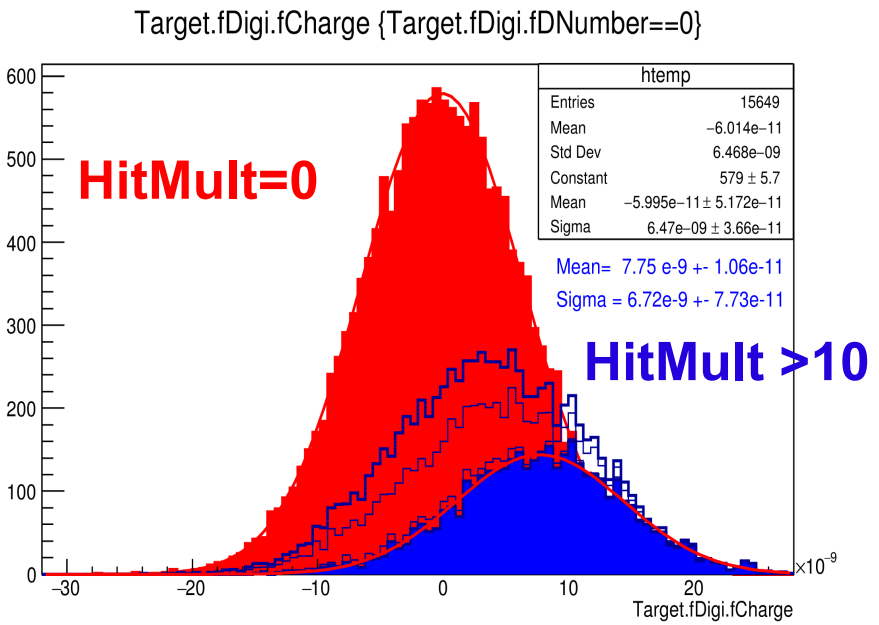
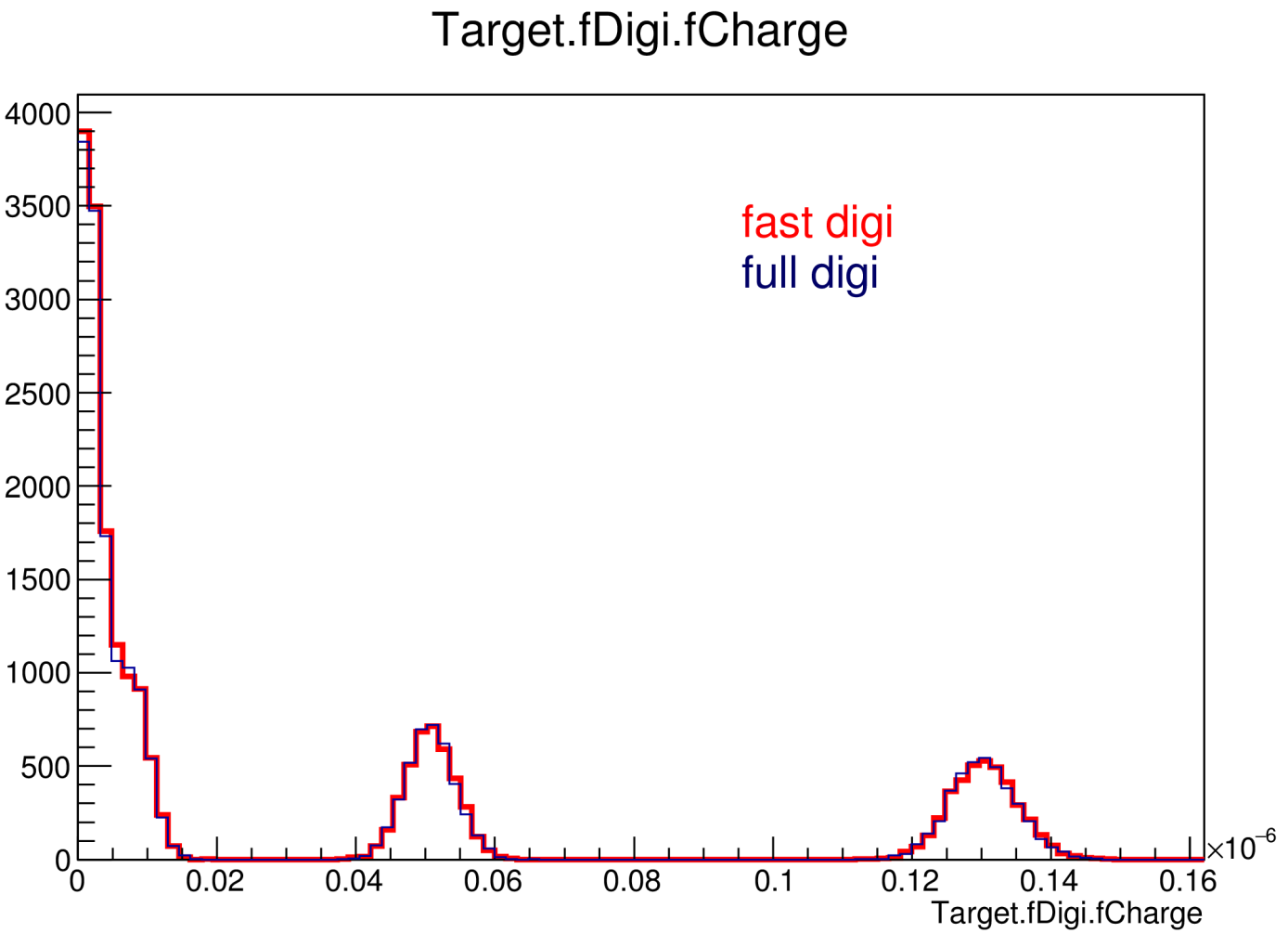




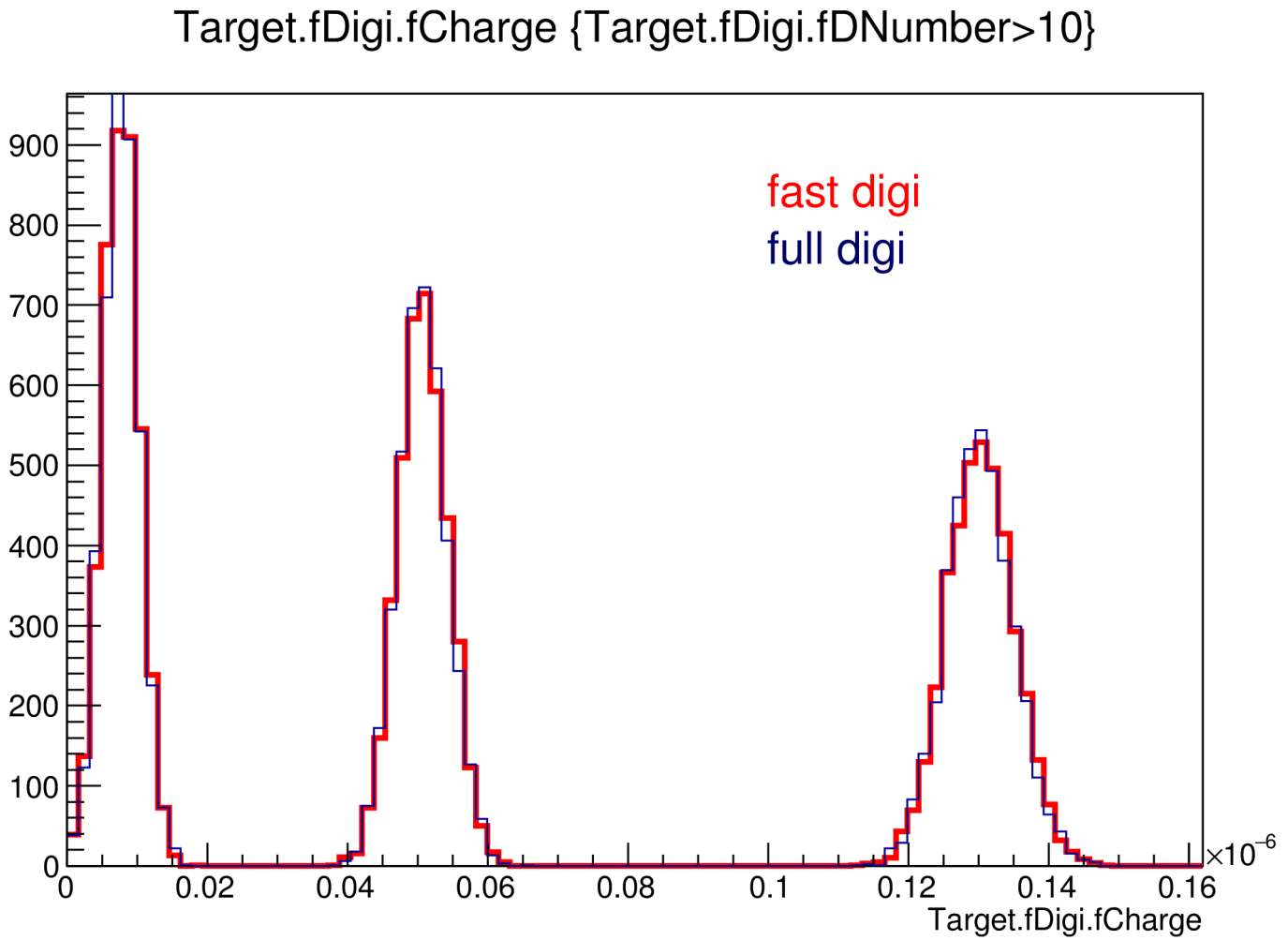
noiseRMS = 2.42 uA

Fast vs Full: Charge Distribution



noiseRMS=0.87 uA no Mult cut

Fast vs Full: Charge Distribution



noiseRMS=0.87 uA **Mult >10**

TargetDigitizer: Full vs Fast + Light

- TargetReconstruction.cc flags:

  - digitization mode
    - digitization (only) time ~ **750 ms / evt**
    - fast digitization **~ 2 ms / evt**

`/Detector/Target/EnableFastDigitization` (default)

  - persistency
    - saving enabled ~ 350 kb / evt
      (rebinning traces → ~ 210 kb / evt)
    - light mode **~ 170 kb / evt (empty waveforms)**

`/Detector/Target/DisableSaveWaveformToDigi` (default)

TargetReconstruction.cc

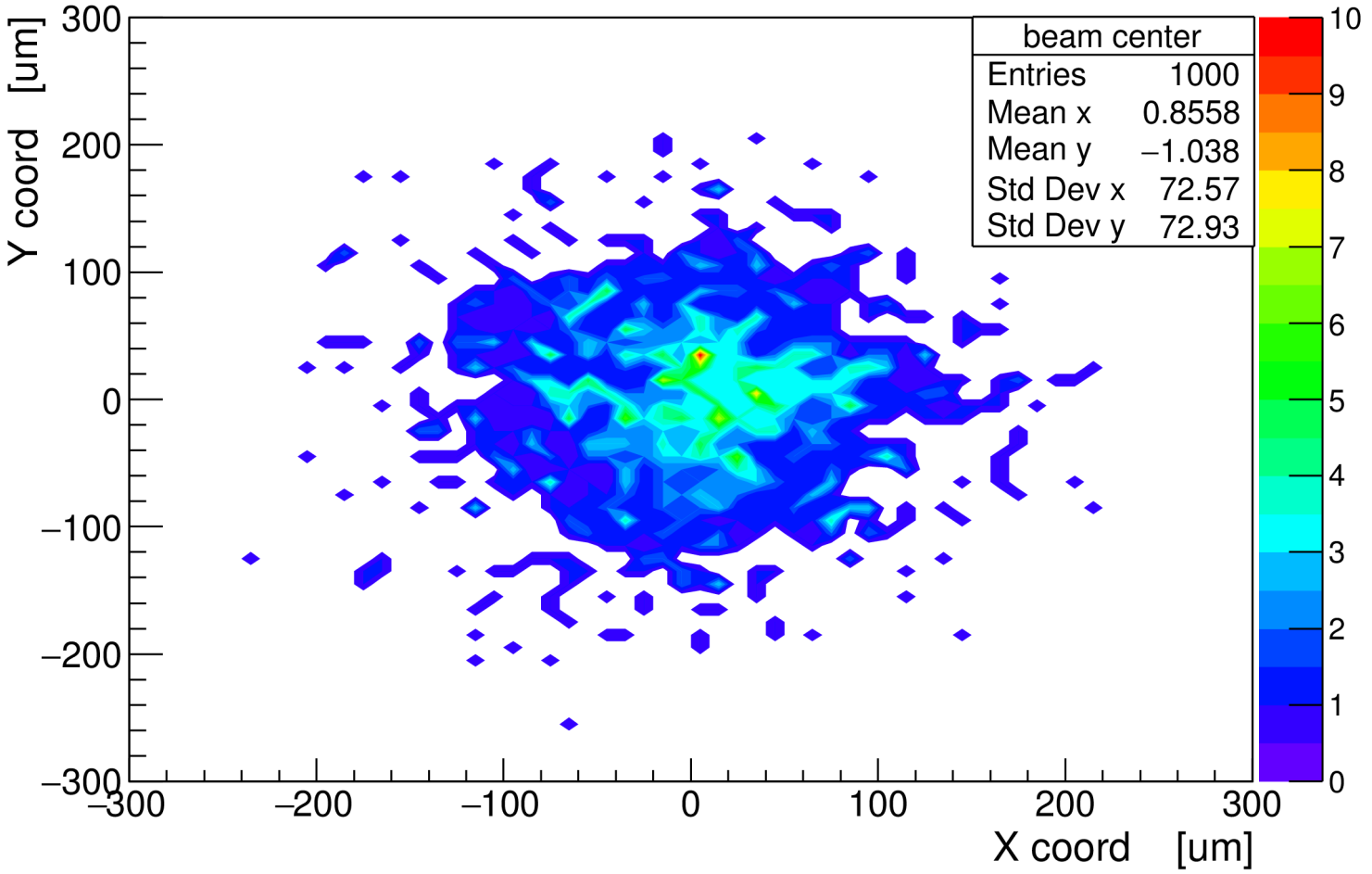
- TargetReconstruction.cc module for:

    - hits and digi processing:
        - calculating charge weighted position
          → uncertainty on charge release
        to do: timing (now event time = time of first G4hit)

→ Added TargetRecoHit and TargetRecoEvent classes

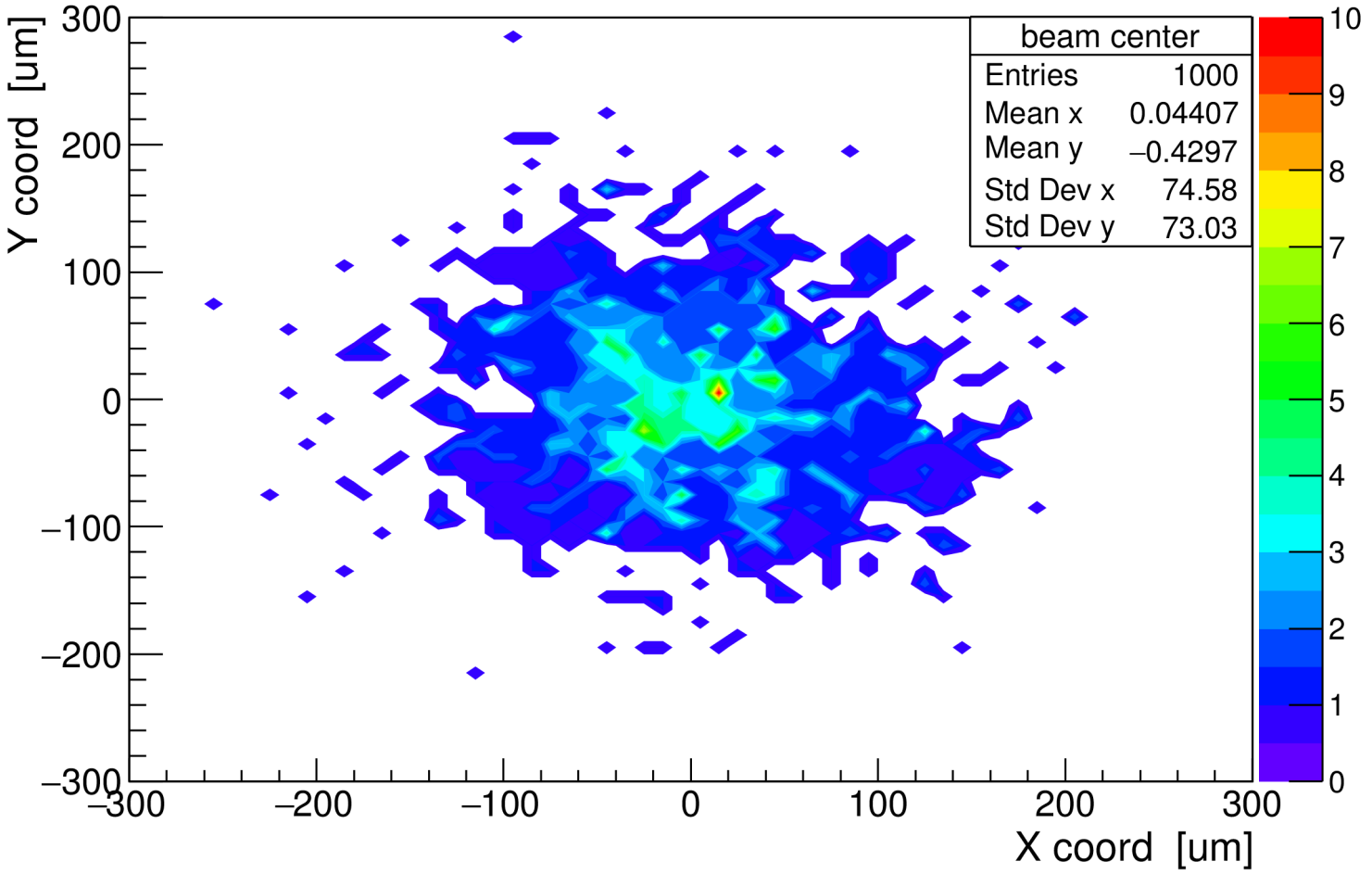
- we deliver:
    beam center position X and Y , charge, time (with errors)
    to do: cout → to root file

Beam Center Reconstruction: FULL



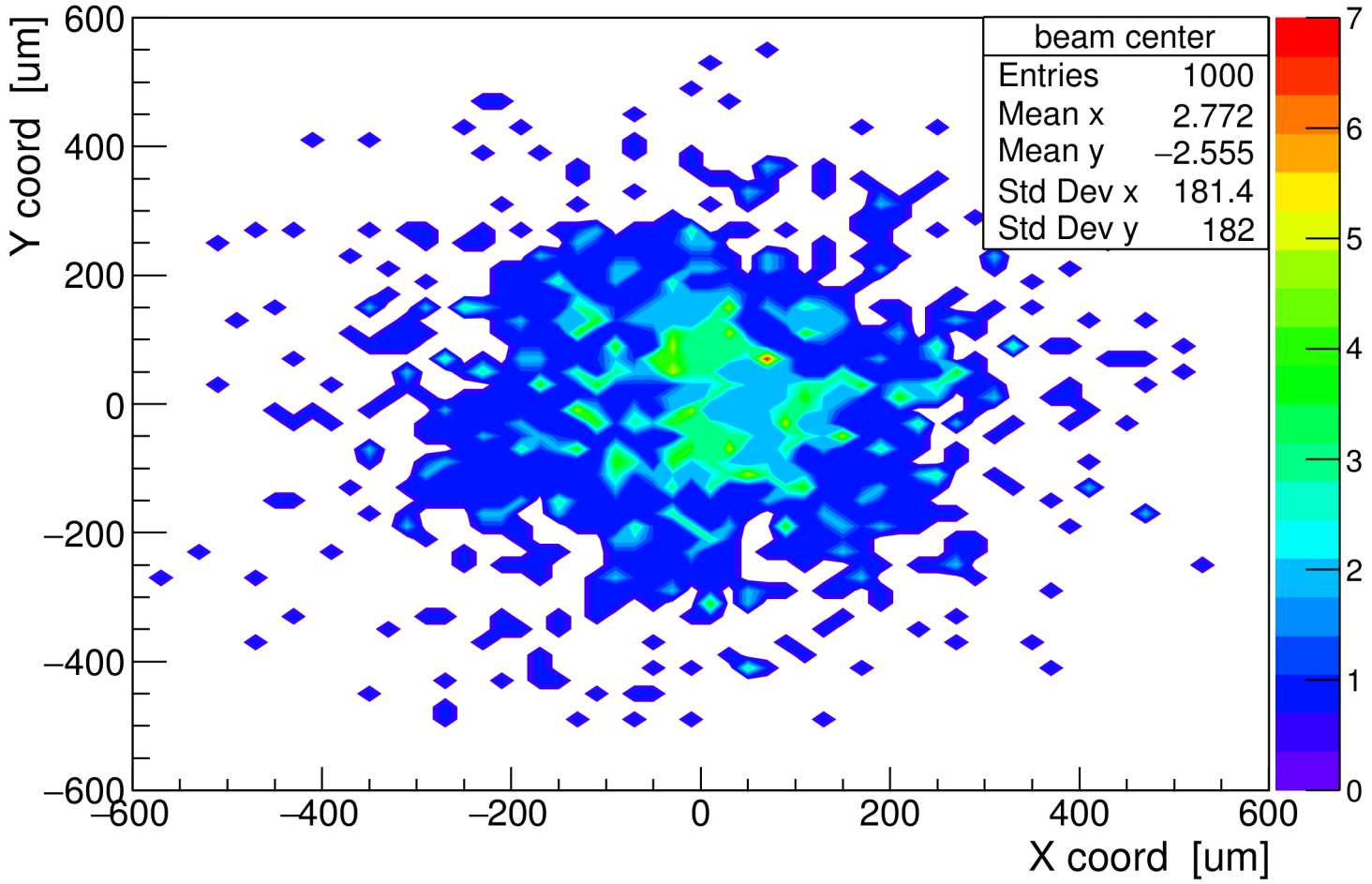
noiseRMS=0.87 uA

Beam Center Reconstruction: FAST



noiseRMS=0.87 uA

Beam Center Reconstruction: noise



noiseRMS=2.42 uA

Backup

PadmeMC: TargetDigi class

```
private:
  G4int              fChannelId;
  G4double           fTime;     time of first hit in channel
  G4double           fEnergy;   sum of energy deposited (G4 hits)
  G4int              fDNumber;  hit multiplicity in channel
  G4double           fCharge;   charge from measured output waveform
  G4double           fChargeT;  charge from raw (G4) waveform

  std::vector<G4double> fWaveformRaw;  current in timebins 0.1 ns
  std::vector<G4int> fWaveform;        output waveform (voltage in
                                       timebins 1 ns)
```

PadmeReco: TargetRecoHit class

```
private:
    double      fChannelId;    id of Digitized Channel
    double      fTime;    Time of Digi (now time of first Channel G4hit)
    double      fTimeError;    Time Error
    double      fCharge;    Charge collected in Channel
    double      fChargeError;    Error on collected charge in Channel
```

PadmeReco: TargetRecoEvent class

```
private:
  double     fX;    Beam Center X position
  double     fY;    Beam Center Y position
  double     fXError;  Error on X position
  double     fYError;  Error on Y position
  double     fChargeX;  Charge collected in X Channels
  double     fChargeY;  Charge collected in Y Channels
  double     fChargeXErr;  Error on collected Charge in X Channels
  double     fChargeYErr;  Error on collected Charge in Y Channels
  double     fTime;    Time of Channel
  double     fTimeError;    Time Error
```