Neutrin AI – Architecture (Inputs)

The data is contained in .parquet files and totals 117 GB. This is the internal structure:

Event_id: Saved as the index column in parquet.

Time: The time of the pulse in nanoseconds in the current event time window. The absolute time of a pulse is irrelevant, and only the relative time with respect to other pulses within an event is relevant.

Sensor_id: The ID of which of the 5160 photomultiplier sensors recorded this pulse.

Charge: An estimate of the amount of light in the pulse, in units of photoelectrons (p.e.). A physical photon does not exactly give a measure of 1 e.p. but it can take values distributed around 1 p.e.

Auxiliary: If true, the pulse was not fully digitized, is of lower quality, and is more likely to originate from noise. If False, then this pulse was contributed to the activation decision and the pulse was fully digitized.

Neutrin AI – Architecture (Parquet processing)

Parquet file

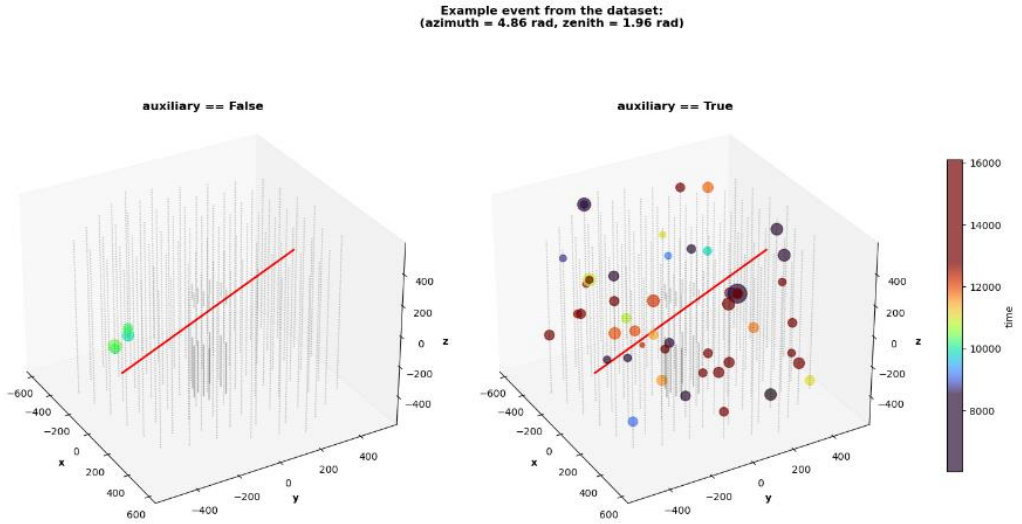
Each batch/parquet file contains tens of thousands of events.

Each event can contain thousands of pulses, each of which is the digitized output of a photo multiplier tube and occupies one row

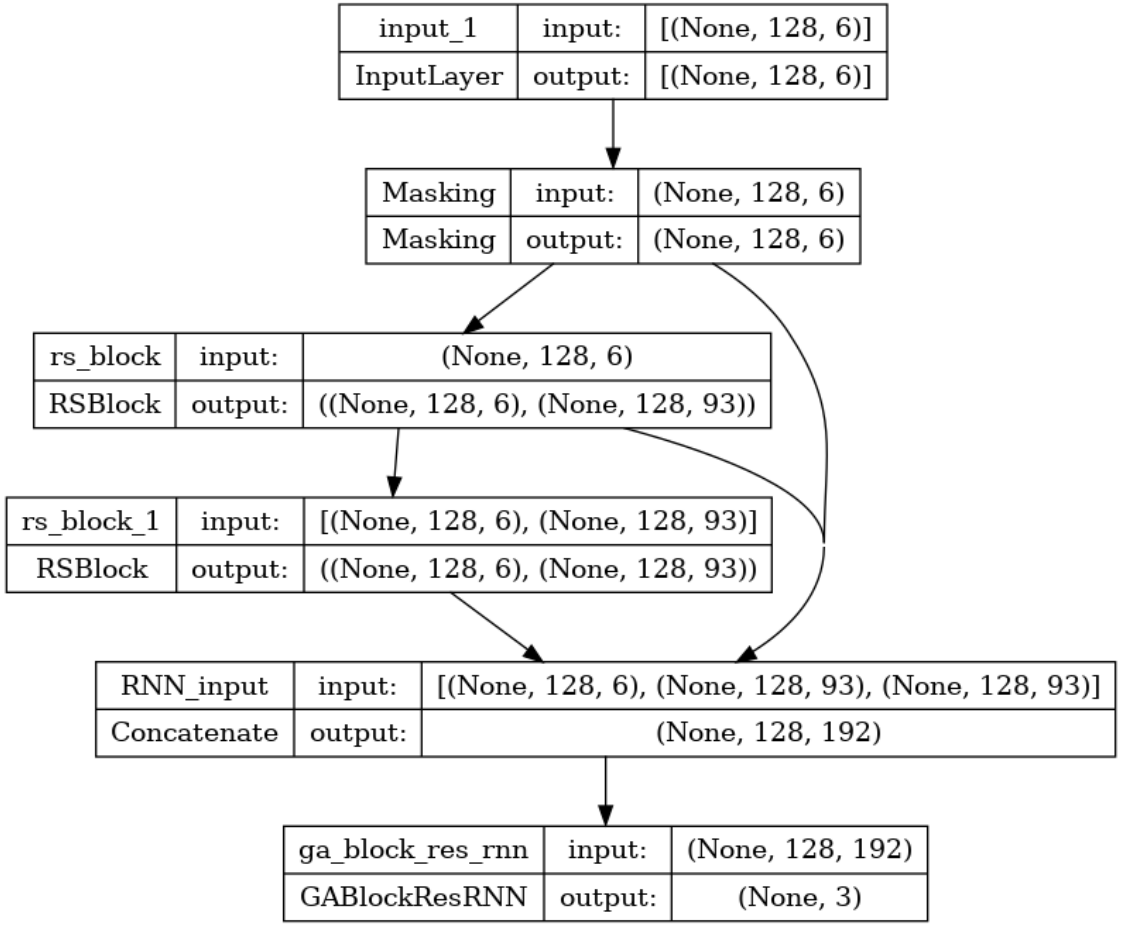
Transformation

Extract:

- Time of event
- Charge of event
- Auxiliary of event
- X, Y, Z coordenates of sensor



Neutrin AI – Architecture (Model RSRNN)



The model returns an estimate of the origin coordinates of the neutrino.
Then, the solution converts the coordinates to azimuth/zenith (angle in radians of the neutrino. A value between 0 and 2*pi for the azimuth and 0 and pi for the zenith)

event_id	pred_x	pred_y	pred_z
2092	0.463641	0.408582	-0.477271
7344	-1.627805	-0.343608	-2.370064
9482	-0.542056	-58.131790	1.999674

	event_id	azimuth	zenith
0	2092	0.722364	2.228424
1	7344	3.349625	2.529557
2	9482	4.703065	1.536413