

Upcoming GArSoft Updates.

ND-GAr group meeting

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15th February 2021

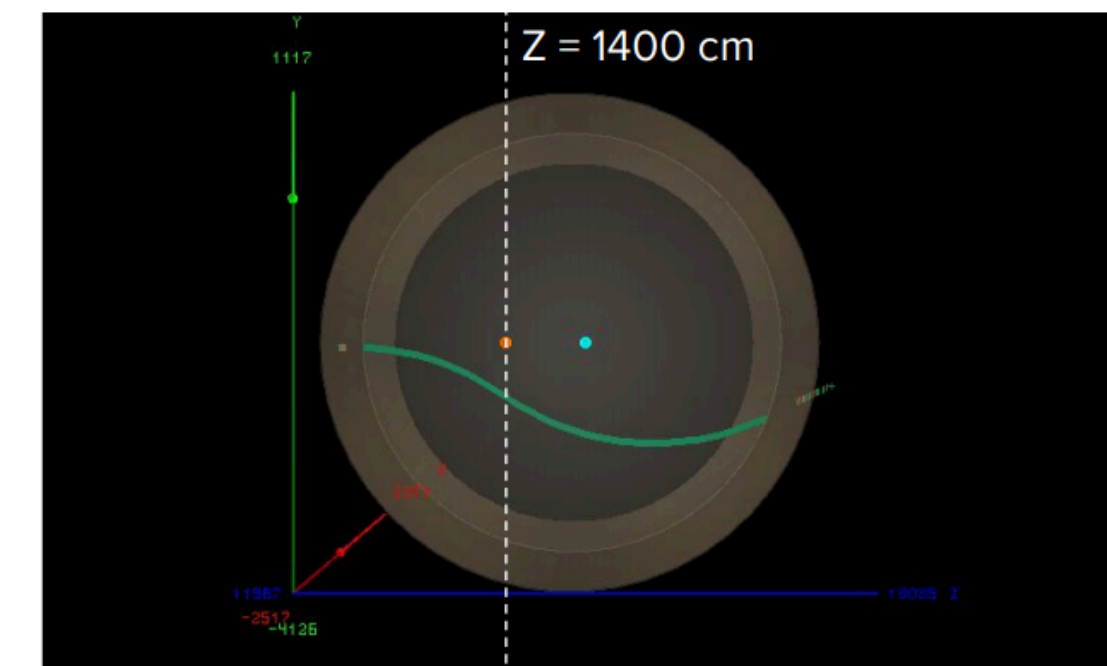
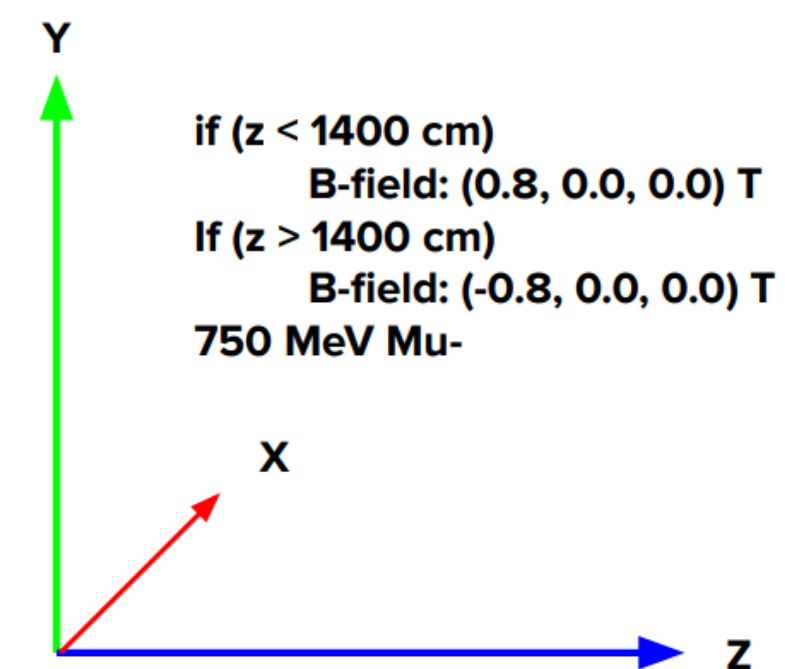


Custom Magnetic Field in edep-sim/GArSoft.

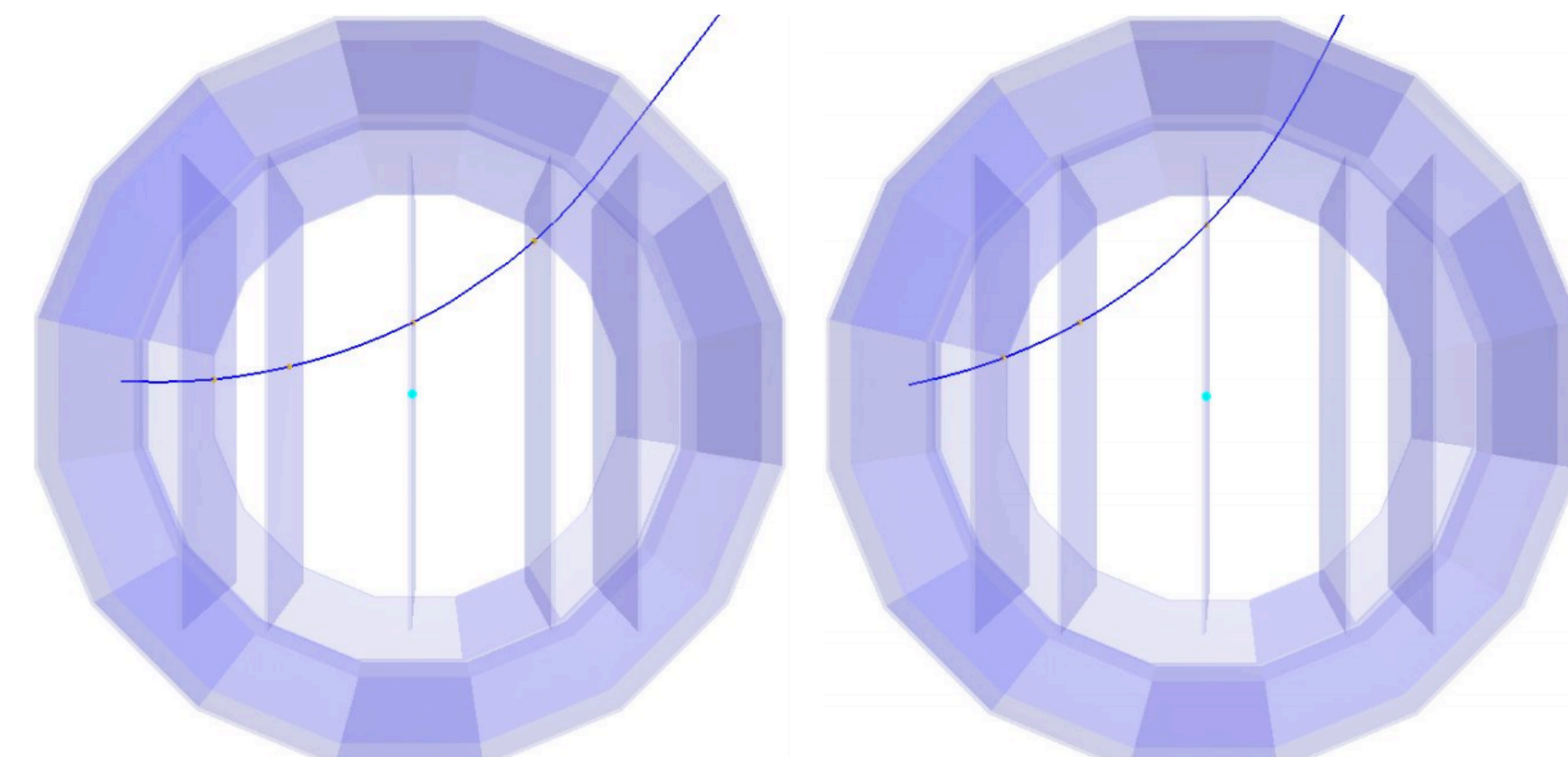
Current Implementation (develop branch)

- Due to the ND-GAr magnet, we need to use a custom magnetic field to simulate non-uniformities and see the impact on tracking performance (also may be good to understand the impact of the fringe field on the ND-LAr)
- **Andrew Cudd** nicely implemented this in
 - edep-sim (see PR: <https://github.com/ClarkMcGrew/edep-sim/pull/10>)
 - GArSoft as an standalone art service (MPDMagneticField_service.cc)
- He demonstrated that it works perfectly with edep-sim
- GArSoft is currently in code-review (branch bfield)
- Current issue
 - Geant4 helper in GArSoft (to call G4 and pass the geometry/physics etc...)
 - Does not handle nicely new mag field service, no custom B-Field
 - -> Tracked to nug4 package

Event Displays



Event Displays!



Simulated with SPY magnetic field map. Yes, these tracks now bend upward. The SPY field map is actually nominally -0.5 T in the X direction.

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Modifications of nug4 package.

Upcoming changes

- The nug4 package handles a generic art Magnetic field service and the geant4 detector construction (read gdml and pass it to geant4)
 - Used in GArG4 module (Geant4 simulation with GArSoft)
- The Magnetic Field service currently is standalone.. and handles only no B or constant B fields
 - service cannot be overridden by user-defined service
- To be done
 - -> Implement a Magnetic Field service interface (abstract provider class)
 - -> Can be loaded by custom service using fhicl service_provider variable
 - -> Need to handle custom magnetic fields in the detector construction
- Implemented: in review (see nug4 feature/MagneticField branch)
 - -> Implemented abstract service implementation and abstract MagneticField class
 - -> Implemented default magnetic field class and service to keep backward compatibility for NOvA and LArSoft
 - -> Rest to implement custom magnetic field class for detector construction

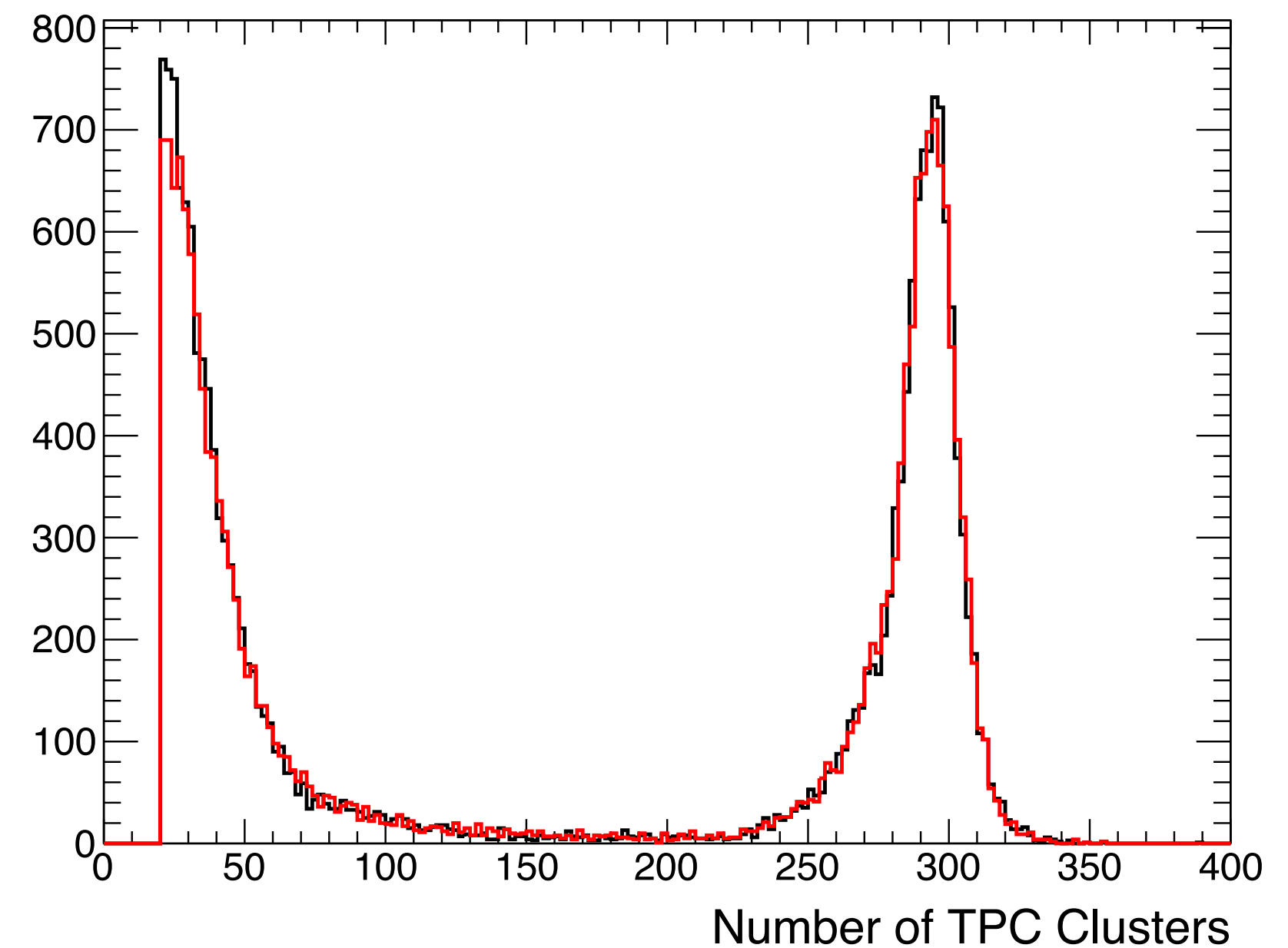
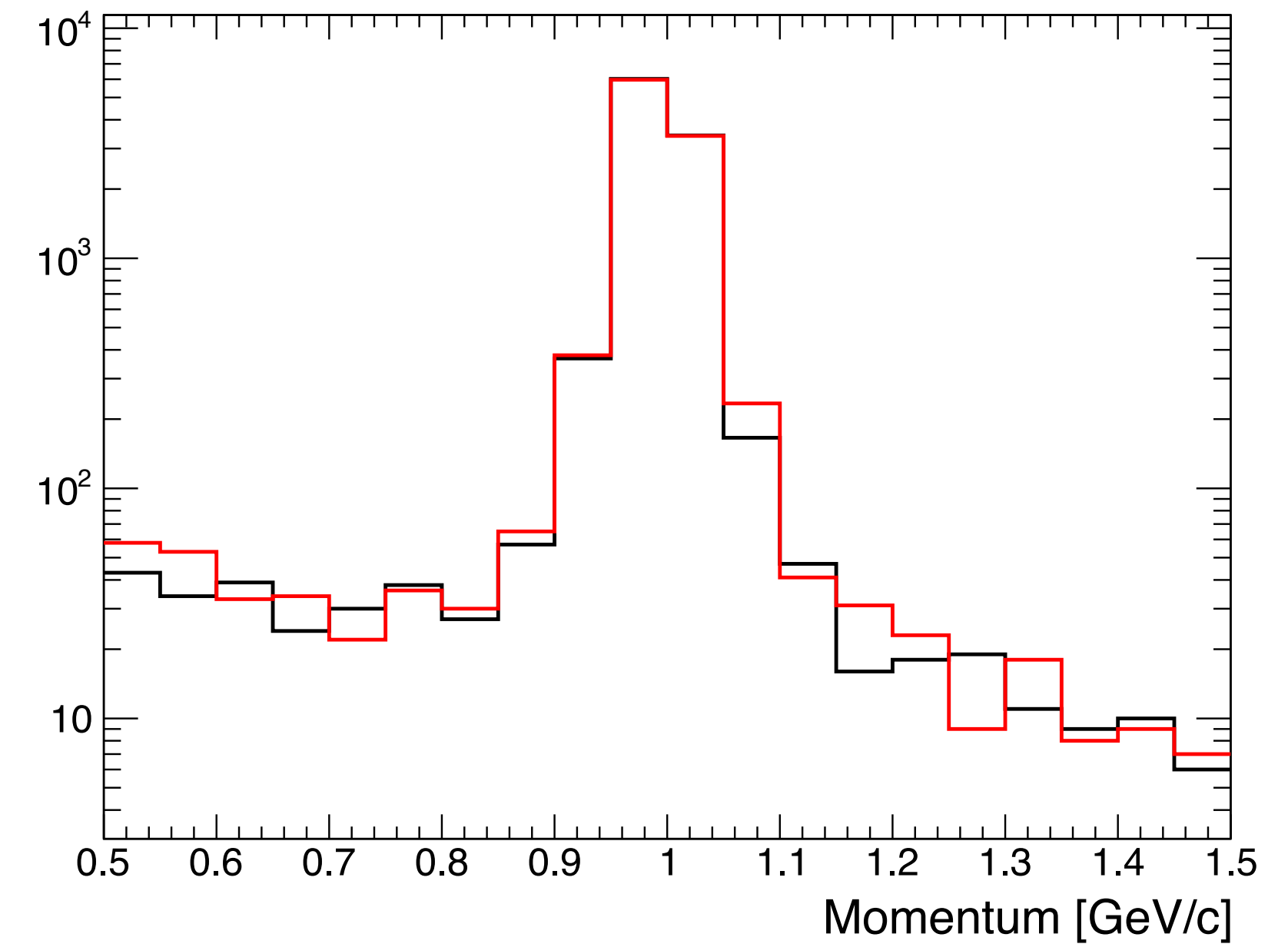
```
////////////////////////////////////  
// \file MagneticFieldService.h  
//  
// \brief pure virtual service interface for magnetic field  
//  
// \author ebrianne@fnal.gov  
//  
////////////////////////////////////  
#ifndef MAGNETICFIELDSERVICE_H  
#define MAGNETICFIELDSERVICE_H  
    You, a day ago • Modified the MagneticFieldService to be able to o...  
#include "nug4/MagneticField/MagneticField.h"  
  
#include "art/Framework/Services/Registry/ServiceHandle.h"  
#include "art/Framework/Services/Registry/ServiceMacros.h"  
  
namespace mag {  
    class MagneticFieldService {  
    public:  
        using provider_type = mag::MagneticField;  
  
        virtual ~MagneticFieldService() = default;  
        virtual const mag::MagneticField* provider() const = 0;  
    };  
}  
  
DECLARE_ART_SERVICE_INTERFACE(mag::MagneticFieldService, SHARED)  
  
#endif // MAGNETICFIELDSERVICE_H
```

```
G4VPhysicalVolume* DetectorConstruction::Construct()  
{  
    // Setup the magnetic field situation  
    art::ServiceHandle<mag::MagneticFieldService> bField;  
    auto const * pProvider = bField->provider(); //get the provider  
  
    // loop over the possible fields  
    for(auto fd : pProvider->Fields()){  
        switch (fd.fMode) {  
            case mag::kNoBFieldMode:  
                /* NOP */  
                break;  
            case mag::kConstantBFieldMode: {  
                // Attach this to the magnetized volume only, so get that volume  
                G4LogicalVolume *bv0l = G4LogicalVolumeStore::GetInstance()->GetVolume(fd.fVolume);  
  
                // Define the basic field, using p we should get the uniform field  
                G4UniformMagField* magField = new G4UniformMagField( fd.fField * CLHEP::tesla );  
                fFieldMgr = new G4FieldManager();  
                fFieldMgr->SetDetectorField(magField);  
                fFieldMgr->CreateChordFinder(magField);  
            }  
        }  
    }  
}
```

First checks.

Checking some anatree plots

- Did a simple check on Anatree variables (constant B field)
 - with develop branch
 - with new B-field service implementation
- Simple particle gun, 1 GeV muon, 10k
- No significant difference in track momentum reconstruction/
number of TPC Clusters
- More checks may be needed but so far positive outcome



Other upcoming changes.

A lot of package updates

- To be able to use the new B-field service implementation, a lot of ups packages needed to be updated
 - Simple definition of the package versions in GArSoft
- Thanks **Tom** for the help to debug things, and update cvmfs rapidly!
- Update to the latest necessary package versions (mostly nu tools related, geant4...)
- Important decision
 - We decided to mirror edep-sim in the DUNE github repo
 - To be able to keep up with ups package updates (new g4 version requires a new edep-sim release)
 - Be able to patch up things (i.e. CI builds failing) and propagate back to base repo
 - Limited rights (Tom, me and Andrew)
- Ultimately should be the version used by the ND groups (easy to keep track of the version)



Backup Slides.

