Update to Fiducial Volume in Larsim Class

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Redmine Issue

- This change addresses larsoft issue #21394

Bug in Fiducial Volume Definition in Larsim

Added by Gray Putnam 16 days ago. Updated about 13 hours ago.

- Which itself was a duplicate of issue #13718

MCRecoPart uses non-portable coordinate system

Added by Gianluca Petrillo over 2 years ago. Updated almost 2 years ago.

- Fix is on feature branch:
  - feature/gputnam_MCSTReco_FV_fix

MCRecoPart

- The “MCRecoPart” class in larsim defines a fiducial volume and throws out sim::MCTrack points that are not contained in that volume
- The code to define that volume is implicitly tied to MicroBooNE (and not quite correct for that detector either)

Old Code Defining Fiducial Volume Box

```
art::ServiceHandle<geo::Geometry> geo;

_y_max = geo->DetHalfHeight();
_y_min = (-1.) * _y_max;
_z_min = 0;
_z_max = geo->DetLength();
_x_min = 0;
_x_max = 2.*(geo->DetHalfWidth());
```

Update

- Proposed update would change how fiducial volume is defined

- Now builds a box that contains every TPC in the detector

New Code Defining Fiducial Volume Box

```
_x_min = std::min_element(geo->begin_TPC(), geo->end_TPC(),
    [](auto const &lhs, auto const &rhs){ return lhs.BoundingBox().MinX() < rhs.BoundingBox().MinX();})->MinX();
_y_min = std::min_element(geo->begin_TPC(), geo->end_TPC(),
    [](auto const &lhs, auto const &rhs){ return lhs.BoundingBox().MinY() < rhs.BoundingBox().MinY();})->MinY();
_z_min = std::min_element(geo->begin_TPC(), geo->end_TPC(),
    [](auto const &lhs, auto const &rhs){ return lhs.BoundingBox().MinZ() < rhs.BoundingBox().MinZ();})->MinZ();
_x_max = std::max_element(geo->begin_TPC(), geo->end_TPC(),
    [](auto const &lhs, auto const &rhs){ return lhs.BoundingBox().MaxX() < rhs.BoundingBox().MaxX();})->MaxX();
_y_max = std::max_element(geo->begin_TPC(), geo->end_TPC(),
    [](auto const &lhs, auto const &rhs){ return lhs.BoundingBox().MaxY() < rhs.BoundingBox().MaxY();})->MaxY();
_z_max = std::max_element(geo->begin_TPC(), geo->end_TPC(),
    [](auto const &lhs, auto const &rhs){ return lhs.BoundingBox().MaxZ() < rhs.BoundingBox().MaxZ();})->MaxZ();
```

Update to Fiducial Volumes

	x [cm]	y [cm]	z [cm]
MicroBooNE (old)	0, 256.35	-116.5, 116.5	0, 1036.8
MicroBooNE (new)	-1.825, 258.175	-127.03, 128.97	-4, 1041
SBND (old)	0, 196.5	-200, 200	0, 500
SBND (new)	-200, 200	-200, 200	0, 500
ICARUS (old)	0, 148.2	-158.41, 158.41	0, 1789.9
ICARUS (new)	-365.63, 365.63	-210, 180	-995, 965

Slightly changed in MicroBooNE

Expanded in SBND and ICARUS

Alternatives

- This update will make SBND and ICARUS MCTrack’s act as expected
- Other possible ways to do this (while only making small changes):
  - Have fiducial volume include all cryostats
  - Don’t delete MCTrack points outside fiducial volume