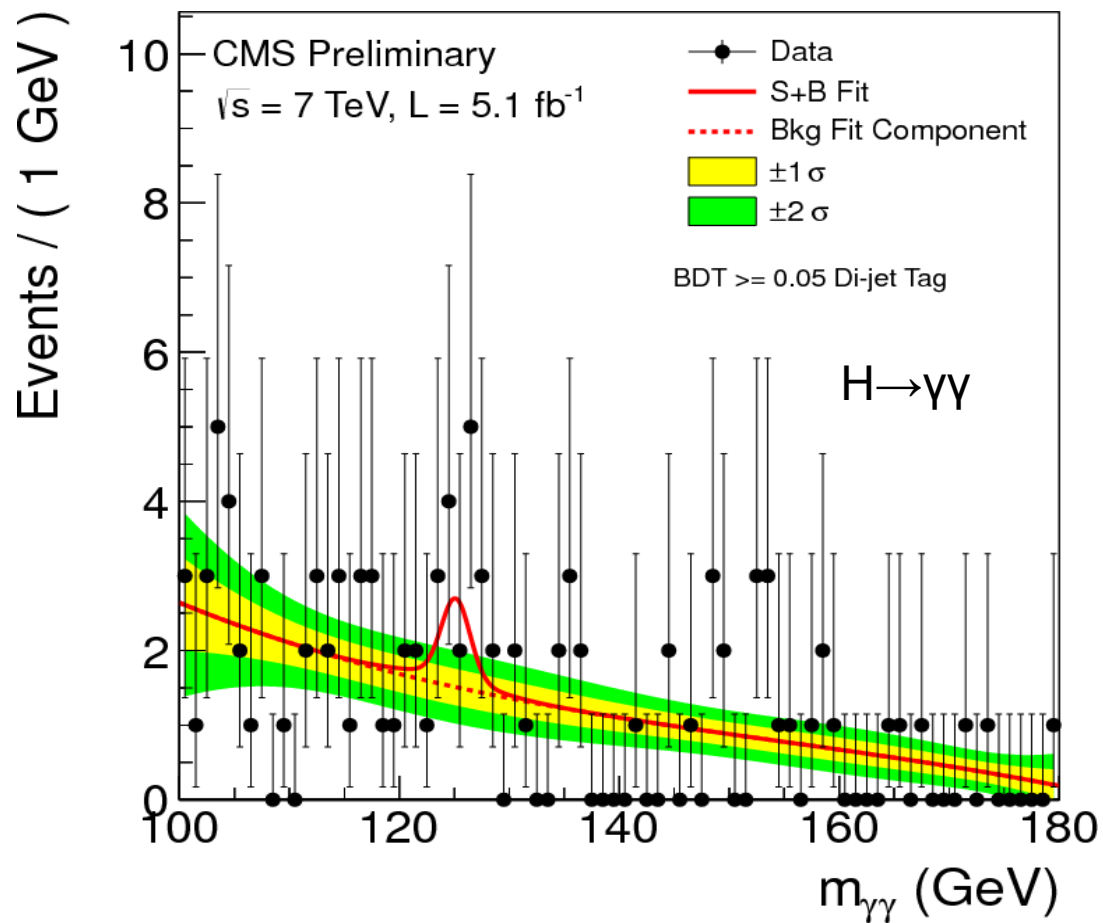


# Probing VBF in CMS



P. Harris, P. Musella

# VBF w/CMS

- 8 TeV + 5 fb<sup>-1</sup> SM expectations for 3 VBF channels

	VBF/ggH	S/B	Ref
H → gg tight	2.0/0.6	0.5	HIG-12-015
H → gg loose	1.4/1.6	0.2	HIG-12-015
H → WW SF	1.5	0.4	HIG-12-017
H → WW OF	0.8	0.25	HIG-12-017
H → ττ	6.1/2.0	0.15	HIG-12-018

With 30 fb<sup>-1</sup> we expect :

72 VBF events (w/H → ττ)

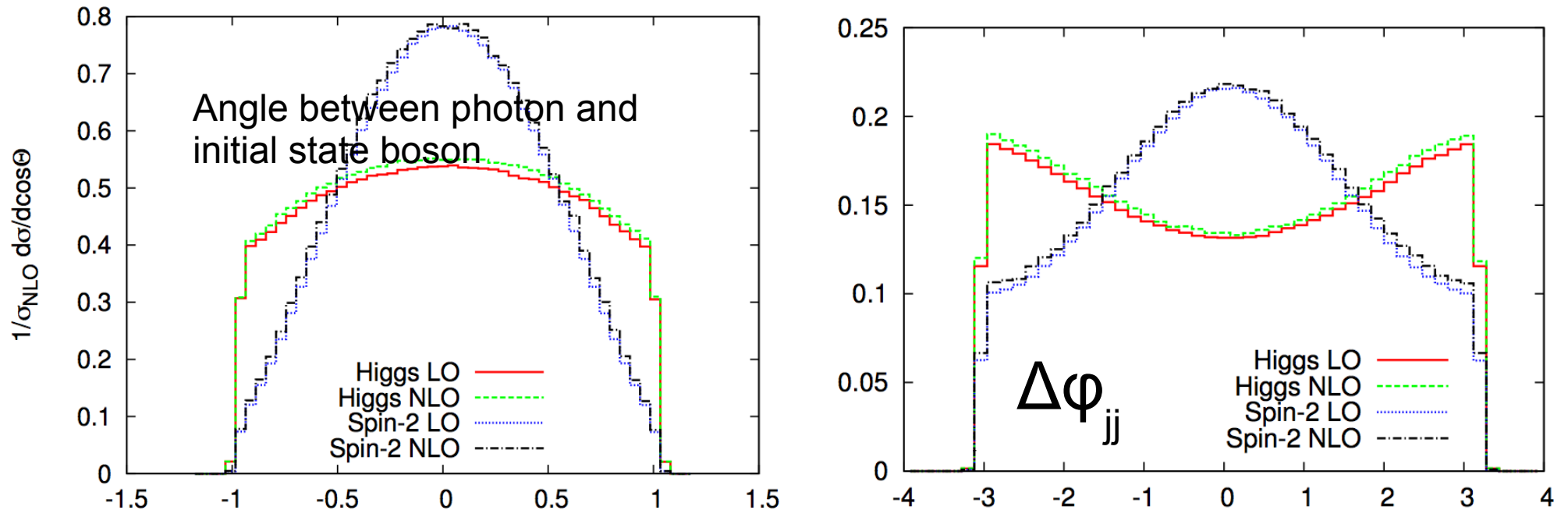
36 VBF events (w/o H → ττ)

In the VBF selection an additional 30% ggH

# Enough for a Statement?

- Spin 2 model (similar cross section)?

Jessica Frank(thesis), Michael Rauch, Dieter Zeppenfeld



- Separation with jets may be feasible
- CP even/odd show similar behavior(ggH)

- Ongoing investigation with VBFNLO 2.6

Plehn, D. Rainwater and D. Zeppenfeld, Phys. Rev. Lett. 88, 051801

P. Harris/P. Musella CMS

# Questions about: shapes in VBF

- Currently we use powheg VBF (LO in VBF)

P. Nason and C.Oleari, JHEP 1002 (2010) 037

- Is there a prescription to reweigh MC to match NLO VBF? Is there an NLO generator?
- For spin 2/CP +/- is there a reweighing prescription?

# Backgrounds with VBF

- Removing background contributions
  - Cuts can be tightened to reduce background
    - Current tuning motivated by maximum sensitivity
      - Optimize for discovery of VBF not necessarily properties
  - Non higgs backgrounds typically constrained w/Data
- **Gluc fusion Higgs separation (~30% in VBF)**
  - Must rely on kinematics + jet properties
  - Gluc fusion Higgs + 2 jets => difficult to simulate
  - Currently we quote large uncertainties

# Gluon fusion Higgs(ggH) in VBF

- Uncertainty breakdown is not public.
  - Published numbers (HIG-12-015)  $H \rightarrow \gamma\gamma$

Dijet selection		
Dijet-tagging efficiency	VBF process	10%
	Gluon-gluon fusion process	50%
(Effect of up to 15% event migration among dijet classes.)		

- Other channels use similar numbers
- Majority of ggH unc. comes from parton shower
  - Computed by running over Pythia tunes computing max difference :

Unc: Tune Z2-MaxDiff(TunesDT6, P0, ProPT0, ProQ20)

# Questions about: ggH in VBF

- Is there a better prescription to assign theory unc for ggH in VBF?
- Currently ggH is Powheg(NLO) what uncertainties do you expect with MLM MC?
  - S. Alioli, P.Nason, C. Oleari and E. Re, JHEP 0904 (2009) 002,
- How could you use data to understand the ggH extrapolation into VBF?