

A simulation study of heavy Higgs bosons decaying to jets at high energy regions of the ILC

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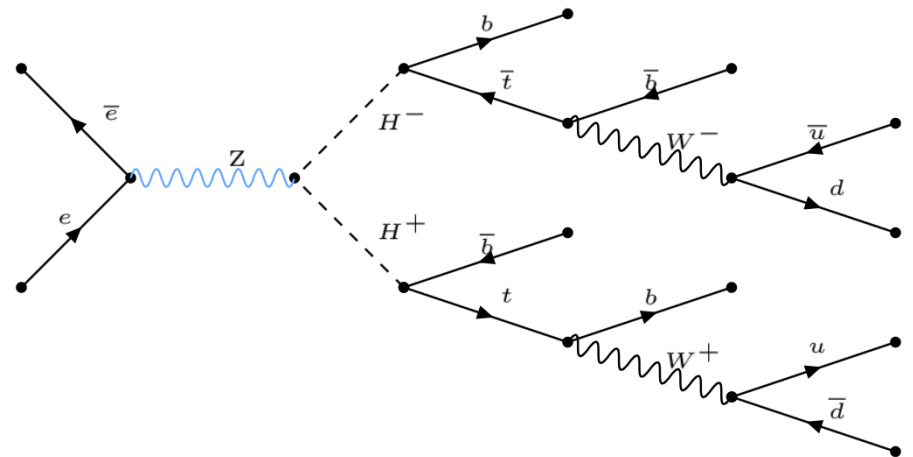


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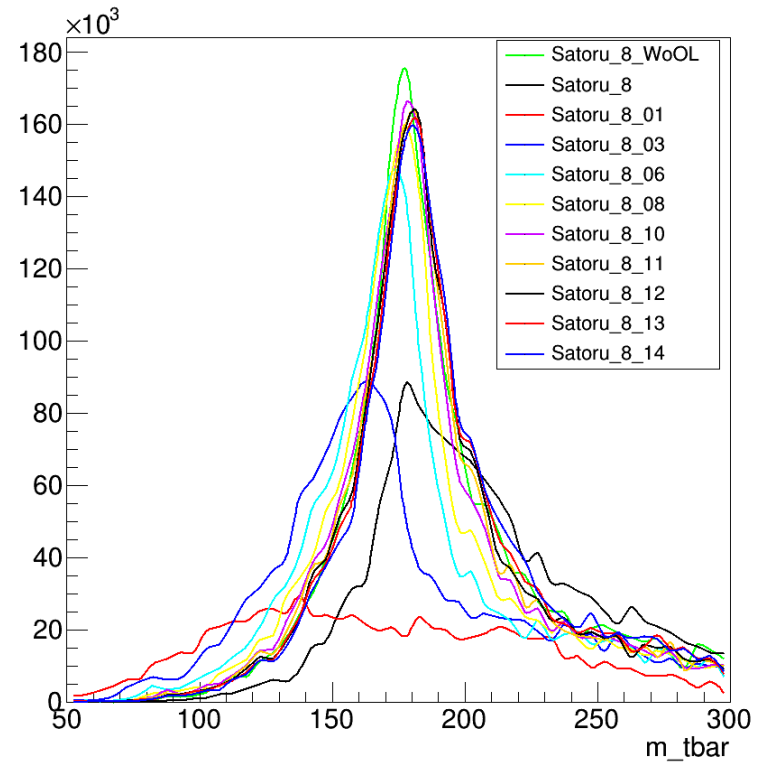
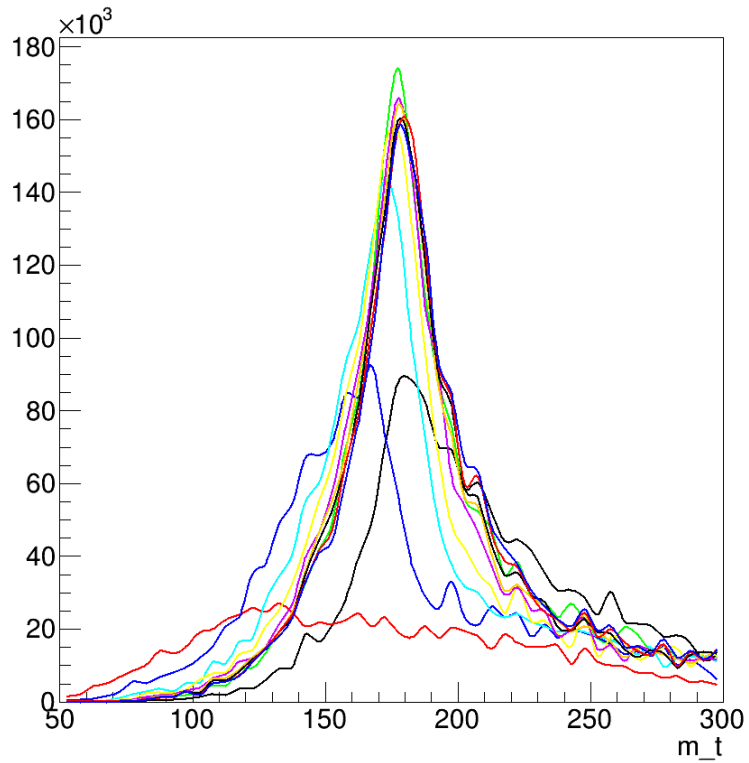
Reconstruction $e^+e^- \rightarrow H^+H^-/HA \rightarrow$ jets

- 8 jets
- Pairing 4 jets with lowest b tag to W mass
- Pairing 4th and 5th jet to top mass
- Pairing other jets to same invariant mass

- Background:
 - ttH/ttZ/ttg \rightarrow ttbb
 - tt \rightarrow bWbW
 - HA \rightarrow bbbb



Find R for kt-Algorithm



Analysing Jetclustering with MC information

- Retracking pfo to MC part
- Separation of Colorsinglet
- Pairing Jets

	CS1 (%)	CS2 (%)
Jet1	0	100
Jet2	100	0
Jet3	100	0
Jet4	0	100

Analysing Jetclustering with MC information

- Retracking pfo to MC part
- Separation of Colorsinglet
- Pairing Jets

	CS1 (%)	CS2 (%)
Jet1	15	85
Jet2	55	45
Jet3	99	1
Jet4	0	100

Analysing Jetclustering with MC information

- Retracking pfo to MC part
- Separation of Colorsinglet
- Pairing Jets

	CS1 (%)	CS2 (%)
Jet1	60	40
Jet2	55	45
Jet3	99	1
Jet4	0	100

Analysing Jetclustering with MC information

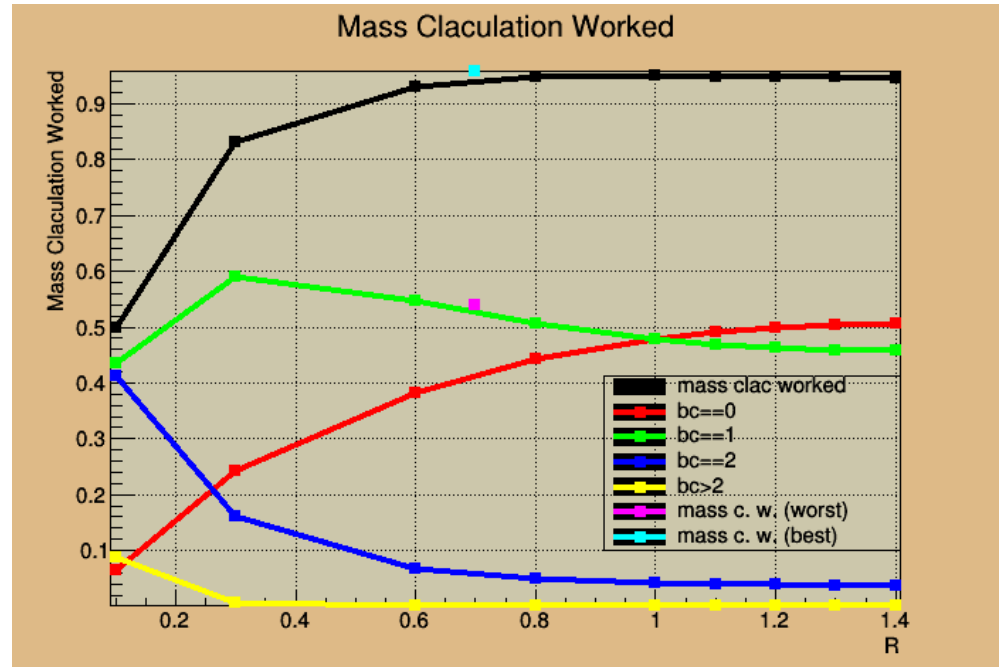
- Retracing pfo to MC part
- Separation of Colorsinglet
- Pairing Jets

- Correcting

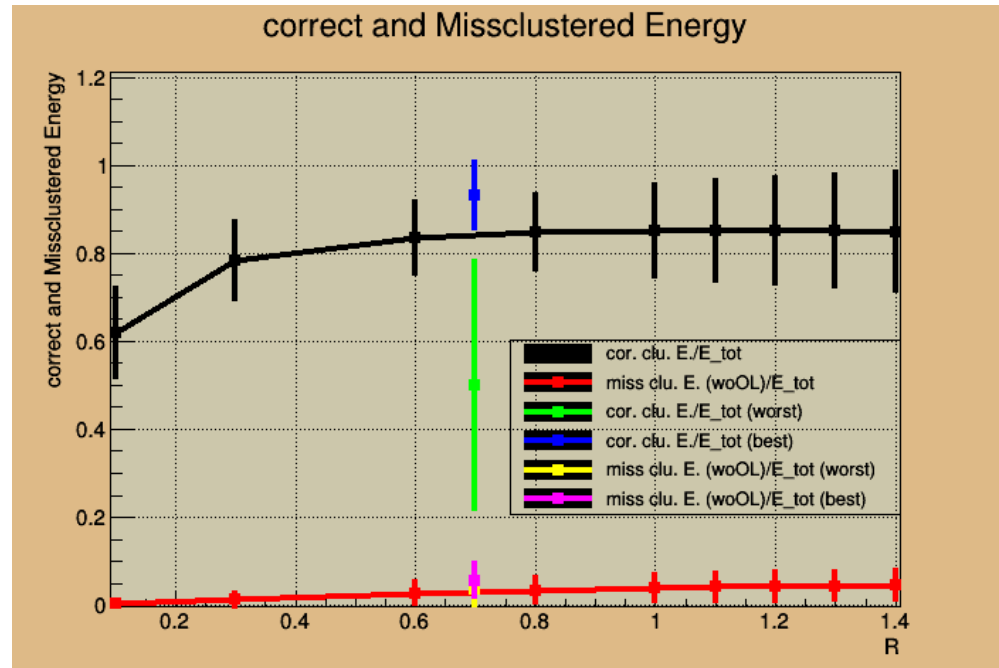
	CS1 (%)	CS2 (%)
Jet1	60	40
Jet2	55	45
Jet3	99	1
Jet4	0	100

Mass Calculation Worked

- $bc == 1$ means one correction is necessary
- I only correct ones because correcting more than one is difficult

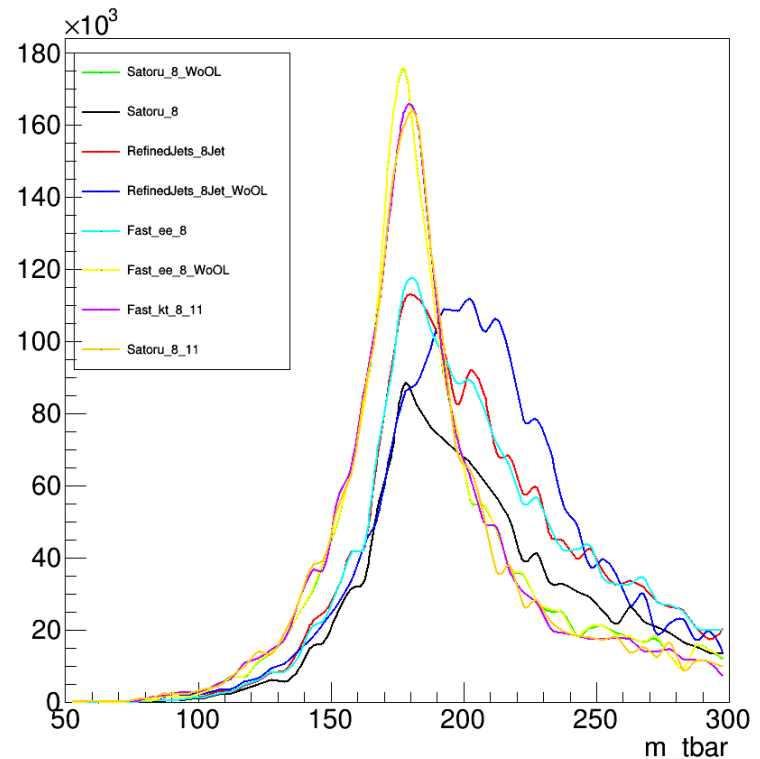
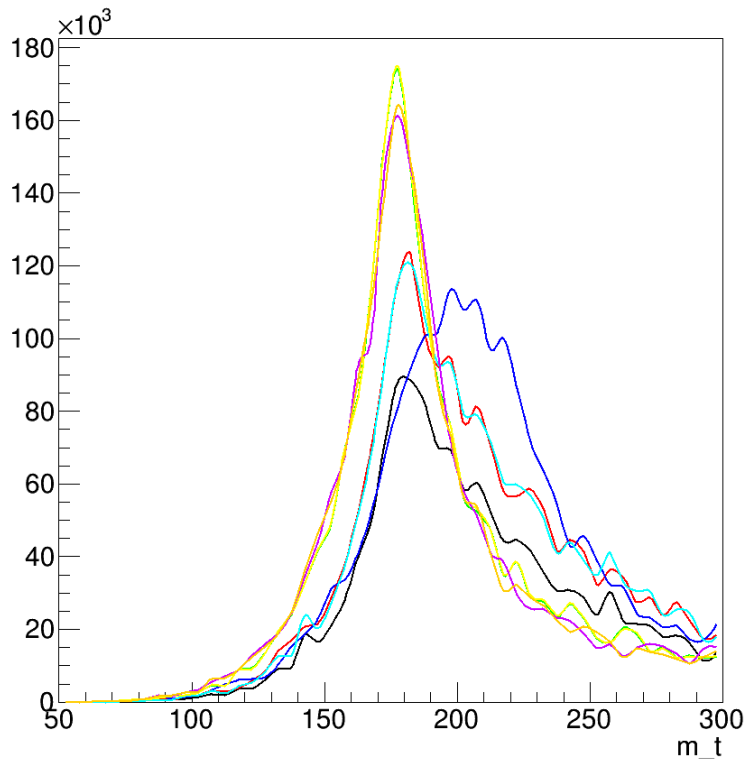


Correctly and Missclustered Energy



Different Algorithms

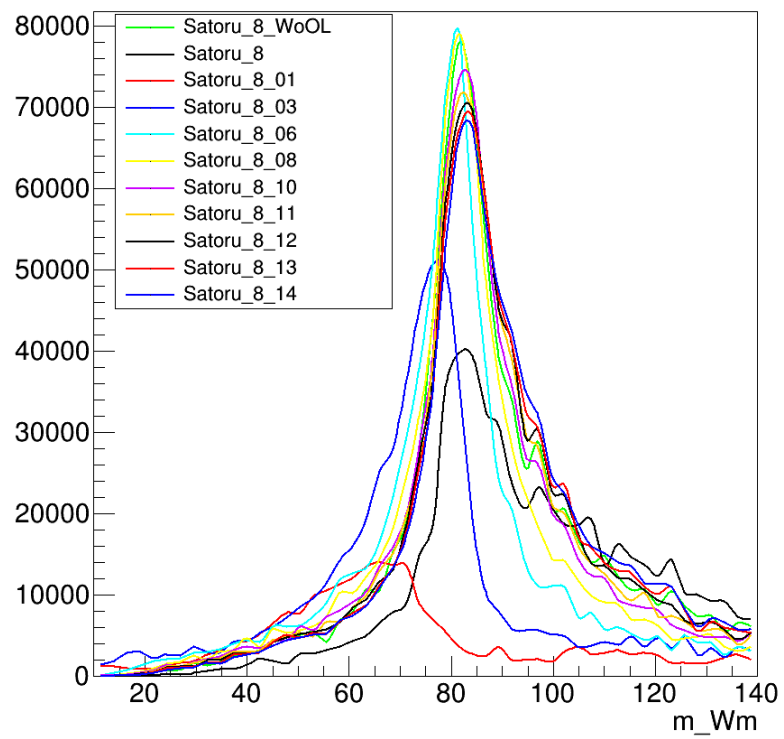
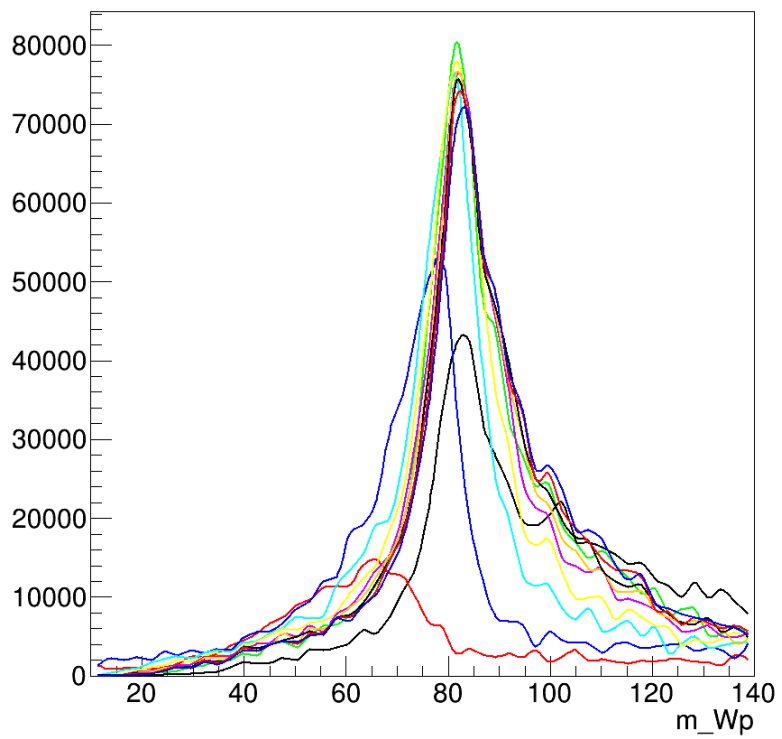
- RefinedJets from LFCIplus
- RefinedJets without overlay is wrong

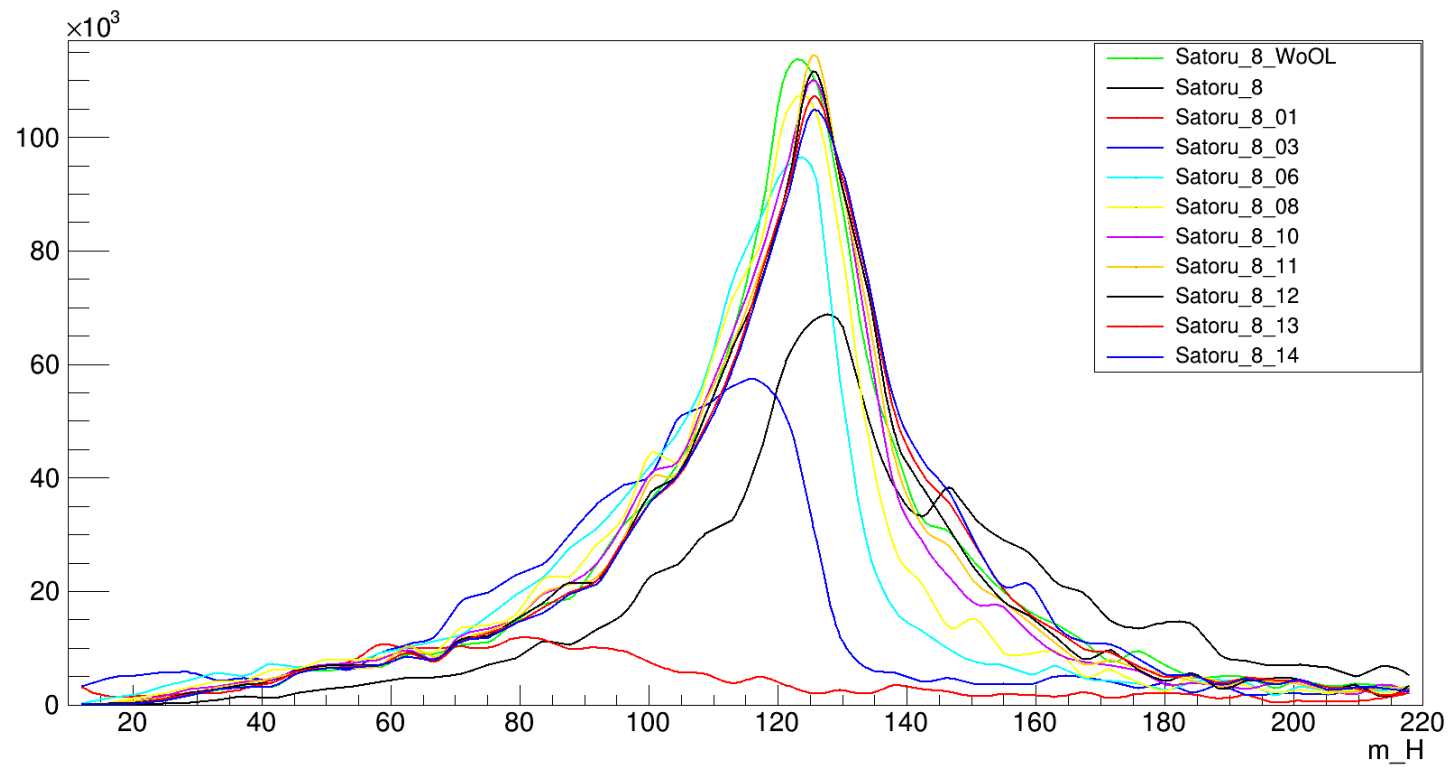


Status

- Best R is around 1.0
- Next:
 - Check why LCFIplus without overlay is wrong
 - Holiday until annual meeting end of March
 - Check χ^2 Pairing (2nd step) with 3D display
 - Need heavy Higgs samples
 - Research how to distinguish H^+ and H^-

Backup





Motivation $e^+e^- \rightarrow H^+H^-/HA \rightarrow \text{jets}$

- Two Higgs doublet model (2HDM)
 - easy extension of SM
 - large outcome (dark matter)
 - EE-Collider very sensitive (up to kin. Limit)
- Light Higgs 126 GeV \rightarrow decoupling limit
 - Heavy Higgs to gauge boson coupling small
 - Hardly visible in LHC
 - Makes fermion final state most promising
 - For high mass resolution \rightarrow 8 jet final state

Chi²

$e^+e^- \rightarrow H^+H^-/HA \rightarrow \text{jets}$

- Testing with tth \rightarrow bqqbqqbb (same final state)
- Makes 40320 combinations
- With b tag consideration \rightarrow 576 combinations
- without jet 3 and 4, 7 and 8, 6 and 2, ... \rightarrow 36 combination

$$\chi^2 = \left| \frac{(m_{j_1j_2})^2 - (m_h)^2}{\sigma_h} \right| + \left(\frac{m_{j_3j_4j_5} - M_t}{\sigma_t} \right)^2$$
$$+ \left(\frac{m_{j_6j_7j_8} - M_t}{\sigma_t} \right)^2 + \left(\frac{m_{j_3j_4} - M_W}{\sigma_W} \right)^2 + \left(\frac{m_{j_7j_8} - M_W}{\sigma_W} \right)^2$$

Chi²

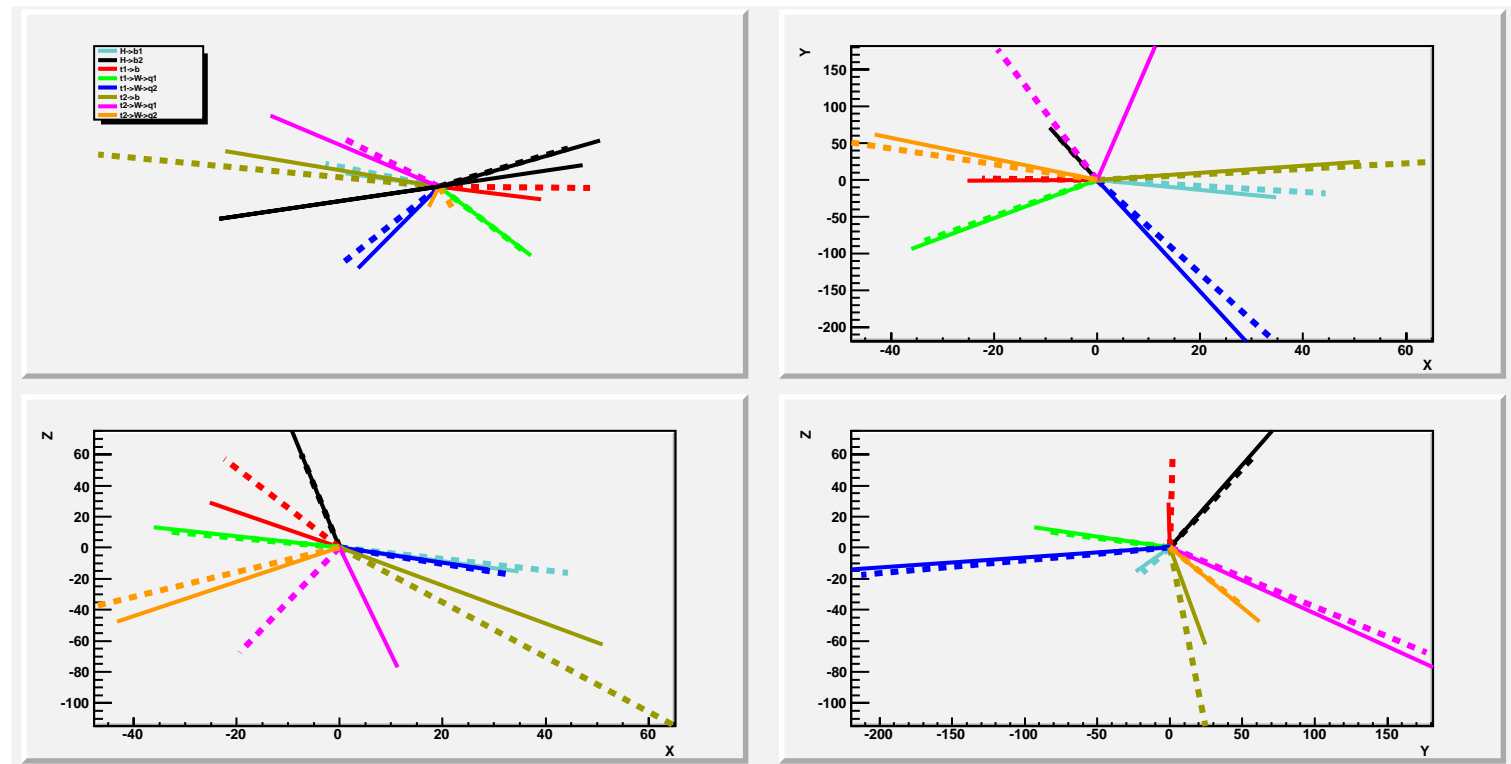
$e^+e^- \rightarrow H^+H^-/HA \rightarrow \text{jets}$

- For H+ H-

$$\chi^2 = \left| \frac{(m_{j_1j_2j_3j_4})^2 - (m_{j_5j_6j_7j_8})^2}{2\sigma_{H^+}^2} \right| + \left(\frac{m_{j_2j_3j_4} - M_t}{\sigma_t} \right)^2$$
$$+ \left(\frac{m_{j_6j_7j_8} - M_t}{\sigma_t} \right)^2 + \left(\frac{m_{j_3j_4} - M_W}{\sigma_W} \right)^2 + \left(\frac{m_{j_7j_8} - M_W}{\sigma_W} \right)^2$$

3D display

- Event by event integrated in Marin processor



CP Violation

- Possible to discover in this channel
- Through decay into invisible SUSY particles
- δ between 0.20 and 0.02 for $\tan(\beta)$ between 5 and 30

$$\delta_{f\bar{f}'}^{CP} \propto \frac{1}{\tan \beta}$$

$$\delta_{f\bar{f}'}^{CP} = \frac{BR(H^+ \rightarrow f\bar{f}') - BR(H^- \rightarrow \bar{f}f')}{BR(H^+ \rightarrow f\bar{f}') + BR(H^- \rightarrow \bar{f}f')}$$