

WCTE beam reconstruction

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WCTE beam data reconstruction

- Beam data R1478, Nominal p -410 [MeV/c], Readouts 64,314
 - Select readout passing **window quality = 0** and **at least 25 accepted hits within 50 ns.**
 - Find the **50 ns interval containing the most usable hits.** Its first hit defines t_0
 - Keep hits in **(t_0-20) to (t_0+100) ns.**
 - Convert the PMT charge to .h5
 - This converting can be modified later
- Reconstruct first 1000 events wo/ PID identification or any selections
- Siren: cosmic muon tuned model, muon-only, charge-only
- fiTQun: muon hypothesis, charge+time

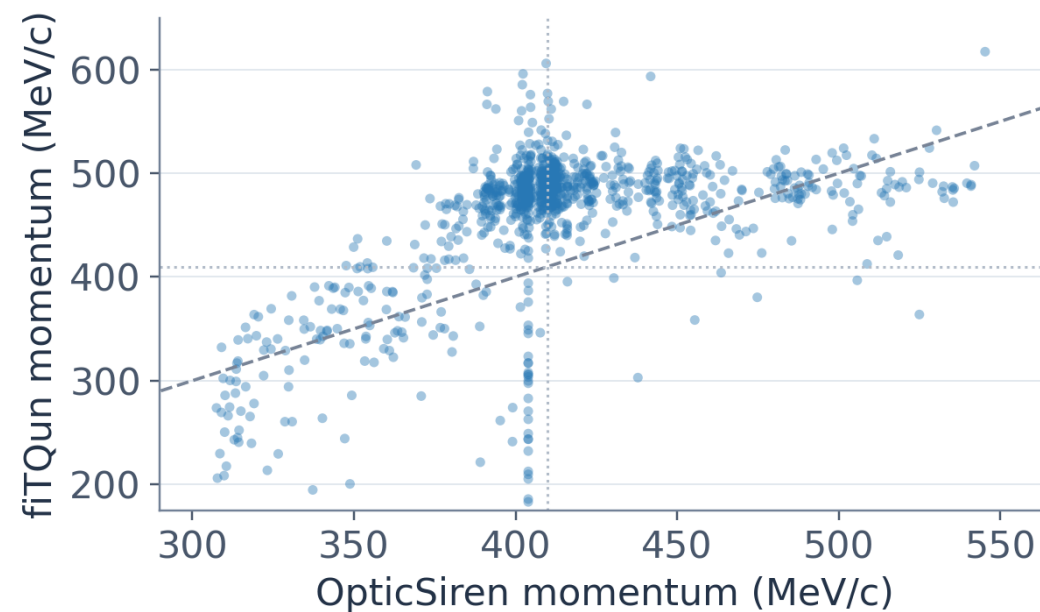
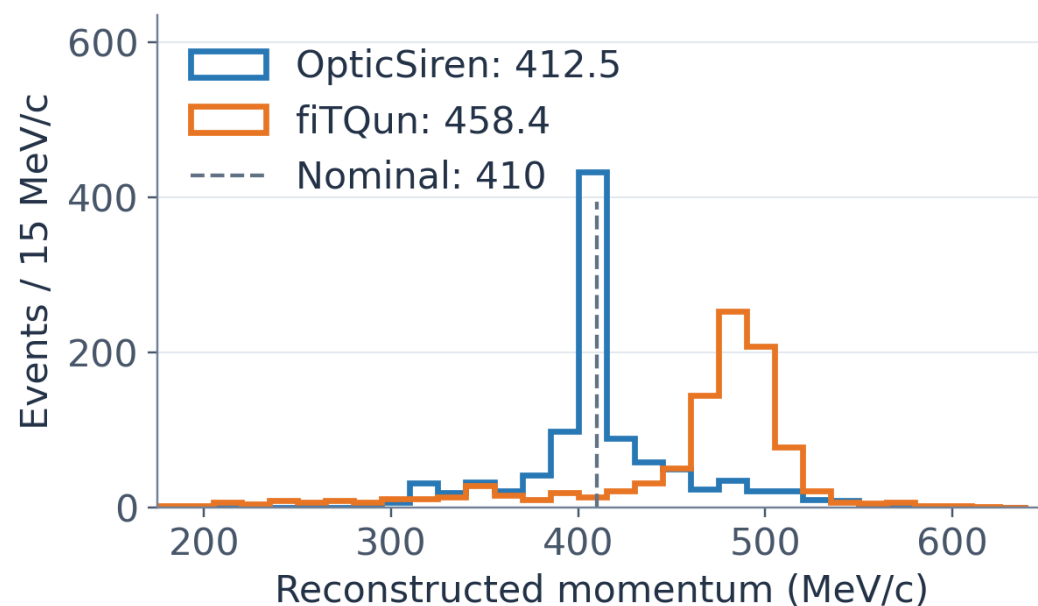
The reconstructed momentum spectra differ

The log gives a nominal beamline setting; it does not supply each event's momentum at the tank.

OpticSiren 412.55

fiTQun 458.42

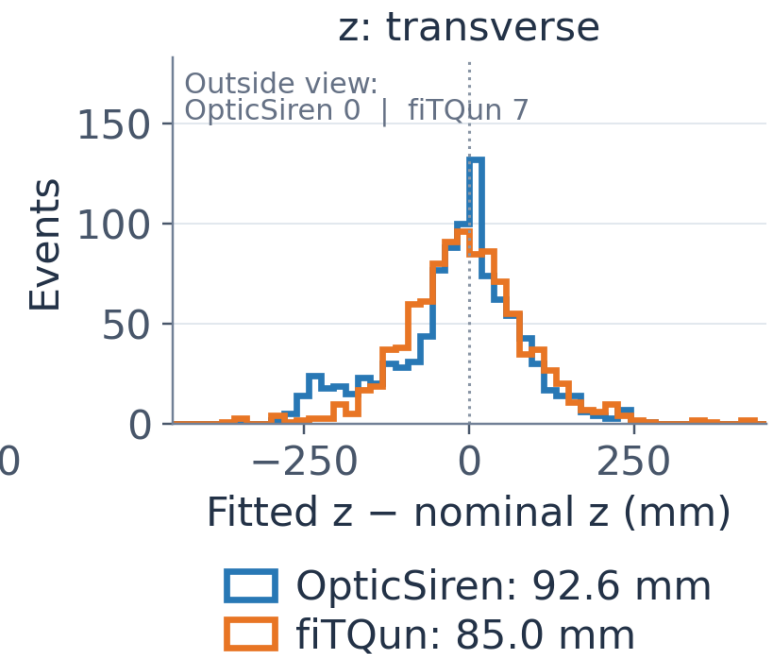
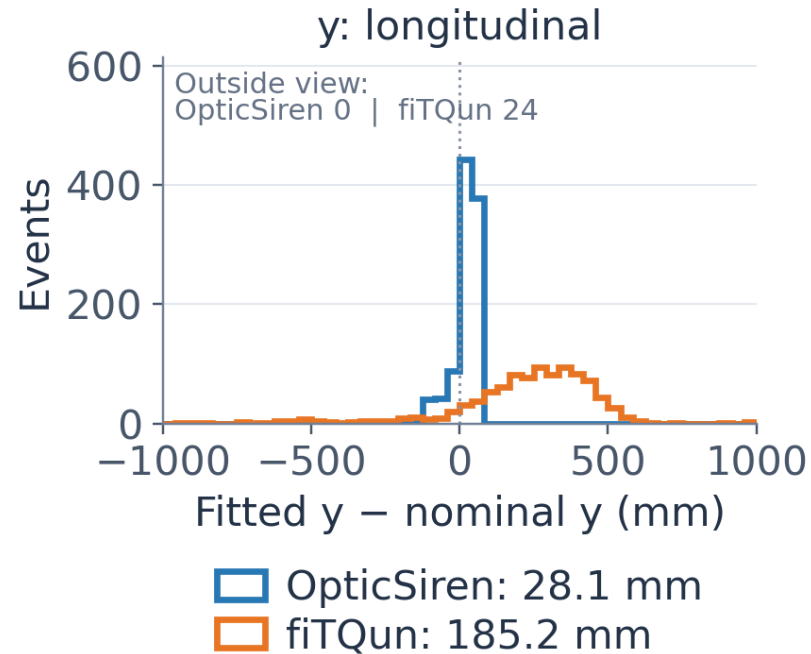
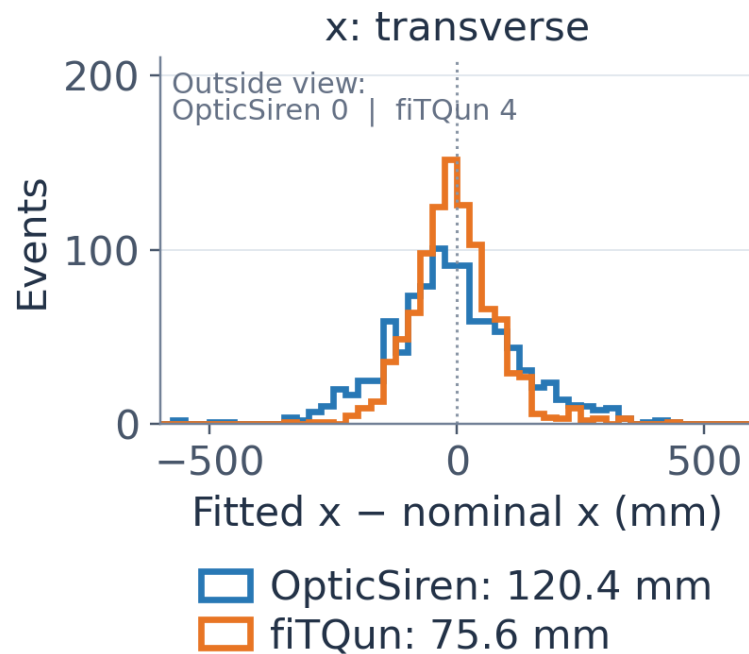
Mean fitted momentum [MeV/c]



Both fits assume a muon.

Vertex differences are mainly along the beam axis

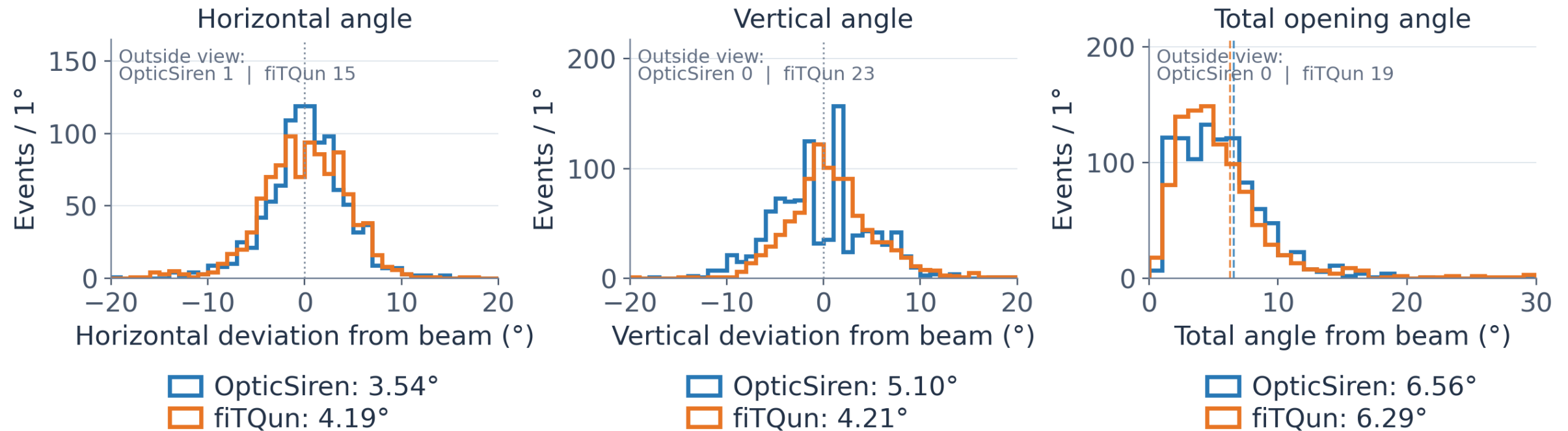
Fitted minus nominal coordinates; x/z are transverse and y is longitudinal. Beam position: (0, 1348.763, -424.7625)



Mean y offset: +19.6 mm (OpticSiren), +240.9 mm (fiTQun).
Width = half the central 68% interval

Angular cores are similar; fiTQun has broader tails

Event-count histograms relative to nominal $-y$; all 1,000 events enter the metrics.



Signed-angle legends: $w68 = (P84 - P16)/2$; total-angle legends: R68.
 Opening angle: R68 = 6.56° / 6.29°; R95 = 11.41° / 14.80° (OpticSiren / fiTQun).

R1478 | beam reconstruction summary

Nominal beam setting: -410 MeV/c (negative polarity) • Same 1,000 events in both fits

Data sample

654,487 offline readouts

555,792 beam candidates

First 1,000 candidates fitted

Quality + prompt cuts; no PID

OpticSiren

Cosmic iteration 5; frozen model

Muon hypothesis; charge only

Start at 410; fit p within $0-1000^1$

549/1,000 hit the 100-step cap

fiTQun

Same events and PMT mask

Muon fit: charge + earliest time

Prompt gate: $[-20, +100)$ ns

1,000 finite fits; no μ -fit warnings

Results on matched events	OpticSiren	fiTQun
Mean fitted momentum [MeV/c]	412.55	458.42
Vertex width x / y / z [mm]	120.4 / 28.1 / 92.6	75.6 / 185.2 / 85.0
Angle to nominal $-y$: R68	6.56°	6.29°

¹ Momentum in MeV/c. Vertex width = $(P84 - P16)/2$; R68 = 68% angular containment.

Preliminary: no PID selection or event-level truth; non-muons may be present.
OpticSiren convergence is unconfirmed. These widths are observed spreads, not intrinsic resolutions.