Update on tau status

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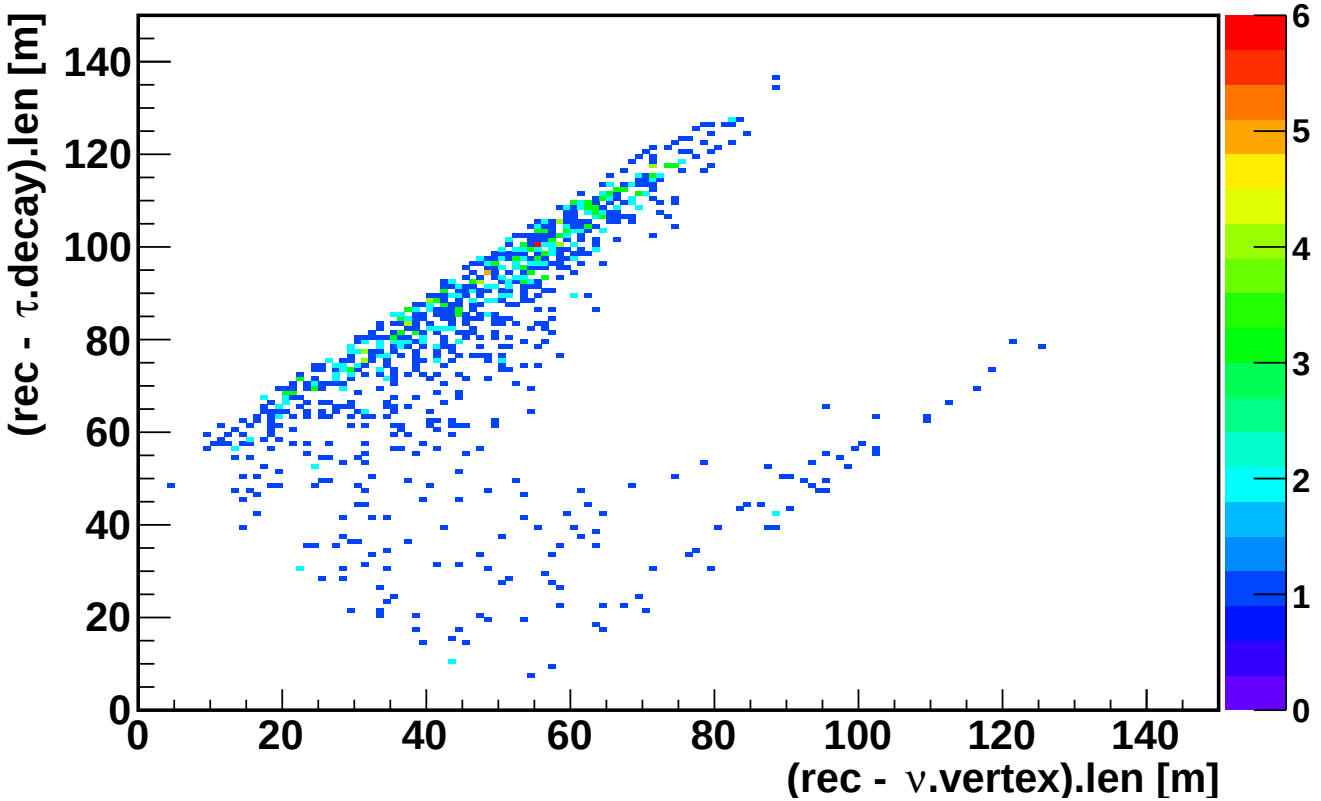
Tau toy MC v2

Method

- Find a innocent looking MC file (used Tau NC file) and remove everything except the neutrino
- Determine second vertex position by going (20,35,50)m in neutrino direction
- Add a tau track with 1 PeV
- Put a Λ neutrino vertex and a Λ or electron at tau decay vertex
- Add preferred energies (used: 200 TeV for first and 1 PeV for second vertex)
- Nomenclature: first vertex is neutrino vertex and second vertex is tau decay vertex

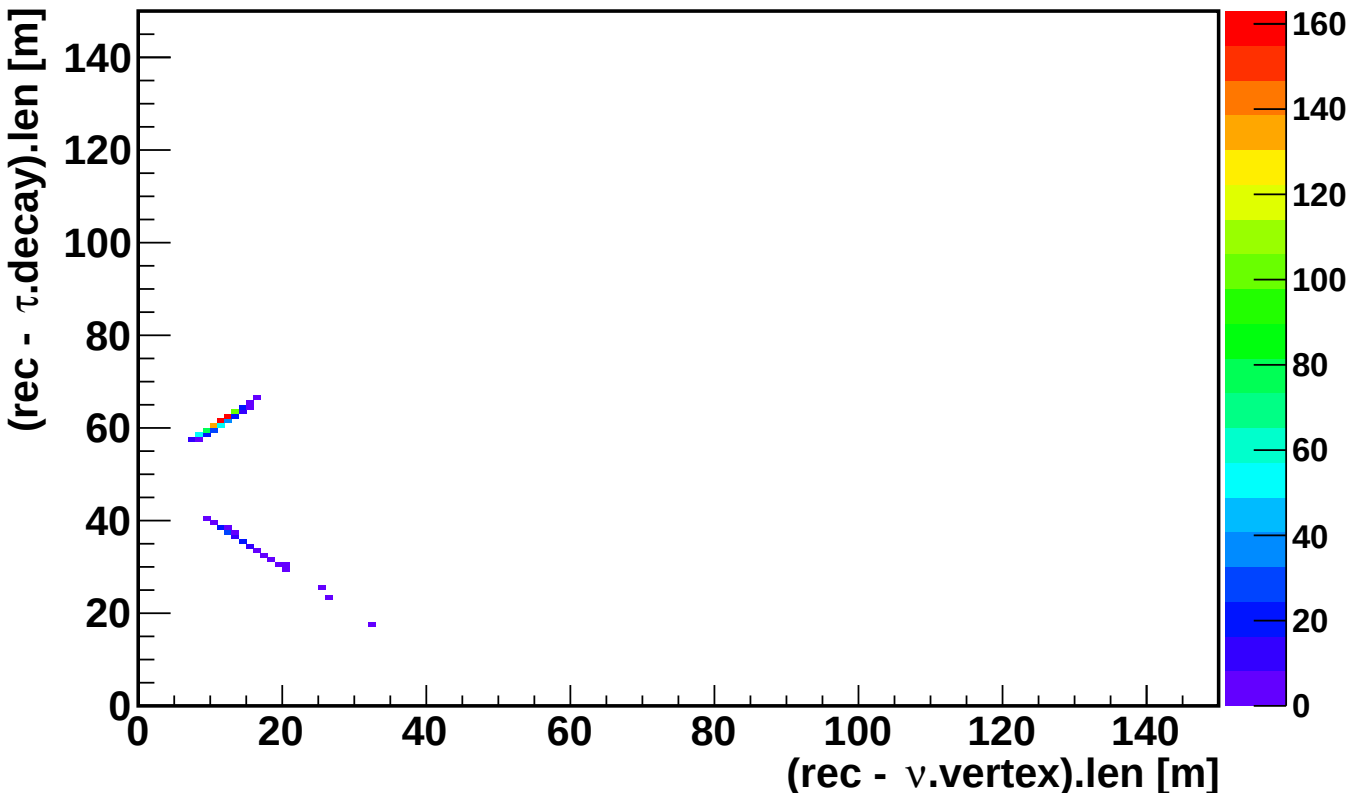
Default aashowerfit on toy

Applying aashowerfit on the toy MC and looking at the selected vertex (highest coinc DOM) I find:



Default aashowerfit on toy

Applying aashowerfit on the toy MC and looking at the reconstructed vertex I find:



Default aashowerfit on toy

$\rightarrow$ The first (neutrino interaction) vertex is highly preferred

$\Updownarrow$

The second (tau decay) has the higher energy (1 PeV $\Leftrightarrow$ 2 TeV)
and therefore has more MC hits ($\approx$ 3 – 4 more)

Hit Residuals for 50 m

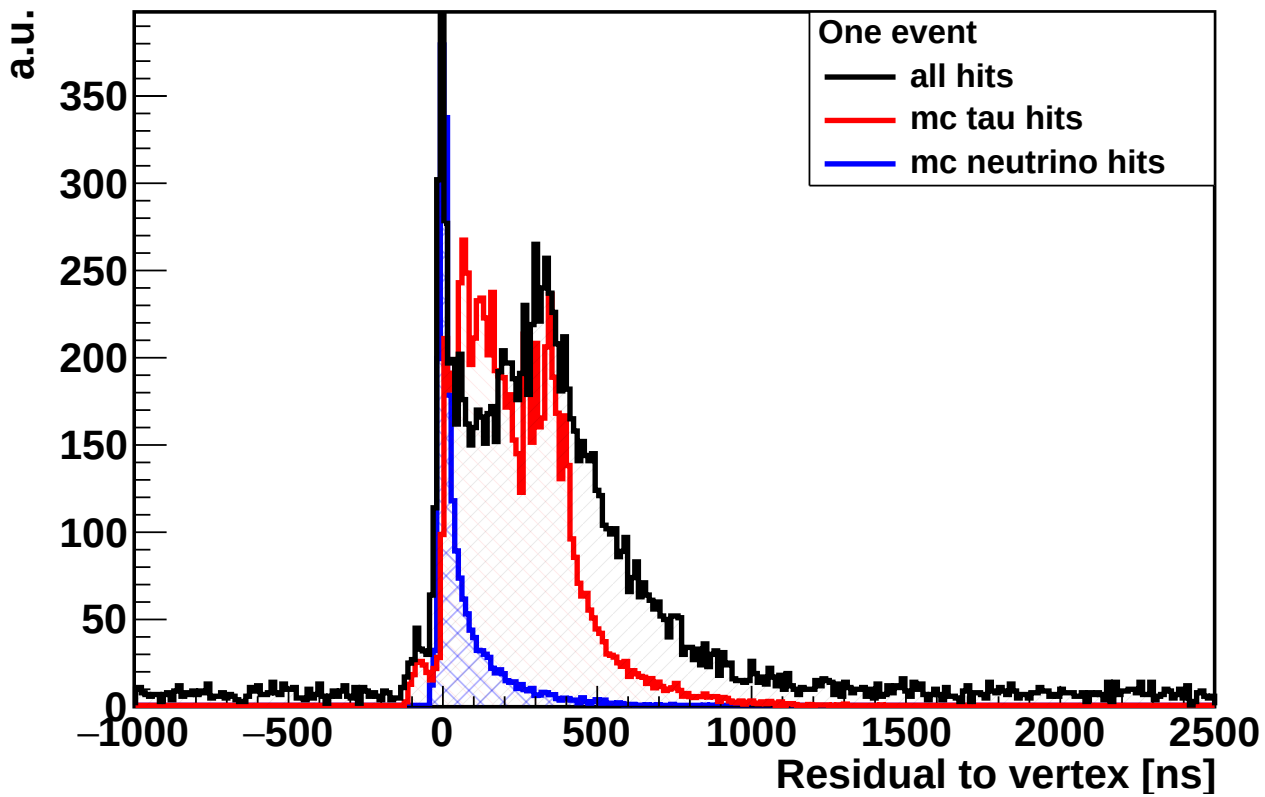


Figure : Hit residuals to first reconstructed vertex for shower hypothesis for tau to em shower(event 0)

Hit Residuals for 50 m

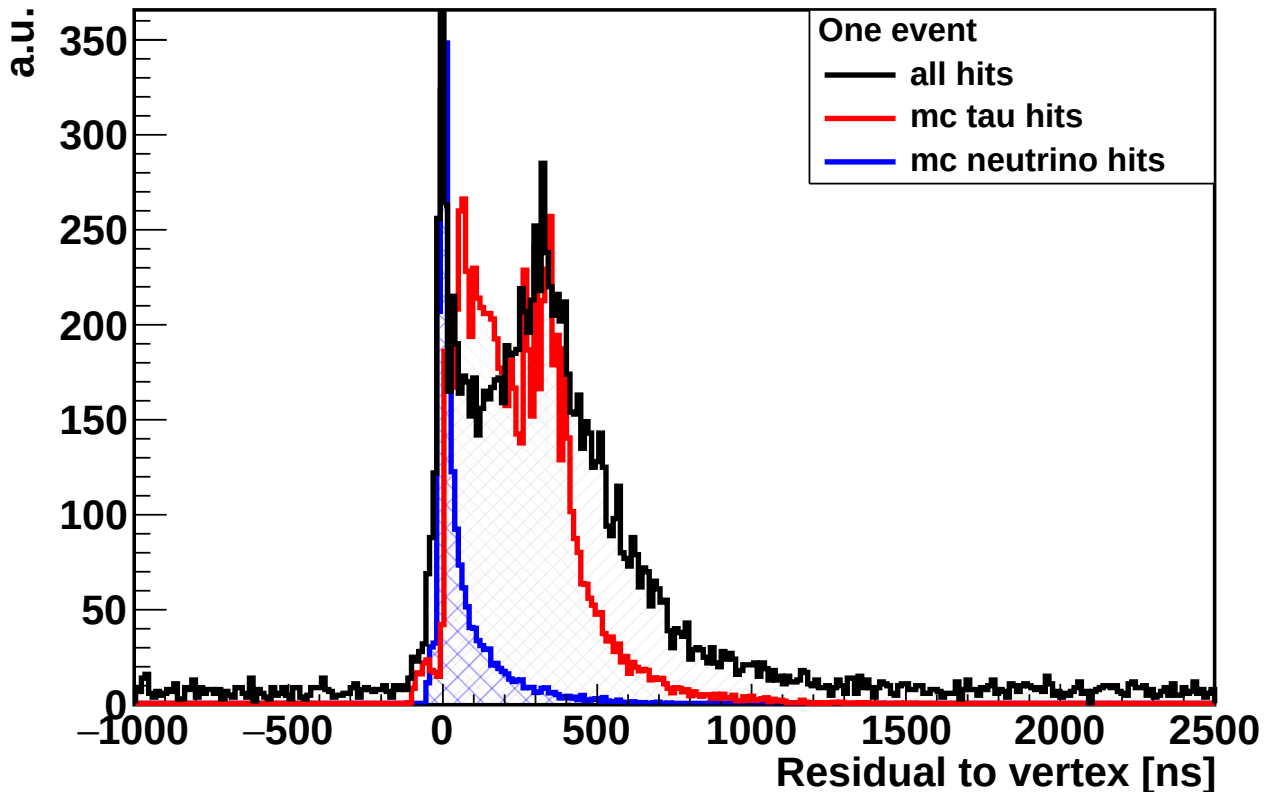


Figure : Hit residuals to first reconstructed vertex for shower hypothesis for tau to hadr shower(event 0)

Hit Residuals for 35 m

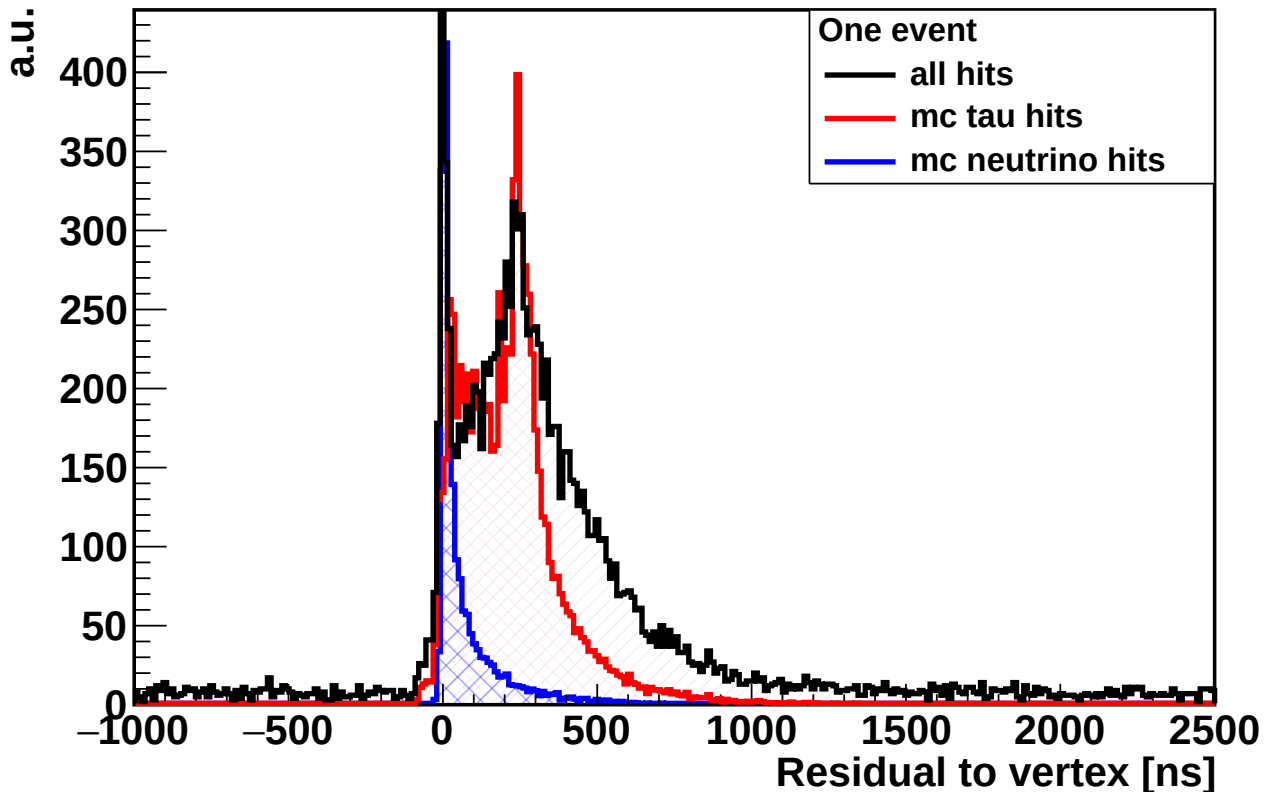


Figure : Hit residuals to first reconstructed vertex for shower hypothesis for tau to em shower(event 0)

Hit Residuals for 35 m

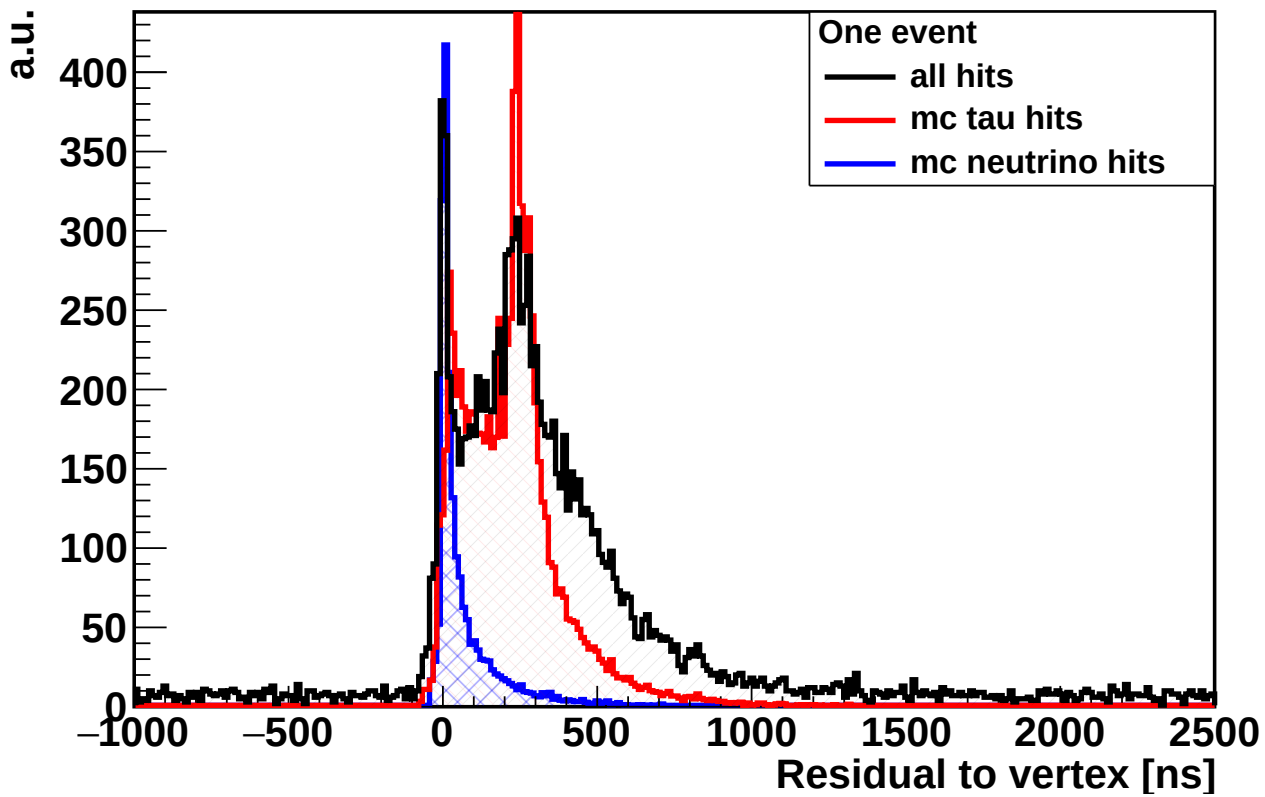


Figure : Hit residuals to first reconstructed vertex for shower hypothesis for tau to hadr shower(event 0)

Hit Residuals for 20 m

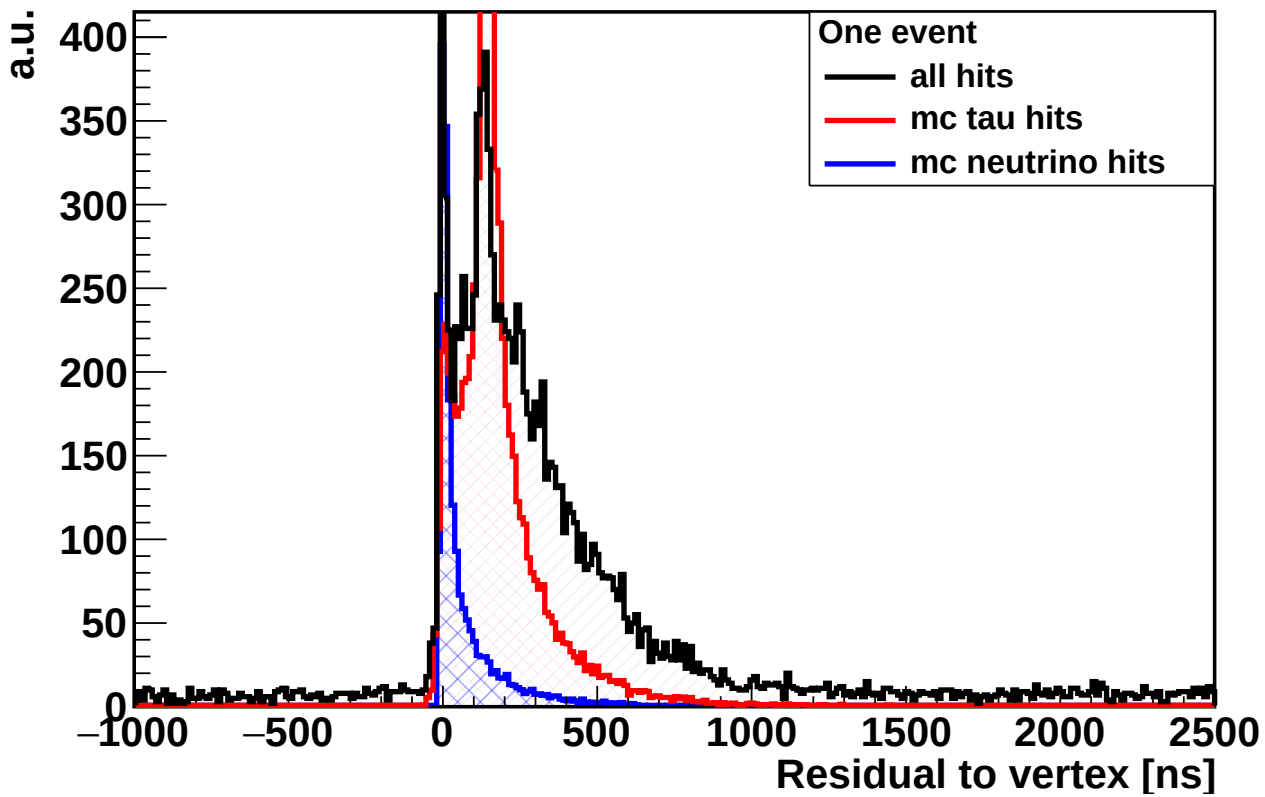


Figure : Hit residuals to first reconstructed vertex for shower hypothesis for tau to em shower(event 0)

Hit Residuals for 20 m

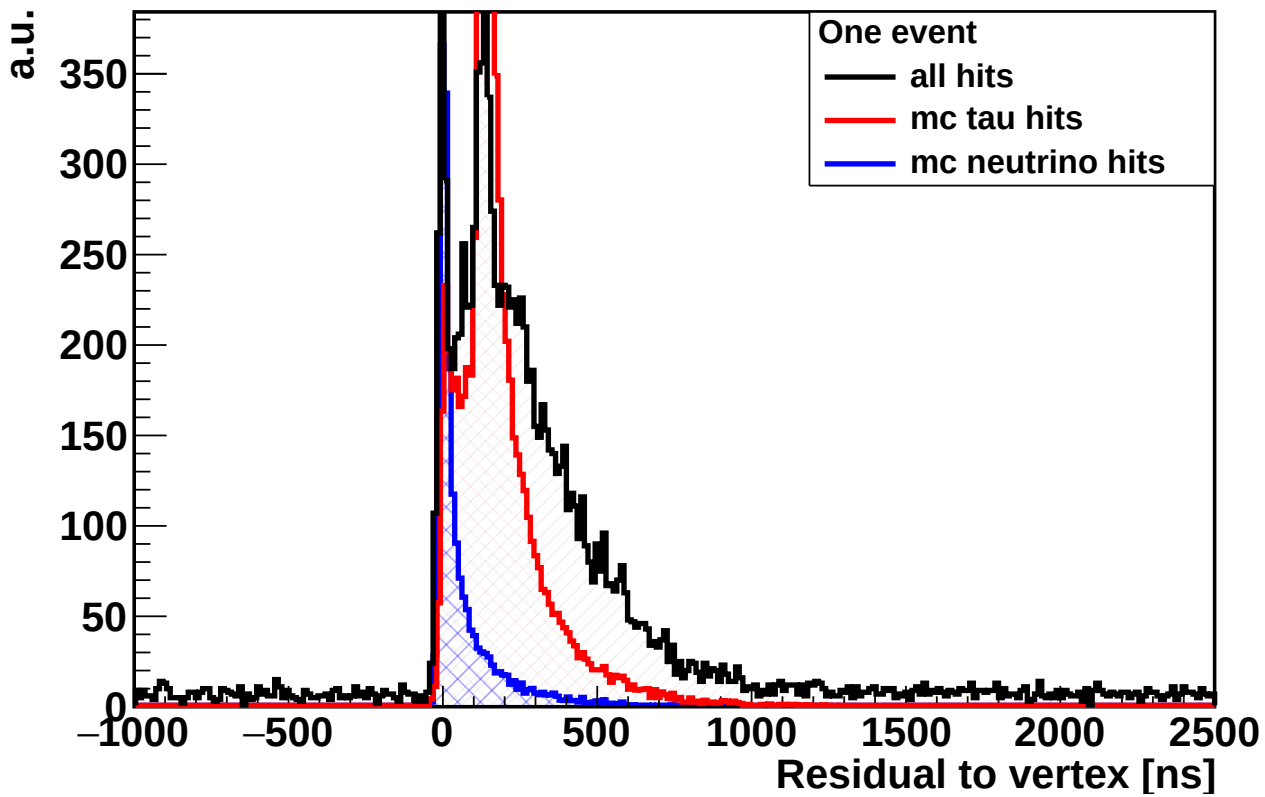


Figure : Hit residuals to first reconstructed vertex for shower hypothesis for tau to hadr shower(event 0)

Reconstructing a second vertex

Method

Make a selection based on hit residuals ± 40 ns and apply aashowerfit on these hits

apply aashowerfit:

- select DOM with highest coincidence in selection as start for m-estimator vertex fit
- use coincidence hits (20 ns) for m-estimator fit
- use all hits for energy and direction fit

Performance of second vertex for 50 m

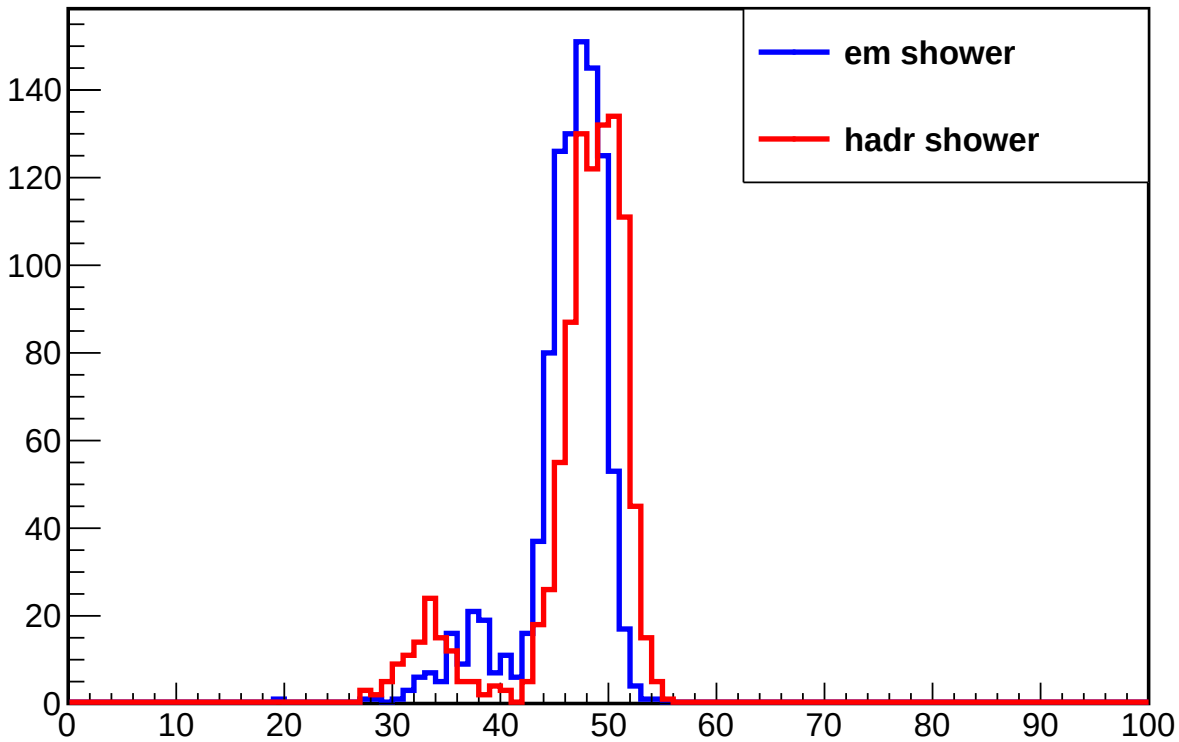
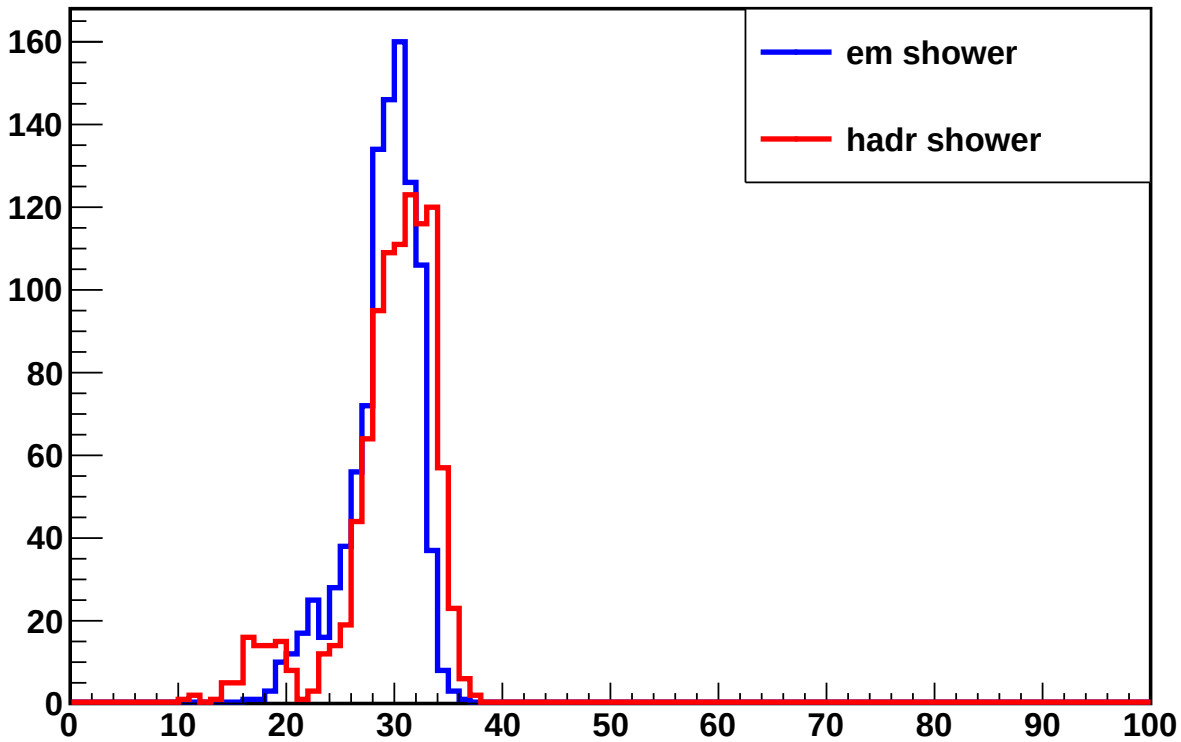


Figure : Distance between first and second reco vertex

Performance of second vertex for 35 m



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Performance of second vertex for 20 m

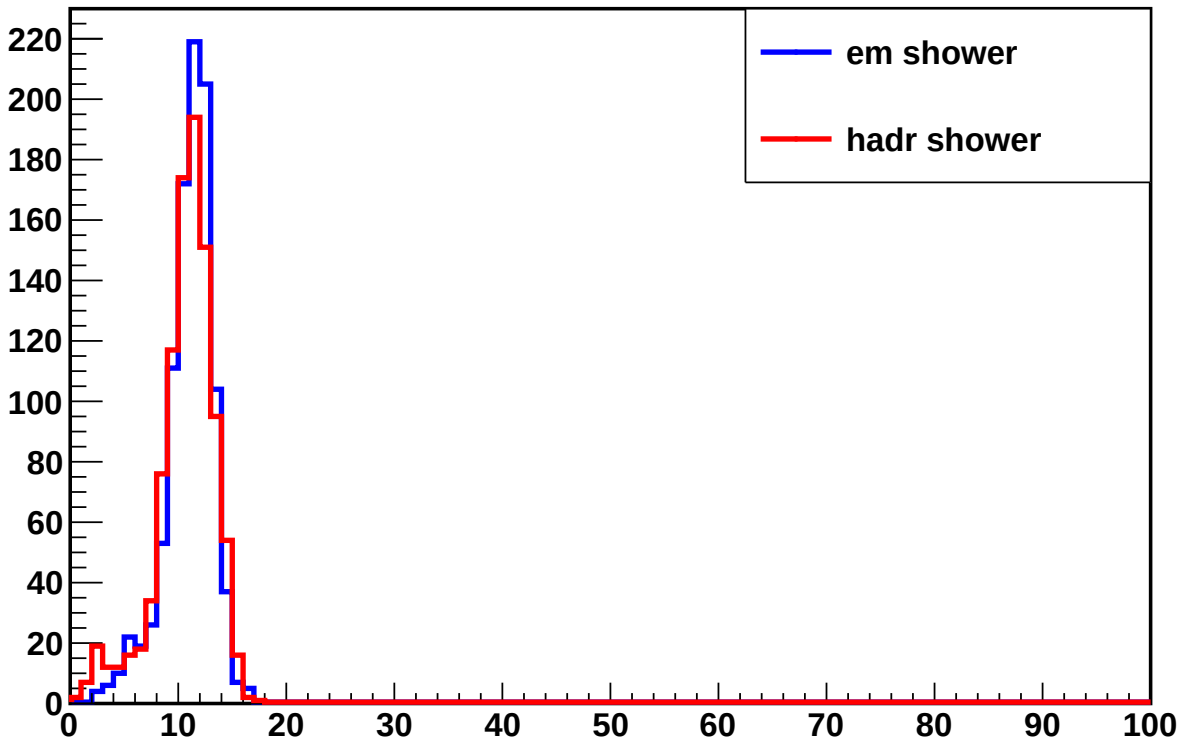


Figure : Distance between first and second reco vertex

Resolution of second vertex for 50 m

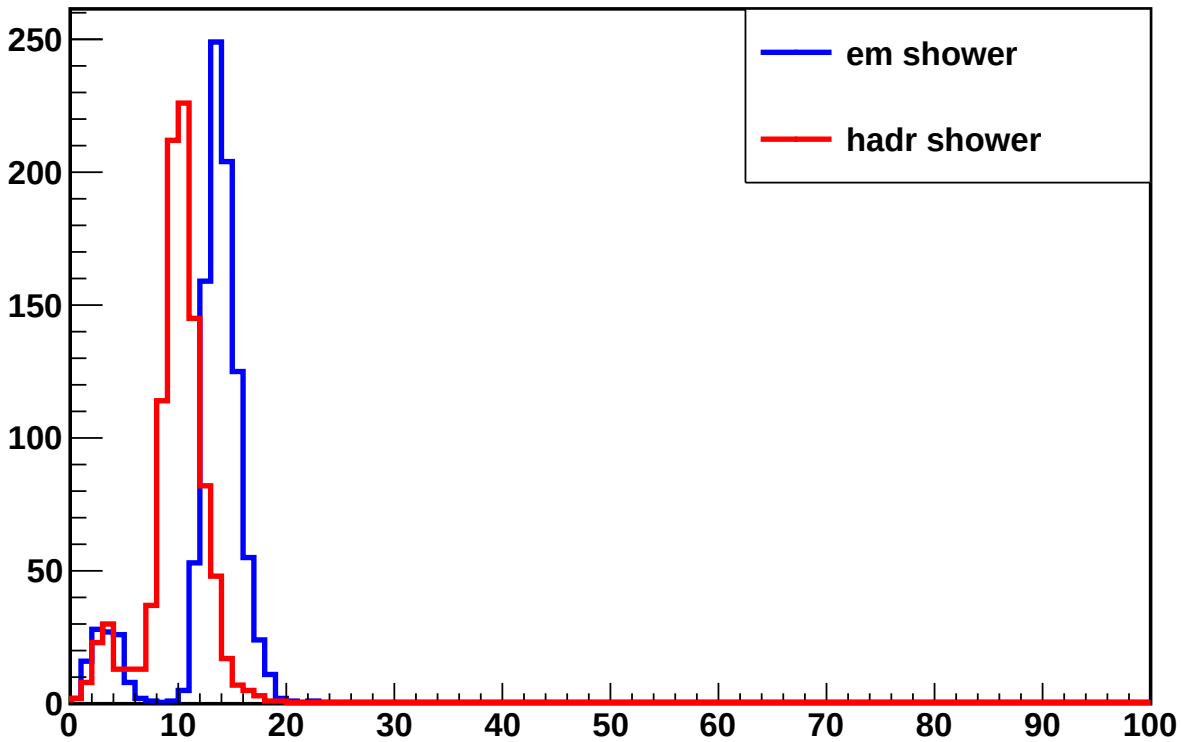
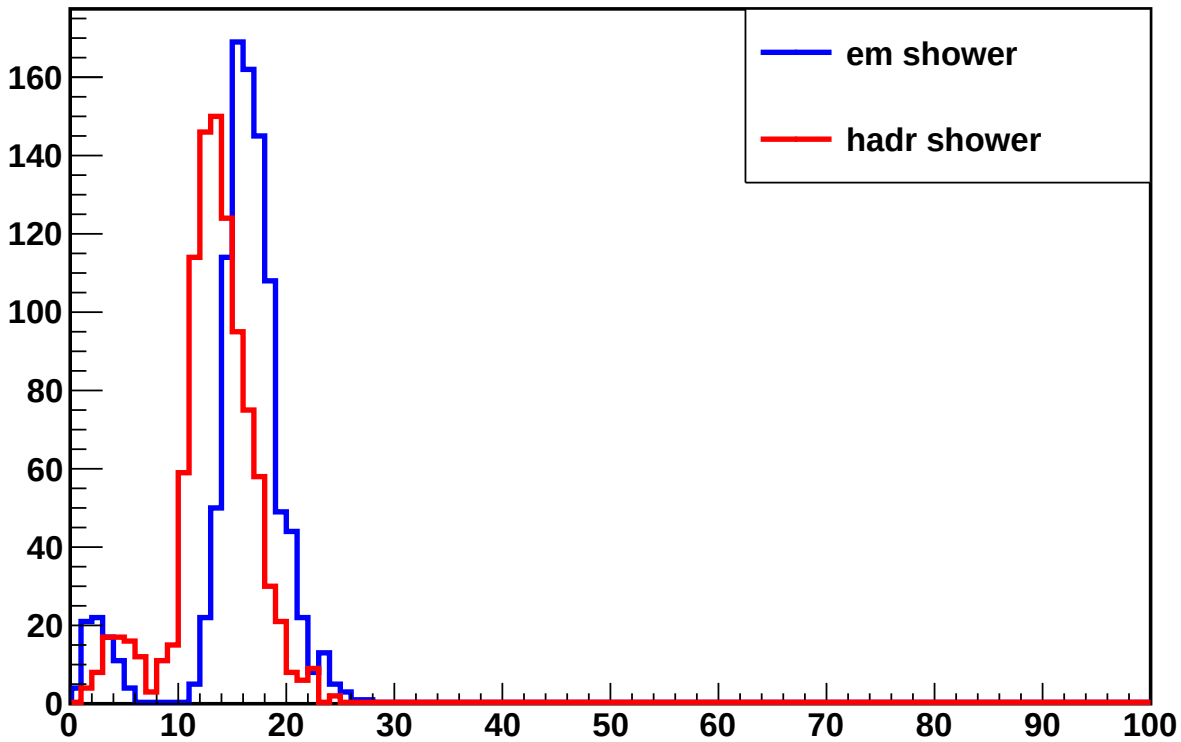


Figure : Distance between reconstructed second vertex and MC tau decay vertex

Resolution of second vertex for 35 m



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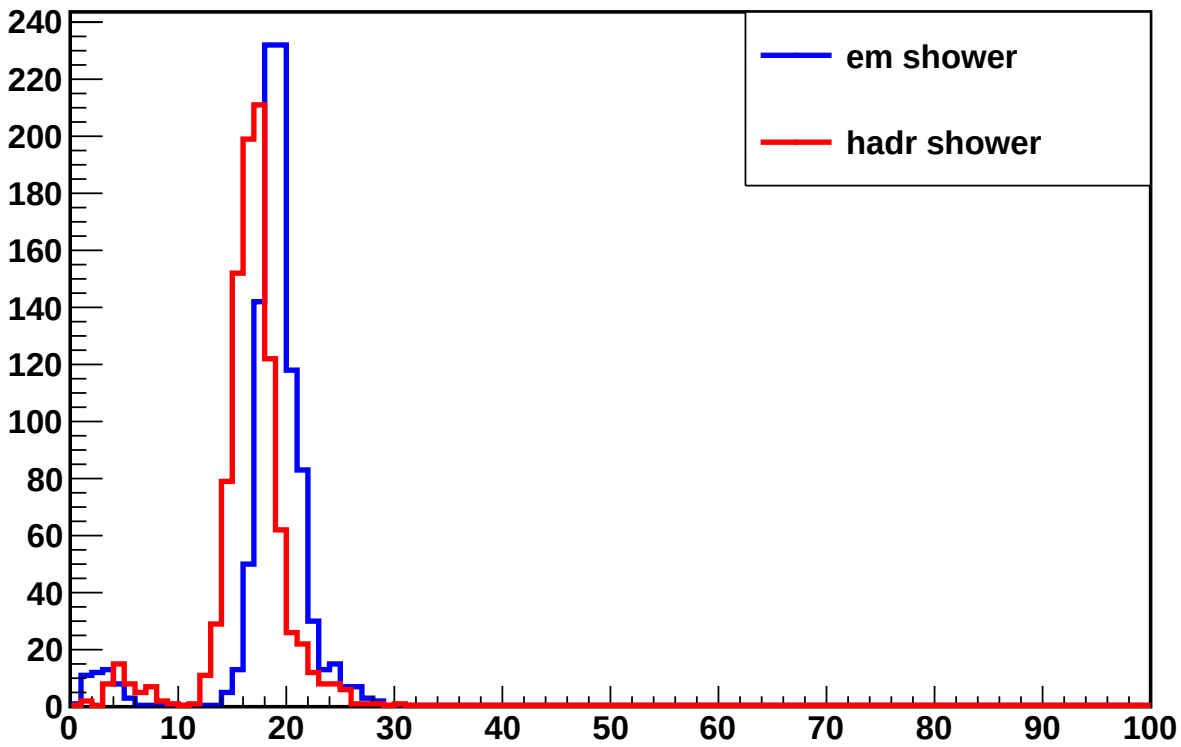
Resolution of second vertex for 20 m



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