A Posterior Analysis on IceCube Double Pulse Tau Candidates
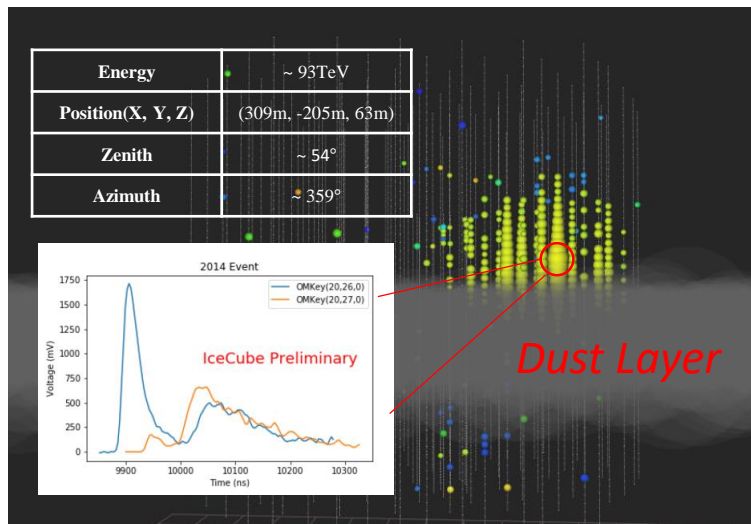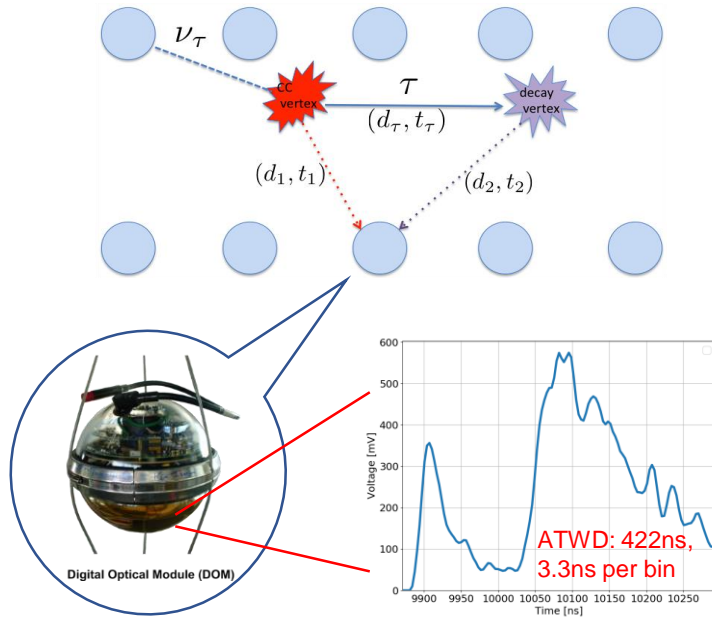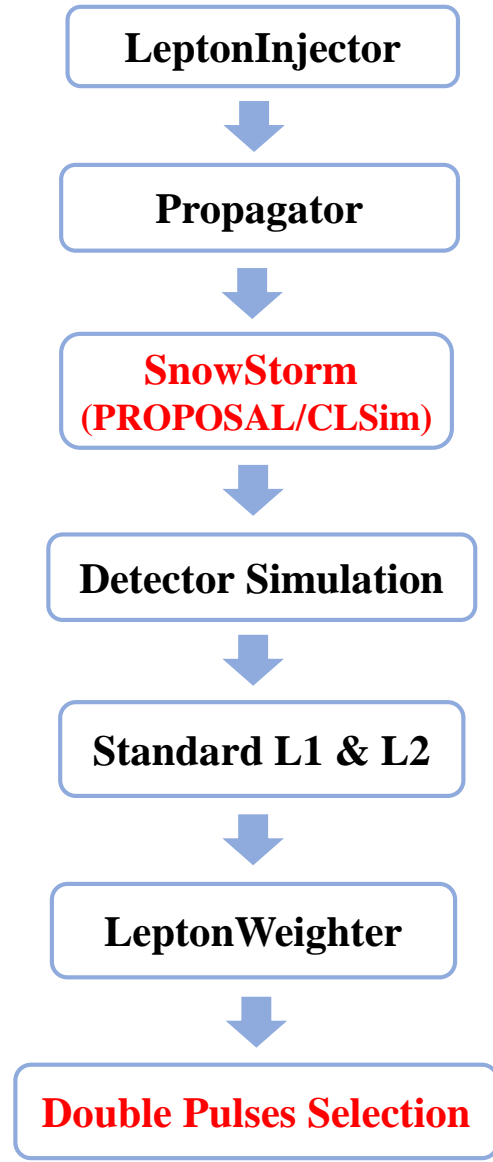
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ν_τ Double Pulse Candidates in IceCube:

Targeted Re-simulation Chain with New Ice Model Treatment

LeptonInjector

Propagator

SnowStorm (PROPOSAL/CLSim)

Detector Simulation

Standard L1 & L2

LeptonWeighter

Double Pulses Selection

LeptonInjector Parameters:	Settings:
Flavor	ν_τ , ν_μ , ν_e
Generated Energy	[50,250], [250,500], [500,1000] TeV
Injected Center (X, Y, Z)	(309m, -205m, 63m)
Injected Volume	Radius =25m, Height =50m
Zenith	[20,80°]
Azimuth	[0°,360°]

SnowStorm Parameters:	Settings:
Events per Model	10
Absorption	Gaussian
Scattering	Gaussian
DOM Efficiency	Gaussian
Anisotropy	Gaussian

LeptonWeighter Parameters:	Settings:
Spectrum Index	-2.5

Expected Double Pulse Event Rates for ν_τ, ν_μ, ν_e
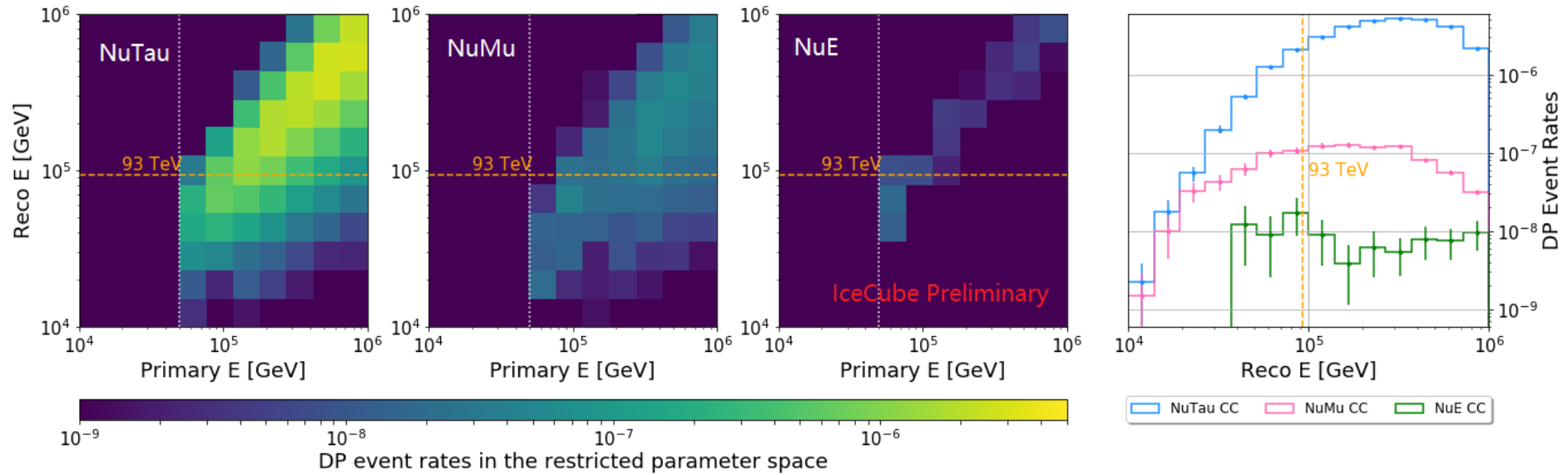
DP passing rate	[50,250] TeV	[250,500] TeV	[500,1000] TeV
ν_τ CC	5785/200k	29425/200k	41698/200k
ν_μ CC	161/200k	1036/200k	2137/200k
ν_e CC	32/200k	47/200k	53/200k

Purity of Double Pulse Signals
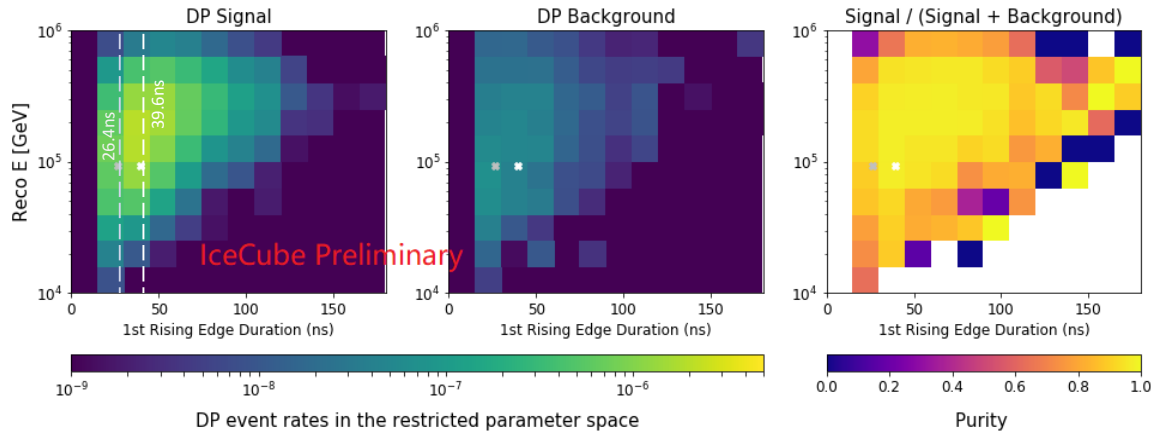
$$Purity = \frac{DP\ \nu_\tau\ Events}{DP\ \nu_\tau\ Events + DP\ \nu_\mu\ Events + DP\ \nu_e\ Events}$$
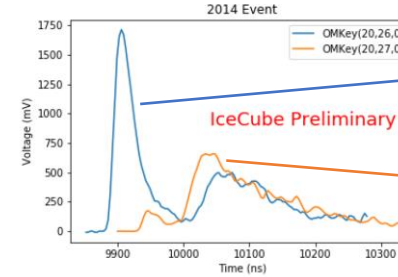
Purity (white point) = 96.8%

Purity (gray point) = 89.7%

Impact of Systematic Uncertainties
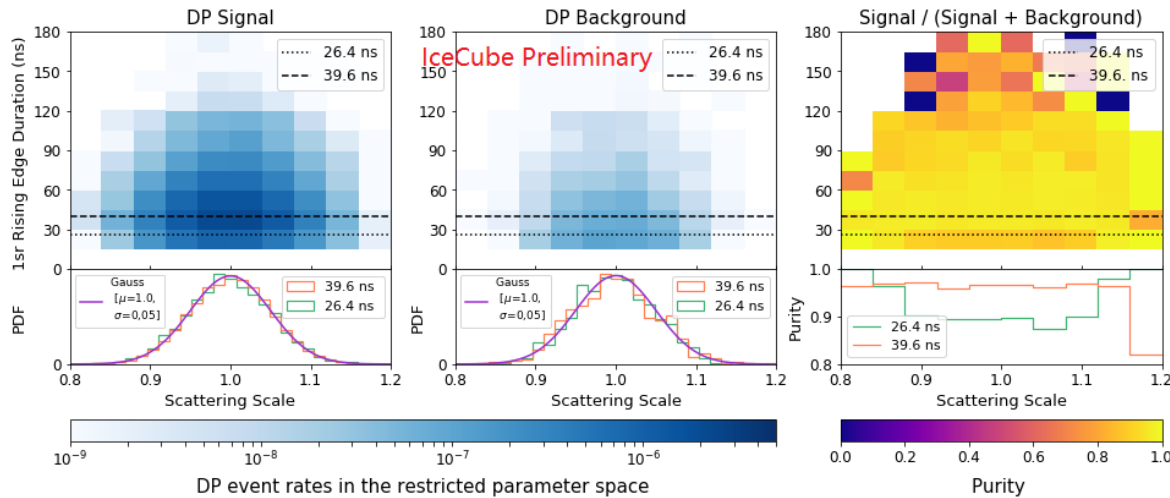
Conclusion:

a) Purity around the candidate almost remains larger than 0.9

b) Two PDF distributions almost follow the same Gaussian distribution used in SnowStorm settings.

c) The impact of ice property uncertainties is not significant for double pulse selection.