

# Status of MicroBooNE MCC9 Larsoft Updates

Larsoft Coordination Meeting  
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# Introduction

- The purpose of this talk is to review updates made to MicroBooNE's MCC9 larsoft branches (v08\_05\_00\_br), since the MCC9-integration release fork (v08\_05\_00).
  - With a view to identifying the status of the various updates.
    - Already merged or have equivalent updates in develop branch.
    - Irrelevant or superseded.
    - Available for merging now (this week's integration release).
    - Intended for merging in the future.

# List of MicroBooNE MCC9 Updates

- Pandora.
- Particle Identification updates (Kirsty Duffy).
- Trajcluster (Bruce Baller).
- MCReco
- Minor updates and bug fixes.
- Genie v3.

# Pandora

- Larpandora branch  
feature/asmith\_ubooneMCC9\_release\_v08\_05\_00\_br was merged  
in larsoft v08\_05\_00\_04.
- This was a pretty significant update to larpandora and related uboone suite packages when this production release was made.
- This branch has merge conflicts with develop branch, therefore is not a candidate for merging directly to develop.
- Pandora team should update this meeting on whether updates to pandora are required on the develop branch.

# Particle Identification

- This topic was presented in the Jan. 15, 2019 larsoft coordination meeting as a proposed update to the `anab::ParticleID` data product class to support additional algorithms besides Chi2 and PIDA.
- Main sticking point since the initial presentation of this idea was inability to make a suitable io rule involving bitsets to preserve backward compatibility with existing data (root bug).
  - MicroBooNE decided we didn't need backward compatibility for MCC9.
- The following branches were merged in larsoft v08\_05\_00\_04:
  - `larana: feature/kduffy_PIDupdate_v08_05_00_br`
  - `larreco: feature/kduffy_PIDupdate_v08_05_00_br`
  - `lardataobj: feature/kduffy_PIDupdate_v08_05_00_br`
  - `lareventdisplay: feature/kduffy_PIDupdate_v08_05_00_br`

# New Struct

Kirsty Duffy

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The change comes down to replacing all variables with a new vector of **sParticleIDAlgScores** structs.

```
struct sParticleIDAlgScores {  
    std::string fAlgName;  
    kVariableType fVariableType;  
    kTrackDir fTrackDir;  
    int fAssumedPdg;  
    Int fNdf;  
    float fValue;  
    std::bitset<5> fPlaneID;  
}
```

This is fed by c++ algorithms:

- Chi2
- PIDA
- ...

Algorithm name, defined by experiment developers. Default: "AlgNameNotSet"

```
enum kVariableType {  
    kGOF,                // Goodness of Fit  
    kLikelihood,         // Likelihood  
    kLogL,               // Log-Likelihood  
    kScore,              // Generic Particle ID score  
    kPIDA,               // PIDA value  
    kdEdxtruncmean,     // dE/dx versus truncated mean  
    kdQdxtruncmean,     // dQ/dx versus truncated mean  
    kTrackLength,       // Track Length  
    kEdeposited,         // Deposited energy  
    kEbyRange,          // Energy by range  
    kNotSet              // Not set  
};
```

Default: kNotSet

```
enum kTrackDir {  
    kForward,            // Direction track is reconstructed  
    kBackward,           // Opposite to reconstruction  
    kNoDirection  
};
```

Default: kNoDirection

Assumed PDG (for likelihoods, GOFs, etc.). Default: 0

Number of degrees of freedom, if applicable. Default: -9999

Value produced by algorithm. Default: -9999

Plane ID for the algorithm result. Default "00000"

Moving to this structure for `anab::ParticleID` is a breaking change

Affects the following modules/algorithms in the repository:

- **Larana:**
  - `Chi2ParticleID_module.cc`
  - `Chi2PIDAlg.h`
  - `Chi2PIDAlg.cxx`
- **Lardataobj:**
  - `ParticleID.h`
  - `ParticleID.cxx`
  - `ParticleID_VariableTypeEnums.h`
- **Larreco:**
  - `KalmanFilterFitTrackMaker_tool.cc`
  - `KalmanFilterFinalTrackFitter_module.cc`
- **Ubana:**
  - `AnalysisTree_module.cc`
  - `XYZvalidatoin_module.cc`
  - `Diffusion_module.cc`
  - `MuonCandidateFinder.cxx`
  - `MuonCandidateFinder.h`
  - `UBXSec_module.cc`
  - [Added folder] `ParticleID`
- **Argoneutcode**
  - `AnalysisTreeT962_module.cc`
- **Dunetpc**
  - `AnalysisTree_module.cc`
  - `ProtoDUNEAnalCosmicTree_module.cc`
  - `ProtoDUNEAnalTree_module.cc`
  - `ProtoDUNETrackUtils.cxx`
  - `AnaRootParser_module.cc`
- **Icaruscode:**
  - `AnalysisTree_module.cc`
- **Lariatsoft:**
  - `AnaTreeT1034_module.cc`
  - `MCAanalysis_module.cc`
  - `MichelWfmReco_module.cc`
  - `AnaTree_module.cc`
- **Sbndcode:**
  - `AnalysisTree_module.cc`
- **Lareventdisplay**

# Particle Identification (cont.)

- MicroBooNE MCC9 branches merge clean into develop (except product\_deps).
- As of ~~last~~ this week's integration release, root version ~~was~~ will be updated to v06\_16\_00, which version should support a bitset io rule that will allow backward compatibility with old anab::ParticleID.
- Other changes suggested at the Jan. 15 meeting were implemented.
- I informed Kirsty about the possibility of developing an io rule for the new anab::ParticleID class, and she promised to make one before the next larsoft coordination meeting.



# Trajcluster

- The following trajcluster update branch was merged in larsoft v08\_05\_00\_04:
  - [larreco: feature/bb\\_trajcluster\\_mcc9](#)
- This was a pretty significant update of trajcluster.
- Merges clean in develop branch as is (except product\_deps).
- Trajcluster author (Bruce Baller) is working on a new branch that includes updates from this branch. These updates should be beneficial to all trajcluster users from any experiment.
  - Not ready to request merging to develop yet.
  - Author will request an update when ready.

# MCReco

- The following feature branch was merged in larsoft v08\_05\_00\_04a and v08\_05\_00\_05.
  - `larsim: feature/davidc_mcreco_fixes`.
- Update MCReco to get truth information from SimEnergyDeposits instead of SimChannels.
- Above branch does not merge clean into larsim develop branch because of post-fork updates to develop. However, the single relevant revision can be cherry-picked clean onto a new branch, which will be ready to be merged in larsim develop branch.
  - `larsim: feature/davidc_mcreco_segfaultfix`.
- Requesting merge in this week's integration release.

# Minor Updates and Bug Fixes

- Space point solver (from Tingjun, branch [larreco:feature/tjyang\\_sps](#)).
  - Merges clean.
  - MicroBooNE-specific fcl update.
  - Request merge.
- Vertex Fitter (from Giuseppe, branch [larreco:feature/cerati\\_fix-vtx-fit-bug-v08\\_05\\_00\\_br](#)).
  - Merges clean.
  - Nonbreaking bug fix.
  - Request merge.

# GENIE V3

- MicroBooNE has decided to go into production with MicroBooNE developed beta release of genie v3.
  - `larsim: feature_v08_05_00/gardiner-genie-v3`.
- I'm assuming that larsoft may wish to wait for an official v3 release from genie collaboraiton before updating larsoft to genie v3.

# Summary

- Merge requests for this week's integration release.
  - `larsim: larsim: feature/davidc_mcreco_segfaultfix`
  - `larreco: feature/tjyang_sps`
  - `larreco: feature/cerati_fix-vtx-fit-bug-v08_05_00_br`
- (Possible) future updates.
  - Pandora
  - PID (by next coordination meeting).
  - Trajcluster.