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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 IVtx=Xiv->Pos();  
        double Ximassv=Xiv->M();  
        double xivz=IVtx.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

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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 neutrally charged particle. Our fitters cannot create a valid 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

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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 constrained by at least two charged tracks. A decay  $X \rightarrow \pi^+ \pi^- \Lambda$  could deliver something like that, but not one with  $X \rightarrow \pi^- \Lambda$ .

Best,  
Klaus

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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

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Subject: Re: Vertex fitter for two consecutive decays

Posted by [Stefano Spataro](#) 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 vary 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.

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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

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