Context

Neutrino mass ordering

- ORCA has a certain sensitivity, $\mathcal{S}$
- Model ORCA sensitivity, $\mathcal{S}$:
- Asimov method

  Other methods
- Sensitivity *curve*: need constraints on θ_{23}
- What do we actually want? θ_{23}, Δm^2_{31} and +/- on Δm^2_{31}

How?

- θ_{23} and Δm^2_{31} are visible in oscillations
- What do we measure? (photon counts/arrival times)
  - Tracks: (anti)muon-neutrino-CC
  - Showers: everything else (nu/nb, e/mu/tau, NC/CC)
- 12 channels would be ideal
- Can’t: flavor information is lost (most of it anyway)

What?

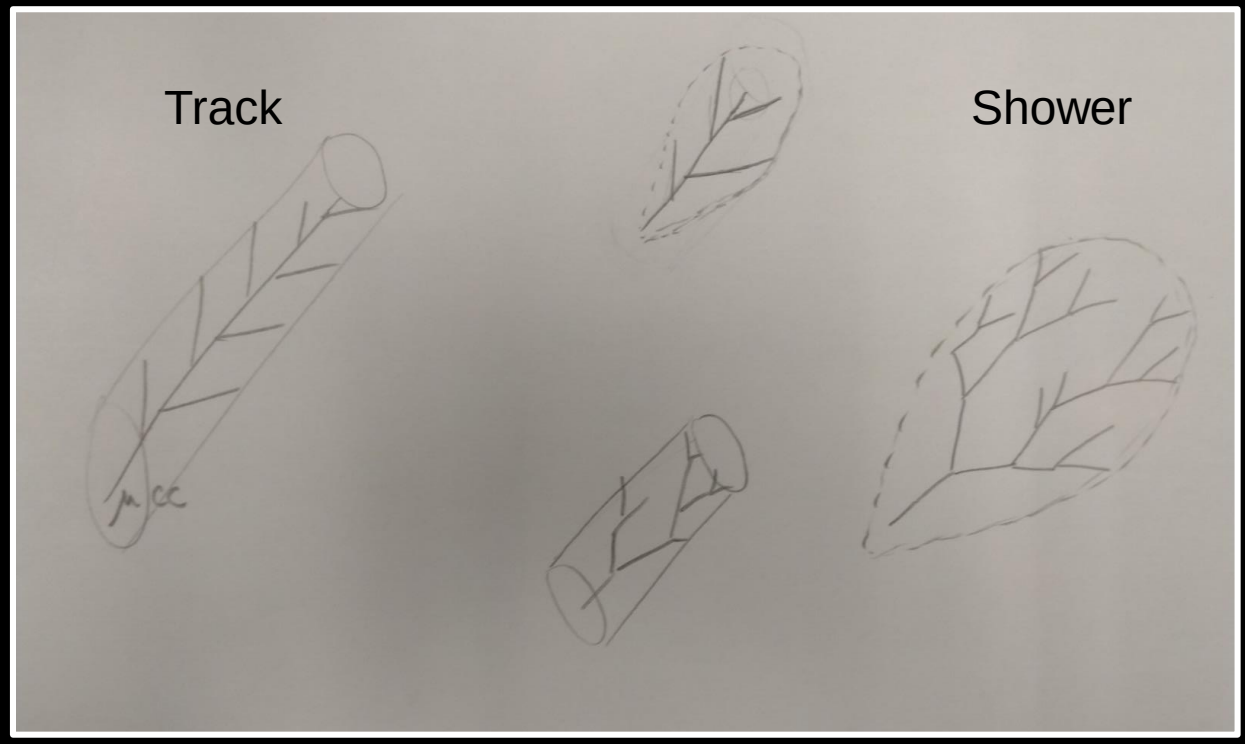
- Sensitivity $\mathcal{S}$: Reject other hypothesis (OH)
- Count tracks and showers
- Asimov method:
  - Generate expectation value distribution under H0
  - Fit to H1
  - Approximate sensitivity
- Competitive: PINGU
- Increase sensitivity

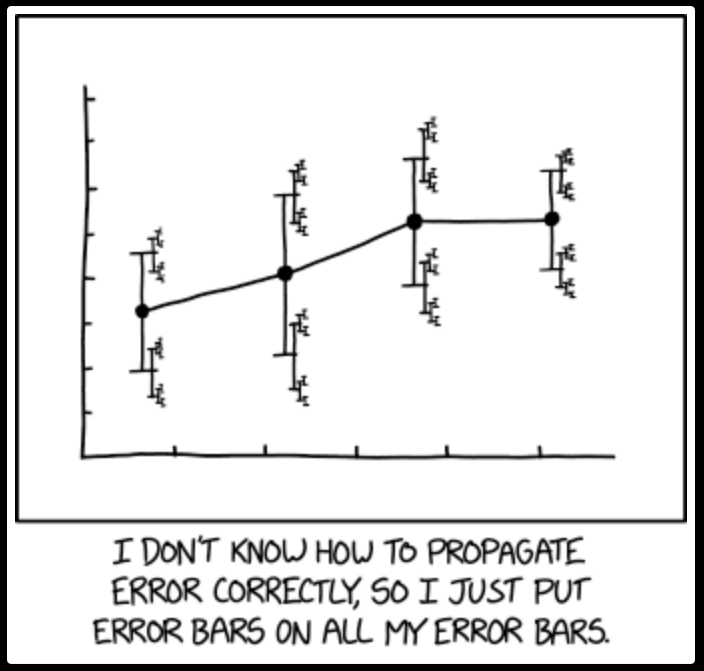
Sensitivity $\mathcal{S}$

- Runtime
- Resolution
- E/L, etc.

- Two channels
  two histograms (E_{reco}, $\cos\theta_{reco}$)

- How to improve $\mathcal{S}$?
  - Add $Y_{Bjorken}$
  - More than two channels

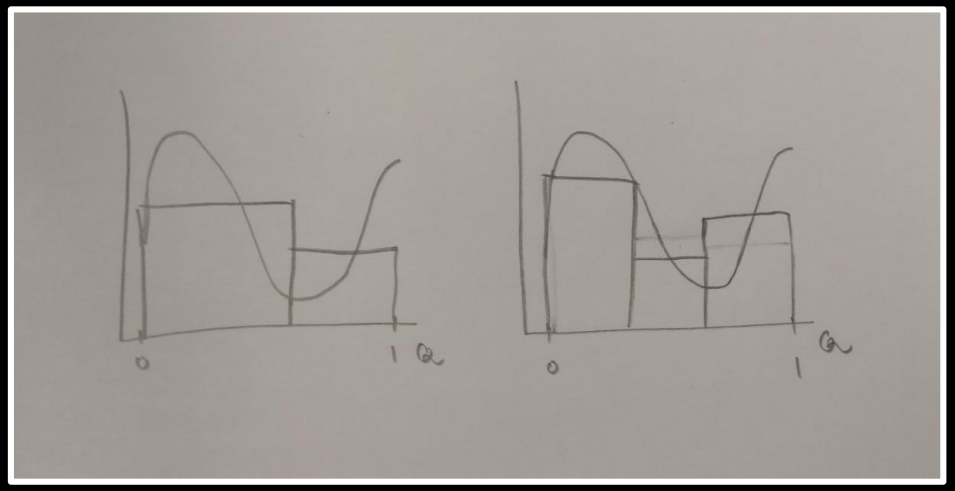




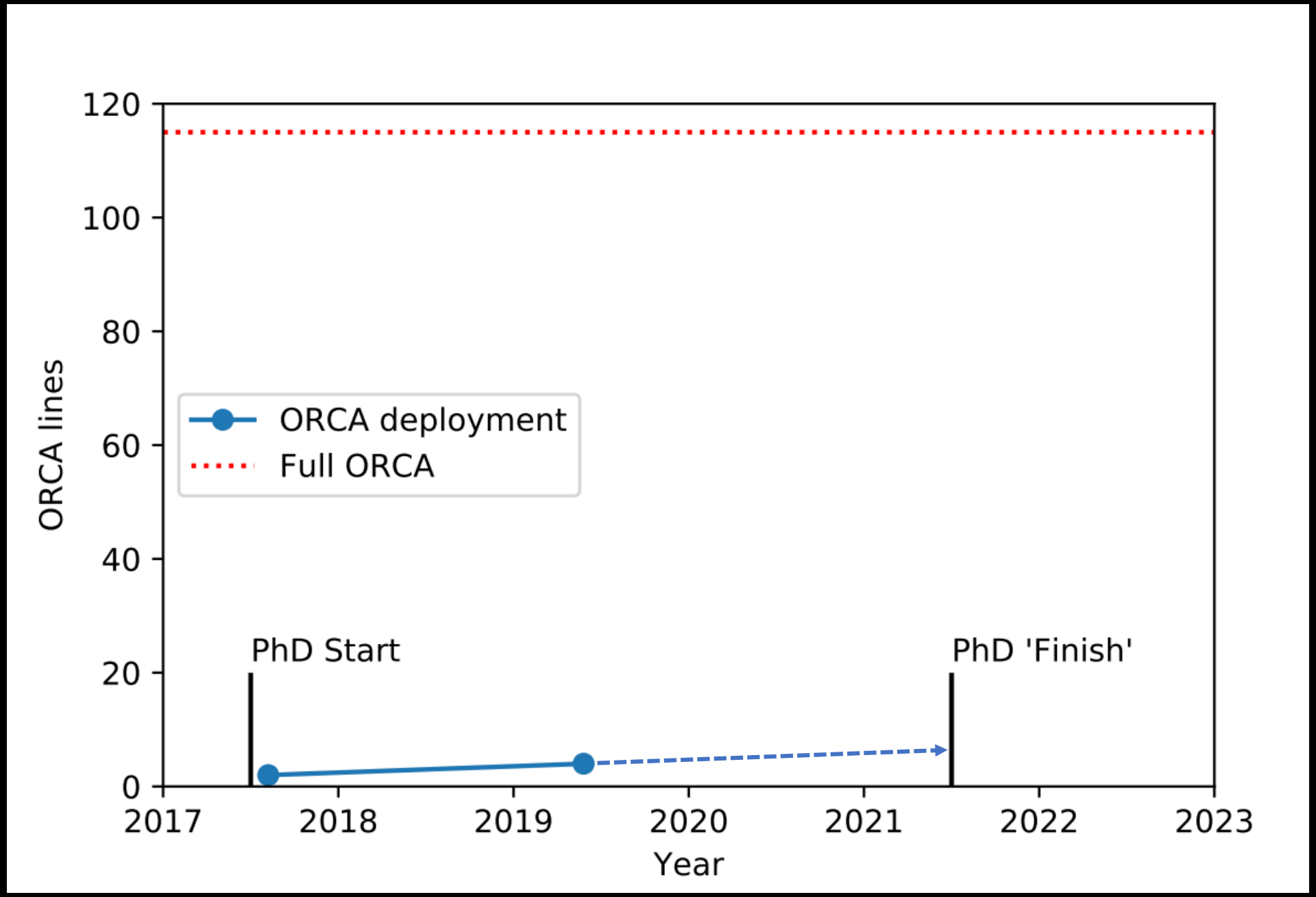
I DON'T KNOW HOW TO PROPAGATE ERROR CORRECTLY, SO I JUST PUT ERROR BARS ON ALL MY ERROR BARS.

Binning in PID variable Q

- Histogram: $(E_{reco}, \cos\theta_{reco})$
  $(E_{reco}, \cos\theta_{reco}, \text{PID})$



- Issue: statistics or signal?
  1. $\mathcal{S}$ always increases w/ bins
  2. Due to detector response matrix
  3. $\langle \Delta\chi^2 \rangle = \Delta\chi^2_\infty + \frac{K}{N}$


120
100
80
60
40
20
0
ORCA lines
ORCA deployment
Full ORCA
PhD Start
PhD 'Finish'
2017
2018
2019
2020
2021
2022
2023
Year

Forward!

- Concrete:
  - Finish PID study
  - ParamNMH parametrization
  - Improve MONA internals (kernels for interpolating)

- Abstract:
  - ORCA data (4 lines)
  - Constraining θ_{23} and Δm^2_{31}

- What I want to work on:
  - ✓Statistical modelling
  - ✓Function fitting
  - LLR studies (Asimov…)
  - Software