Optimization of LBNE full detector geometry

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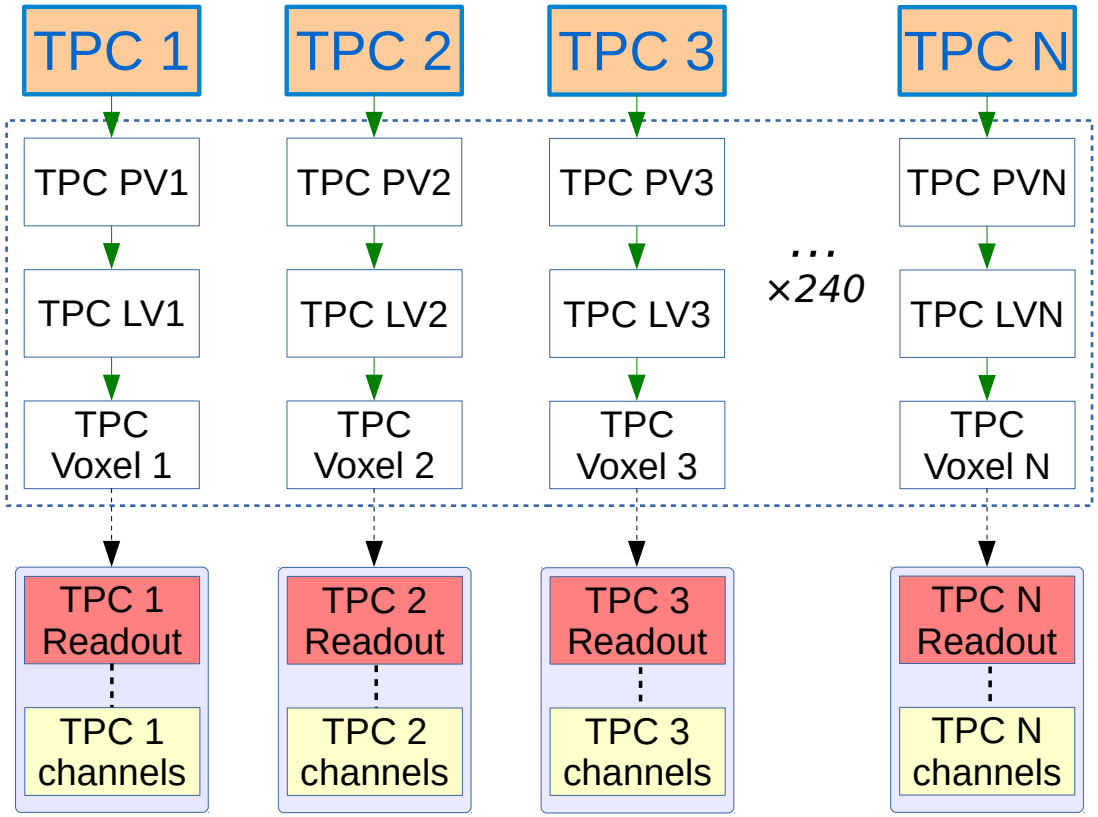
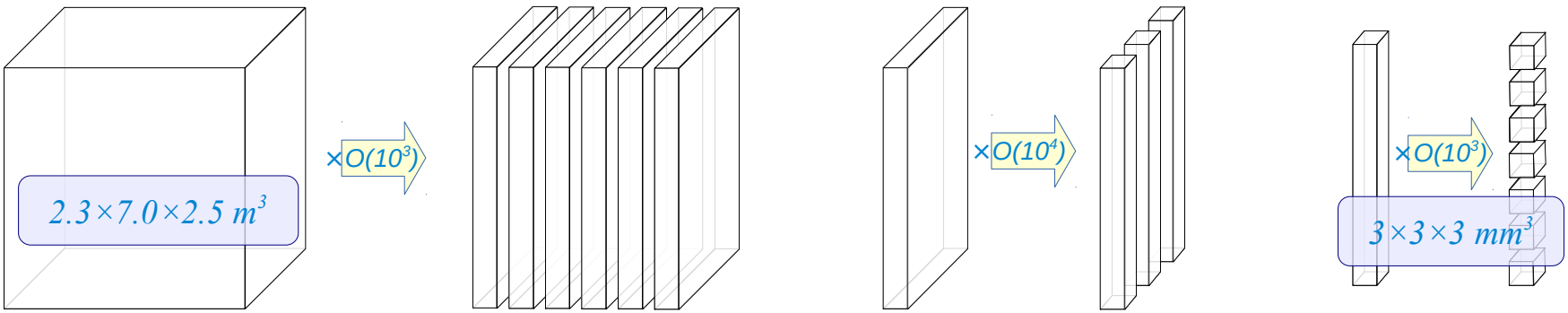
LBNE full detector geometry



LBNE full detector currently consists of 240 TPCs in 2 cryostats.
Each TPC has its own independent geometry and readout objects.

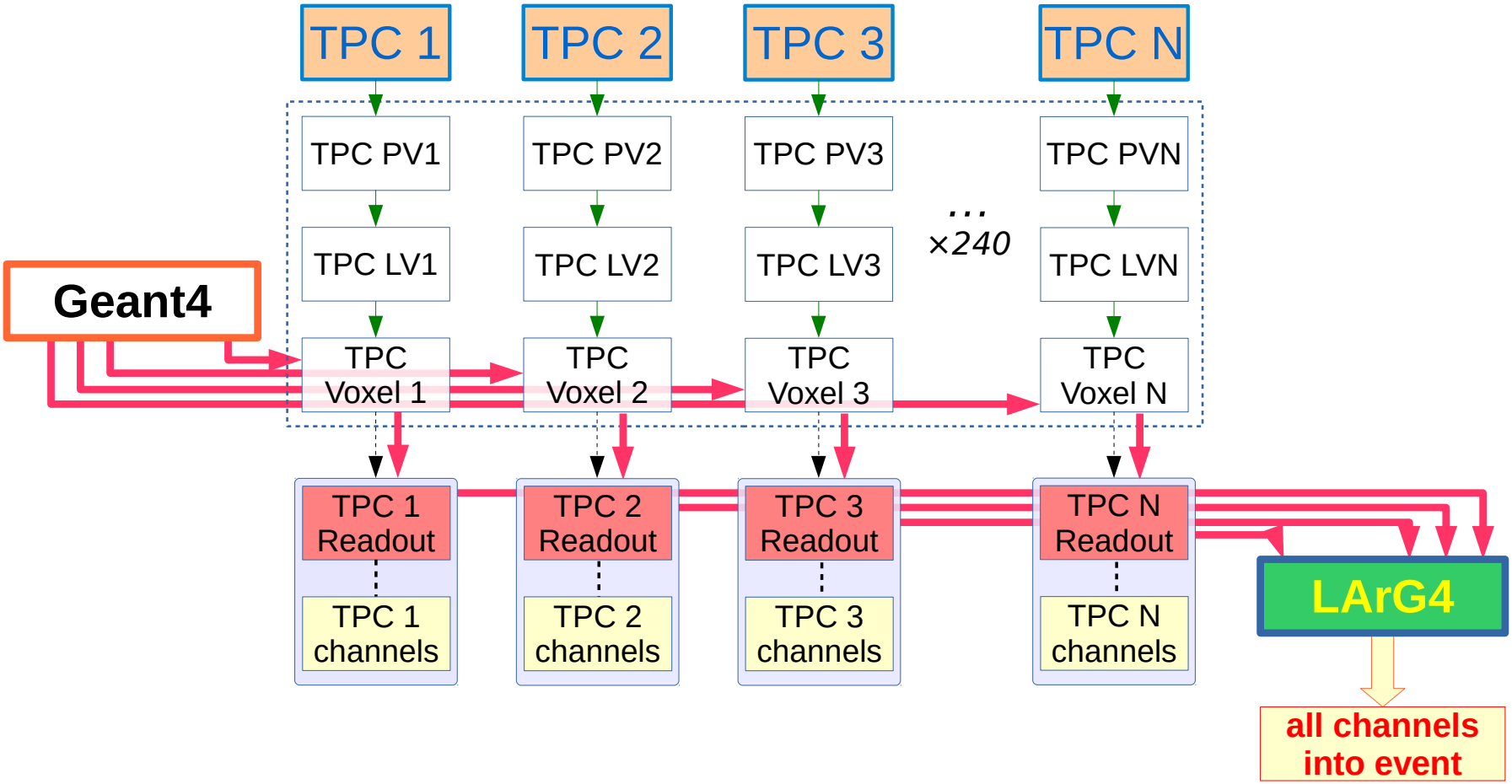
Voxelization



- GEANT uses the detector geometry borders to define where to simulate interactions
- each TPC is a large uniform liquid argon volume...
- ... so we artificially split it in small volumes ("voxels", $(3\ \mathrm{mm})^3$)
- these volumes live in a "parallel world" used only when simulating interactions

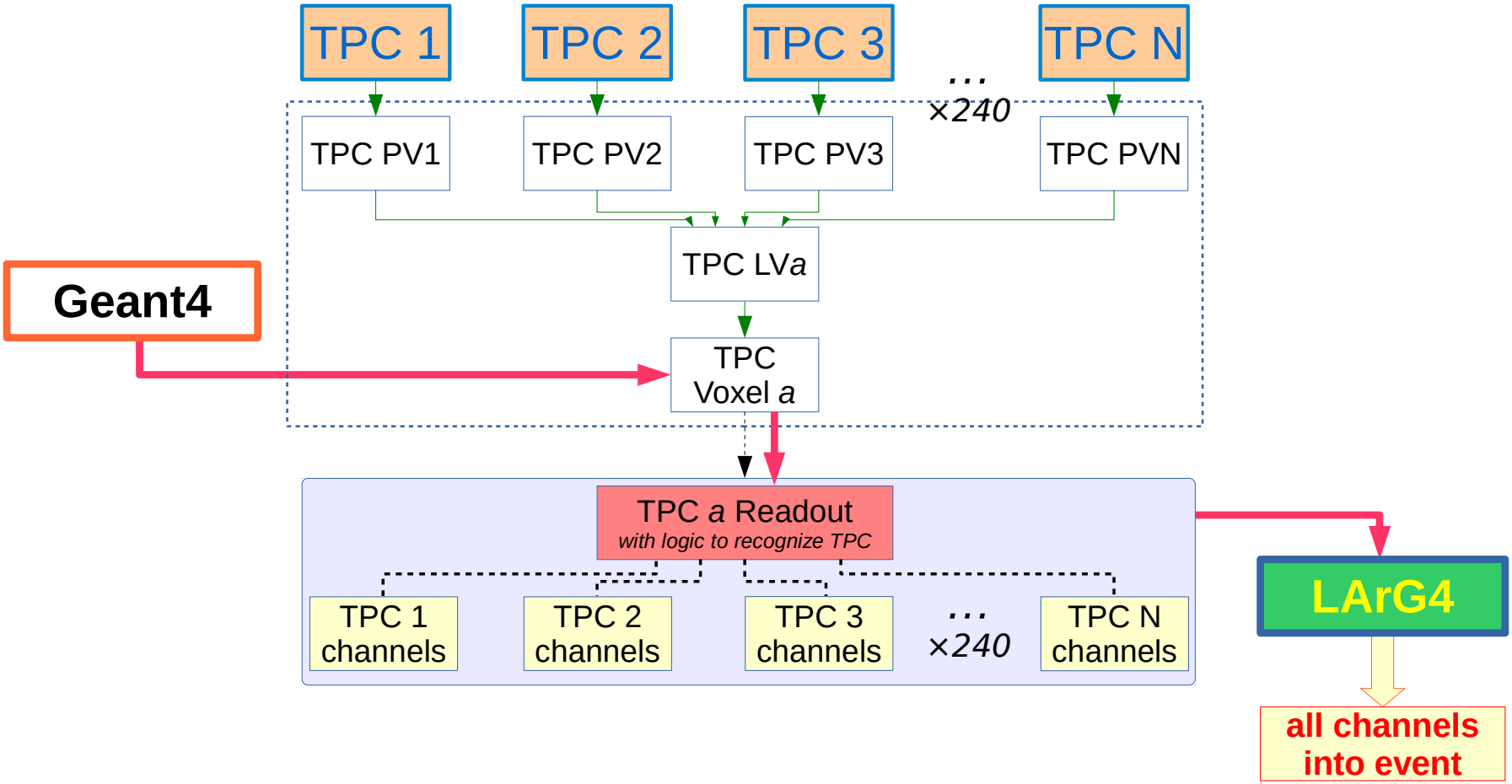
The result for a typical LBNE TPC is $\mathcal{O}\left(10^{12}\right)$ voxels.
That takes *some* memory... (about 1.8 MB).

LArSoft detector readout



1. GEANT simulates some interaction in one of the voxels
2. the readout object stores the outcome for LArSoft
3. after GEANT is done, LArSoft (LArG4 module) collects the data

LArSoft detector readout: new design



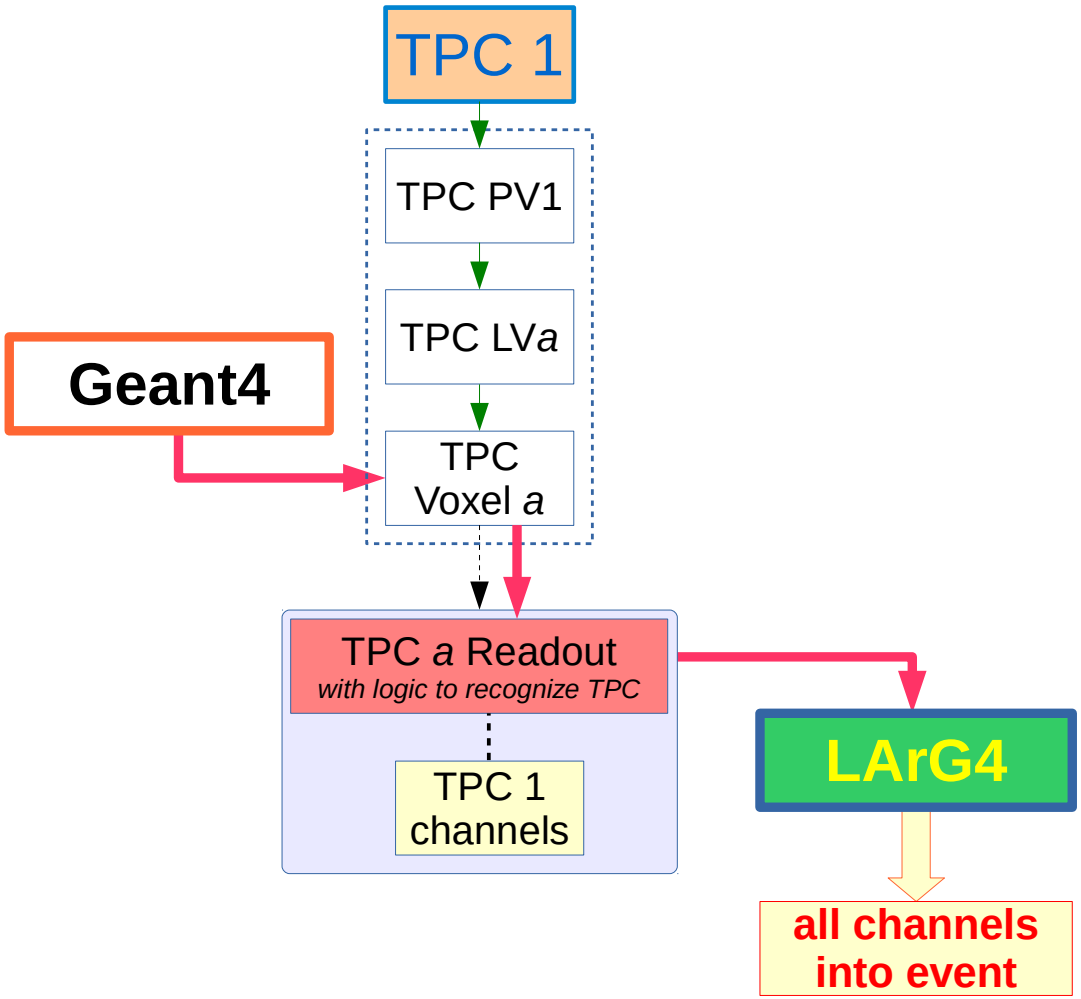
1. voxels are now shared among TPCs (readout object too)
2. the readout object needs to discover which TPC each charge is in

Sharing of TPC voxels is implemented by a cache.

Summary

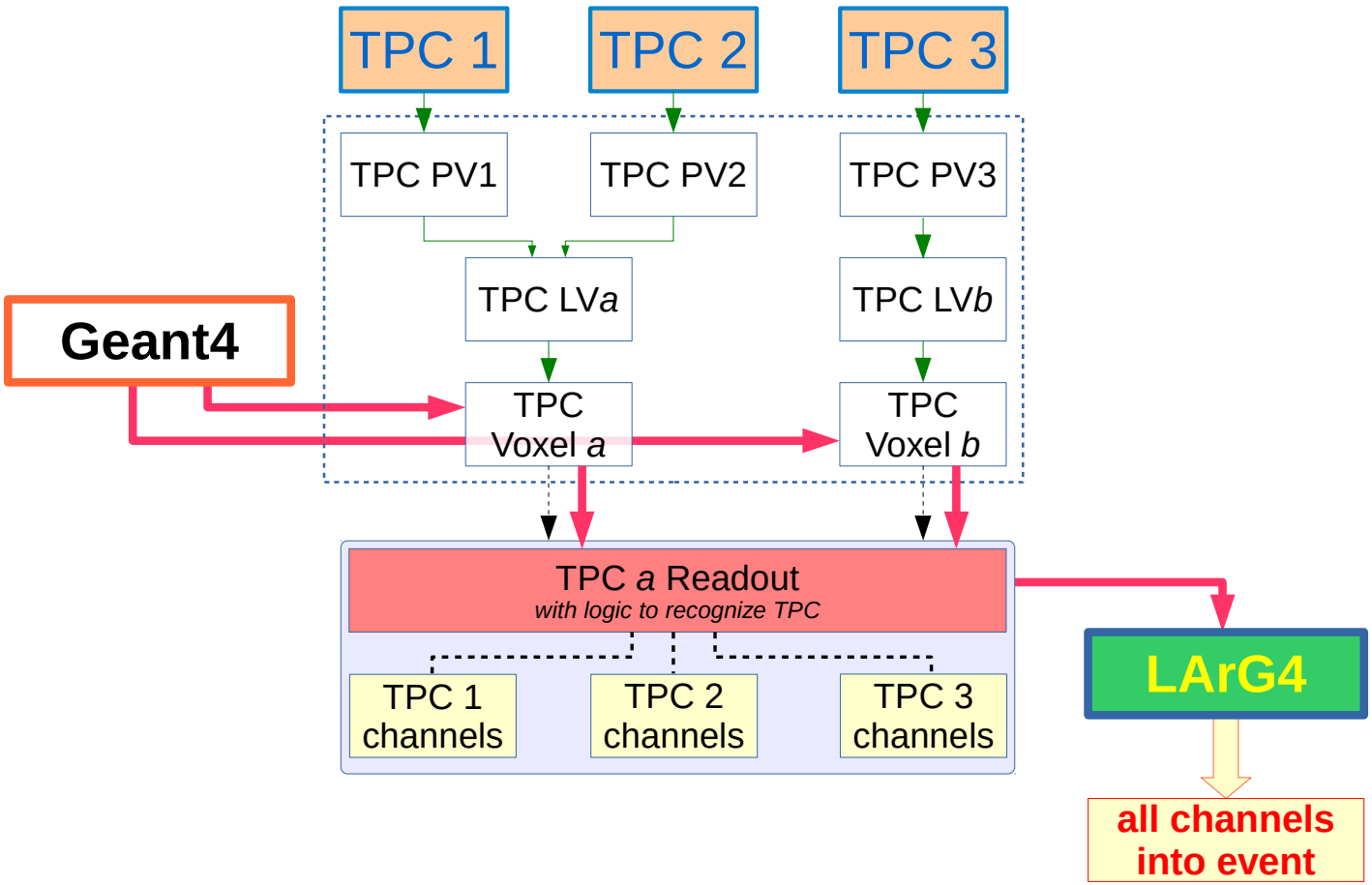
- LBNE FD requires about 500 MB for readout geometry
- that can be reduced to less than one tenth by duplicating structure
- some major changed in the readout code are required
- testing a solution on LBNE FD, then on MicroBooNE and LBNE 35t geometry
- the impact on MicroBooNE jobs should be small

LArSoft detector readout: new design (MicroBooNE)



MicroBooNE geometry in the new design is not very different, but there is at least one overhead for the determination of which TPC the charge is in.
I have implemented a shortcut when there is only one TPC in the geometry.

LArSoft detector readout: new design (LBNE 35t)



Detectors with TPCs with different geometries should be supported:

- all TPCs with the same size (and voxel size) will share voxels
- the readout object uses GEANT to learn which TPC we are in