Background studies in the new and old framework

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Introduction: background in BASF2

➢ want to get as many answers about background in PXD as from simulation as possible

➢ status of BASF2:

  ➢we can run event generation and simulation

 ➢we get simulated hits

  ➢digitizer is coming soon

Work in basf2 framework

➤ what have we done up to now:

➤ (unfortunately not plots to show here ☹)

  ➤ run generators in BASF2 and check output ✓

    ➤ so far: nice an consistent picture!

  ➤ look at generated hits in PXD

  ➤ detailed study of pixel distribution once digitizer is available in BASF2

  ➤ then also more work on amplitude analysis

Pixel & Cluster studies (ILC framework)

- Questions (for online data reduction):
  - can we use pixel and cluster properties for a rough selection of physics pixels?
    - expect photons do make small cluster (~1 pixel only)
    - clusters from tracks are larger
  - can we detect pixels from low momentum tracks by their energy deposition?
    - does it make sense to use pixel or cluster amplitudes for fast hit selection
    - especially: slow pions 50MeV<p<100MeV
- these criteria would allow some data selection for PXD standalone → important for slow pions
- Use particle gun to find answers

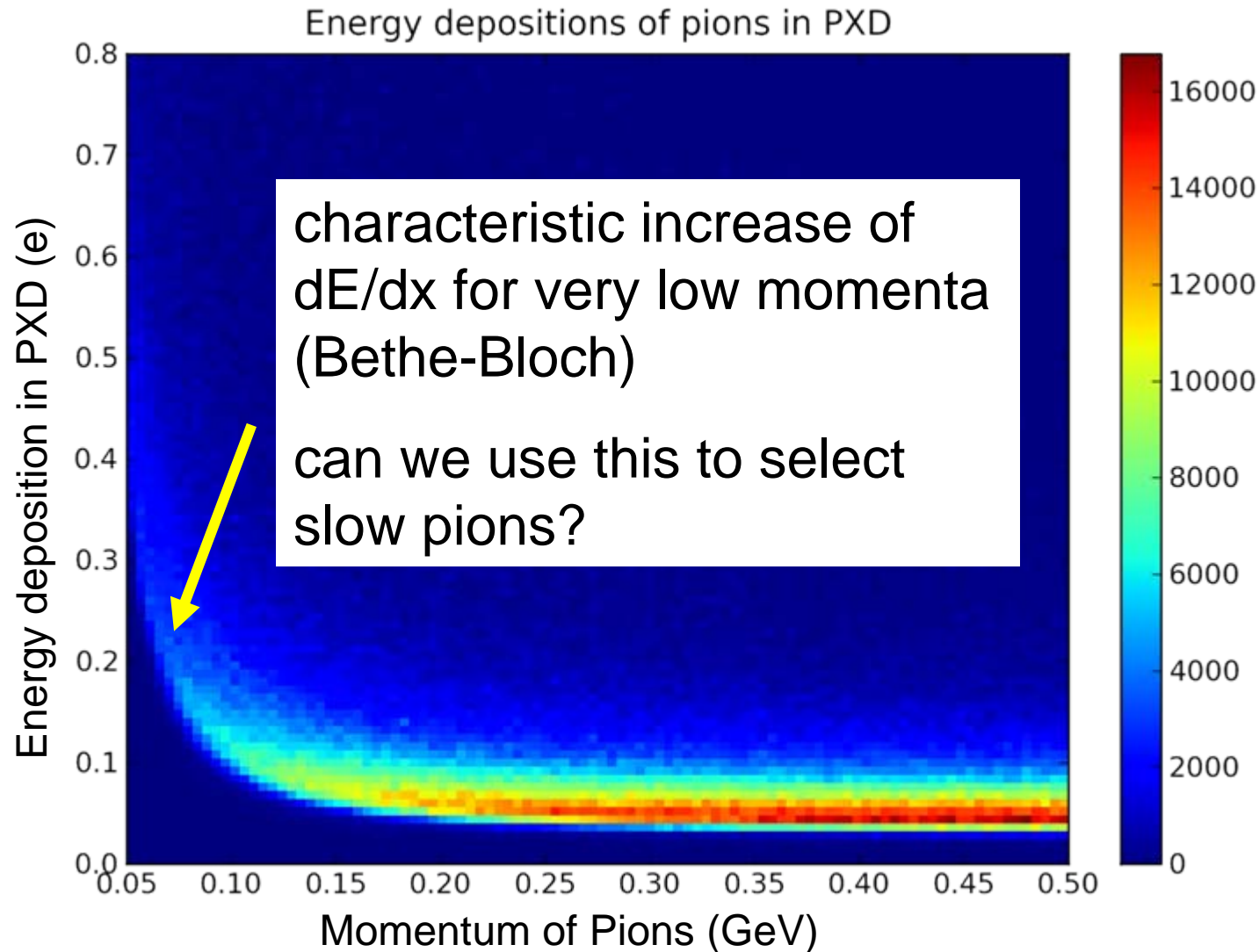# Photons in the PXD (Martin Ritter)

Clustersize versus Photon energy
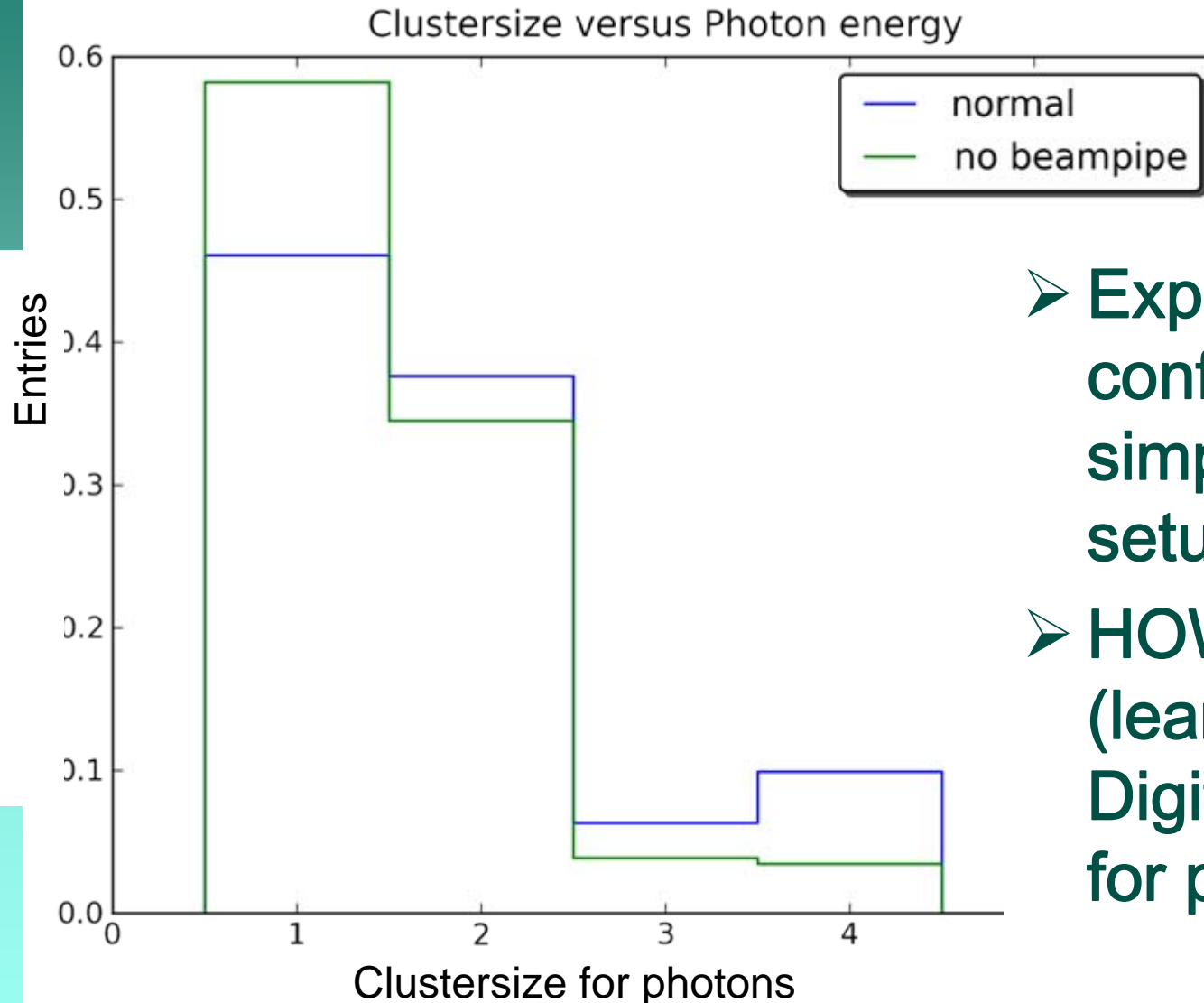
- ➢ Expectation not confirmed in simple simulation setup
- ➢ HOWEVER: (learned today) Digitizer not tuned for photons

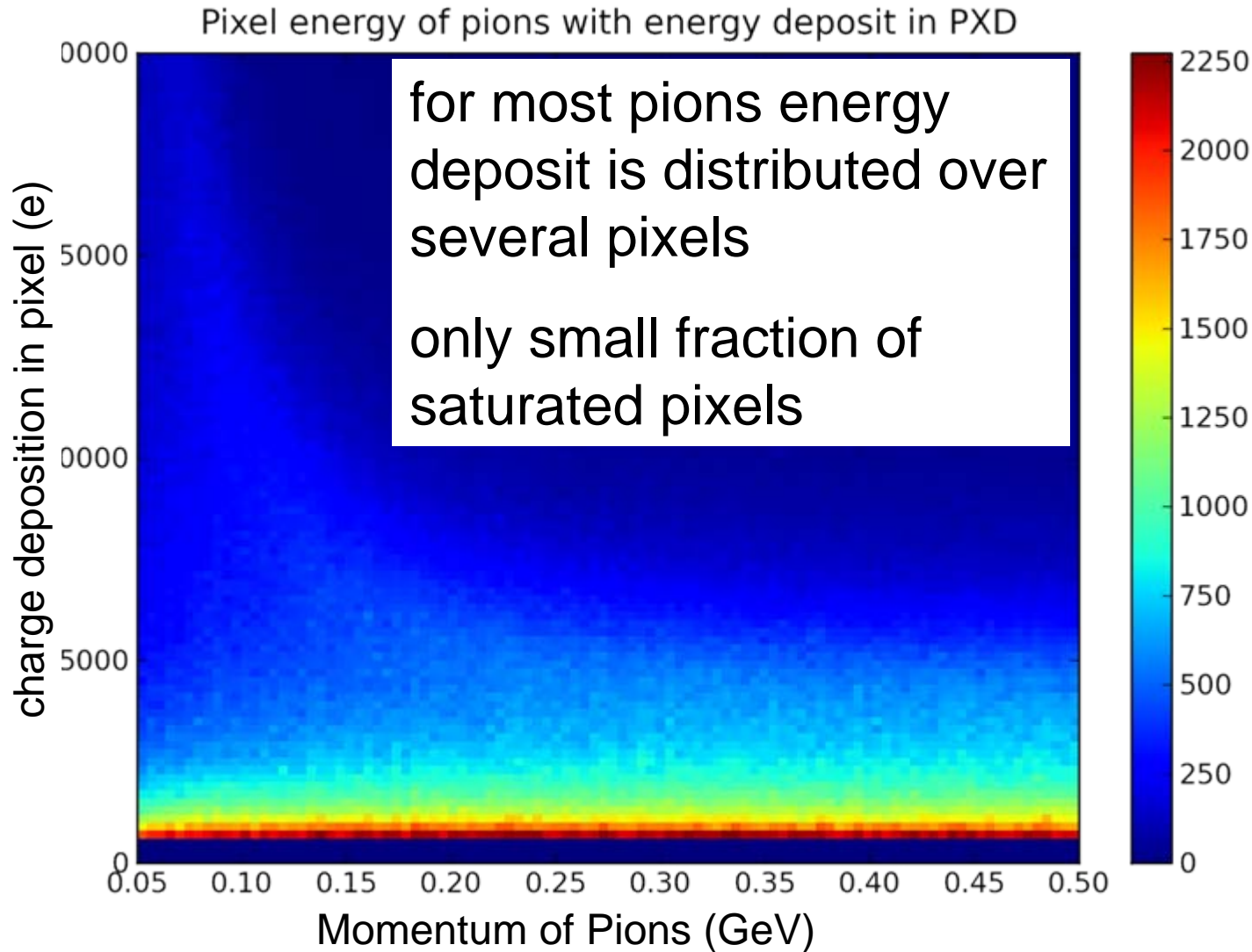# Role of the beampipe (MR)

photon clusters with and without beampipe
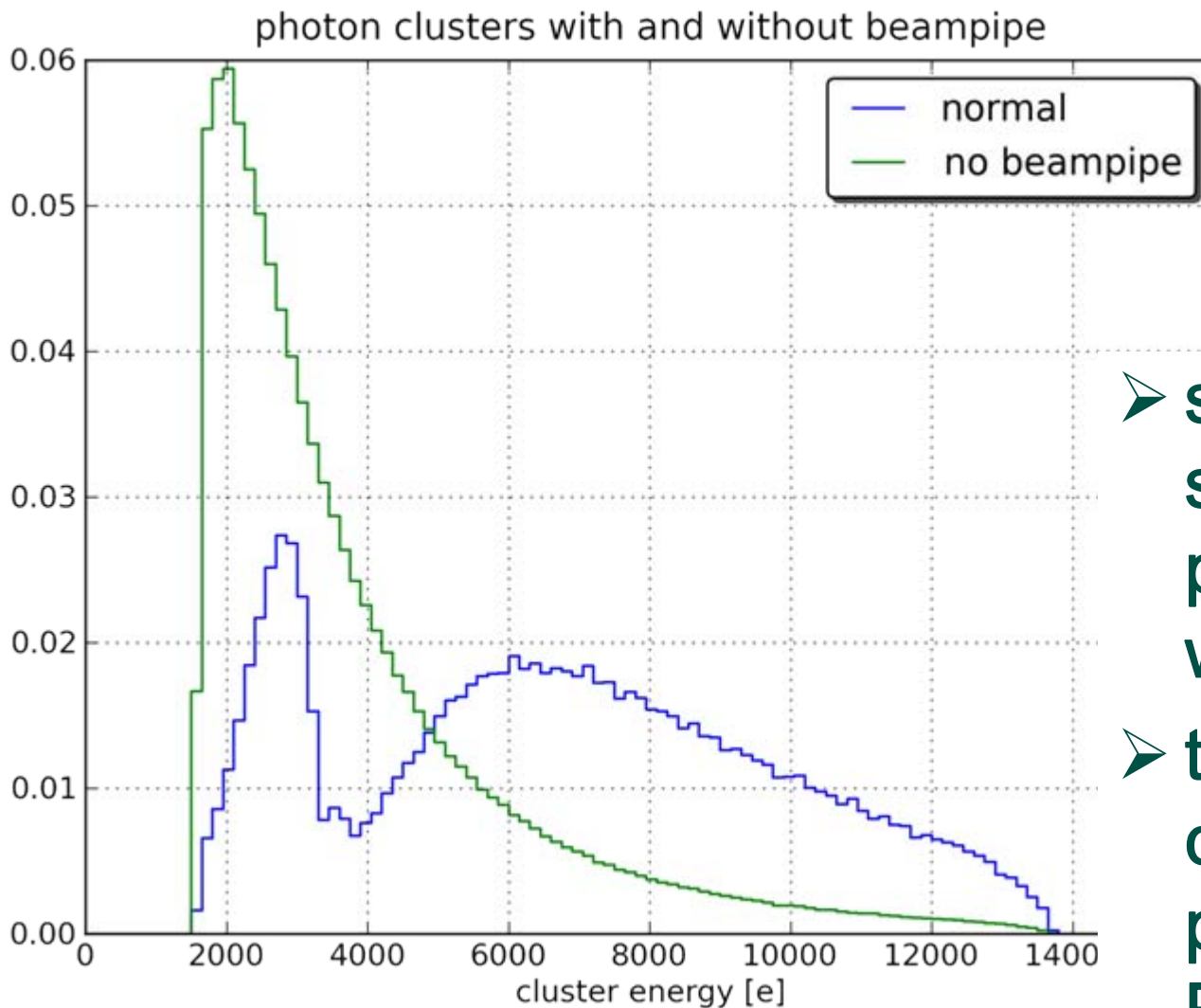
- ➤ simulation shows: a lot of photons interact with beam pipe
- ➤ this widens the clusters from photons in the PXD

Pions in the PXD (MR)

Energy depositions of pions in PXD

characteristic increase of dE/dx for very low momenta (Bethe-Bloch)

can we use this to select slow pions?

Pion pixels in the PXD (MR)

Pixel energy of pions with energy deposit in PXD

for most pions energy deposit is distributed over several pixels

only small fraction of saturated pixels

charge deposition in pixel (e)

Momentum of Pions (GeV)

Pion pixels in the PXD (MR)

Pixel energy in different momentum regions

Legend:
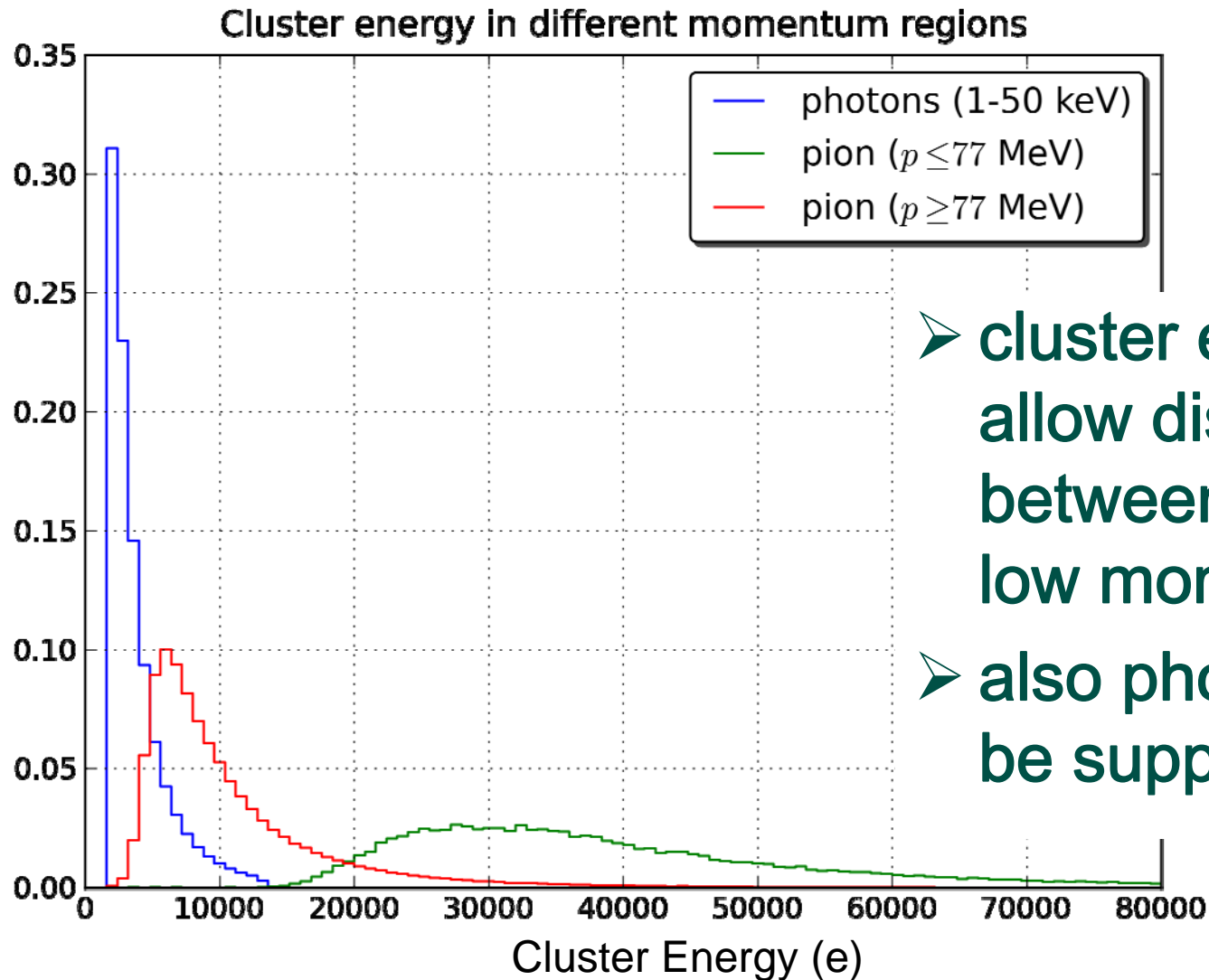- photons (1-50 keV)
- pion ($p \leq 77$ MeV)
- pion ($p \geq 77$ MeV)

➢ large energy depositions do not show up in individual pixels

➢ look at entire clusters instead

Pixel Energy (e)

Pion clusters in the PXD (MR)

Cluster energy of pions with energy deposit in PXD

> ➢ increase of deposited energy much better reproduced when looking at full clusters

Pion clusters in the PXD (MR)

Cluster energy in different momentum regions

Legend:
- photons (1-50 keV)
- pion ($p \leq 77$ MeV)
- pion ($p \geq 77$ MeV)

y-axis: 0.00, 0.05, 0.10, 0.15, 0.20, 0.25, 0.30, 0.35

x-axis: 0, 10000, 20000, 30000, 40000, 50000, 60000, 70000, 80000
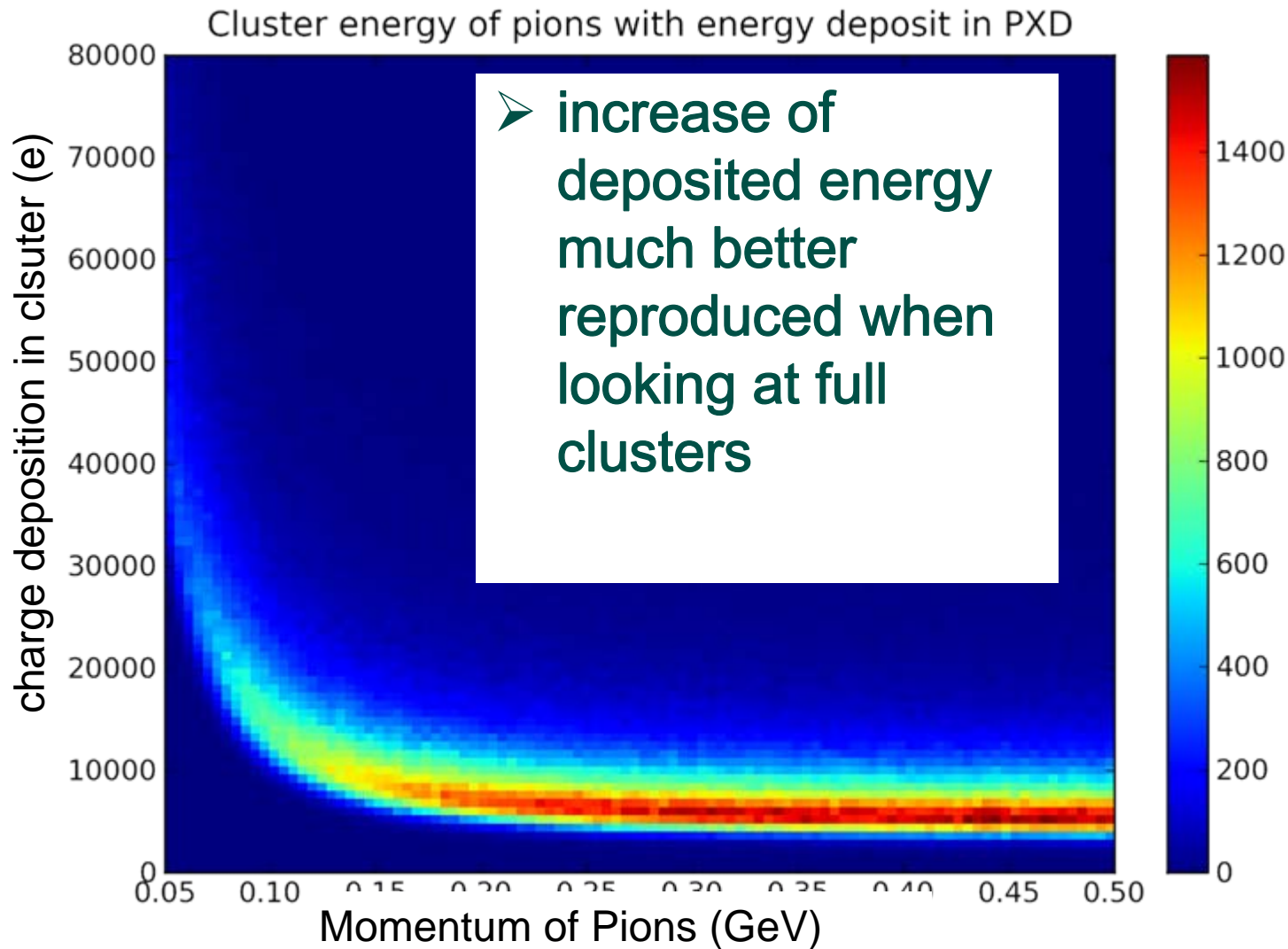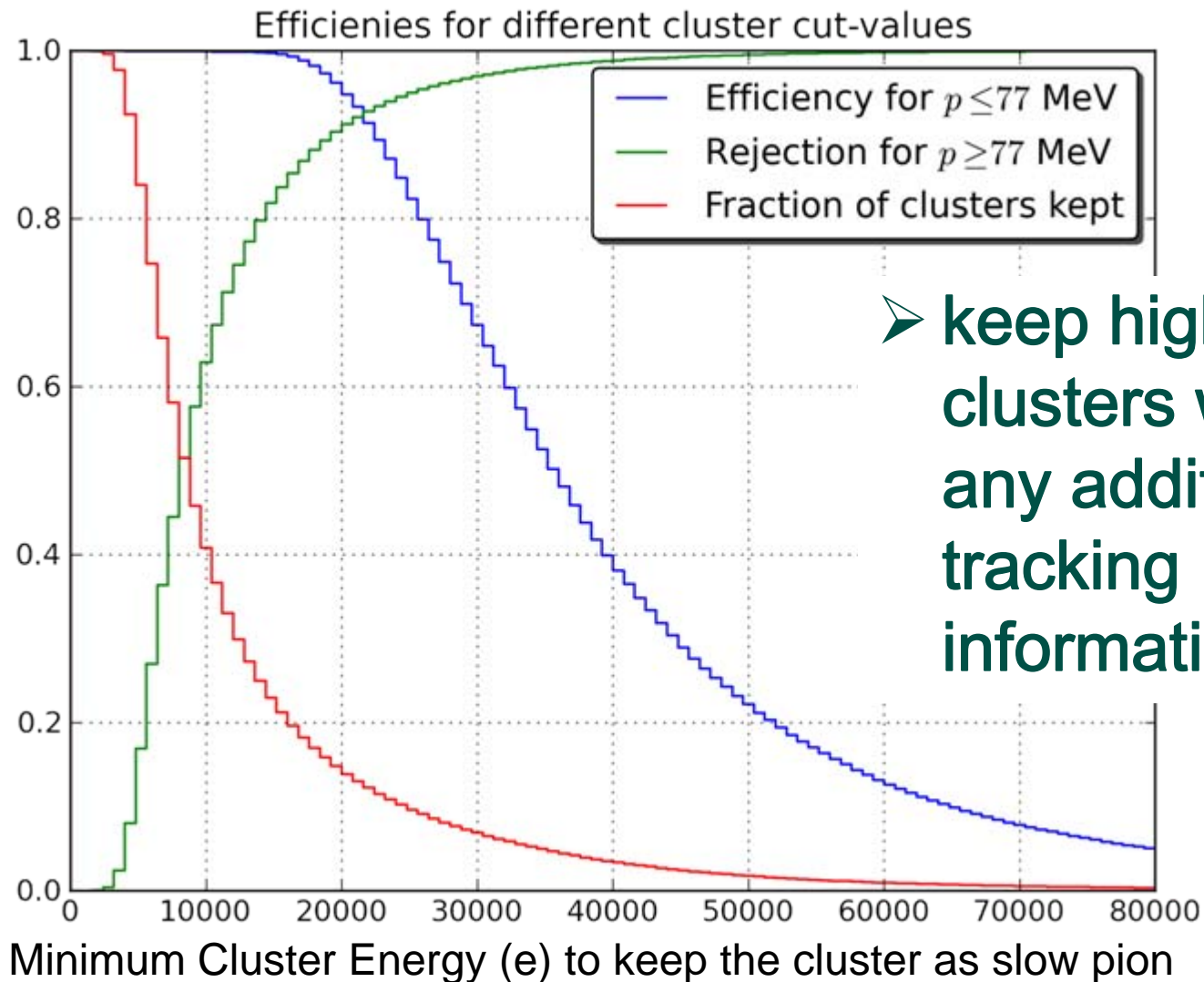
Cluster Energy (e)

➢ cluster energies allow distinction between high and low momenta

➢ also photons can be suppressed!

Cutting on cluster energies in the PXD

Efficienies for different cluster cut-values

Legend:
- Efficiency for $p \leq 77$ MeV
- Rejection for $p \geq 77$ MeV
- Fraction of clusters kept

Minimum Cluster Energy (e) to keep the cluster as slow pion

➢ keep high energy clusters without any additional tracking information

Conclusion

➢ first background studies have started in BASF2

➢ some steps are still missing, but a lot of progress can be observed

➢ study of pixel sizes in PXD gives promising perspective:

  ➢ we can detect hits from low momentum tracks from cluster energies PXD STANDALONE

  ➢ situation for photons not quite clear, but stand alone rejection should be possible

  ➢ waiting for digitizers in BASF2 for analysis of amplitude range