Comparison between neutrino and anti-neutrino CC-/NC-interactions

Intro

- Goal:
  1. Investigate difference between tau- and antitau-neutrino interactions
  2. Check if different emission profiles for CC- and NC-interactions also result in different hit patterns within the detector

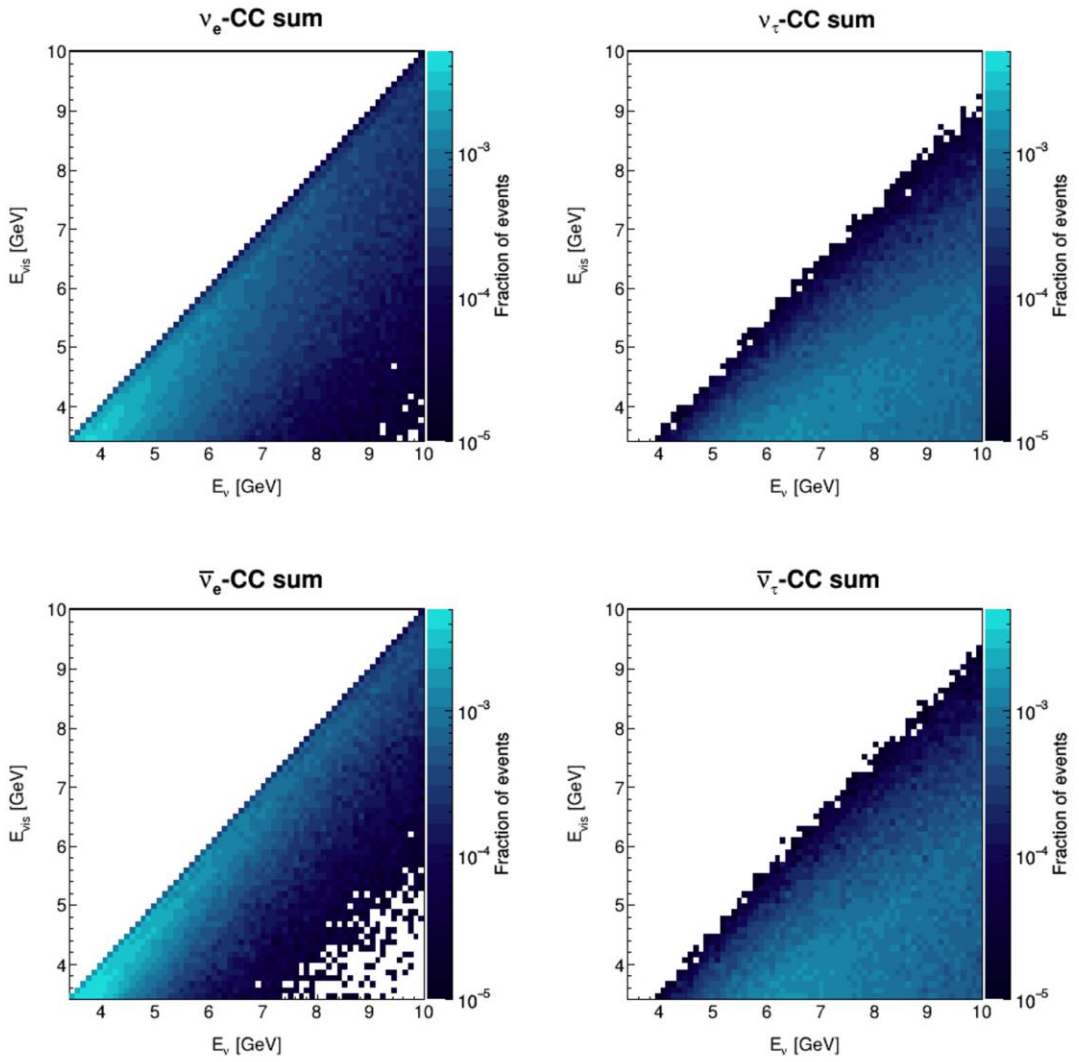
- If no difference between tau- and antitau and if this is caused by tau-lepton being produced at threshold, then expect huge difference in angular distribution of hits

  - Final state particles created via the decay of the tau-lepton, should not have little to no preferred direction

- v5.0 ORCA 115 string production (2018, 20m vs 9m)

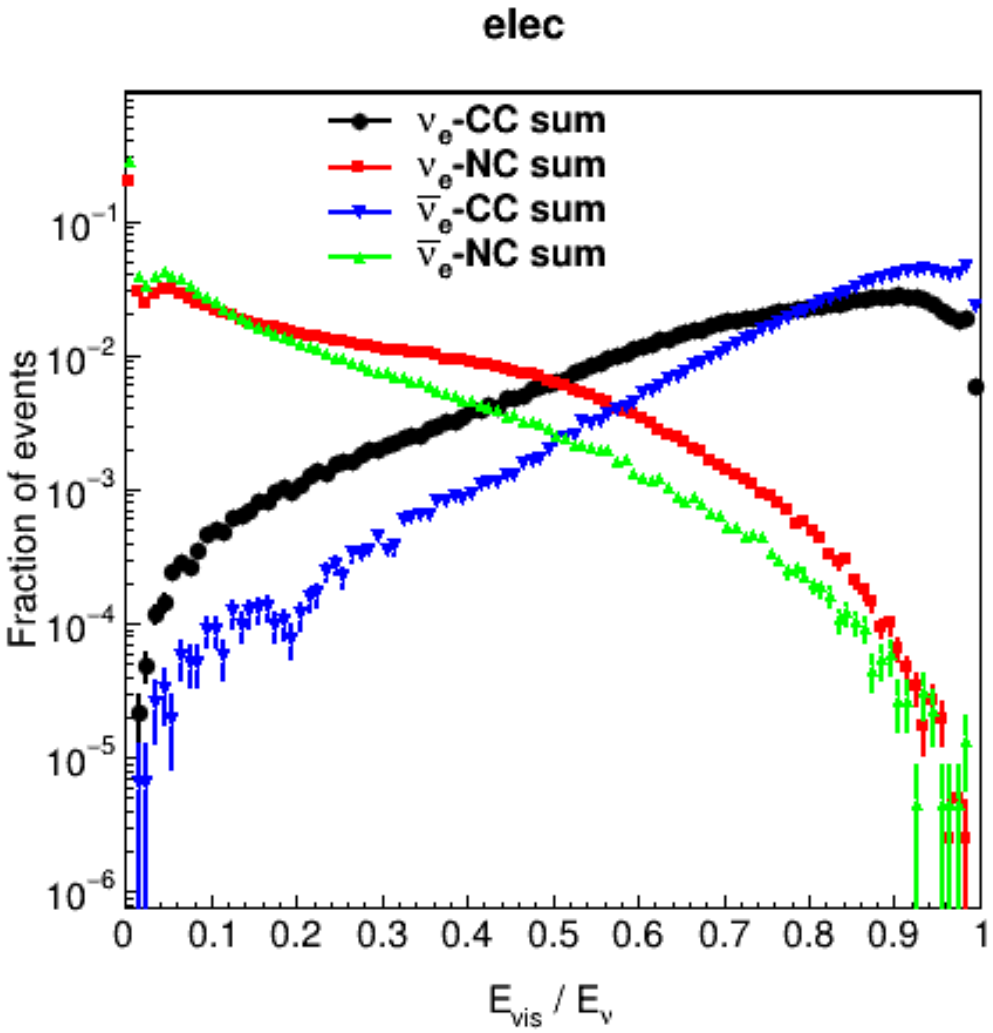
- Light simulation through KM3Sim

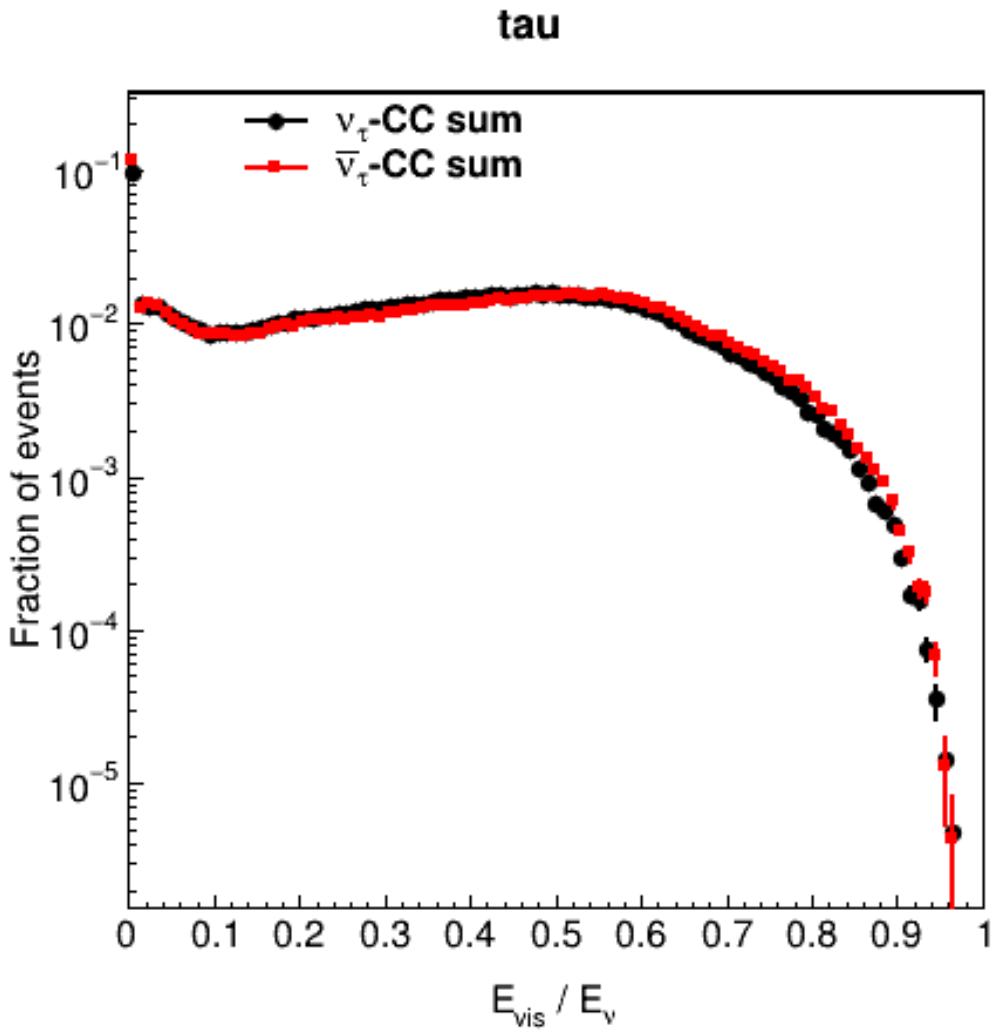
Visible energy



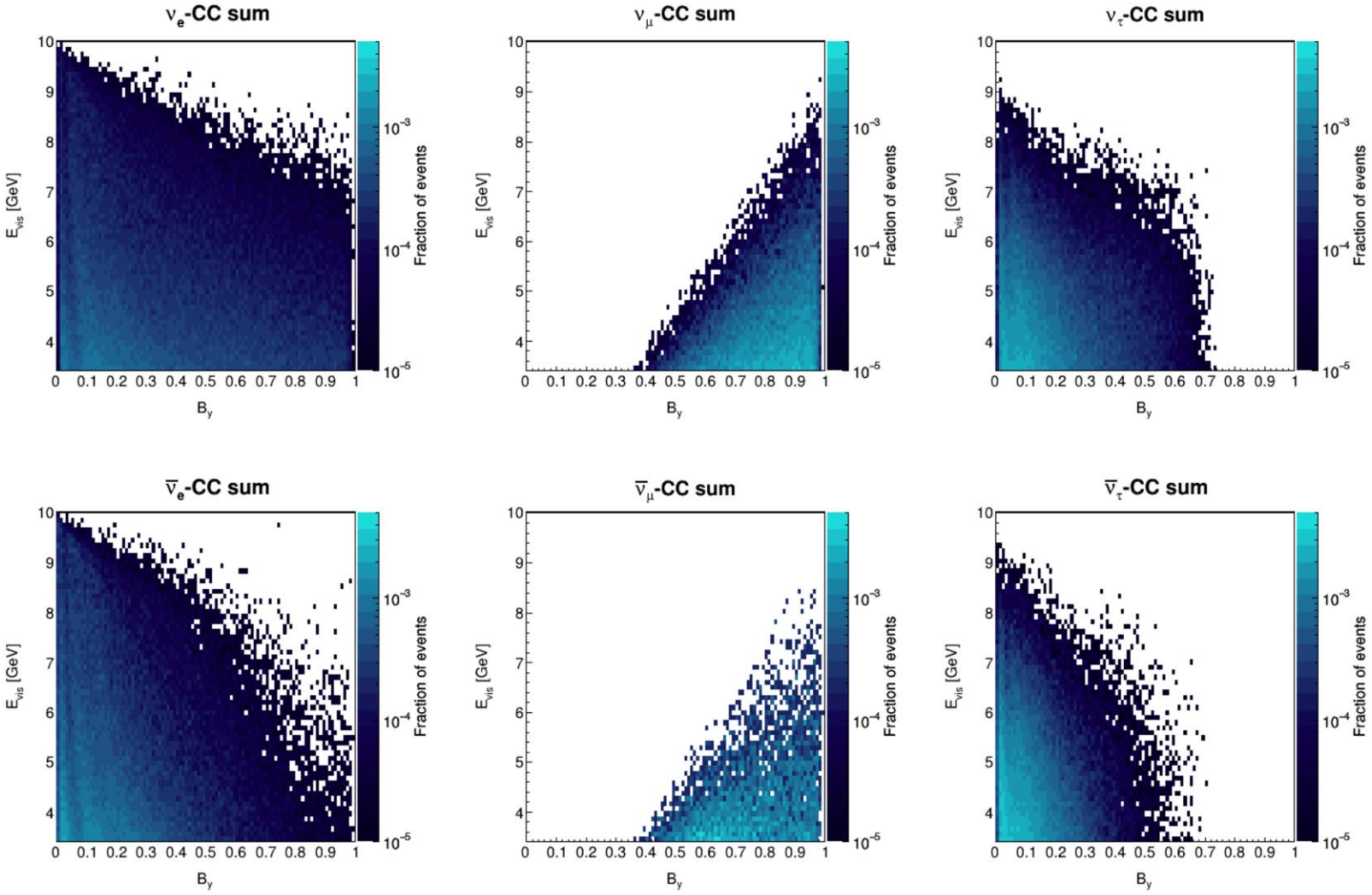
- For electron neutrino interactions
  almost all neutrino energy transfers into visible energy
- Difference between electron-neutrinos and electron-antineutrinos may be explained via different effective cross-section
- No such difference for tau-neutrinos!

Directional distribution of hits



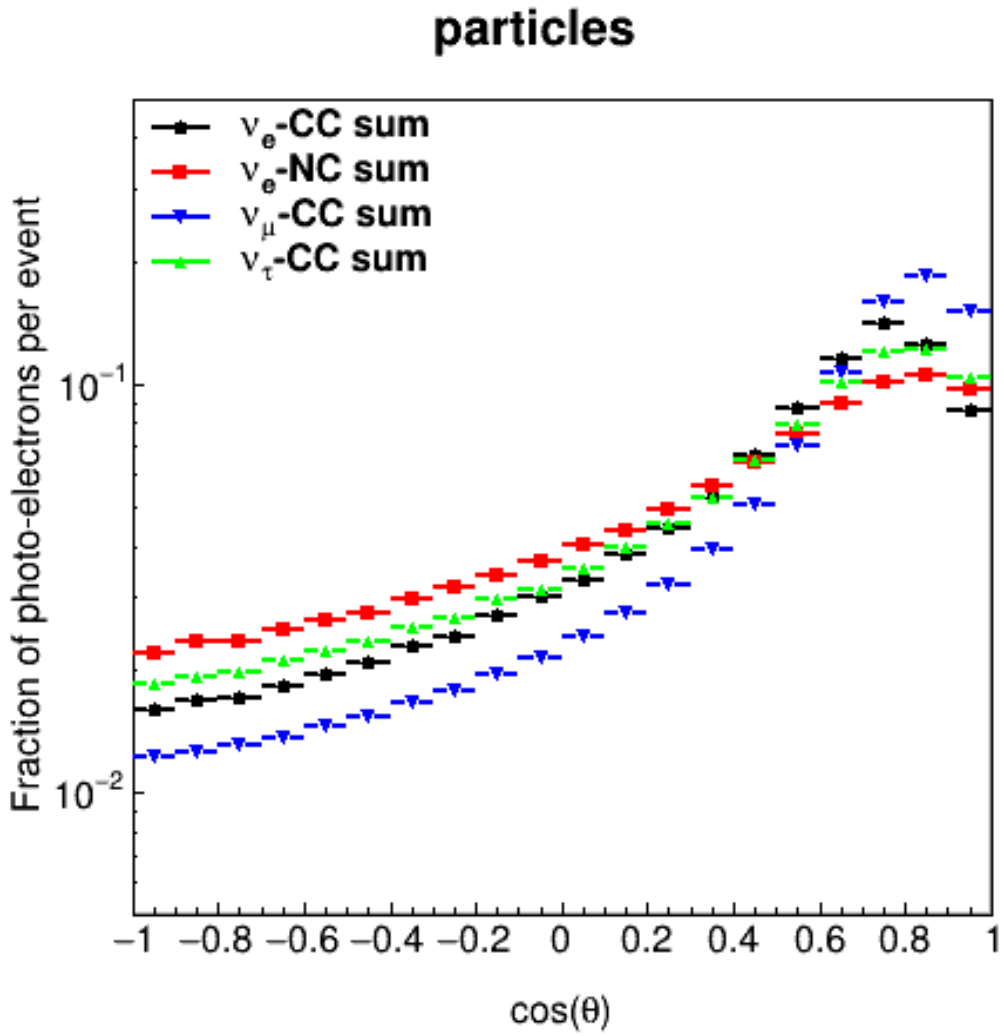


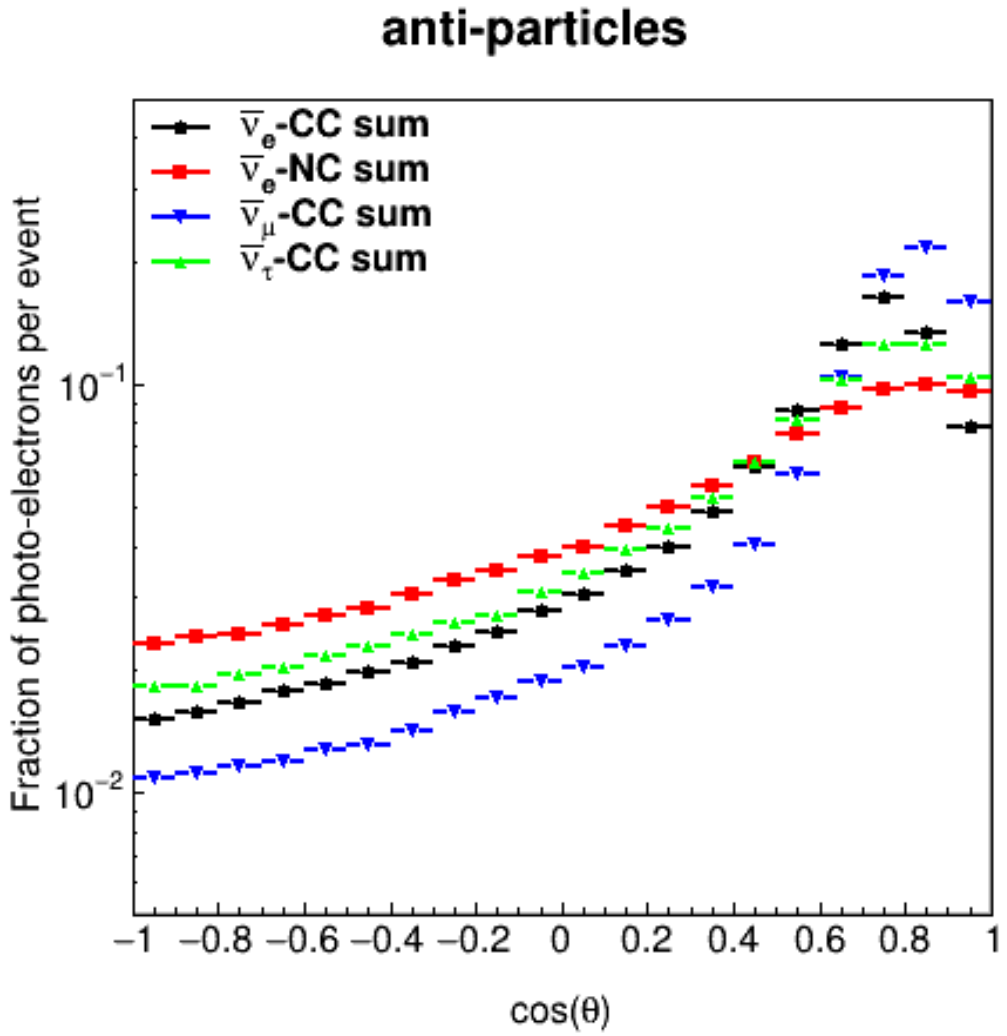
Bjorken-y



- Several features (vertical lines) visible at low By
  - Possibly due to energy thresholds for the production of discrete number of hadronic final state particles
- How come the By-dependence for the muon is so different?

Directional distribution of hits





Conclusions

- Plotting visible energy versus neutrino energy reveals
  a slight difference between electron neutrinos and electron anti-neutrinos

- This difference is not seen for tau (anti-)neutrino interactions

- No difference is found between electron neutrino and tau-neutrino interactions
  in the angular distribution of hits either

- There is a 1%-10% difference between the directional hit distributions of NC-interactions and CC-interactions
  (with NC-interactions resulting in more hits in the backwards direction w.r.t. the neutrino-direction)