Examples:

1. To convert all events in the *input GHEP* file '*myfile.ghep.root*' into the 't2k_rootracker' format, type:

   ```
   $ gntpc -i myfile.ghep.root -f t2k_rootracker
   ```

   The output file is automatically named '*myfile.gtrac.root*'

2. To convert the first 20,000 events in the GHEP file '*myfile.ghep.root*' into the 'gst' format and name the output file '*out.root*', type:

   ```
   $ gntpc -i myfile.ghep.root -f gst -n 20000 -o out.root
   ```

6.6.2 Formats supported by *gntpc*

The 'gst' format

The 'gst' is a GENIE summary ntuple format. It is a simple, plain ntuple that can be easily used for plotting in interactive ROOT sessions. The stored ROOT *TTree* contains the following branches:

- **iev** (*int*): Event number.
- **neu** (*int*): Neutrino PDG code.
- **tgt** (*int*): Nuclear target PDG code (10LZZZAAAI).
- **Z** (*int*): Nuclear target Z.
- **A** (*int*): Nuclear target A.
- **hitnuc** (*int*): Hit nucleon PDG code (not set for coherent, inverse muon decay and ve- elastic events).
- **hitqrk** (*int*): Hit quark PDG code (set for deep-inelastic scattering events only).
- **sea** (*bool*): Hit quark is from sea (set for deep-inelastic scattering events only).
- **resid** (*bool*): Produced baryon resonance id (set for resonance events only).
- **qel** (*bool*): Is it a quasi-elastic scattering event?
- **res** (*bool*): Is it a resonanec neutrino-production event?
- **dis** (*bool*): Is it a deep-inelastic scattering event?
- **coh** (*bool*): Is it a coherent meson production event?
- **dfr** (*bool*): Is it a diffractive meson production event?
- **imd** (*bool*): Is it an invese muon decay event?
- **nuel** (*bool*): Is it a ve- elastic event?
- **cc** (*bool*): Is it a CC event?

- **nc** (*bool*): Is it a NC event?
- **charm** (*bool*): Produces charm?
- **neut_code** (*int*): The equivalent NEUT reaction code (if any).
- **nuance_code** (*int*): The equivalent NUANCE reaction code (if any).
- **wght** (*double*): Event weight.
- **xs** (*double*): Bjorken x (as was generated during the kinematical selection / off-shell kinematics).
- **ys** (*double*): Inelasticity y (as was generated during the kinematical selection / off-shell kinematics).
- **ts** (*double*): Energy transfer to nucleus (nucleon) at coherent (diffractive) production events (as was generated during the kinematical selection).
- **Q2s** (*double*): Momentum transfer Q^2 (as was generated during the kinematical selection / off-shell kinematics) (in GeV^2).
- **Ws** (*double*): Hadronic invariant mass W (as was generated during the kinematical selection / off-shell kinematics).
- **x** (*double*): Bjorken x (as computed from the event record).
- **y** (*double*): Inelasticity y (as computed from the event record).
- **t** (*double*): Energy transfer to nucleus (nucleon) at coherent (diffractive) production events (as computed from the event record).
- **Q2** (*double*): Momentum transfer Q^2 (as computed from the event record) (in GeV^2).
- **W** (*double*): Hadronic invariant mass W (as computed from the event record).
- **Ev** (*double*): Incoming neutrino energy (in GeV).
- **pxv** (*double*): Incoming neutrino px (in GeV).
- **pyv** (*double*): Incoming neutrino py (in GeV).
- **pzv** (*double*): Incoming neutrino pz (in GeV).
- **En** (*double*): Initial state hit nucleon energy (in GeV).
- **pxn** (*double*): Initial state hit nucleon px (in GeV).
- **pyn** (*double*): Initial state hit nucleon py (in GeV).
- **pzn** (*double*): Initial state hit nucleon pz (in GeV).
- **El** (*double*): Final state primary lepton energy (in GeV).
- **pxl** (*double*): Final state primary lepton px (in GeV).
- **pyl** (*double*): Final state primary lepton py (in GeV).
- **pzl** (*double*): Final state primary lepton pz (in GeV).
- **nfp** (*int*): Number of final state p and $\bar{p}$ (after intranuclear rescattering).

- **nfn** (*int*): Number of final state n and $\bar{n}$.
- **nfpip** (*int*): Number of final state π^+.
- **nfpim** (*int*): Number of final state π^-.
- **nfpi0** (*int*): Number of final state π^0.
- **nfkp** (*int*): Number of final state K^+.
- **nfkm** (*int*): Number of final state K^-.
- **nfk0** (*int*): Number of final state K^0 and $\bar{K^0}$.
- **nfem** (*int*): Number of final state γ, $e^-$and e^+.
- **nfother** (*int*): Number of heavier final state hadrons (D+/-,D0,Ds+/-,Lamda,Sigma,Lamda_c,Sigma_c,...).
- **nip** (*int*): Number of 'primary' ('primary' : before intranuclear rescattering) p and $\bar{p}$.
- **nin** (int): Number of 'primary' n and $\bar{n}$.
- **nipip** (*int*): Number of 'primary' π^+.
- **nipim** (*int*): Number of 'primary' π^-.
- **nipi0** (*int*): Number of 'primary' π^0.
- **nikp** (*int*): Number of 'primary' K^+.
- **nikm** (*int*): Number of 'primary' K^-.
- **nik0** *(int)*: Number of 'primary' K^0 and $\bar{K^0}$.
- **niem** (*int*): Number of 'primary' γ, $e^-$and e^+ (eg from nuclear de-excitations or from pre-intranuked resonance decays).
- **niother** (*int*): Number of other 'primary' hadron shower particles.
- **nf** (*int*): Number of final state particles in hadronic system.
- **pdgf** (*int[kNPmax]*): PDG code of k^{th} final state particle in hadronic system.
- **Ef** (*double[kNPmax]*): Energy of k^{th} final state particle in hadronic system (in GeV).
- **pxf** (*double[kNPmax]*): Px of k^{th} final state particle in hadronic system (in GeV).
- **pyf** (*double[kNPmax]*): Py of k^{th} final state particle in hadronic system (in GeV).
- **pzf** (*double[kNPmax]*): Pz of k^{th} final state particle in hadronic system (in GeV).
- **ni** (*int*): Number of particles in the 'primary' hadronic system ('primary' : before intranuclear rescattering).
- **pdgi** (*int[kNPmax]*): PDG code of k^{th} particle in 'primary' hadronic system.
- **Ei** (*double[kNPmax]*): Energy of k^{th} particle in 'primary' hadronic system (in GeV).
- **pxi** (*double[kNPmax]*): Px of k^{th} particle in 'primary' hadronic system (in GeV).

- **pyi** (*double[kNPmax]*): Py of k^{th} particle in 'primary' hadronic system (in GeV).
- **pzi** (*double[kNPmax]*): Pz of k^{th} particle in 'primary' hadronic system (in GeV).
- **vtxx** (*double*): Vertex x in detector coord system (in SI units).
- **vtxy** (*double*): Vertex y in detector coord system (in SI units).
- **vtxx** (*double*): Vertex z in detector coord system (in SI units).
- **vtxt** (*double*): Vertex t in detector coord system (in SI units).
- **calresp0** (*double*): An approximate calorimetric response to the generated hadronic vertex actibity, calculated by summing up: the kinetic energy for generated $\{\pi^+, \pi^-, p, n\}$, the energy+mass for generated $\{\bar{p}, \bar{n}\}$, the (e/h)*energy for generated $\{\pi^0, \gamma, e^-, e^+\}$ (with an e/h = 1.3) and the kinetic energy for any other generated particle.

Using ROOT to plot quantities stored in a 'gst' ntuple The 'gst' summary ntuples make it especially easy to plot GENIE information in a ROOT/CINT session. Some examples are given below:

1. To draw a histogram of the final state primary lepton energy for all ν_μ CC DIS interactions with an invariant mass $W > 3$ GeV, then type:
   ```
   root[0] gst->Draw("El","dis&&cc&&neu==14&&Ws>3");
   ```

2. To draw a histogram of all final state π^+ energies in CC RES interactions, then type:
   ```
   root[0] gst->Draw("Ef","pdgf==211&&res&&cc");
   ```

The 'gxml' format

The 'gxml' format is a GENIE XML-based event format[2].

Each event is included within <ghep> </ghep> tags as in:

```
<ghep np         = "{number of particles; int}"
      unphysical = "{is it physical?; boolean (T/F)}">

</ghep>
```

Both information with event-wide scope such as:

```
<wght>      {event weight; double}        </wght>
<xsec_evnt> {event cross section; double} </xsec_evnt>
<xsec_kine> {cross section for event kinematics; double} </xsec_kine>

<vx> {vertex x in detector coord system (SI); double} </vx>
<vy> {vertex y in detector coord system (SI); double} </vy>
<vz> {vertex z in detector coord system (SI); double} </vz>
<vt> {vertex t (SI); double} </vt>
```

[2] In the format description that follows, the curly braces within tags are to be 'viewed' as a single value of the specified type with the specified semantics. For example '{number of particles; int}' is to be thought of as an integer value describing a number particles.