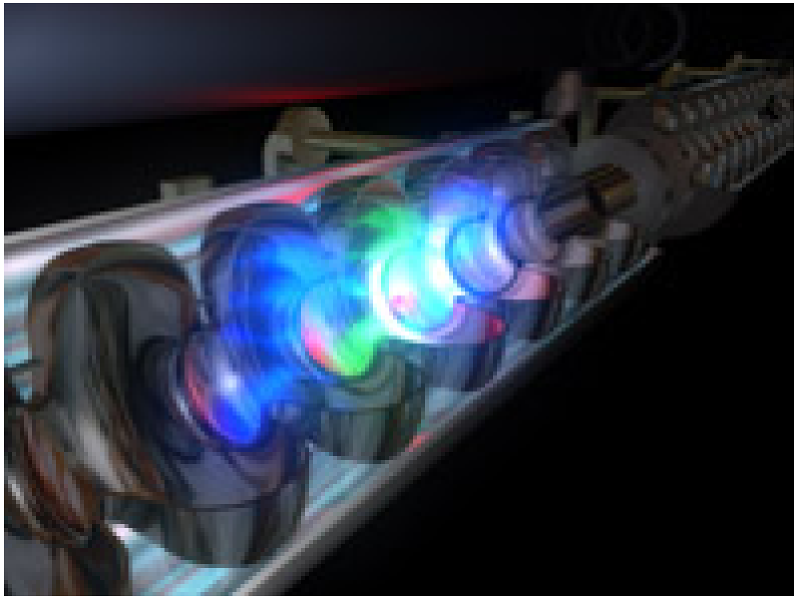

Two photon width of the Higgs boson

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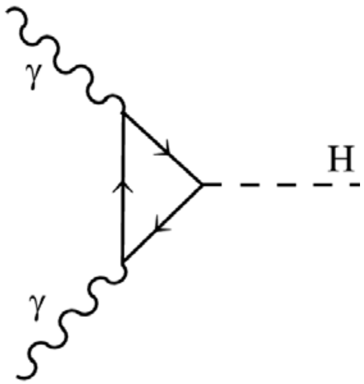
Motivation

- Measure the two-photon partial width:
  - Contribution to the two photon decay width from any kind of massive charged particles. Deviation of the partial width from Standard Model prediction:



    - Evidence for new physics;
    - Can be directly compared to predictions of alternative models (MSSM, NMSSM, general 2HDM).

How to Get Widths?

- The Higgs mass peak gives

$$\Gamma(h \to \gamma\gamma) \times BR(h \to b\bar{b}) \quad (m_h < 140 \text{ GeV})$$

- Taking $BR(h \to b\bar{b})$ and $BR(h \to \gamma\gamma)$ from LHC or LC,

$$\Gamma_{\gamma\gamma} = \frac{\Gamma(h \to \gamma\gamma) \times BR(h \to b\bar{b})}{BR(h \to b\bar{b})}$$

$$\Gamma_{tot} = \frac{\Gamma_{\gamma\gamma}}{BR(h \to \gamma\gamma)}$$

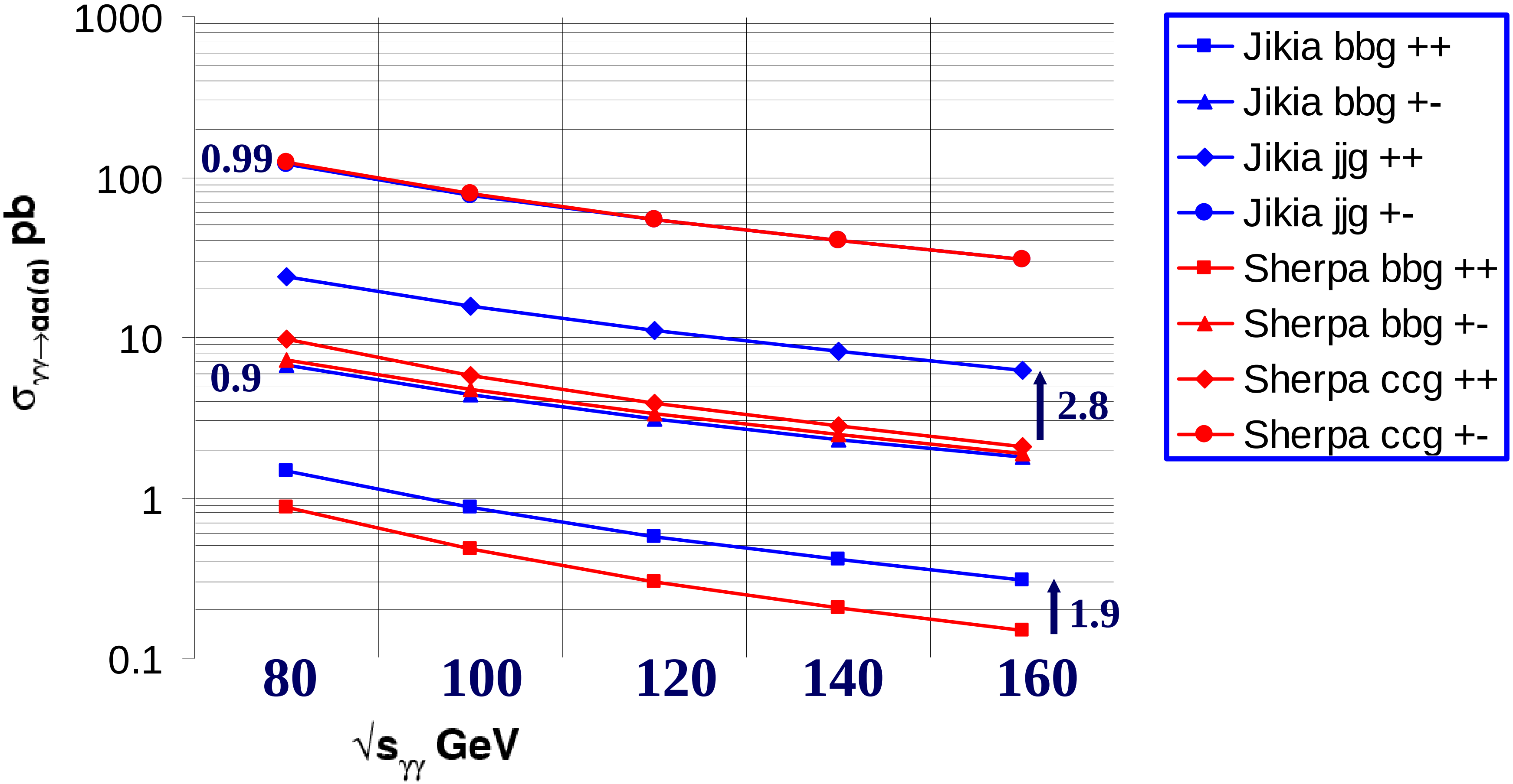
- This is proposed as way to get the total Higgs width. Model-independent result.

The analysis

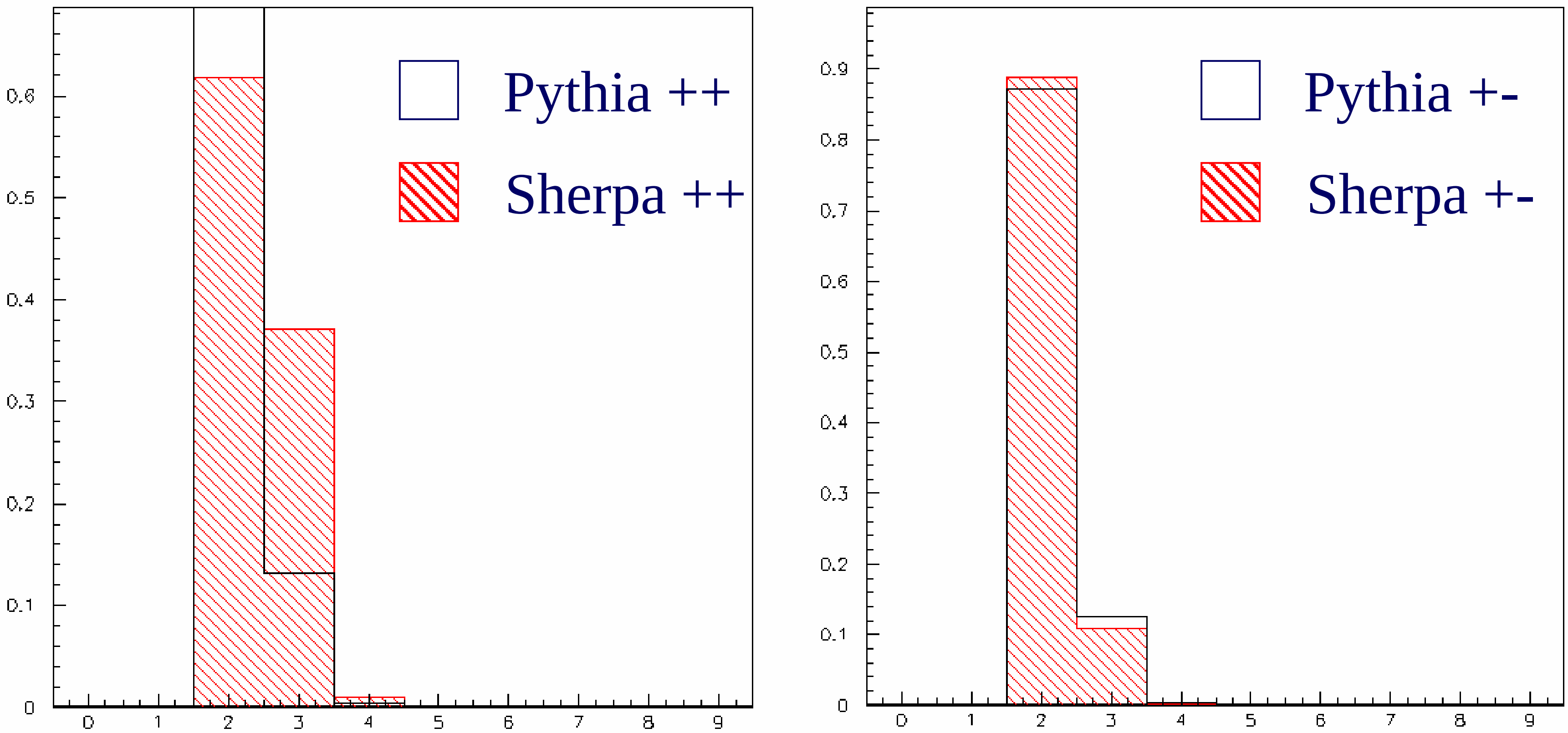
- Background MC generated with SHERPA (CERN-TH/2003-284) and passed through the TESLA fast simulation:
  - $\sqrt{s_{\gamma\gamma}} > 80$ GeV
  - Convolution with the realistic photon spectrum for ++ and +- photon helicities

- Selection:
  - $N_{jet} = 2,3$
  - $|\cos\theta_T| < 0.7$
  - $E_{vis} > 95\,\mathrm{GeV}, \quad E_{long}/E_{vis} < 0.1$
  - $NN_{out}^{\text{fastest jet}} > 0.95, \ NN_{out}^{\text{2nd fast jet}} > 0.2$

Background Cross Sections

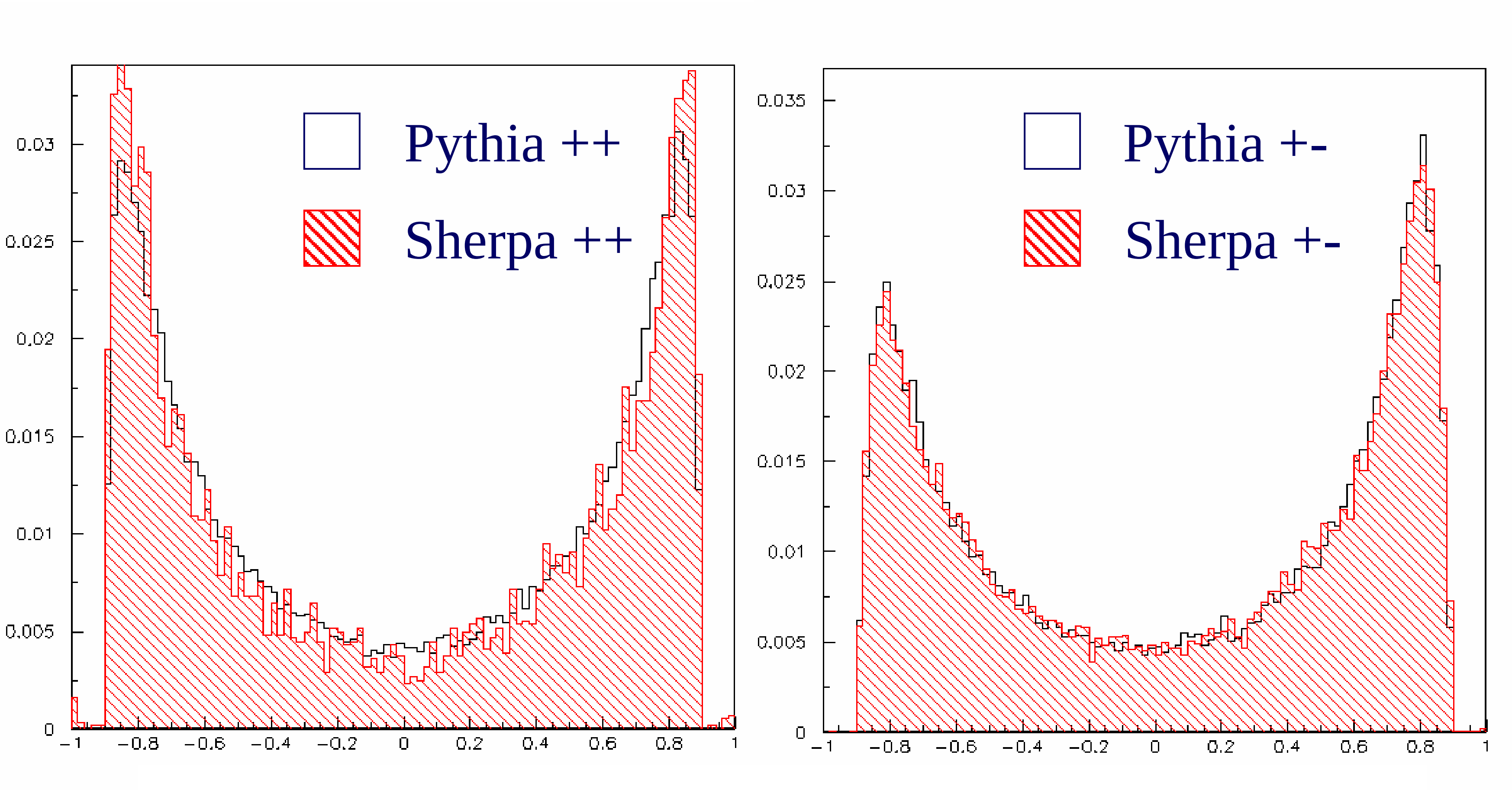


Sherpa versus Pythia



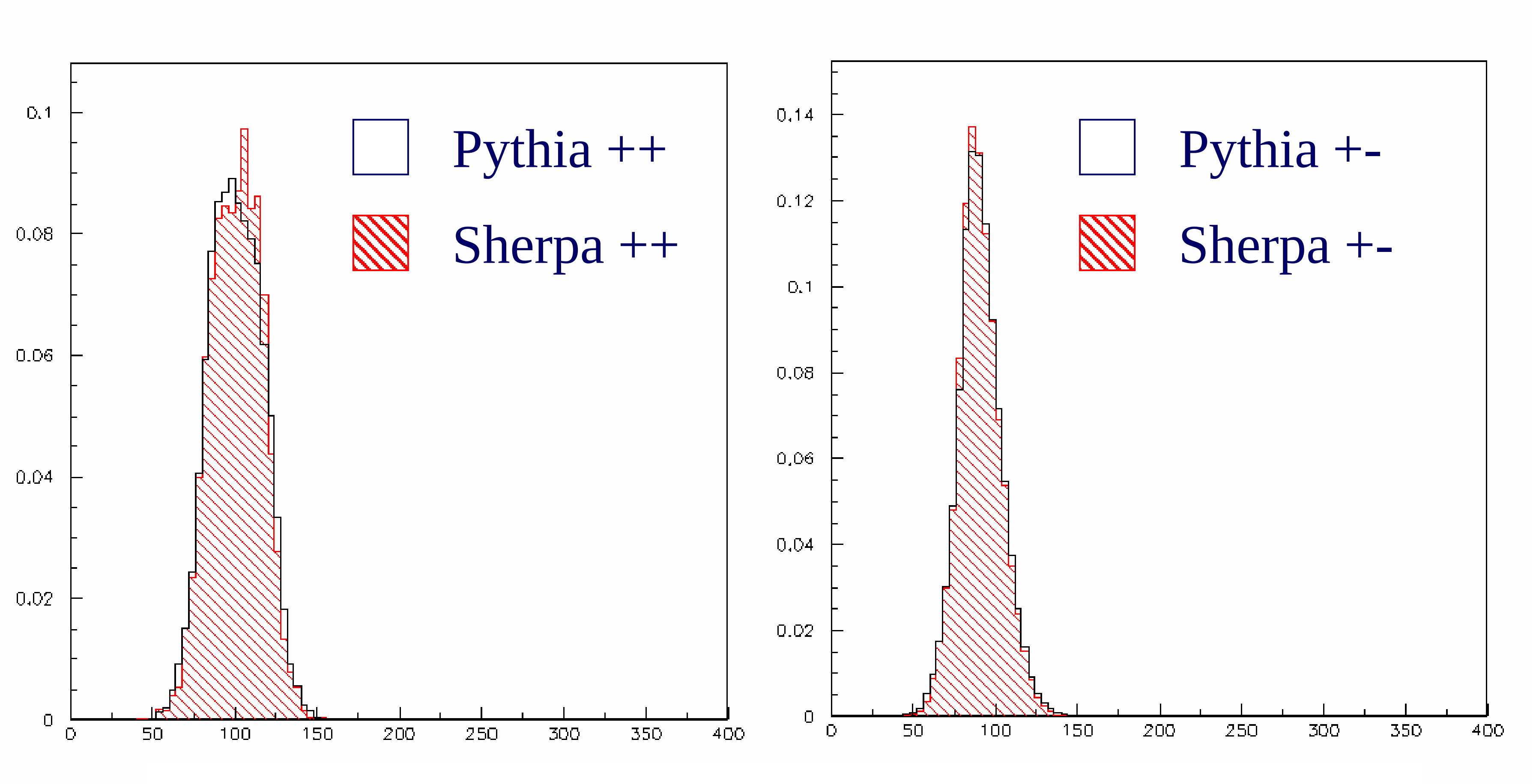
N_{jet}

Sherpa versus Pythia



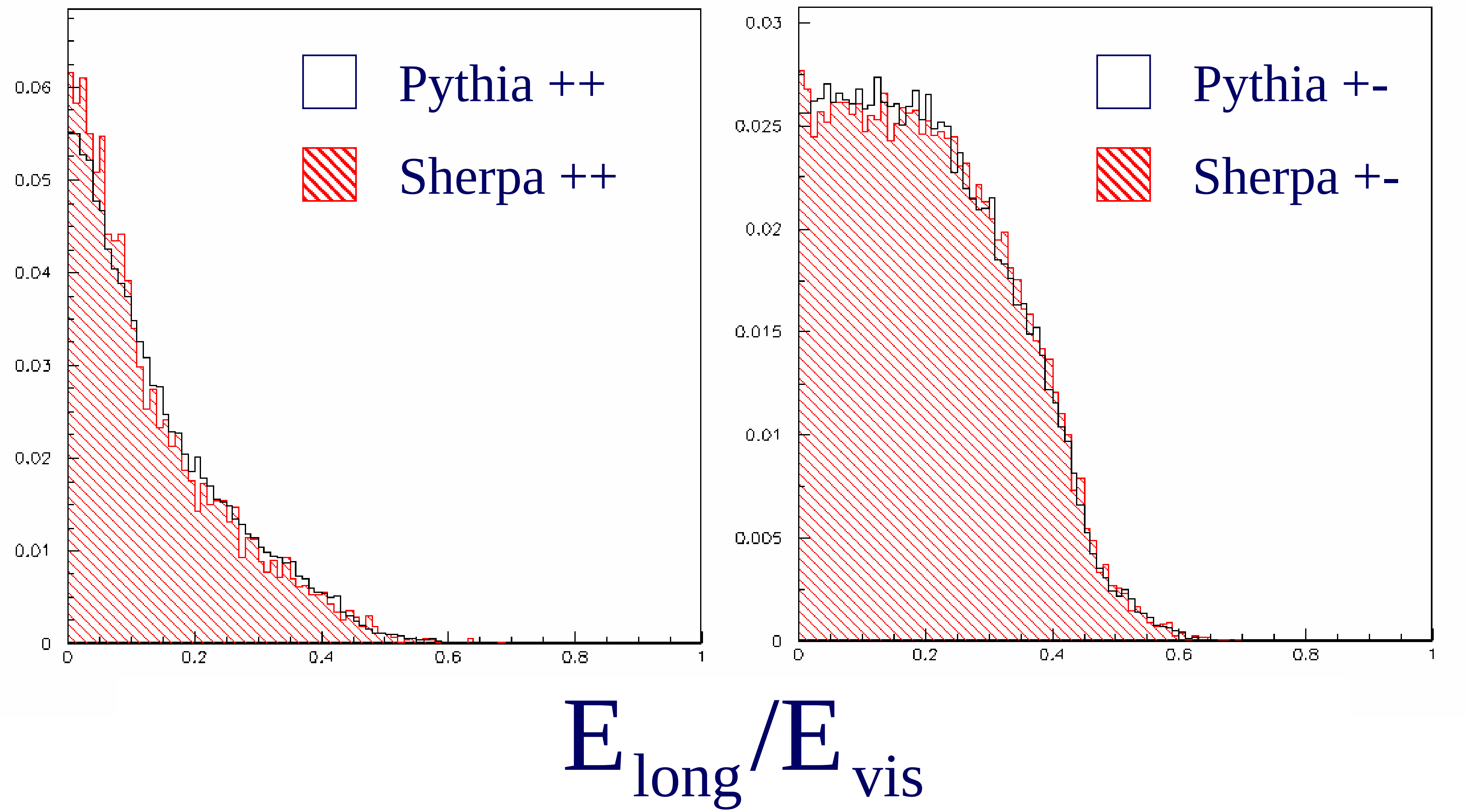
$\cos\theta_T$

Sherpa versus Pythia

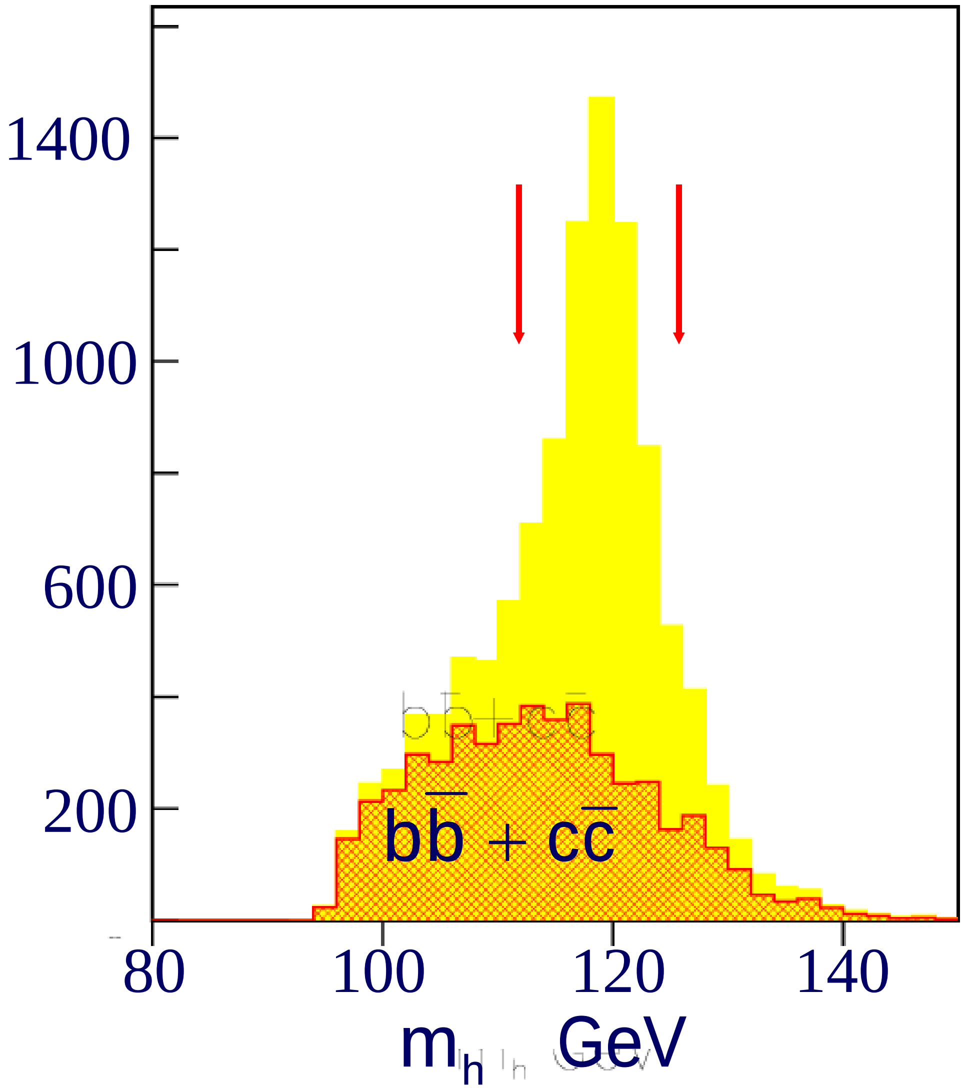


E_{vis}

Sherpa versus Pythia



Invariant Mass Spectrum



$$N_{sig} = 4505 \text{ events}$$

$$N_{bkg} = 1698 \text{ events}$$

$$\frac{\Delta\left[\Gamma(h \to \gamma\gamma)BR(h \to b\bar{b})\right]}{\left[\Gamma(h \to \gamma\gamma)BR(h \to b\bar{b})\right]} =$$

$$= \frac{\sqrt{N_{obs}}}{N_{obs} - \langle N_b \rangle} = 1.7\%$$

Summary

- Measure $\Gamma(h \to \gamma\gamma) \times BR(h \to b\bar{b})$ with a precision below 2% by:
  - Taking into account the QCD radiative corrections to the background process $\gamma\gamma \to q\bar{q}$;
  - Adopting a b-quark tagging algorithm based on a neural network.