

S-curve-based corrections in data and MC

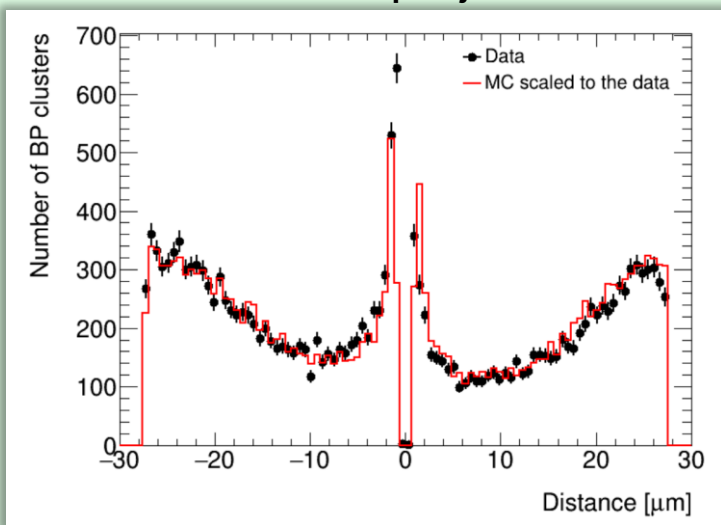
Yury Smirnov

TRD test beam analysis meeting
July 17th 2024

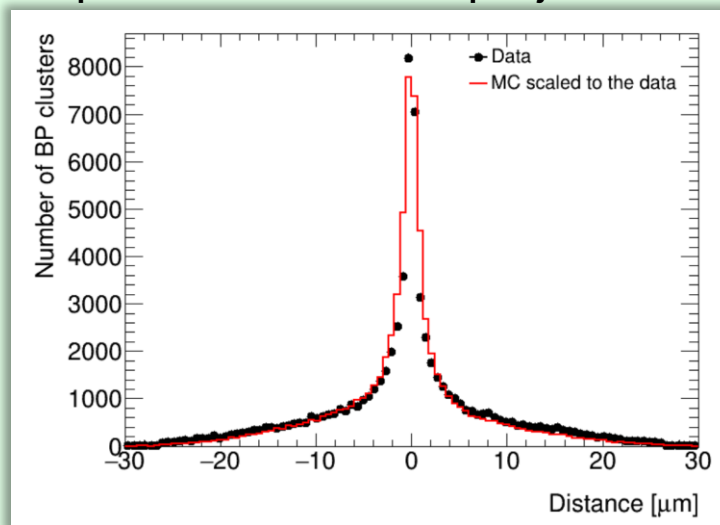
From July 3rd: sides+corners

MC with muons and dummy radiator, run 7 in the data

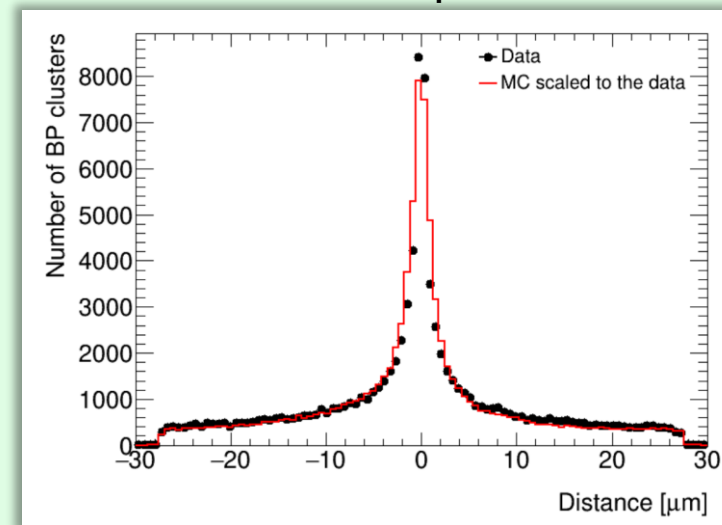
Clusters consisting of 2 pixels
after X-axis projection



Clusters consisting of 3 or more
pixels after X-axis projection

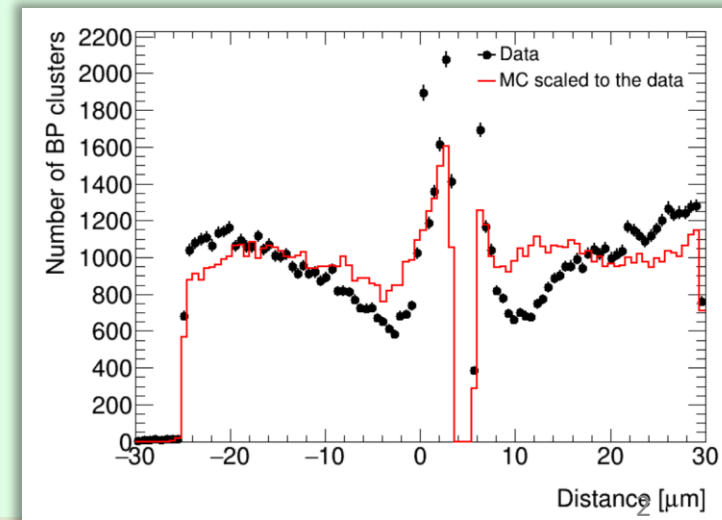
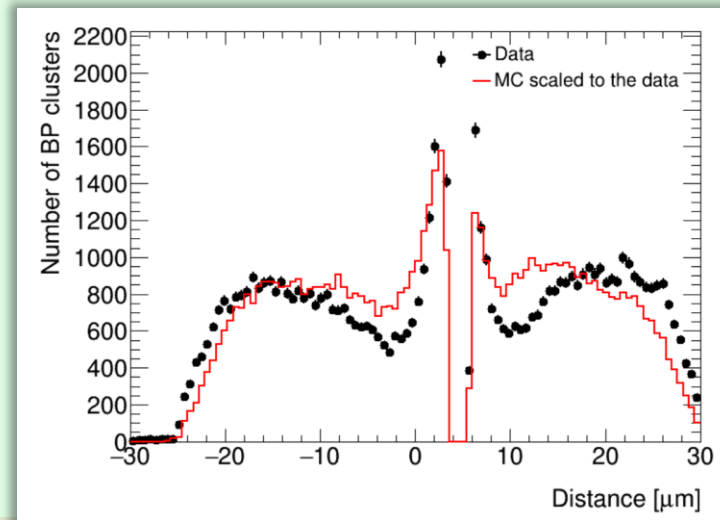
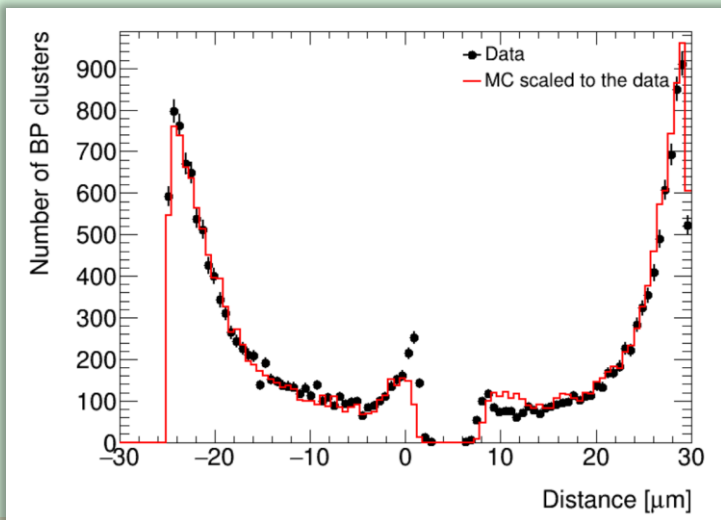


Clusters consisting of any
number of pixels



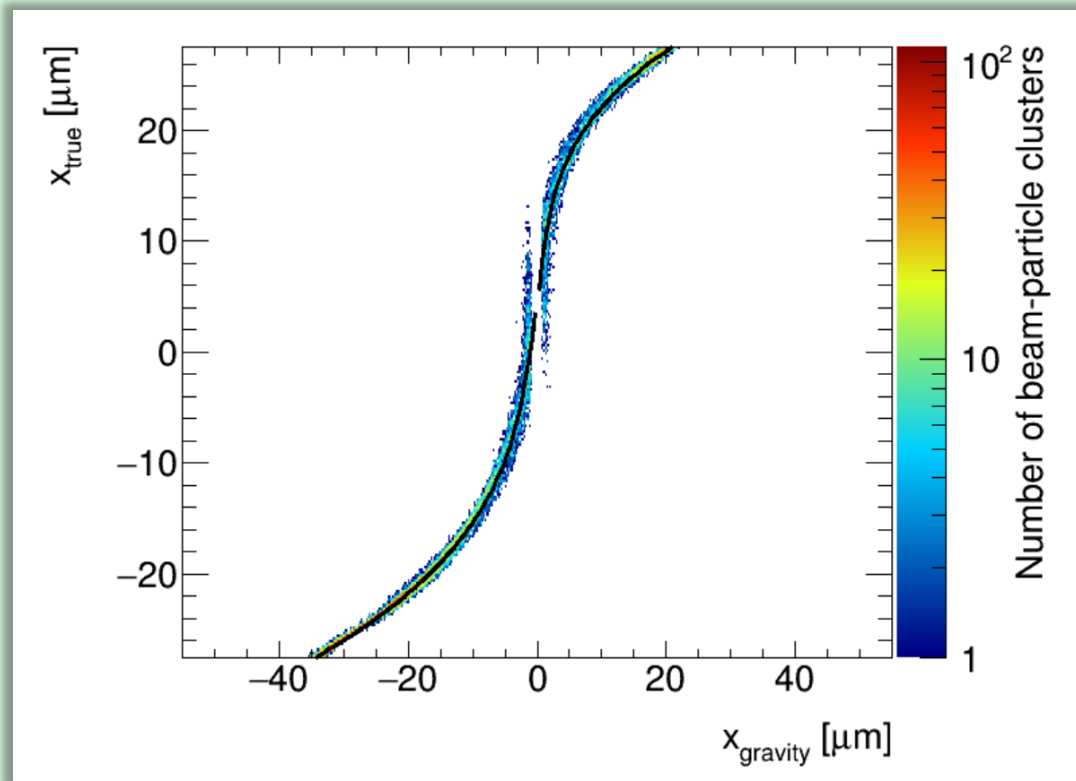
before correction

after correction

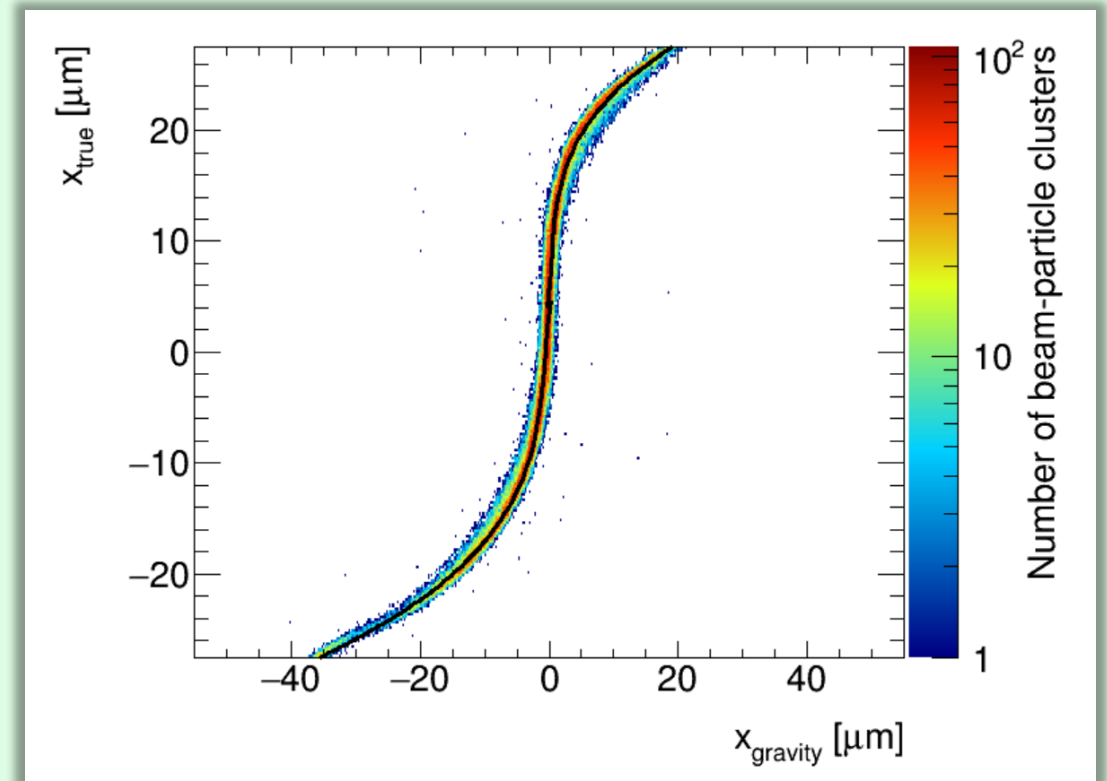


S-curves from MC clusterized with the “sides-only” option

Clusters consisting of exactly 2 pixels after X-axis projection



Clusters consisting of 3 or more pixels after X-axis projection



S-curves from MC clusterized with the “sides-only” option

Clusters consisting of exactly
2 pixels after X-axis projection

Formula for the left fit is

```
std::cbrt((2.*std::pow(-4.22501e-03/1.11416e-03,3)/27.- -4.22501e-03/1.11416e-03*2.49558e-01/1.11416e-03/3.+(-1.16474e+00-x)/1.11416e-03)/(-2.)+std::sqrt(TMATH::Sq(2.*std::pow(-4.22501e-03/1.11416e-03,3)/27.- -4.22501e-03/1.11416e-03*2.49558e-01/1.11416e-03/3.+(-1.16474e+00-x)/1.11416e-03)/4.+std::pow(-TMATH::Sq(-4.22501e-03/1.11416e-03)/3.+2.49558e-01/1.11416e-03,3)/27.))+std::cbrt((2.*std::pow(-4.22501e-03/1.11416e-03,3)/27.- -4.22501e-03/1.11416e-03*2.49558e-01/1.11416e-03/3.+(-1.16474e+00-x)/1.11416e-03)/(-2.)-std::sqrt(TMATH::Sq(2.*std::pow(-4.22501e-03/1.11416e-03,3)/27.- -4.22501e-03/1.11416e-03*2.49558e-01/1.11416e-03/3.+(-1.16474e+00-x)/1.11416e-03)/4.+std::pow(-TMATH::Sq(-4.22501e-03/1.11416e-03)/3.+2.49558e-01/1.11416e-03,3)/27.))- -4.22501e-03/1.11416e-03/3.
```

Formula for the right fit is

```
std::cbrt((2.*std::pow(-4.47738e-02/2.00241e-03,3)/27.- -4.47738e-02/2.00241e-03*5.39528e-01/2.00241e-03/3.+(-1.68322e+00-x)/2.00241e-03)/(-2.)+std::sqrt(TMATH::Sq(2.*std::pow(-4.47738e-02/2.00241e-03,3)/27.- -4.47738e-02/2.00241e-03*5.39528e-01/2.00241e-03/3.+(-1.68322e+00-x)/2.00241e-03)/4.+std::pow(-TMATH::Sq(-4.47738e-02/2.00241e-03)/3.+5.39528e-01/2.00241e-03,3)/27.))+std::cbrt((2.*std::pow(-4.47738e-02/2.00241e-03,3)/27.- -4.47738e-02/2.00241e-03*5.39528e-01/2.00241e-03/3.+(-1.68322e+00-x)/2.00241e-03)/(-2.)-std::sqrt(TMATH::Sq(2.*std::pow(-4.47738e-02/2.00241e-03,3)/27.- -4.47738e-02/2.00241e-03*5.39528e-01/2.00241e-03/3.+(-1.68322e+00-x)/2.00241e-03)/4.+std::pow(-TMATH::Sq(-4.47738e-02/2.00241e-03)/3.+5.39528e-01/2.00241e-03,3)/27.))- -4.47738e-02/2.00241e-03/3.
```

Clusters consisting of 3 or more
pixels after X-axis projection

Formula for the left fit is

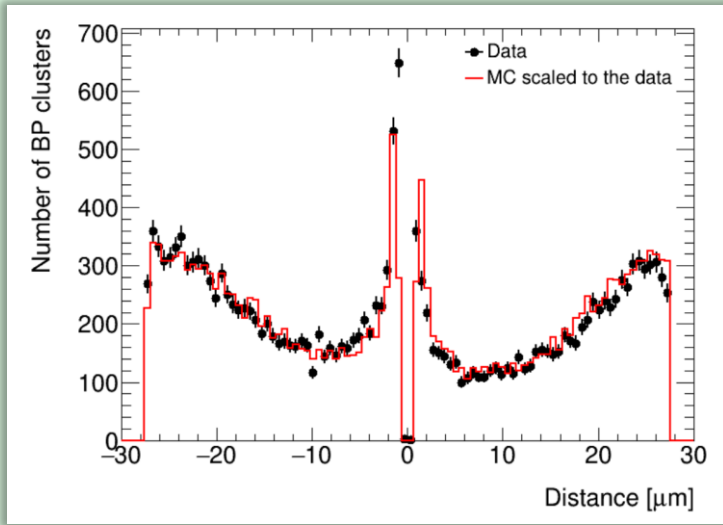
```
std::cbrt((2.*std::pow(3.55110e-03/1.62882e-03,3)/27.- -3.55110e-03/1.62882e-03*1.40762e-01/1.62882e-03/3.+(-5.78362e-01-x)/1.62882e-03)/(-2.)+std::sqrt(TMATH::Sq(2.*std::pow(3.55110e-03/1.62882e-03,3)/27.- -3.55110e-03/1.62882e-03*1.40762e-01/1.62882e-03/3.+(-5.78362e-01-x)/1.62882e-03)/4.+std::pow(-TMATH::Sq(3.55110e-03/1.62882e-03)/3.+1.40762e-01/1.62882e-03,3)/27.))+std::cbrt((2.*std::pow(3.55110e-03/1.62882e-03,3)/27.- -3.55110e-03/1.62882e-03*1.40762e-01/1.62882e-03/3.+(-5.78362e-01-x)/1.62882e-03)/(-2.)-std::sqrt(TMATH::Sq(2.*std::pow(3.55110e-03/1.62882e-03,3)/27.- -3.55110e-03/1.62882e-03*1.40762e-01/1.62882e-03/3.+(-5.78362e-01-x)/1.62882e-03)/4.+std::pow(-TMATH::Sq(3.55110e-03/1.62882e-03)/3.+1.40762e-01/1.62882e-03,3)/27.))- -3.55110e-03/1.62882e-03/3.
```

Formula for the right fit is

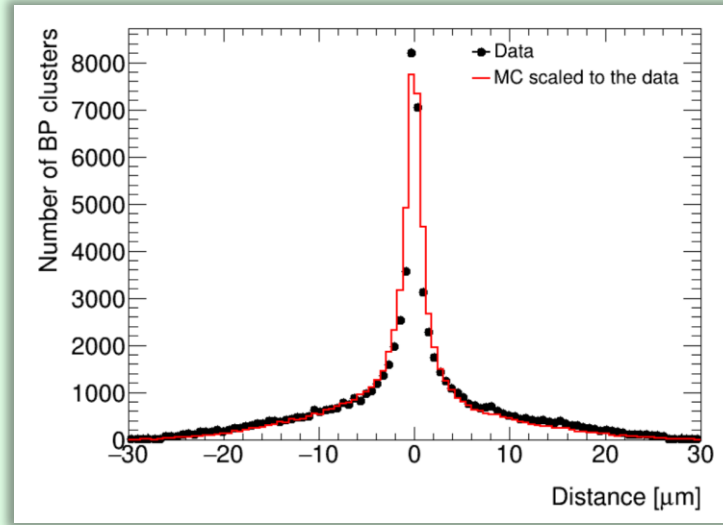
```
std::cbrt((2.*std::pow(-5.87393e-02/2.35483e-03,3)/27.- -5.87393e-02/2.35483e-03*5.96812e-01/2.35483e-03/3.+(-1.92508e+00-x)/2.35483e-03)/(-2.)+std::sqrt(TMATH::Sq(2.*std::pow(-5.87393e-02/2.35483e-03,3)/27.- -5.87393e-02/2.35483e-03*5.96812e-01/2.35483e-03/3.+(-1.92508e+00-x)/2.35483e-03)/4.+std::pow(-TMATH::Sq(-5.87393e-02/2.35483e-03)/3.+5.96812e-01/2.35483e-03,3)/27.))+std::cbrt((2.*std::pow(-5.87393e-02/2.35483e-03,3)/27.- -5.87393e-02/2.35483e-03*5.96812e-01/2.35483e-03/3.+(-1.92508e+00-x)/2.35483e-03)/(-2.)-std::sqrt(TMATH::Sq(2.*std::pow(-5.87393e-02/2.35483e-03,3)/27.- -5.87393e-02/2.35483e-03*5.96812e-01/2.35483e-03/3.+(-1.92508e+00-x)/2.35483e-03)/4.+std::pow(-TMATH::Sq(-5.87393e-02/2.35483e-03)/3.+5.96812e-01/2.35483e-03,3)/27.))- -5.87393e-02/2.35483e-03/3.
```

Sides only

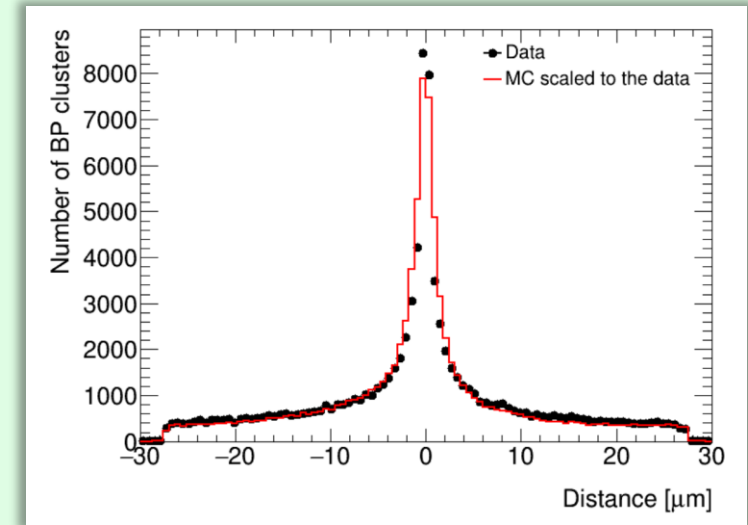
Clusters consisting of 2 pixels after X-axis projection



Clusters consisting of 3 or more pixels after X-axis projection

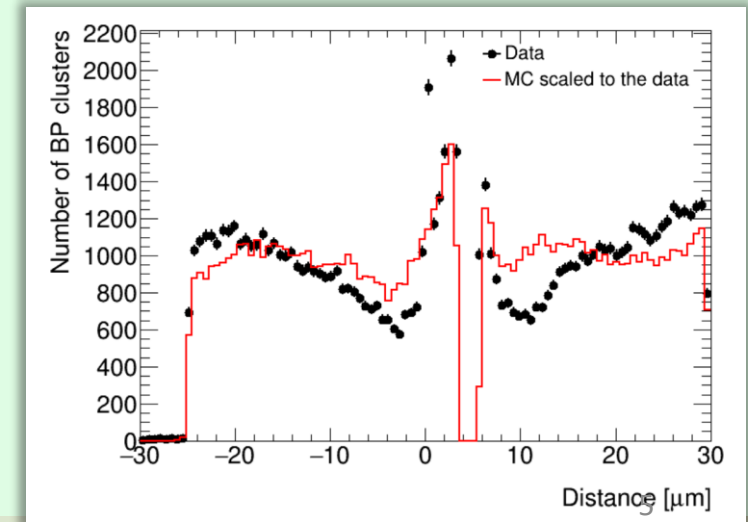
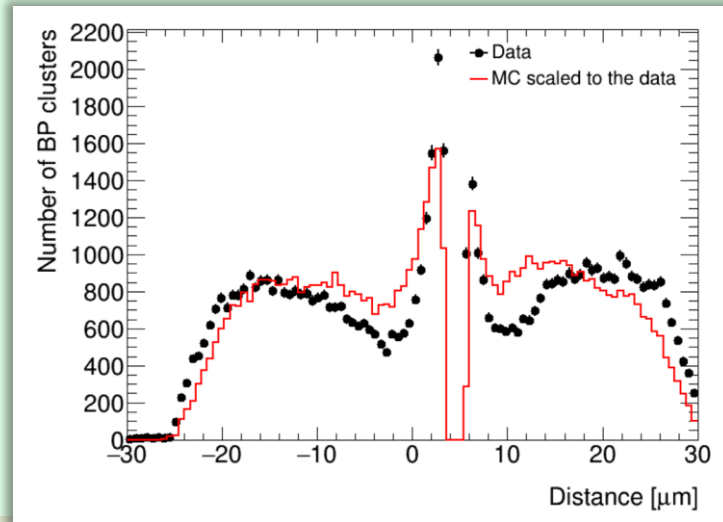
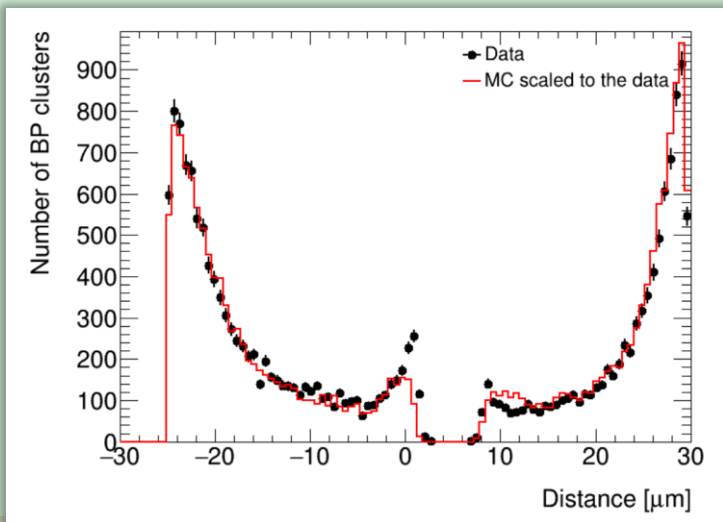


Clusters consisting of any number of pixels



before correction

after correction



A possible new approach to calculate the distance from previous slides

17 99 6

Our usual approach:

- CoG: $\frac{(17 \text{ keV} \times 0 + 99 \text{ keV} \times 1 + 6 \text{ keV} \times 2) \times 55 \mu\text{m}}{17 \text{ keV} + 99 \text{ keV} + 6 \text{ keV}} = \frac{111 \text{ keV} \times 55 \mu\text{m}}{122 \text{ keV}} = 50.04 \mu\text{m}$ (to the right of the center of the pixel with number “0” – the leftmost one)
- Position of the center of the pixel with max E: $55 \mu\text{m}$ (to the right of the center of the same pixel)
- Distance: $50.04 \mu\text{m} - 55 \mu\text{m} = -4.96 \mu\text{m}$

Another approach:

- CoG: $\frac{(17 \text{ keV} \times (-1) + 99 \text{ keV} \times 0 + 6 \text{ keV} \times (+1)) \times 55 \mu\text{m}}{17 \text{ keV} + 6 \text{ keV}} = \frac{-11 \text{ keV} \times 55 \mu\text{m}}{23 \text{ keV}} = -26.30 \mu\text{m}$ (26.30 μm to left of the pixel with number “0” – the central one)
- Position of the center of the pixel with max E: ??? (is it the center of the central pixel? Or the leftmost one?)
- Distance: $-26.30 \mu\text{m} - 0 \mu\text{m} = -26.30 \mu\text{m}$ if option 1, $-26.30 \mu\text{m} - (-55 \mu\text{m}) = +28.70 \mu\text{m}$ if option 2

A case when the most energetic pixel is not at the center of the cluster



Our usual approach:

- CoG: $\frac{(136 \text{ keV} \times 0 + 74 \text{ keV} \times 1 + 28 \text{ keV} \times 2) \times 55 \text{ } \mu\text{m}}{136 \text{ keV} + 74 \text{ keV} + 28 \text{ keV}} = \frac{130 \text{ keV} \times 55 \text{ } \mu\text{m}}{238 \text{ keV}} = 30.04 \text{ } \mu\text{m}$ (to the right of the center of the pixel with number “0” – the leftmost one)
- Position of the center of the pixel with max E: $0 \text{ } \mu\text{m}$ (to the right of the center of the same pixel)
- Distance: $30.04 \text{ } \mu\text{m} - 0 \text{ } \mu\text{m} = 30.04 \text{ } \mu\text{m}$

Another approach:

- CoG: ???
- Position of the center of the pixel with max E: ???
- Distance: ???

THANKS!