

DANIEL STOLARSKI

Short CV:

- Ph.D. at Berkeley with Nomura ('10)
- Postdoc at U Maryland and Johns Hopkins ('10-'13)
- CERN Oct '13 - Dec '15
- Starting at Carleton University Jan 2016.

DANIEL STOLARSKI

Short CV:

- Ph.D. at Berkeley with Nomura ('10)
- Postdoc at U Maryland and Johns Hopkins ('10-'13)
- CERN Oct '13 - Dec '15
- Starting at Carleton University Jan 2016.



TH RETREAT 2013

OTHER WORK

Current Projects

- CP violation in tth
- Radion couplings in RS
- Flavor mixing in natural SUSY

Recent Papers

- “Reach in all Hadronic Stop Decays” (Snowmass)
- “Dynamics of a Stabilized Radion and Duality”
- “Gauging the Way to MFV”
- “Directly Measuring the Tensor Structure of the Scalar Coupling to Gauge Boson”

TH RETREAT 2013

OTHER WORK

Current Projects

- CP violation in tth
- Radion couplings in RS
- Flavor mixing in natural SUSY

Recent Papers

- “Reach in all Hadronic Stop Decays” (Snowmass)
- “Dynamics of a Stabilized Radion and Duality”
- “Gauging the Way to MFV”
- “Directly Measuring the Tensor Structure of the Scalar Coupling to Gauge Boson”

Chacko, Mishra, DS, Verhaaren, PRD,
arXiv:1411.3758.

TH RETREAT 2014

FUTURE DIRECTIONS

- Running of α_3 at 100 TeV
- Flavor violation in LH squarks
- Dark matter EFT at colliders
- Spin correlations in tth
- Lights stops and Higgs data

TH RETREAT 2014

FUTURE DIRECTIONS

- Running of α_3 at 100 TeV
- Flavor violation in LH squarks
- Dark matter EFT at colliders
- Spin correlations in tth
- Lights stops and Higgs data

Ongoing 2013 - present



TH RETREAT 2014

FUTURE DIRECTIONS

- Running of α_3 at 100 TeV ← Ongoing 2014 - present
- Flavor violation in LH squarks
- Dark matter EFT at colliders
- Spin correlations in tth ← Ongoing 2013 - present
- Lights stops and Higgs data

TH RETREAT 2014

FUTURE DIRECTIONS

- Running of α_3 at 100 TeV ← **Ongoing 2014 - present**
- Flavor violation in LH squarks
- Dark matter EFT at colliders ← **Scooped!**
- Spin correlations in tth ← **Ongoing 2013 - present**
- Lights stops and Higgs data ← **Ongoing 2013 - present**

TH RETREAT 2014

FUTURE DIRECTIONS

- Running of α_3 at 100 TeV ← Ongoing 2014 - present
- Flavor violation in LH squarks
- Dark matter EFT at colliders ← Scooped!
- Spin correlations in tth ← Ongoing 2013 - present
- Lights stops and Higgs data ← Ongoing 2013 - present

Batell, McCullough, DS, Verhaaren, JHEP,
arXiv:1508.01208.

LESSONS

- I need a new keynote template.

LESSONS

- I need a new keynote template.
- Physics is hard.

LESSONS

- I need a new keynote template.
- Physics is hard.
- More interesting questions than I have time to work on.

LESSONS

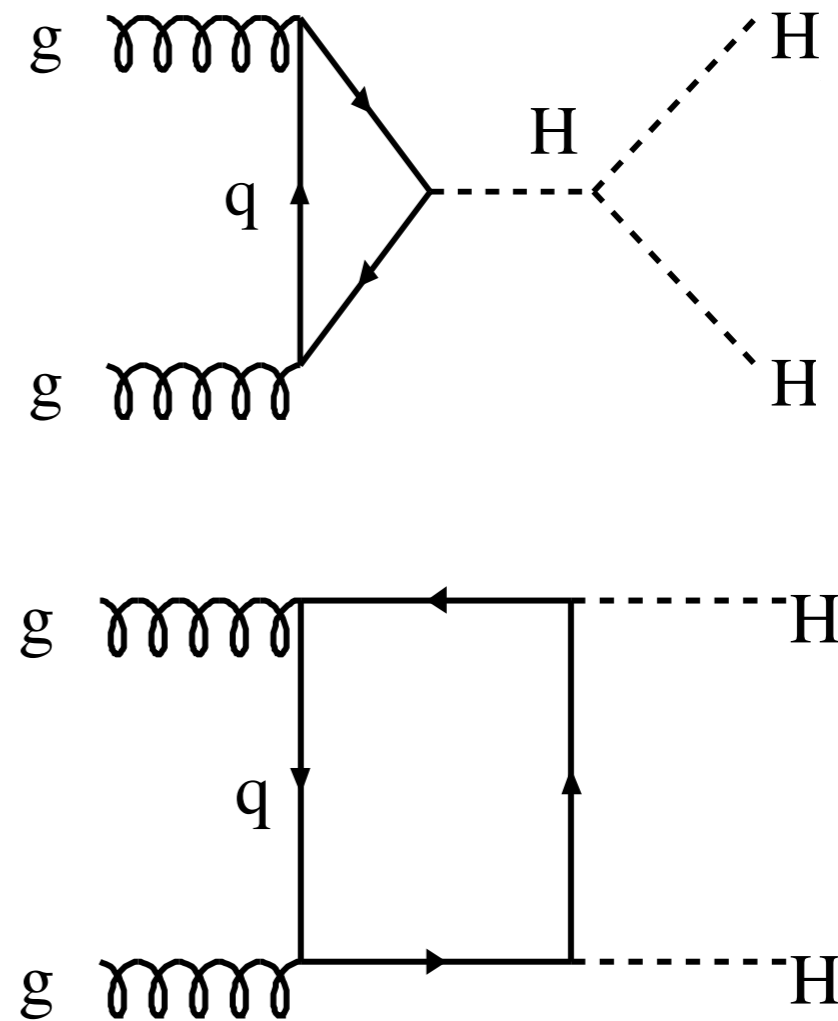
- I need a new keynote template.
- Physics is hard.
- More interesting questions than I have time to work on.
- Maybe I need some students?

DI-HIGGS PRODUCTION

Di-Higgs production a loop process at LHC.

Two diagrams, strong destructive interference —amplitude vanishes at threshold.

Perhaps can be sensitive to new physics?



Li and Voloshin [arXiv:1311.5156].

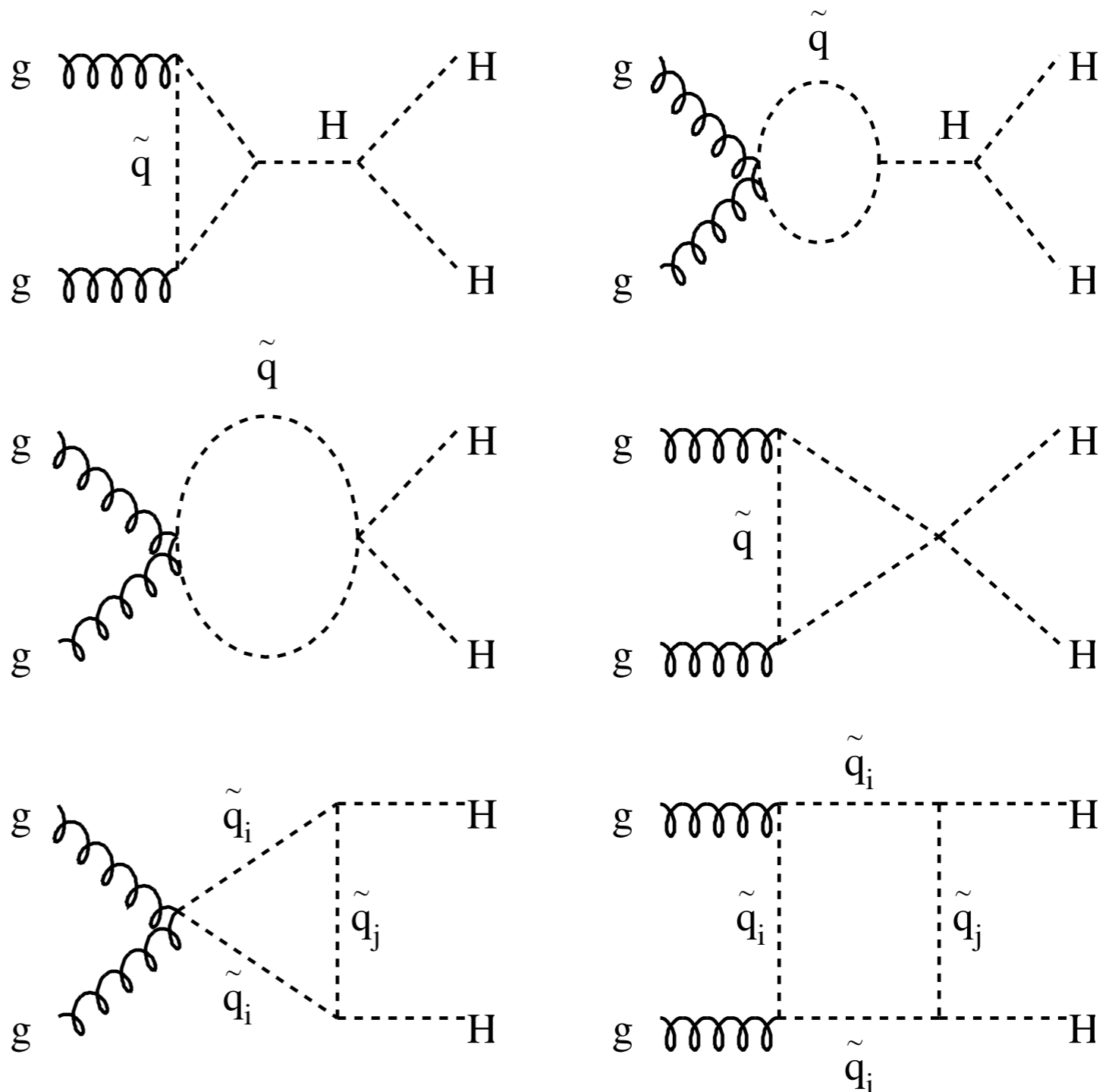
STOPS

No cancellation in the presence of new physics.

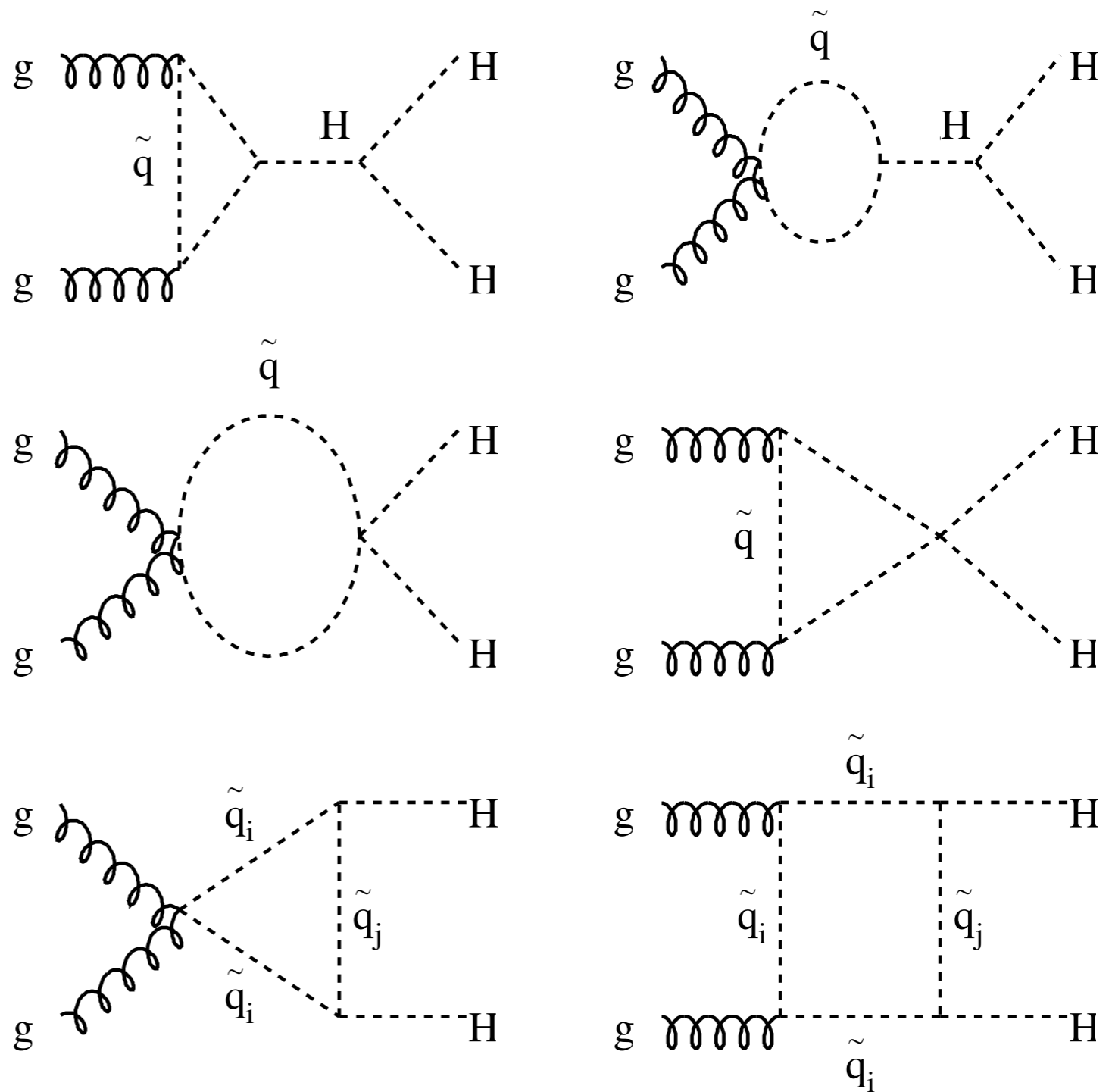
Effects could be large.

Balyaev et. al.,
[hep-ph/9905266](https://arxiv.org/abs/hep-ph/9905266).

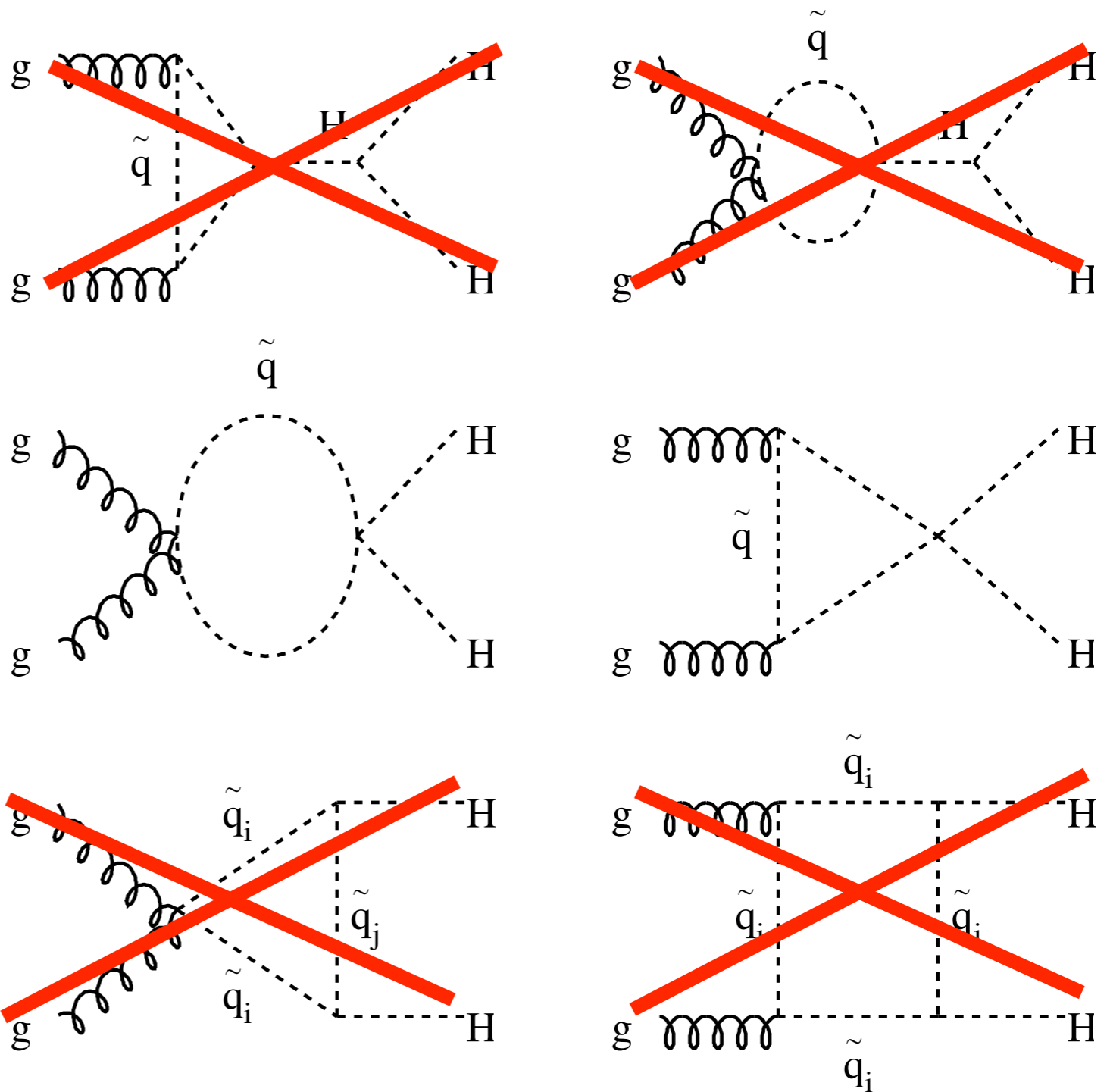
Barrientos Bendezu and
Kniehl, [hep-ph/0103182](https://arxiv.org/abs/hep-ph/0103182).



CAN PROBE BLIND SPOTS?



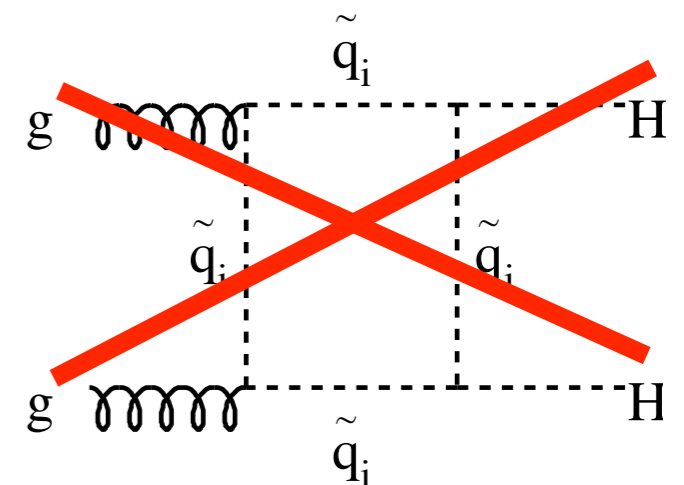
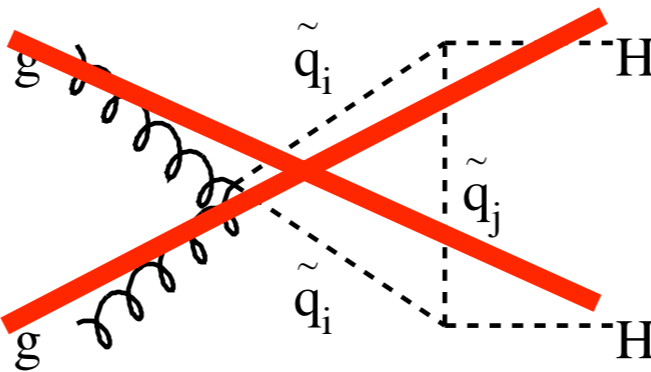
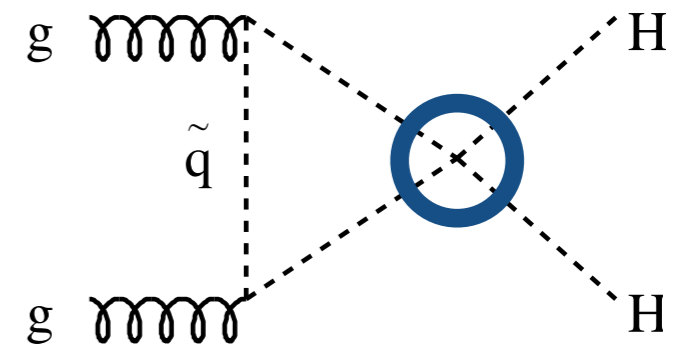
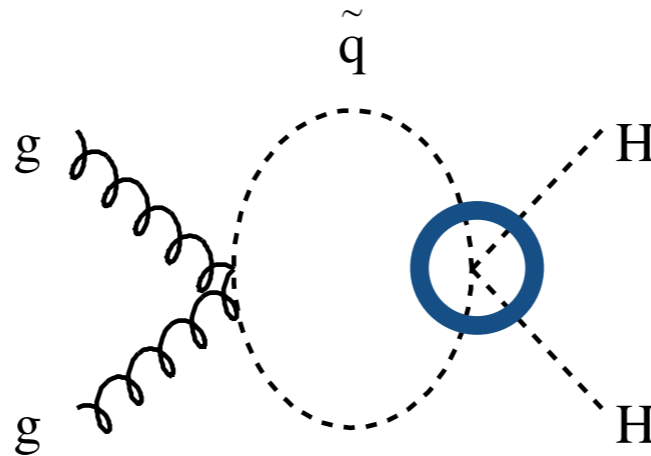
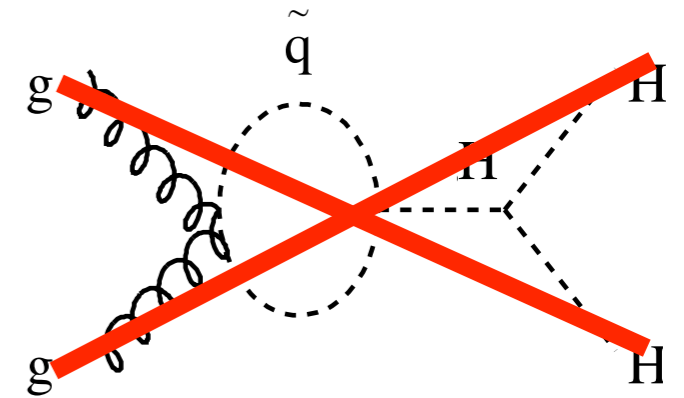
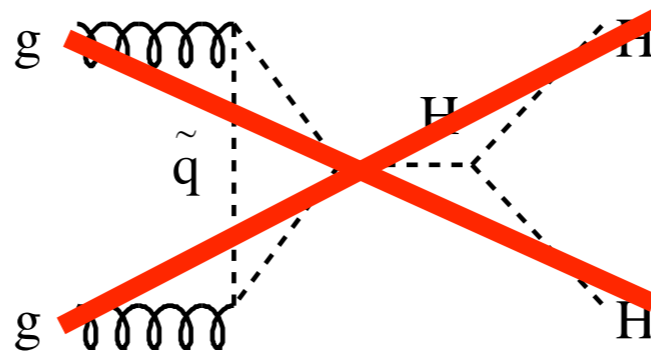
CAN PROBE BLIND SPOTS?



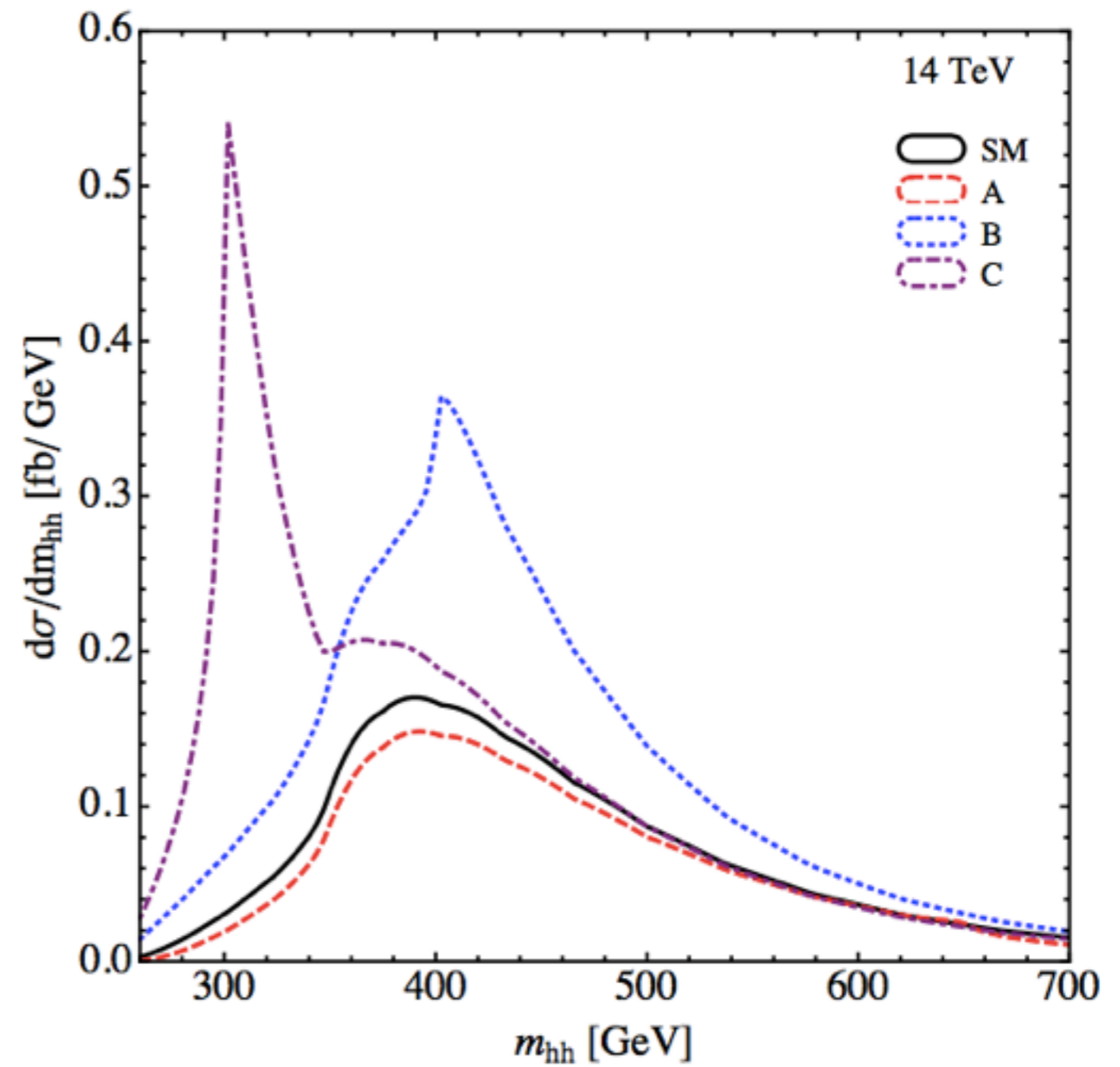
CAN PROBE BLIND SPOTS?

Di-Higgs sensitive to different couplings than single Higgs.

$$\lambda_{\tilde{t}_1\tilde{t}_1 hh} \simeq \frac{m_t^2}{v^2}$$



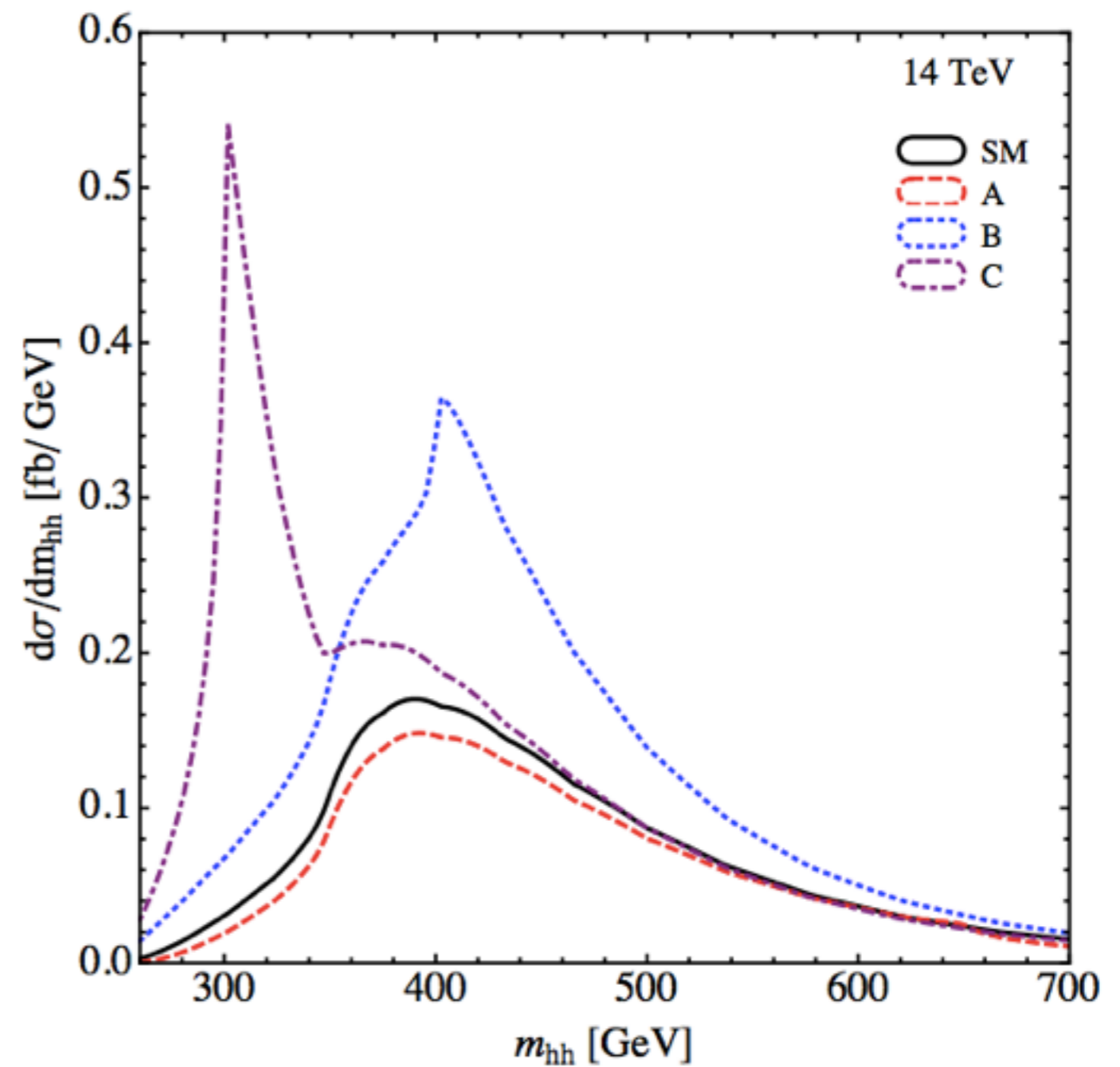
SPECTRA



SPECTRA

A: $m = 325, 500 \text{ GeV}$

$\sin\theta = 0.4$



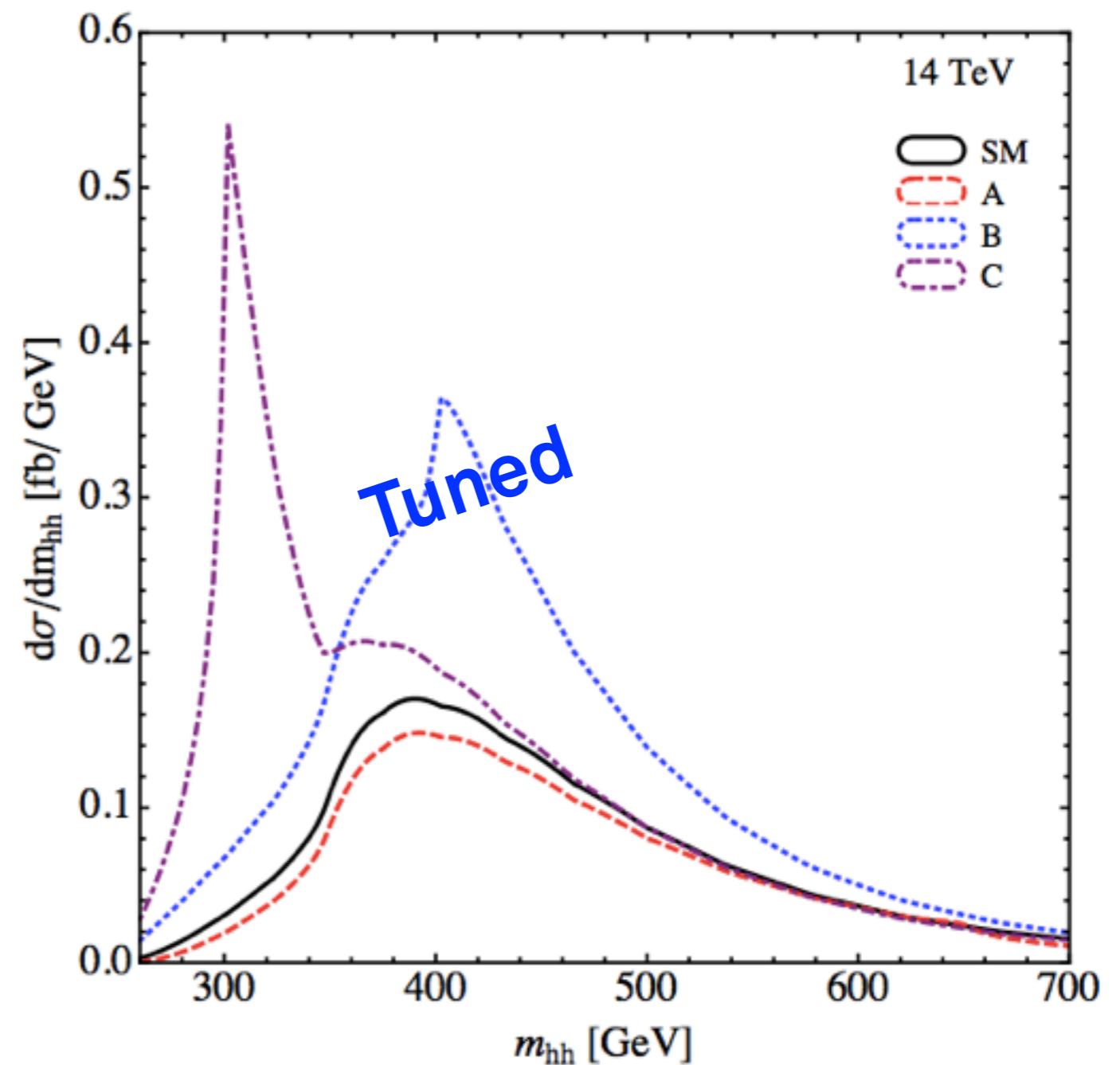
SPECTRA

A: $m = 325, 500 \text{ GeV}$

$\sin\theta = 0.4$

B: $m = 200, 1000 \text{ GeV}$

$\sin\theta = 0.223$



SPECTRA

A: $m = 325, 500 \text{ GeV}$

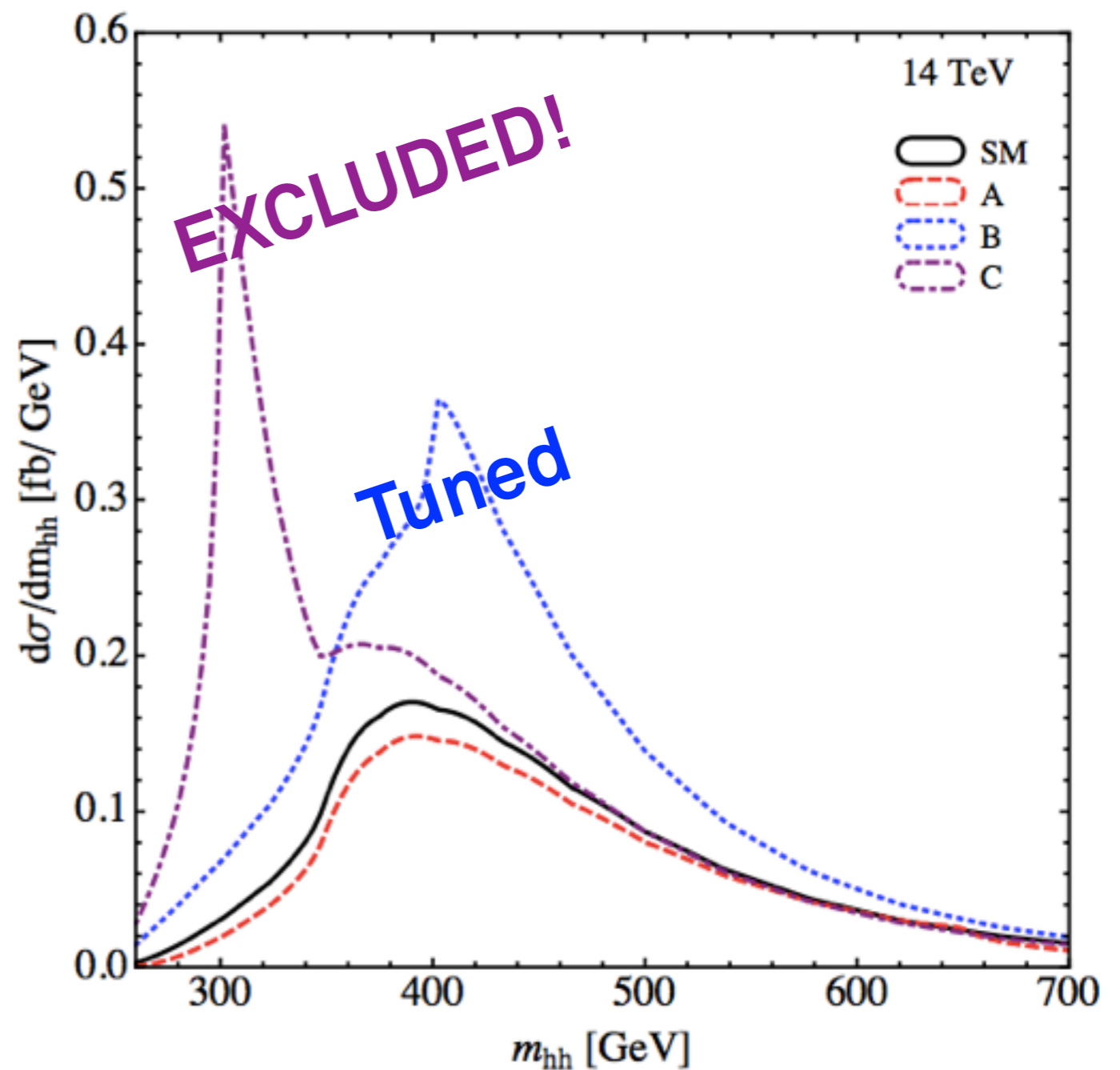
$\sin\theta = 0.4$

B: $m = 200, 1000 \text{ GeV}$

$\sin\theta = 0.223$

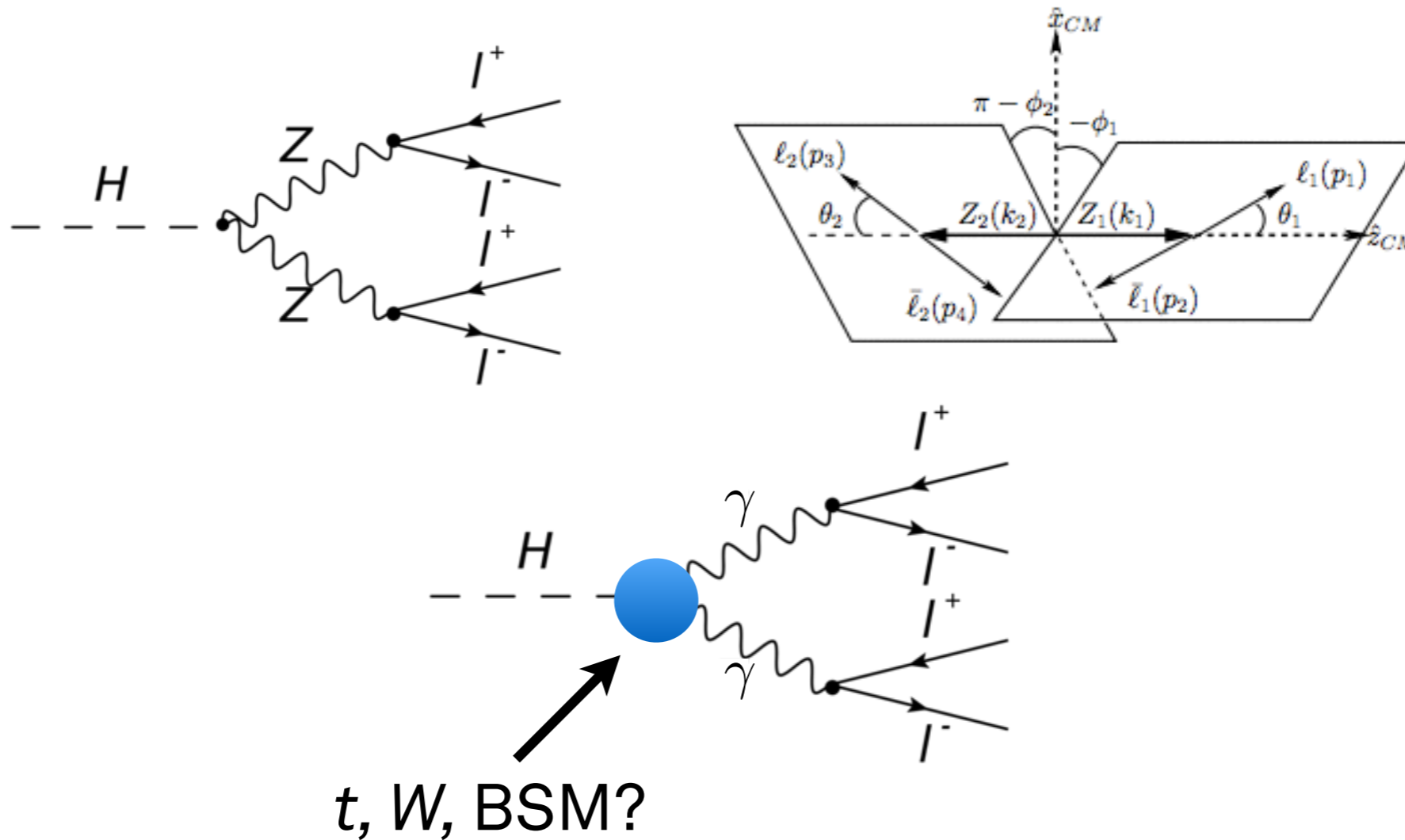
C: $m = 150, 1000 \text{ GeV}$

$\sin\theta = 0$



2014 SLIDE

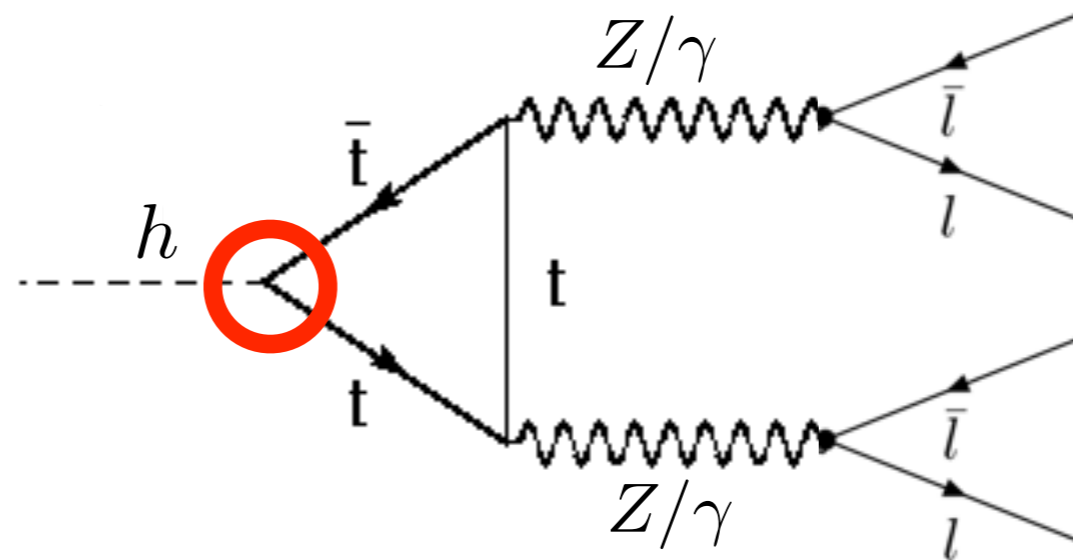
HIGGS TO 4 LEPTONS



TOP YUKAWA

Start with just top, keep all other couplings fixed.

$$h \bar{t} (y_t + i \tilde{y} \gamma^5) t$$



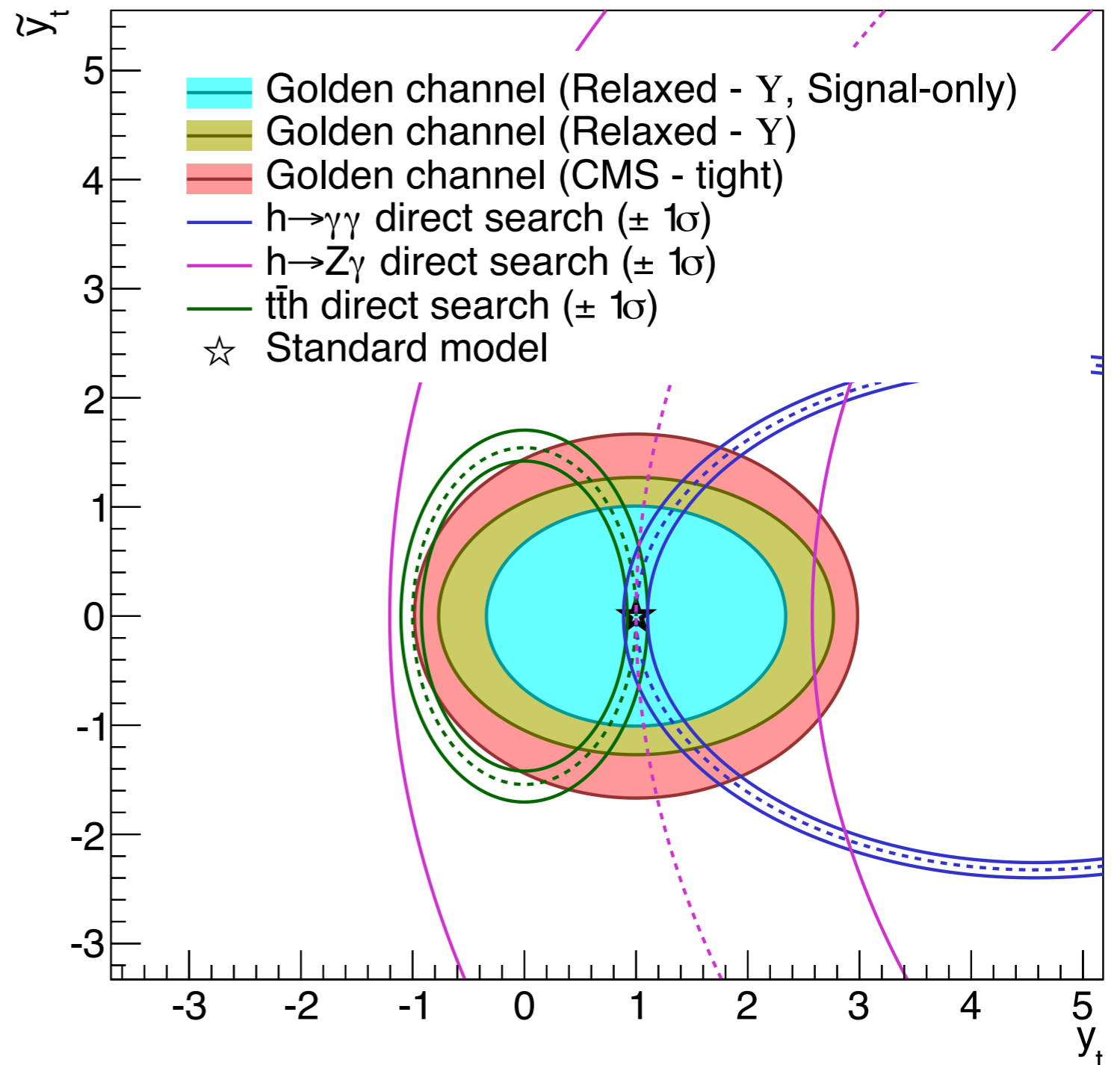
Can probe CP nature of top Yukawa coupling.

LHC SENSITIVITY

8,000 events ~
3,000 fb⁻¹

Better constraint.

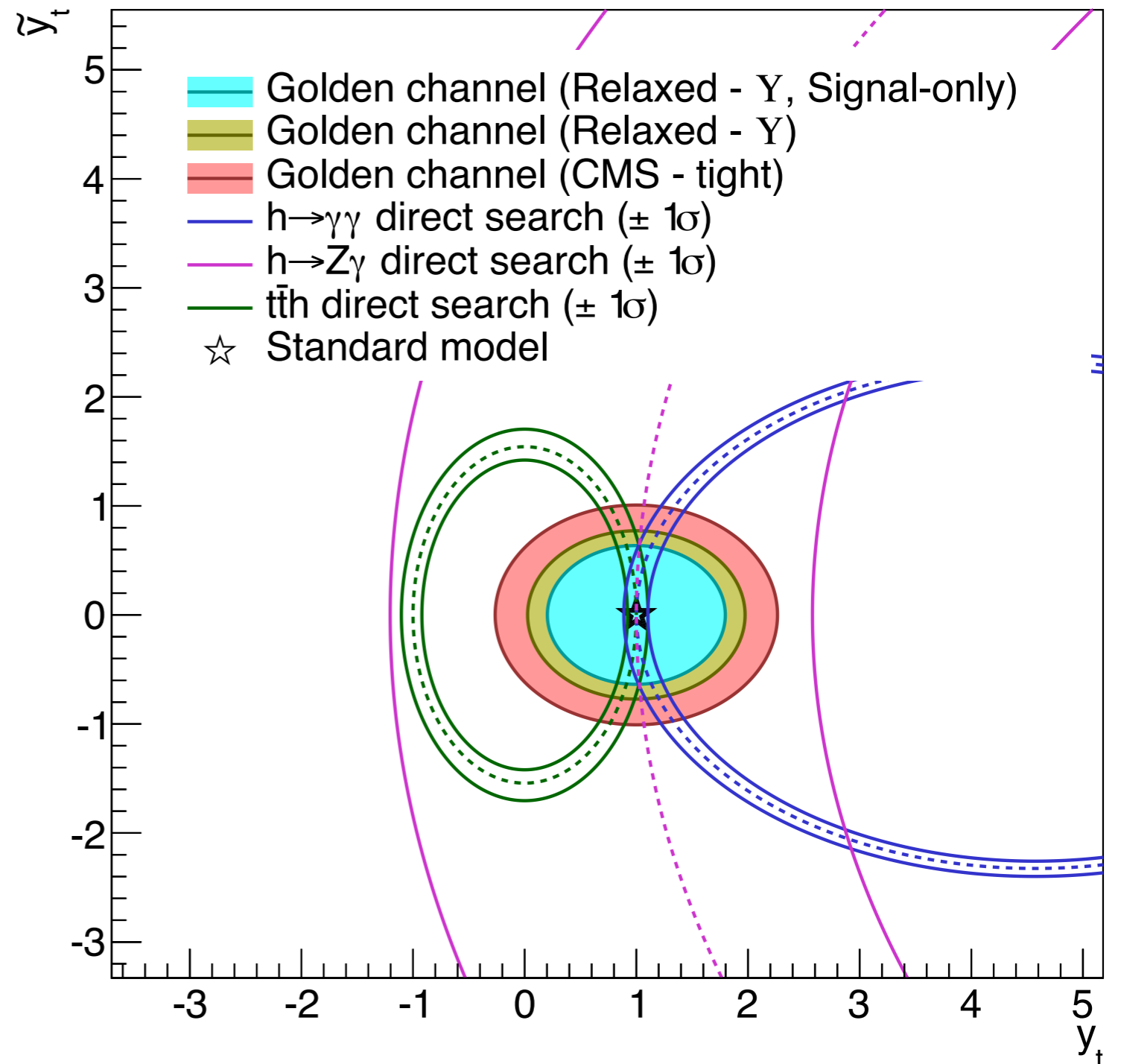
If there is anomaly,
will help characterize.



100 TEV?

20,000 events ~
3,000 fb⁻¹ @ 100 TeV

Improvement with
larger Higgs cross
section.



FUTURE DIRECTIONS

- Using $h \rightarrow 4l$ to measure Higgs-gauge boson couplings and deviations from custodial symmetry.
- SUSY explanation for di-boson anomaly.
- Flavour universality violation in top decays.
- Triggers for displaced object searches at LHC.

**THANK
YOU**