

Flavour Tagging Requirements

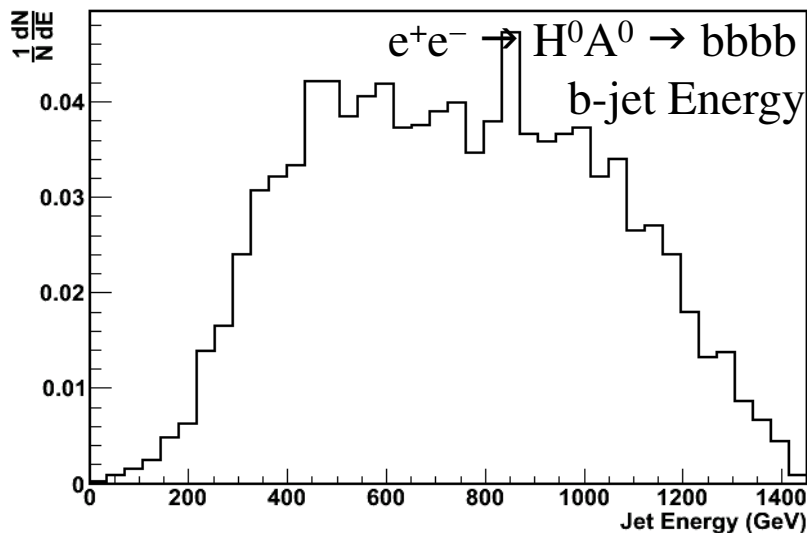
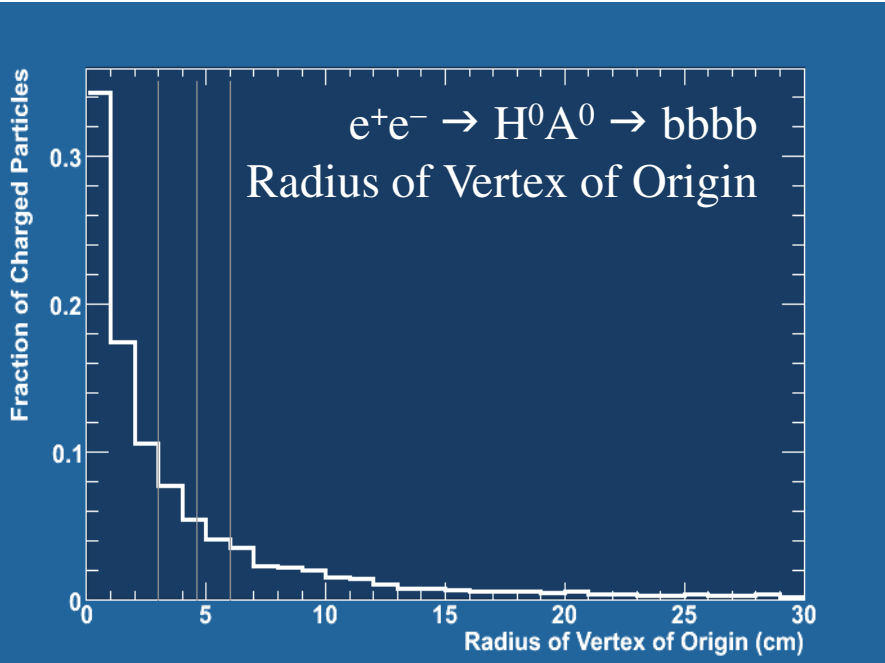
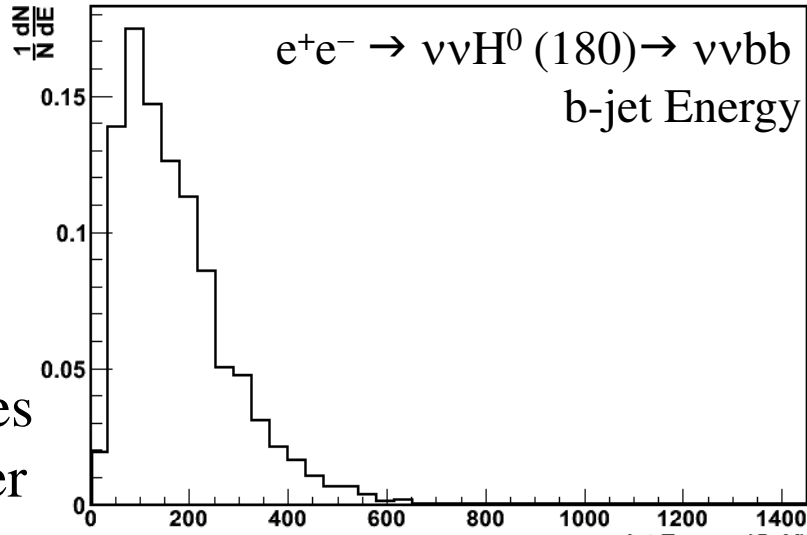
M Battaglia



Kinematics and Topology

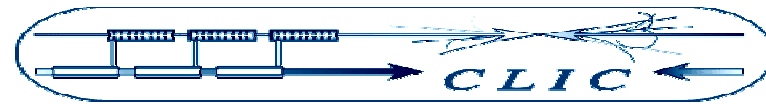
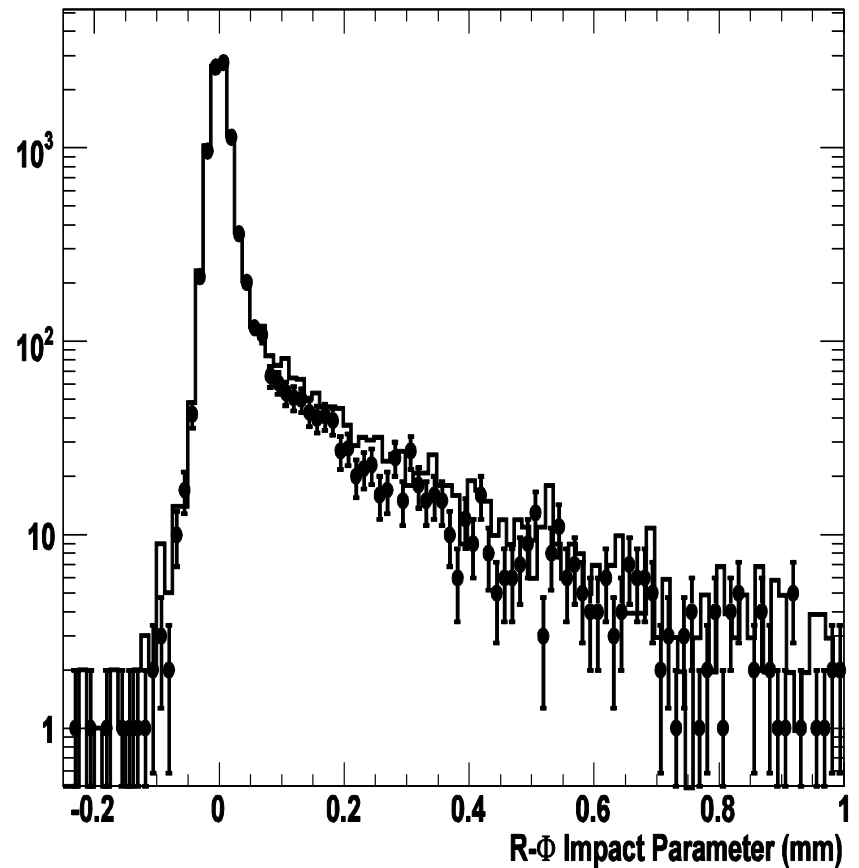
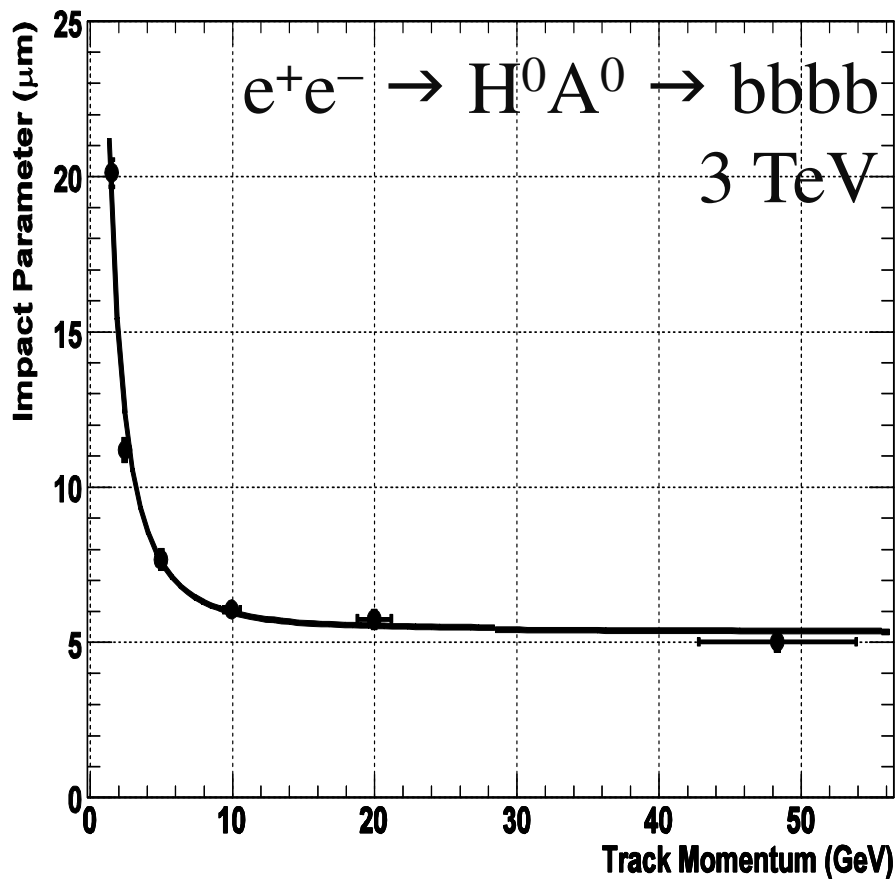
Broad range of b-jet energies of interest:
 ~0.1 → 1.5 TeV;

Long lived hadrons in b-jets acquire significant flight distance: in four jet 3 TeV events over 1/3 of charged particles with $p > 1$ GeV decay after first VTX layer



Impact Parameter Resolution

Five-layered barrel VTX with $R_{in} = 30$ mm, $R_{out} = 60$ mm
15 μm pixels, 3 μm single point resolution,
MOKKA+ dedicated Marli



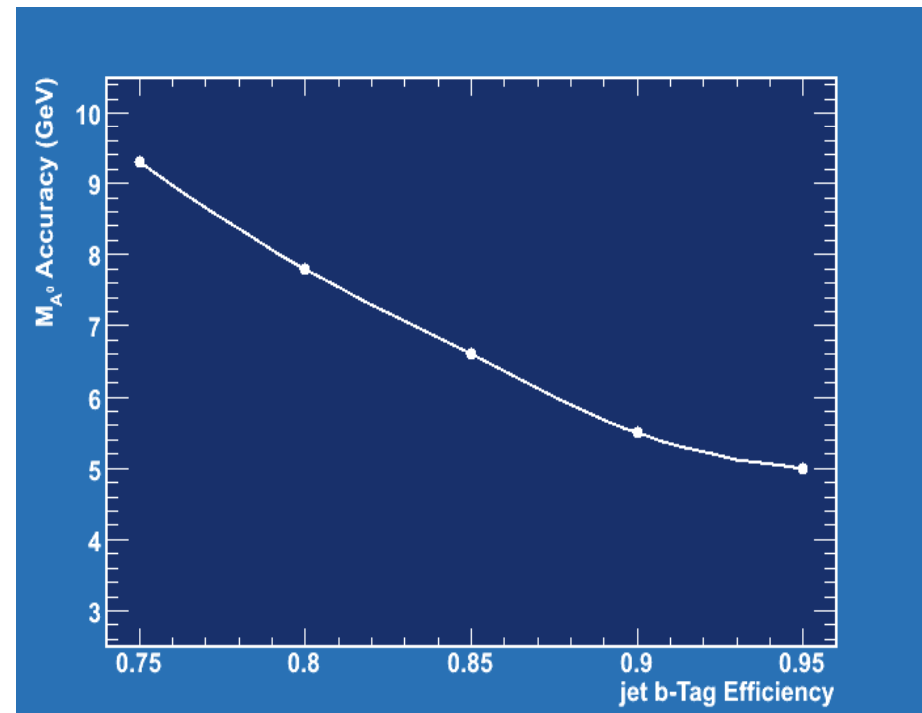
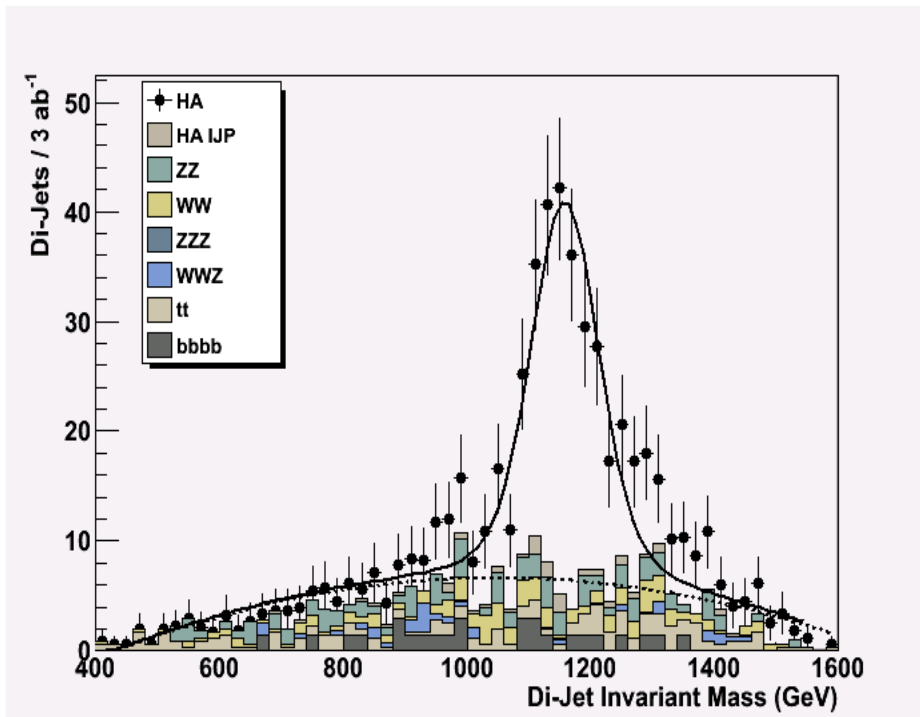
b-tag in Multi-parton Processes:

$$e^+e^- \rightarrow H^0 A^0 \rightarrow bbbb$$

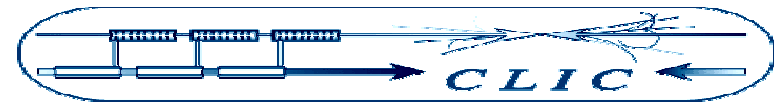
SUSY heavy Higgs boson expected to be a genuine feast for flavour tagging

- $e^+e^- \rightarrow H^0 A^0 \rightarrow bbbb, \rightarrow bb\tau\tau, \rightarrow \tau\tau\tau$;
- $e^+e^- \rightarrow H^+H^- \rightarrow tbtb, \rightarrow \tau\nu\tau\nu$.

Production central but cross sections only O(1 fb) and $\varepsilon = \varepsilon_{\text{tag}}^4$



Full MOKKA+Marlin w/ Full SM Bkg + 20 BX $\gamma\gamma$

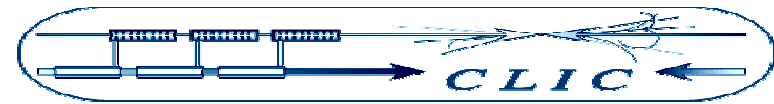
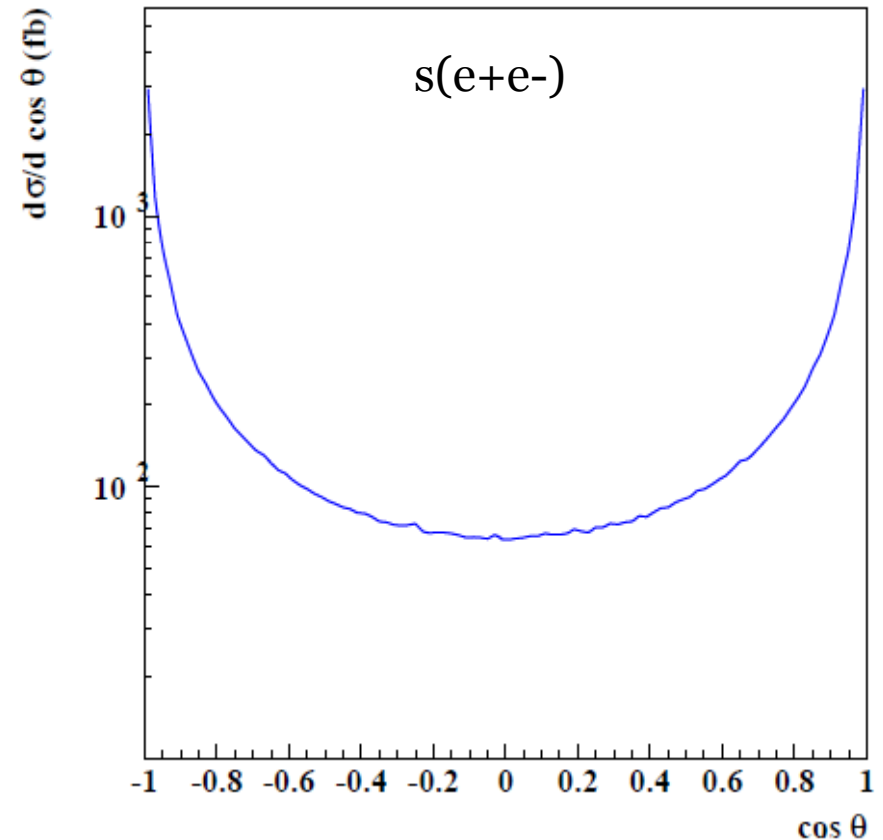
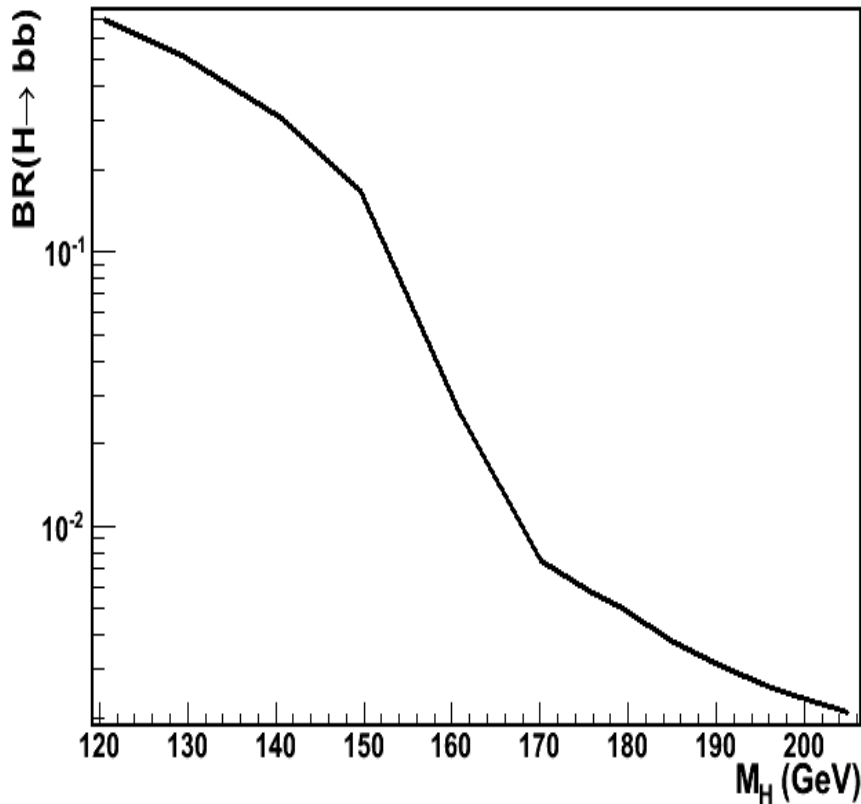


b-tag in Missing Energy Processes:

$$e^+e^- \rightarrow \nu\nu H^0 \rightarrow \nu\nu bb$$

Determine intermediate-mass Higgs fermionic coupling g_{Hbb}

$H \rightarrow bb$ as “Rare Higgs Decay”



b-tag in Missing Energy Processes:

$$e^+e^- \rightarrow \nu\nu H^0 \rightarrow \nu\nu b\bar{b}$$

Preliminary

MOKKA+Marlin

H(180) $\nu\nu$ signal

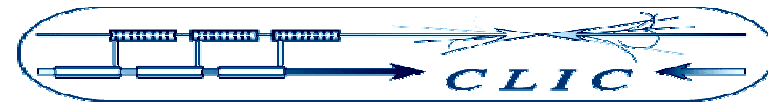
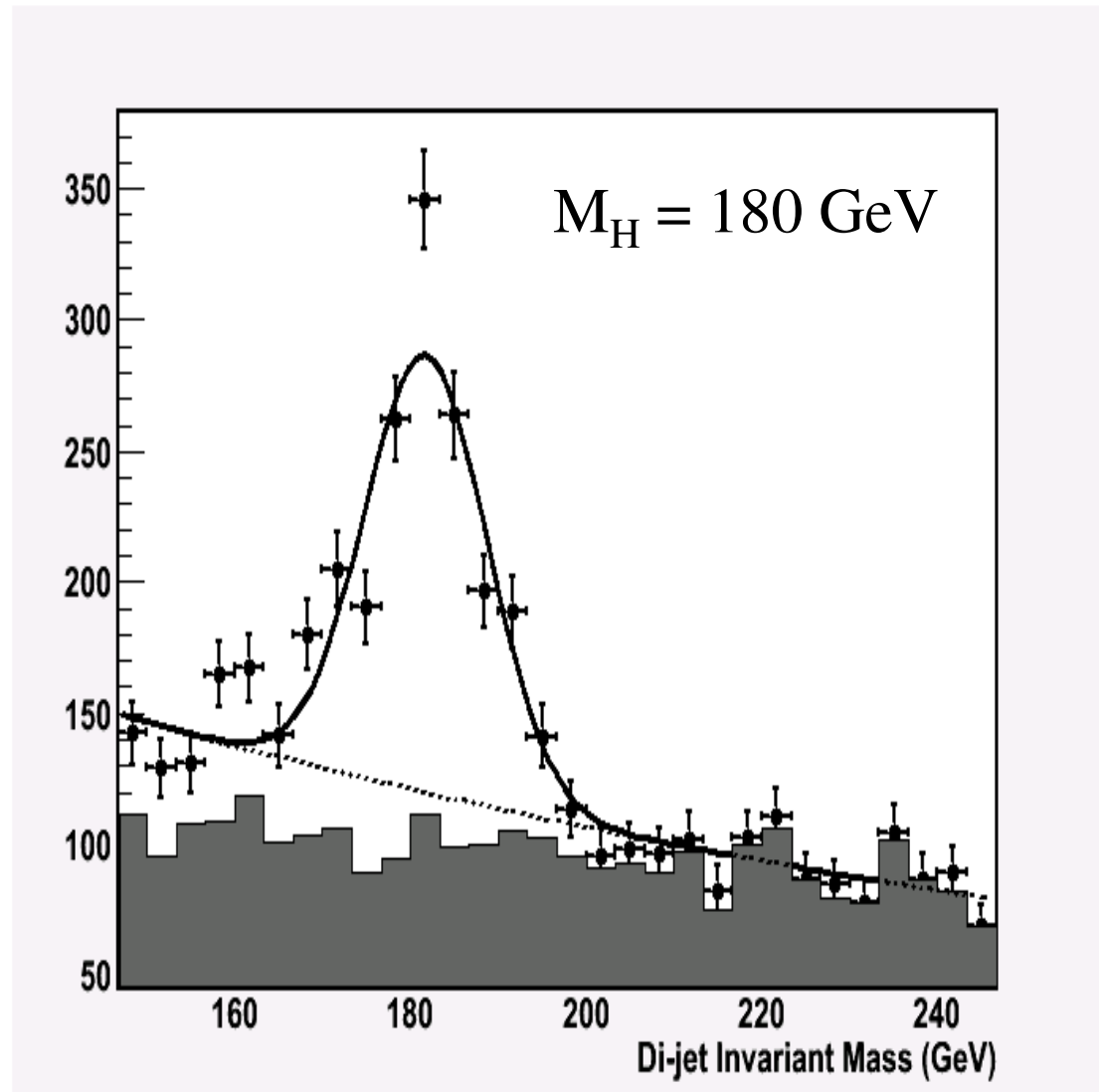
+ simulation level

SM background;

Assume $\varepsilon_b = 0.90$

$\delta\text{BR}(H \rightarrow b\bar{b})/\text{BR}(H \rightarrow b\bar{b})$

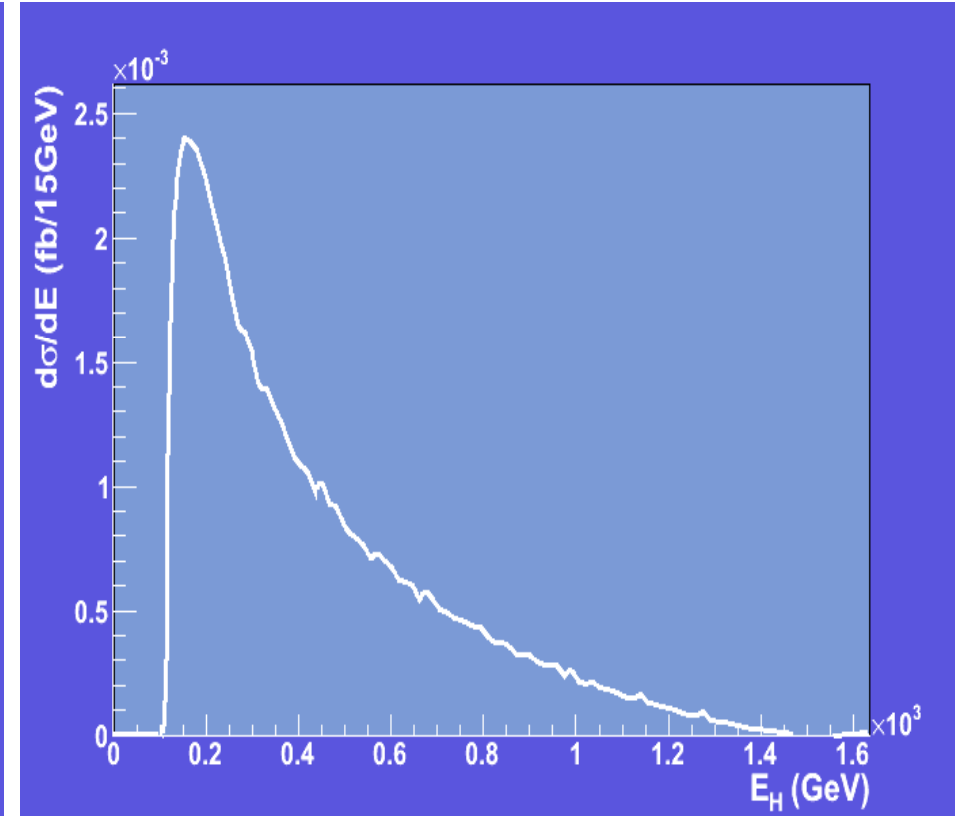
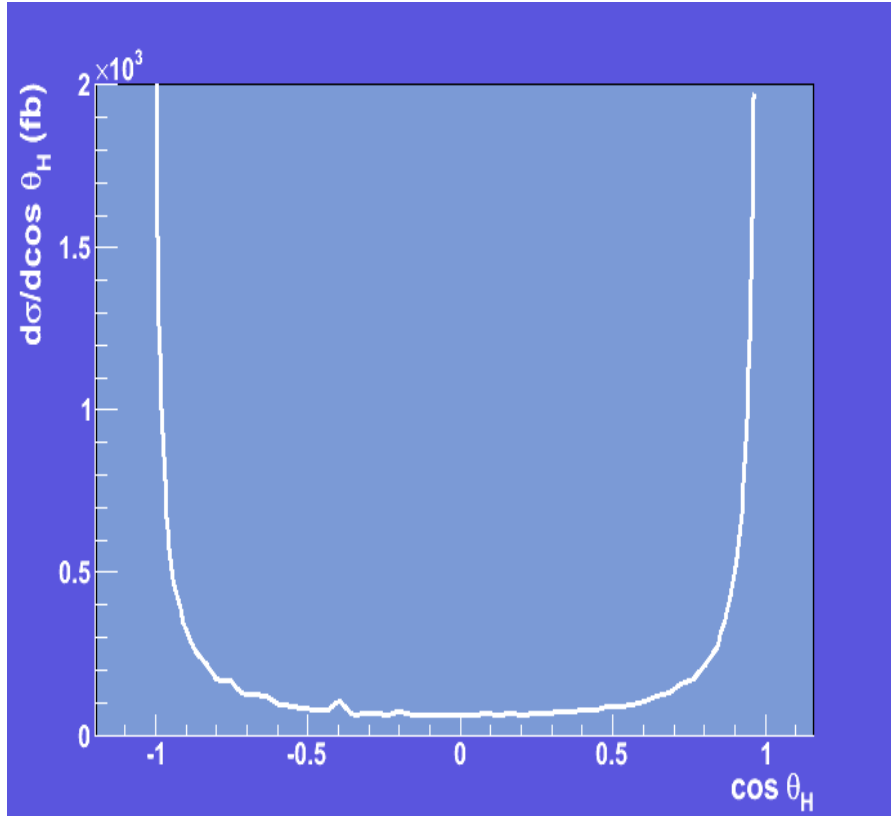
= 0.045



b-tag in Missing Energy Processes:

$$e^+e^- \rightarrow \nu\nu H^0 H^0 \rightarrow \nu\nu bbbb$$

Unique opportunity to precisely probe Higgs potential through g_{HHH}



Experimental “tour de force” : xSec ~ 1 fb; soft, fwd b-jets and $ZZ\nu\nu$, $WW\nu\nu$, $t\bar{t}$ backgrounds

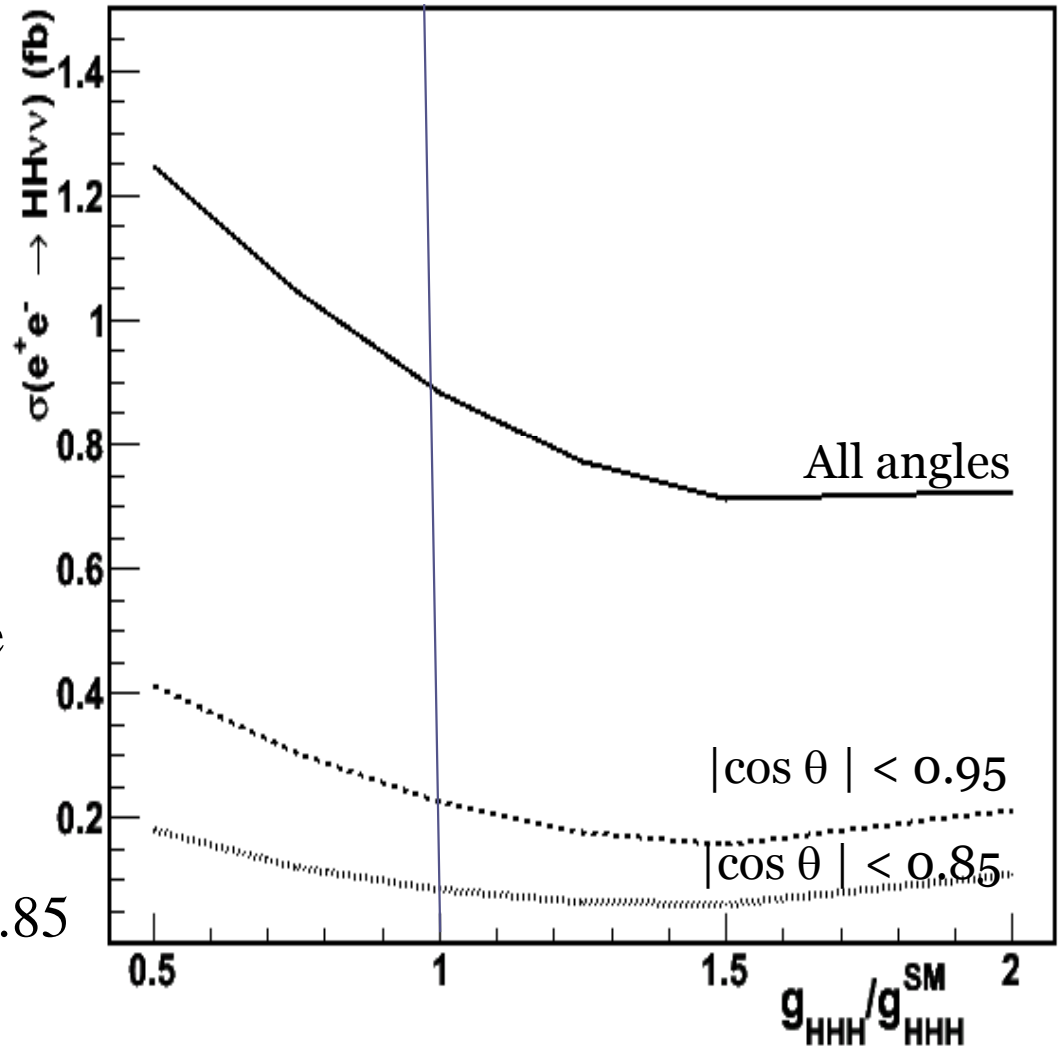


Non-trivial interference of double WW fusion with other diagrams yielding double Higgs production but not involving the triple Higgs vertex;

Imperative to accept (b-tag ?) jets at low angles to retain the sensitivity to g_{HHH} ;

$\epsilon = \epsilon_b^4$ with $\sim 1.5\text{-}2.0\text{k}$ useful evts \rightarrow need to achieve $\epsilon_b > 0.85$

Sensitivity of HH $\nu\nu$ cross section to triple Higgs coupling for various polar angle coverages



b-tag in 2-fermion Processes:

$$e^+e^- \rightarrow bb$$

Electroweak observables open up window on high mass scale beyond kinematic reach and enable us to identify nature of new bosons;

Cross sections, A_{FB} and A_{LR} main observables for tagged fermions;

No significant loss of sensitivity discarding small angles but needs high tagging efficiency and purity and potentially vertex charge for A_{FB} .

Sensitivity to Z'_{SSM} from $\sigma(e^+e^- \rightarrow bb)$ for various polar angle coverages

