Subject: Vertex fitter for two consecutive decays
Posted by Karin Schönning on Tue, 25 Nov 2014 10:49:49 GMT
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Dear Pandaroot experts,

I am trying to use the vertex fitter to improve the resolution of the Xi- mass, reconstructing Xi- from the decay Xi- -> Lambda pi-, Lambda -> p pi- .
I have used the vertex fitter for the lambda and it works. I take the fitted lambda candidates and combine with a pion which I have checked, using MC truth match, that it is a daughter of Xi- and not Lambda. Then I try to apply the vertex fit again, see below:

```
------------------------------------------------------------------------ ------------------------

Xi.Combine(goodlam,pim);
 Xibar.Combine(goodlamb,pip);
 for (j=0;j<Xi.GetLength();++j)
 {
   //PndVtxPRG vtxfitterx(Xi[j]);
     PndKinVtxFitter vtxfitterx(Xi[j]);        // instantiate a vertex fitter

  bool checkx = vtxfitterx.Fit();
  double chi2_vtx = vtxfitterx.GetChi2(); // access chi2 of fit
  double prob_vtx = vtxfitterx.GetProb(); // access probability of fit

  if (checkx)                              // when good enough, fill some histos
  {

    RhoCandidate *Xiv = Xi[j]->GetFit(); // access the fitted cand
   TVector3 lVtx=Xiv->Pos();
   double Ximassv=Xiv->M();
   double xivz=lVtx.Z();

   cout<<"Xibar mass : "<<Xi[j]->M()<<endl;
   cout<<"Xibar mass vertex: "<<Ximassv<<endl;
   cout<<"Xibar vertex z: "<<xivz<<endl;

   Ximass->Fill(Xiv->M());}

 }


---------------------------------------------------------------------
```

But when running this I get into trouble, the printout is shown below. Is the vertex fitter supposed to work in this way or does it only handle single vertices?

```
Error in <TDecompLU::DecomposeLUCrout>: matrix is singular
Error in <TDecompLU::InvertLU>: matrix is singular, 0 diag elements < tolerance of 2.2204e-16
Xibar mass : 0.186496
Xibar mass vertex: 0.167329
Xibar vertex z: 69.2357
```

Xibar mass : 1.32154
Xibar mass vertex: -nan
Xibar vertex z: -nan
Xibar mass : 1.31012
Xibar mass vertex: -nan
Xibar vertex z: -nan
Xibar mass : 1.32721
Xibar mass vertex: -nan
Xibar vertex z: -nan

Does anybody have an idea of what one can do about this?

Kindest regards,
/Karin

Subject: Re: Vertex fitter for two consecutive decays
Posted by Ralf Kliemt on Tue, 25 Nov 2014 11:00:02 GMT
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Hi Karin,

The Lambda is a neutrlly charged particle. Our fitters cannot create avalid Helix & Covariance from that.
Since the Xi does fly some distance my only suggestion is you try and make an analytical helix-line point-of-closest-approach finder by hand.

Cheers
Ralf

Subject: Re: Vertex fitter for two consecutive decays
Posted by Klaus Götzen on Tue, 25 Nov 2014 11:01:48 GMT
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Hi Karin,

I don't see how you can fit a second secondary vertex (of the Xi-), since this vertex is not constraint by at least two charged tracks. A decay X -> pi+ pi- Lambda could deliver something like that, but not one with X -> pi- Lambda.

Best,
Klaus

Subject: Re: Vertex fitter for two consecutive decays

Posted by Karin Schönning on Tue, 25 Nov 2014 11:04:55 GMT
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Thanks for the rapid response. I wasn't aware of the inner machinery and thought that maybe one could make a fit based on four vectors instead.

Cheers,
/Karin

Subject: Re: Vertex fitter for two consecutive decays
Posted by StefanoSpataro on Tue, 25 Nov 2014 11:05:07 GMT
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Why not? A neutral track has a momentum, a direction, and a covariance matrix, you can variate such parameters to find better values, moreover adding a charged track you can find the PVA point, thus finding the production point of the charged.
I think this is a feature missing in the code, but this is possible to implement.

Subject: Re: Vertex fitter for two consecutive decays
Posted by Karin Schönning on Tue, 25 Nov 2014 11:18:49 GMT
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In Erik Thomé's thesis he writes that

He used the old framework but since this is on the analysis level maybe there is only some cutting and pasting required. I will try to get a hold of him (he quitted academia and I am not sure if his email works) and check if he has some code on his own or if there was some standard part of pandora.

Cheers,
/Karin