Physics Plots for CDR

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Volume II - Physics

Fast MC Inputs

- Now all spectra and physics studies based on Fast MC outputs
  - Smearing
  - Efficiencies
 - KNN cuts against NC and ν_τ

Placeholder:
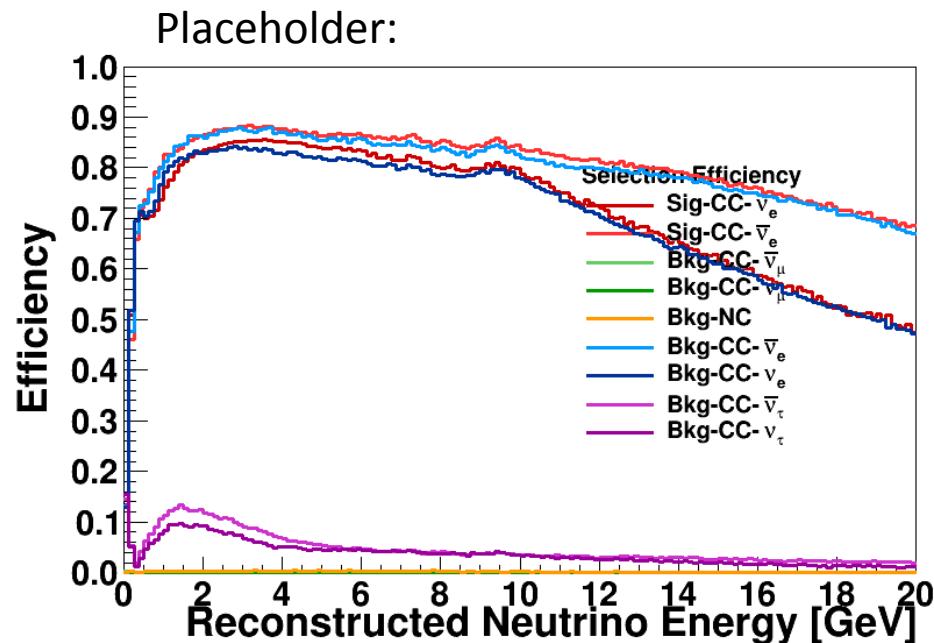
Appearance Spectra
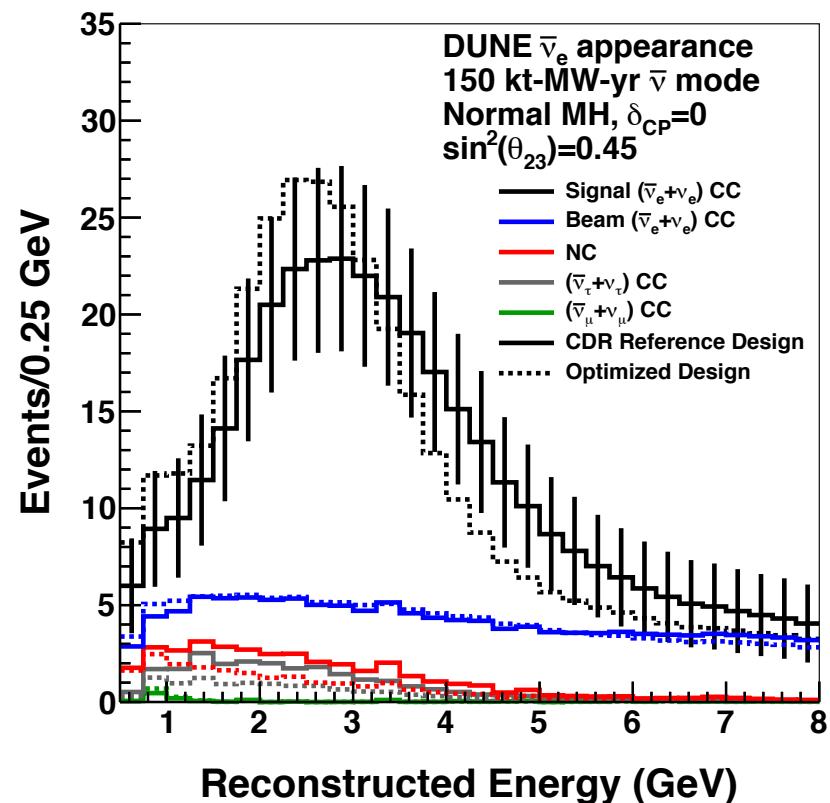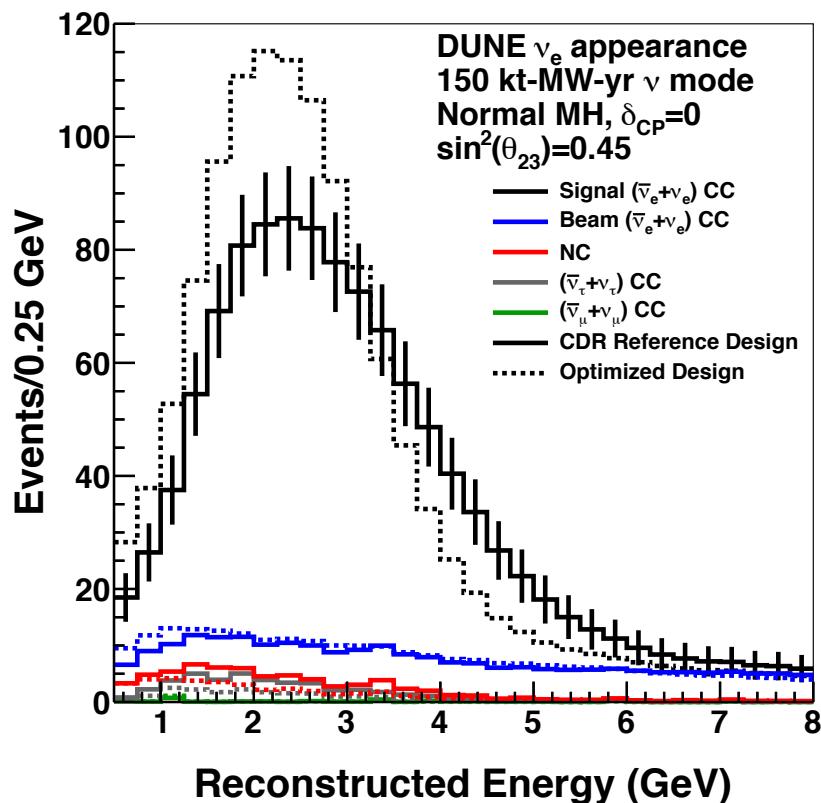
Disappearance Spectra
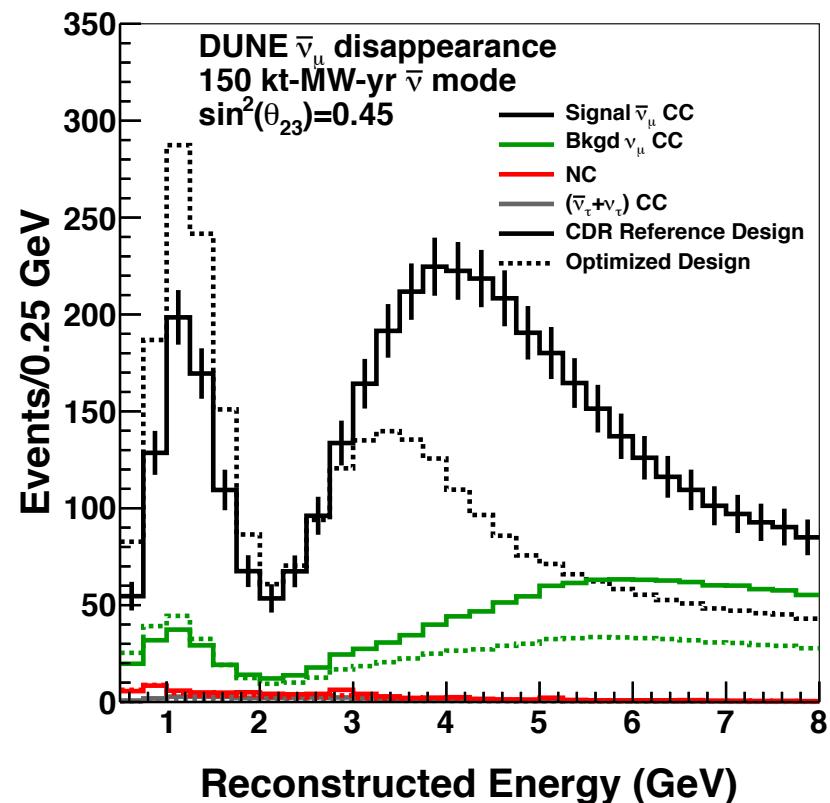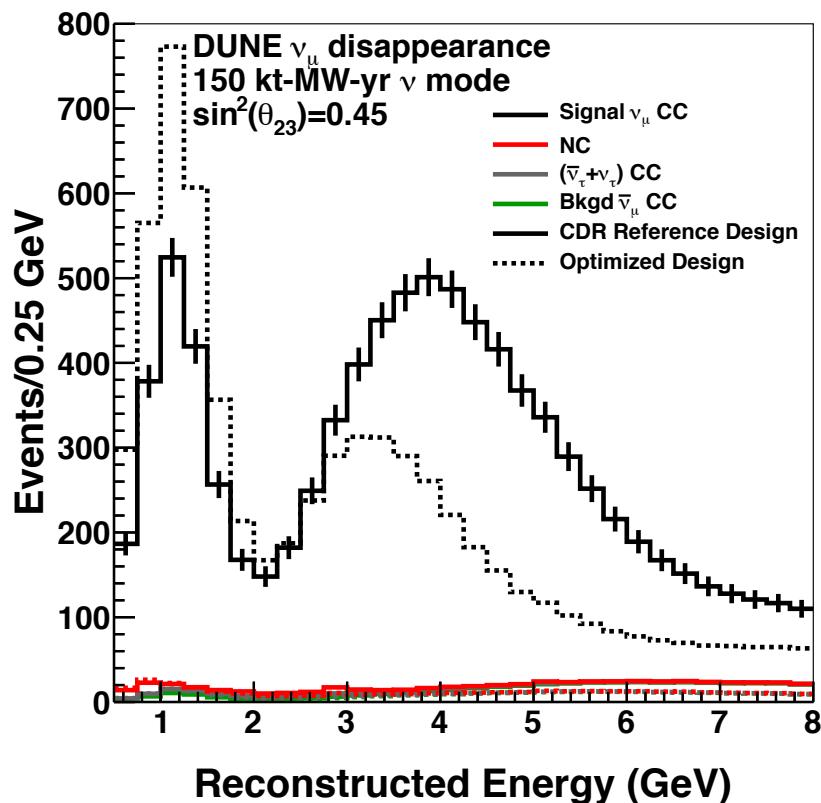
Event Rate

	CDR Reference Design	Optimized Design
ν mode (150 kt-MW-yr)		
ν_e Signal NH (IH)	881 (510)	968 (538)
$\bar{\nu}_e$ Signal NH (IH)	17 (29)	11 (23)
Total Signal NH (IH)	898 (539)	979 (561)
Beam $\nu_e + \bar{\nu}_e$ CC Bkgd	284	293
NC Bkgd	30	26
$\nu_\tau + \bar{\nu}_\tau$ CC Bkgd	43	20
$\nu_\mu + \bar{\nu}_\mu$ CC Bkgd	3	3
Total Bkgd	360	342
$\bar{\nu}$ mode (150 kt-MW-yr)		
ν_e Signal NH (IH)	68 (43)	52 (31)
$\bar{\nu}_e$ Signal NH (IH)	172 (383)	173 (441)
Total Signal NH (IH)	240 (426)	225 (472)
Beam $\nu_e + \bar{\nu}_e$ CC Bkgd	177	173
NC Bkgd	16	13
$\nu_\tau + \bar{\nu}_\tau$ CC Bkgd	24	11
$\nu_\mu + \bar{\nu}_\mu$ CC Bkgd	2	2
Total Bkgd	219	199

300 kt-MW-years

CP Violation Sensitivity
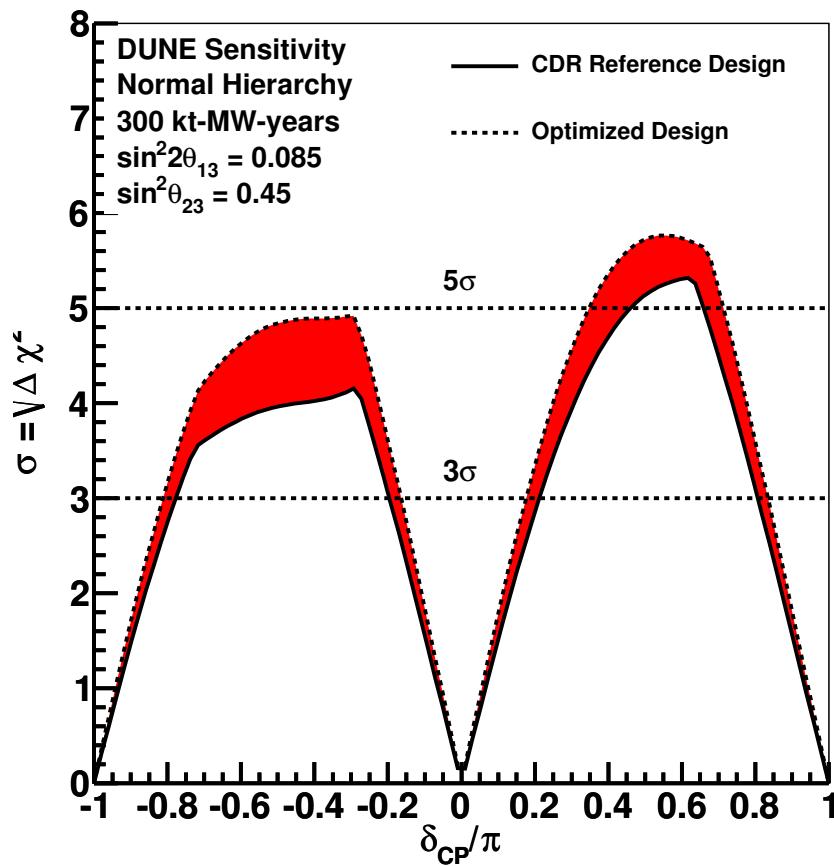
Mass Hierarchy Sensitivity
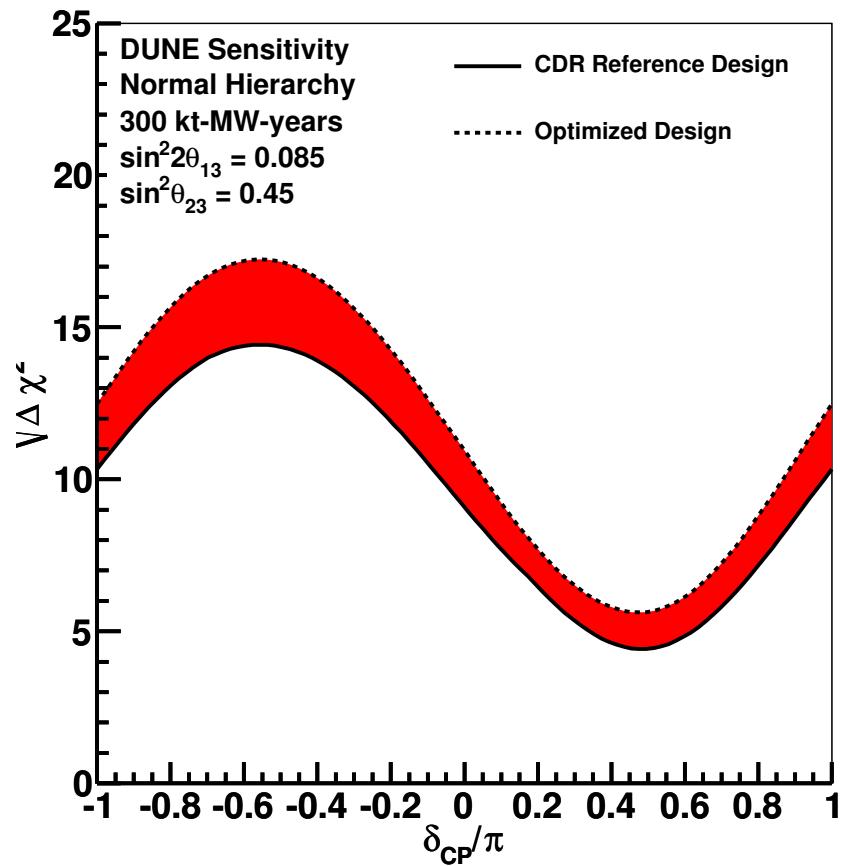
Exposure
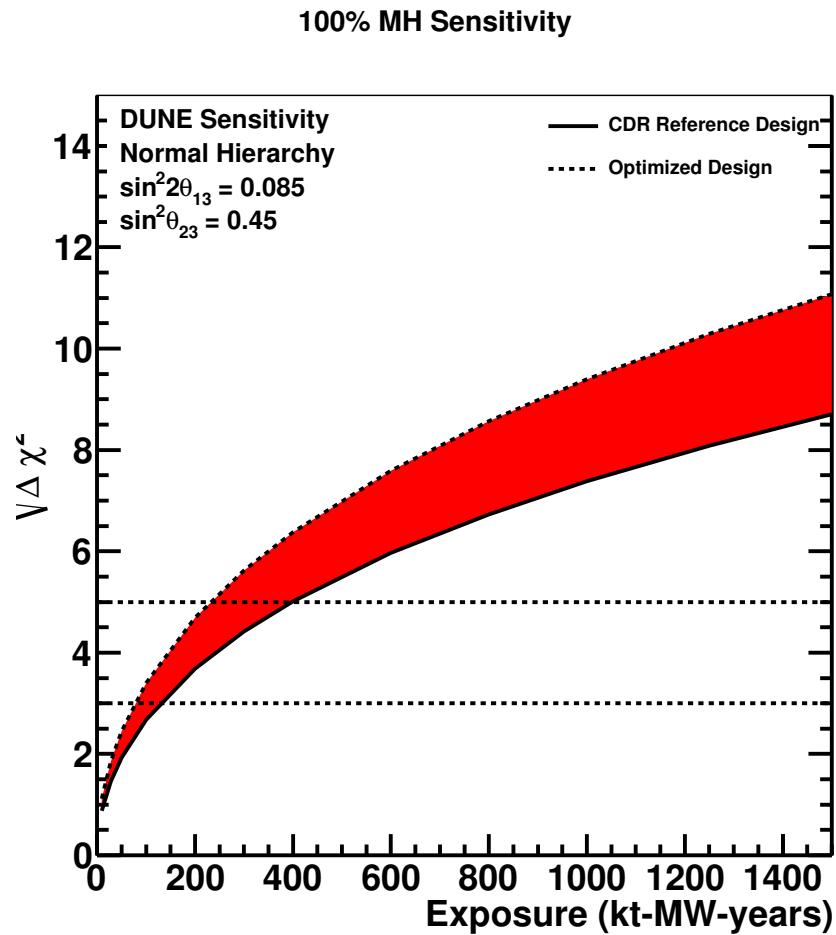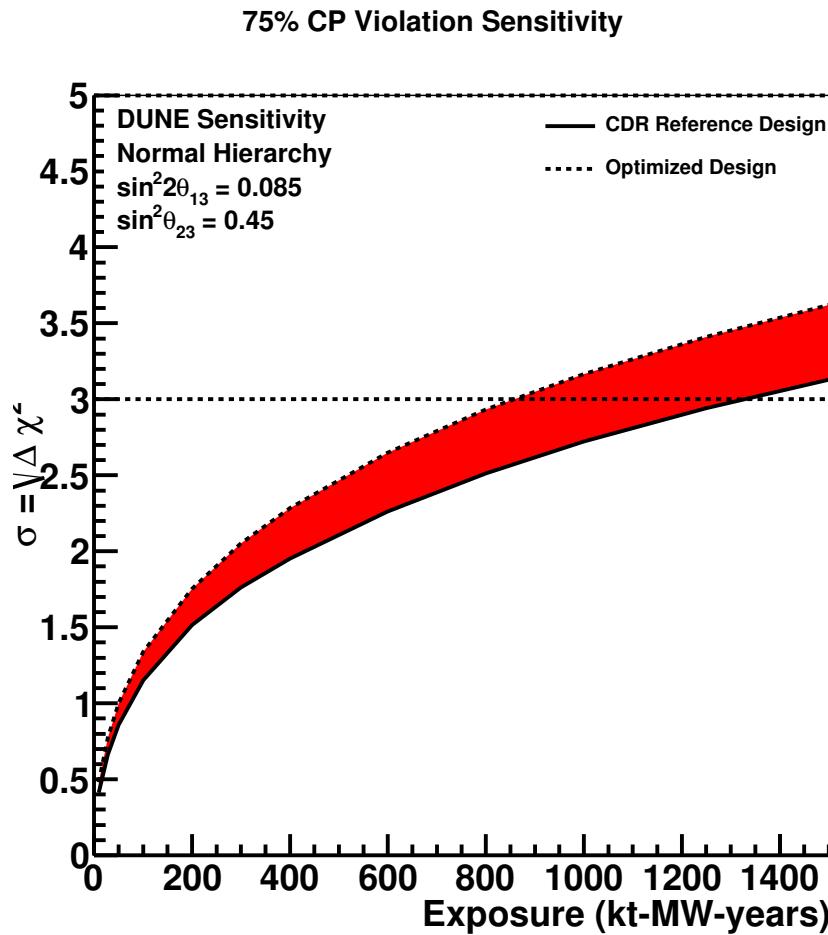
Parameter Variations: CPV

CP Violation Sensitivity

DUNE CPV Sensitivity

Normal Hierarchy

$\sin^2 2\theta_{13} = 0.085$

$\sigma = \sqrt{\Delta \chi^2}$

5σ

3σ

δ_{CP}/π

.... $\sin^2\theta_{23} = 0.38$
——— $\sin^2\theta_{23} = 0.45$
- - - $\sin^2\theta_{23} = 0.5$
-·-·- $\sin^2\theta_{23} = 0.64$

CP Violation Sensitivity

DUNE CPV Sensitivity

Normal Hierarchy

$\sin^2 2\theta_{23} = 0.45$

$\sigma = \sqrt{\Delta \chi^2}$

5σ

3σ

δ_{CP}/π

.... $\sin^2 2\theta_{13} = 0.073$
——— $\sin^2 2\theta_{13} = 0.085$
-·-·- $\sin^2 2\theta_{13} = 0.098$
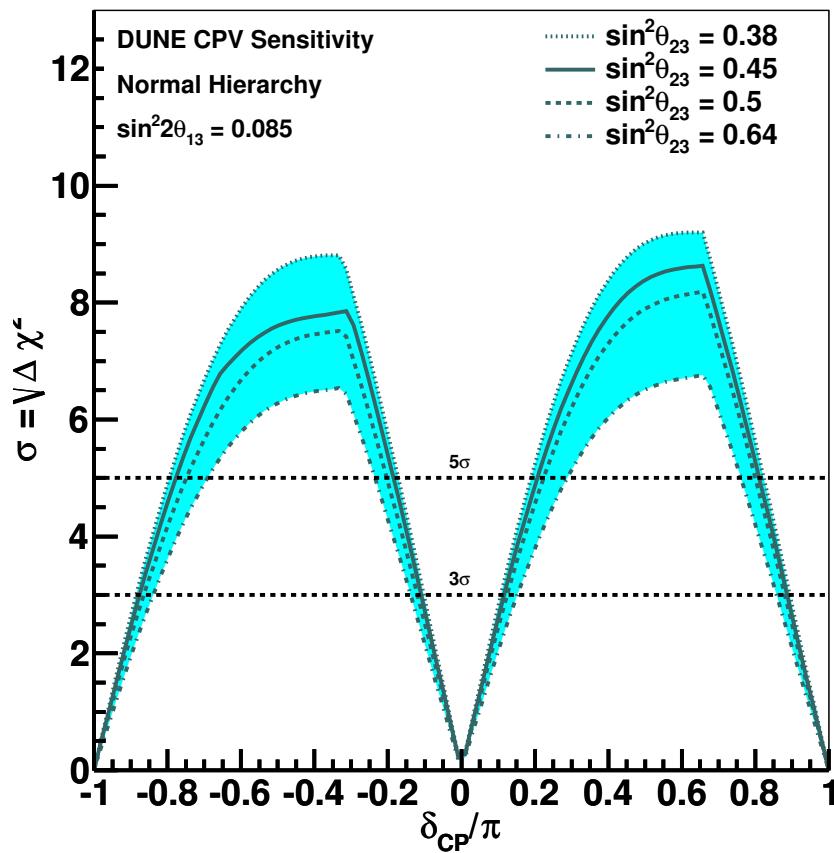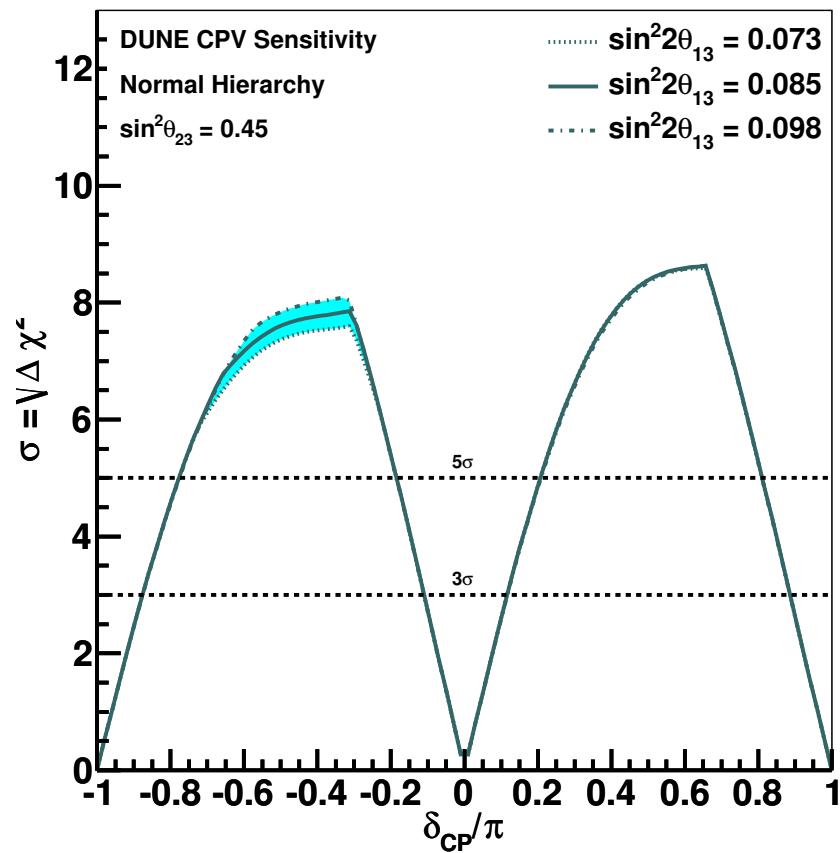
890 kt-MW years = 3σ for 75% of δ_{CP} values

Parameter Variations: MH
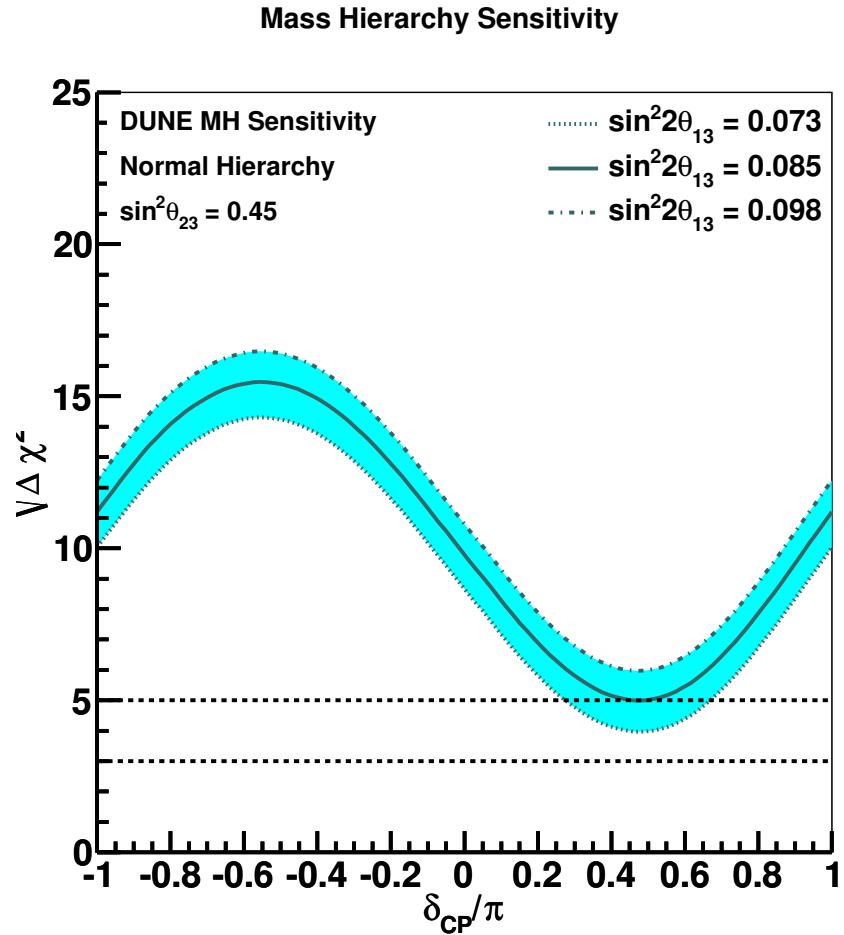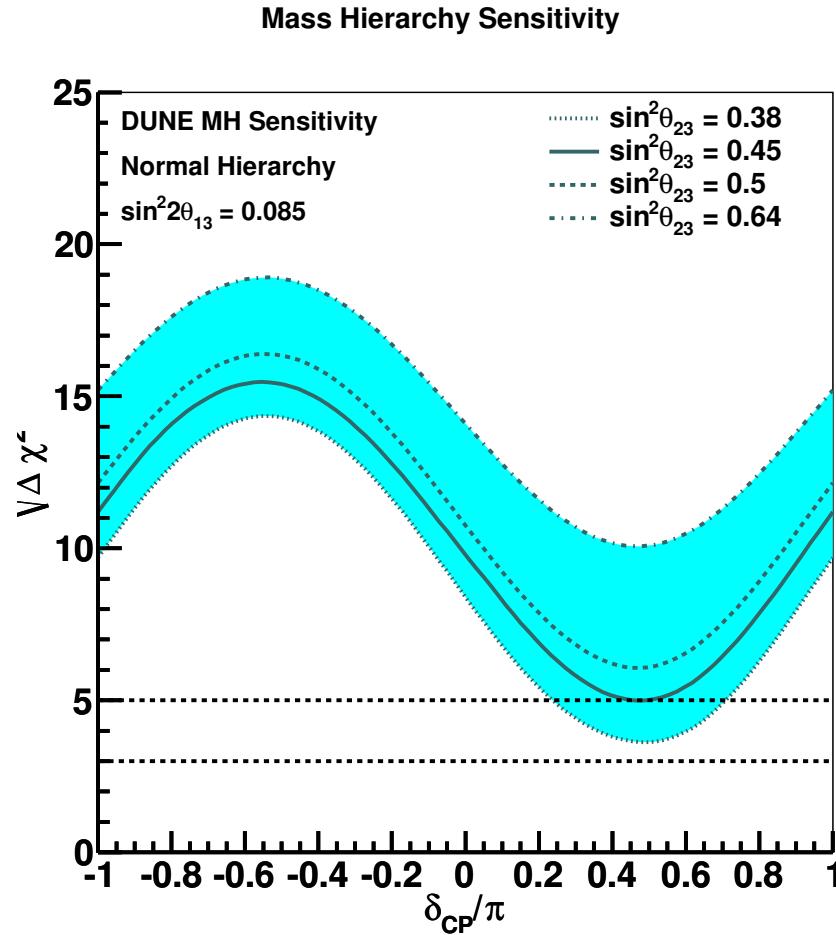
230 kt-MW years = 5σ for 100% of δ_{CP} values

MH Stats
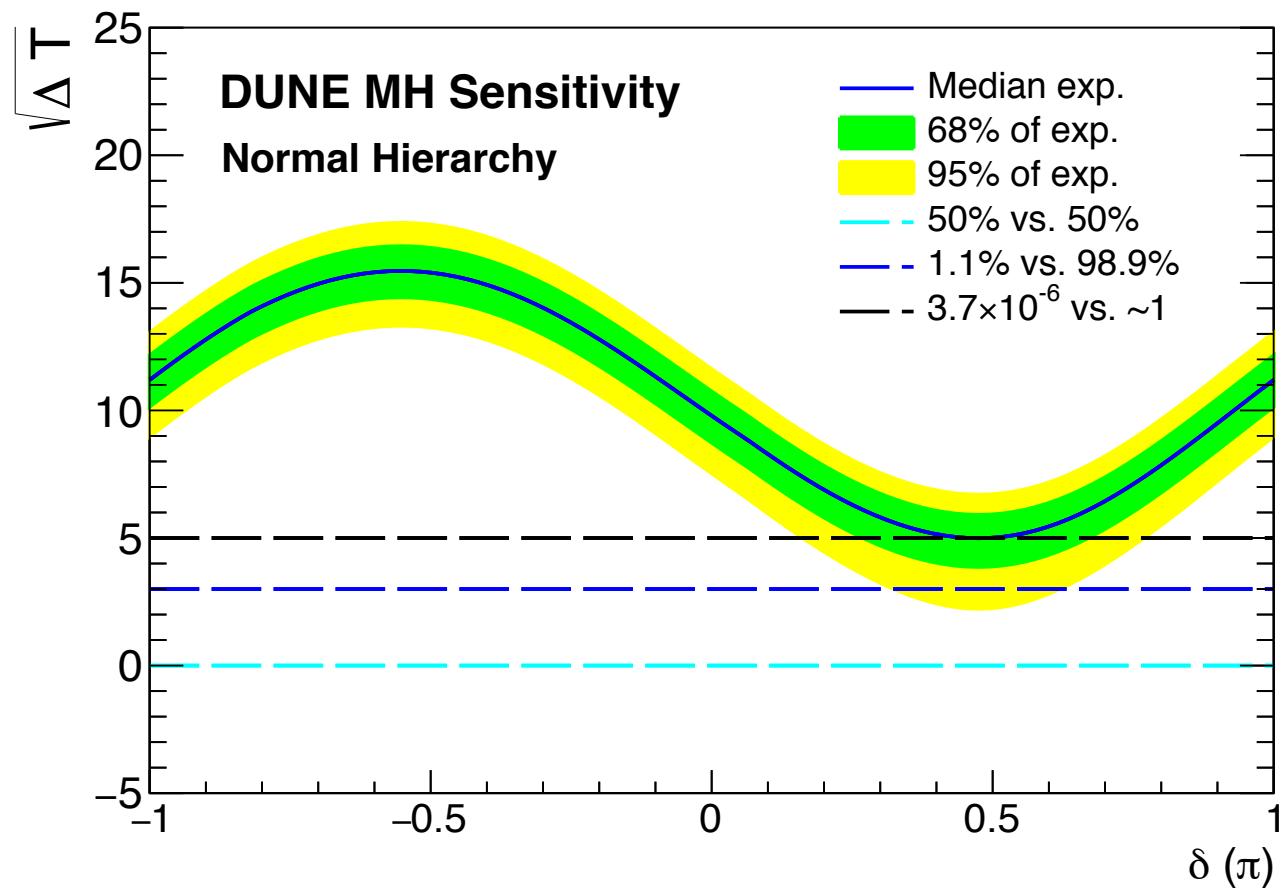
230 kt-MW years = 5σ for 100% of δ_{CP} values

Staging Plan

- Very Preliminary!
- Includes staging of FD mass, ND installation, and beam power
- Does not include upgrades to focusing

- Year 1: 10 kt, no ND
- Year 2: +10 kt, no ND
- Year 3: +10 kt, preliminary ND constraint
- Year 4: +10 kt
- Year 5: Full ND constraint
- Year 7: Upgrade power to 2.14 MW

Staging Plan


75% CP Violation Sensitivity
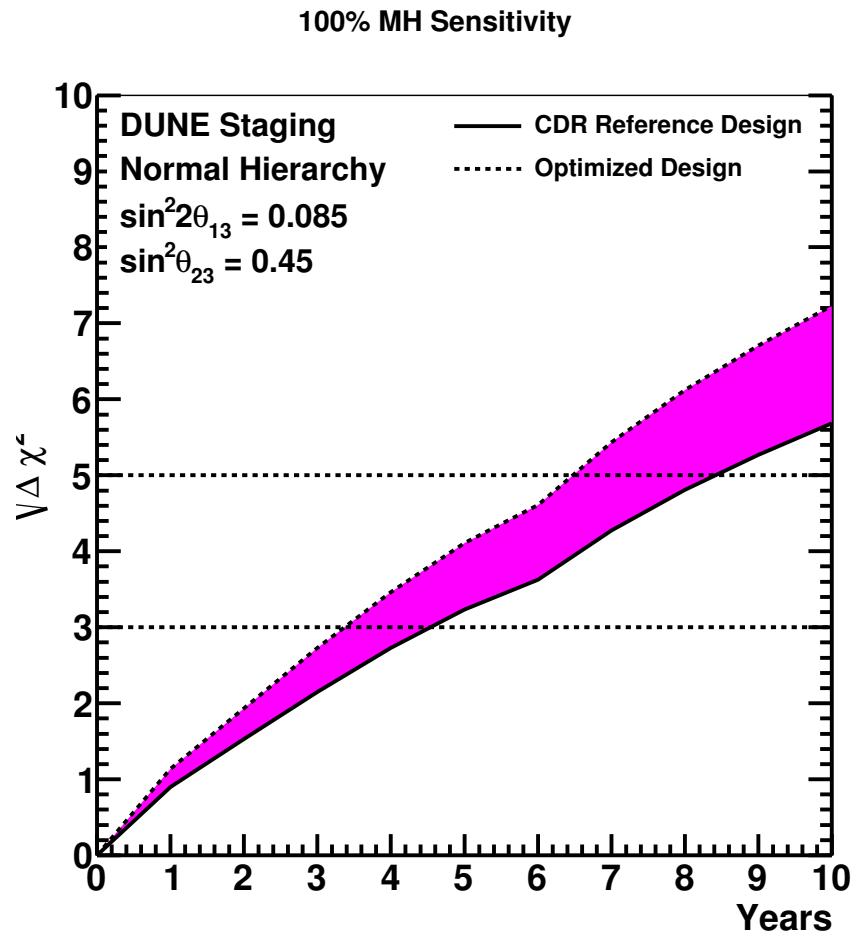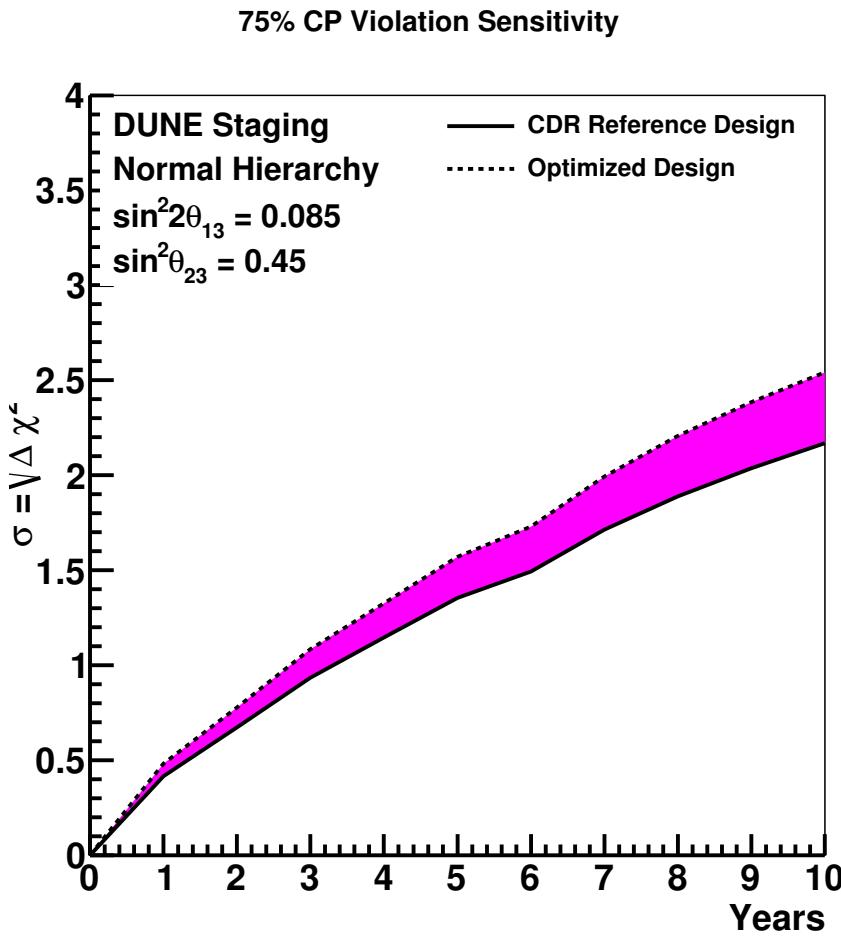
100% MH Sensitivity

Resolutions

Resolutions (cont)

sin²2θ₁₃ Resolution

DUNE Sensitivity
Normal Hierarchy
sin²2θ₁₃ = 0.085
sin²θ₂₃ = 0.45

Δm²₃₁ Resolution

DUNE Sensitivity
Normal Hierarchy
sin²2θ₁₃ = 0.085
sin²θ₂₃ = 0.45
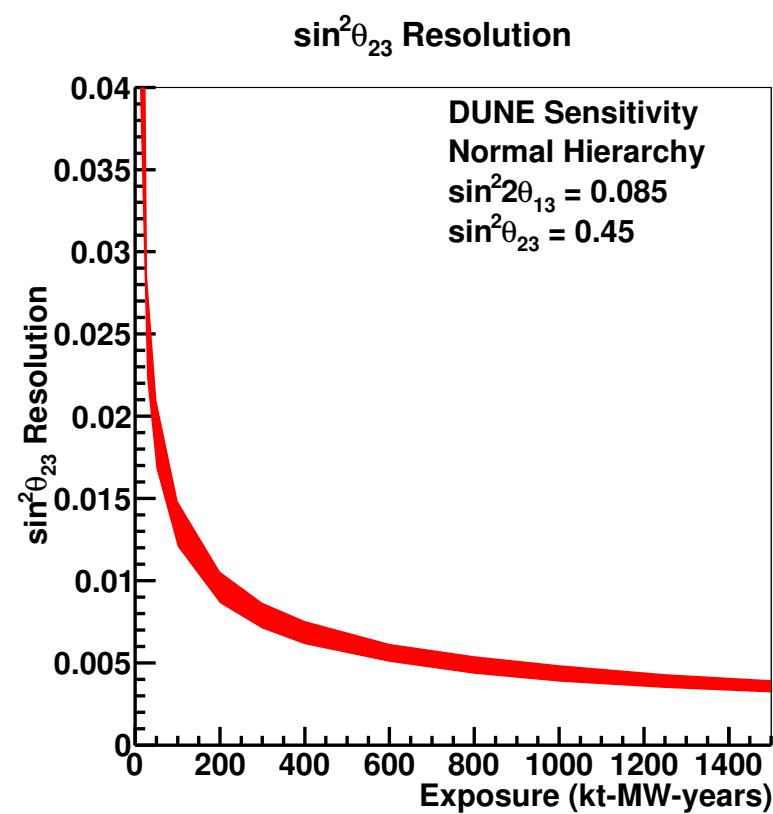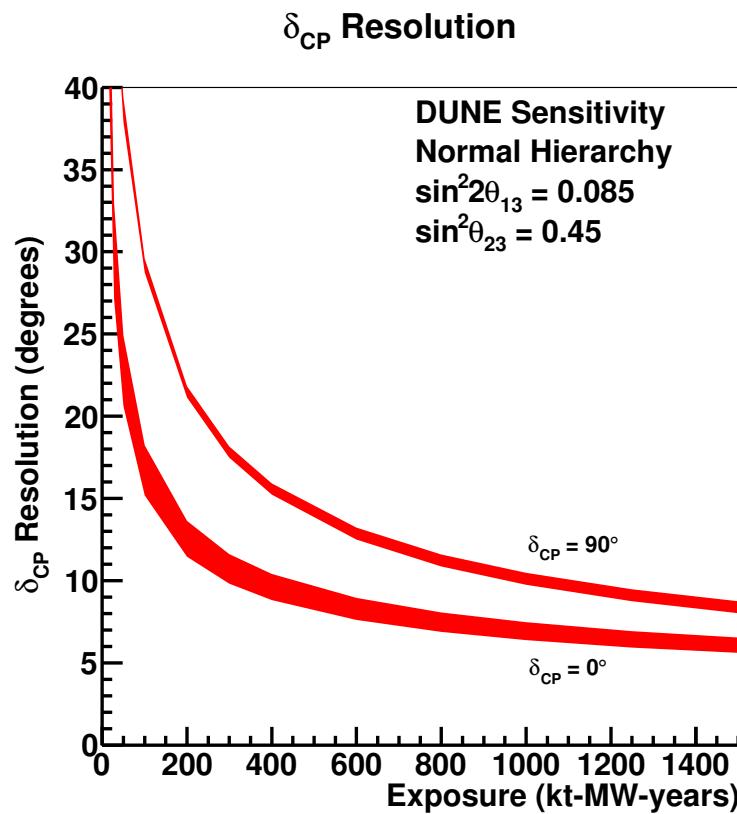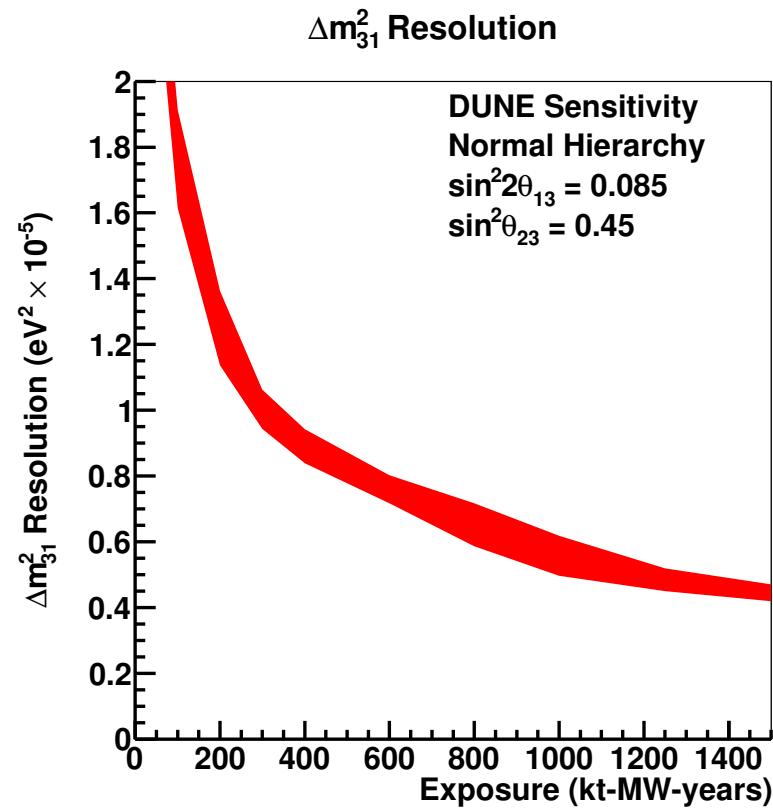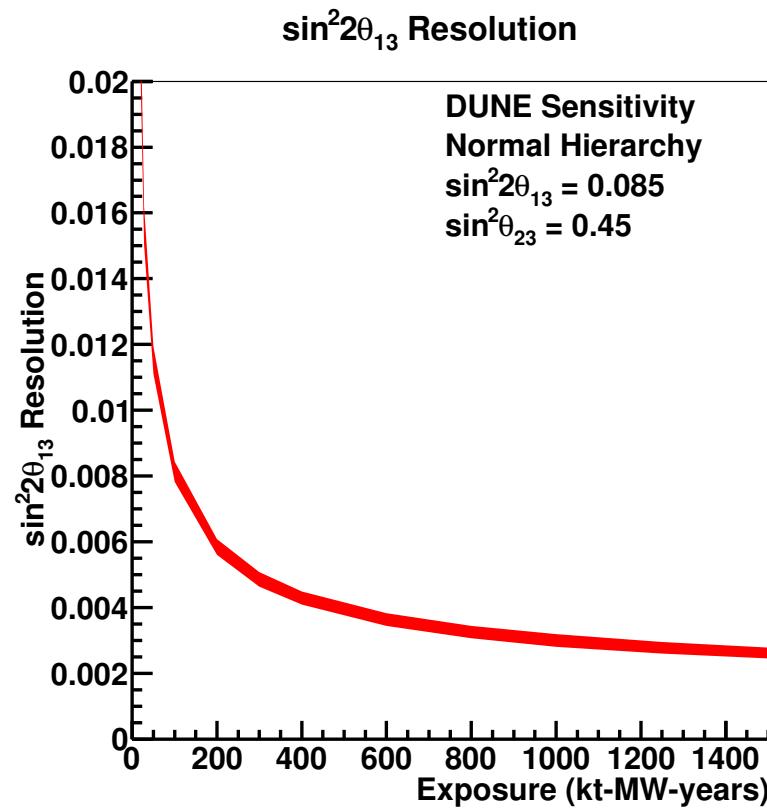
Beam Variations
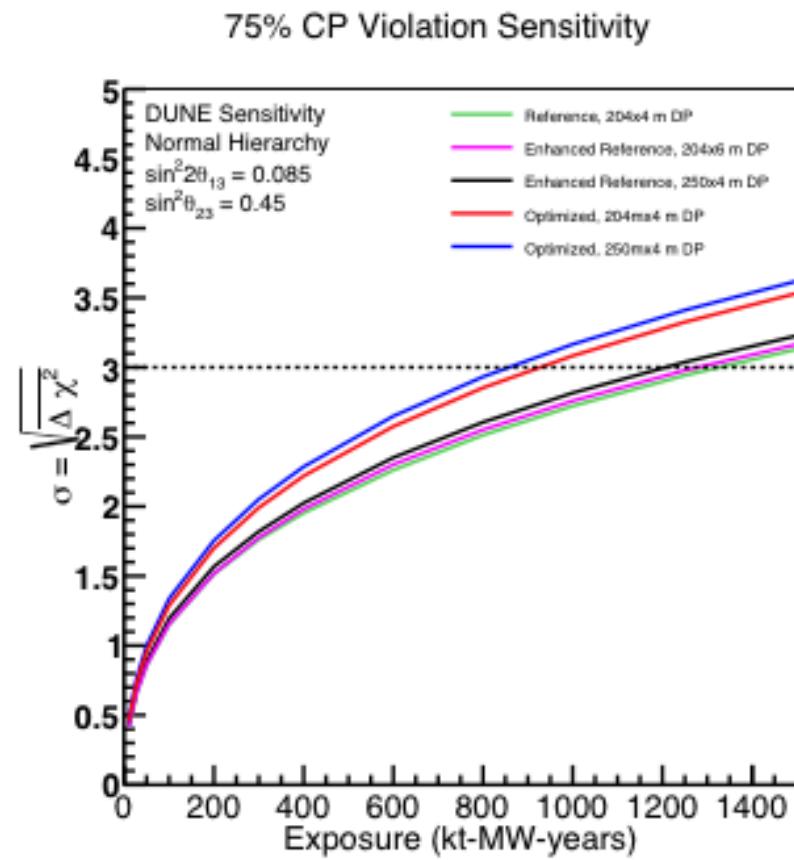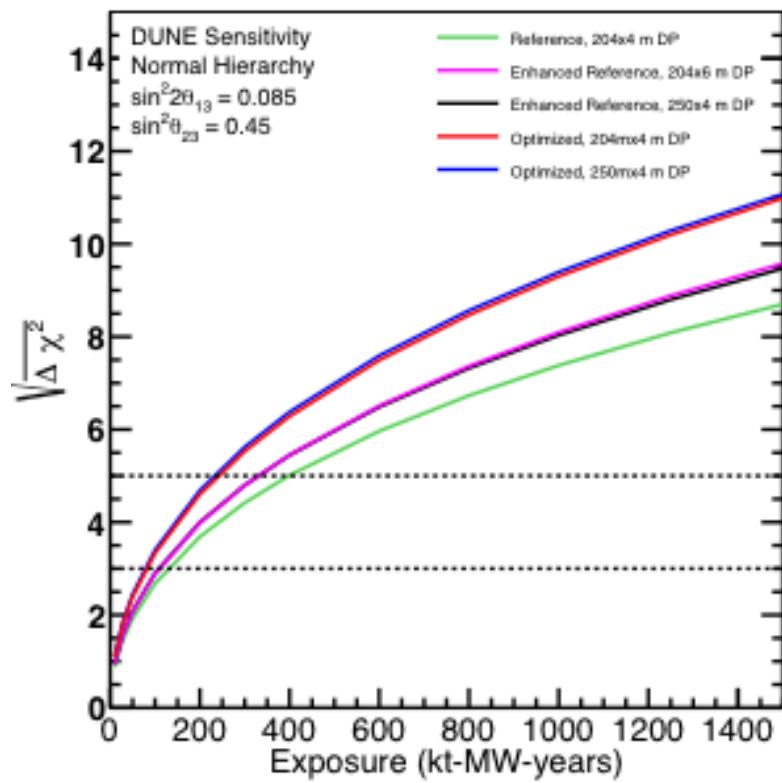
Systematics

75% CP Violation Sensitivity
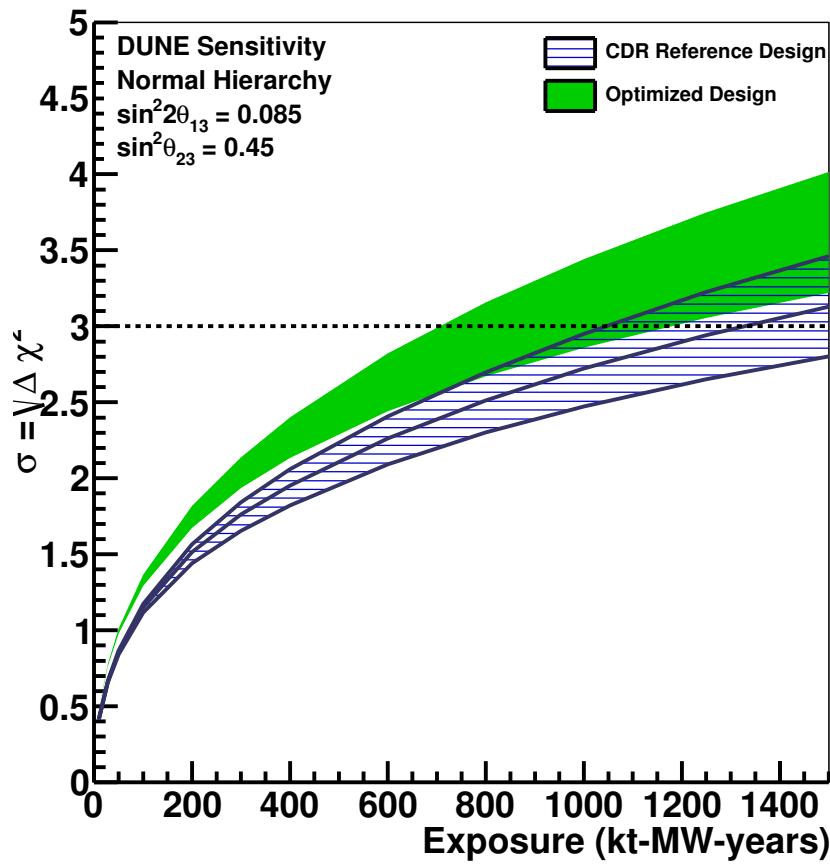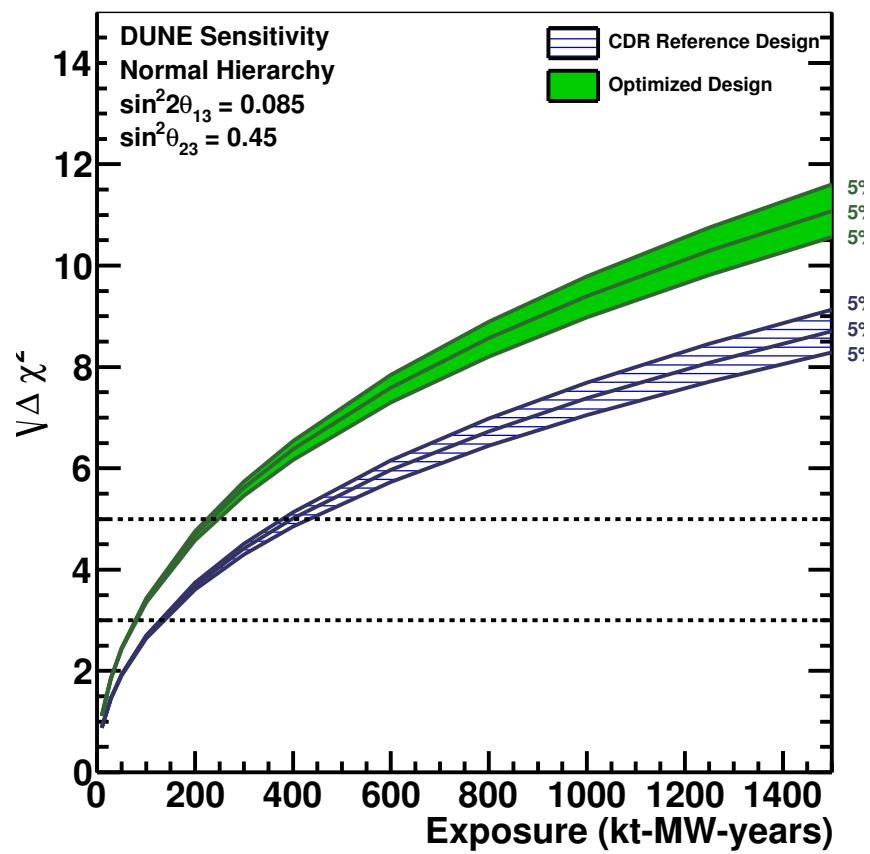
100% MH Sensitivity

Energy Scale Systematics