
Subject: [FIXED] Problems with PndKinFitter::AddMassConstraint

Posted by [Stefano Spataro](#) on Mon, 05 May 2014 15:54:34 GMT

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Dear all,

most probably the "analysis" topic would be better, but since I did the tests with fast sim then I report here.

I run the standard $\psi(2S) \rightarrow J/\psi \pi^+ \pi^-$ which you can find in macro/scrut simulation macros. I modified the analysis macro (ana_ste.C) in order to have montecarlo ID and to plot some variables from the fit. The analysis macro is attached.

If I take my $J/\psi \pi^+ \pi^-$ combinations (ψ) and put a 4 constraint fit:

```
PndKinFitter kinfit(ψ2s[j]);  
    kinfit.Add4MomConstraint(ini);  
kinfit.Fit();
```

I have decent results:

You can see the original invariant mass, the fitted invariant mass (RMS from 48 MeV to 50 KeV), χ^2 peaked around 3 (4 degrees of freedom), flat probability between 0 and 1.

But if I try to apply a mass constraint fit to only the $\mu^+ \mu^-$ (J/ψ):

```
PndKinFitter mfitter(jψ[j]); // instantiate the PndKinFitter in ψ(2S)  
mfitter.AddMassConstraint(m0_ψ); // add the mass constraint  
mfitter.Fit(); // do fit
```

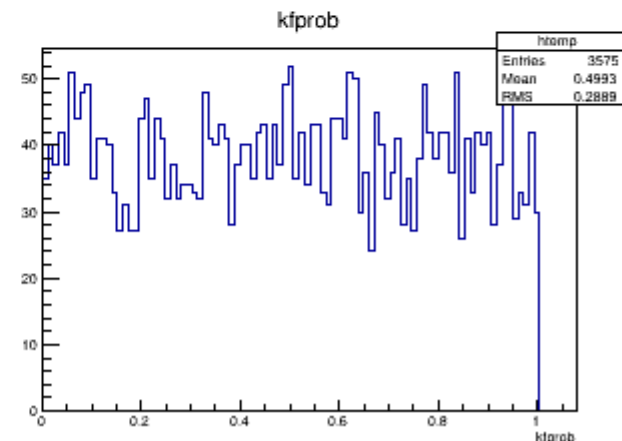
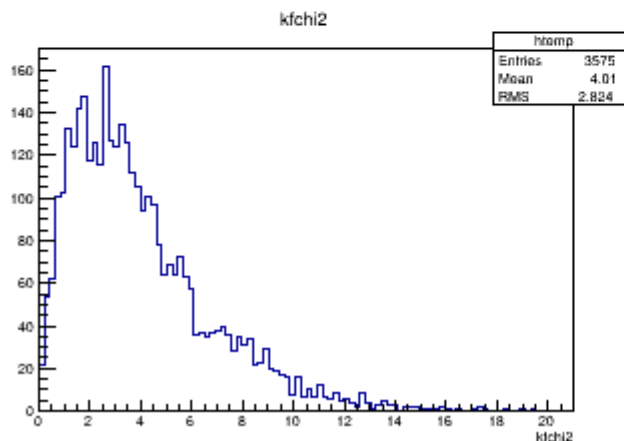
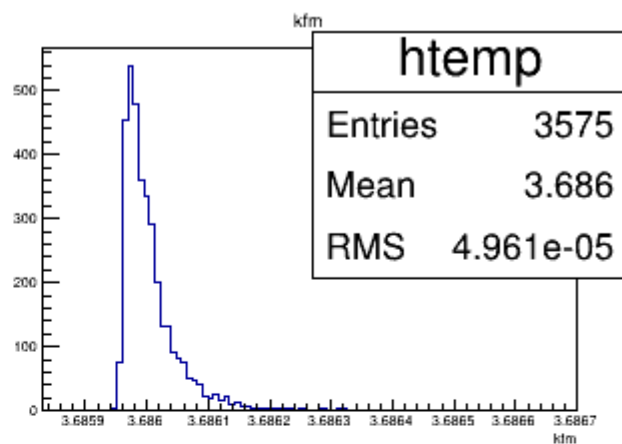
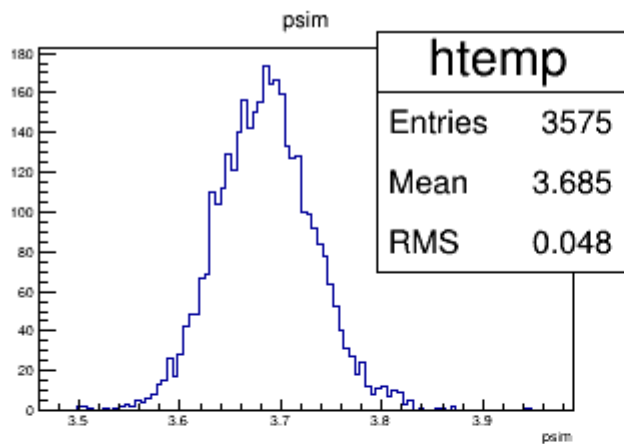
Then the results are not so fine:

Invariant mass before and after the fit (RMS from 46 MeV top 6 MeV, which is a big value considering that it is a mass constraint fit and it should be a delta, 1 NDF), χ^2 peaked at very low values, and prob not flat.

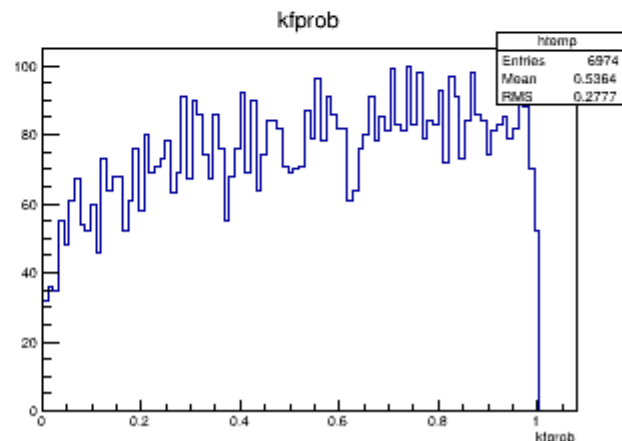
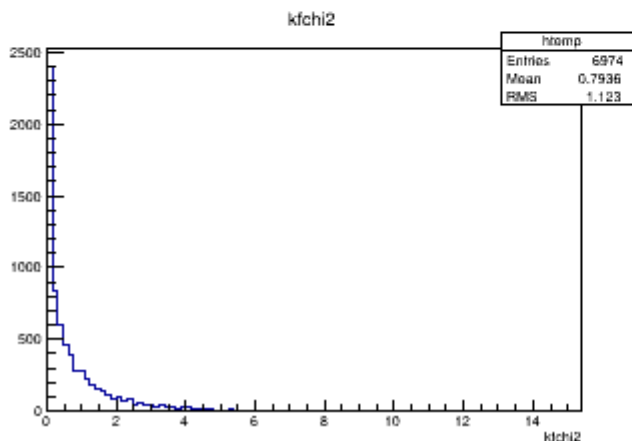
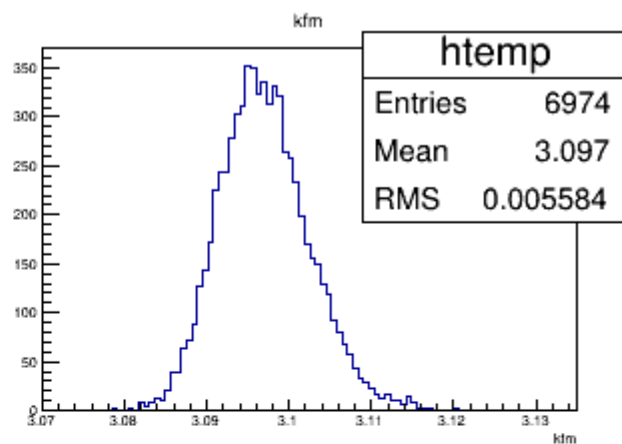
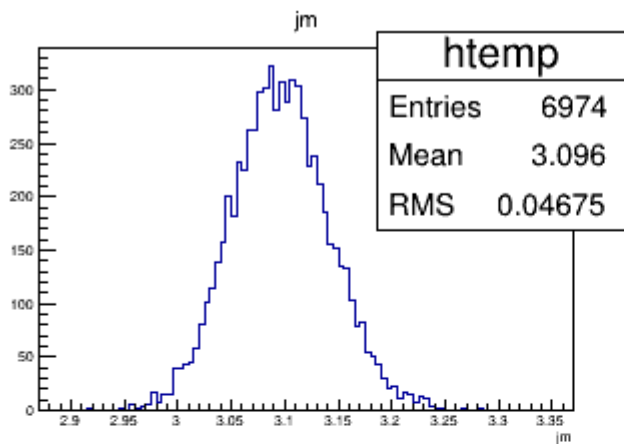
I would say tht the AddMassConstraint function has some problems.

File Attachments

1) [ψ.gif](#), downloaded 1158 times



2) [jpsi.gif](#), downloaded 1216 times



3) [ana_ste.C](#), downloaded 579 times

Subject: Re: Problems with PndKinFitter::AddMassConstraint
Posted by [StefanoSpataro](#) on Tue, 06 May 2014 08:39:40 GMT
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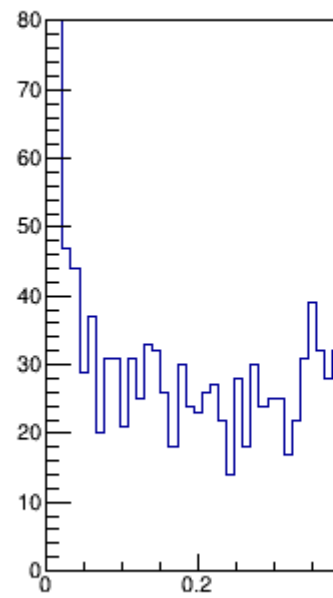
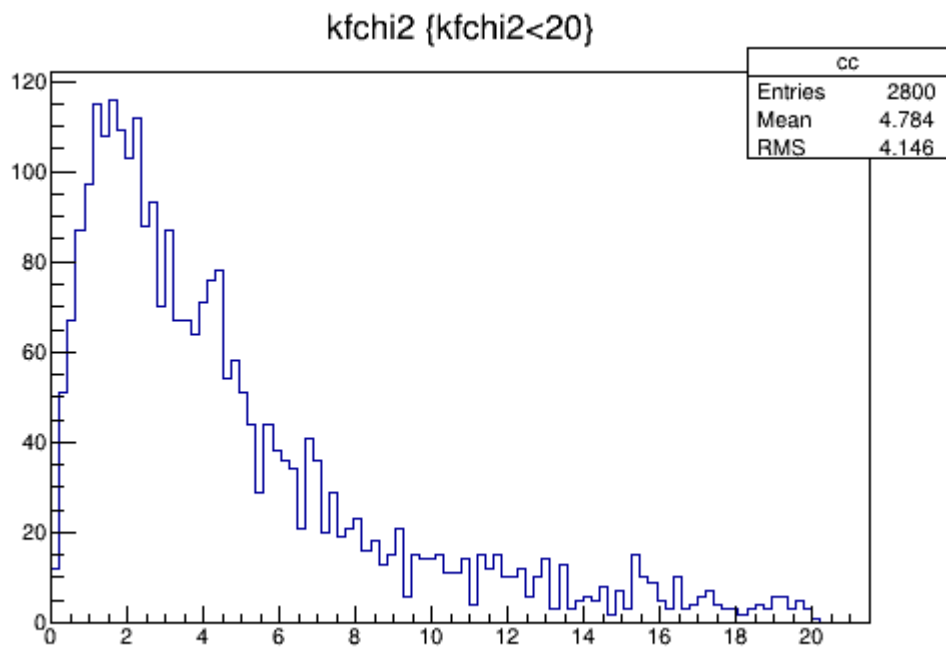
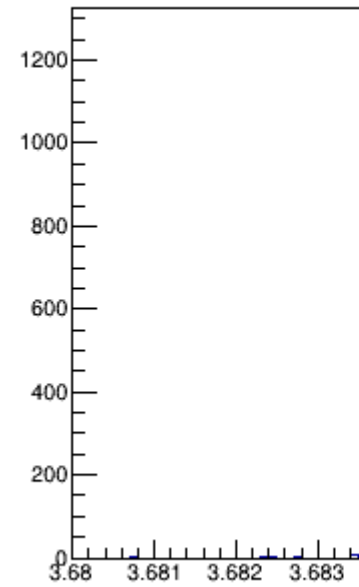
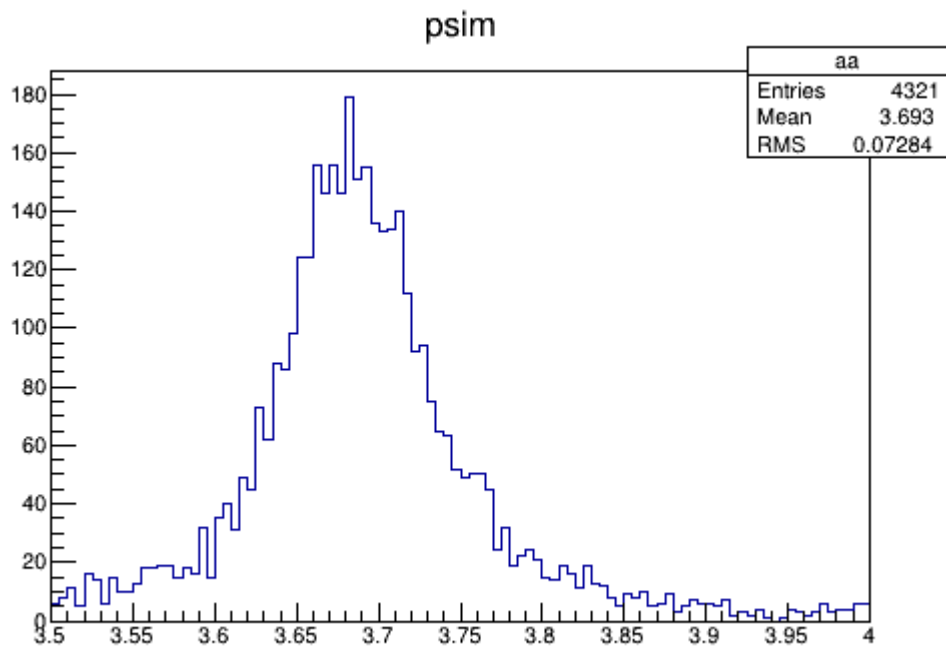
For completeness I attach here the plots obtained with full reco. The behaviour is the same of the fast sim.

psi(2S)

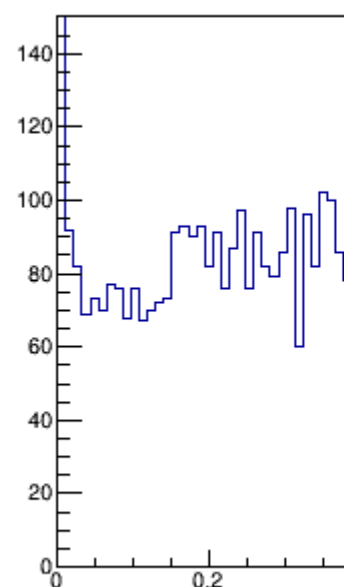
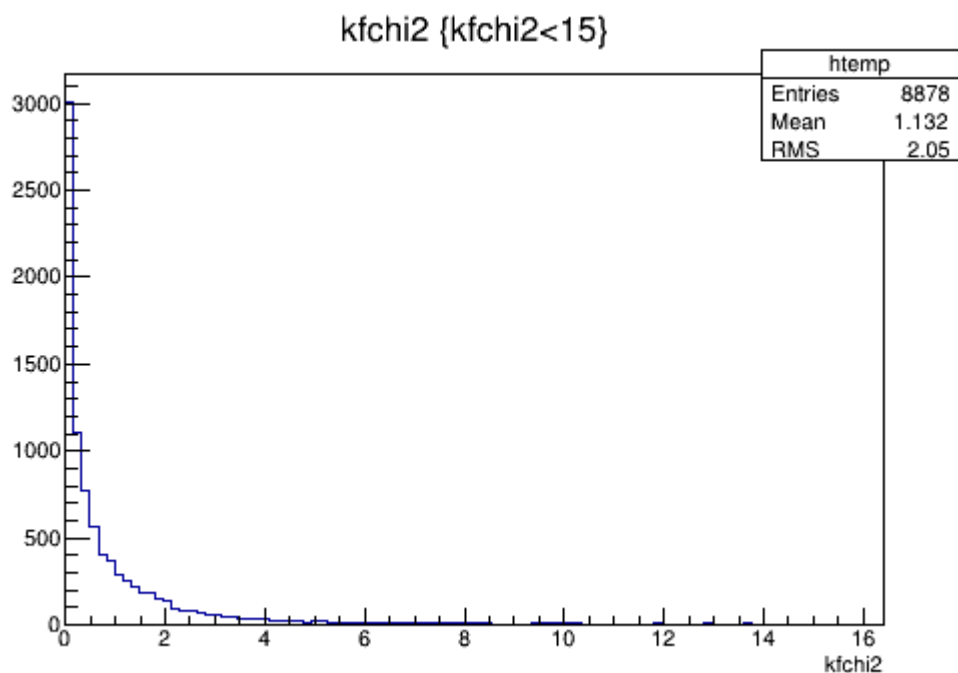
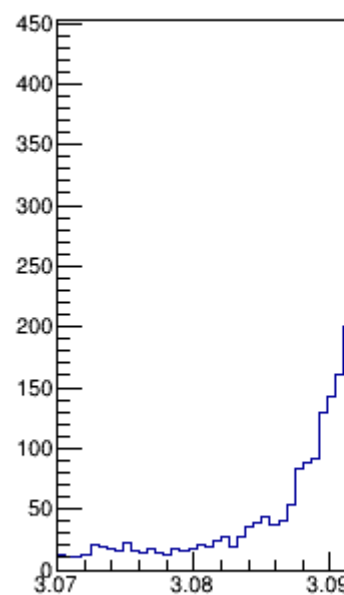
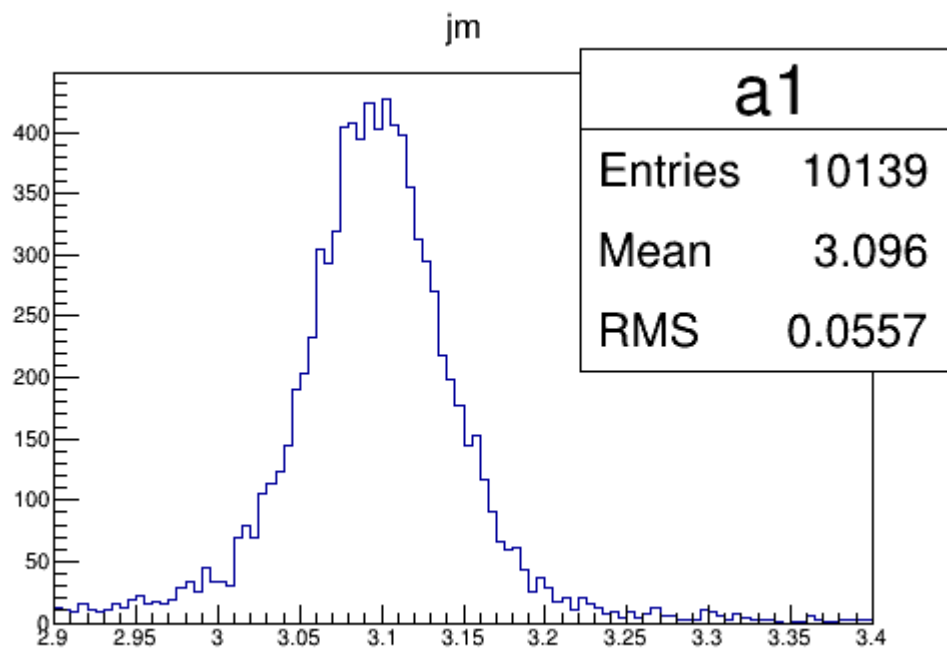
J/psi

File Attachments

1) [psi_full.gif](#), downloaded 839 times



2) [jpsi_full.gif](#), downloaded 765 times



Subject: Re: Problems with PndKinFitter::AddMassConstraint

Posted by [Ralf Kliemt](#) on Wed, 07 May 2014 13:36:02 GMT

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Hi Stefano.

Why should the mass after the fit be a delta peak? The fitter tries to match the constraint by adjusting the final state four-momenta within the errors in a linearized way. The fitted composites are then recalculated by that adjusted final state. As you can see the resolution is much better after the fit.

Cheers
Ralf

Subject: Re: Problems with PndKinFitter::AddMassConstraint
Posted by [StefanoSpataro](#) on Wed, 07 May 2014 15:32:57 GMT

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This is a mass constraint fit, you force the total mass being a defined value, and then you use the modified parameters to check other distributions (i.e. you fit the j/psi mass and check the improvement in the resolution of psi mass). The mass must be a delta, or must have sigma much narrower than resolution... in this case you have only one moderate improvement. The 4C fitter works nicely and you have a delta there, or better a very narrow distribution. A broader distribution means that the fit did not converge to a global minimum, and I am not surprised seeing that chi2 distribution.

The main question is: why the chi2 distribution is screwed? Once fixing this, I believe the fitter will produce good results. The fact that the 4C fitters works nicely, in both full and fast sim, means that covariances are fine.

Subject: Re: Problems with PndKinFitter::AddMassConstraint
Posted by [StefanoSpataro](#) on Fri, 09 May 2014 15:05:23 GMT

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Hi,
I have received this answer from Vishwajeet:

Quote:Dear Stefano,

What you are looking at is a simplistic Mass constraint fit which fixes everything with respect to the constrained mass.

I had a look at the PndKinFitter class.

The delta mass peak can be obtained by replacing (line : 339 -348 Trunk version (rev: 21681) by the following code snippet

```
fmD[fNc+0][kN+0] = -2.*Px;  
fmD[fNc+0][kN+1] = -2.*Py;;  
fmD[fNc+0][kN+2] = -2.*Pz;  
fmD[fNc+0][kN+3] = 2.*Etot;  
fmD[fNc+0][kN+4] = 2.*a*Py;  
fmD[fNc+0][kN+5] = -2.*a*Px;  
fmD[fNc+0][kN+6] = 0.0;
```

I have tested it with the macro in /macro/run/ana_complete.C Unfortunately my wiki and forum login access is no longer there (as it was with my FZ email) .

Actually the full mass constraint fit should include the vertex information and this can be

implemented with not much effort.

I will see if I can do that. In that case, what Ralf pointed out in the forum is right.

Please tell me if it is fine.

cheers,
Vishwajeet

Subject: Re: Problems with PndKinFitter::AddMassConstraint
Posted by [Ralf Kliemt](#) on Mon, 12 May 2014 10:26:43 GMT
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Hi Stefano,

I tried these matrices and find a good behaviour in the Compound system mass.

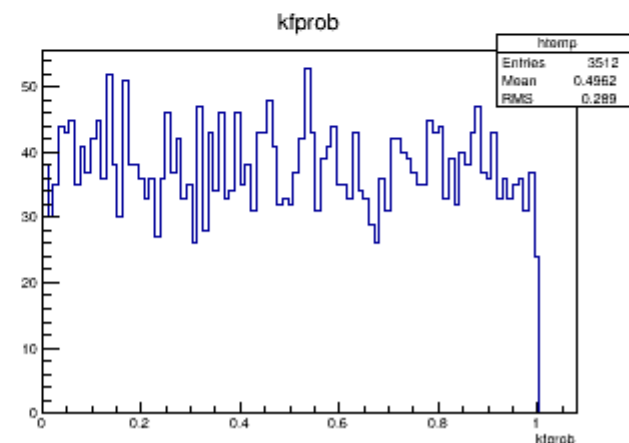
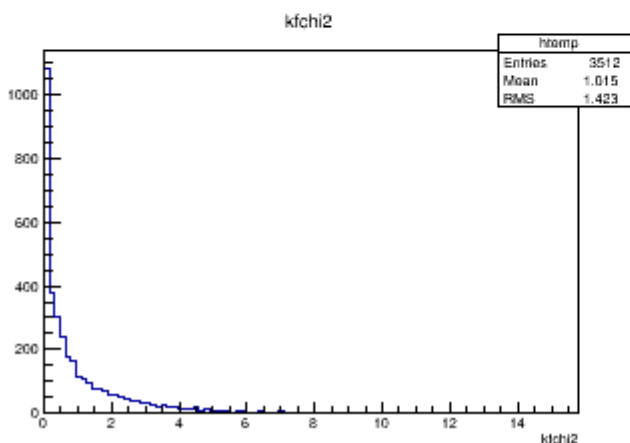
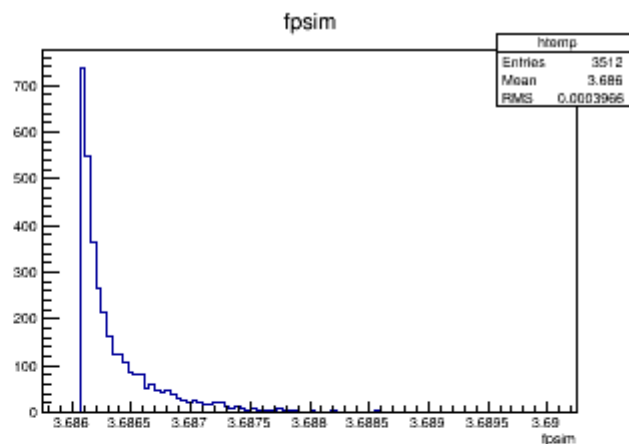
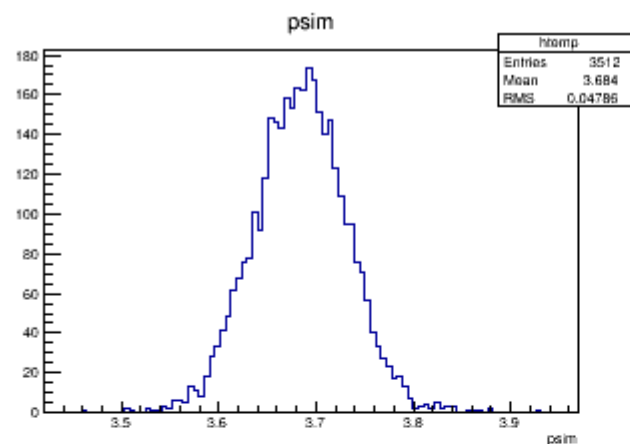
You see the $\Psi(2S)$ is reconstructed "as a needle". However, the pion masses differ, which is expected because their masses are not constrained entering the fit.

Shall I submit those changes to the trunk?

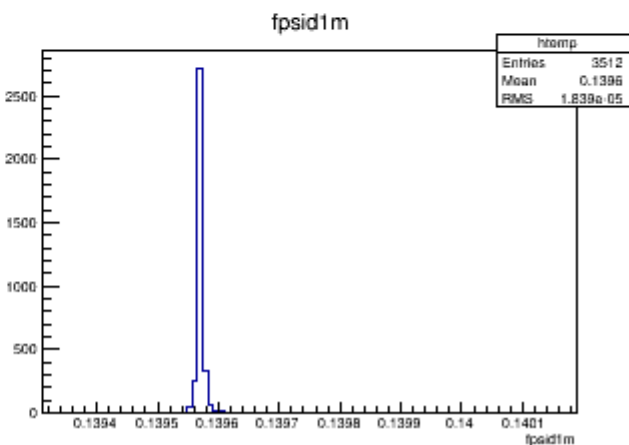
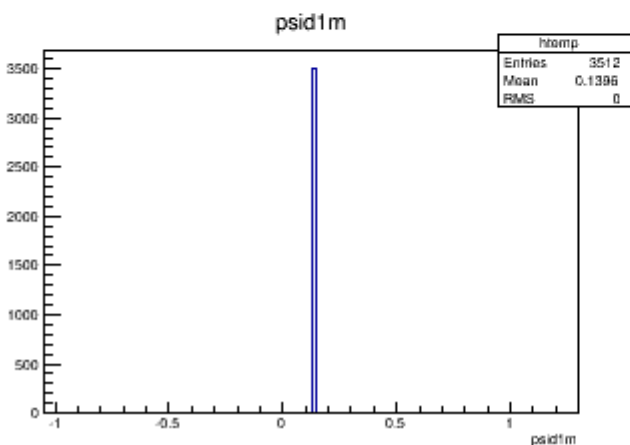
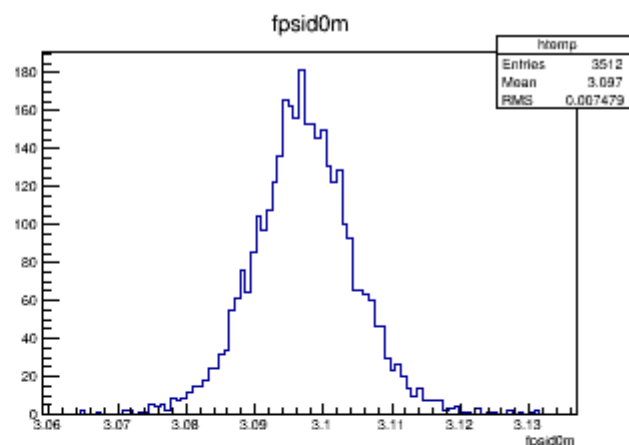
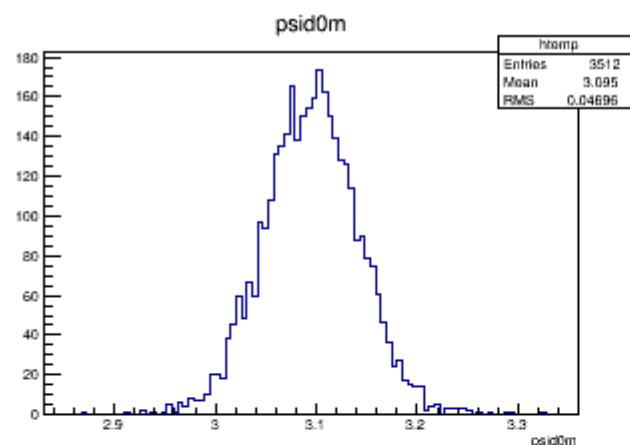
Cheers
Ralf

File Attachments

1) [kftest.gif](#), downloaded 735 times



2) [kfdtst.gif](#), downloaded 873 times



Subject: Re: Problems with PndKinFitter::AddMassConstraint

Posted by [Ralf Kliemt](#) on Mon, 12 May 2014 10:33:02 GMT

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Hi Stefano,

I tried these matrices and find a good behaviour in the Compound system mass.

You see the $\Psi(2S)$ is reconstructed "as a needle". However, the pion masses differ, which is expected because their masses are not constrained entering the fit.

Shall I submit those changes to the trunk?

Cheers

Ralf

Subject: Re: Problems with PndKinFitter::AddMassConstraint

Posted by [Stefano Spataro](#) on Mon, 12 May 2014 10:34:16 GMT

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Mass and probability seems fine, still the χ^2 is strange. But checking the code it seems it is calculated in the same way of other constraint fits, I don't understand...

Subject: Re: Problems with PndKinFitter::AddMassConstraint

Posted by [Ralf Kliemt](#) on Mon, 12 May 2014 12:22:16 GMT

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Well, the χ^2 function should look like that for $\text{ndf}=1$.

See: http://en.wikipedia.org/wiki/Chi-squared_distribution

Ralf

Subject: Re: Problems with PndKinFitter::AddMassConstraint

Posted by [Stefano Spataro](#) on Mon, 12 May 2014 12:27:14 GMT

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Ok, then you can commit

Subject: Re: Problems with PndKinFitter::AddMassConstraint

Posted by [Ralf Kliemt](#) on Mon, 12 May 2014 13:33:04 GMT

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Well.

I submitted it to both, the trunk and scrut14. I suppose people want to use it today.

Ralf

Subject: Re: Problems with PndKinFitter::AddMassConstraint
Posted by [Stefano Spataro](#) on Tue, 13 May 2014 14:57:13 GMT
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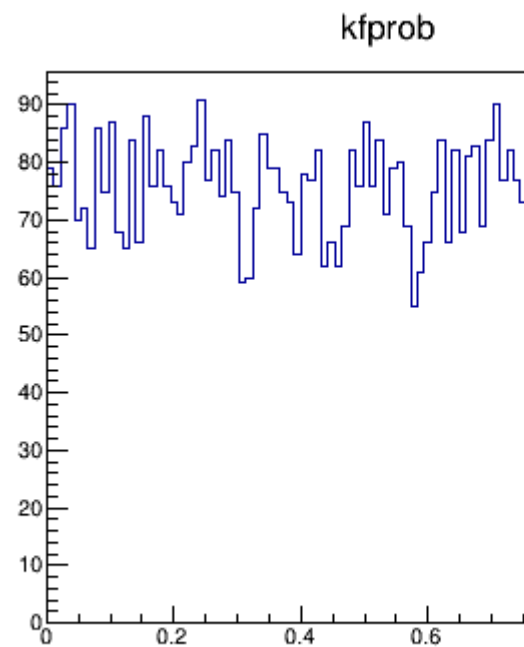
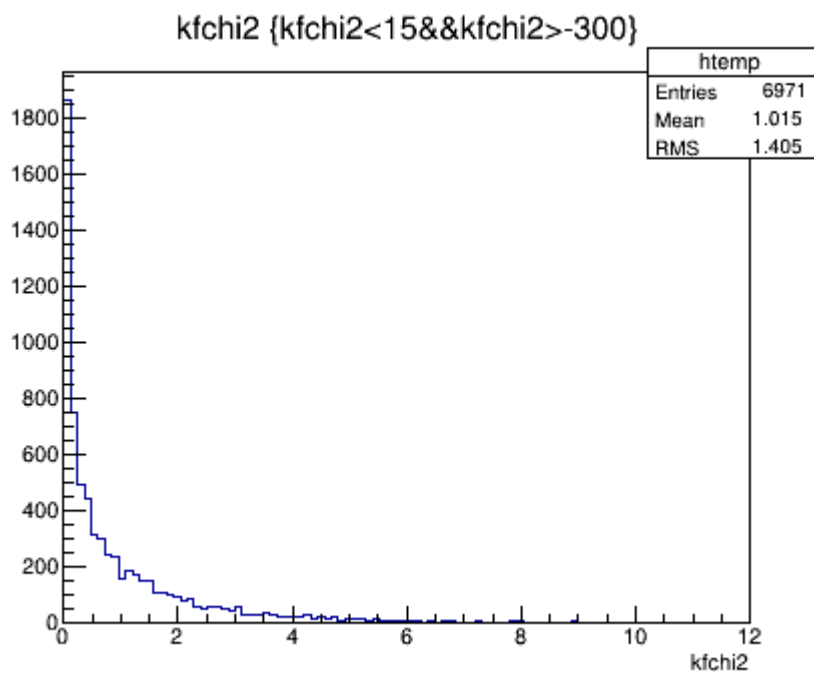
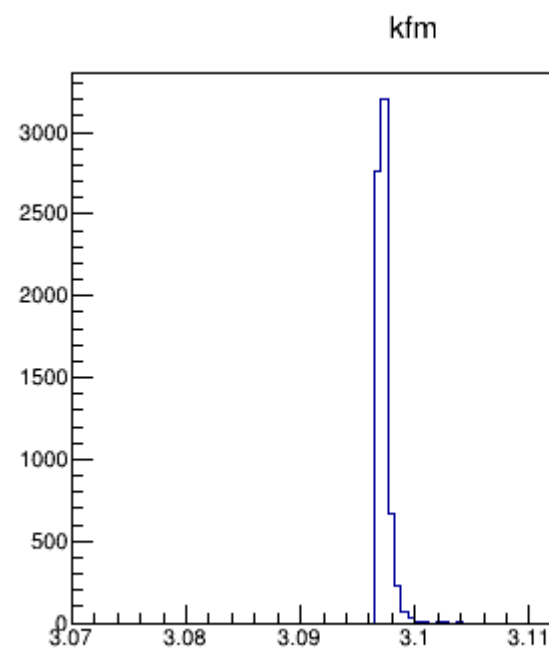
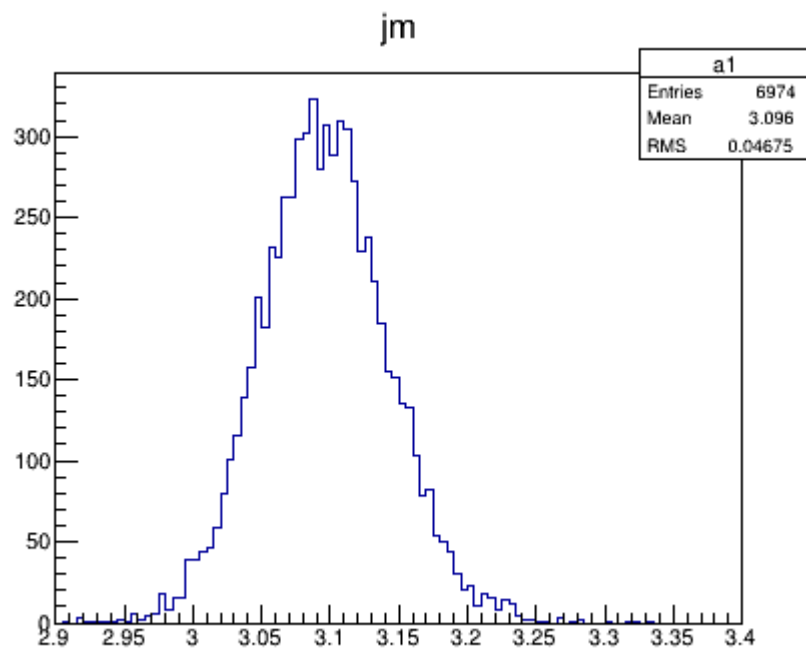
To close the topic,
I put here the new J/psi plots for fast simulation:

and for full:

Everything seems fine now. Only one comment: in full I found one combination with negative chi2 over 10k events. I suppose the cut in probability will take it away.

File Attachments

1) [jpsi_fast_new.gif](#), downloaded 922 times



2) [jpsi_full_new.gif](#), downloaded 897 times

