GRB - neutrino

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Context

So far, no HE neutrino signal has been identified despite important searches (>2000 GRBs) from GeV to PeV. It is quite clear that the prompt emission of classical GRBs is not very powerful neutrino producer.

In theory, the conditions to accelerate CRs are there, but not the target density in the jets. So, we need to create a different sample based on either on the precursor (early phase of the jet) or absorbed/choked GRBs. Afterglow neutrino models are also poorly constrained due to the UHE neutrino limited detection capability.

$\Longrightarrow$ In this absorbed/partially chocked, we expect an under-luminous X-ray/gamma-ray prompt emission (SVOM-ECLAIRs low energy threshold) and an absorbed optical afterglow, that can be mainly seen in NIR bands (COLIBRI fast NIR observations) + SN for the closest cases.

$\Longrightarrow$ For model constrains, it is important to have simultaneous X-ray measurements as the X-ray flux mainly fixes the neutrino production efficiency (PeV protons will interact mainly with keV photons).
$\Longrightarrow$ We have a few hadronic models in hands (NeuCosma, AM3, FIRESONG…)

SVOM-KM3NeT

(Similar for IC)

<u>3 complementary ways of doing GRB-nu analysis performed in the collaboration:</u>

- Automatic real-time follow-up of GRB triggers (typical delay <~15min, depends mainly on the search time windows)
- Neutrino alert sending: very fast afterglow detection in visible (tiling ?) and then ToO SVOM if not already detected by ECLAIRs [APC/CPPM]
- Offline analysis of the GRB catalogues (individual searches or stacking analyses using likelihood binned/unbinned method), link with GRB contribution to the diffuse flux, GRB populations…

$\Longrightarrow$ What we need? Direction, time, flux, duration, class (ECLAIRs localisation sufficient for us)
$\Longrightarrow$ We have all the tools to estimate the significance of the association
$\Longrightarrow$ We have tools to perform model fitting