π^+ Decay-At-Rest Beam for LENA

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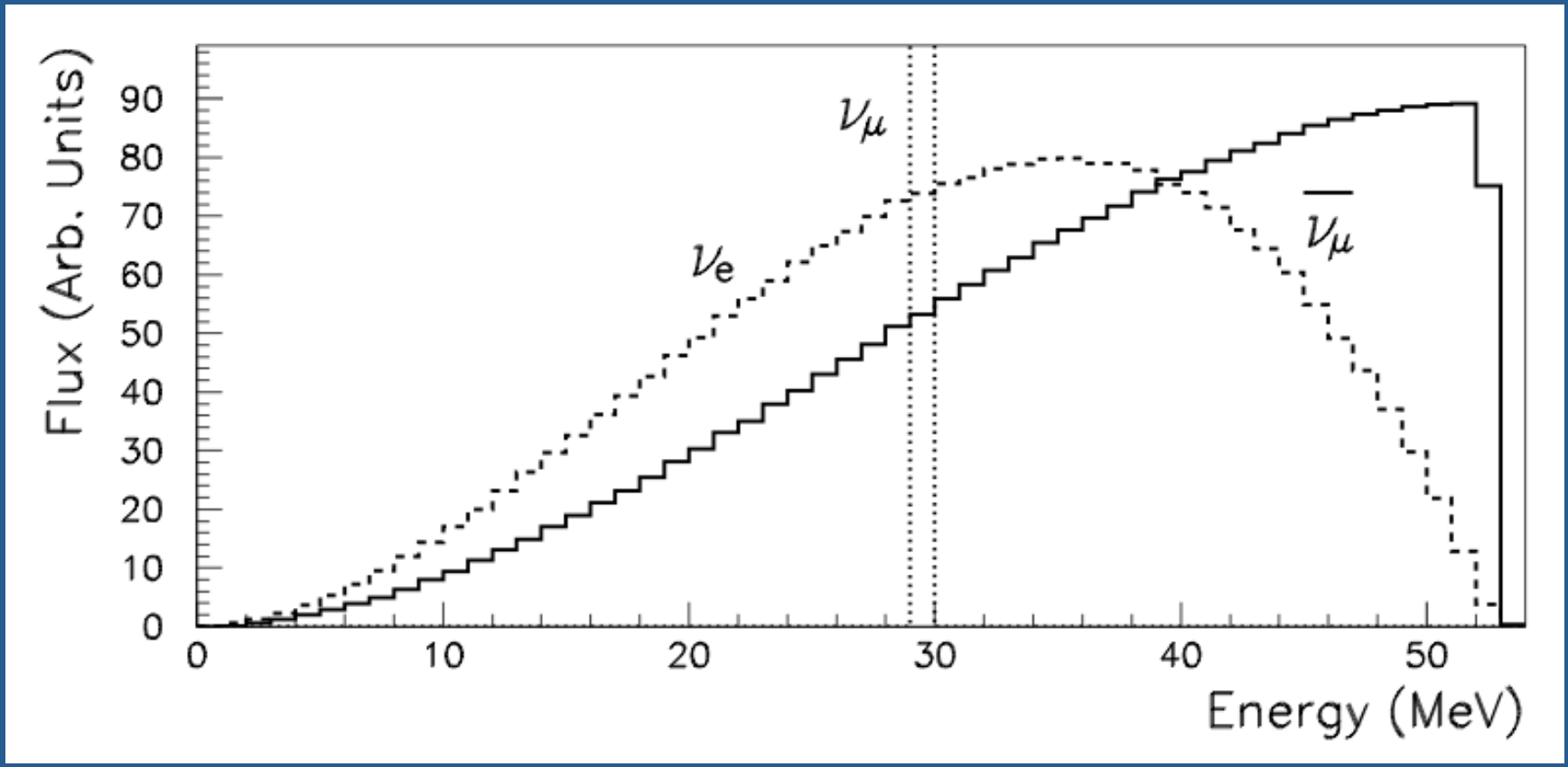
DAEδALUS: Experimental Concept

- resonant production of LE π^+ by ~1GeV proton synchrotrons; π^+ are stopped
- Neutrinos produced in π^+ decay: no $\bar{\nu}_e$ (10^{-4})!

$$\pi^+ \rightarrow \mu^+ \nu_\mu; \quad \mu^+ \rightarrow e^+ \nu_e \bar{\nu}_\mu$$

- Synchrotrons at three different baselines: 1.5km (1MW), 8km (2MW), 20km (3MW)

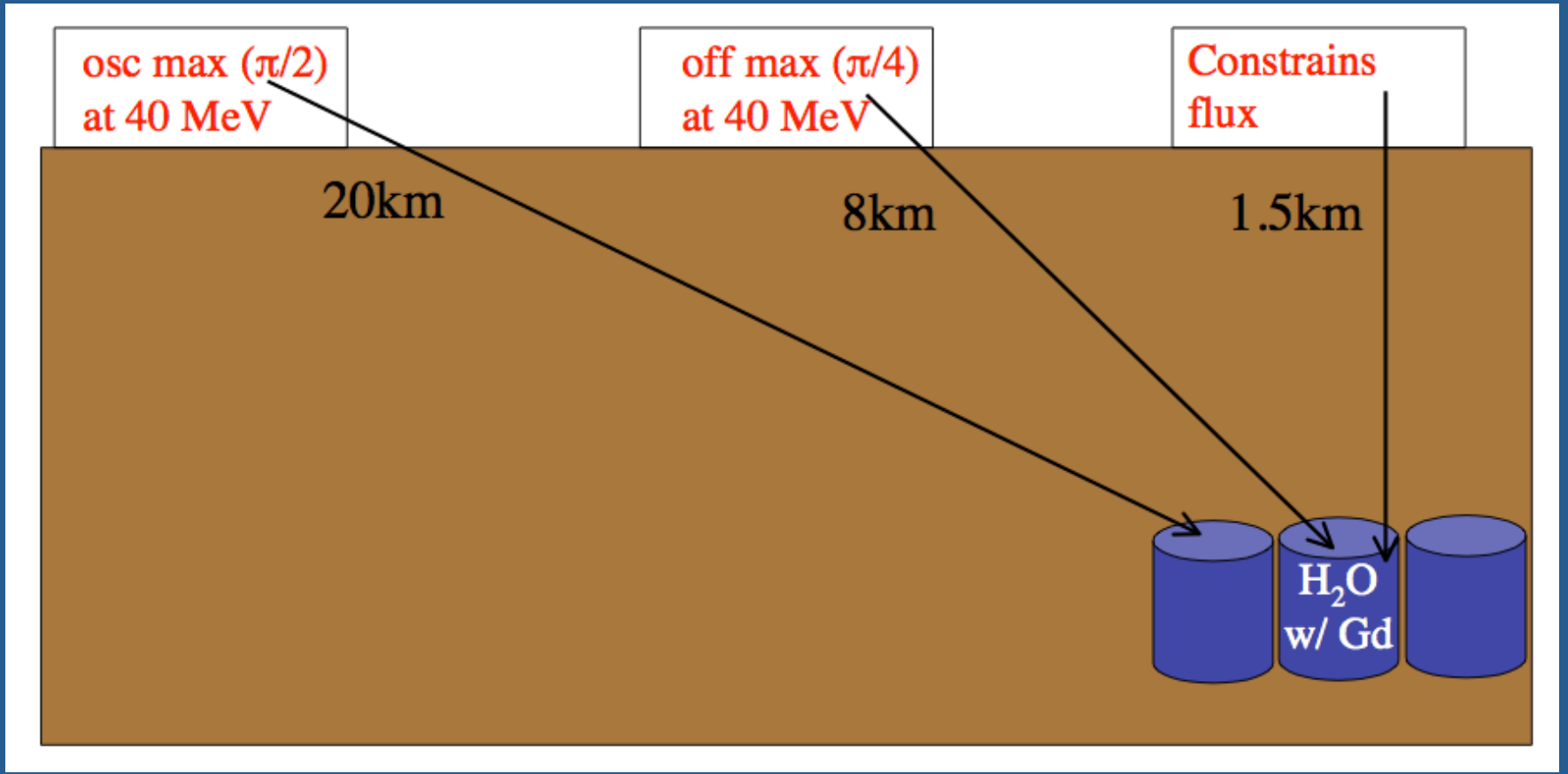
Neutrino energy spectrum



Motivation for DAEδALUS

- Search for the CP-violating phase δ_{CP}
- Complementary to Superbeam approach:
  - exclusively $\bar{\nu}_\mu \rightarrow \bar{\nu}_e$
  - no interfering matter effects
  - better signal-to-background ratio
- For LENA:
  - perfect energy range: E_ν = 50 MeV

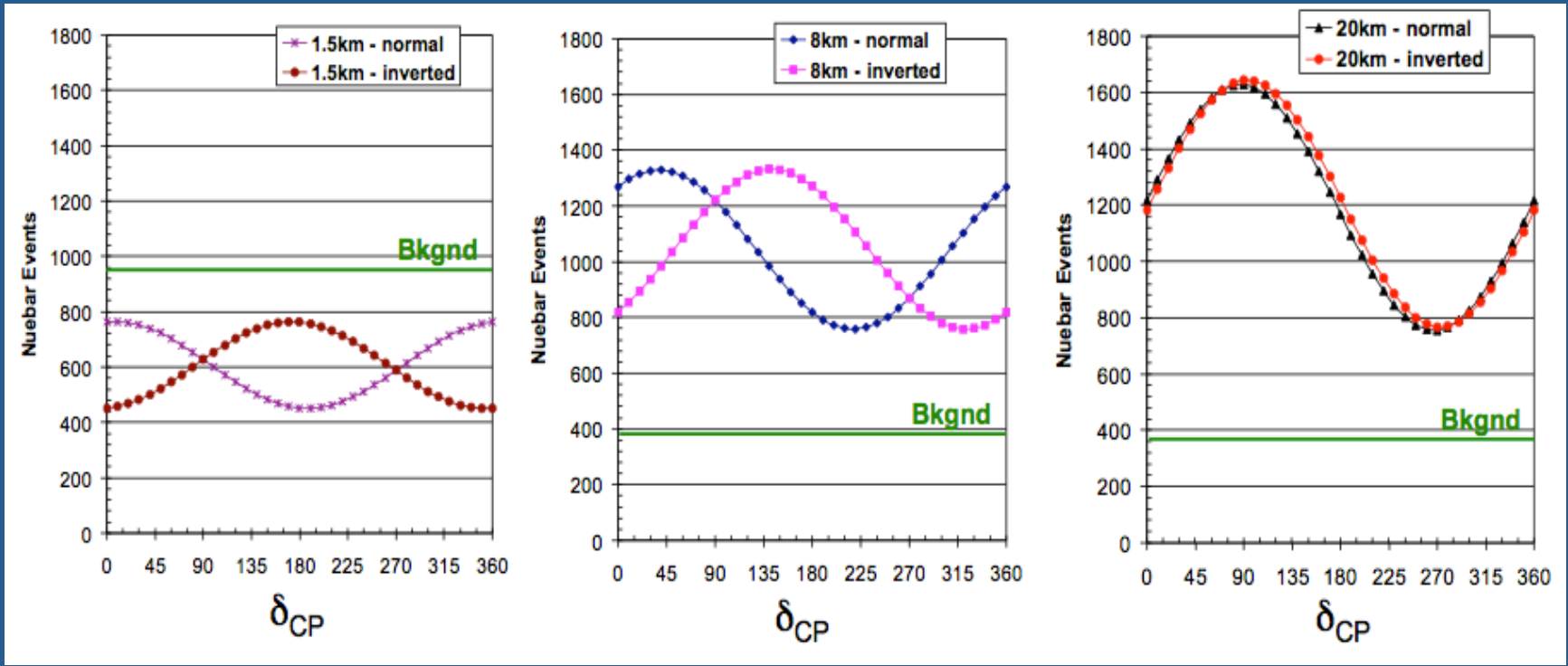
Role of the three baselines



Role of the three baselines

- elastic νe scattering provides flux normalization for the short baseline
- CC reactions on ^{12}C (^{16}O for water) from all 3 baselines are used to obtain the relative fluxes
- inverse beta decay events from medium and far baseline are used for oscillation search ($\bar{\nu}_e$ appearance signal)

Signal depending on δ_{CP}



- 10 yrs of data taking in LBNE, $\sin^2 2\theta_{13}=0.05$

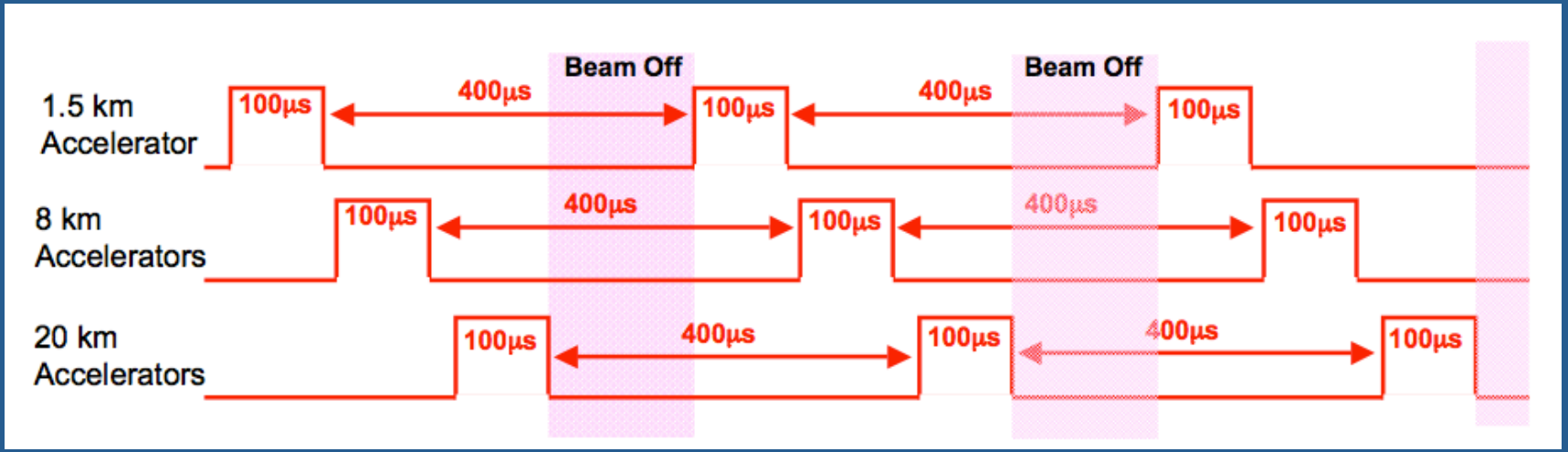
Backgrounds

- **νe scattering:** contamination of the sample with ^{12}C/IBD events where 2nd signal is lost
- **^{12}C (CC):** none?
- **Inverse beta decay:**
  - beam-intrinsic $\bar{\nu}_e$ ($1/r^2$)
  - ^{12}C reaction with neutron knock-out

  beam on
  - DSNB signal
  - influence of atmospheric NC?

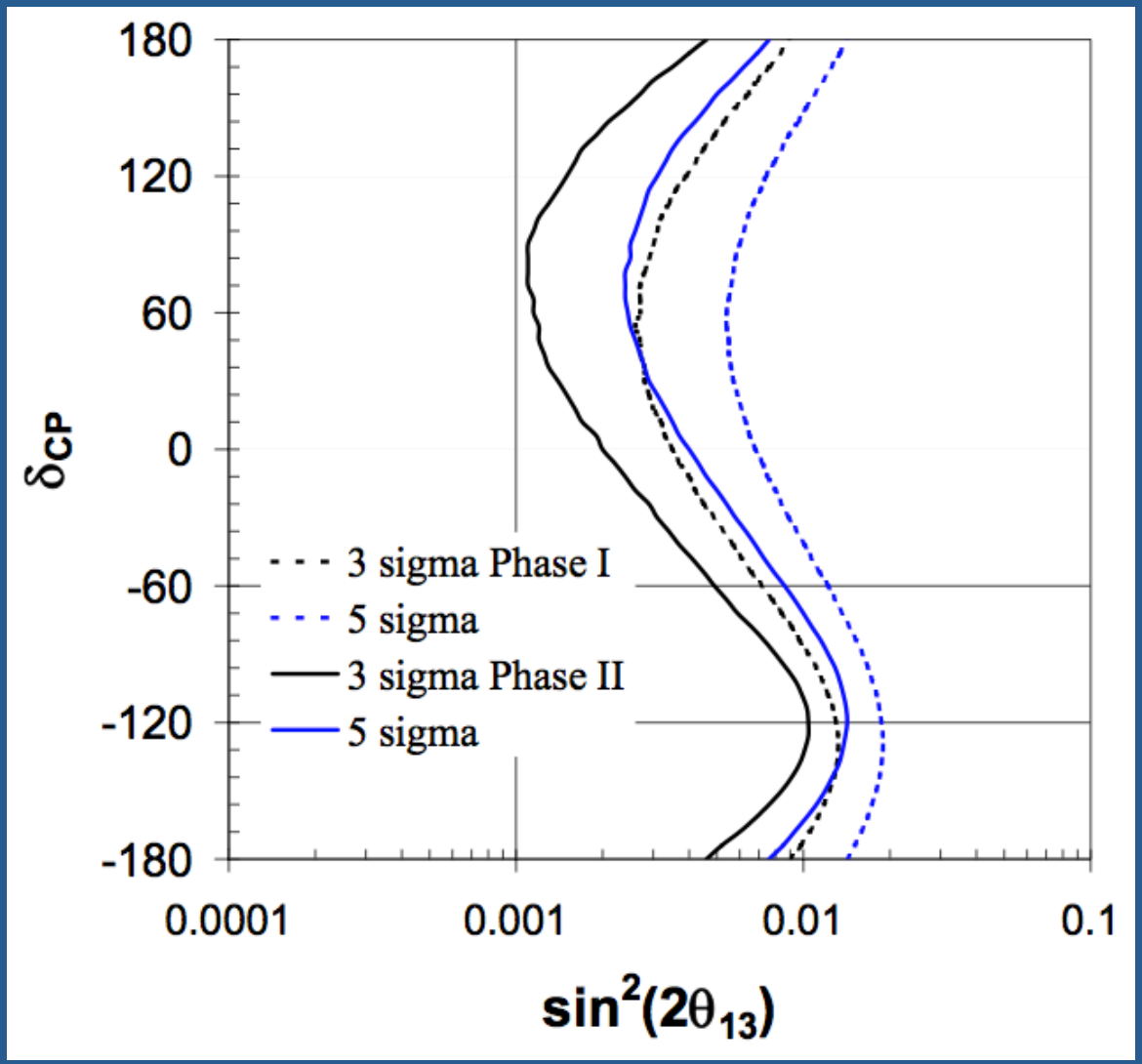
  beam off

Time structure – „Pulsed beam “



- Relatively long time windows → background for IBD (especially NC atmospheric events) will play a role.

DAEδALUS Sensitivity to θ_{13}



DAEδALUS Sensitivity to δ_{CP}