$$\boxed{HA \to b\bar{b}\tau^+\tau^-}$$

Experimental conditions: $\sqrt{s} = 500$ GeV; $\mathcal{L} = 500$ fb^{-1}

Monte Carlo Tools

- PYTHIA : $HA \to b\bar{b}\tau^+\tau^-, \tau^+\tau^- b\bar{b}$
- PYTHIA : WW, ZZ, $q\bar{q}(\gamma)$, $t\bar{t}$
- CIRCE : beamstrahlung
- SIMDET : TESLA detector response

Analysis Strategy

- Selection of 4-jet events
- 2 b-jets + 2 τ-jets
- Kinematical fit $\Longrightarrow$ improvement of mass resolution
- Analysis of $m_{b\bar{b}}$ and $m_{\tau^+\tau^-}$ spectra $\Longrightarrow$ mass and cross section determination

Assumption:

$$\sin^2(\beta - \alpha) = 1; \quad Br(H, A \to b\bar{b}) = 85\%; \quad Br(H, A \to \tau^+\tau^-) = 15\%$$

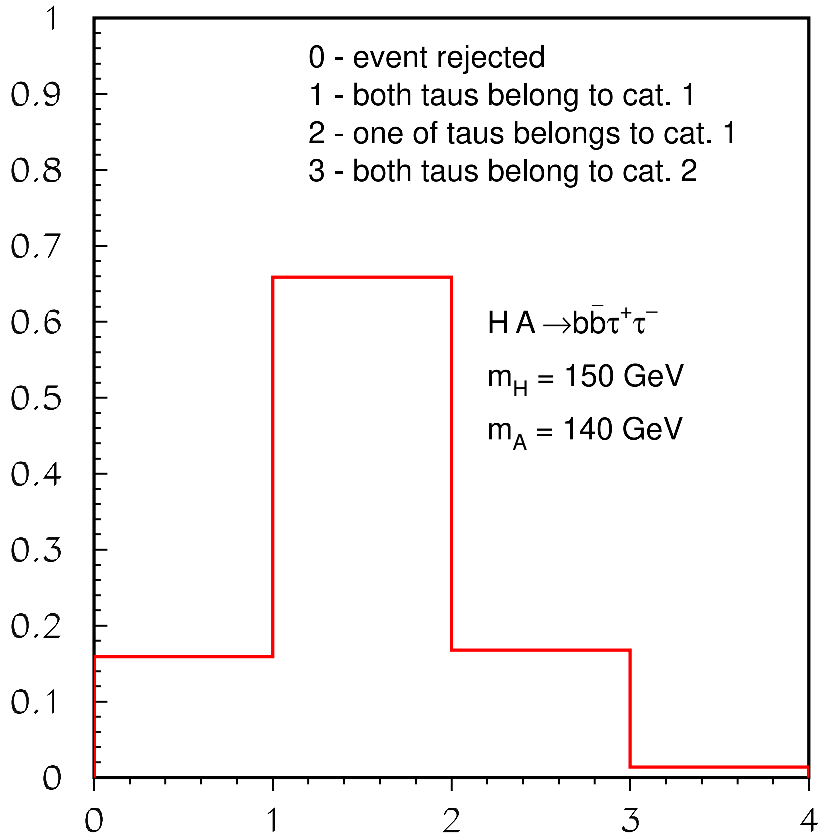
Tau Identification

Tau ID categories

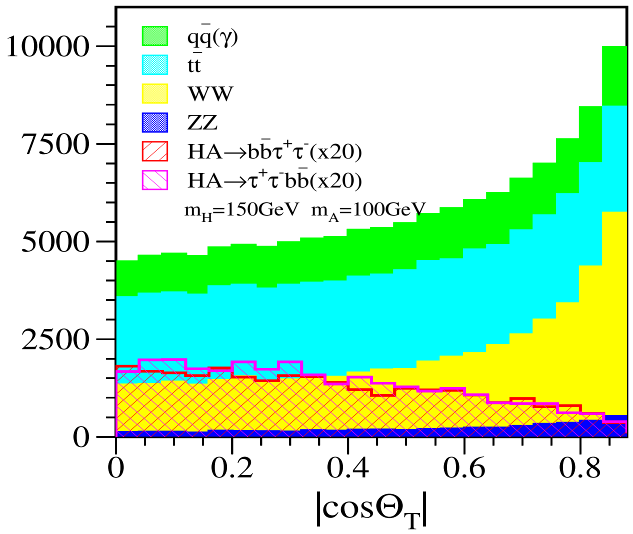
- Category 1:
  o jet $- e^+$ or μ^+, no N_0
  o jet $- h^+$, $N_0 < 5$
  o jet $- h^+h^+h^-$, $N_0 < 3$

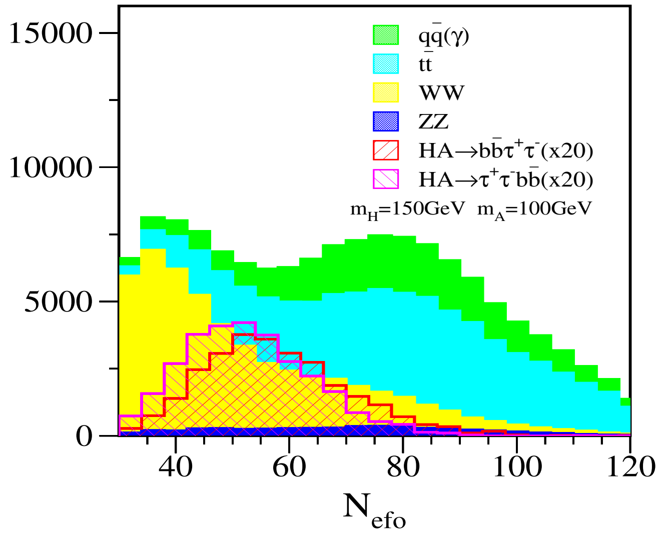
- Category 2:
  o jet with less than 4 tracks

- At least one τ must belong to category 1

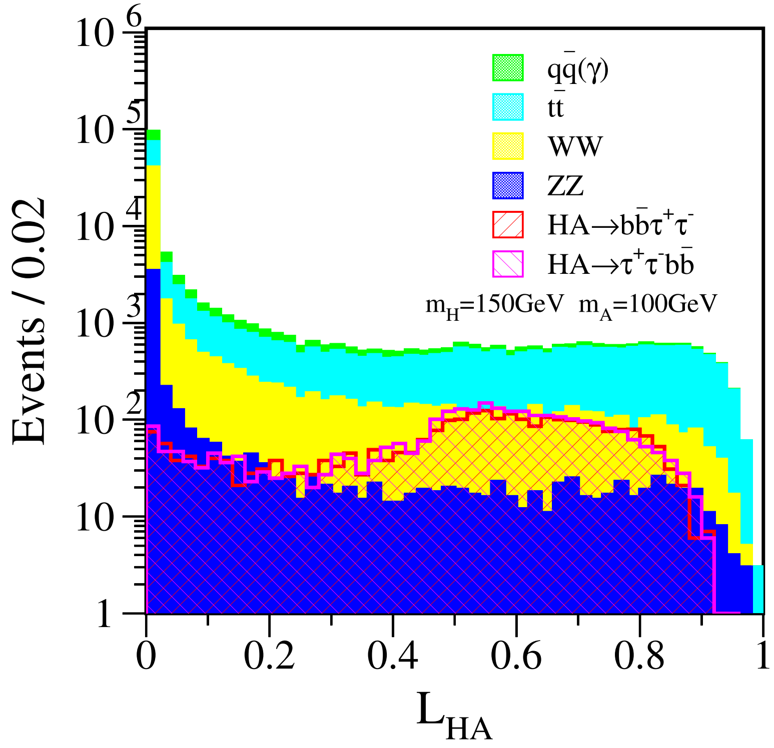


Likelihood selection





- Discr. var. $\rightarrow$ likelihood
  N_{efo}, T, $|\cos\Theta_T|$, B_1, B_2, *etc*
- b-tag: ZVTOP flavour tagger



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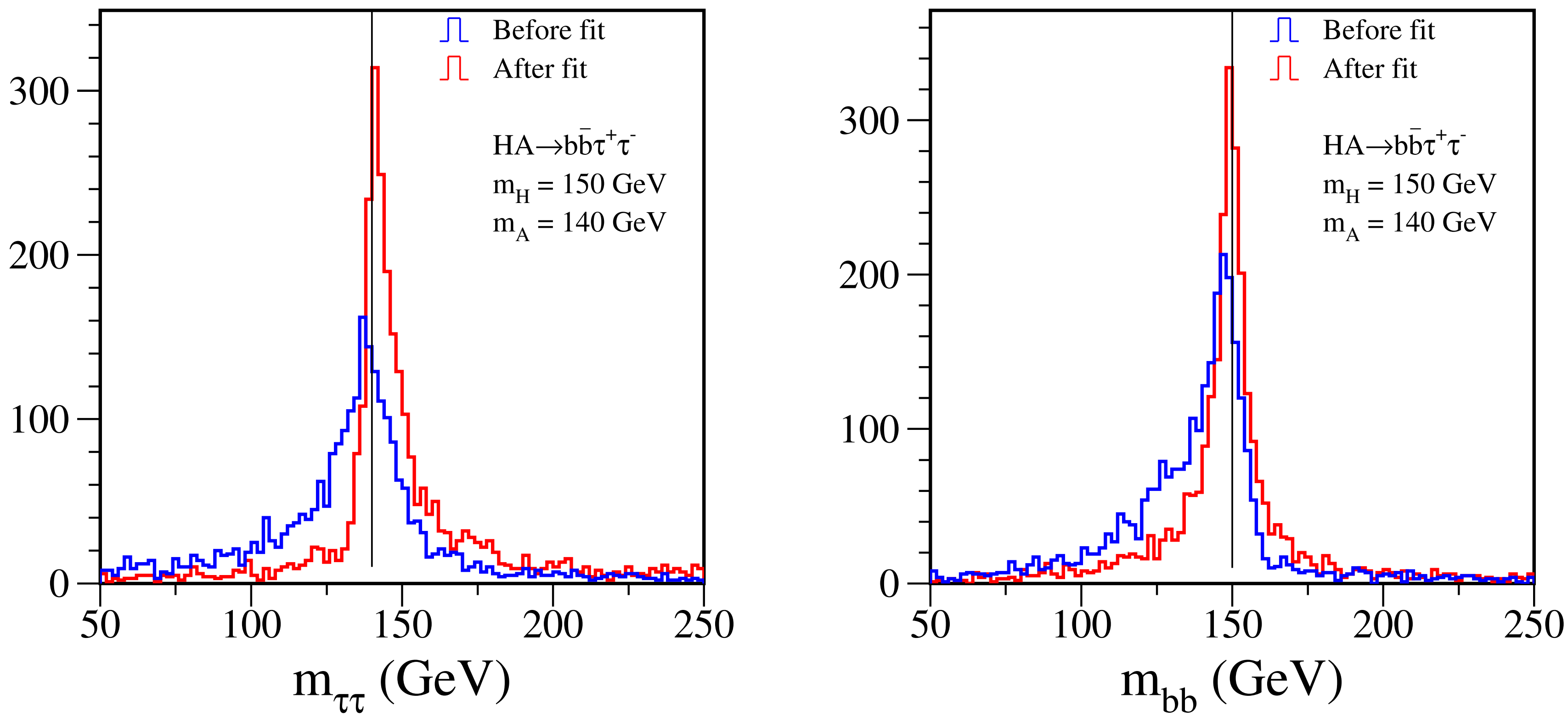
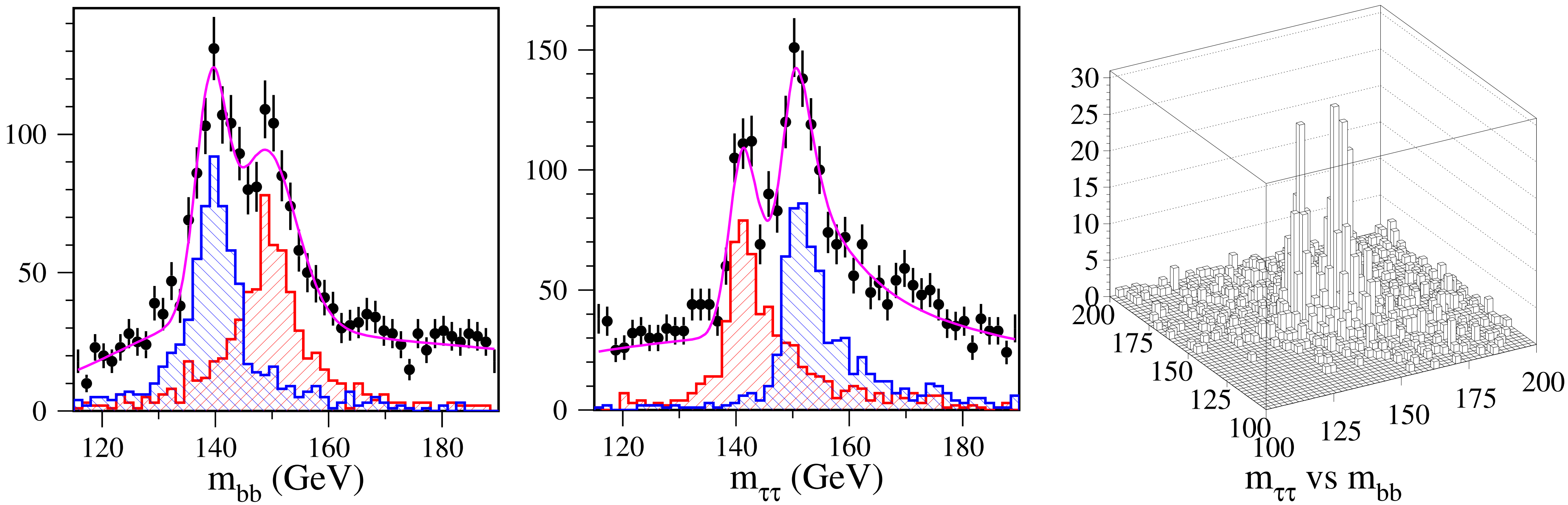
Kinematical Fit

o 4P conservation requirement

o τ direction information

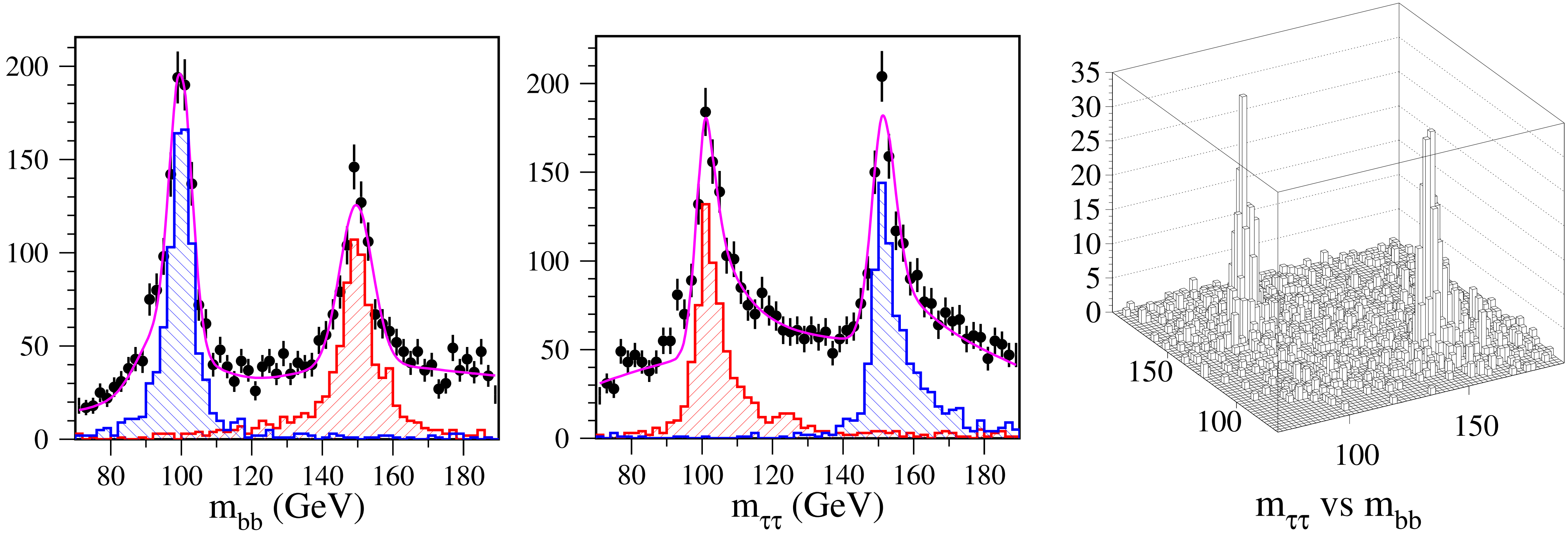


Invariant mass spectra



$$m_H = 150 \text{ GeV}; \qquad m_A = 140 \text{ GeV}$$

Invariant mass spectra



$$m_H = 150\ \mathrm{GeV}; \qquad m_A = 100\ \mathrm{GeV}$$

$\sqrt{s} = 500$ GeV; $\mathcal{L} = 500$ fb^{-1}

$\sin^2(\beta-\alpha) = 1$; $Br(H, A \to b\bar{b}) = 85\%$; $Br(H, A \to \tau^+\tau^-) = 15\%$

(m_H, m_A), GeV	$\delta\sigma/\sigma\ _{HA\to b\bar{b}\tau^+\tau^-}$	$\delta\sigma/\sigma\ _{HA\to\tau^+\tau^- b\bar{b}}$	m_H, GeV	m_A, GeV
(100,90)	4.7%	4.2%	100.56 ± 0.16	90.66 ± 0.14
(150,100)	4.3%	4.0%	150.82 ± 0.20	100.31 ± 0.15
(200,100)	5.9%	4.8%	200.84 ± 0.40	99.63 ± 0.27
(250,100)	13.1%	7.3%	250.62 ± 0.80	99.50 ± 0.60
(150,140)	5.9%	5.2%	150.42 ± 0.29	140.19 ± 0.25
(200,150)	6.9%	6.3%	200.52 ± 0.36	149.86 ± 0.36
(250,150)	17.1%	9.8%	251.27 ± 0.70	149.88 ± 0.66
(200,190)	11.8%	10.2%	201.51 ± 0.87	190.88 ± 0.78