

Spin correlation effects in the $t\bar{t}+H$ production channel

$t\bar{t}H$ subgroup meeting

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arXiv:1212.3460

Keeping track of spin correlation effects at NLO

Frixione, Laenen, Motylinski, Webber

- generate NLO events keeping the resonances **on-shell without the decay**
- read the event file before the shower
- generate the virtuality of each resonance and reshuffle the momenta
- generate the kinematics of the decay
- reweight the event by the ratio $|M_{prod+decay}|^2 / |M_{prod}|^2$
or do secondary **unweighting**:
keep generating decay configurations until

$$|M_{prod+decay}|^2 / |M_{prod}|^2 > Rand() \times \left(|M_{prod+decay}|^2 / |M_{prod}| \right)_{max}$$

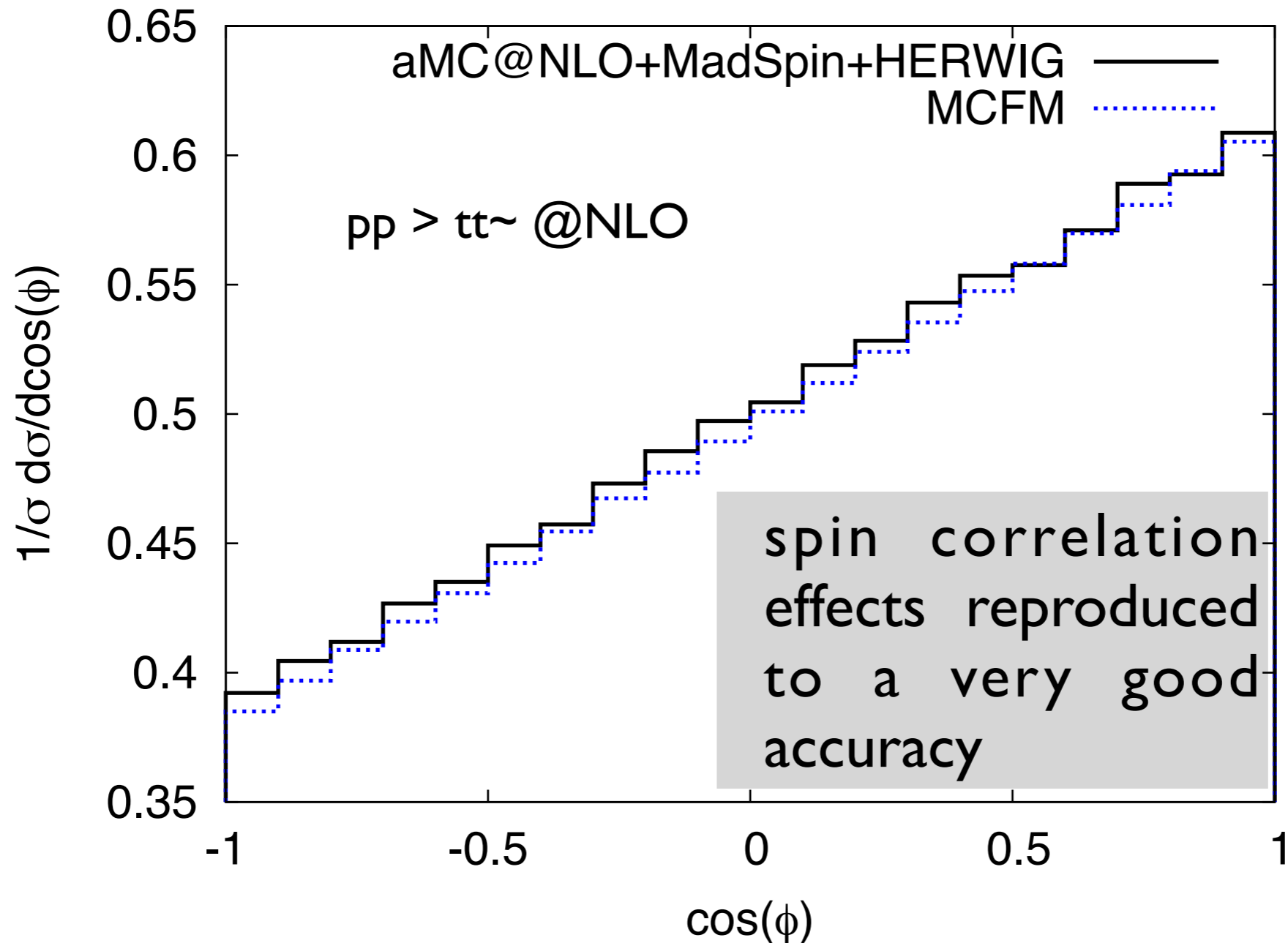
Generic implementation

PA, Frederix, Mattelaer, Rietkerk

- the previous algorithm has been implemented in madgraph 5, and the corresponding module is called **MADSPIN**
- it takes advantage of the **user-friendly interface** inherent to mg5
- it can be used to generate the decay of **any processes** of which matrix elements are available in mg5
- it can take as an input **any LHE event file**, e.g. it can also decay hard events generated by POWHEG (up to a straightforward modification of the banner)

Validation

Spin correlation effects: example of a validation plot

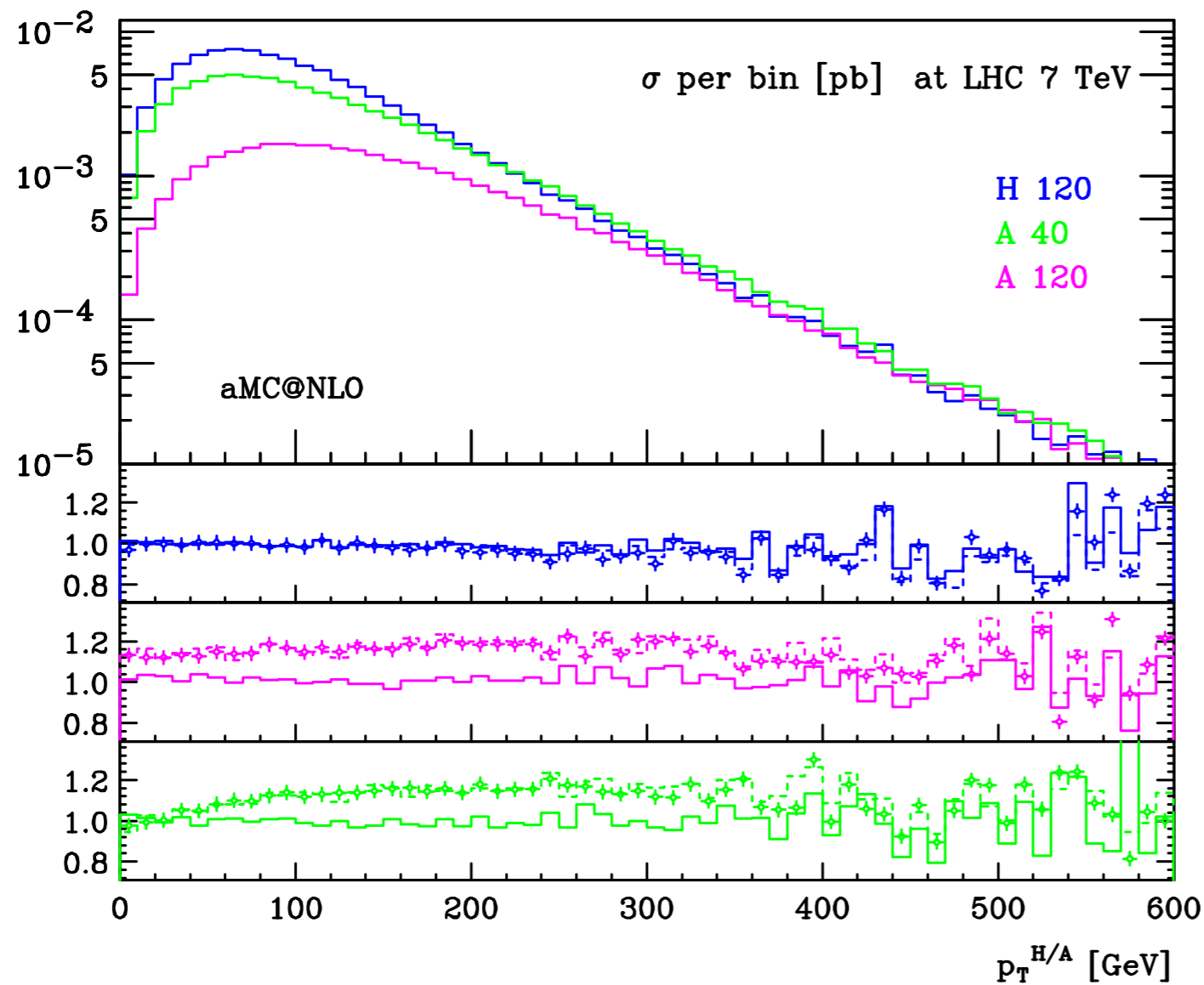


ϕ : angle between the direction of the muon in the t rest frame and the direction of the anti-muon in the anti-t rest frame

Application

process : $p p \rightarrow t t \sim H @ NLO$

undecayed events generated with aMC@NLO



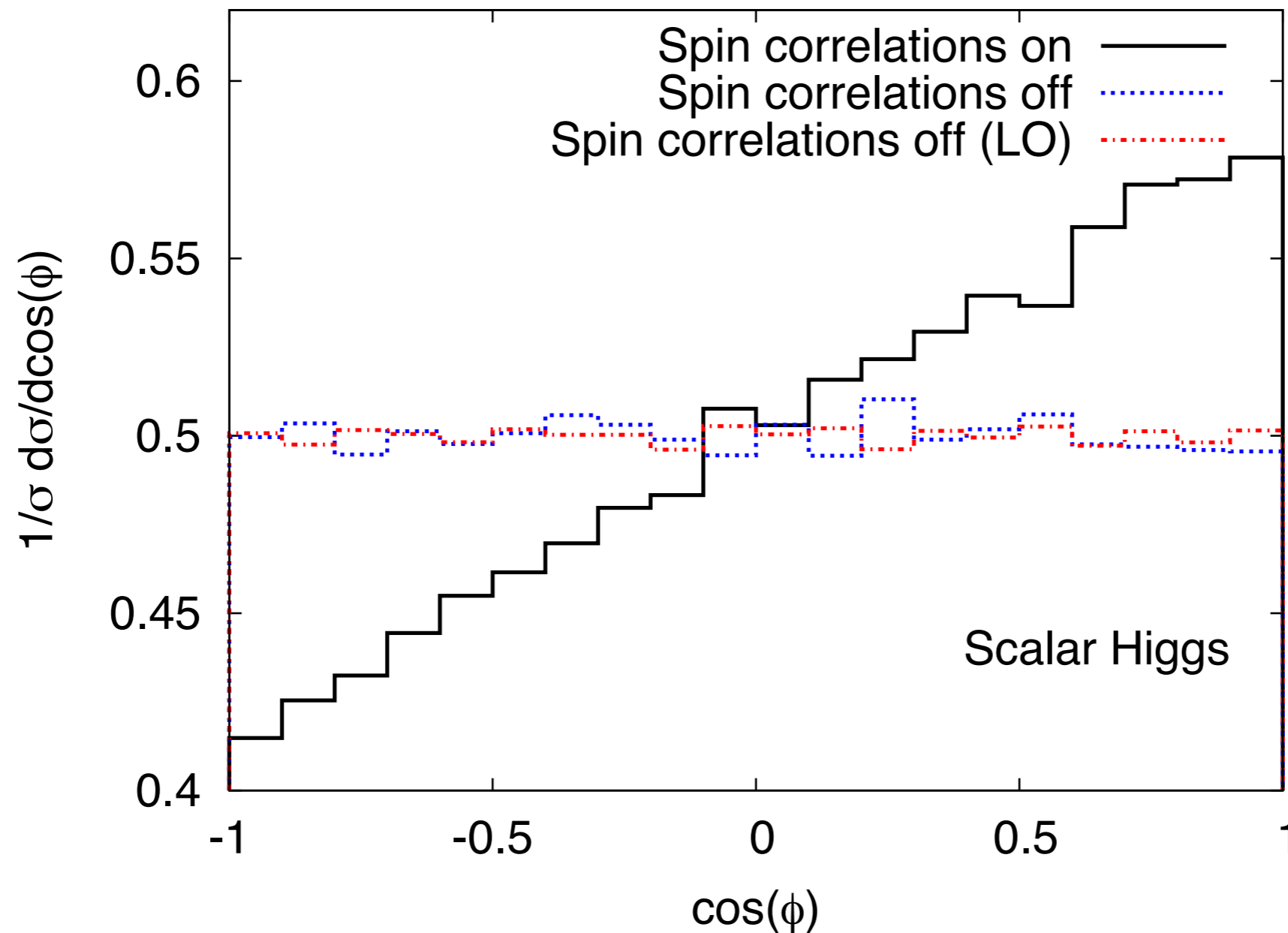
Pt spectrum of H
predicted by

Frederix, Frixione,
Hirschi, Maltoni,
Pittau, Torielli

Application

process : $p p \rightarrow t \bar{t} H$ @ NLO, dileptonic channel

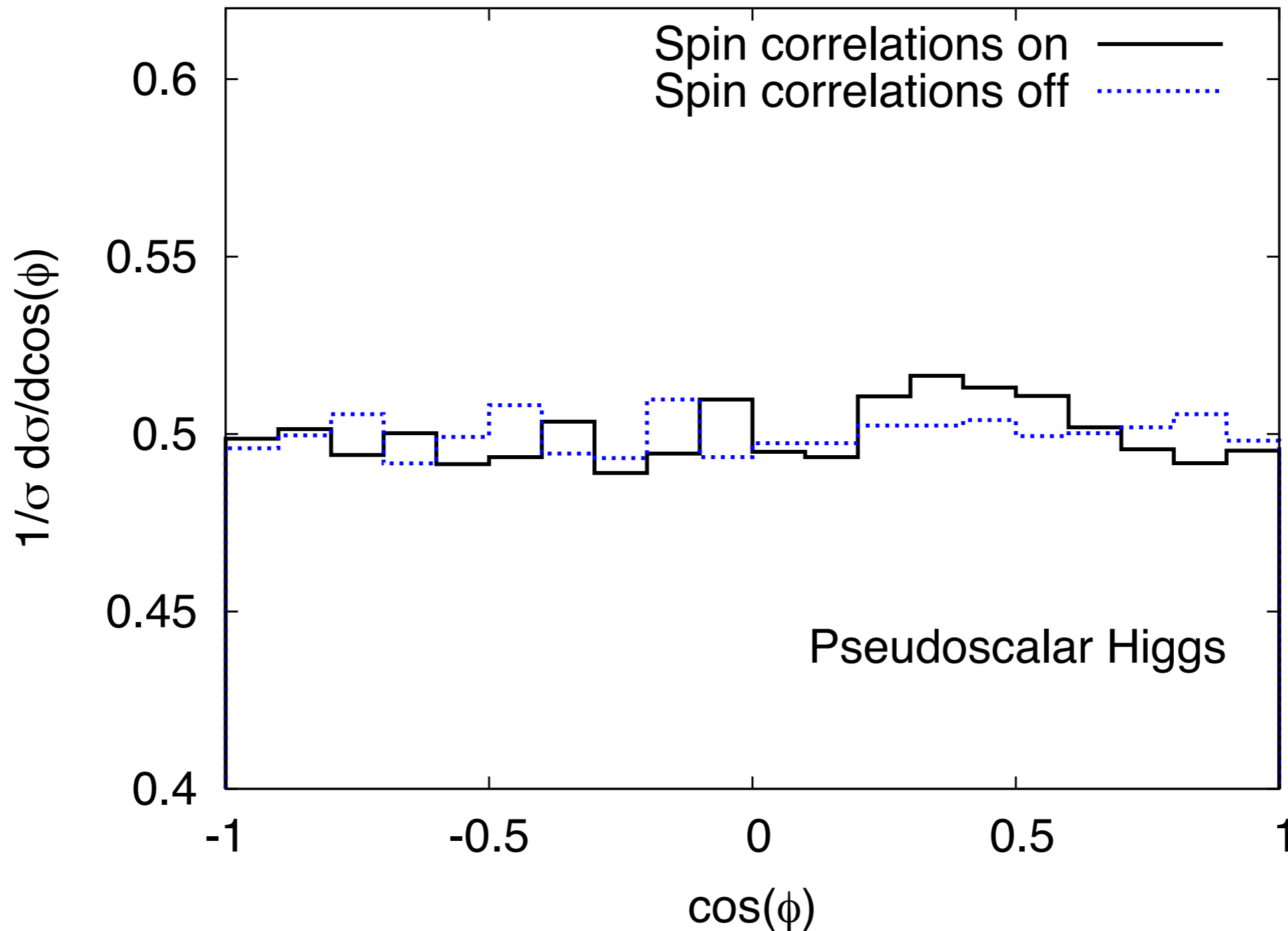
predictions from aMC@NLO + MadSpin + Herwig



Application

process : $p p \rightarrow t \bar{t} H$ @ NLO, dileptonic channel

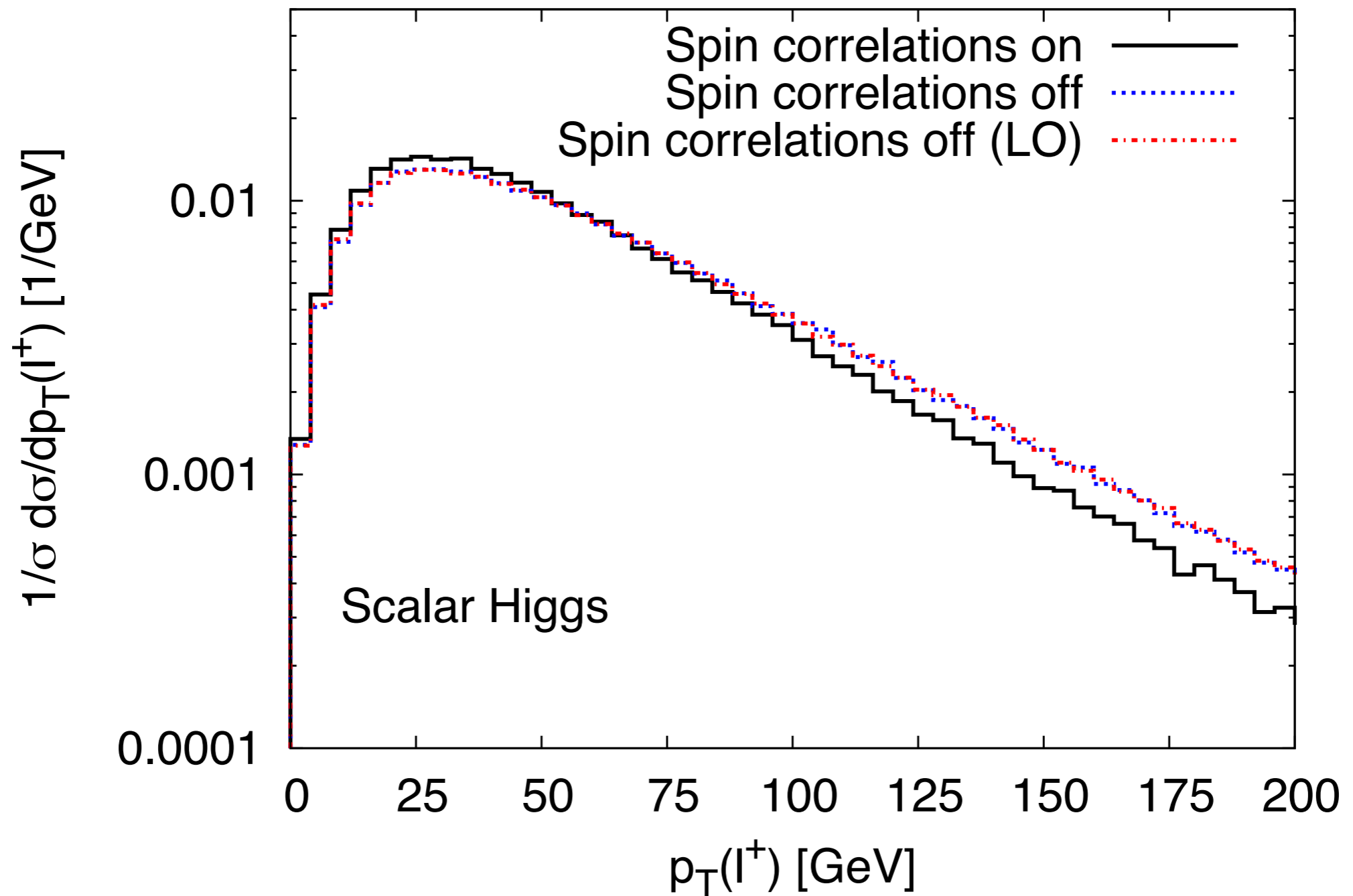
predictions from aMC@NLO + MadSpin + Herwig



Application

process : $p p \rightarrow t t \sim H$ @ NLO, dileptonic channel

predictions from aMC@NLO + MadSpin + Herwig



Application

- ➔ large effects from spin correlation effects in comparison with the size of QCD corrections in the production
- ➔ angular distributions of the leptons depend on the parity of the Higgs