Space Point Service Update

LarSoft Meeting
Oct. 26, 2011

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Outline

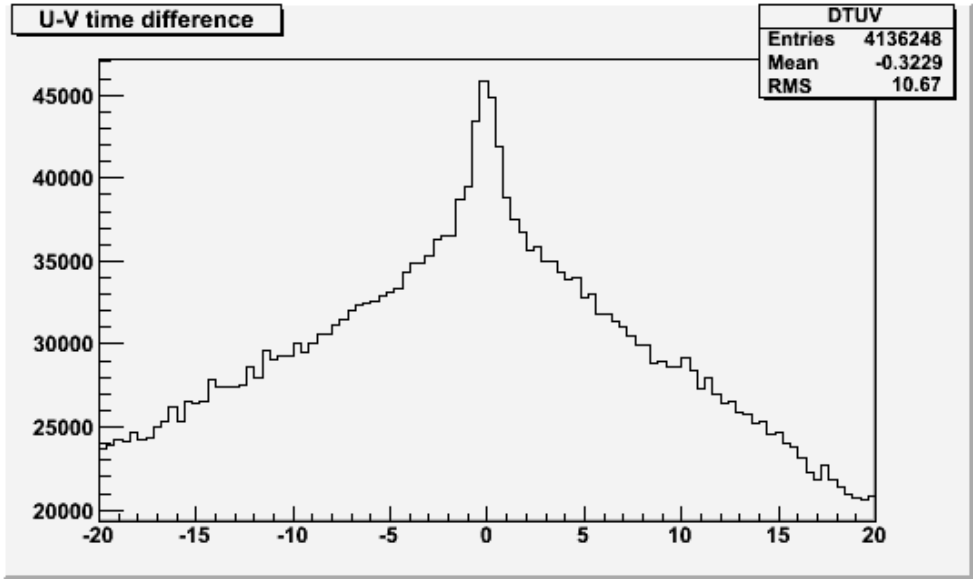
- Using wire and time information efficiently to identify hits.
- Filtering space points.

Identifying Space Points

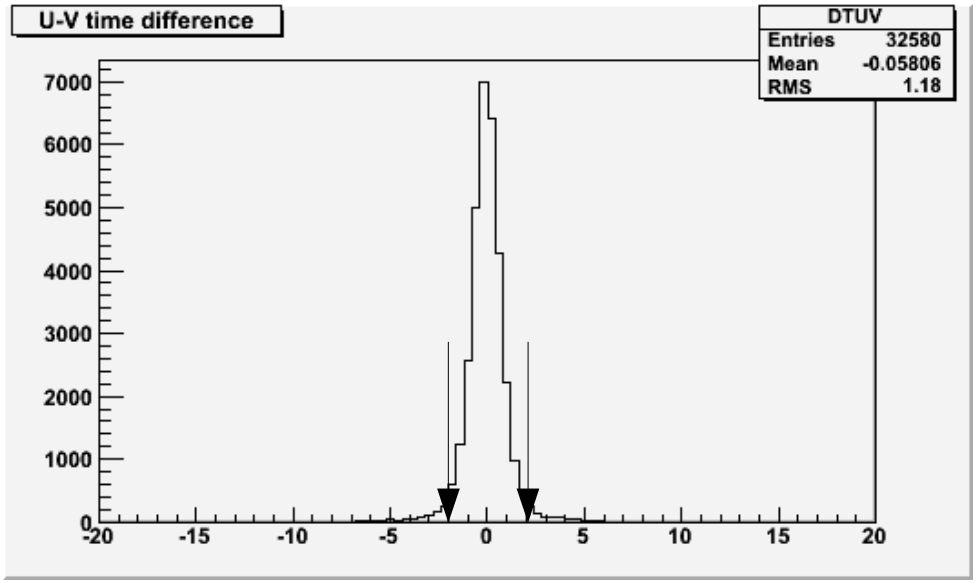
- For any two views, require hits to be in-time (after correction).
  - $|t_1 - t_2| \leq \Delta t_{max}$.
- For three views, require wire separation to be small.
  - $|\sin(\theta_v - \theta_w)u + \sin(\theta_w - \theta_u)v + \sin(\theta_u - \theta_v)w| \leq S_{max}$.
- Current default cuts.
  - $\Delta t_{max} = 2.0$ ticks.
  - $S_{max} = 0.3$ cm.

U-V Time Difference (Microboone)

No MC truth



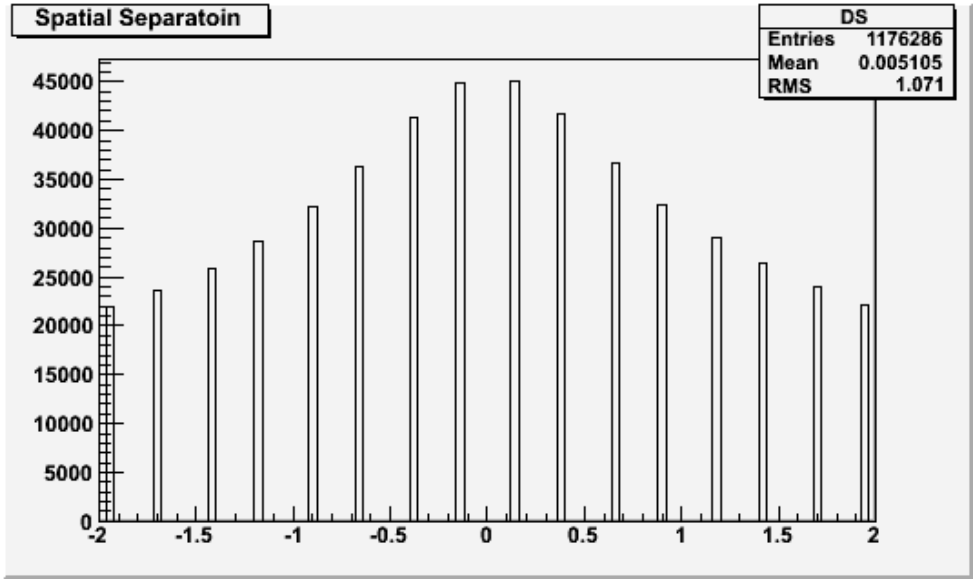
MC truth



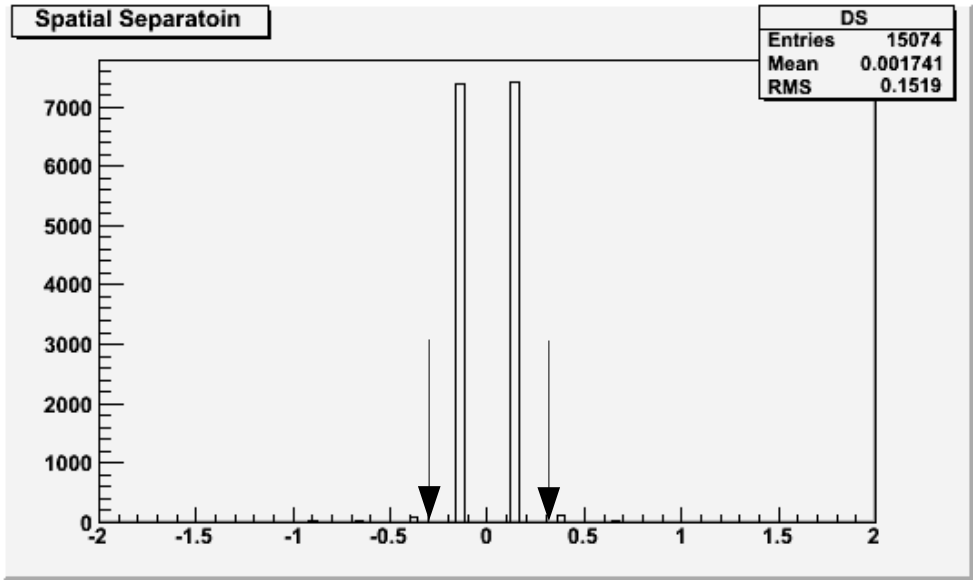
Δt (ticks)

Three-Wire Separation (Microboone)

No MC truth



MC truth



S (cm)

Identifying Space Points Conclusions

- Wire separation is quantized.
  - Good space points are all in bins with smallest possible separation.
- Default cuts are tight.
  - Separation cut is as tight as possible.
  - Time difference cut is a little tighter than 2σ.
- Time difference cut can be tightened further, but (without using MC truth) good space point purity will be limited to about 15% no matter how tight time difference cut is.

Identifying Space Points Conclusions (cont.)

- Given the large number of reconstructed space points, each input hit is being used many times.
  - By definition, each space point has exactly three hits (microboone).
  - Each hit belongs to about seven space points.

Filtering Space Points

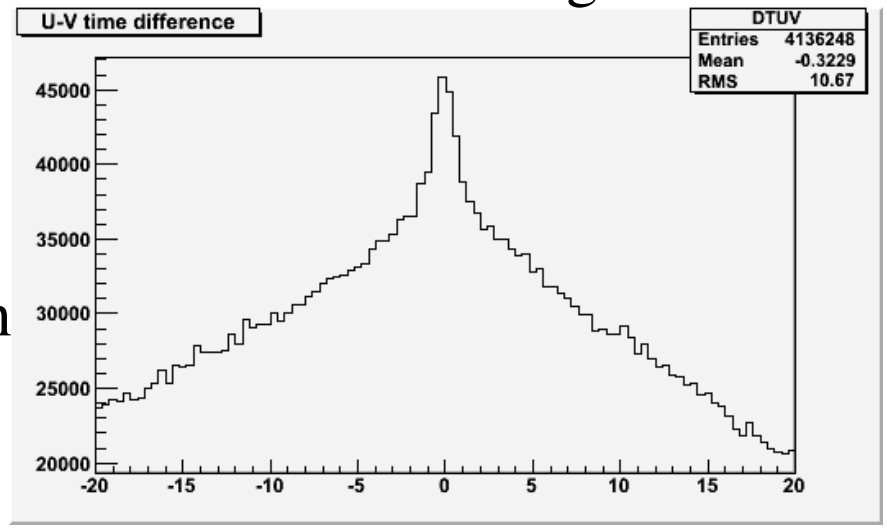
- Group reconstructed space points according to the hit in most populated plane.
  - Can expect about seven space points in each such group.
- Keep the space point with the smallest time difference and throw away the rest.
  - Time difference is the only criterion available, as all candidate space points have the same separation.
- After this procedure, hits from the most populated plane can belong to at most one space point.
  - Hits from other planes can freely belong to multiple space points.
  - There can be multiple hits on the same wire (at different times), which can belong to different space points, etc.

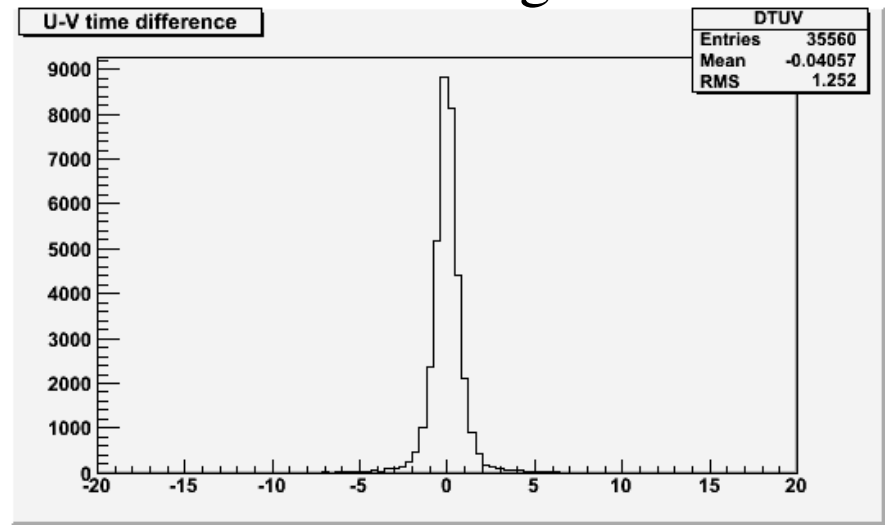
U-V Time Difference With Filtering (Microboone)

No Filtering

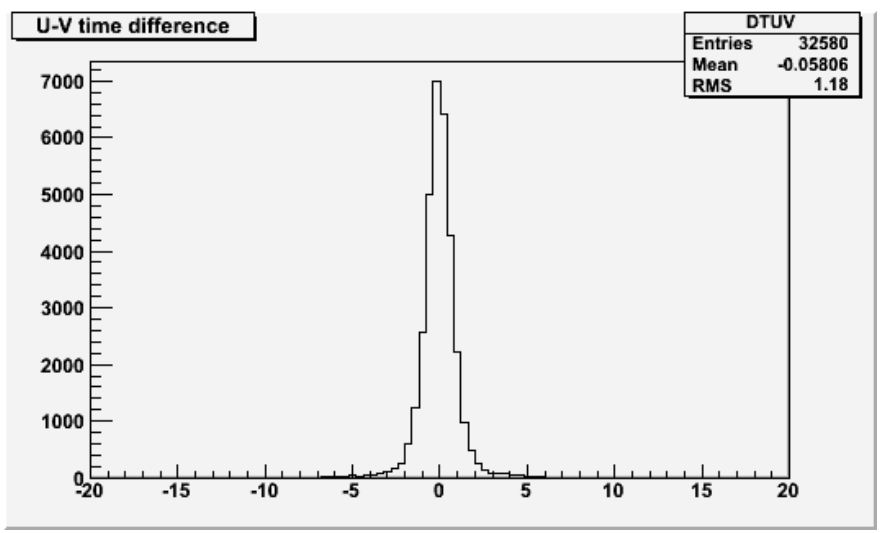
Filtering

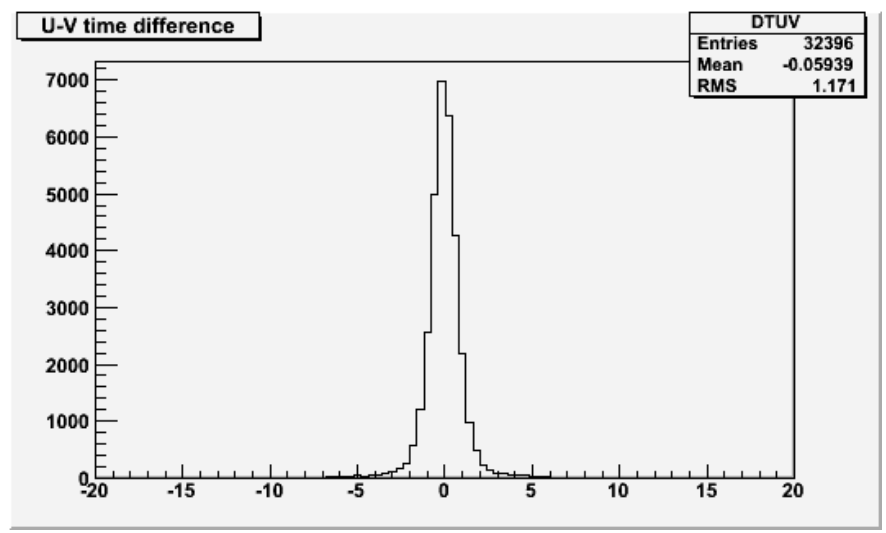
No MC truth





MC truth





Δt (ticks)

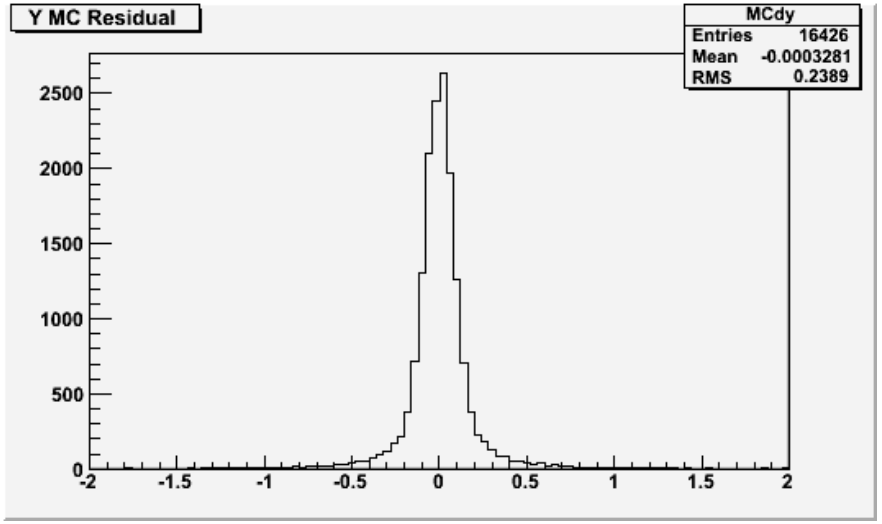
Δt (ticks)

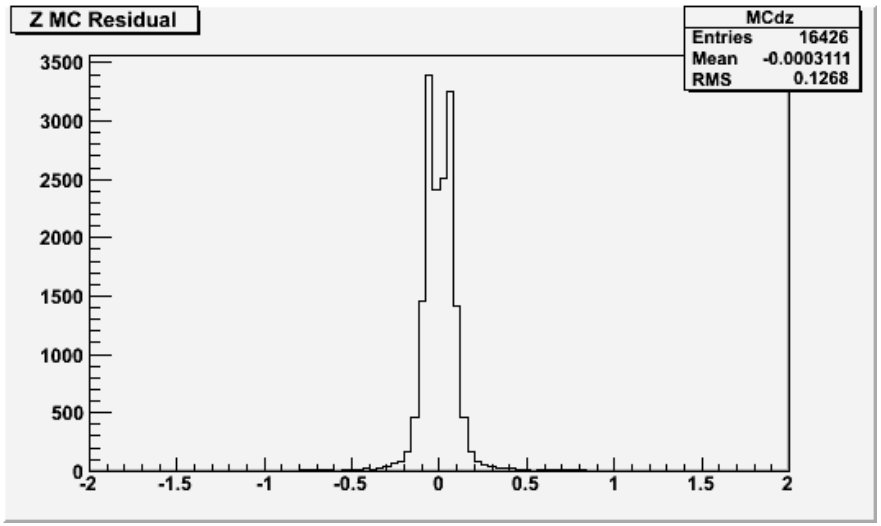
Space Point Residuals vs. MC Truth

Y Residuals

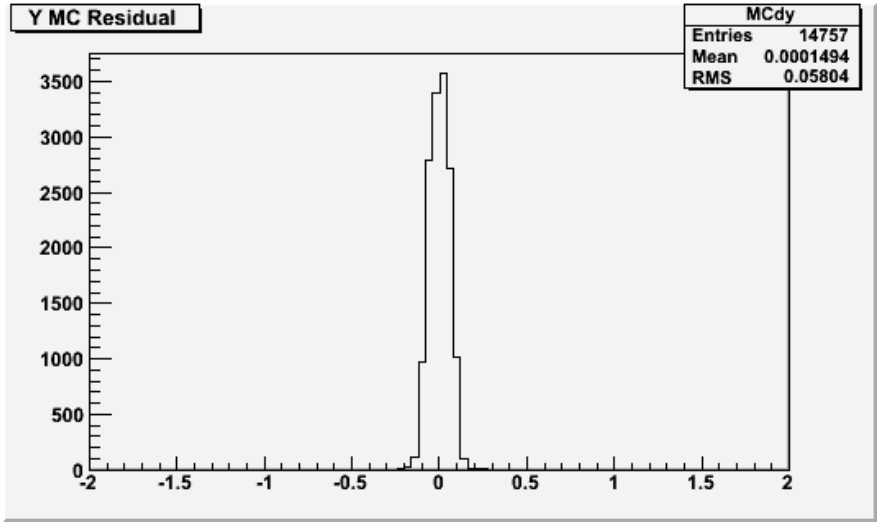
Z Residuals

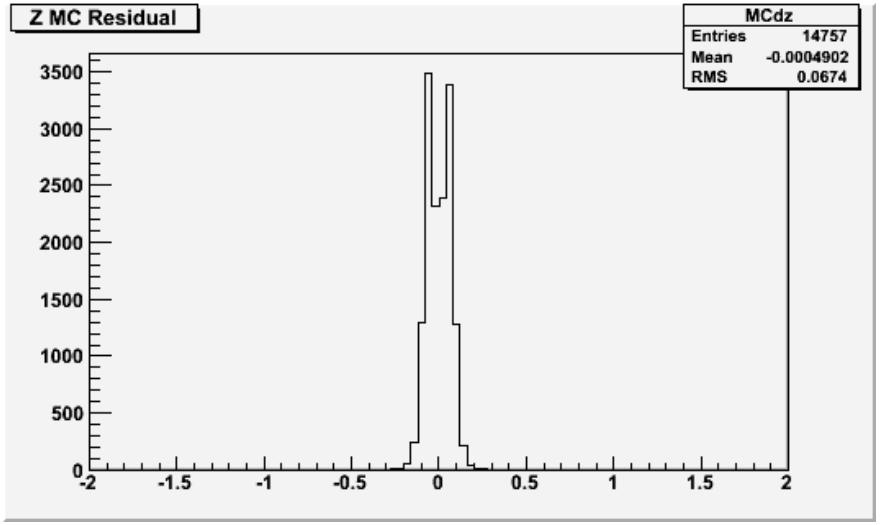
No MC truth/ Filtered





MC truth





Δy (cm)

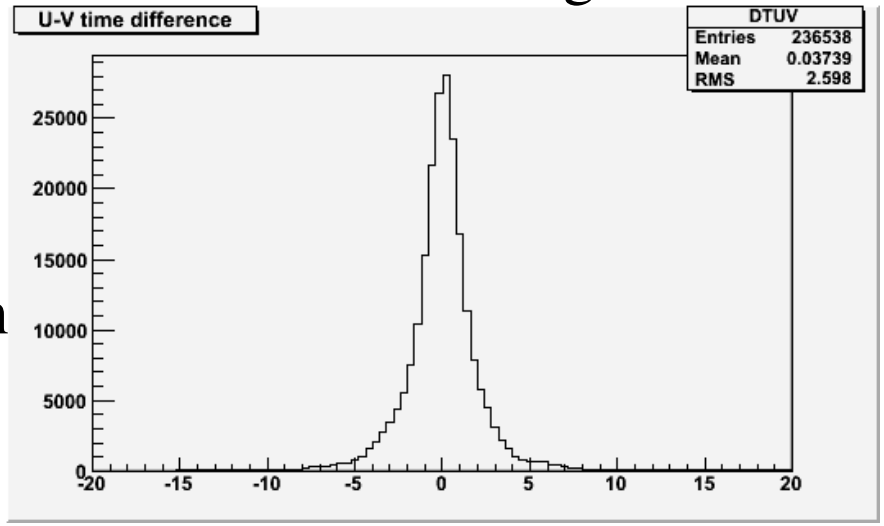
Δz (cm)

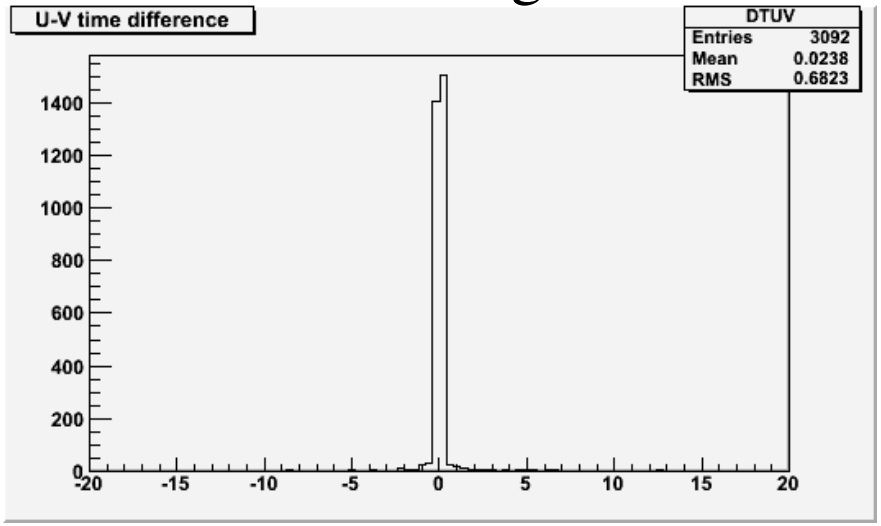
U-V Time Difference With Filtering (Argoneut)

No Filtering

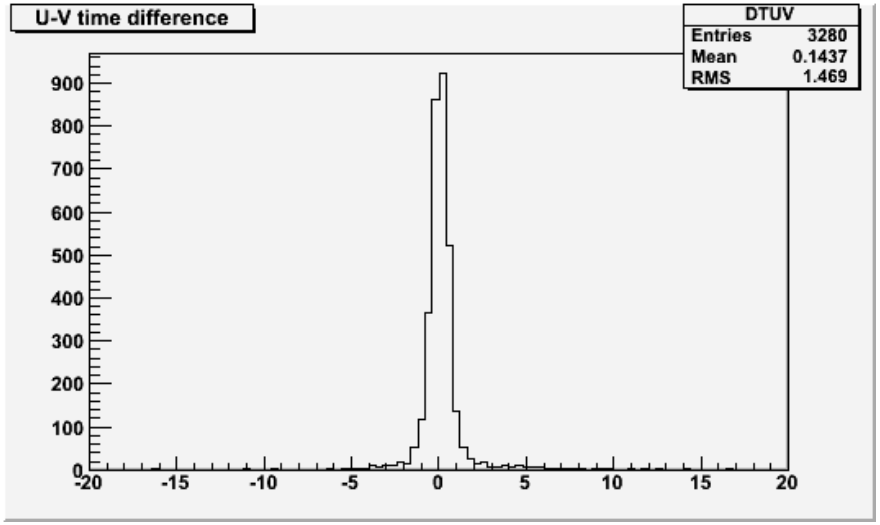
Filtering

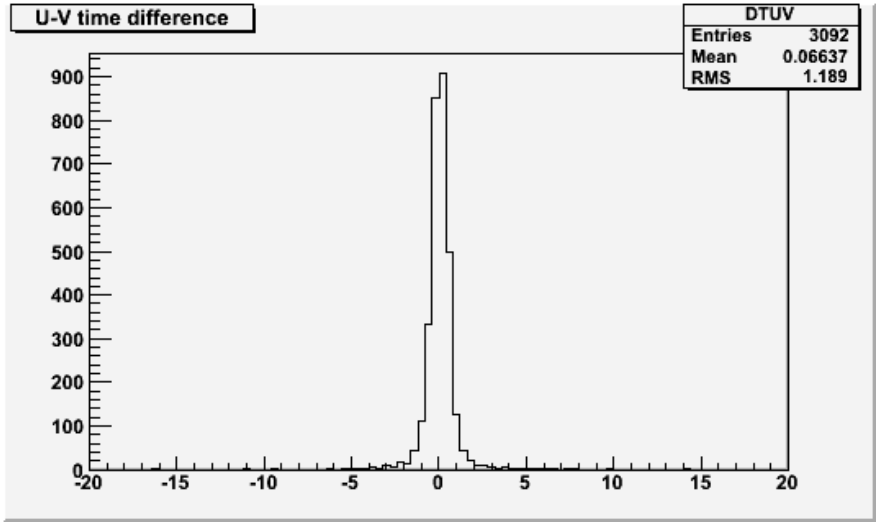
No MC truth





MC truth





Δt (ticks)

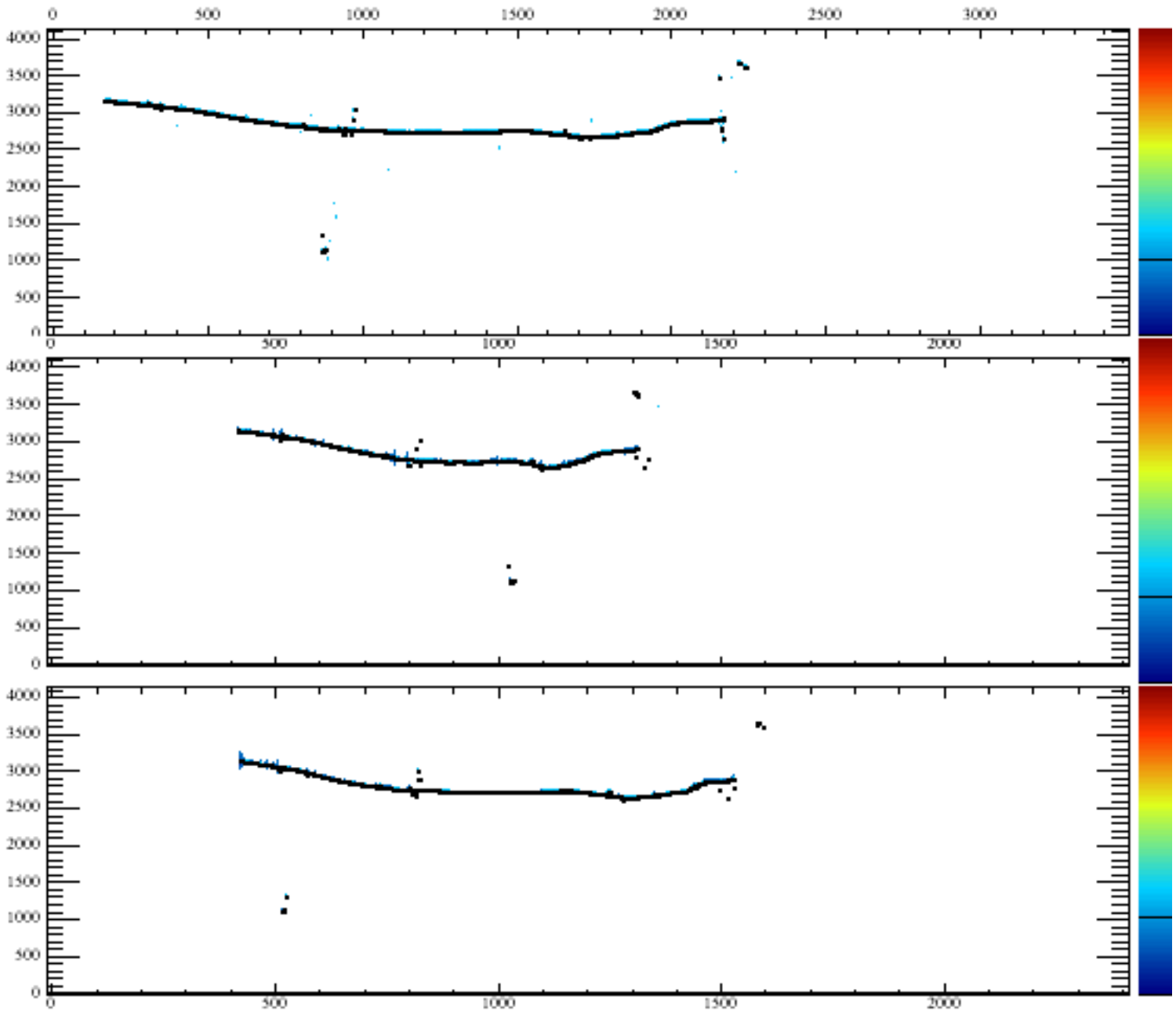
Δt (ticks)

Filtering Conclusions

- Filtering successfully gets rid of many (presumably fake) space points.
- Filtered space points time difference distribution looks similar to time distribution made using mc truth.
  - Plot is consistent with filtered space points being 90% pure, but we can not definitely make that conclusion yet.
- It would be interesting to see how Kalman tracks reconstructed using filtered space points stacked up against Kalman tracks reconstructed using mc truth space points.

Future Directions

- Ability to visualize space points (together with mc truth), especially in y-z or full 3D views.
- Using features (delta rays, kinks, endpoints) as an aid in matching views.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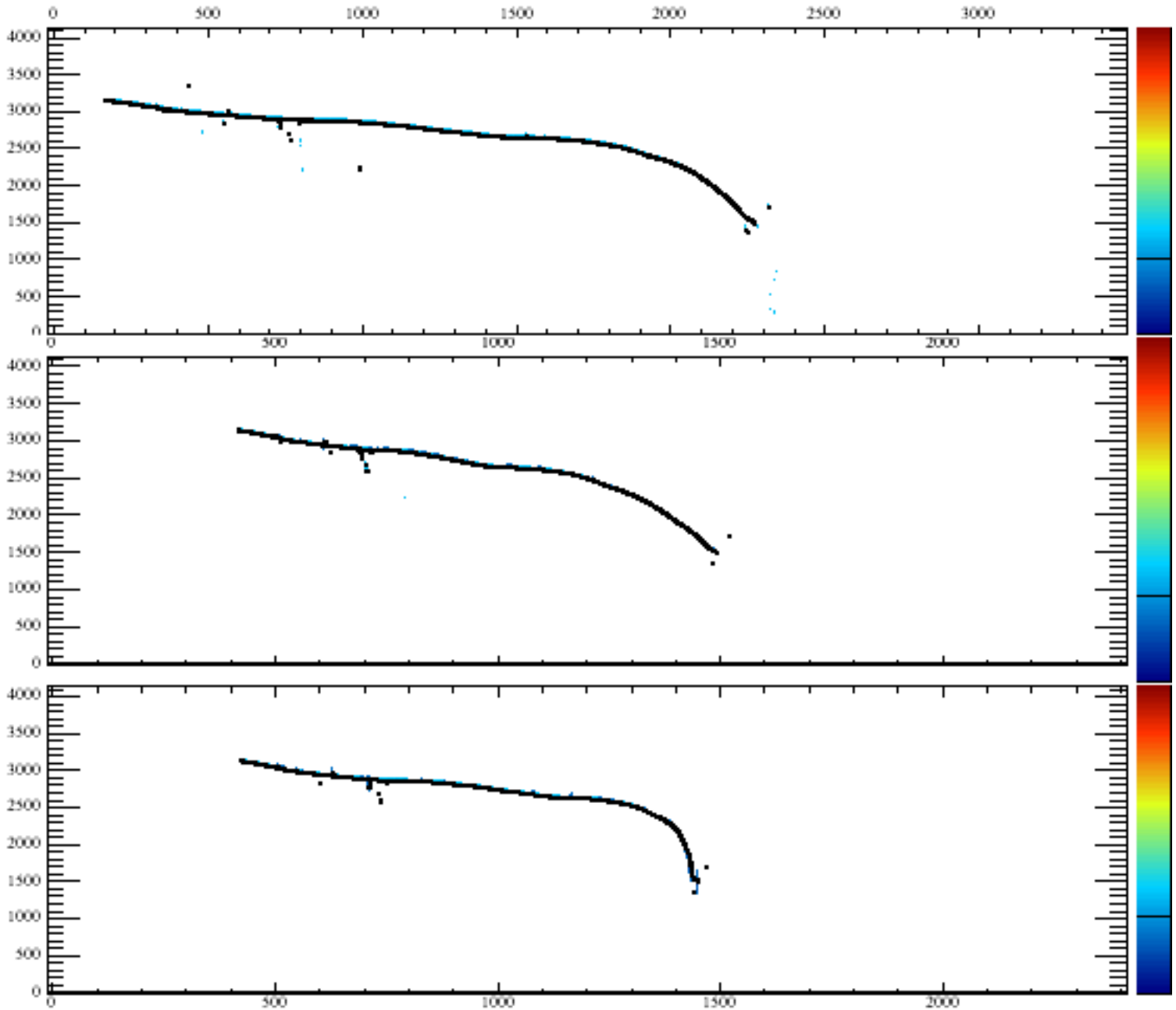
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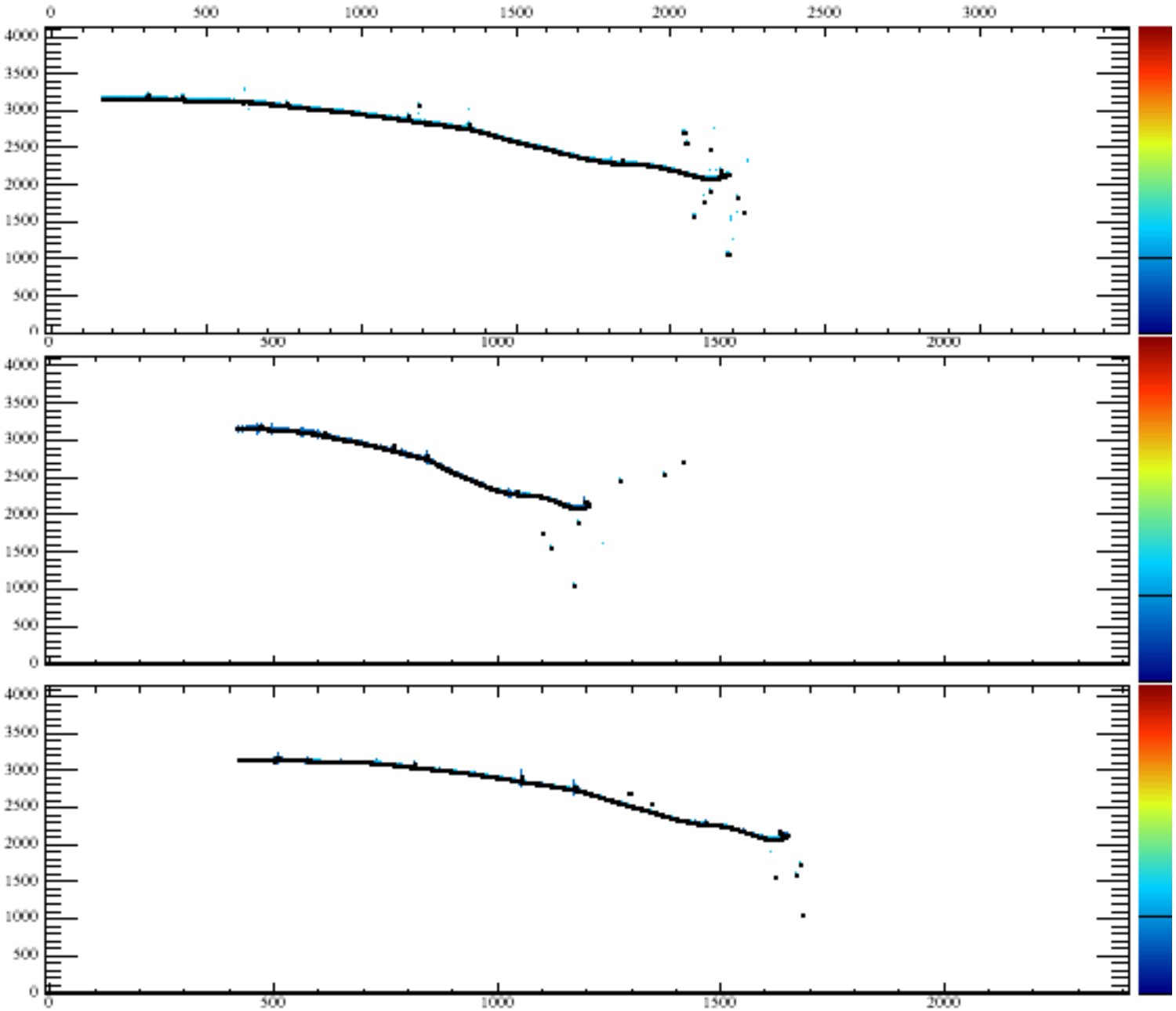
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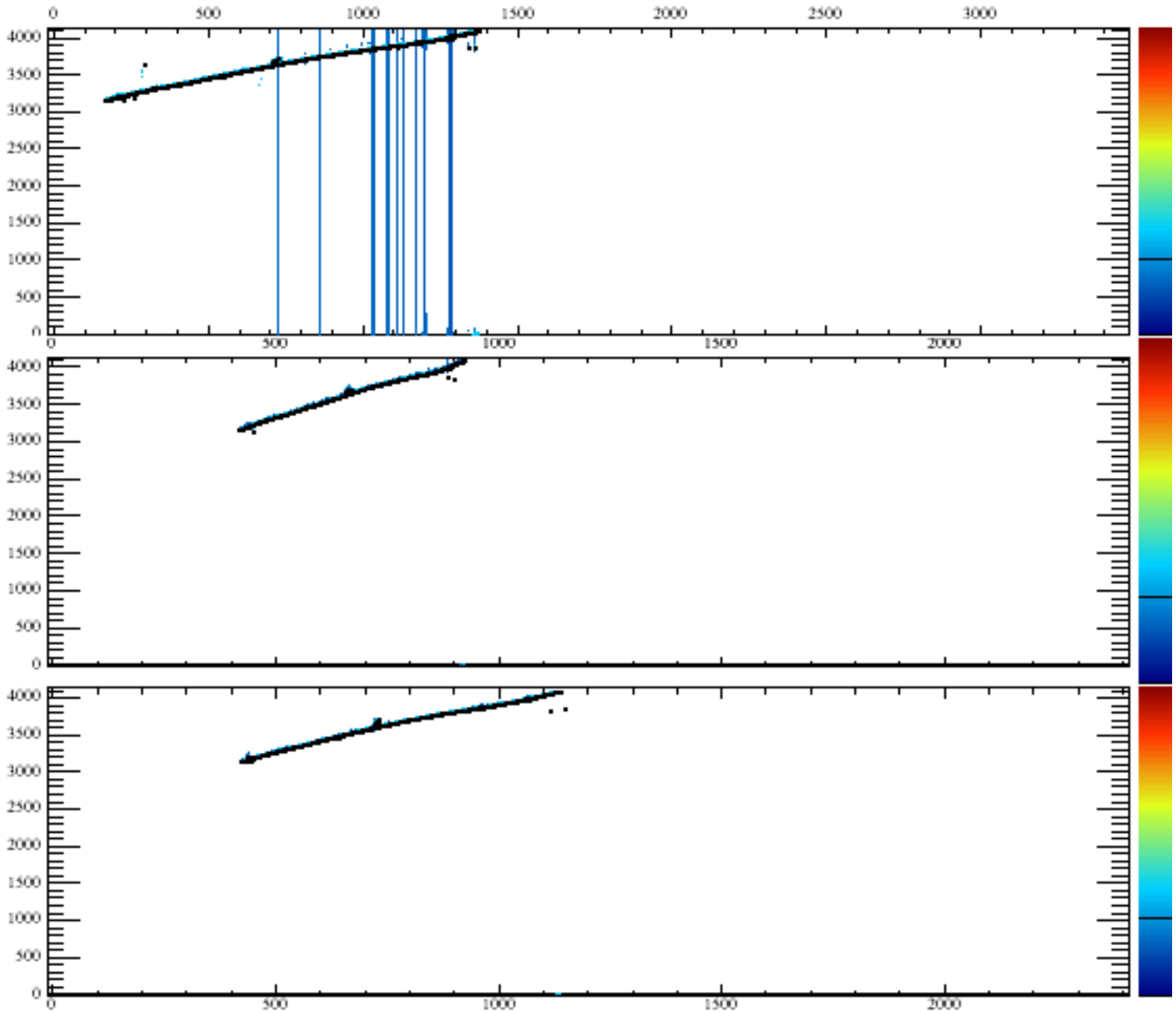
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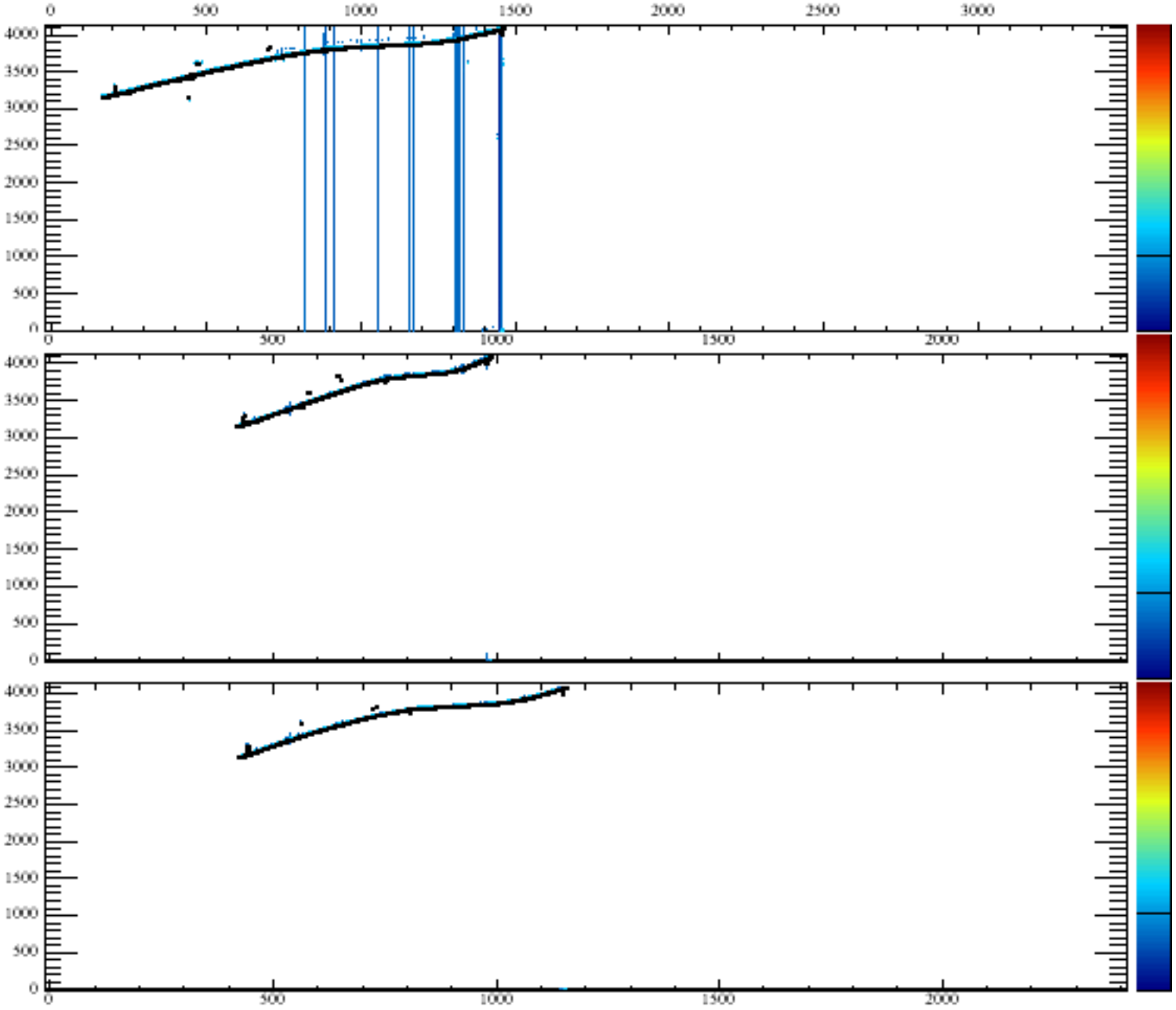
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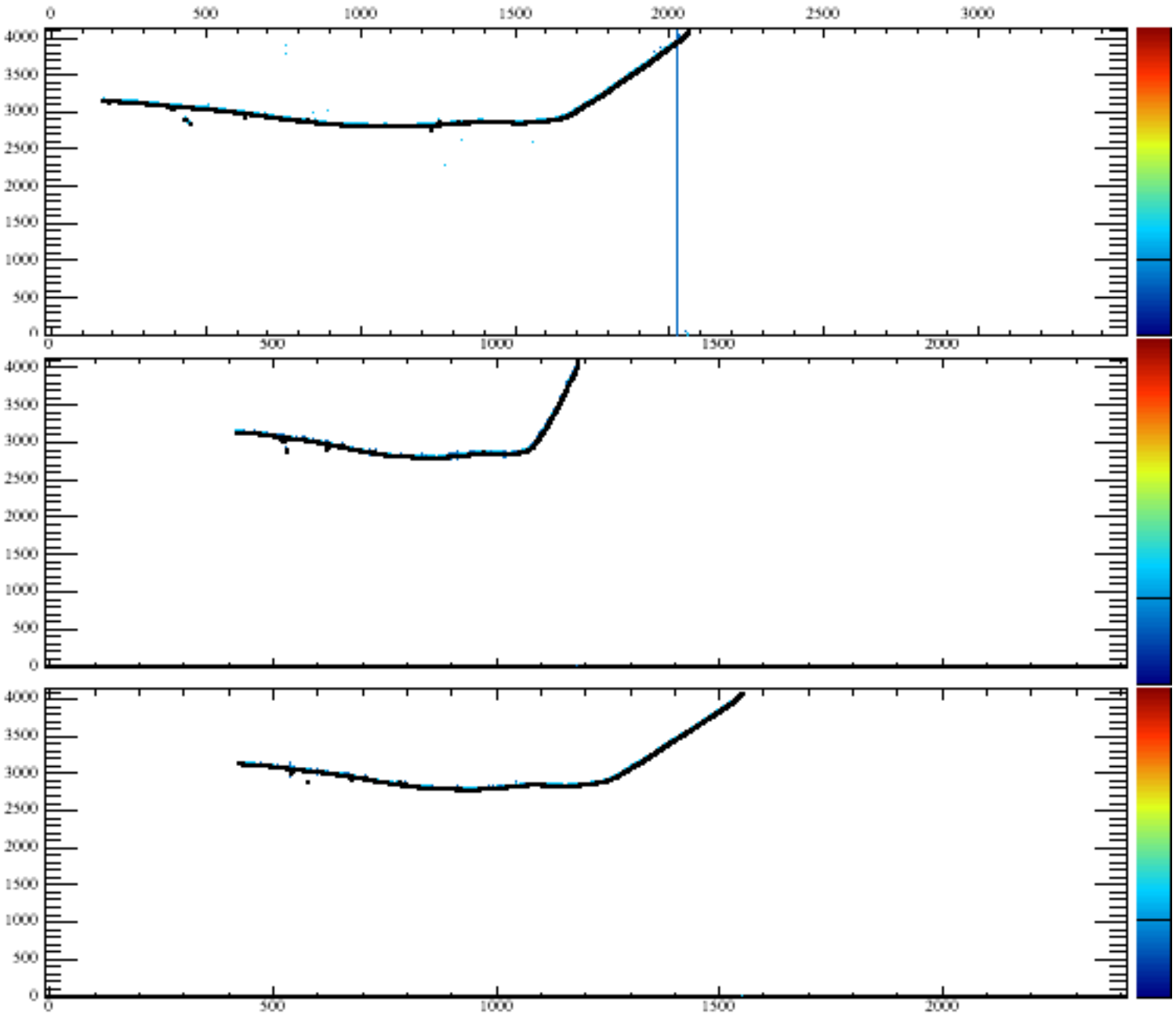
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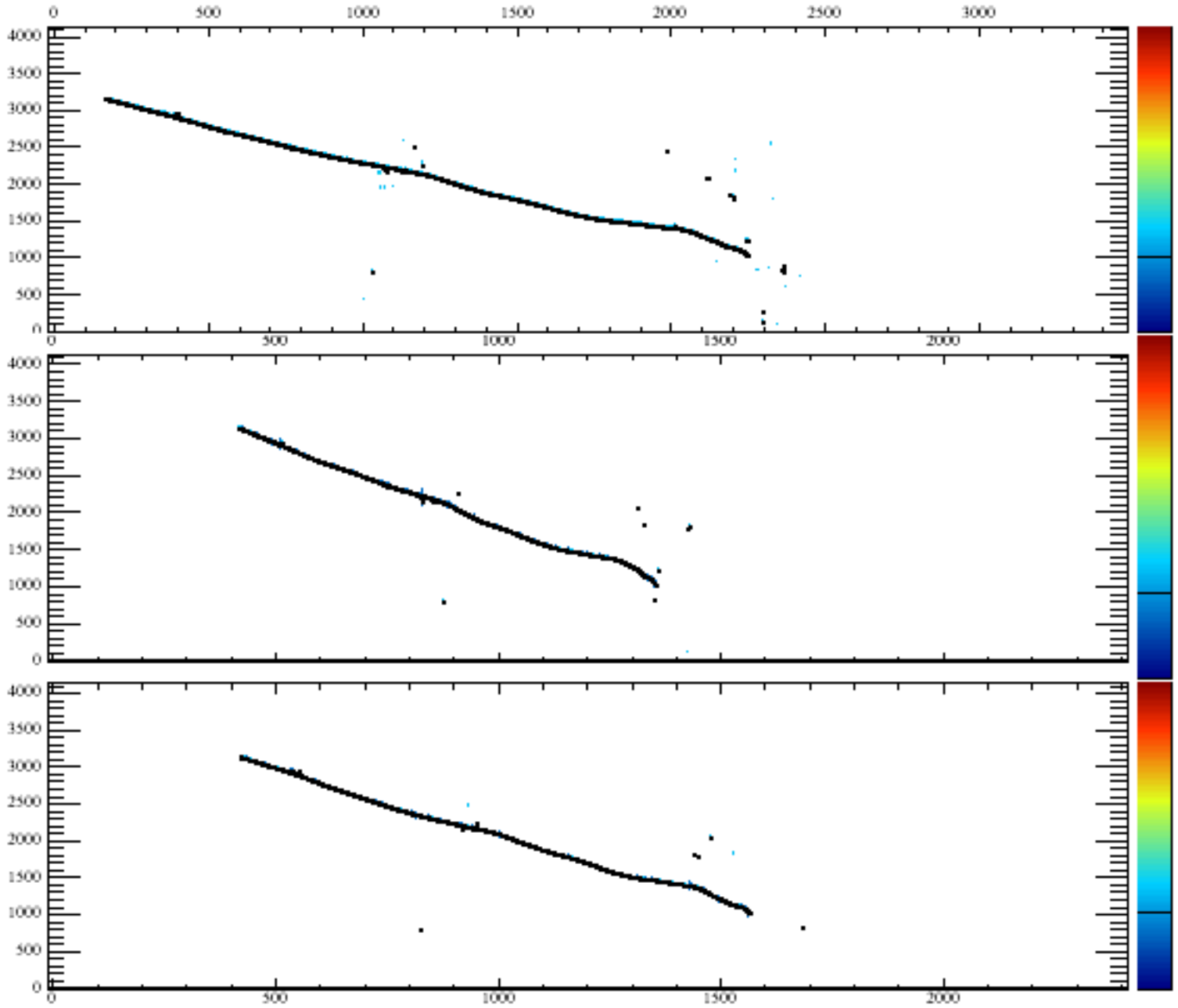
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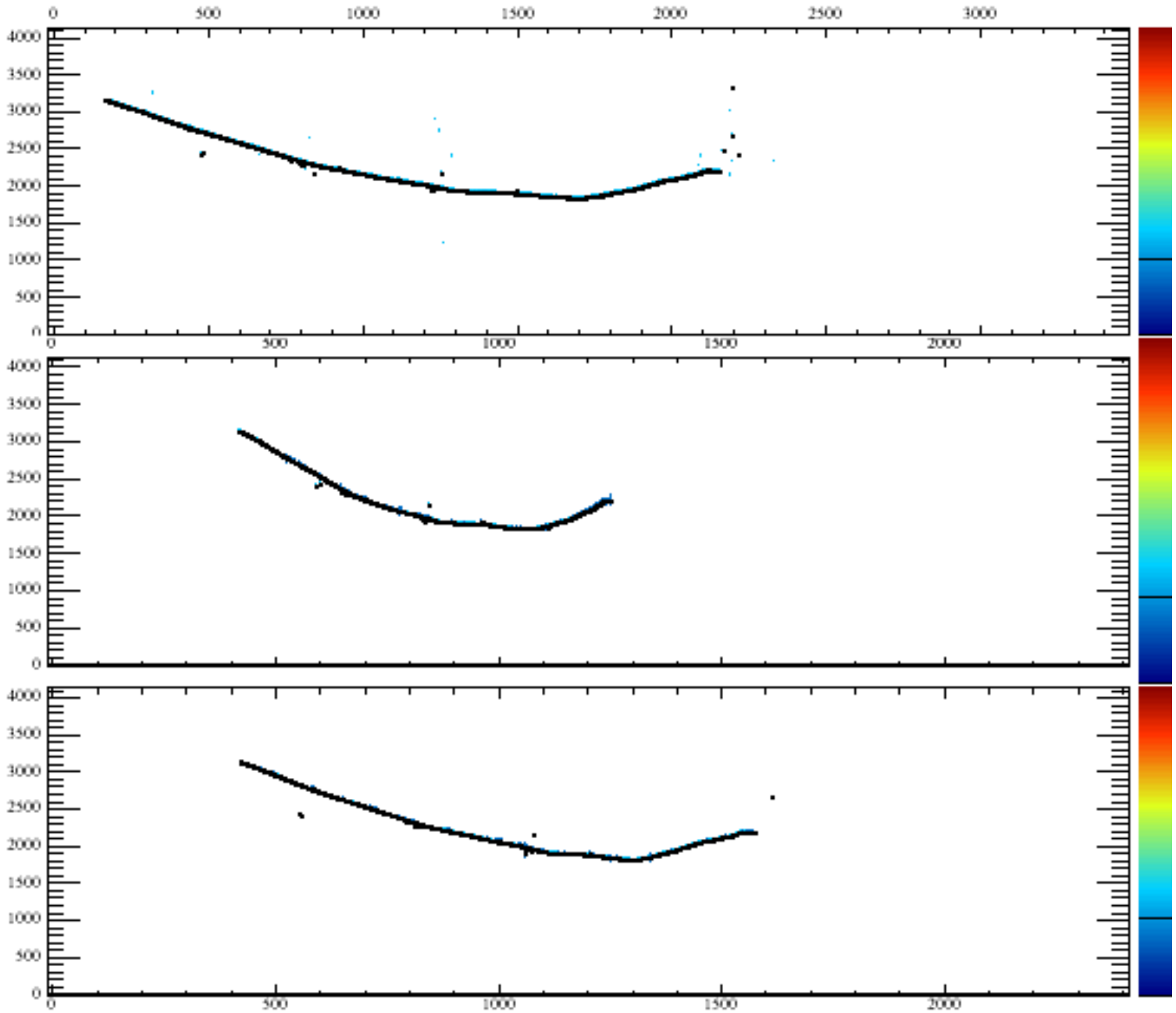
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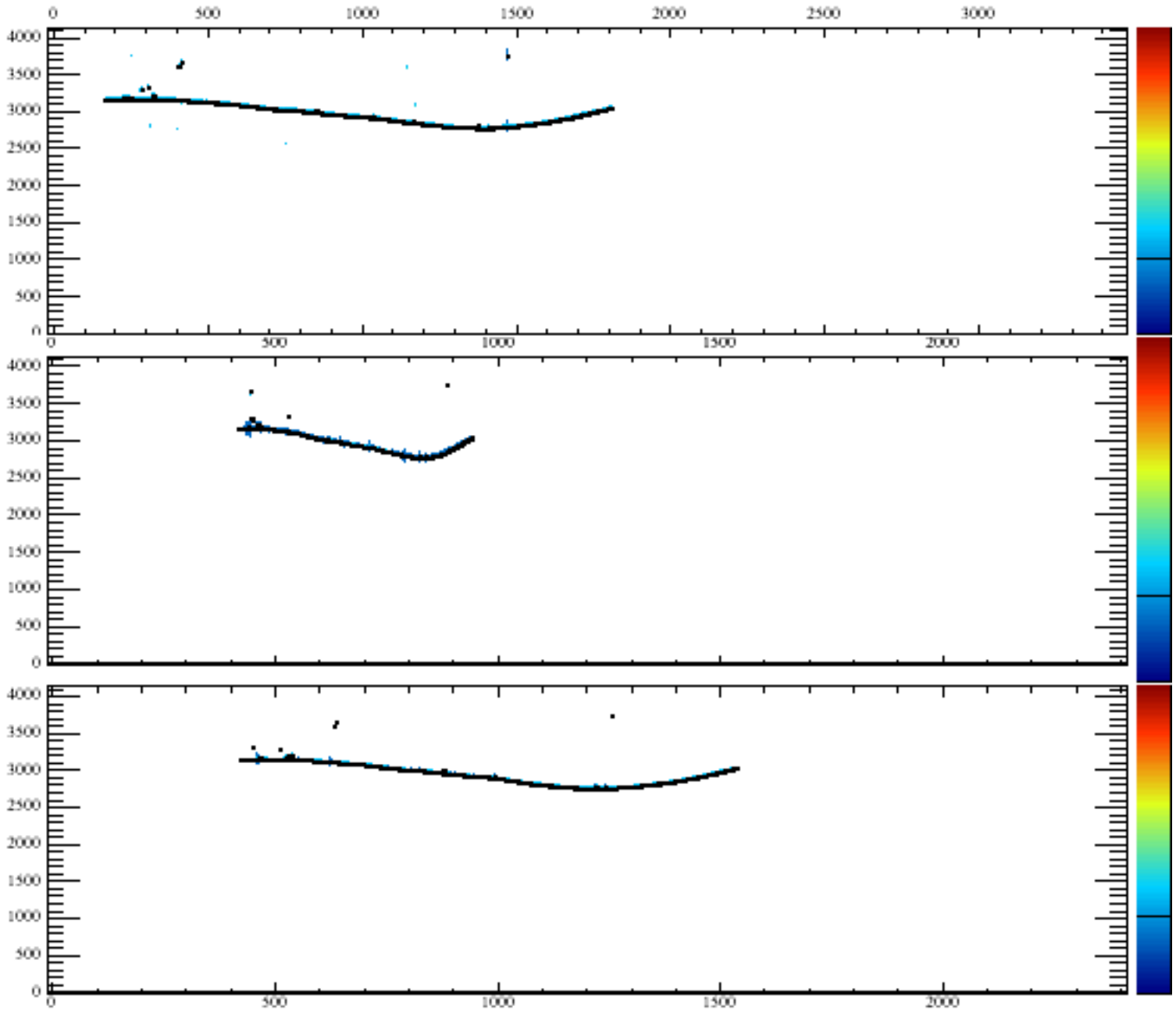
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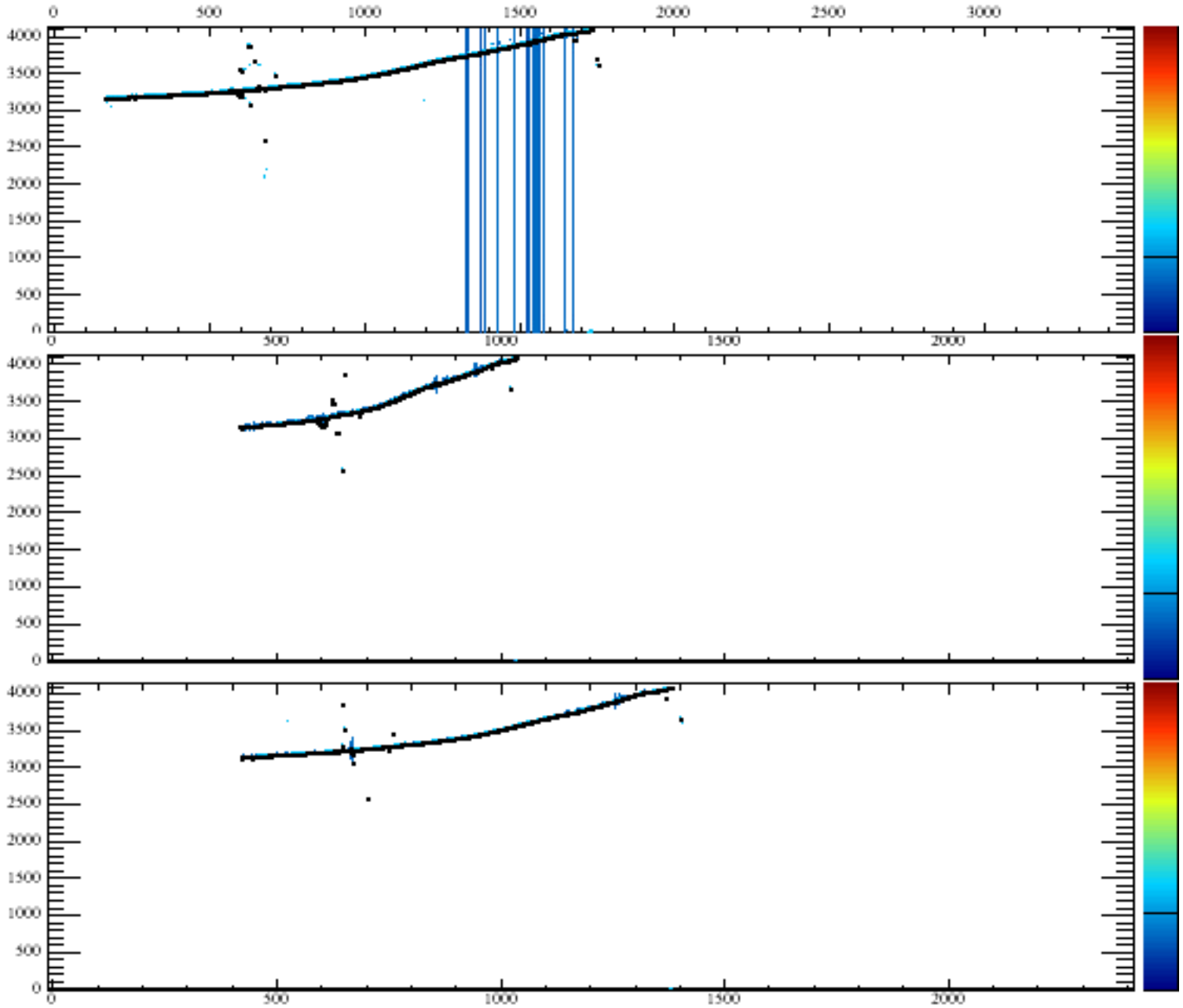
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