

Wirecell Group Update

Evander Espinoza

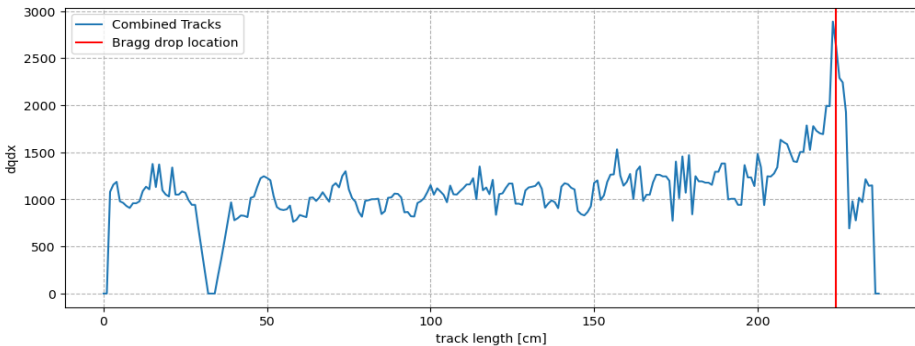
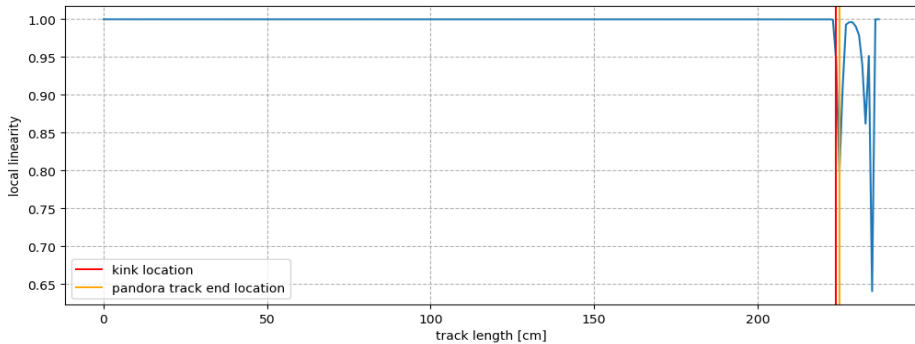
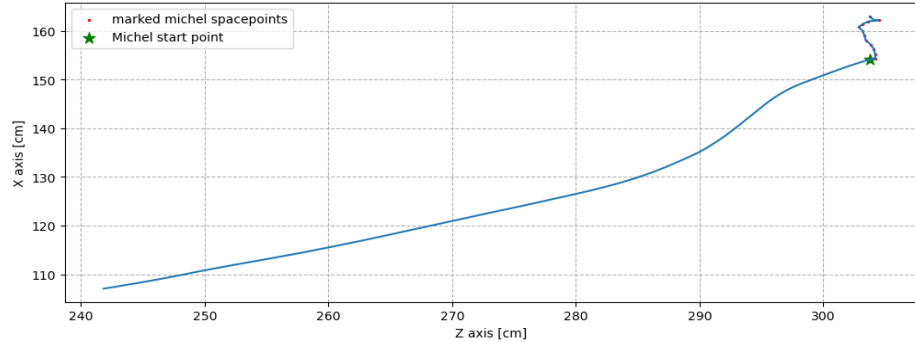
June 18, 2026

Louisiana State University

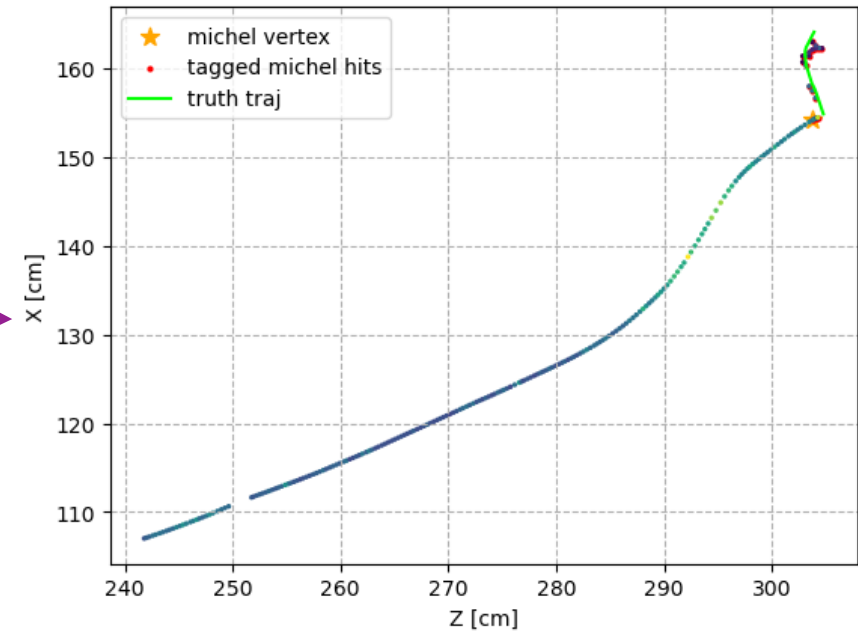
LSU

Louisiana State University

From the Collaboration Meeting...

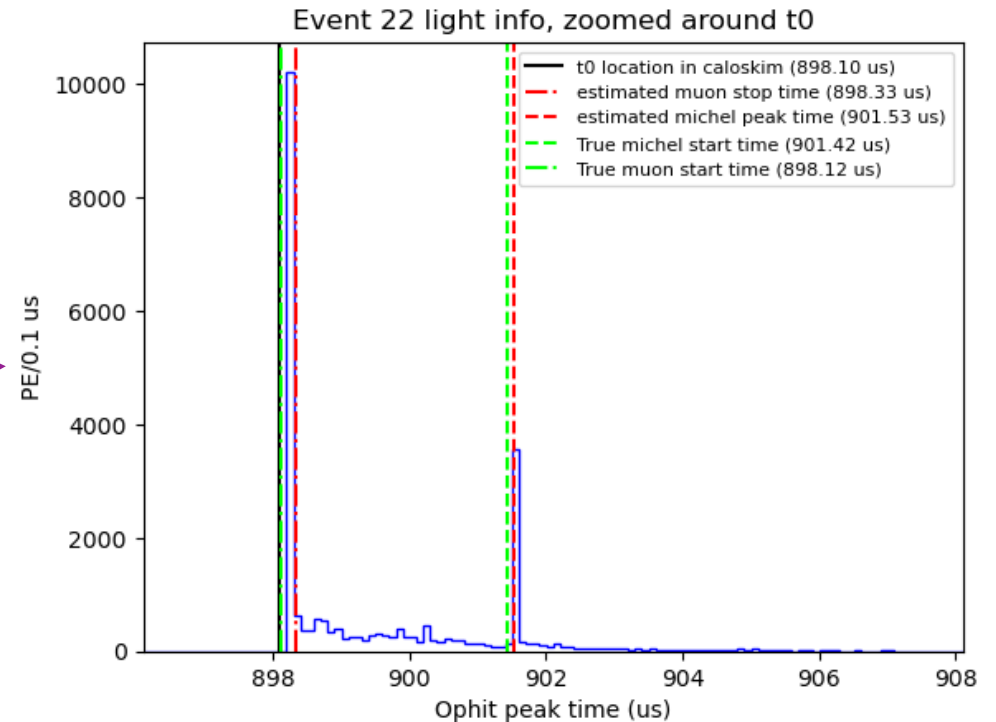
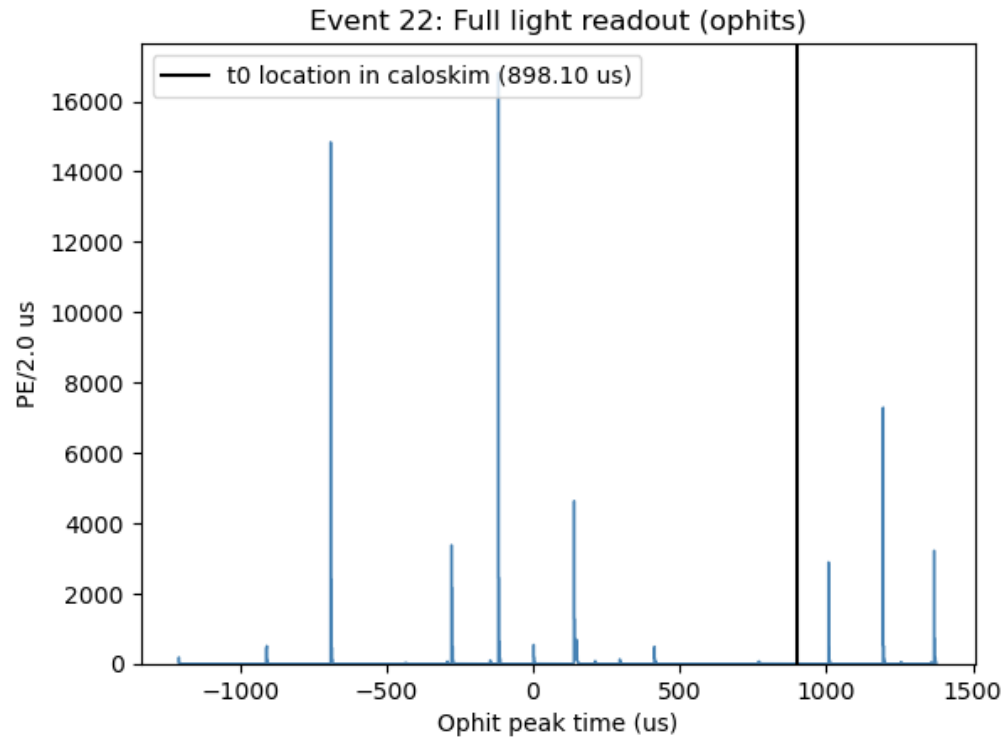


- I presented overall progress on Michel electron identification in calib ntuples using both charge and *light* information independently



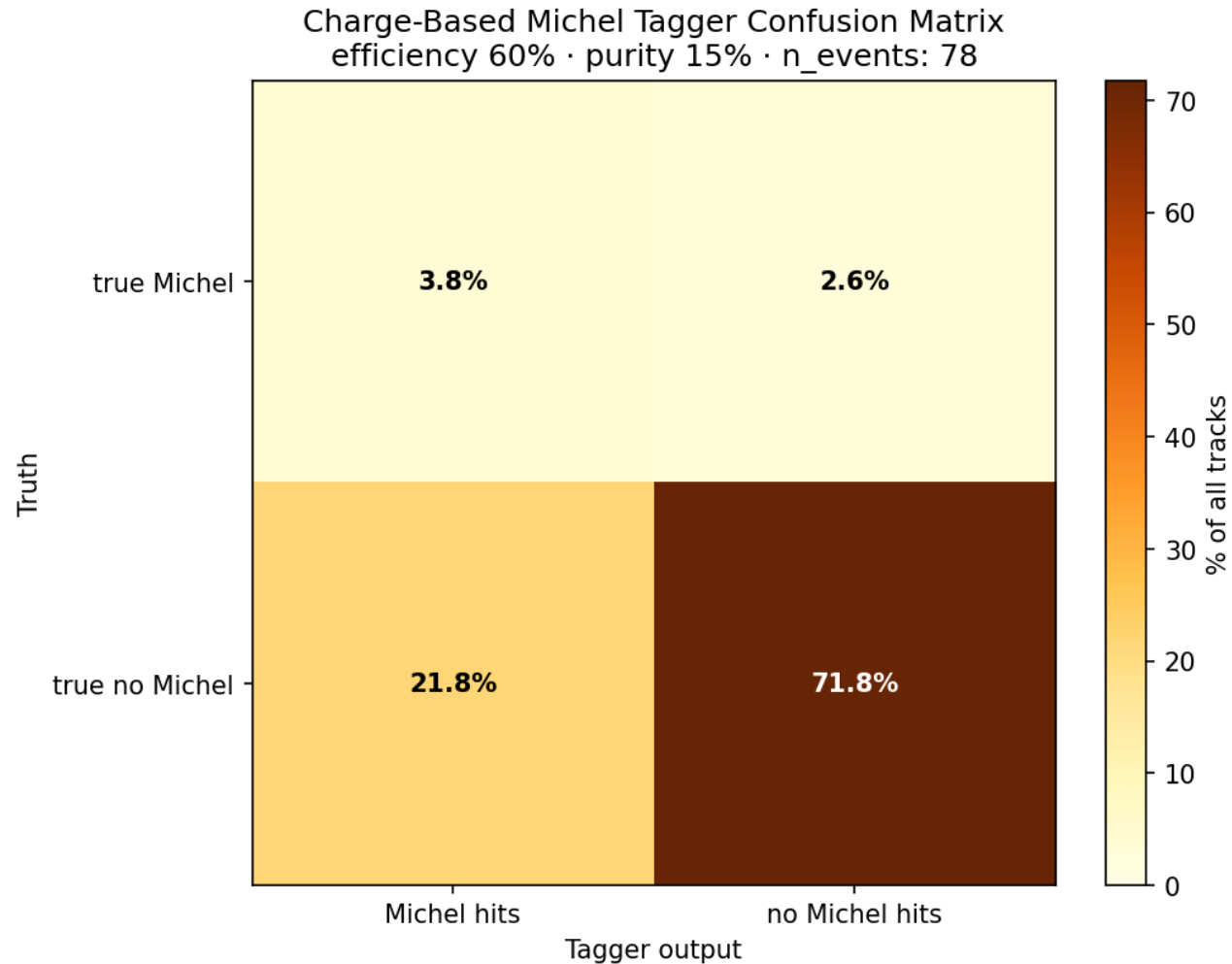
From the Collaboration Meeting...

- I presented overall progress on Michel electron identification in calib ntuples using both *charge* and *light* information independently



How does the charge-based tagging hold up?

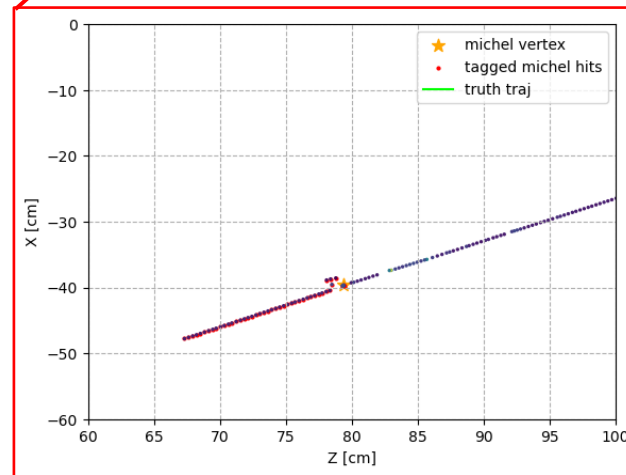
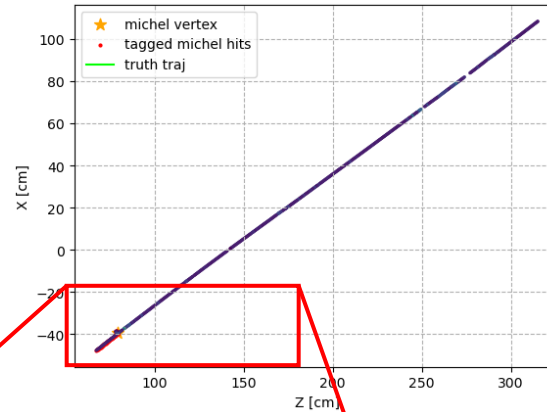
- From eye-scan (78 events), there is a significant percentage of false-positives!!!
- Other metrics:
 - # correctly ID'd Michels/total Michels in truth: 60%
 - # correctly rejected tracks/true "non-Michels": 76.7%
 - Accuracy ((TP+TN)/all events): 75.6%
 - False-positive rate (FP/(FP+TN)): 23.3%



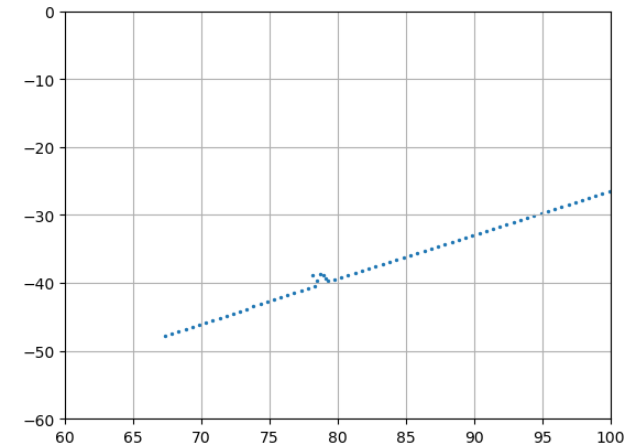
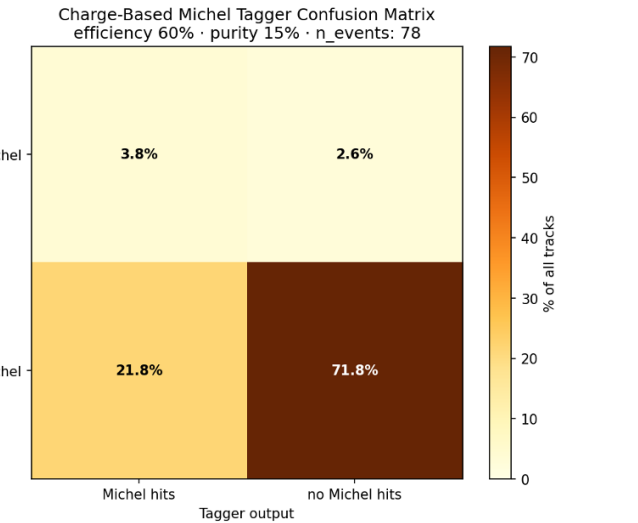
Additional failure mode correction

Old confusion matrix before correction, many more FPs

- High # of false positives, due to spacepoints themselves fluctuating at times
- Adding an extra discriminator (length-based cut between linearity-based and Bragg peak Michel regions) improved both efficiency and purity metrics

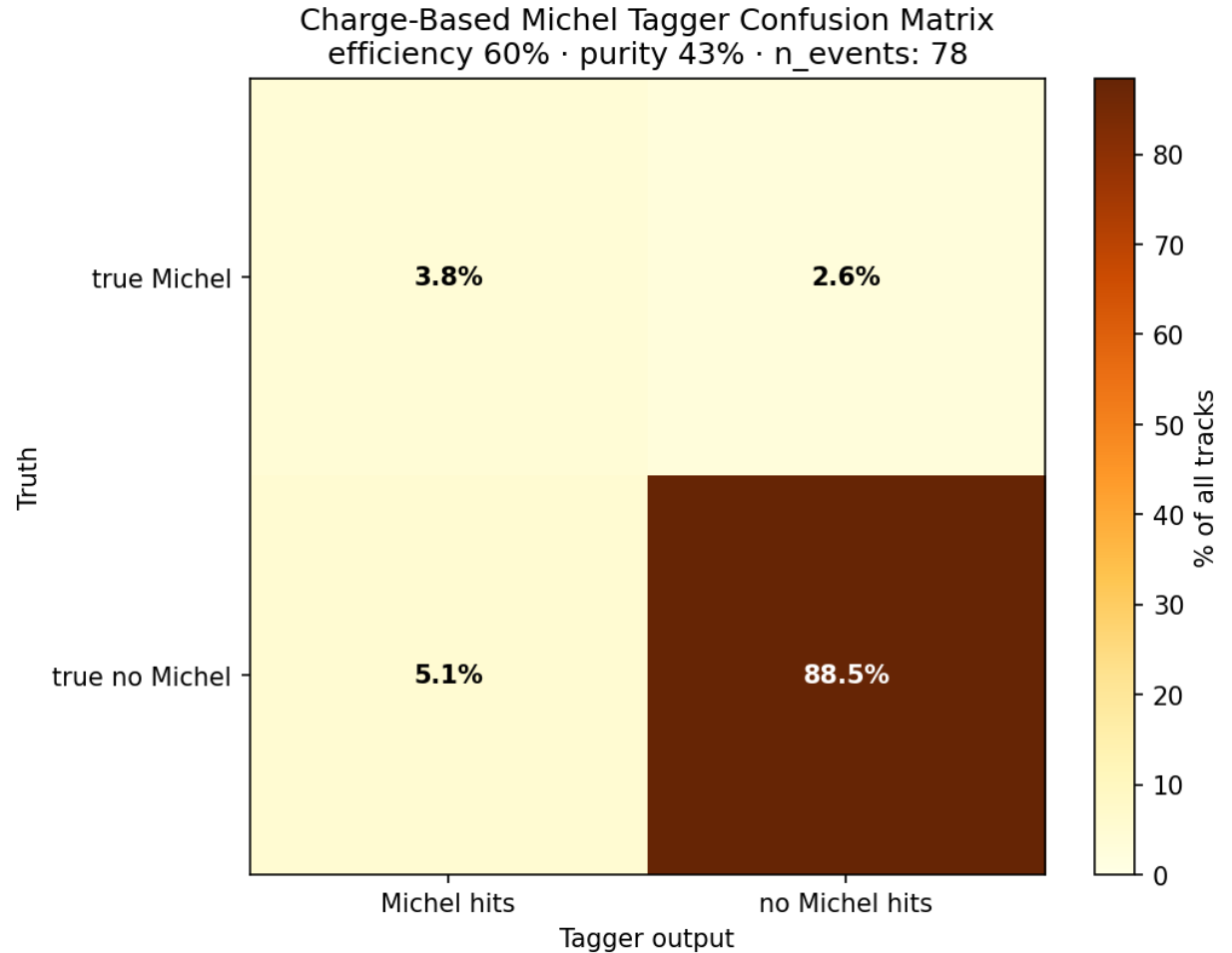


After Bragg/kink cut



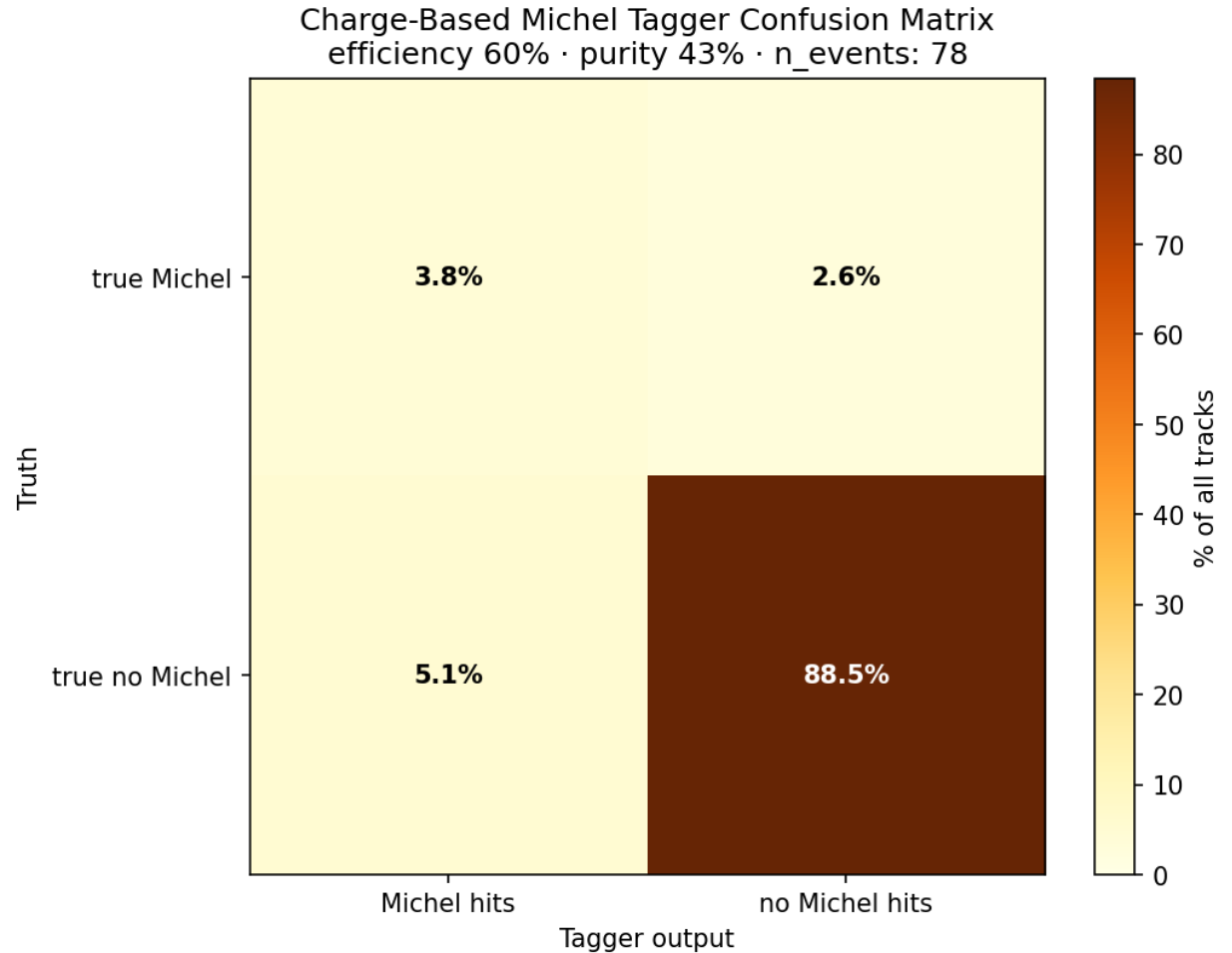
After failure mode correction

- Large reduction in false-positives
- What about the false negatives?
 - So far, I've only seen it caused due to upstream rejection (i.e. shower rejection from ntuples). In practice, I don't think the tagger would cause many false negatives in data, but efficiency due to this will drop.
 - Should still verify on a larger dataset



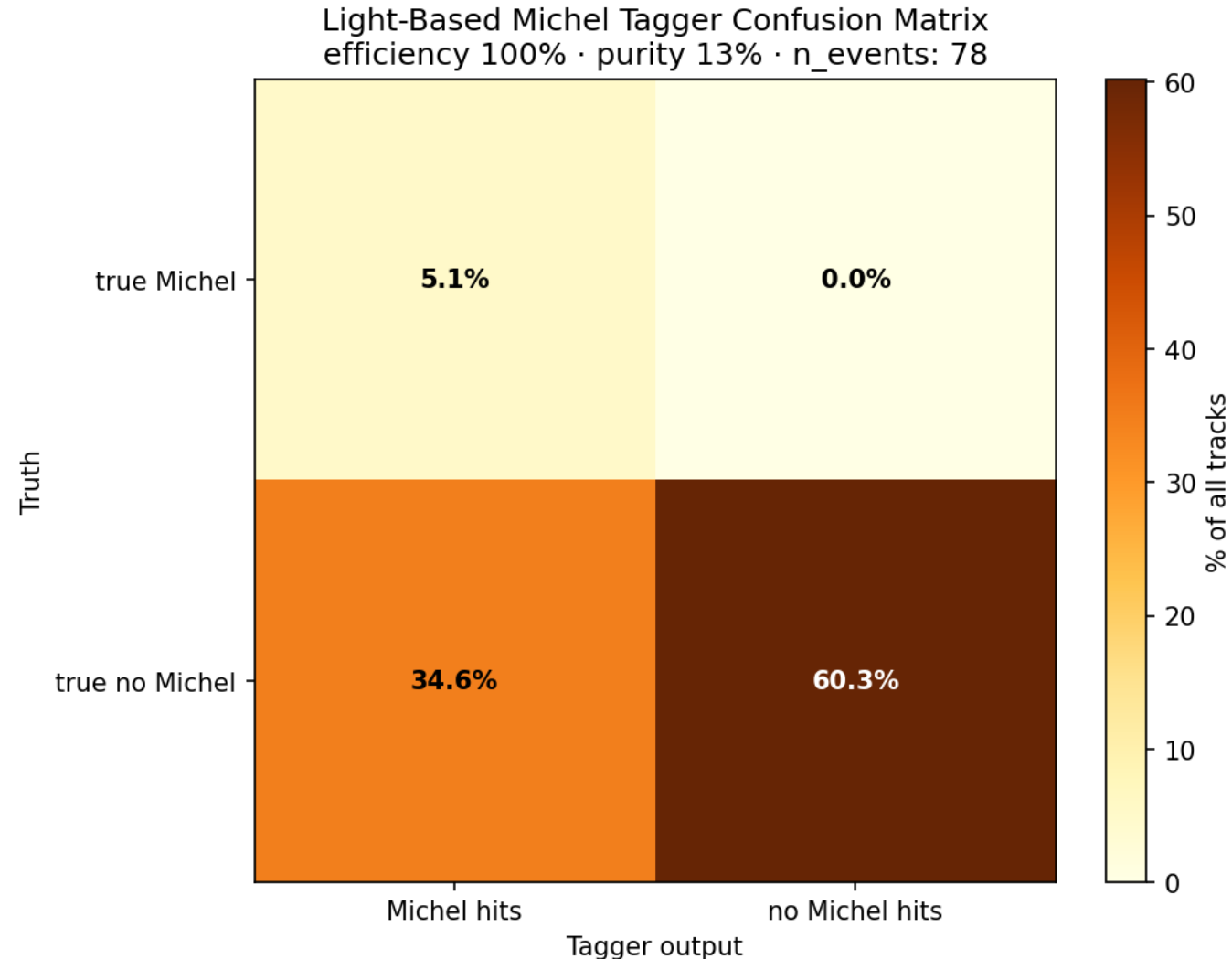
After failure mode correction

- # correctly ID'd Michels/total Michels in truth: 60%
- # correctly rejected tracks/true "non-Michels": 94.5%
- Accuracy ((TP+TN)/all events): 92.3%
- False-positive rate (FP/(FP+TN)): 5.5%



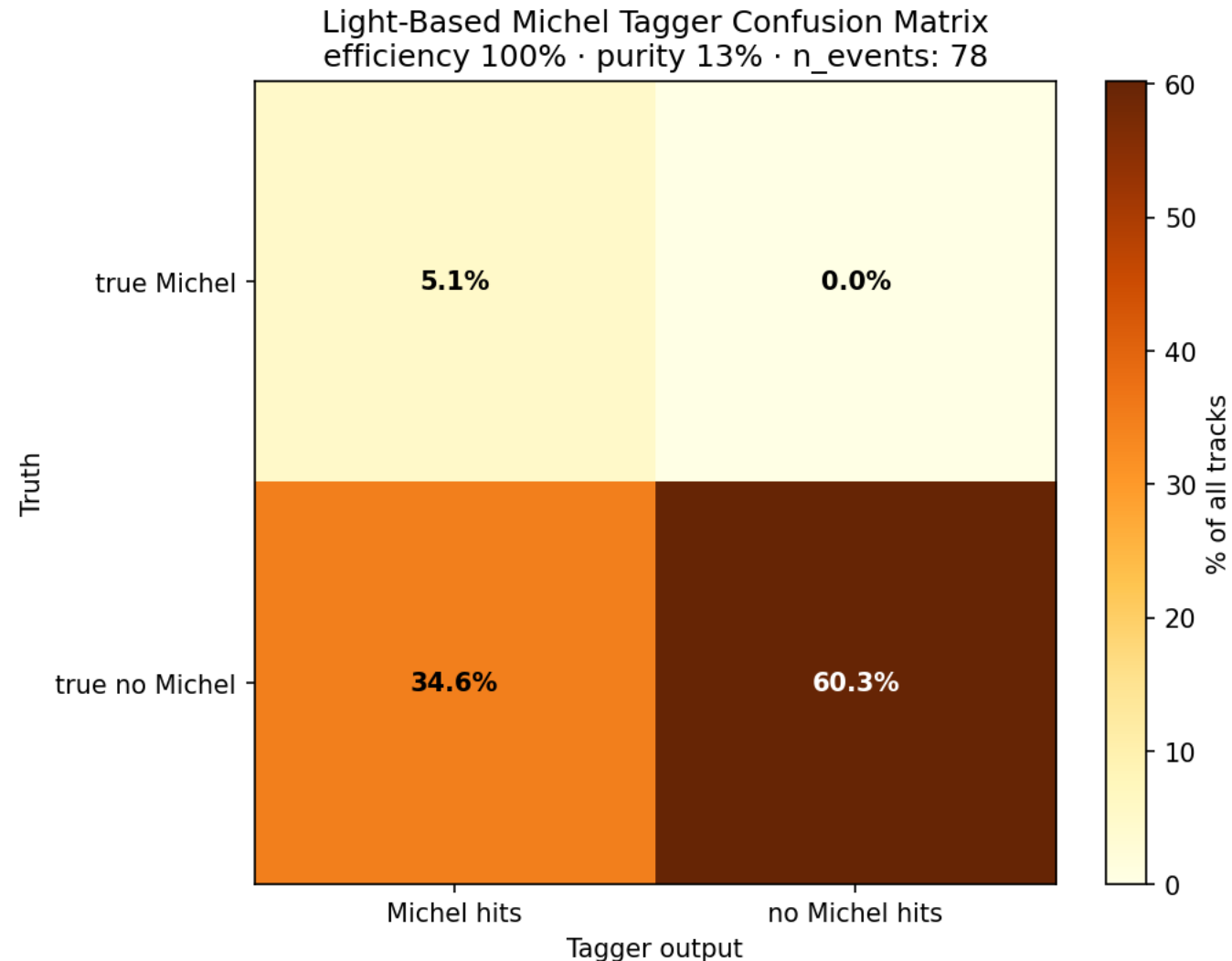
How does light-based tagging hold up?

- From same event sample
- Good at catching false-negatives in charge-based tagging, however too inclusive
 - Essentially, finds any pulses higher than median PE, spaced at least a distance away equal to standard deviation from previous peak
 - This allows many more peaks than expected, including fluctuations
- Some interesting things of note:
 - Truth info often shows Michel time even when not present in other caloskim variables
 - The eval metrics for some events don't align with the charg-based ones



How does light-based tagging hold up?

- From same event sample
- # correctly ID'd Michels/total Michels in truth: 80%
- # correctly rejected tracks/true "non-Michels": 63.5%
- Accuracy $((TP+TN)/\text{all events})$: 65.4%
- False-positive rate $(FP/(FP+TN))$: 36.5%



Michel failure mode correction

- Typically, there were 2 main failure modes, I noticed when hand-scanning:

1. Bump caught along muon's "tail"
2. Pulse found later, usually due to a much brighter track

