Notes on the `GlueX FSRoot` Format

Ryan Mitchell

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Abstract

This document describes the `GlueX FSRoot` format.

Contents

1 Overview

The `GlueX FSRoot` format is a flat `TTree` format. All variables are `float`. Multiple combinations within an event are listed as separate `TTree` entries, just like entries from distinct events.

2 Final States

The `FSRoot` format can hold information from any final state composed of a combination of Λ (decaying to $p\pi^-$), $\overline{\Lambda}$ (decaying to $\bar{p}\pi^+$), e^+, e^-, μ^+, μ^-, p, $\bar{p}$, η (decaying to $\gamma\gamma$), γ, K^+, K^-, K_S^0 (decaying to $\pi^+\pi^-$), π^+, π^-, and π^0 (decaying to $\gamma\gamma$).

Final state particles are listed in trees in the following order:

```
Lambda ALambda e+ e- mu+ mu- p+ p- eta gamma K+ K- Ks pi+ pi- pi0
```

For example, in the process $\gamma p \to \pi^+\pi^- J/\psi p$; $J/\psi \to \mu^+\mu^-$, the μ^+ is particle 1, the μ^- is particle 2, the p is particle 3, the π^+ is particle 4, and the π^- is particle 5. Or as another example, in the process $\gamma p \to \gamma \chi_{c1} p$; $\chi_{c1} \to \eta\pi^0\pi^0$, the p is particle 1, the η is particle 2, the γ is particle 3, one π^0 is particle 4, and the other π^0 is particle 5. In cases like this where there are identical particles, no ordering is assumed.

3 Event Information

The "Event Information" variables contain information about the event as a whole:

```
Run:          run number
Event:        event number
Chi2:         chi2 of the kinematic fit
Chi2DOF:      chi2/dof of the kinematic fit
RFTime:       RF time determined from the kinematic fit
RFDeltaT:     difference between RF time and beam photon time
EnUnusedSh:   total energy of unused showers
ProdVx:       production vertex parameters
ProdVy:          "
ProdVz:          "
ProdVt:          "
PxPB:         kinematically fit beam parameters
PyPB:            "
PzPB:            "
EnPB:            "
RPxPB:        measured beam parameters
RPyPB:           "
RPzPB:           "
REnPB:           "
```

4 Particle Four-Momenta

The "Particle Four-Momenta" variables contain the four-momentum for each particle in the final state:

```
(prefix)PxP(n):  x momentum of particle (n)
(prefix)PyP(n):  y momentum of particle (n)
(prefix)PzP(n):  z momentum of particle (n)
(prefix)EnP(n):  energy of particle (n)
```

Different types of four-momenta are distinguished using prefixes. Raw four-momenta have a prefix R; the final four-momenta (the fully-constrained four-momenta resulting

from the kinematic fit) have no prefix.

Different particles are differentiated using the postfix `P(n)`, where `(n)` is the number of the particle in the ordered list. Four-momenta for secondaries originating from particle `(n)`, such as the two γ's from a π^0, are recorded using `P(n)a` and `P(n)b`, where the ordering follows the same conventions as above, or, in the case of identical daughter particles, no ordering is assumed. As two examples: in the process $\gamma p \to \pi^+ \pi^- J/\psi p; J/\psi \to \mu^+ \mu^-$, the raw energy of the π^+ is given by `REnP4`; and in the process $\gamma p \to \pi^+ \pi^- J/\psi p; J/\psi \to \pi^+ \pi^- \pi^0$, the y-momentum of a photon from the π^0 decay, after the kinematic fit, is given by `PyP6b`.

5   Track Information

Track information is written out for every reconstructed track that is part of a final state. The postfix `P(n)` follows the same convention as for the four-momenta (section 4).

```
TkChi2P(n):   chi2 of the track fit
TkNDFP(n):    number of degrees of freedom for the track fit
```