garana updates

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ND-GAr Meeting

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Overview of garana

- New repository, garana
  - Condensed versions of garsoft products
  - Tools for reading class-based or flat trees
  - Tools for class-based → flat tree conversion, consistency checking
  - Standalone, lightweight event display
  - Backtracking
  - Support for C++ or Python analysis with ROOT
- garsoft depends on garana
  - Class-based trees produced by new garsoft analyzer module, StructuredTree_module.cc
  - garana takes care of the rest

Configurability

- Avoid too much configurability
- Offer a few configurations by task
  - General (default)
  - Reco development (largest files)
  - Readout simulation development
- displayTree on or off

Trees (all analysis configs)

- Multiple trees in a single file
- headerTree (1 entry per file)
  - Flux component weights
  - Geometry used
  - Run-level info
  - Other relevant config values
- genTree
  - Generator-level info
  - Full GHEP record if applicable
  - Final state particle 4-vectors
- g4Tree
  - G4-level info
  - MCParticle initial/final 4-vectors
  - MCParticle parentage
- detTree
  - Readout sim info, e.g. RawDigits
- recoTree
  - Info from final reco pass
  - TPC Track, Vertex ECal (or MuID) clusters
- displayTree
  - Info for event display
  - Sparsified trajectory points and reco hits

Intertree associations

- Backtracker-like utilities for different ana configs
- Same # entries/tree (1 per “event”)
- Association methods
  - Get associations from art::Assns when producing structuredtree
  - Use flat index maps to store associations
  - Not using pointers in the trees (appear to duplicate data)
  - Another possibility: TRefs
- Backtracker configuration
  - General analysis
    - Focus on best match(es) (e.g. get true muon track but ignore delta rays)
  - Reco or readout sim R&D
    - Provide (nearly) all matches
  - Configurable energy threshold for each config. determine which associations written to tree

Open question: data products

- Commonly need only subset of information provided by garsoft data product
- garana only reads data products that don't depend on garsoft, nusimdata, etc.
- Introduce condensed versions of garsoft products into garana
- garsoft utility translates garsoft products into garana products
- The tricky part
  - In the interest of long term maintenance, should avoid duplication
  - In initial version of garana, this is **not** done
  - Could have garsoft products inherit from garana products (thoughts?)

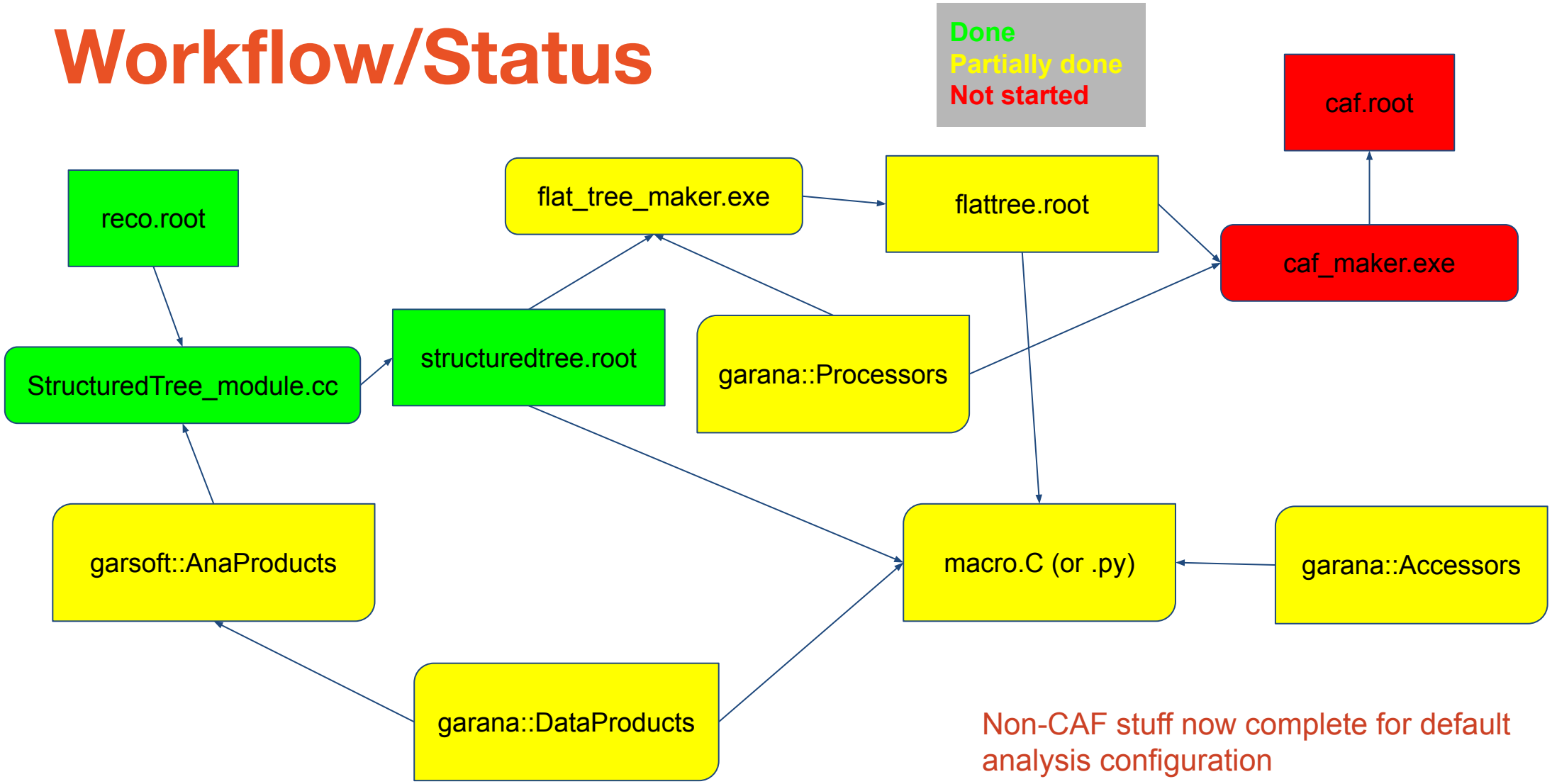
Open question: CAF

- CAF files → CAFAna used for oscillation analyses (e.g. TDR, ND CDR)
- CAF file maker exists in garsoft
  - Takes anatree.root as input
  - Outputs CAF-ready flat ntuple
- Met with Eldwan, Tanaz, and Chris Backhouse to discuss what we have and want from DUNE CAF files
  - Chris B. is helping to overhaul the CAF structure, starting with GAr (other NDs to follow)
  - Still unclear what garsoft should provide for CAF support
- For LBL analysis, want to move to using realistic readout simulation and reconstruction
  - Now is the time for improving the CAF infrastructure
  - Tricky points - POT accounting, multi-detector events (e.g. muons LAr → GAr)
- Interested in joining the discussion? New Slack channel, #caf_structure

Open question: long-term maintenance

- I can be the de facto release manager for garana while we iron out the usual issues with a fresh software package
- We should also move toward making semi-regular garsoft releases
- Can we find a tech savvy student or other unwitting victim to take on the role of release manager?
- Summer software/analysis school → add garsoft/garana (should have all of the kinks worked out by then)
  - Once other analysis configurations implemented (hopefully this or next week), would people in this group be interested in a garana tutorial?

Workflow/Status



Non-CAF stuff now complete for default analysis configuration (headerTree, genTree, g4Tree, recoTree)

Next steps

- garana repo currently at: https://github.com/chilge/garana
- garsoft changes on branch feature/chilgenb_NewAnaScheme
- First release this week (along with new garsoft release)
  - Add garana to UPS
  - Migration of garana to DUNE github area
  - Import existing analysis tools already developed inside garsoft into garana
    - E.g. Tanaz's event selection tools