$CC\pi^0$ Update

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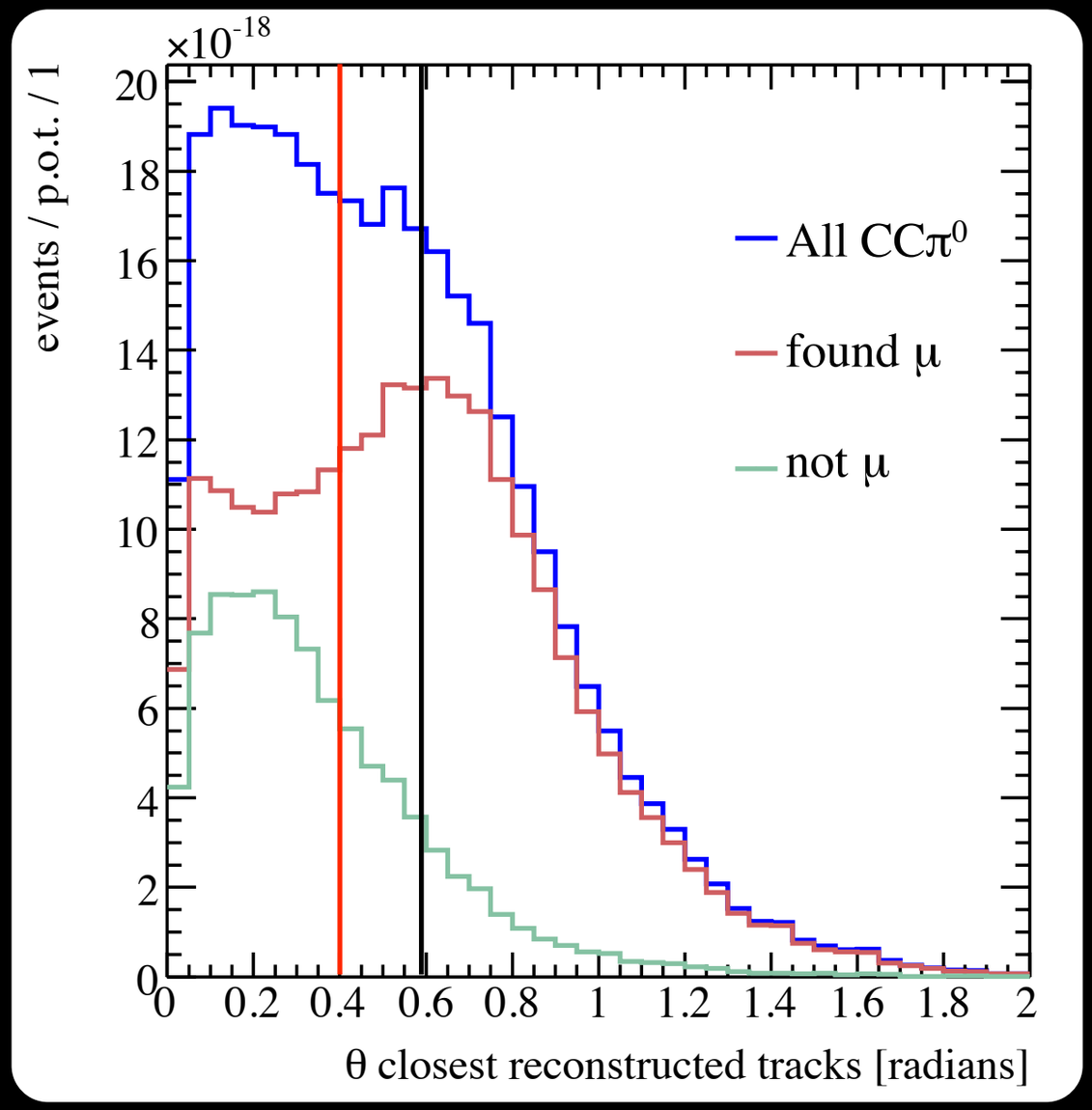
2010.01.26

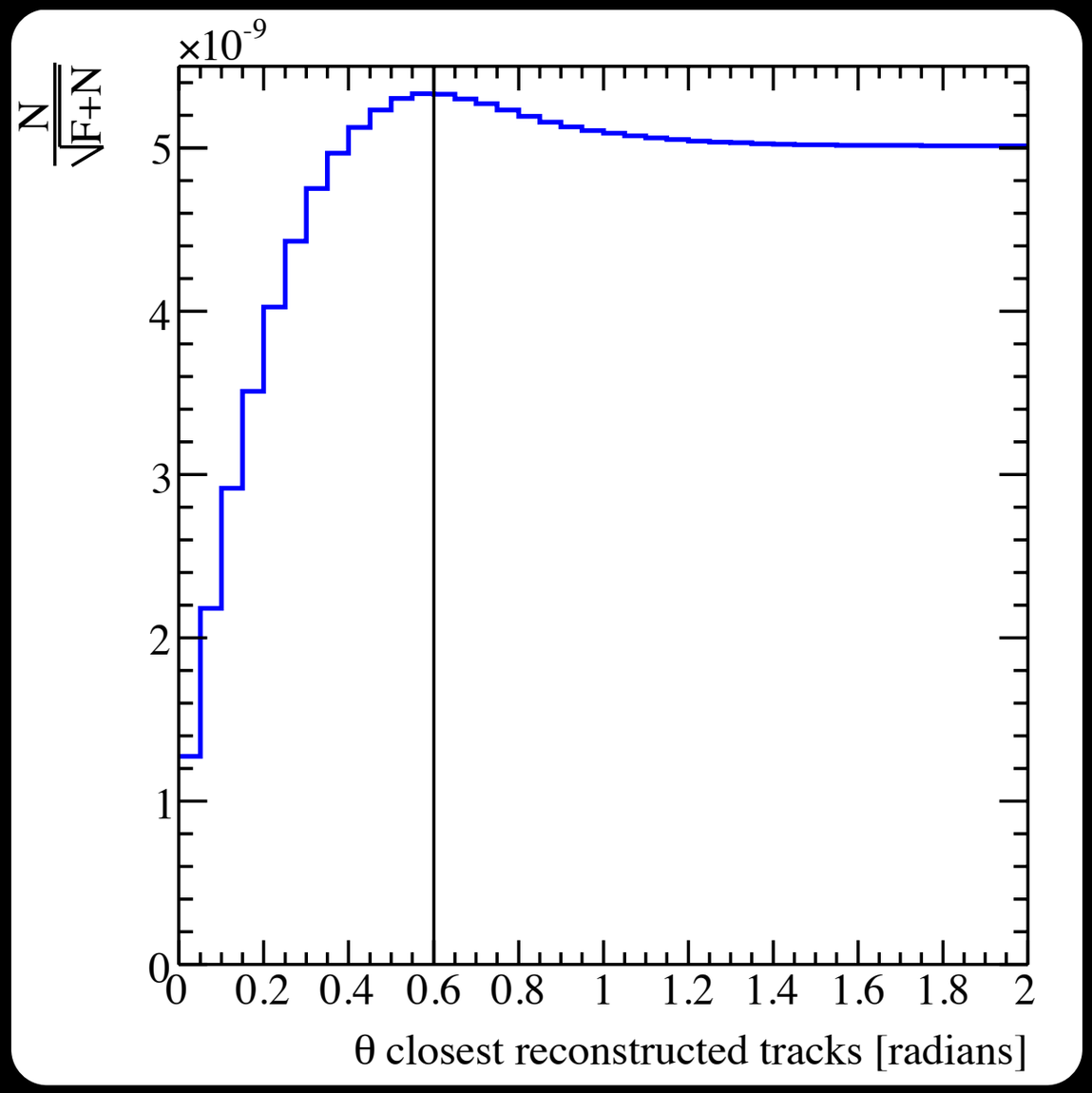
Two topics

- Cut optimization; effect of total cross-section
- Differential cross-sections

Mis-reconstruction cut got tighter

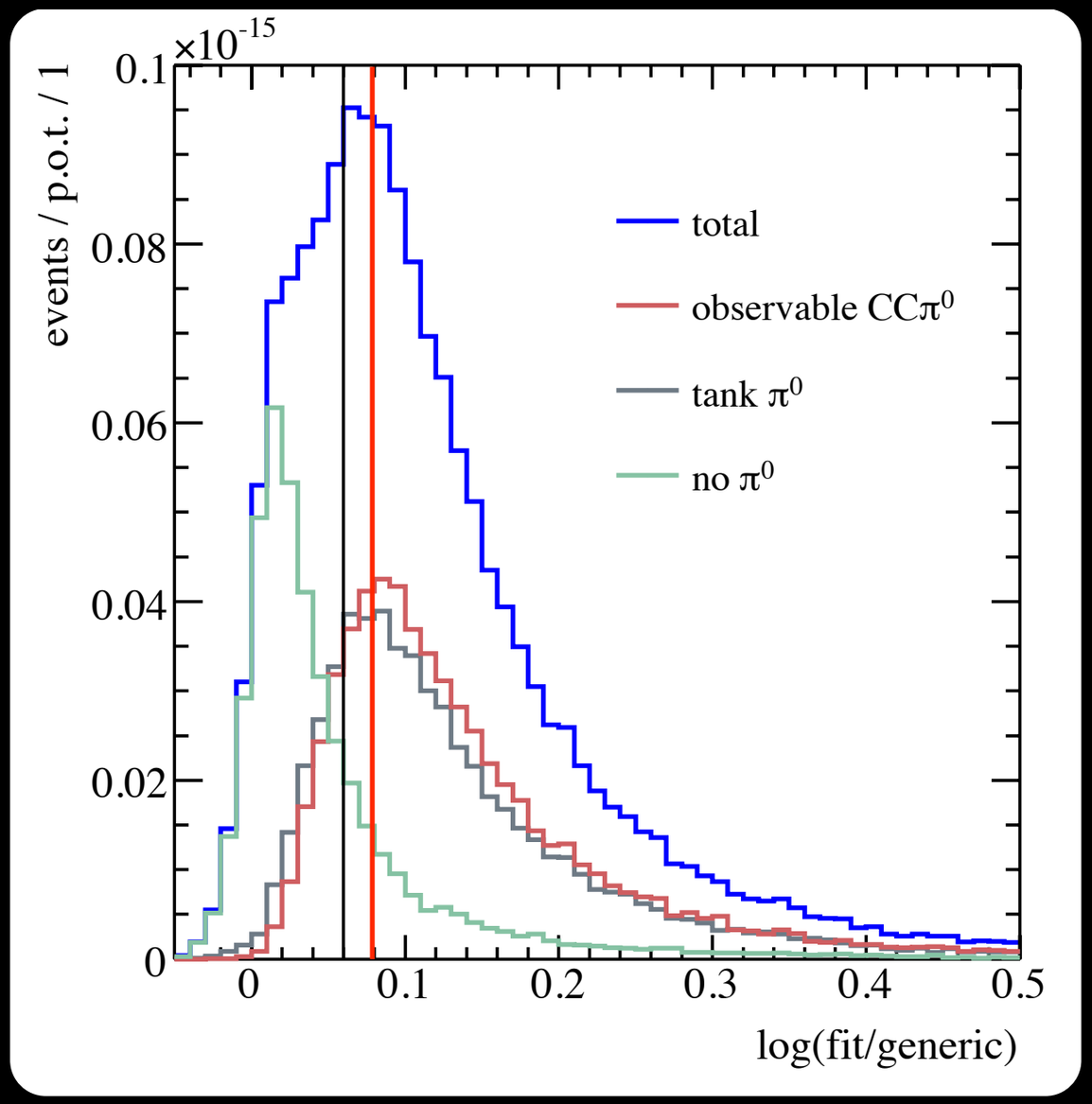
- Optimized to reject mis-reconstructions.
- "eye-balled" cut was at 0.4 (red), optimized is 0.6 (black)

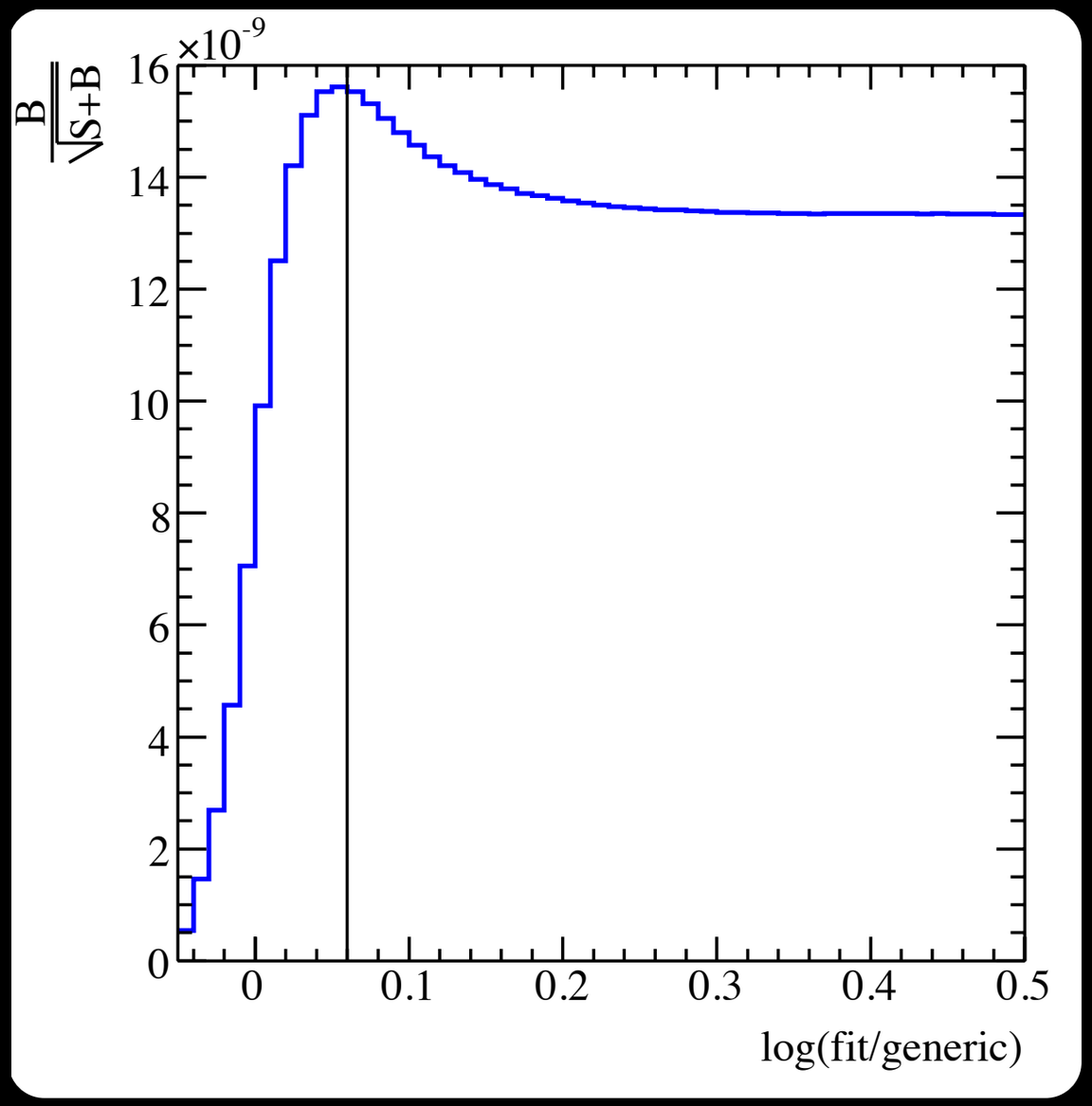




Likelihood cut got looser

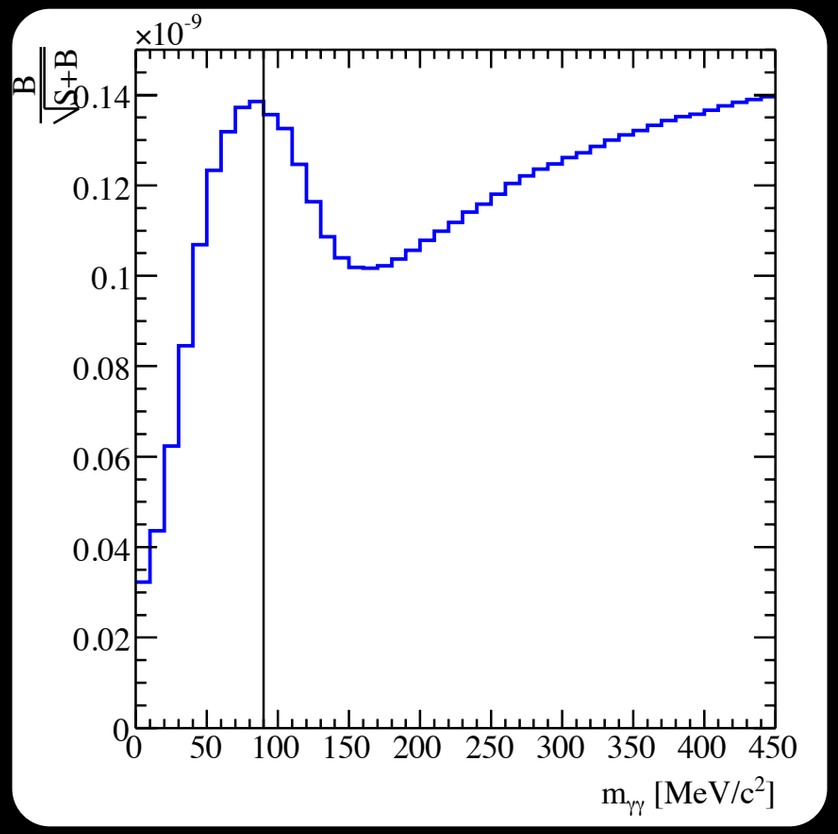
- Optimized to remove non-π^0 events.
- Optimized after the mis-reconstruction cut.
- "eye-balled" cut was at 0.08 (red), optimized at 0.06 (black)

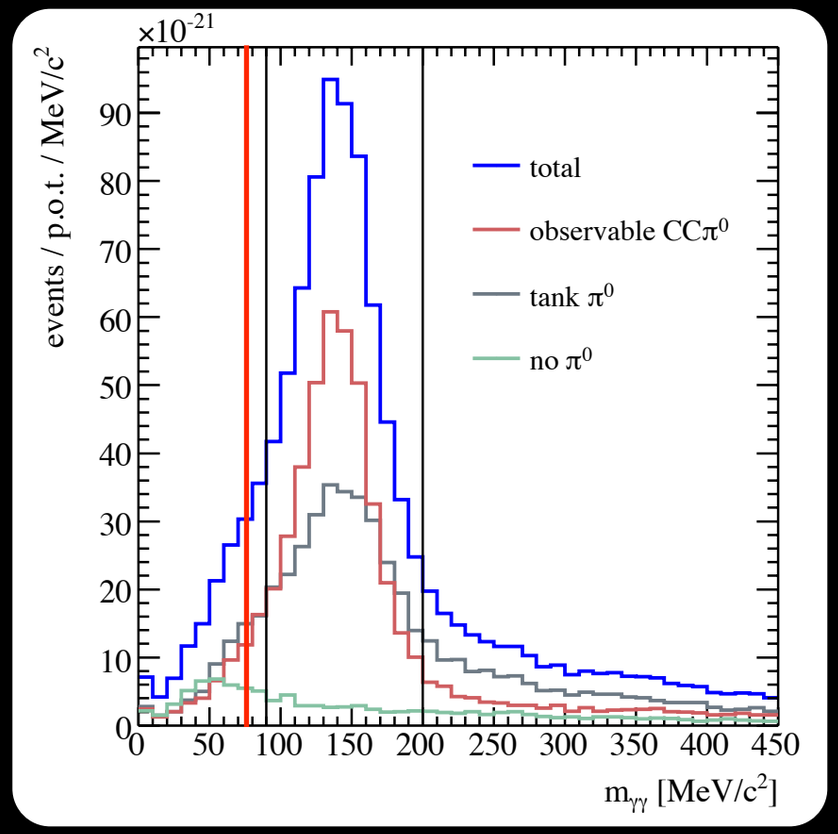


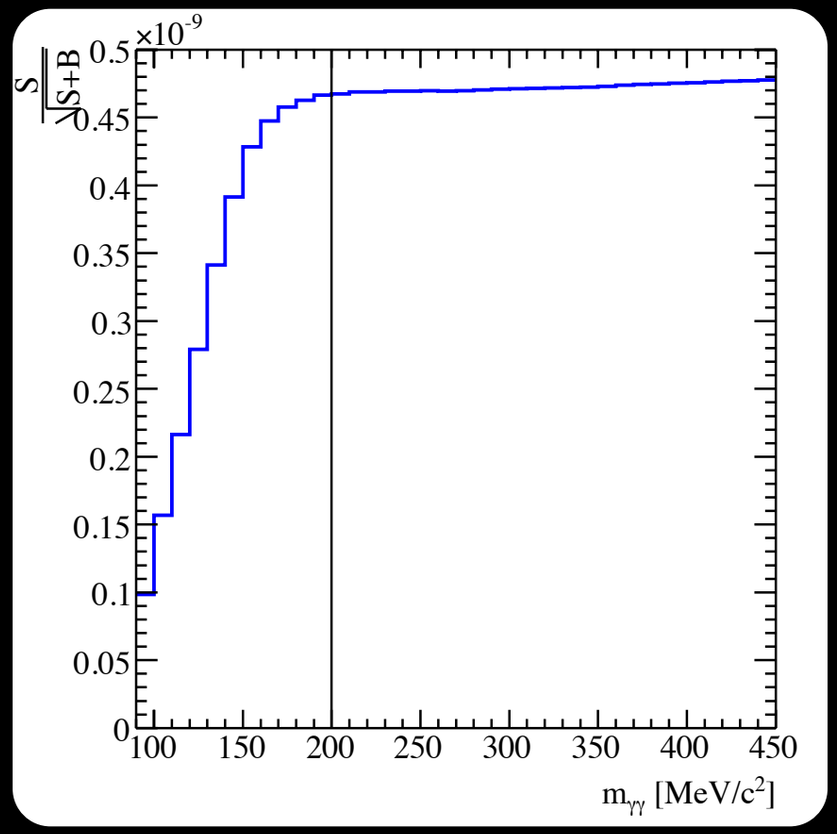


Pion mass cut got slightly tighter

- Low mass cut was optimized to reject non-π^0 events.
- High mass cut is optimized to preserve signal and it made at the start of the plateau.
- "eye-balled" cuts were at (75,200), optimized are at (90,200)

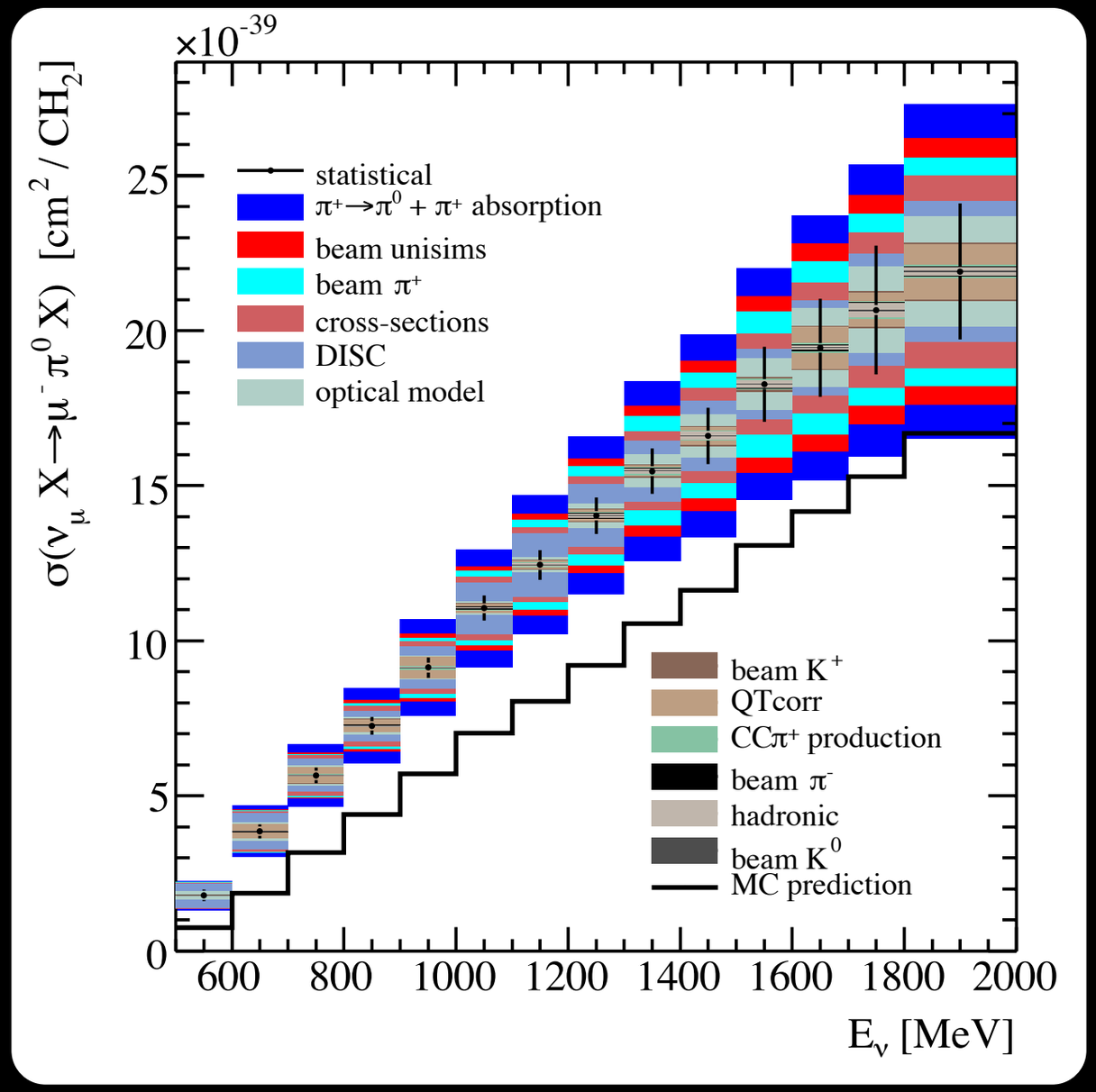


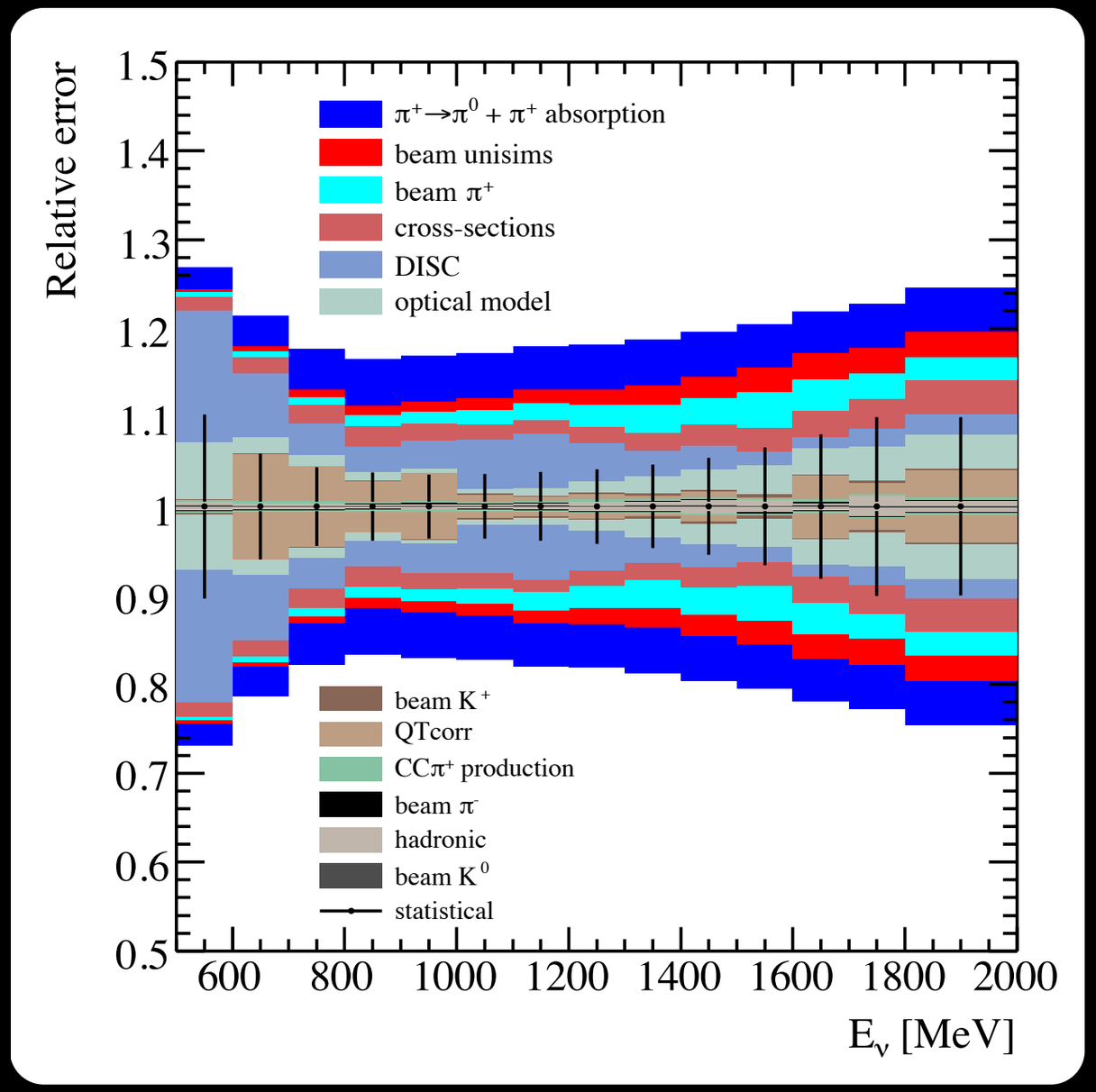




Observable CCπ^0 total cross-section

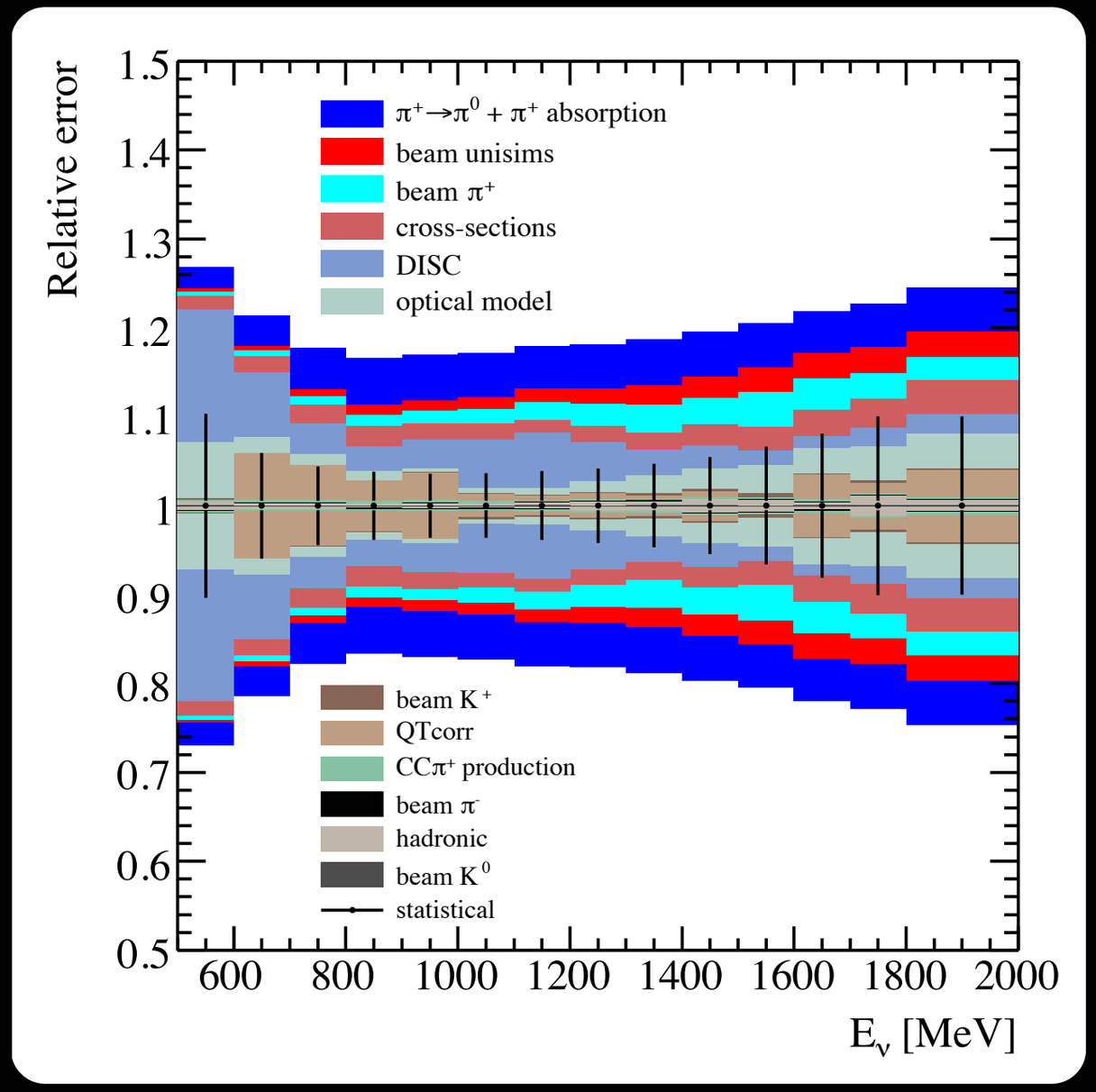
- Data increased by 10% in the last bin, still within errors, and errors got reduced.
- Beam errors dominate (after cex/abs), DISC is now below xsec errors.
- DISC is still large in the first 2 bins, but significantly reduced.





Normalization Errors

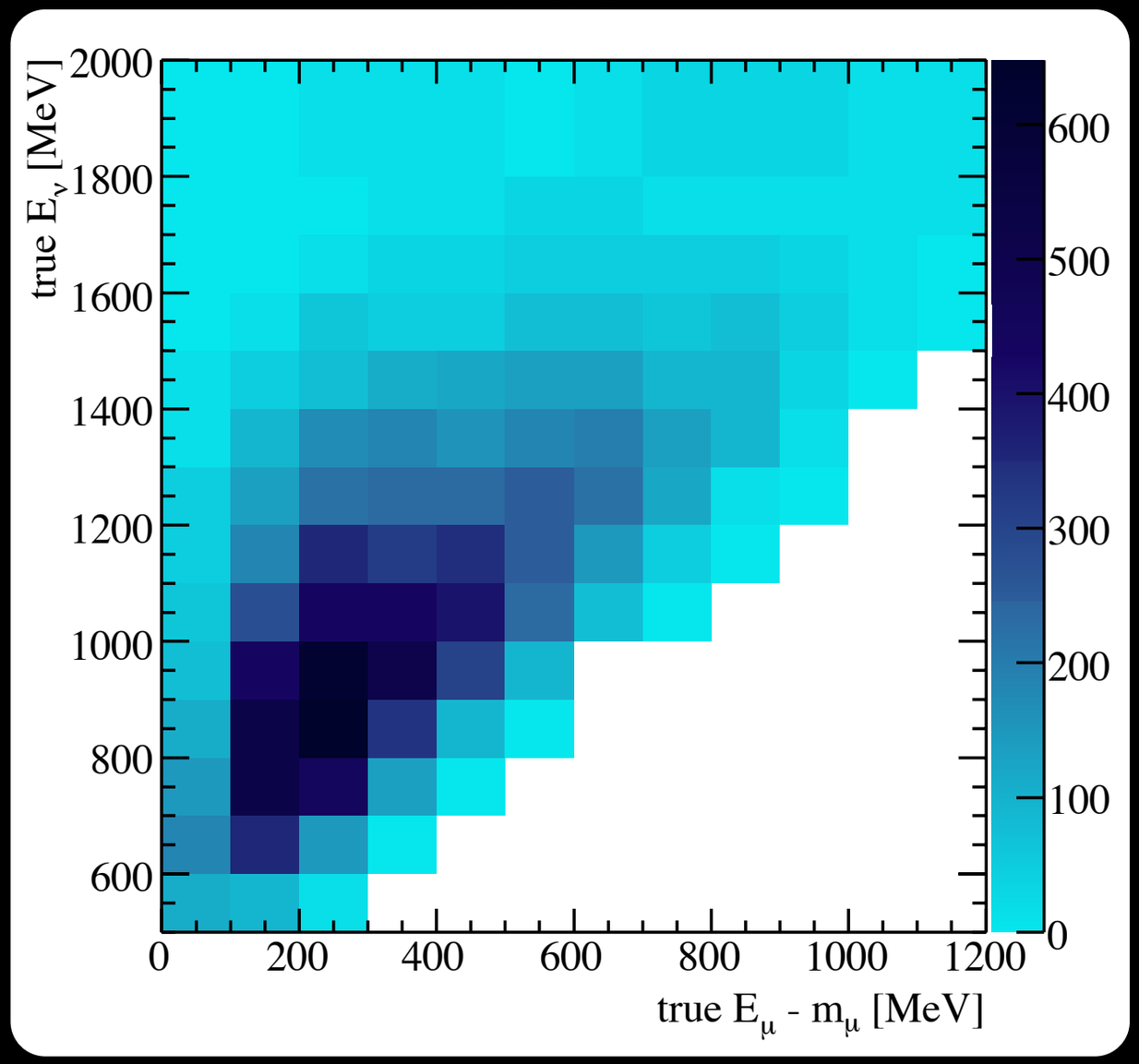
Error	Old Cuts	Optimized Cuts
Statistical	2.97%	3.19%
$\pi^+ \rightarrow \pi^0$ and π^+ absorption	15.2%	13.2%
DISC	9.34%	6.1%
Beam Unisims	8.61%	7.72%
Cross-sections	8.25%	6.15%
Beam π^+	8.11%	7.44%
QT correlation	2.30%	0.62%
Optical Model	2.23%	2.84%
Beam K^+	1.26%	0.91%
$CC\pi^+$ production	0.7%	0.5%
Beam π^-	0.35%	0.31%
Hadronic	0.15%	0.21%
Beam K^0	0.06%	0.03%
Total Systematic Error	23.18%	**19.31%**



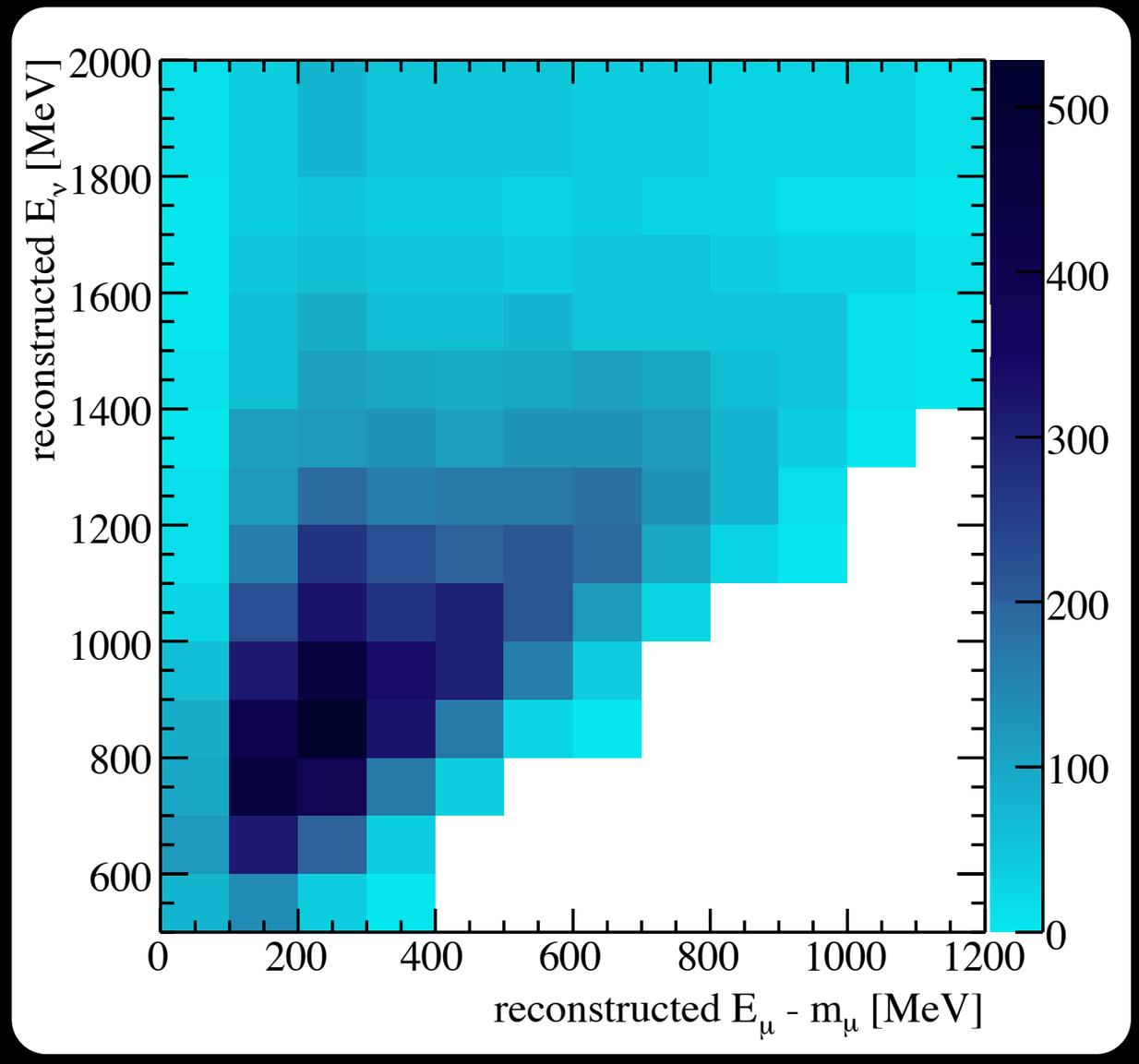
E_ν vs T_μ

- MC true and reconstructed distributions.
- They are not the same, T_μ resolution 8%, E_ν is 11%.

True

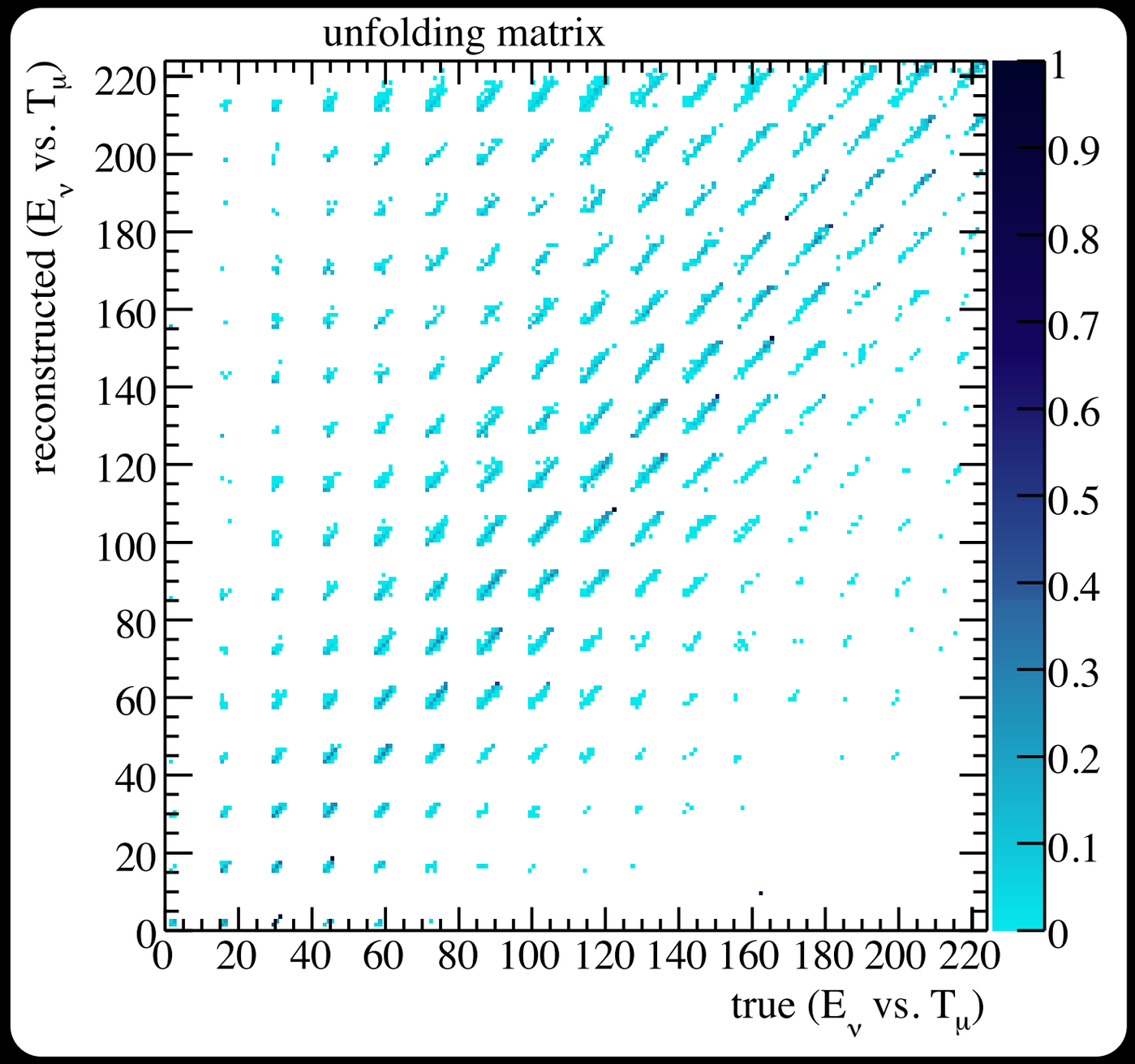


Reconstructed



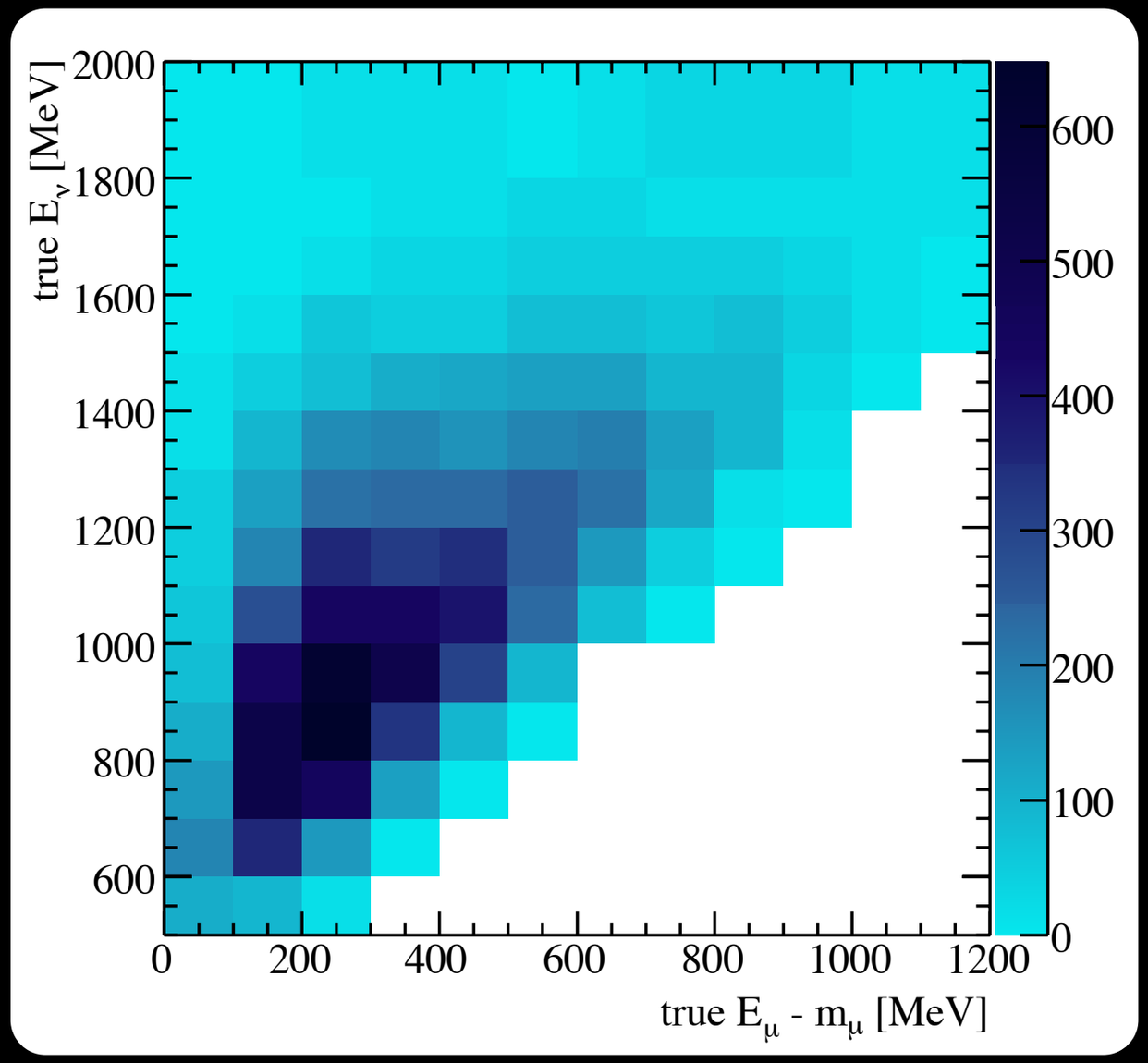
4D unfolding matrix in 2D representation

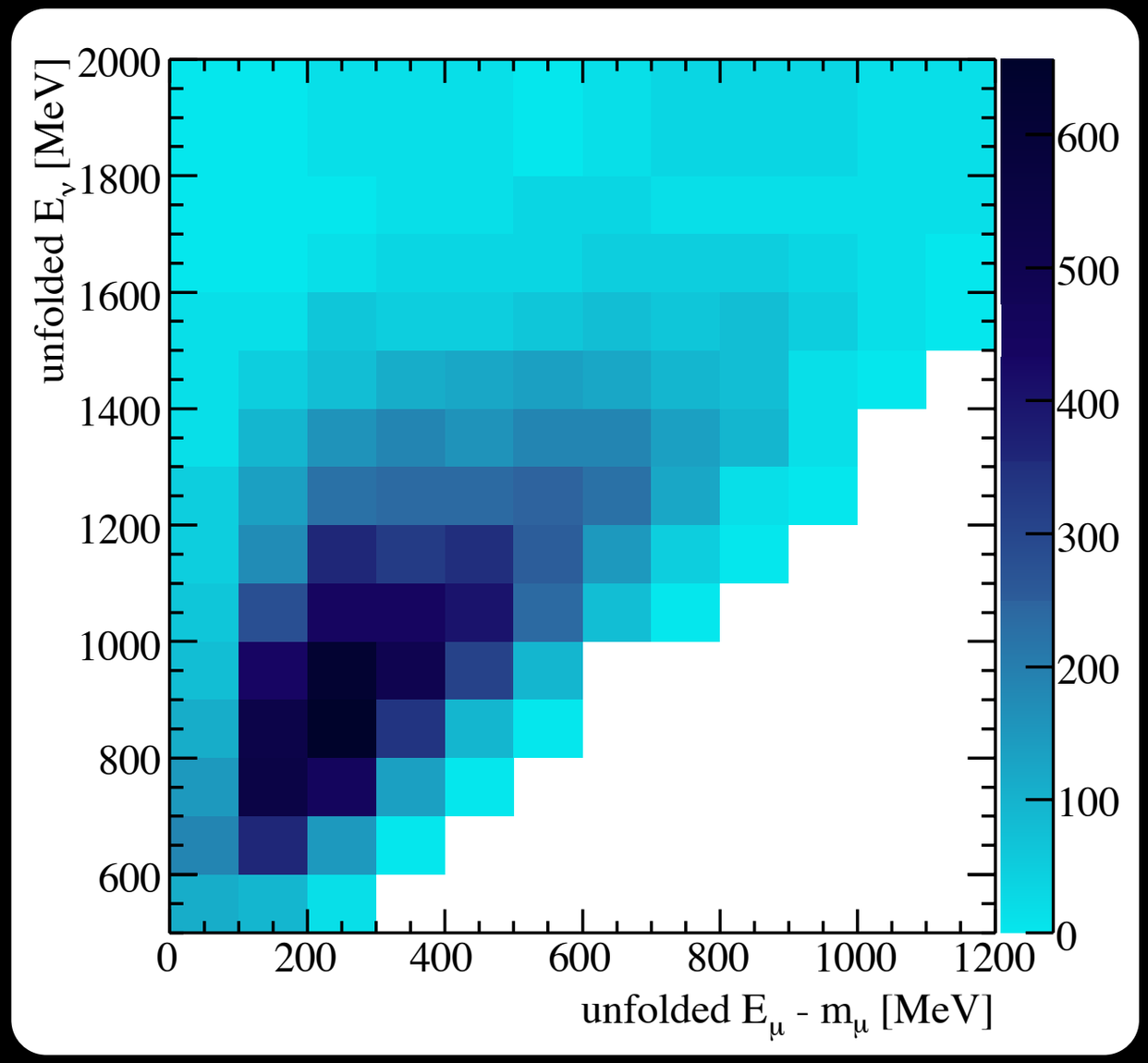
- Multidimensional unfolding can be performed identically to 1D unfolding by introducing a global unique bin number:
  bin = $bin_\mu + N_{bins\mu}\, bin_\nu$



Unfolded E_ν vs T_μ

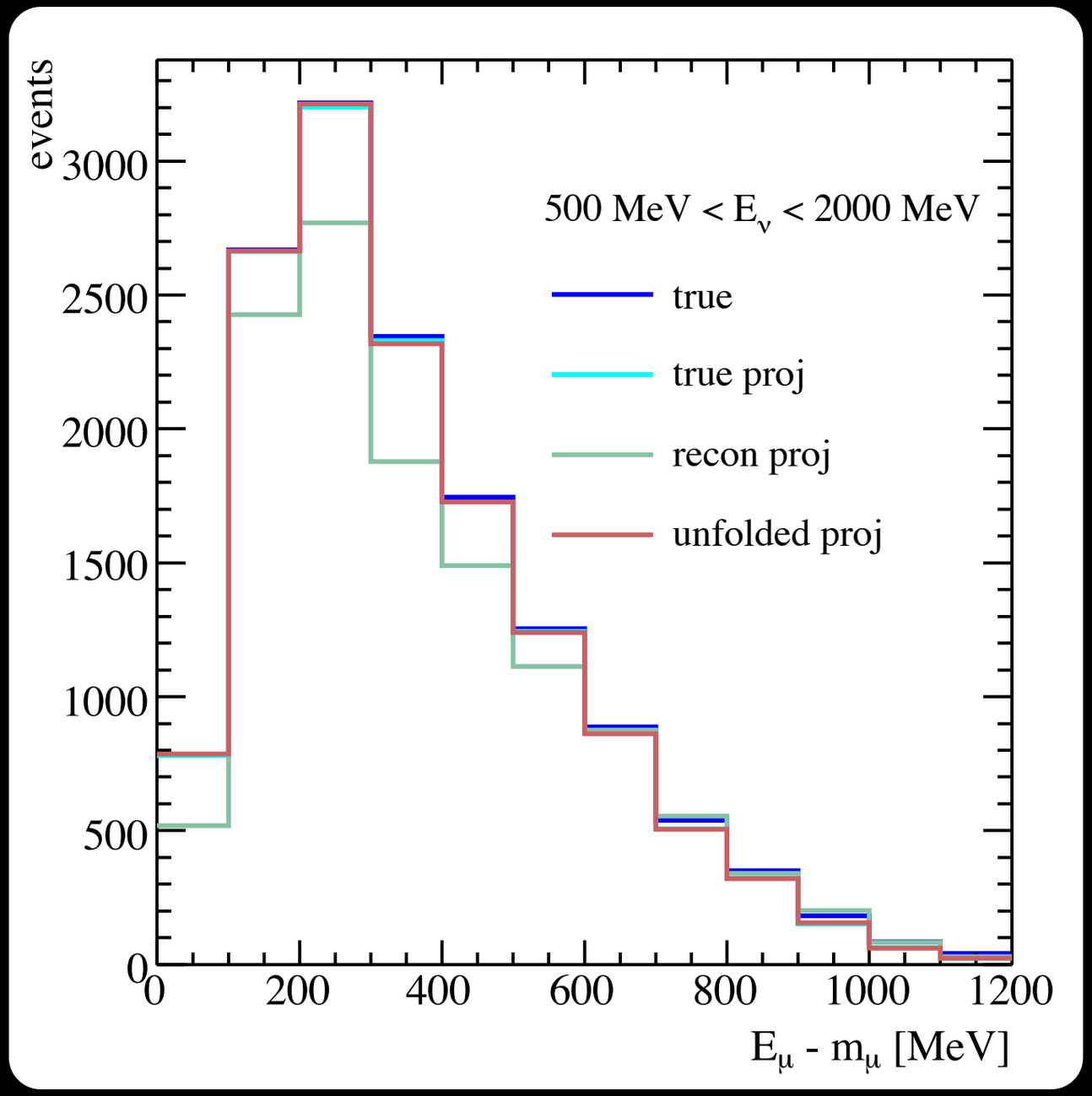
- The unfolding is nearly perfect. However, it should always be perfect when applied to the same events that formed the histogram.





T_μ projection

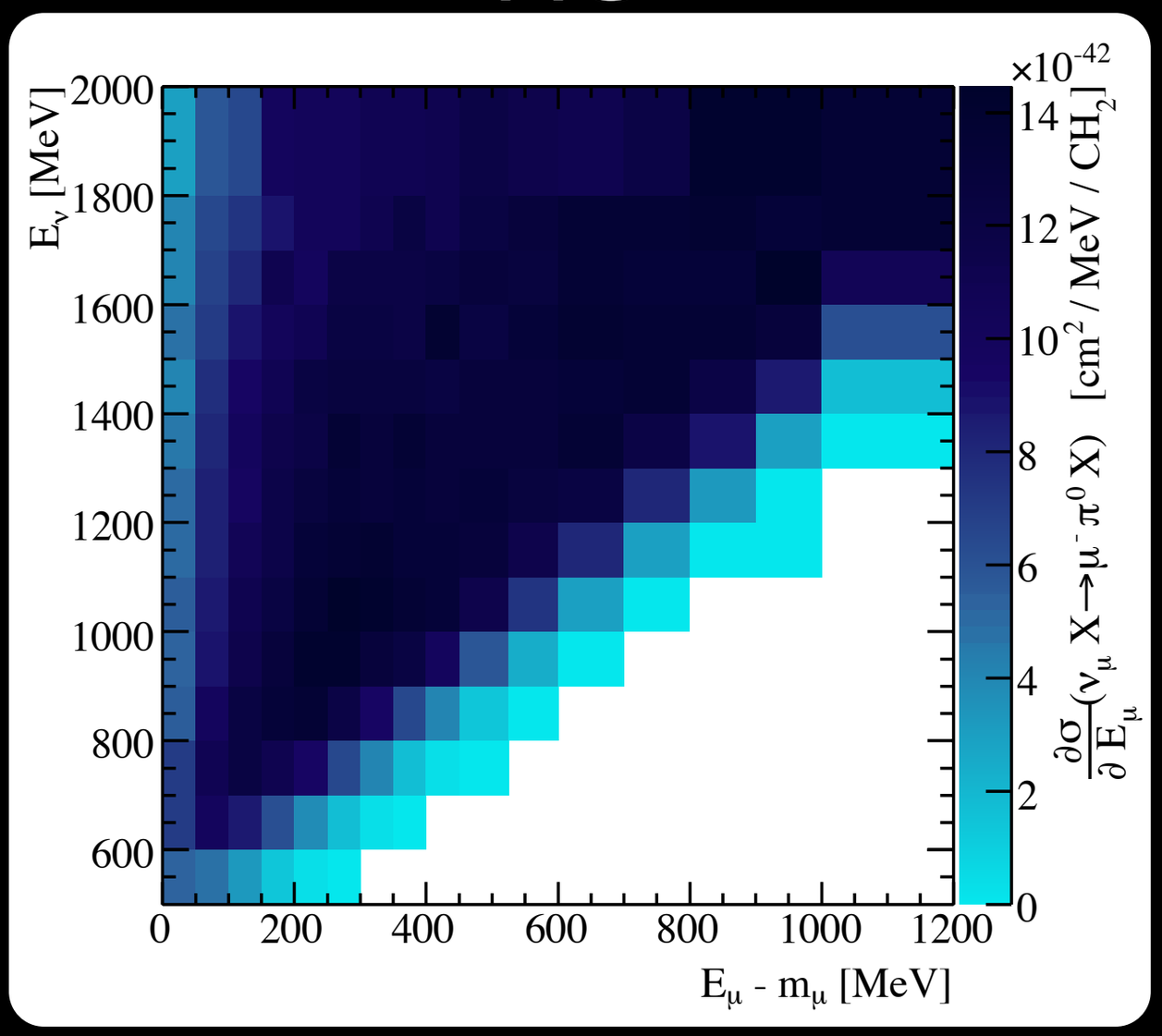
- "true" are true events with a cut on the true flux.
- "true proj" is the E_ν vs T_μ plot projected onto the T_μ axis.
- There are slight differences between the 2 trues and unfolded distributions (Fixed I think).
- However, I think this survives the proof of principle test.



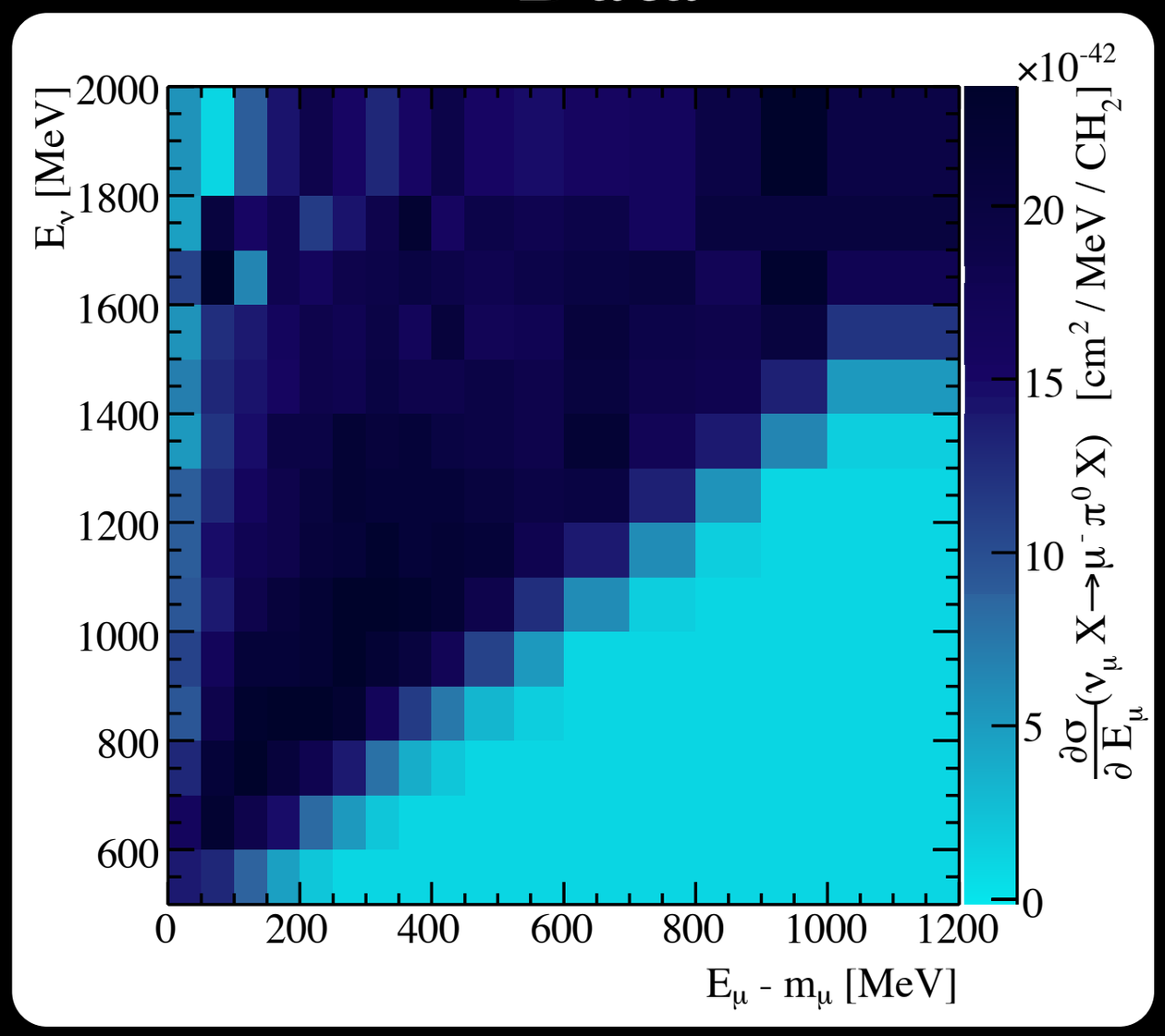
Differential cross-section vs E_ν

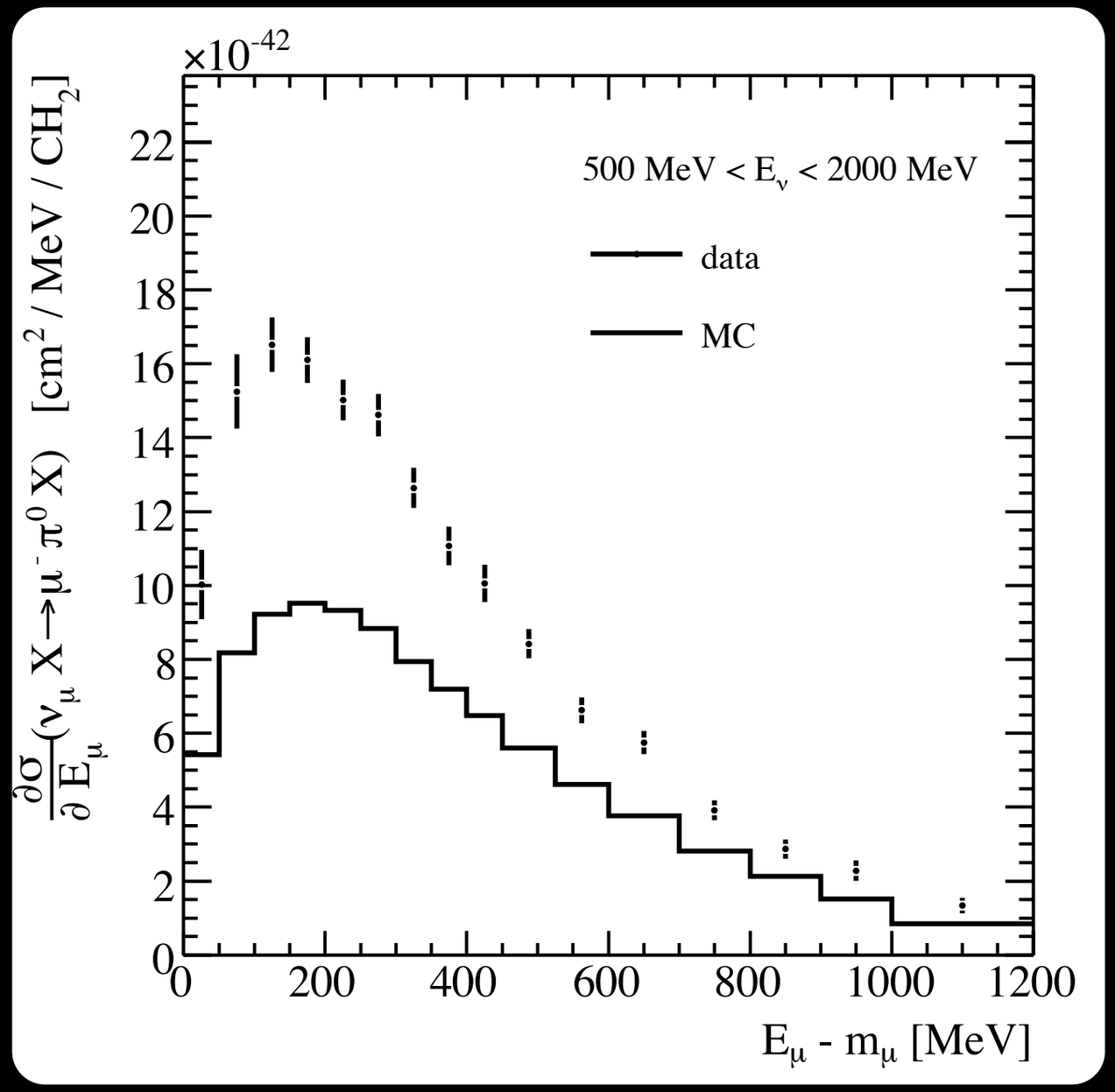
- Large statistical fluctuations in the data, will "not-report" those bins.
- Also, I'll make the color axises the same.

MC



Data



Differential cross-section

- Calculated after 2D unfolding to restrict the flux between 500 and 2000 MeV
- Should have the same Integral as the total xsec (will check).