MarlinRave

An Alternative for Vertexing and Kinematic Fitting within Marlin

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The Rave Toolkit

http://projects.hepforge.org/rave/

- Toolkit in form of a shared library providing vertex finding and fitting tools
- Written in C++ with bindings to Java as well
- Has its roots in the CMS vertexing community
- Source code compatibility with CMSSW
- Thoroughly tested code
- Full range of robust vertexing algorithms
- B-Tagging
- Kinematic fitting

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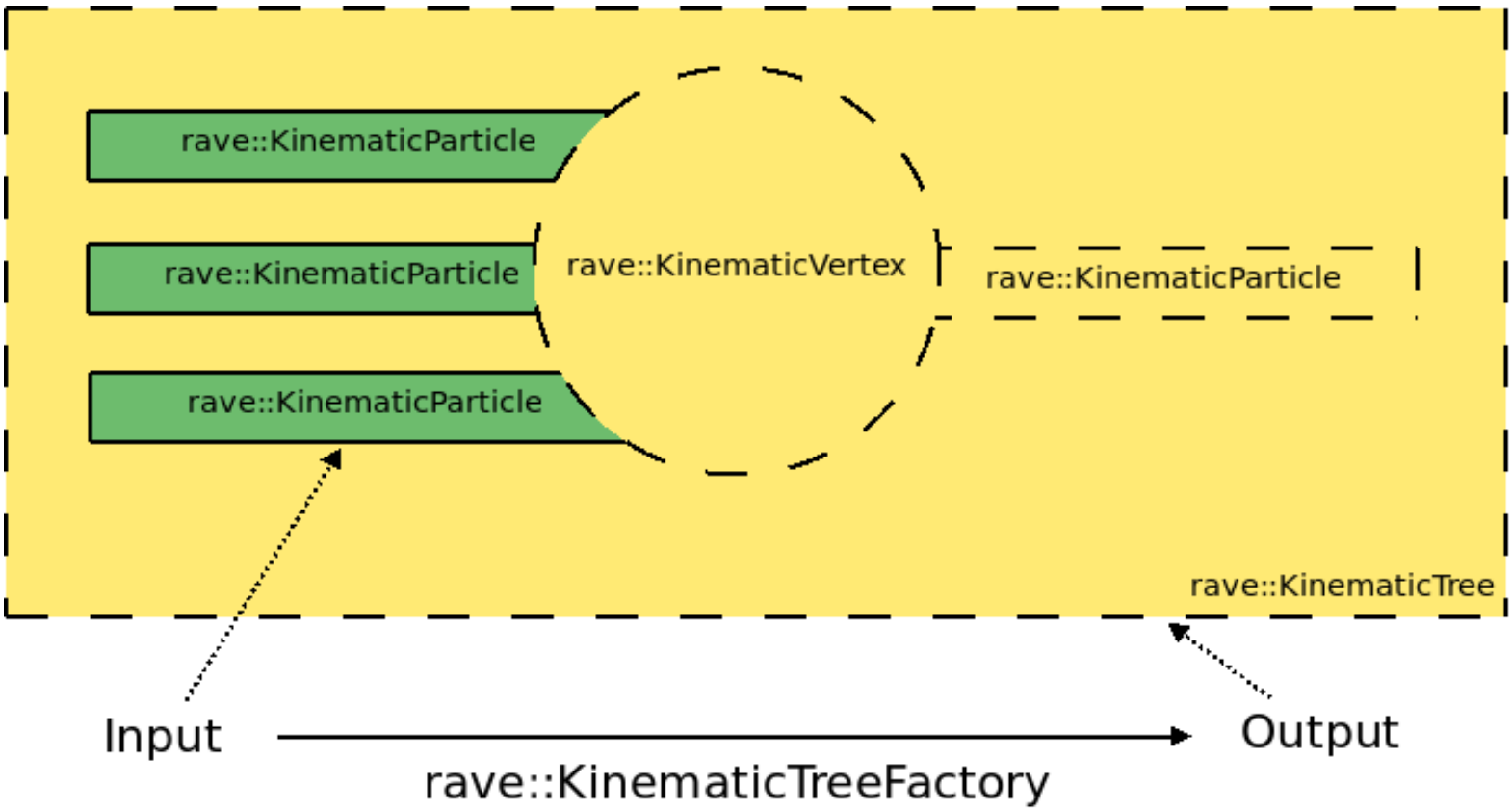

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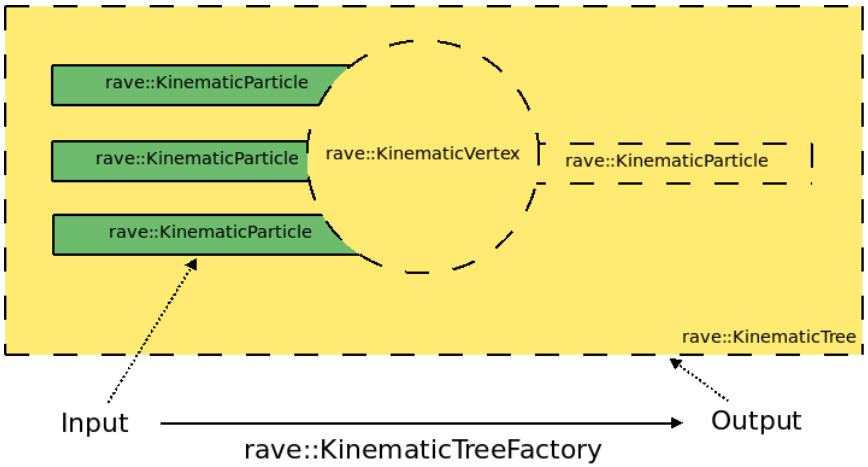

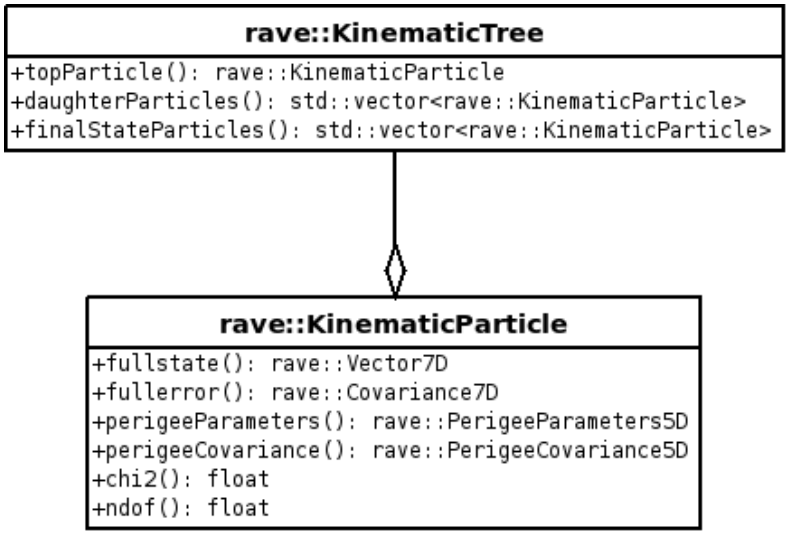

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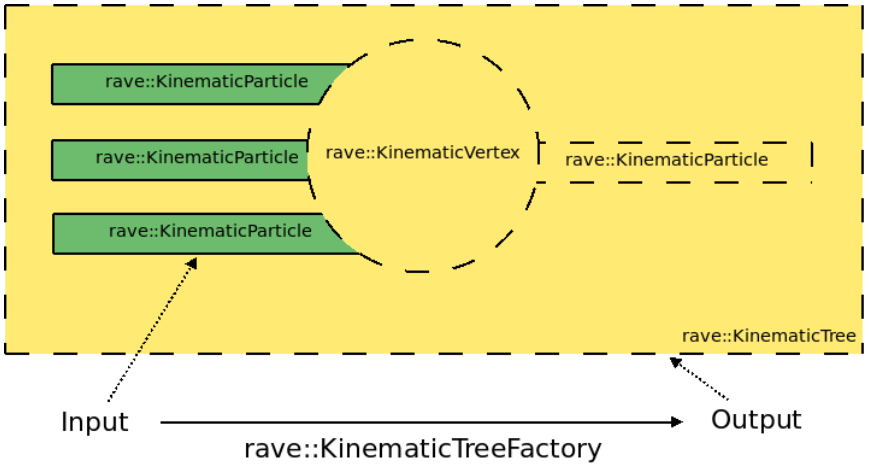

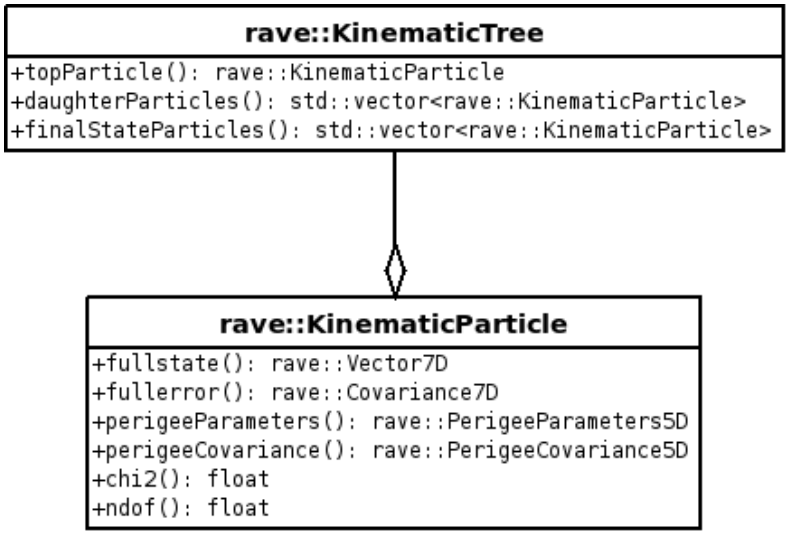


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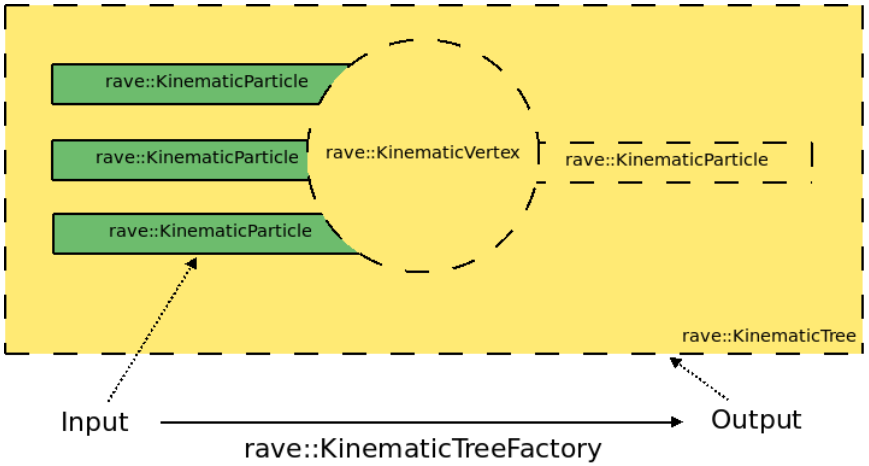

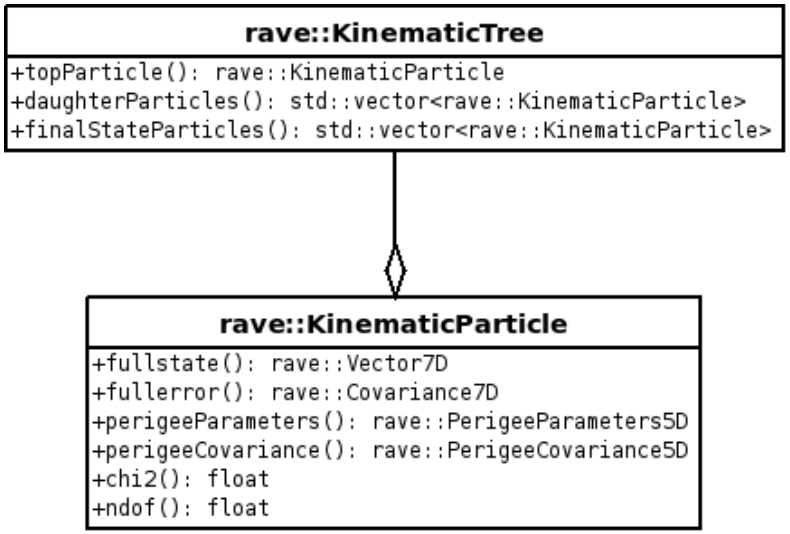


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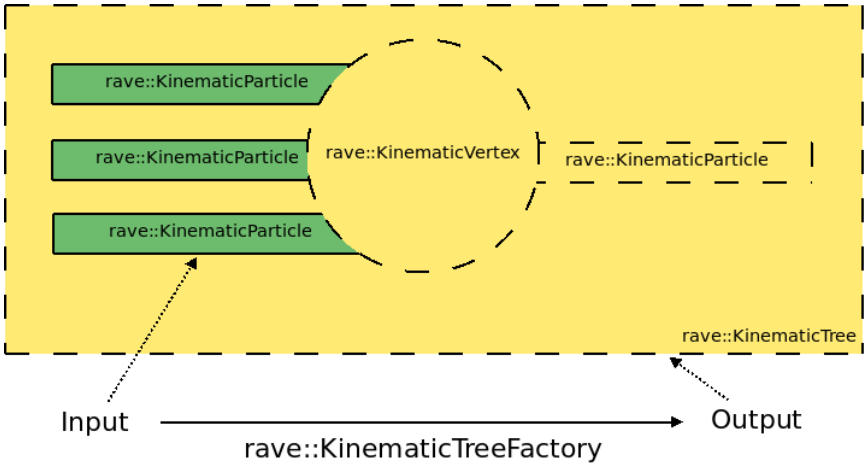

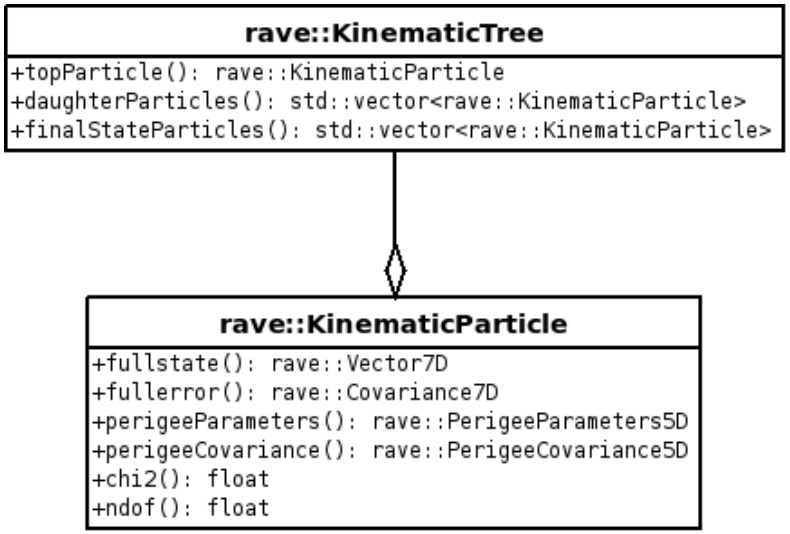


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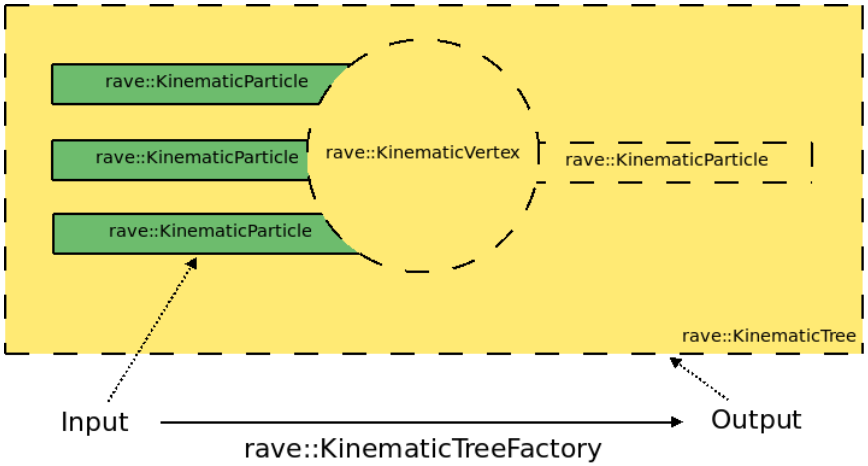

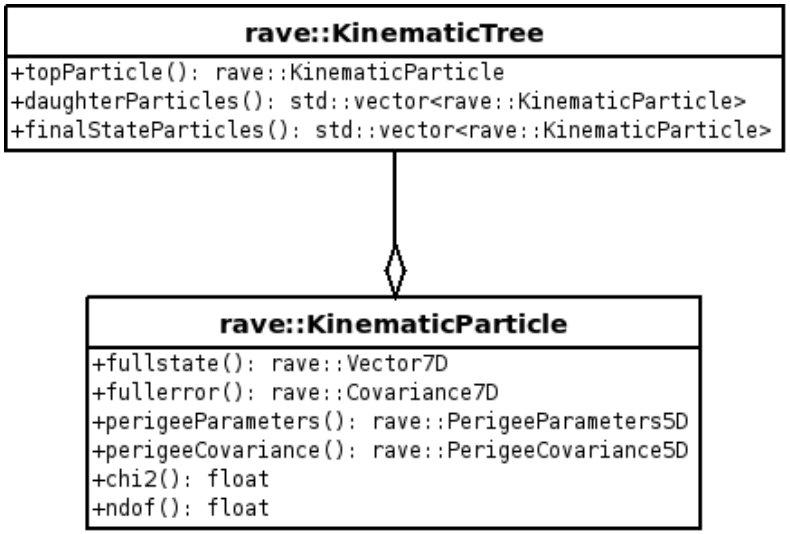


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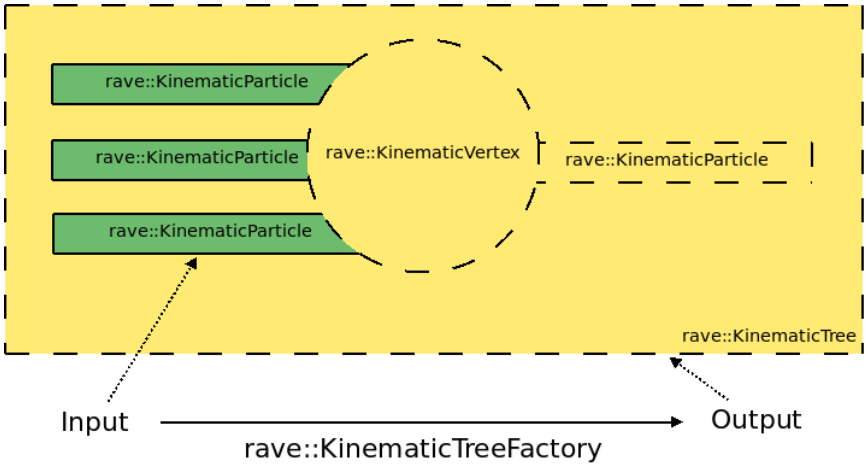

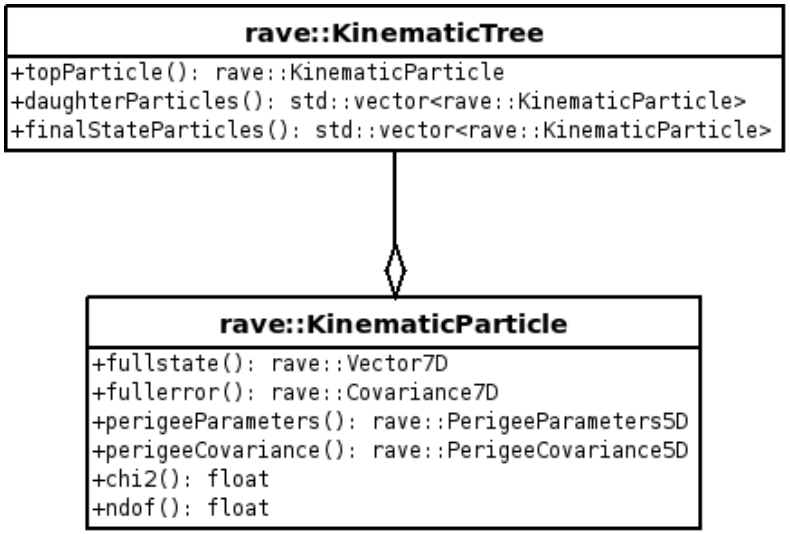


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rave::KinematicConstraintBuilder
+createFourMomentumKinematicConstraint(momentum:rave::Vector4D, deviation:rave::Vector4D): rave::KinematicConstraint
+createMassKinematicConstraint(mass:const float, sigma:const float): rave::KinematicConstraint
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The Marlin Processors

RaveVertexing Takes a `LCIO::Track` collection and produces a refitted `LCIO::Track` collection and a `EVENT::Vertex` collection.

RaveKinematics Takes a `LCIO::ReconstructedParticle` collection and produces a collection of new and refitted `LCIO::ReconstructedParticles` representing the edges of the `rave::KinematicTree` togehter with a `LCIO::Vertex` collection holding its nodes.

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  <parameter name="Verbose" type="int">0 </parameter>
  <parameter name="Vertices" type="string">Vertices </parameter>
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</processor>
```

Available Methods:

- default Standard Kalman filter
- tkf Trimmed Kalman vertex finder
- avf Adaptive vertex finder/fitter
- mvf Multi vertex finder/fitter

All methods accept optional tuning parameters.

Performance has been shown in Berlin 2008 and Hamburg in May/June 2007

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Currently available topologies:

SingleVertex Fits all given particles to one vertex

TwoTrackMass Assumes an invariant mass of the first two given particles

WW4Jet Takes four jets and pairs them to two Ws histogramming the resulting W masses

New topologies are easily introduced by pasting them into the "topologies" directory of the MarlinRave processor

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The RaveKinematics Processor 2

The SingleVertex topology

```
#include "KinematicTopology.h"
#include <rave/KinematicTreeFactory.h>

class TopologySingleVertex :
  public KinematicTopology
{
  public:
    std::string describe() const {
      return "Reconstructs a mother particle from all given daughters.";
    };

    rave::KinematicTree build(
        const rave::KinematicTreeFactory & factory,
        const std::vector< rave::KinematicParticle > & particles,
        const int verbose = 0) const {
      return factory.useVertexFitter( particles );
    };

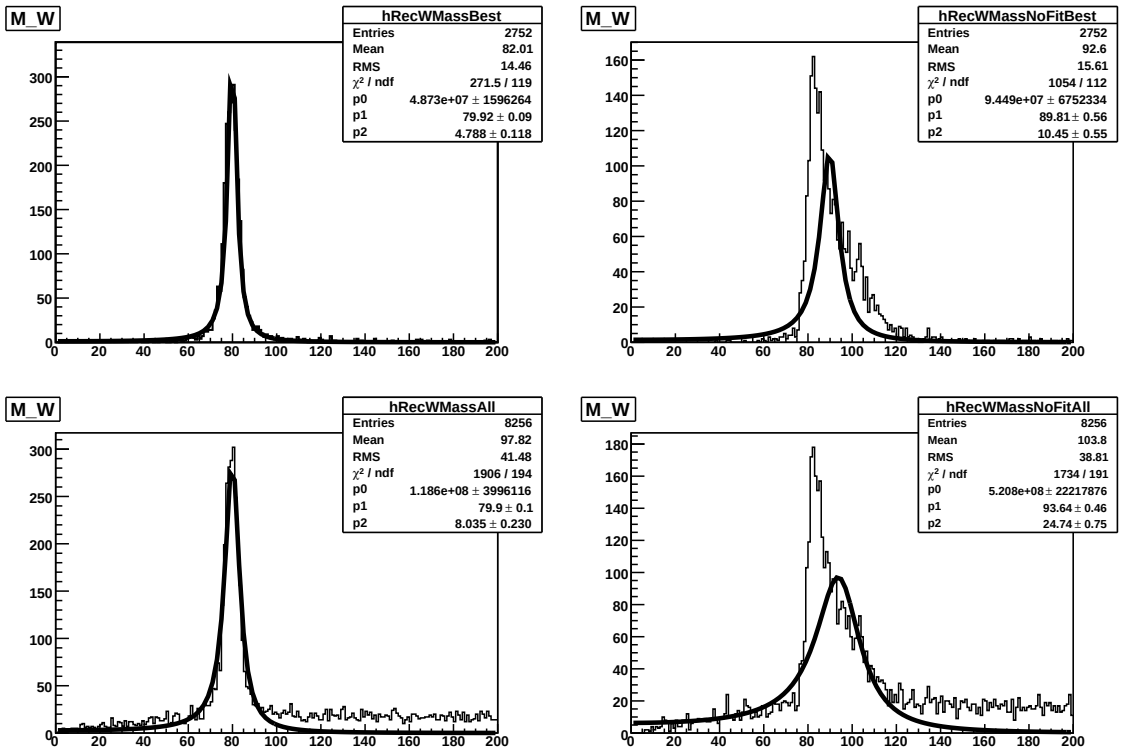
    bool valid() const { return true; };
};

#include "TopologyBuilder.h"
namespace {
  TopologyBuilder<TopologySingleVertex> t( "SingleVertex", "Only vertex" );
}
```

The RaveKinematics Processor 3

Reconstruction of $WW \longrightarrow 4jet$ input events

Constraint to 500 GeV CME; Best association between jets and Ws.



$30\%/\sqrt{E}$ energy resolution and angular resolution of 10 mrad both on ϕ and θ.

MarlinRave Installation

- The MarlinRave build system is CMake which should faciliate integration into the existing Marlin toolchain.
- The Rave library is fully integrated, automatically built along with MarlinRave and statically linked to it. (Presence of Autotools is required for Rave to build automatically)
- For detailed instructions please visit the MarlinRave wiki page at http://projects.hepforge.org/rave/trac/wiki/MarlinRave
- If accepted, integration into the ilcinstall setup scripts should be easliy realized

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MarlinRave Installation

- The MarlinRave build system is CMake which should faciliate integration into the existing Marlin toolchain.
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Summary

- Rave provides full CMSSW vertex finding and fitting facilities and parts of its kinematic fitting algorithms
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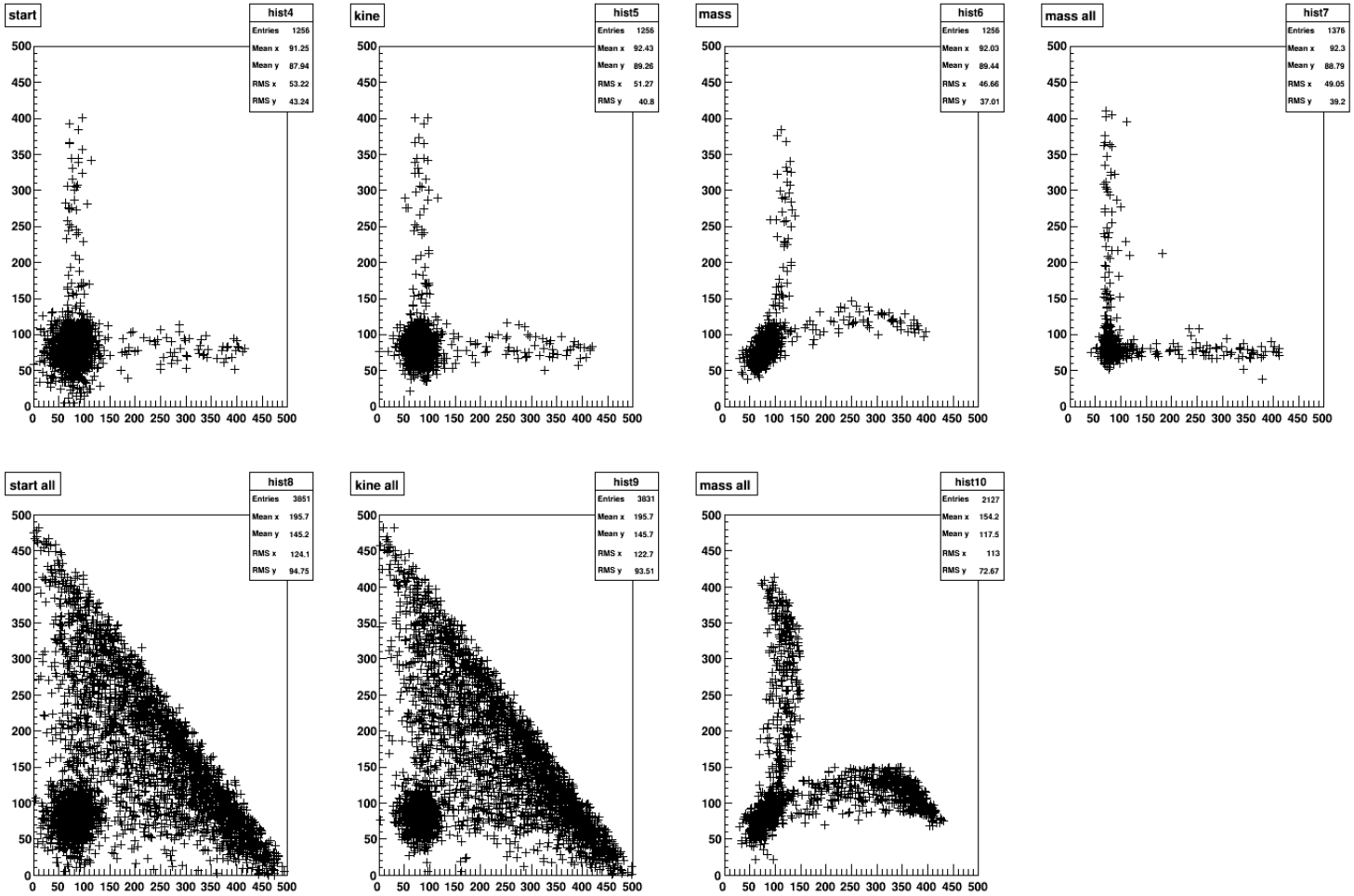
Why no mass constraint?

PiPlots W masses against each other



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1D Hist of W masses