

Plans and task for LOI

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Possible Final state & Background

* The primary focus will be on looking at the possible decay signature with following topology

- Signatures with 1 shower like & 1 track like ($e\mu$, $e\pi$, $\pi\mu$)
- Signatures with 2 shower like (ee , gamma-gamma)
- Signatures with 2 track like (not possible within the present trigger scheme, unless shower developed due to cosmic and 2 tracks from BSM)

* Possible background

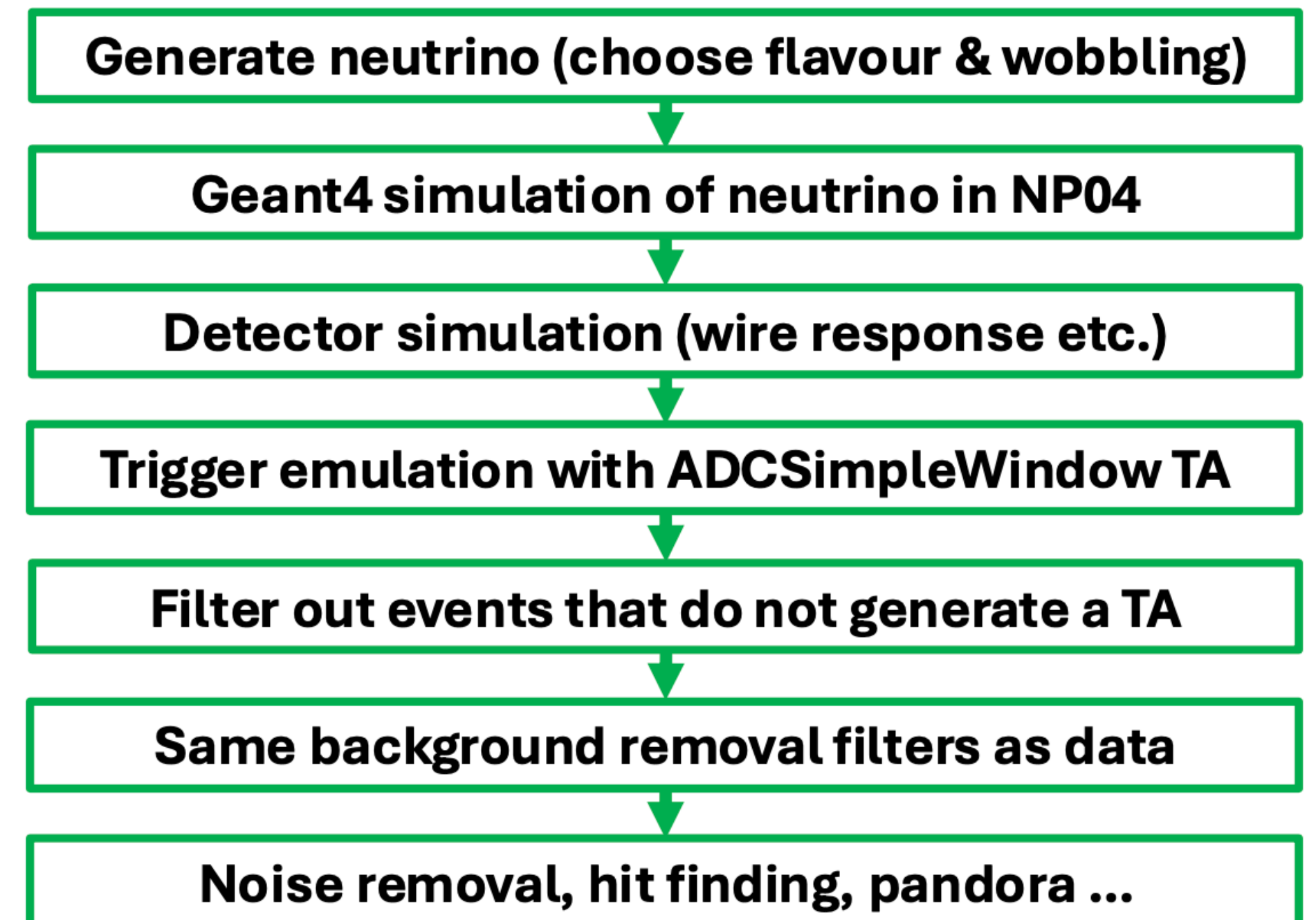
- Single pion production from ν_μ resonant or coherent nucleus scattering
- Multiple pion production from ν_μ resonant nucleus scattering
- Neutral pion production from NC resonant nucleus scattering. And only one $\gamma \rightarrow 2e$ converts in the TPC
- Dirt (neutron), any other hadronic activity coming from the beam line

Plan : Signal & Background MC production

- * Generate both CC and NC sample of neutrino-Ar interactions within the detector
- * Generate both neutrino +cosmic sample within the full drift window
- * Software in place to generate the events and go through the entire chain till reconstruction
- * Once validated, production of larger sample will be requested.

Events	Sample size
Signal	5000
Background (ν_μ ν_e $\bar{\nu}_\mu$ $\bar{\nu}_e$)	(5000,1000,1000,1000)

Ciaran



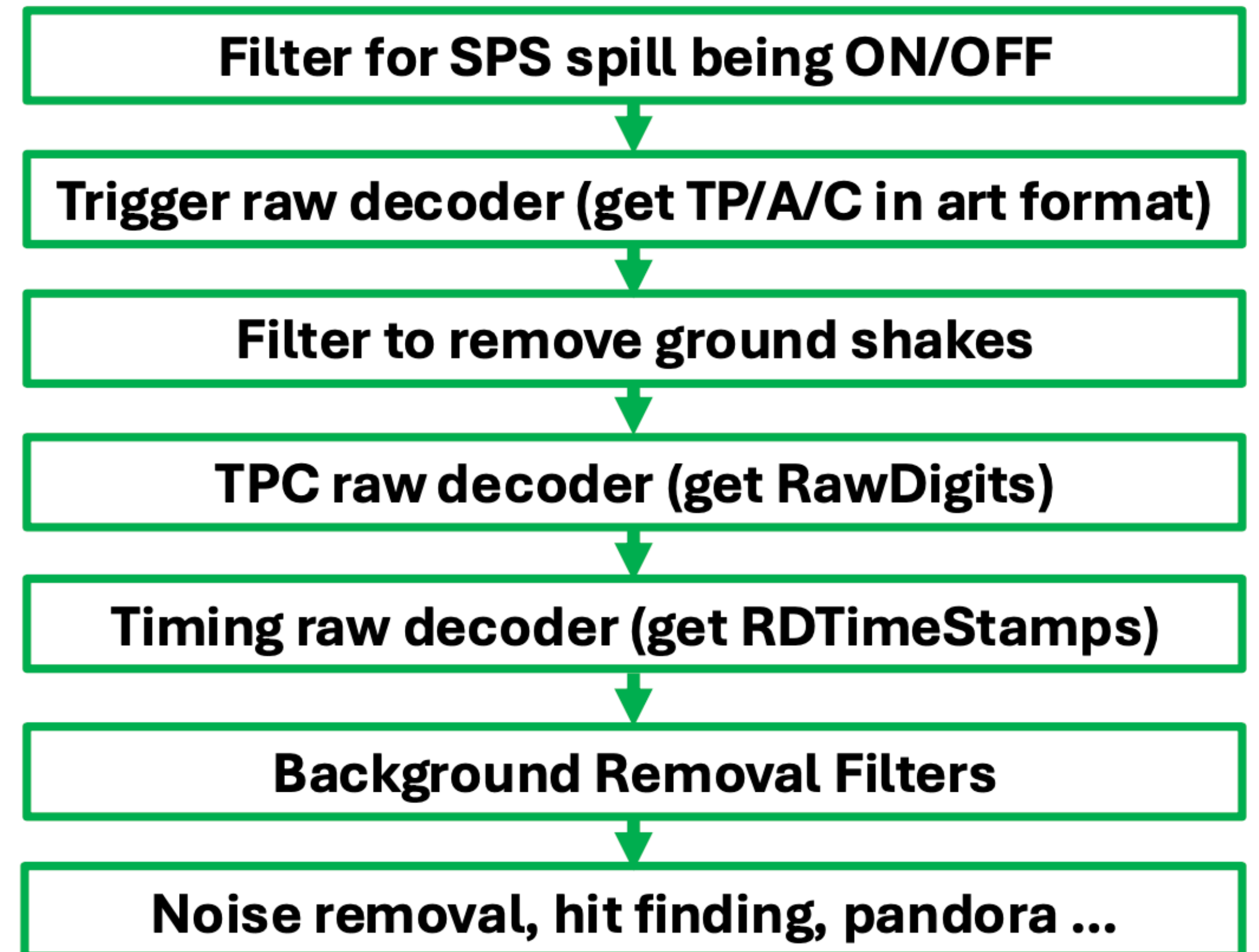
Timescale: one month

Plan : Data processing

- * Start processing few runs (100 events) to test all the steps
- * Prepare an analyser module to dump all the output files (in each stage) in ROOT Tree
- * Verify 2D vertex from pandora
- * Submit all the jobs for reconstructions.

Generate reconstructed variable (shower angle, shower length, energy estimate)

Timescale: one month



Plan : MC/Data comparison

- * **Preselection** : Decay vertex must be within fiducial volume; (1 shower & 1 track) or 2 shower or 2 reconstructed tracks with start points within 5cm of reconstructed slice vertex
- * **Shower/track directionality cut** : Shower/track coming from beam direction
- * **Particle ID cut** : Requirement of more stringent calorimetric particle ID
- * **Kinematic cuts** : Transverse momentum, shower angle cut,...
- * **Shower length cut** : Comparison between neutrino/signal with MC and data and determine the cut.

Once cuts are optimized, sensitivity estimate using cuts.

Task

- * We will have two different groups to work on MC and data production and processing
- * MC production and validation : Ciaran, Josu, Parshathi, Emanuel, Animesh
- * Data processing and validation : Hamza, Dario, Laura, Ciaran, Animesh
- * MC/data comparison and optimization of the cuts : Both groups
- * Sensitivity estimate using the cuts : Josu, Slava, Justo, Jacobo, Laura, Animesh, Pilar

Milestone	Timeline
Signal, background MC production	Mid-Jan 2025
Data processing	Mid-Jan 2025
MC/Data comparison	Mid-Feb 2025
Sensitivity estimate	End of Feb-2025