Test on p̄p→Ξ⁻Ξ̄⁺ η with updated fitters

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1:IKP-1,Forschungszentrum Juelich, Helmholtz Association of Germany Research Centers
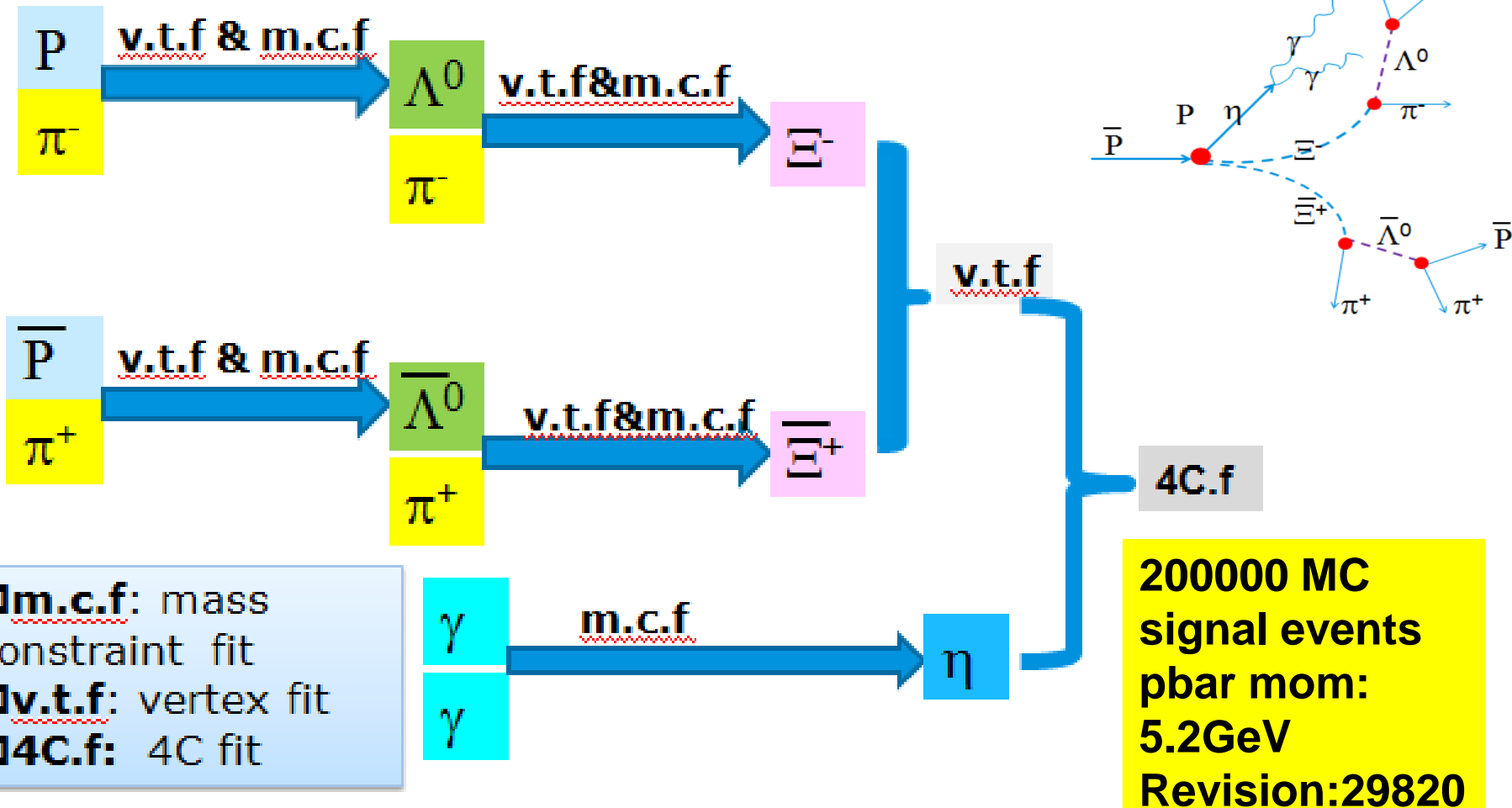
2: Institute of High Energy Physics, Chinese Academy of Science

2017/6/2

Xinying Song, computing sesstion,PANDA collaboration meeting,Darmstadt, Germany

Outline

☐ The channel used to test and update fitters

☐ Status about Peak @ 1 in Probability Distribution(solved)

☐ Fitted mass is not constrained as a single value(solved)

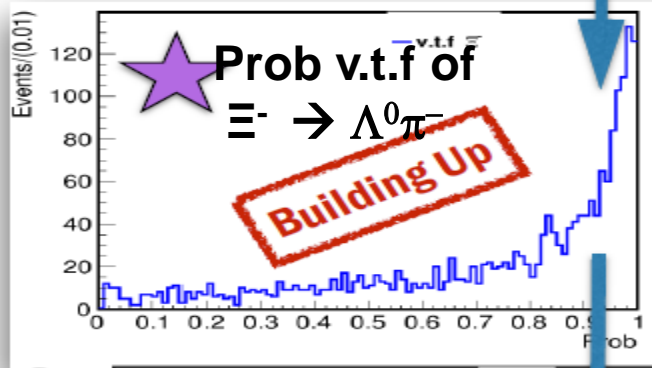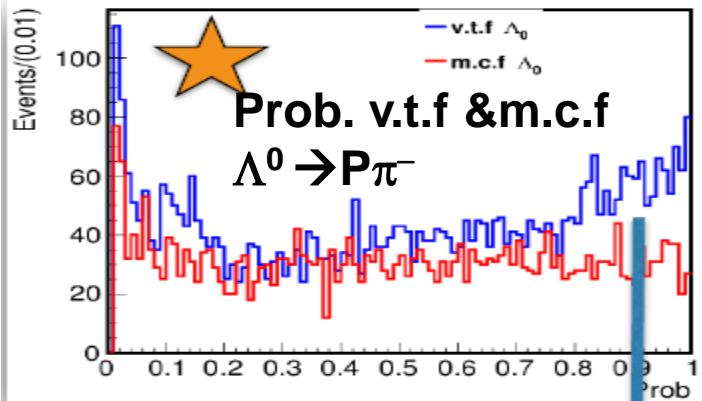☐ Test in 4C case with RhoKinFitter(fit converges , solved)

☐ summary

P →[v.t.f & m.c.f]→ **Λ⁰** →[v.t.f&m.c.f]→ **Ξ⁻**

π^-

π^-

P̄ →[v.t.f & m.c.f]→ **Λ̄⁰** →[v.t.f&m.c.f]→ **Ξ̄⁺**

π^+

π^+

v.t.f

4C.f

□**m.c.f**: mass constraint fit
□**v.t.f**: vertex fit
□**4C.f**: 4C fit

γ →[m.c.f]→ **η**

γ

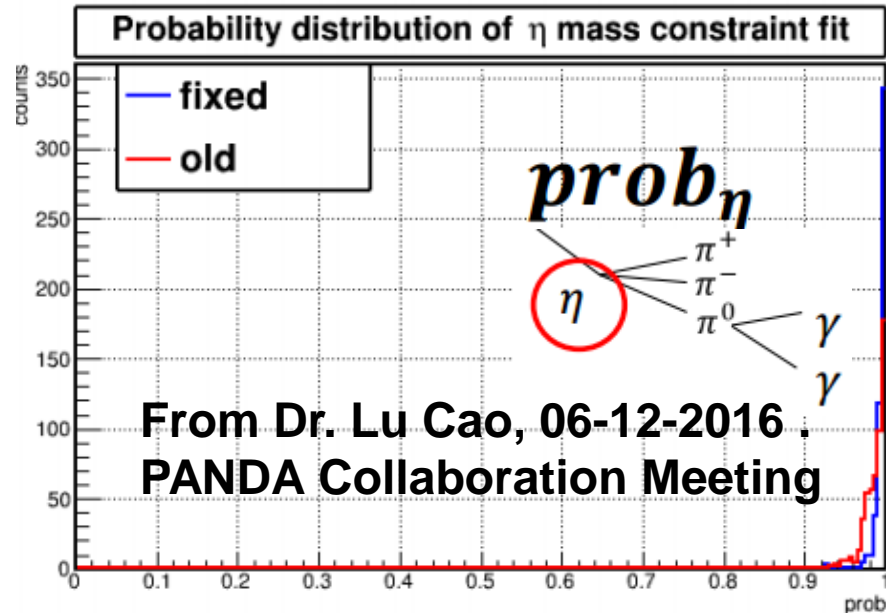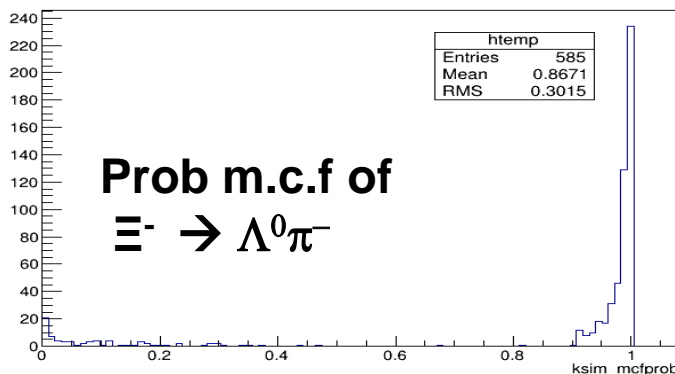**200000 MC signal events pbar mom: 5.2GeV Revision:29820**

Note: in the fit process the E does not take part in fit because the daughters are treated as "stable" ones(e, mu, pi, K, p) or long-lived ones (lambda, Xi …) so that the masses are conserved in v.t.f and 4c.f

Status about Peak @ 1 in Probability Distribution(solved)

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Prob. v.t.f &m.c.f
$\Lambda^0 \rightarrow P\pi^-$

Prob v.t.f of
$\Xi^- \rightarrow \Lambda^0 \pi^-$

Building Up

ksim_mcfprob {abs(ksim_mcfprob)<1}

htemp	
Entries	585
Mean	0.8671
RMS	0.3015

Prob m.c.f of
$\Xi^- \rightarrow \Lambda^0 \pi^-$

Probability distribution of η mass constraint fit

**From Dr. Lu Cao, 06-12-2016 .
PANDA Collaboration Meeting**

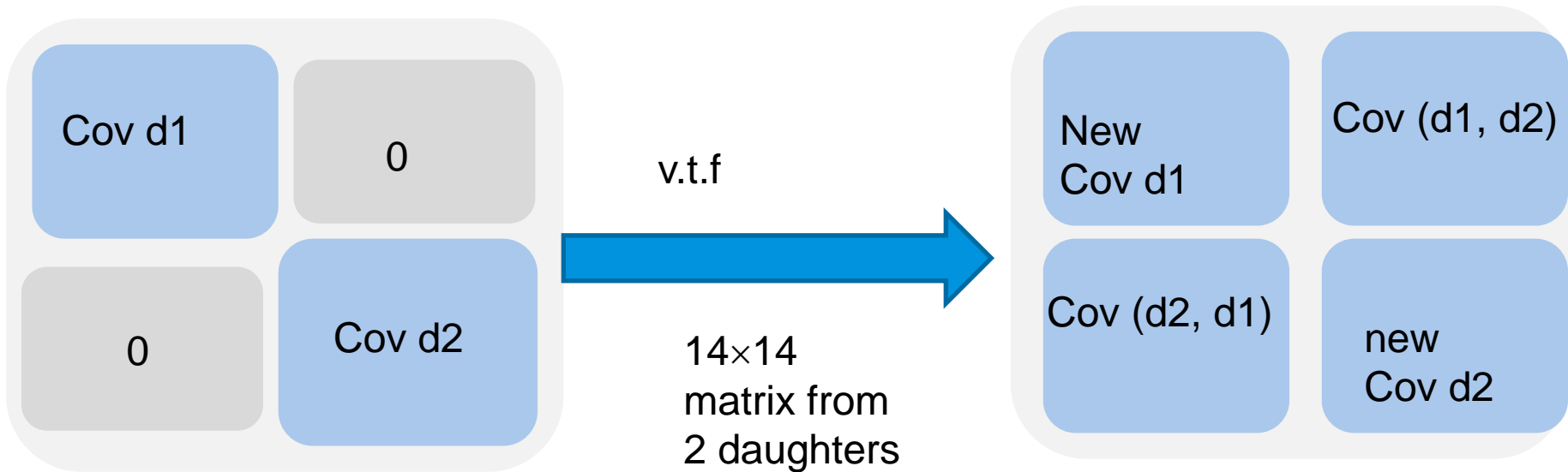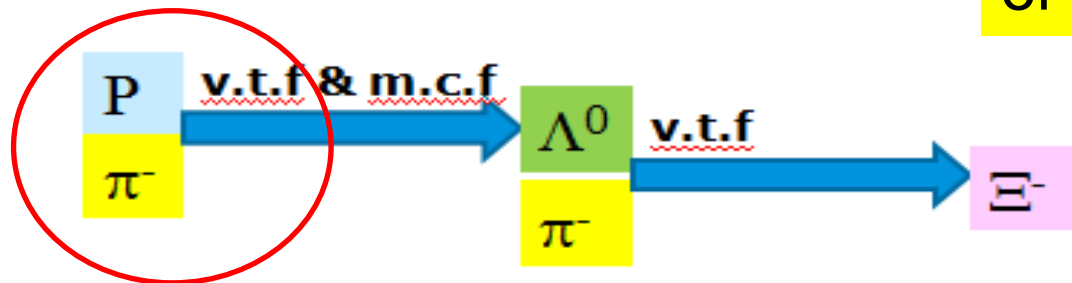☐ $\Xi^- \rightarrow \Lambda^0 \pi^-$:prob of v.t.f & m.c.f has **same** abnormal distributions.

☐The peak @ 1 in Prob of m.c.f happens in combinations including refitted particles(not only in neutral and charged combinations)
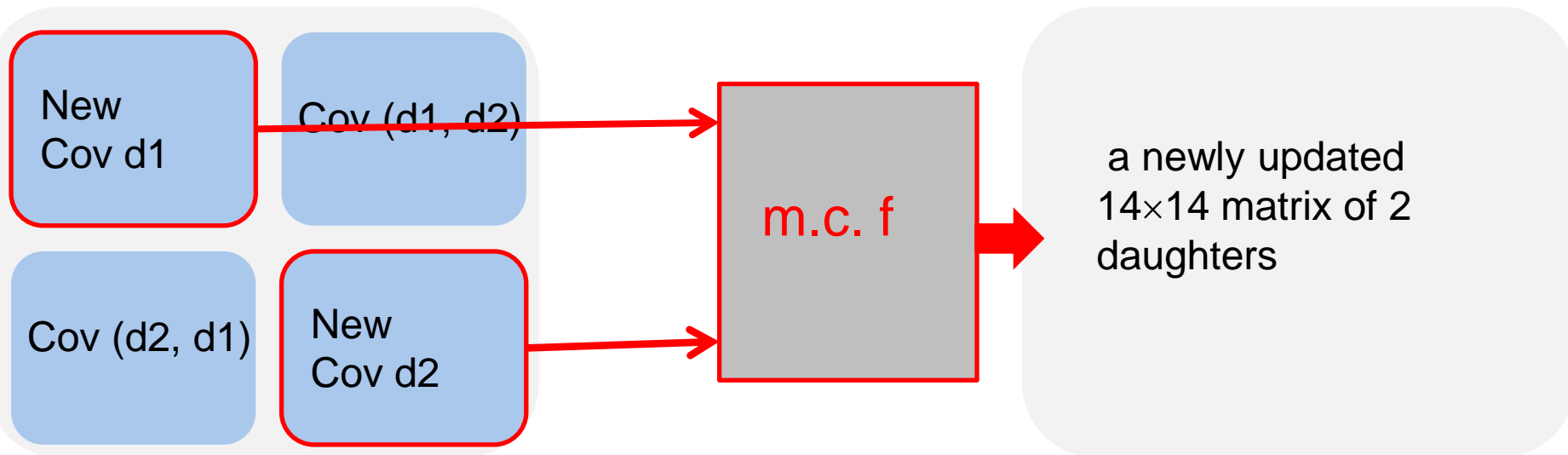
Why?

Reason1: after tracking , covariance matrix

Reason2:

P / π⁻ — **v.t.f & m.c.f** → Λ^0 / π⁻ — **v.t.f** → Ξ^-

Cov d1	0
0	Cov d2

v.t.f

14×14 matrix from 2 daughters

→

New Cov d1	Cov (d1, d2)
Cov (d2, d1)	new Cov d2

Reason2: after v.t.f, begin m.c.f

New Cov d1

Cov (d1, d2)

Cov (d2, d1)

New Cov d2

m.c. f

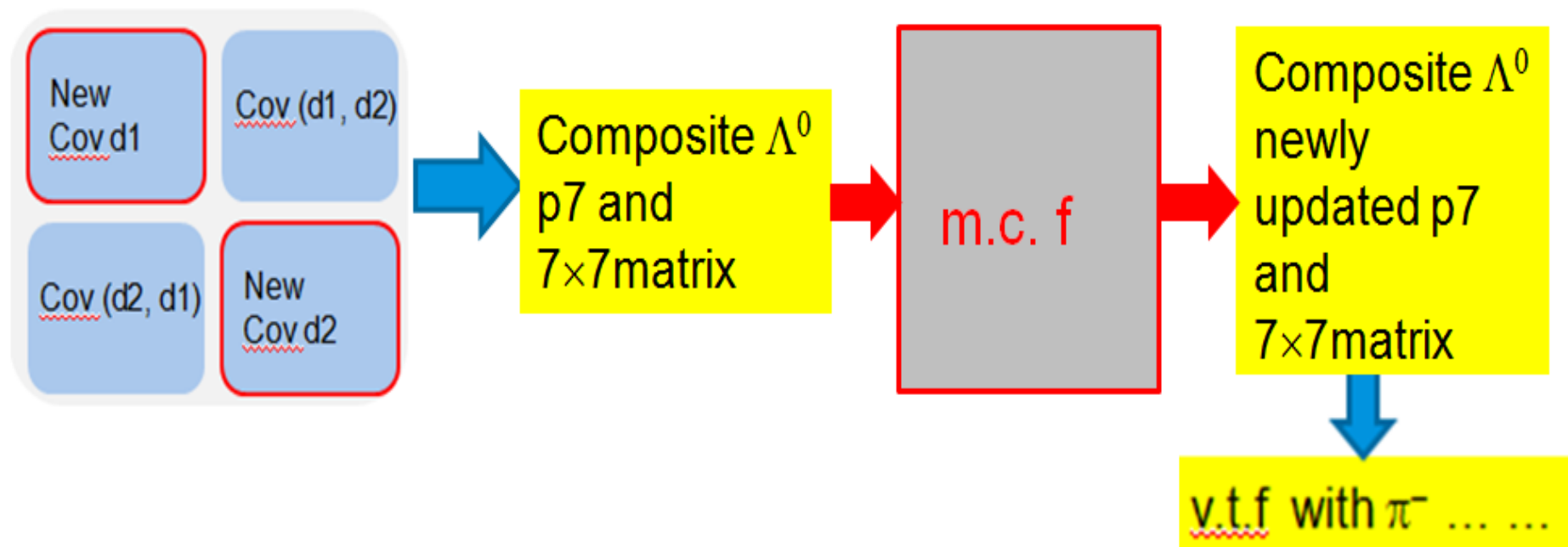a newly updated 14×14 matrix of 2 daughters

☐The Cov(d1,d2) and Cov(d2,d1) are not used in m.c.f!

☐ The (7×nd)×(7×nd)matrix after v.t.f should be fully considered in m.c.f;

☐That may be reason why the results of DecayTreeFitter does not have this problem(or not so significant).

Composite Λ^0

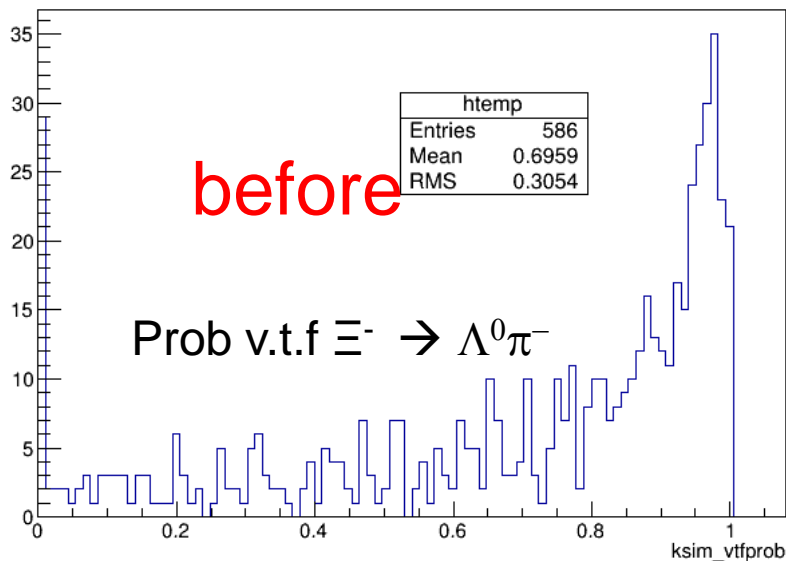v.t.f with π^- … …

How? Two solutions:

Solution1: add interface in v.t.f, and read this $(7 \times nd) \times (7 \times nd)$ matrix as input for m.c.f (too large, I don't take it)

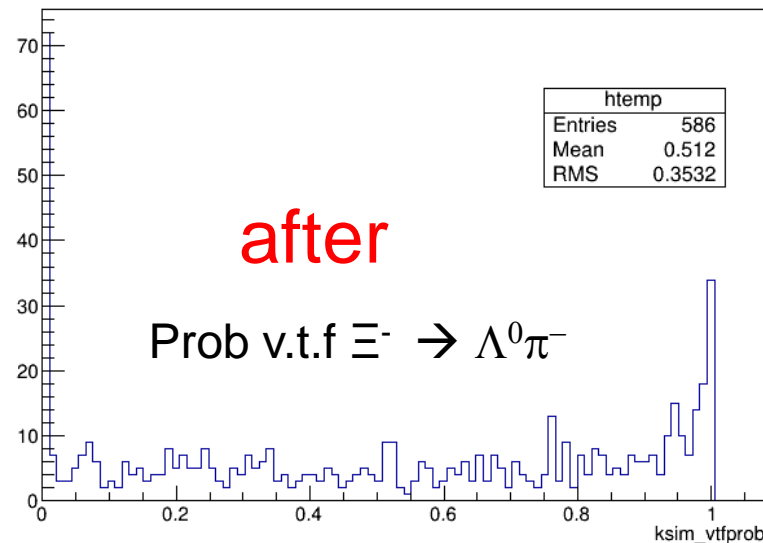**Solution2**: calculate the composite cov7 from full covd1,d2

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ksim_vtfprob {abs(ksim_vtfprob)<1}

before

htemp	
Entries	586
Mean	0.6959
RMS	0.3054

Prob v.t.f $\Xi^- \rightarrow \Lambda^0 \pi^-$

ksim_vtfprob {abs(ksim_vtfprob)<1}

after

htemp	
Entries	586
Mean	0.512
RMS	0.3532

Prob v.t.f $\Xi^- \rightarrow \Lambda^0 \pi^-$

ksim_mcfprob {abs(ksim_mcfprob)<1}

before

htemp	
Entries	585
Mean	0.8671
RMS	0.3015

Prob m.c.f $\Xi^- \rightarrow \Lambda^0 \pi^-$
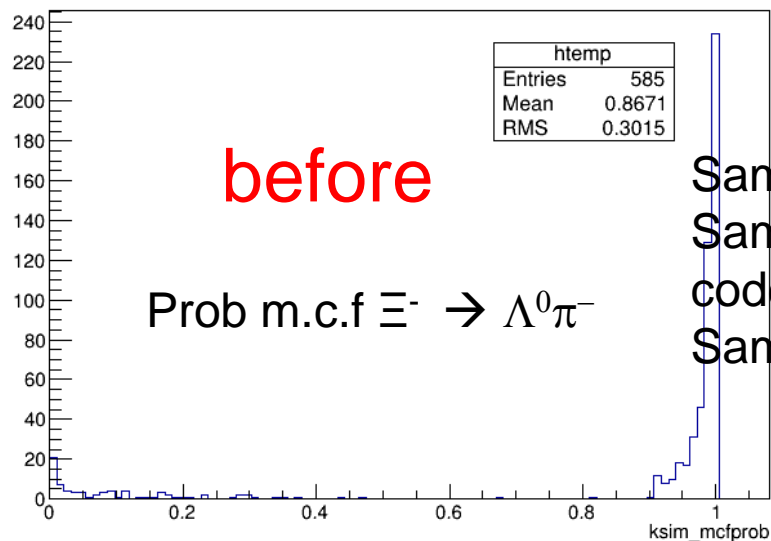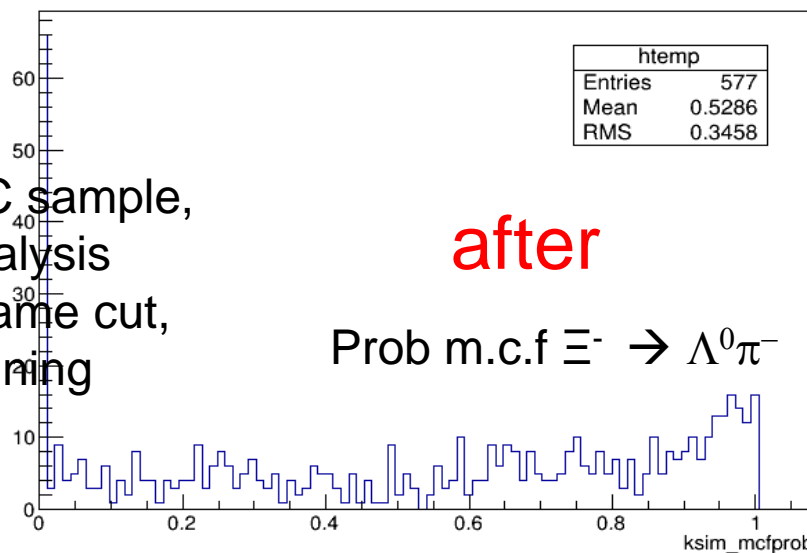
Same MC sample,
Same analysis
codes. Same cut,
Same binning

ksim_mcfprob {abs(ksim_mcfprob)<1}

after

htemp	
Entries	577
Mean	0.5286
RMS	0.3458

Prob m.c.f $\Xi^- \rightarrow \Lambda^0 \pi^-$

Fitted mass is not constrained as a single value(solved)

Fitted mass is not constrained as a single value

- m.c.f in $\Lambda_0 \to p\pi^-$: not constrained value with a prob>0.01

- Reason to all the fit performed by RhoKinFiiter::Solve()
  - Only 1st solution linear constrained matrix equation;
  - No iteration;

- Add the iteration process in Solve()

- Now:
  - $\Delta\chi^2 <0.01$
  - Max iteration=40 times;

mcf_lambdam {abs(mcf_lambdam-1.115683)<0.002}

htemp	
Entries	480
Mean	1.116
RMS	0.0002827

old

mcf_lambdam {abs(mcf_lambdam-1.115683)<0.002}

htemp	
Entries	492
Mean	1.116
RMS	0.0002221

New
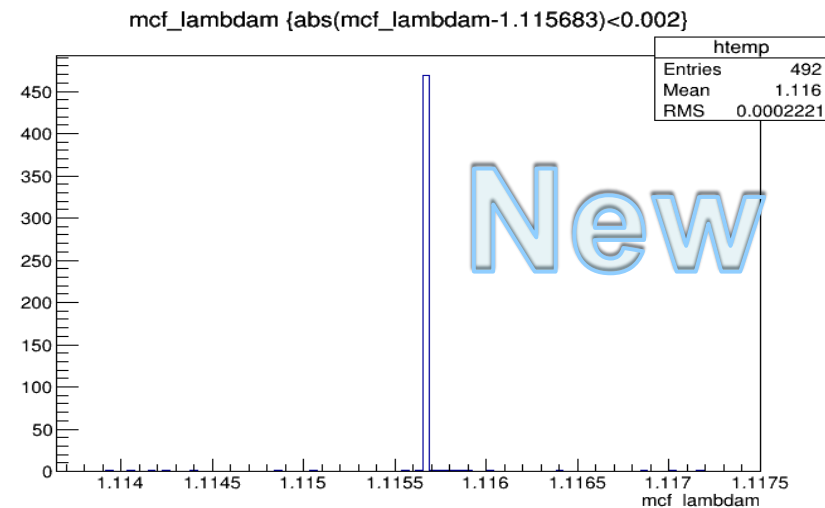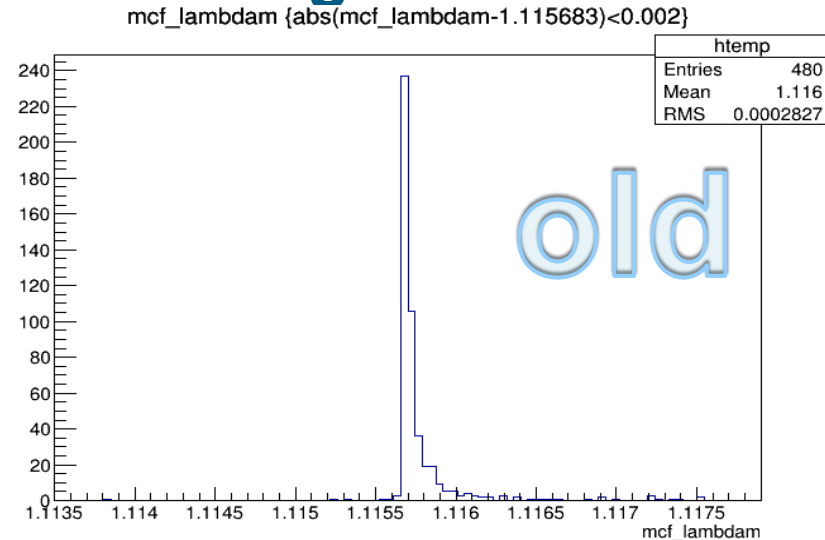
Changes

some changes on the fitters:

☐ For RhoKinVtxFitter:

- ✓ added TransportToPoca() before vertex fit
- ✓ added TransportToVertex() after vertex fit (replace the old one)
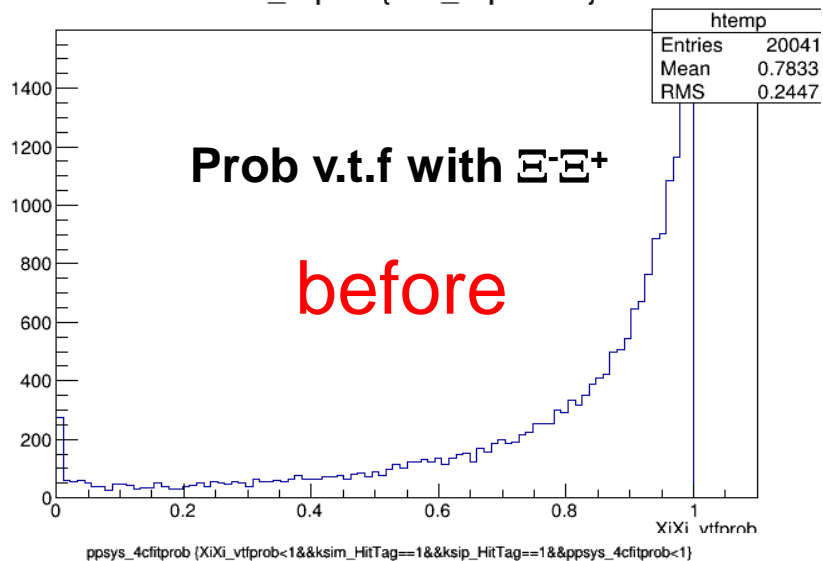- ✓ Some little changes on SetOutput() (details in backup)

☐ For RhoKinFitter

- ✓ added iteration in fit process
- ✓ added SetInputMatrix() to take the full covariance matrix as input
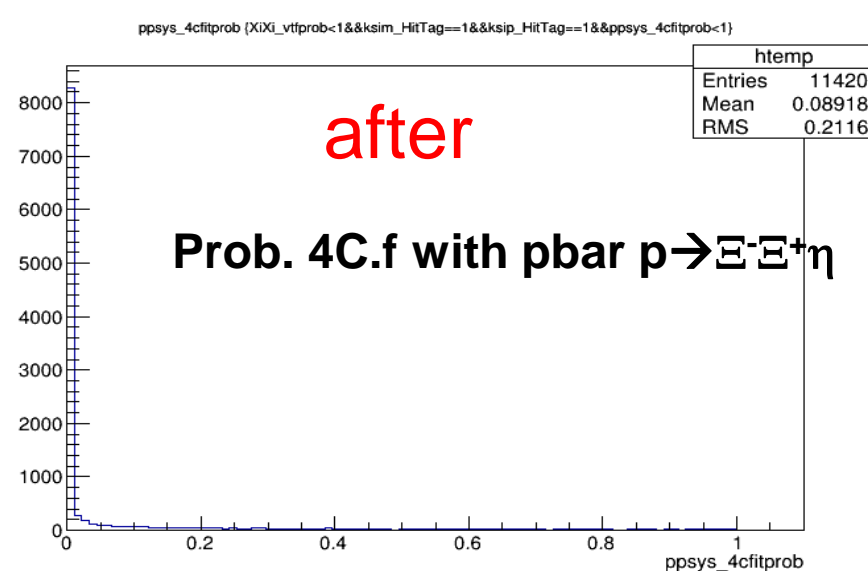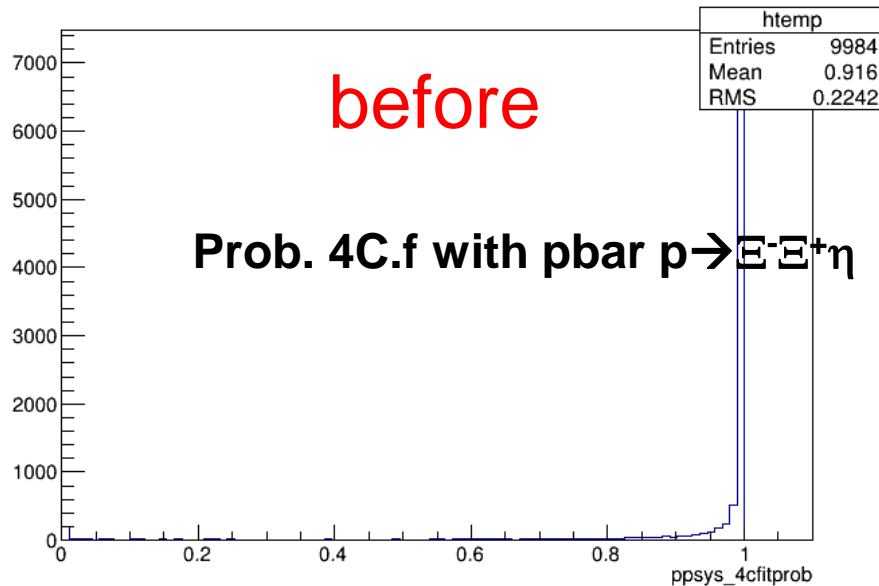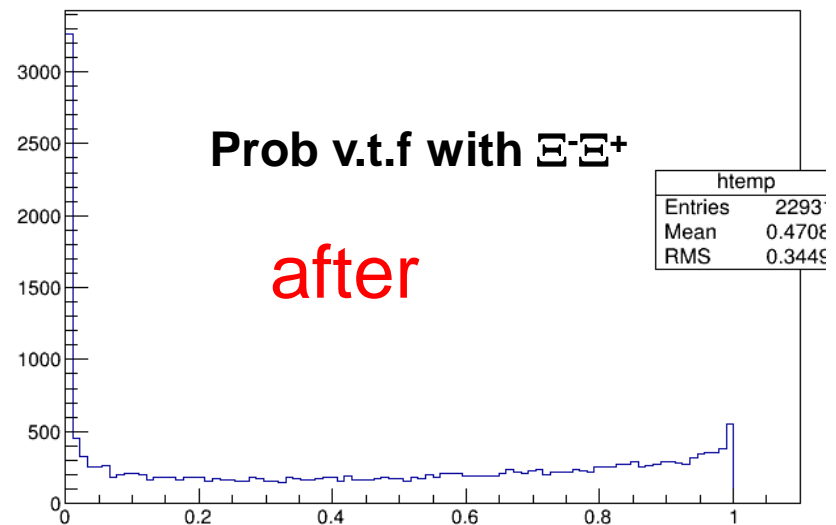- ✓ modified the SetOutput() according to the type of constraints

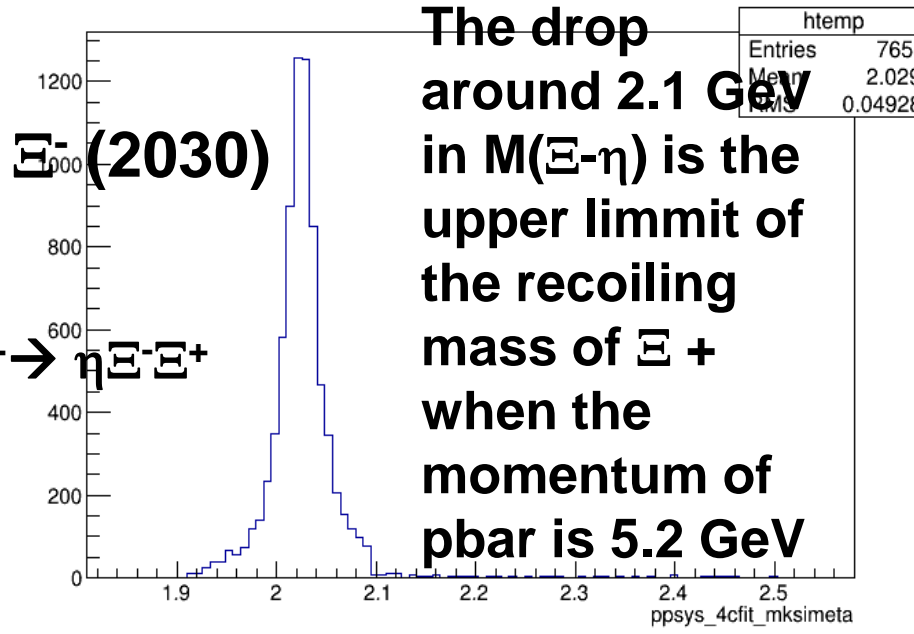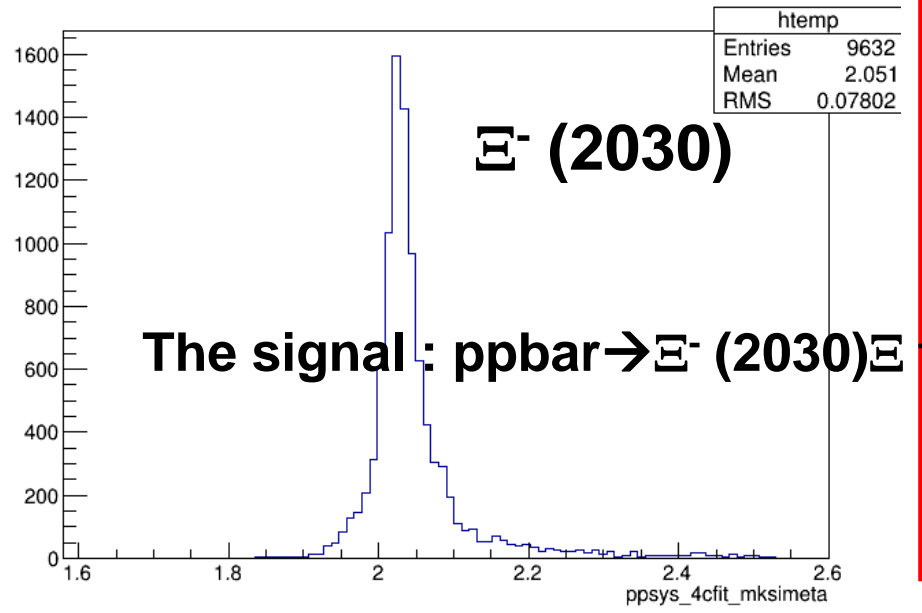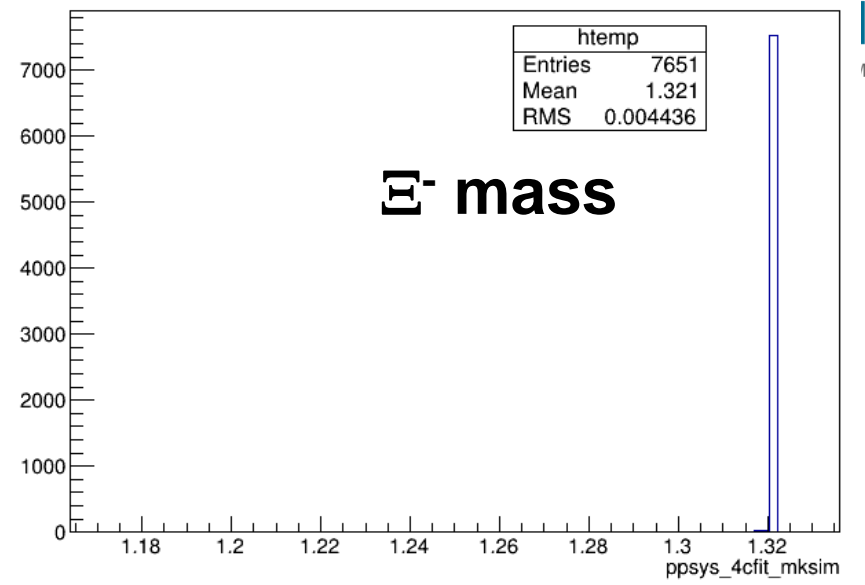# Test with 4C case with RhoKinFitter(fit converges , solved)

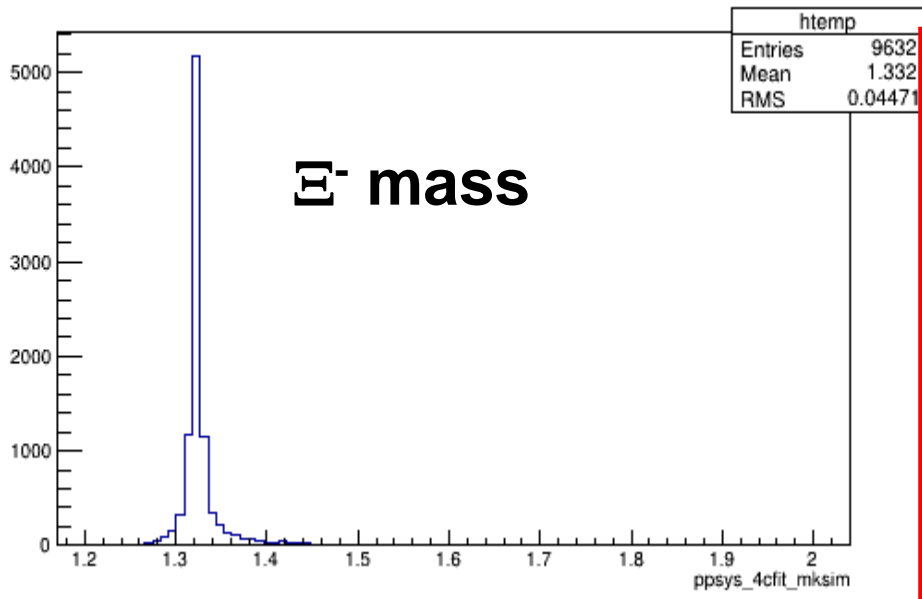# v.t.f with Ξ⁻Ξ̄⁺ and 4C.f with p̄ p→Ξ⁻Ξ̄⁺η

Ξ⁻ mass

Ξ⁻ mass

Ξ⁻ (2030)

Ξ⁻ (2030)

The signal : ppbar→Ξ⁻ (2030)Ξ⁺→ ηΞ⁻Ξ⁺

The drop around 2.1 GeV in M(Ξ-η) is the upper limmit of the recoiling mass of Ξ + when the momentum of pbar is 5.2 GeV

Summary

☐ Status about Peak @ 1 in Probability Distribution(solved)

☐ Fitted mass is not constrained as a single value(solved)

☐ 4C case with RhoKinFitter(fit converges , solved)

  mom of Pbar 5.2 GeV/c→5.4 GeV/c(updated)

The updated fitters is in

https://subversion.gsi.de/fairroot/pandaroot/development/xsong/RhoFitter/

And don't forget to set full cov as input for 4C fitter (as shown in

https://subversion.gsi.de/fairroot/pandaroot/development/xsong/rho/PndTutAnaTask.cxx_bak   and backup

Back up

for the m.c.f, Kinfitter is used as before,
for the 4c fit , you need to put the p7*n and cov7n*7n as input for the KinFitter. so I attach my analysis codes PndTutAnaTask.cxx.

```
          "

              PndKinFitter fitter4c(ppsys_raw[j]);
              fitter4c.Add4MomConstraint(ini);
              fitter4c.SetInputMatrix(TaI0, TV_aI0);
              fitter4c.Fit();
          "
```

Here the TaI0 is the Xi+Xi and eta's p21, and TV_aI0 is cov21*21, which should be put into the fitter as shown above fore we perform 4c fit. And how to get these matrix also can be found in PndTutAnaTask.cxx.

2. Cross check with DecayTreeFitter

Apply a mass constraint fit for the η candi. with decay tree fitter.
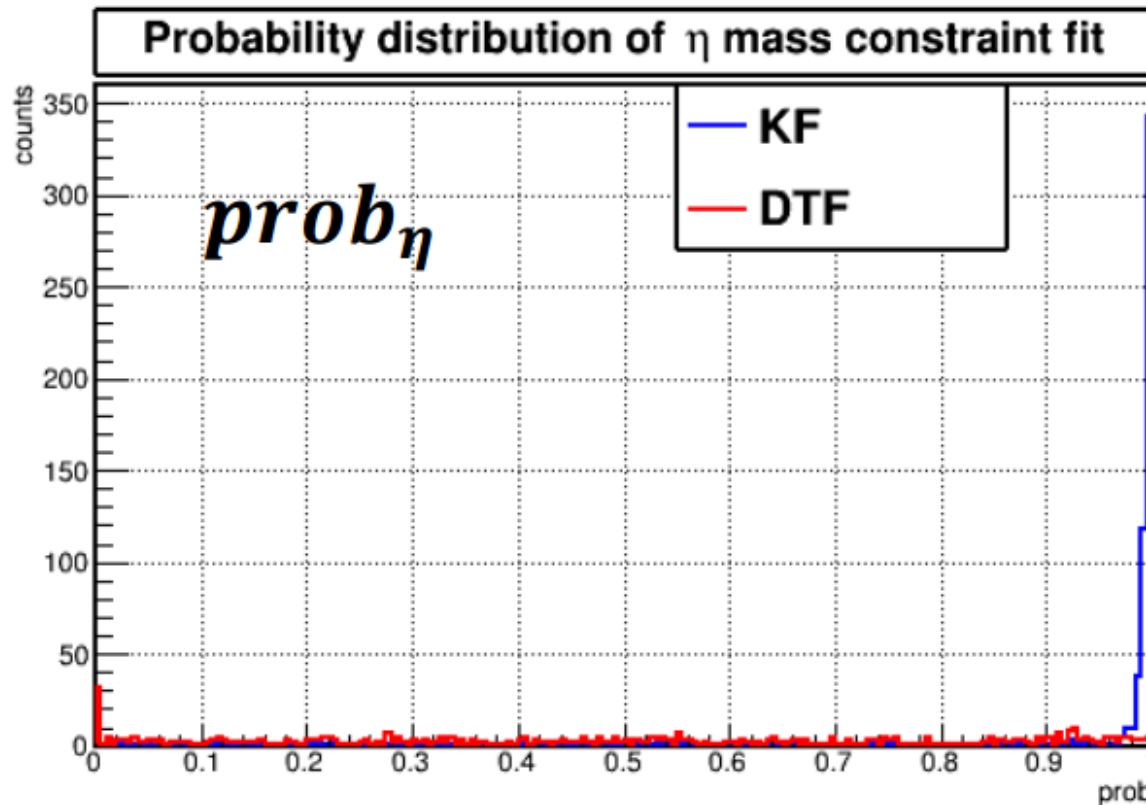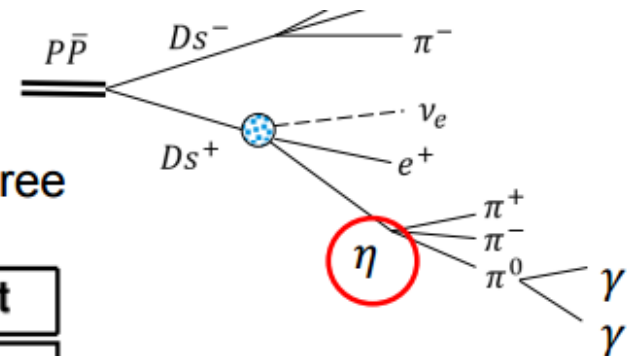
KF: PndKinFitter (fixed)
DTF: PndDecayTreeFitter

DTF prob. seems OK

Modified the SetOutput() according to the type of constraints

constraints	Output
MassConstraints (MomConstraints,tentatively)	the p7 & cov7 of composite particle
4MomConstraints (TotMomConstraints, TotEConstraints)	the p7and cov7 of each daughters and the ppbar system

Note in Fitters:

FindAndAddFinalStateDuaghters() is replaced by

SetDaughtersFromComposite