Latest Measurement of the Appearance of Tau Neutrinos in the Flux of Atmospheric Neutrinos at Super-Kamiokande

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NARODOWE CENTRUM BADAŃ JĄDROWYCH ŚWIERK

ATMOSPHERIC NEUTRINOS AT SUPER-KAMIOKANDE

Cosmic ray

Fiducial volume (FV) defined by D>1m

Γ above Cherenkov threshold

FV D
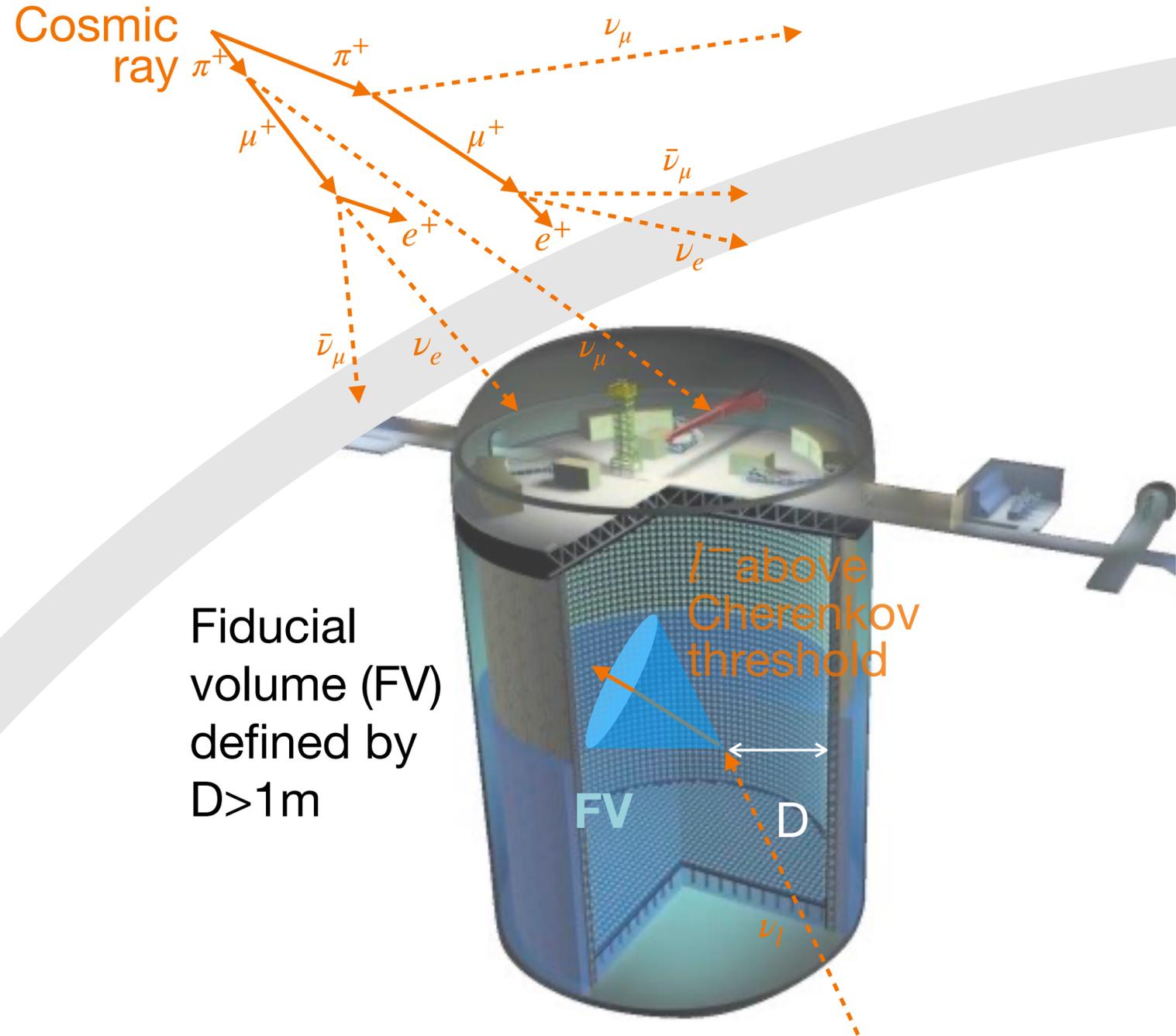
Multi-GeV events
484.2 kT.years

Background
Tau CC signal

2% ν_τ**CC**
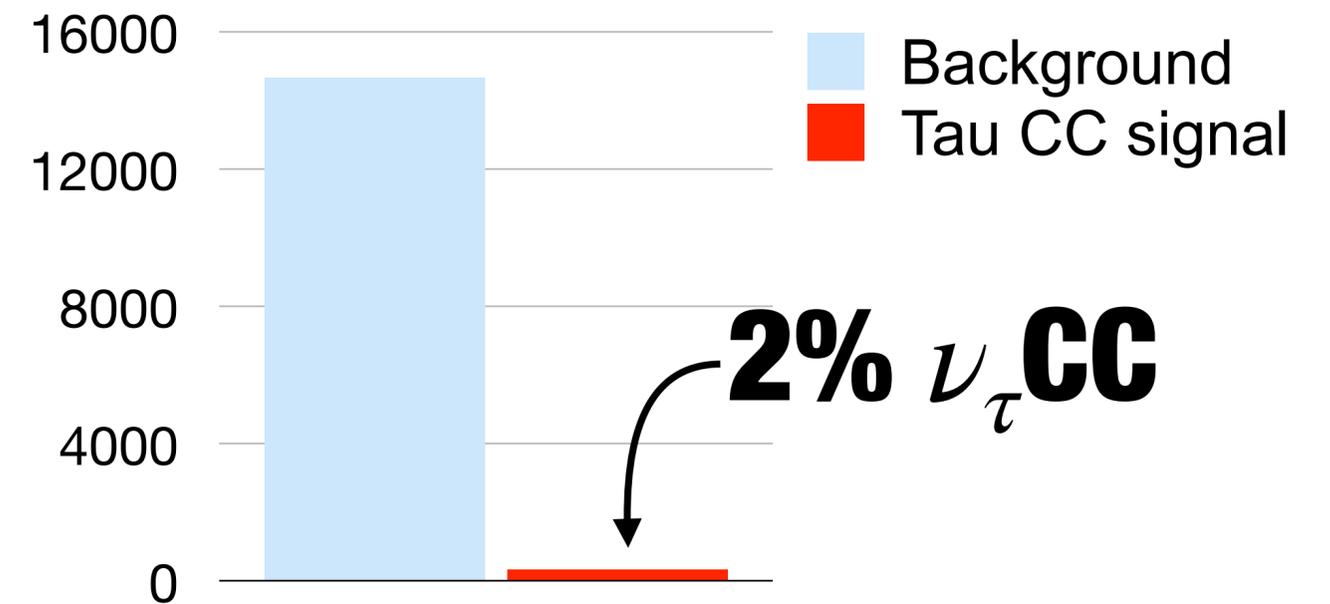
LATEST MEASUREMENT OF TAU NEUTRINO APPEARANCE

Livetime, in years

50% more exposure

since the last published results (2018)
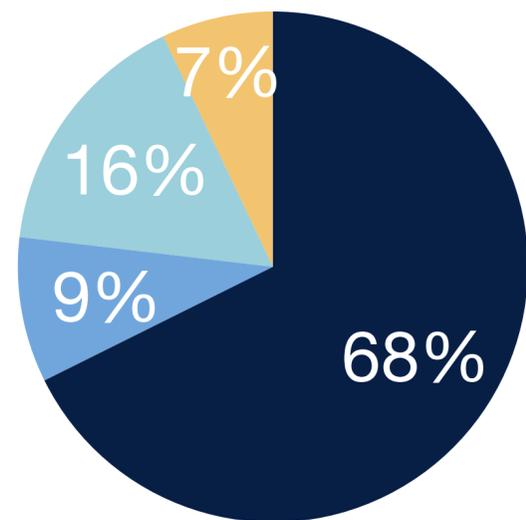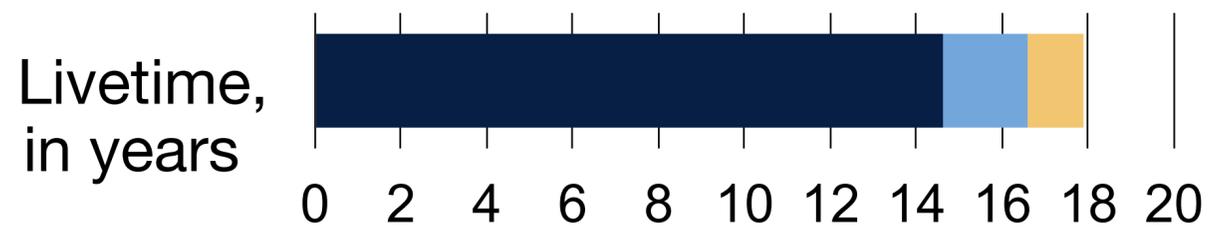
- SK I-IV (2018 analysis, old FV)
- Rest of SK IV (old FV)
- Expansion of FV in SK I-IV
- SK V (expanded FV)

Neural network to separate ν_τ CC interactions from the background of atmospheric neutrino interactions.

Background
Tau CC signal

Neural network output

Cosine of zenith angle
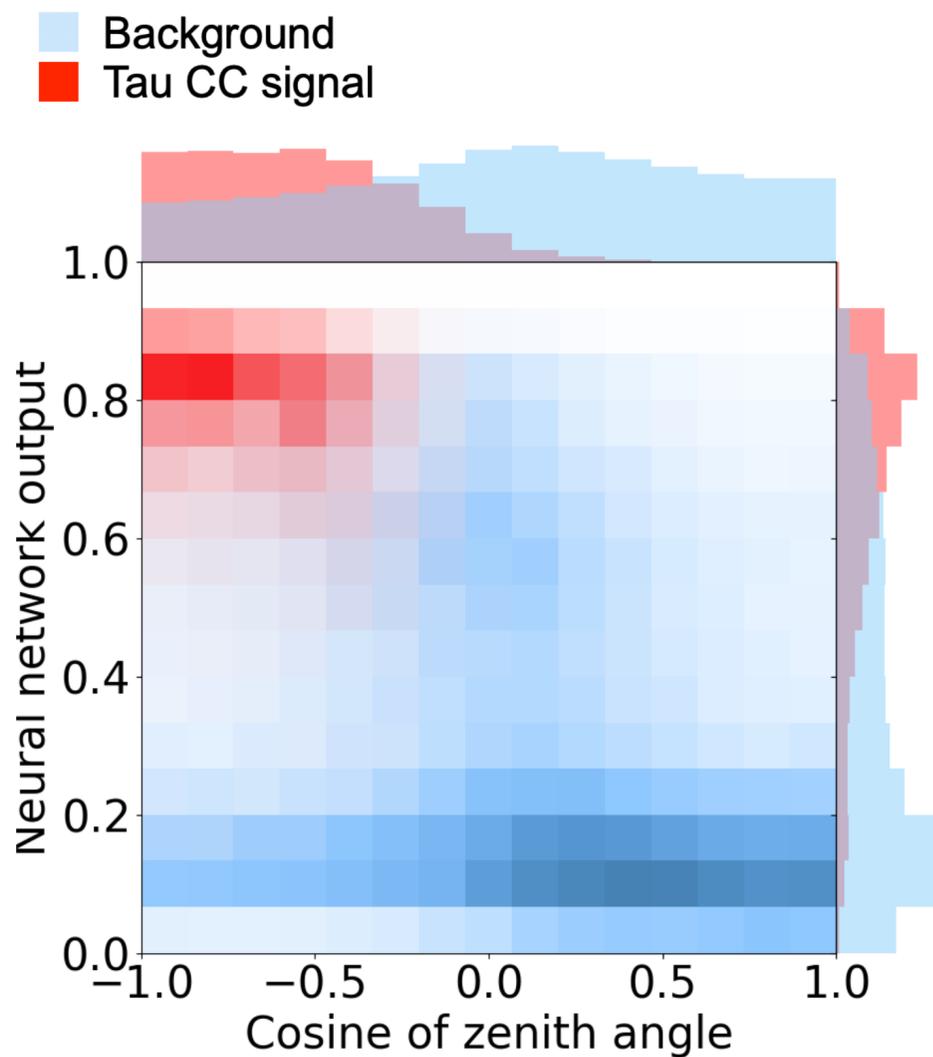
Typical tau-like event
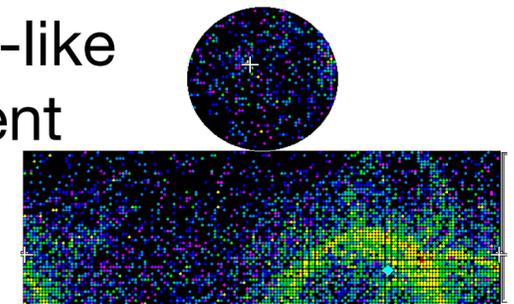
Typical non tau-like event
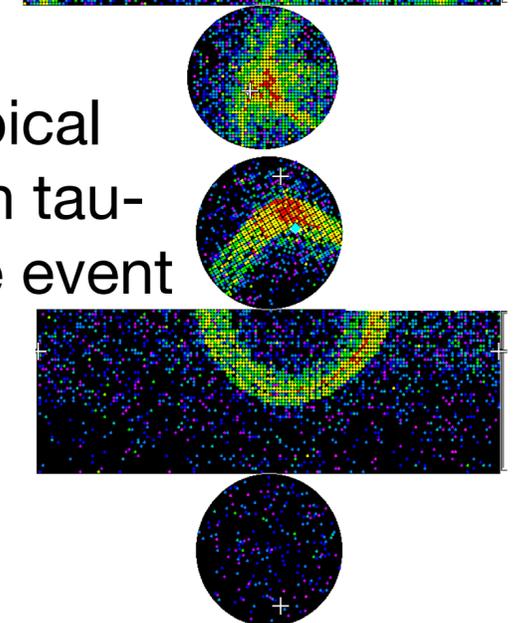
LATEST RESULTS FOR 484.2 kT.YEARS EXPOSURE

Extended maximum likelihood fit accounting for 54 systematic uncertainties, assuming normal neutrino mass-ordering.
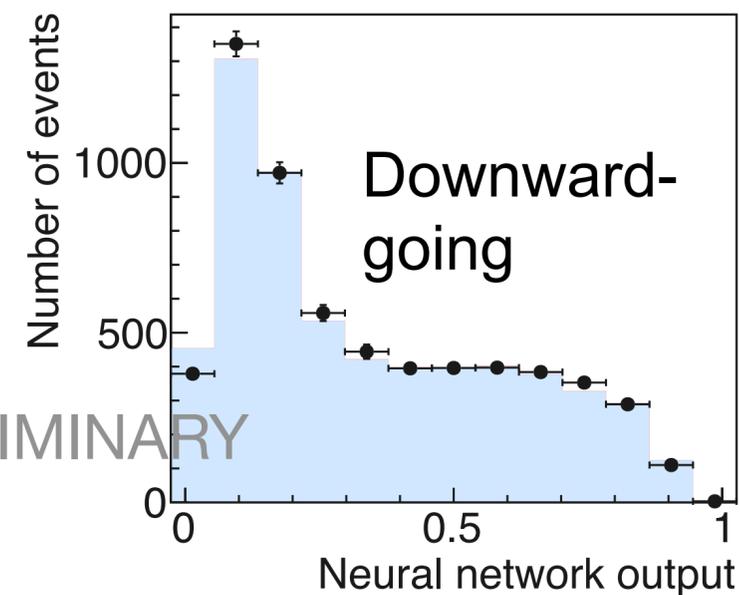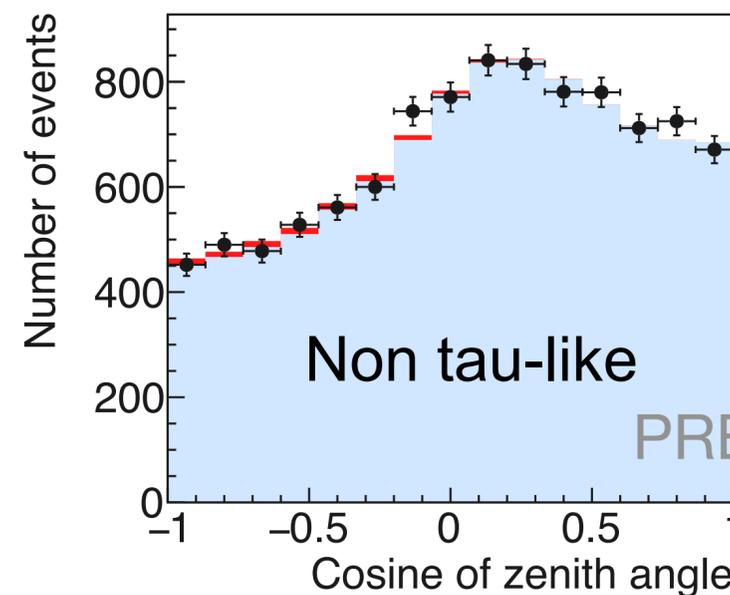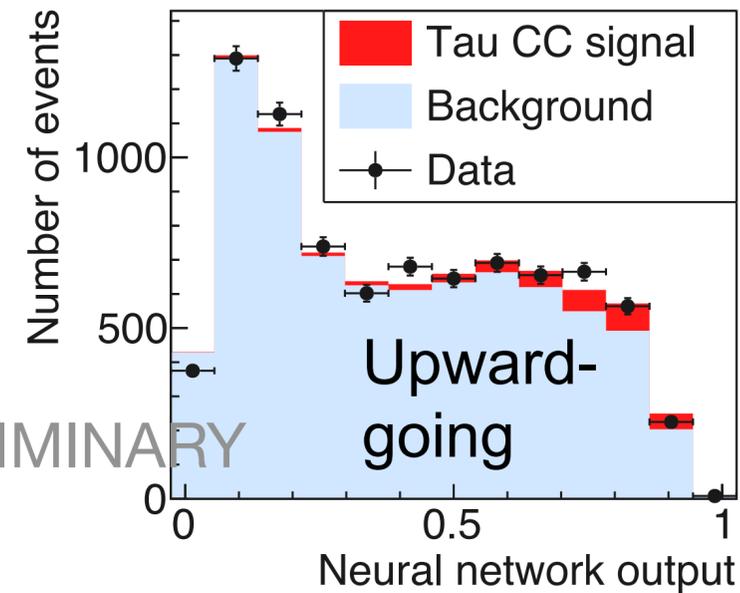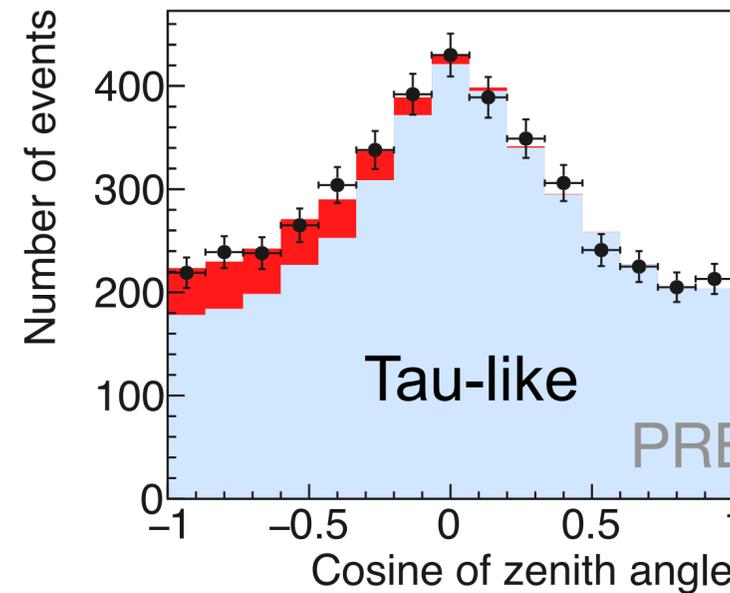
428±92 tau neutrinos observed.

4.8σ

exclusion of the hypothesis of no tau neutrino appearance.

CONCLUSIONS AND WAY FORWARD

Tau neutrino appearance is characterised by

tau normalisation,
N = 1.36±0.29

N=1: perfect agreement of data with prediction model based on standard three-flavor oscillation theory.

SK analyses over the years

Super-Kamiokande (27.2 kT)

Hyper-Kamiokande (187 kT)

Expected start date: 2027
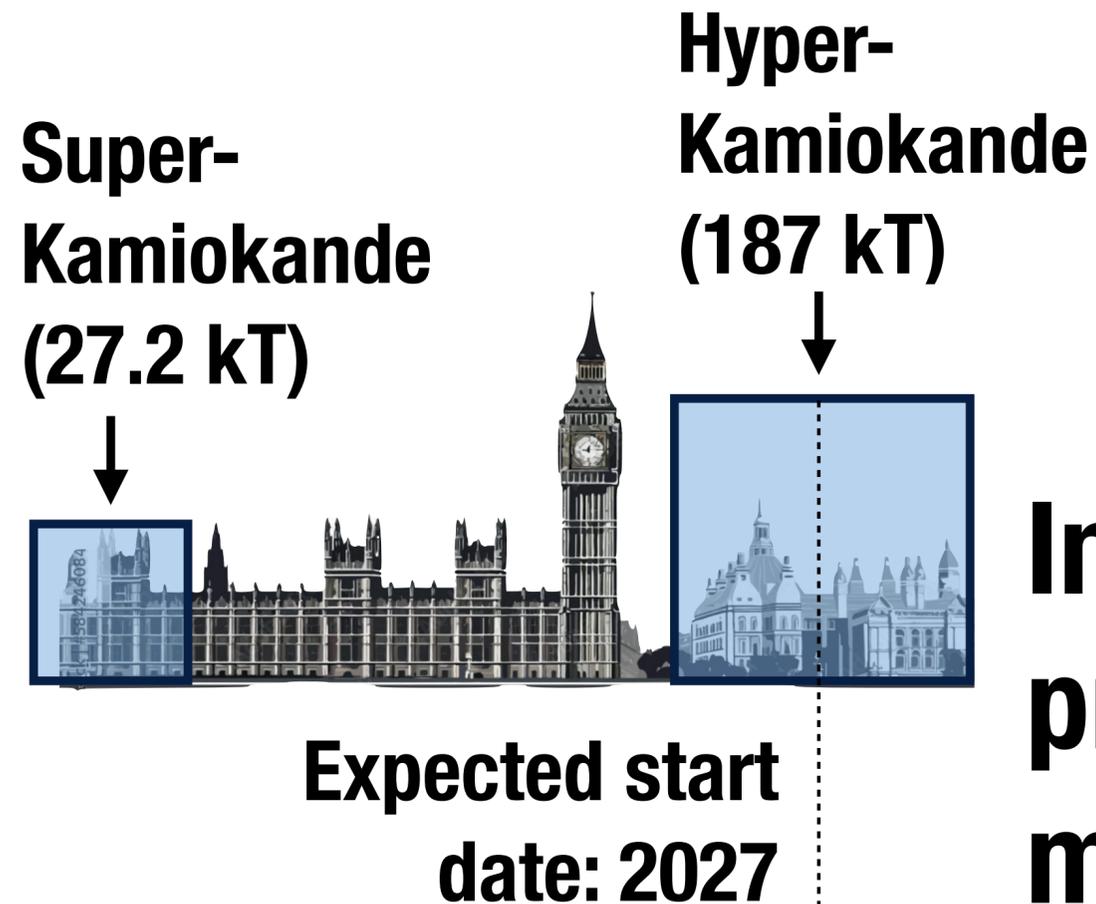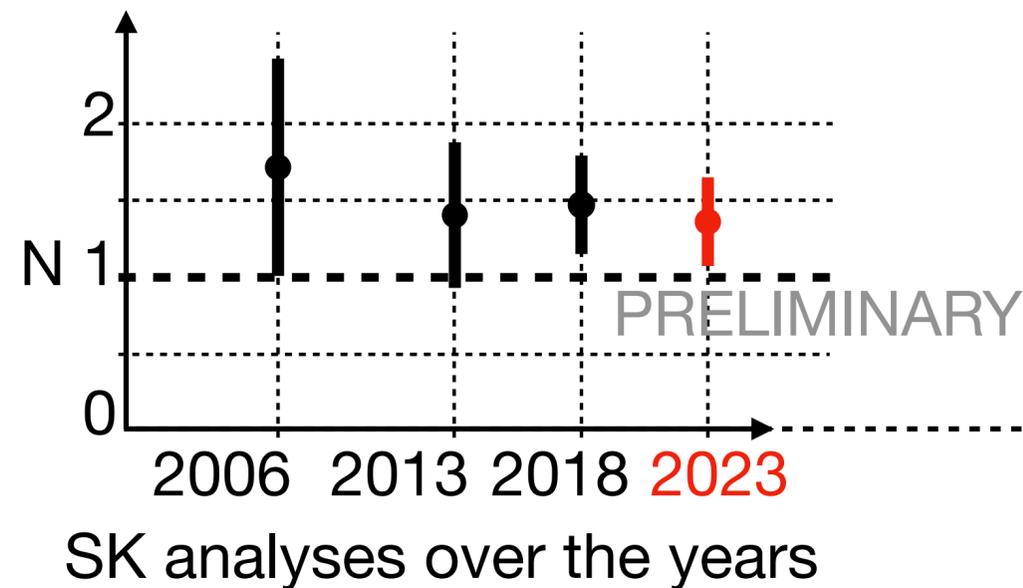
Increase in the precision of measuring tau normalisation.