Search for Dark Matter towards the center of the earth with ANTARES

Dark Ghosts - 1st GNN workshop on DM searches

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Dark Matter accumulation in the earth

- capturing is dominated by spin-independent elastic scattering on heavy nucleons
- the earth is generally not in equilibrium

  $\rightarrow$

  Dark Matter annihilation rate today depends on the total WIMP annihilation cross section
- distribution of WIMPS is generally not point-like

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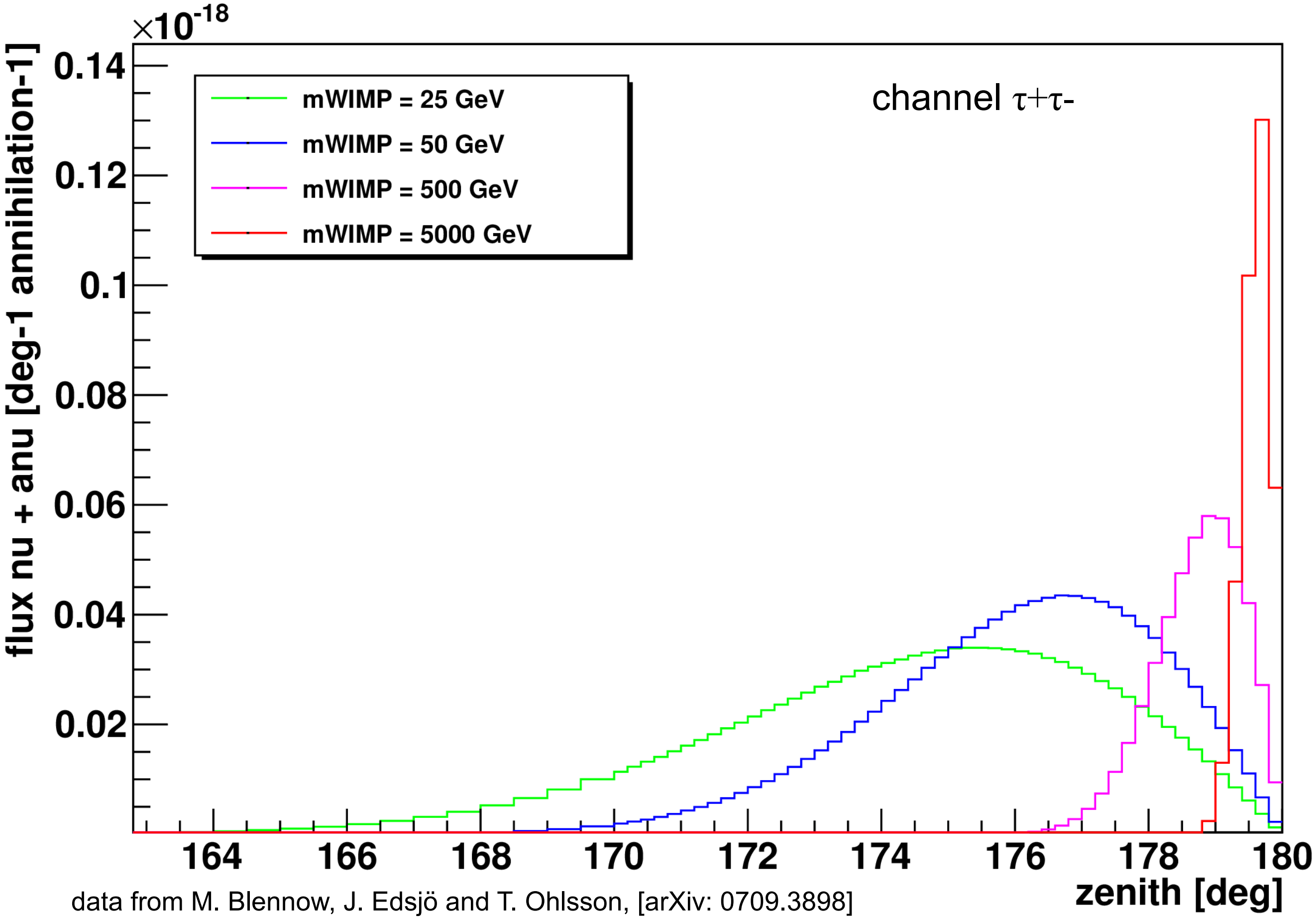
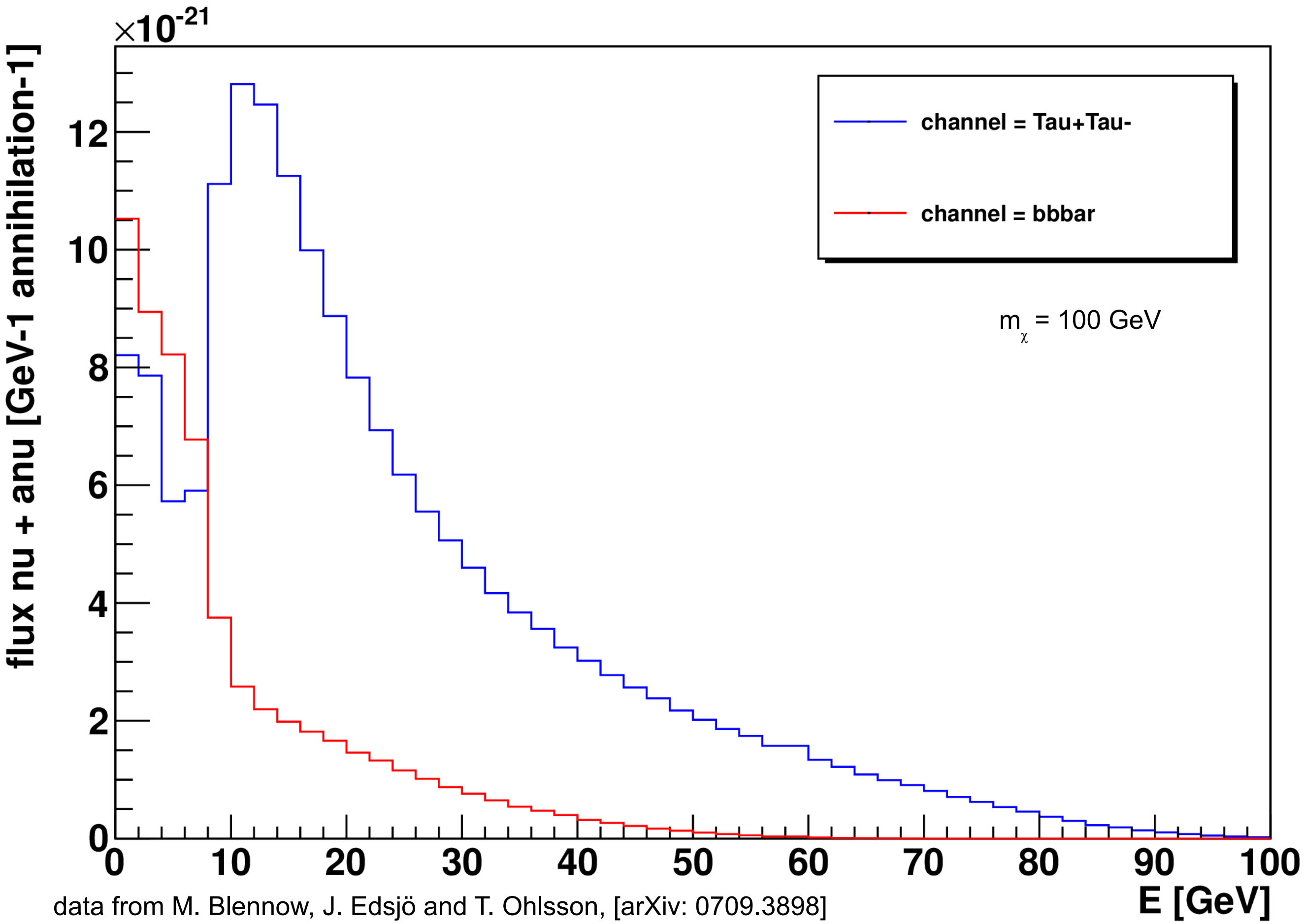
Angular distribution of the neutrino flux



data from M. Blennow, J. Edsjö and T. Ohlsson, [arXiv: 0709.3898]

Energy distribution of the neutrino flux



data from M. Blennow, J. Edsjö and T. Ohlsson, [arXiv: 0709.3898]

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Expected results of the analysis

spin-independent elastic scattering cross section of neutralinos to ordinary matter

for each WIMP mass and annihilation channel

under various assumptions
e.g. local halo mass density, dark matter velocity dispersion, annihilation cross section, masses of the nucleons in the earth, mass fractions of the elements in the earth, the distribution of the elements in the earth, form factors,

WIMP annihilation rate

various fluxes

Lepton/neutrino/hadronic shower flux conversion
http://copsosx03.physto.se/cgi-bin/edsjo/wimpsim/flxconv.cgi

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The analysis

- define cuts on:

  - zenith angle

  - energy

  - quality

- get the number of expected atm. neutrinos, atm. muons and signal neutrinos per WIMP annihilation from simulations
- optimize cuts for sensitivity on the annihilation rate
- compare background simulations to real background
- compare simulations to data and set limit on the annihilation rate
- set limit on the spin-independent elastic scattering cross section

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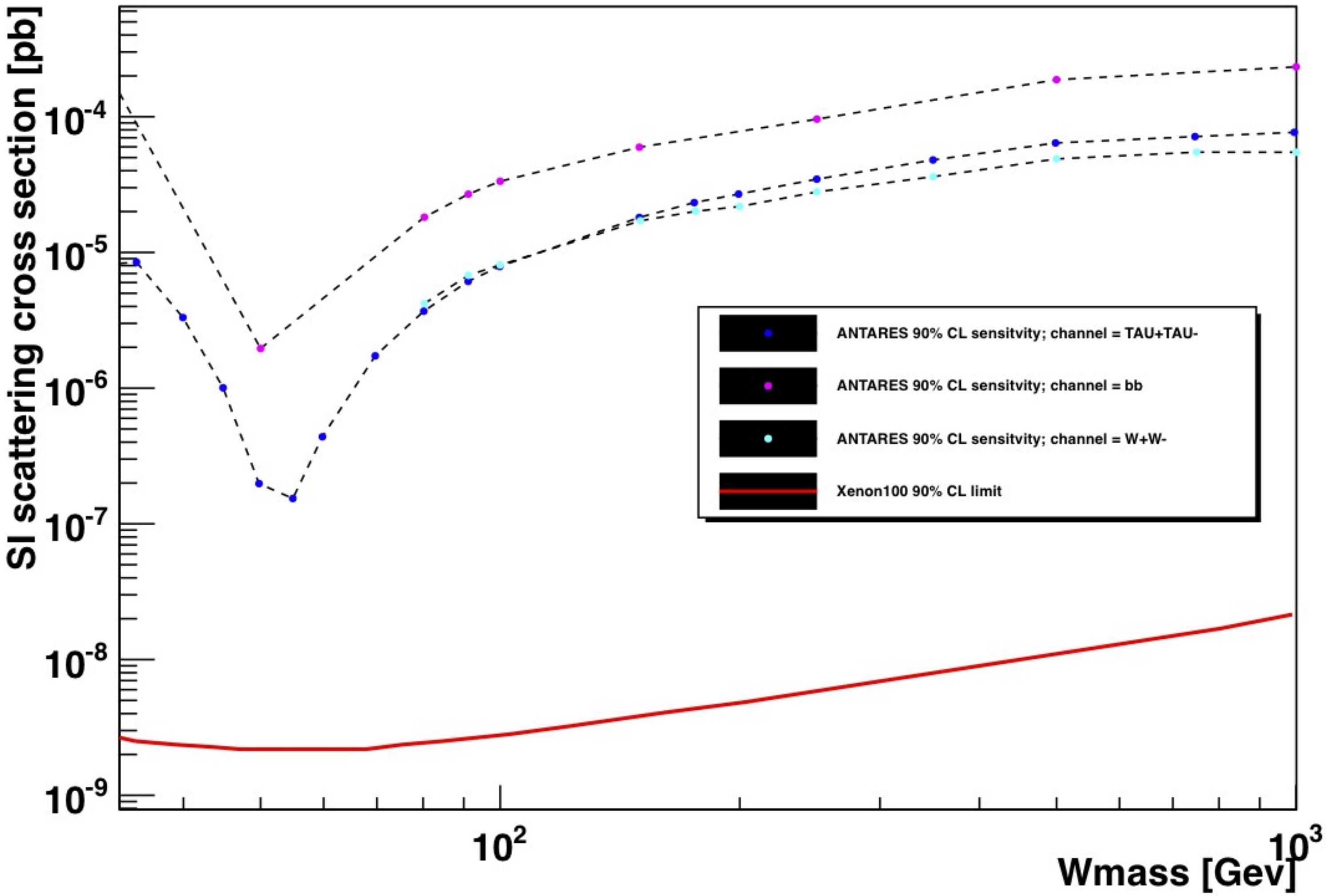
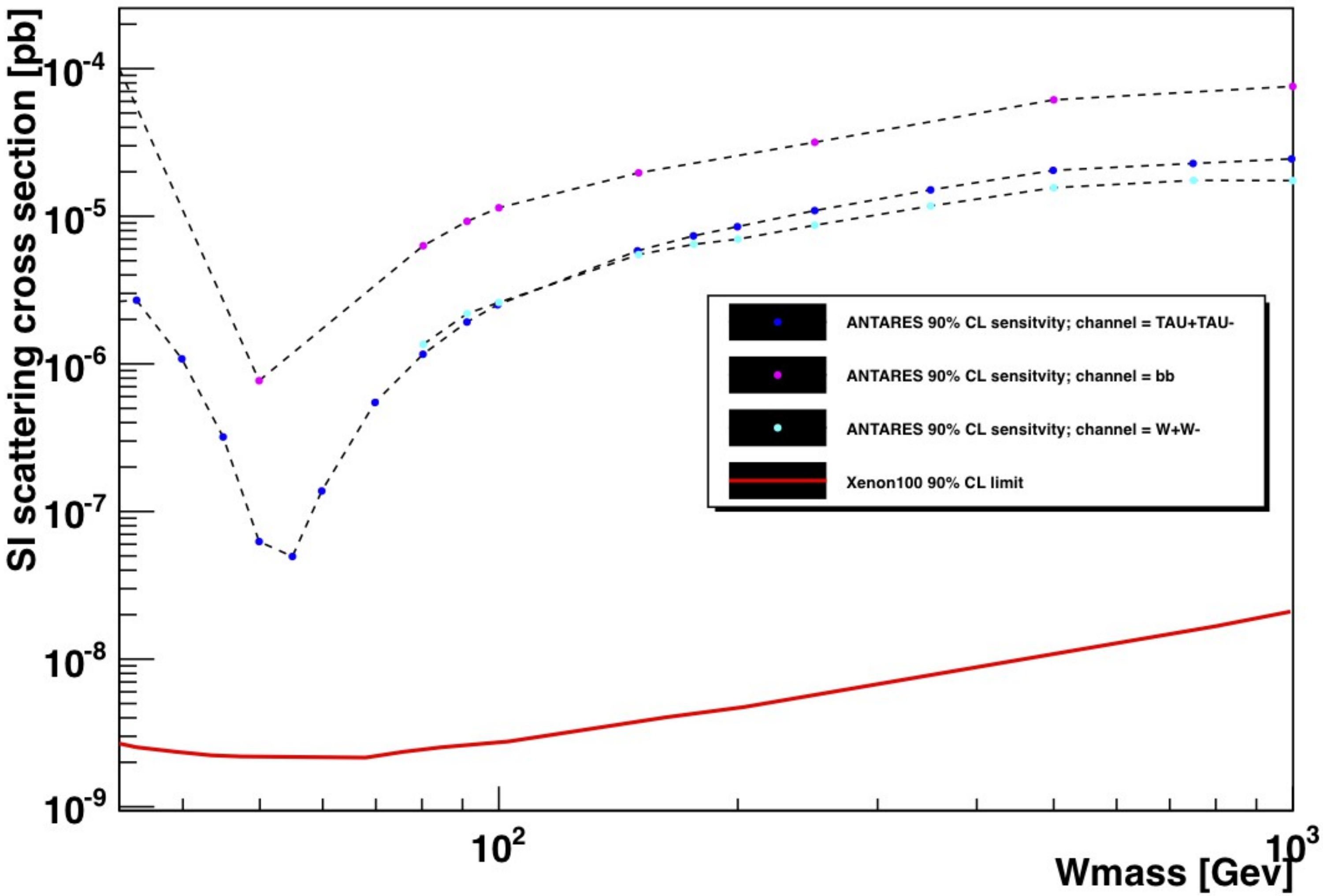
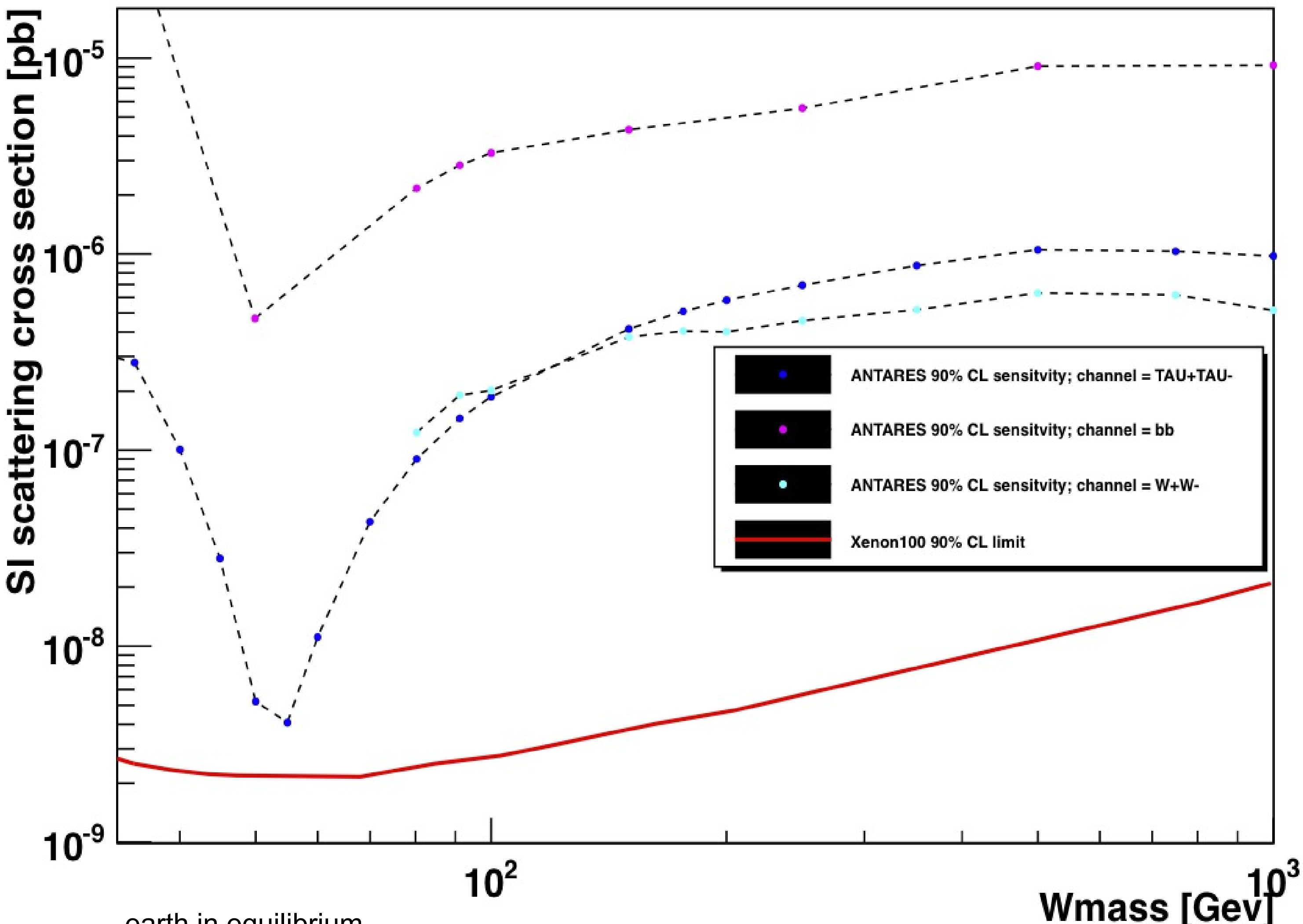


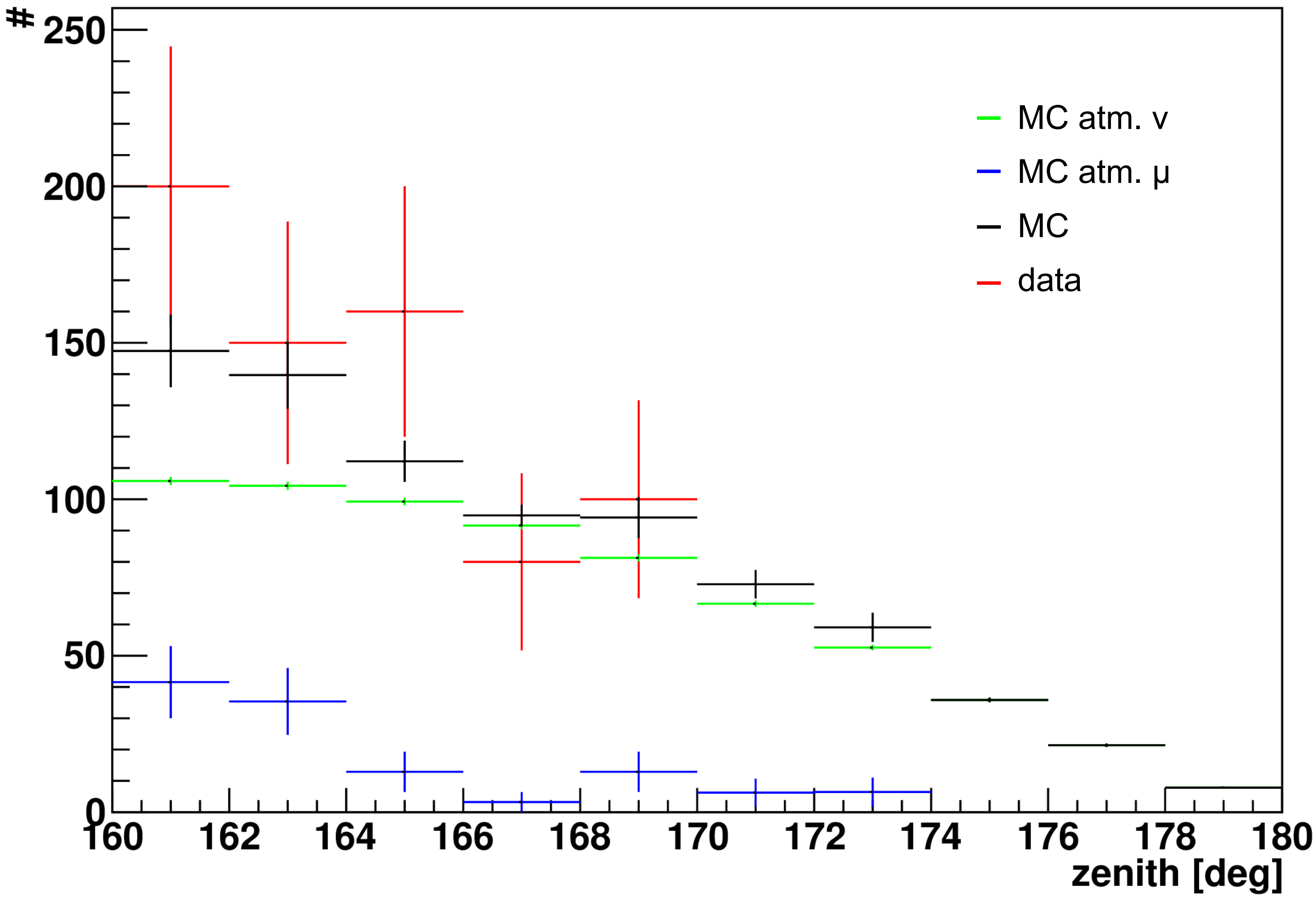
$$\langle \sigma v \rangle = 3 \times 10^{-27}\, cm^3 s^{-1}$$



$\langle \sigma v \rangle = 3 \times 10^{-26}\, cm^3\, s^{-1}$



earth in equilibrium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zenith [deg]
MC atm. ν
MC atm. μ
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data