

EventWeight for DUNE

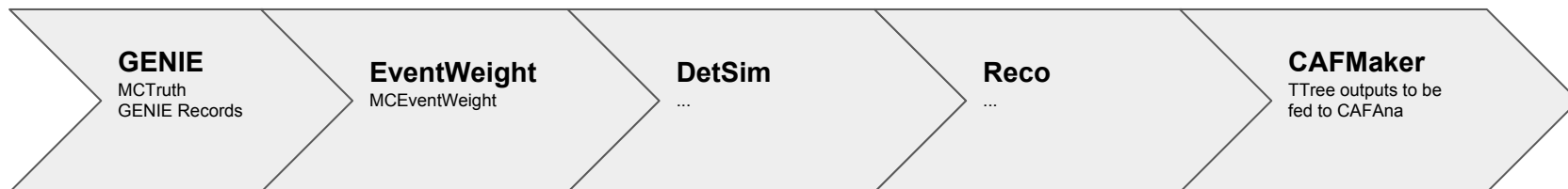
Matt Bass

Overview

- **EventWeight:** larsim module to run reweighting on specified GENIE systematics at various sigma values
 - Production/analysis chain implementation
 - Status
 - Future Work

Production Chain

Production Chain:



- EventWeight will be new step in production. Can run standard set of systematics along with GENIE (larsim) event generation.
- Will evaluate cpu/disk usage once we have set of systematics in place

MCEventWeight

- [MCEventWeight](#): larsim module run GENIE reweighting given specified parameters in various modes:
 - **Modes**: +/- 1 sigma, gaussian throws, custom sigma levels (limited)
 - Possible to add **custom** (non-GENIE) event weights based on anything in the art::Event
 - Flux weighting in MicroBooNE done within this module
- Run configuration is customizable via **fcl parameters**

```
namespace evwgh {  
  struct MCEventWeight  
  {  
    std::map<std::string, std::vector<double> > fWeight;  
  };  
}
```

```
genie_qema: {  
  type: Genie  
  random_seed: 1  
  parameter_list: ["QEMA"]  
  parameter_sigma: [1]  
  mode: pm1sigma  
  number_of_multisims: 0  
}
```

MCEventWeight: ToDo

- Not currently possible to provide a **custom list of sigma values** to EventWeight module
 - Not clear if current modes were intended to implement this functionality
- Will add a new **mode** to allow fcl parameter to pass a list of sigma levels to generate weights at values to be used by CAFAna, e.g.
 - parameter_list: ["QEMA"]
 - parameter_sigma: [-2,-1,1,2]

CAFMaker Changes

- CAFMaker module produces the TTree outputs needed by [CAFAna](#) analysis framework
 - From larsoft data products (e.g. MCTruth, MCParticle, etc)
- Added export of a caf TTree variable for each systematic; vector<double> with dimension the number of sigma levels

```
*Br 94 :fgenie_AKYPt_Genie : vector<double> *
*Entries : 2 : Total Size= 698 bytes File Size = 132 *
*Baskets : 1 : Basket Size= 32000 bytes Compression= 1.16 *
*Br 95 :fgenie_AKYYxF_Genie : vector<double> *
*Entries : 2 : Total Size= 698 bytes File Size = 132 *
*Baskets : 1 : Basket Size= 32000 bytes Compression= 1.16 *
*Br 96 :fgenie_DISAth_Genie : vector<double> *
*Entries : 2 : Total Size= 698 bytes File Size = 132 *
*Baskets : 1 : Basket Size= 32000 bytes Compression= 1.16 *
*Br 97 :fgenie_DISBth_Genie : vector<double> *
*Entries : 2 : Total Size= 698 bytes File Size = 132 *
*Baskets : 1 : Basket Size= 32000 bytes Compression= 1.16 *
*Br 98 :fgenie_DISCv1u_Genie : vector<double> *
*Entries : 2 : Total Size= 703 bytes File Size = 133 *
*Baskets : 1 : Basket Size= 32000 bytes Compression= 1.16 *
```

Future Work

- Add new mode to **MCEventWeight** module (larsim) to allow custom set of sigma levels
- Finish **CAFMaker** (dunetpc) changes and testing to export weights
- Add new CAF fields and reweighting systematic implementation to **CAFAna** based on new weights
- Choose standard set of systematics to be included in production