H->ττ

M. Schumacher and A. Nikitenko

First LHC results for SUSY H->ττ and MCs (I)
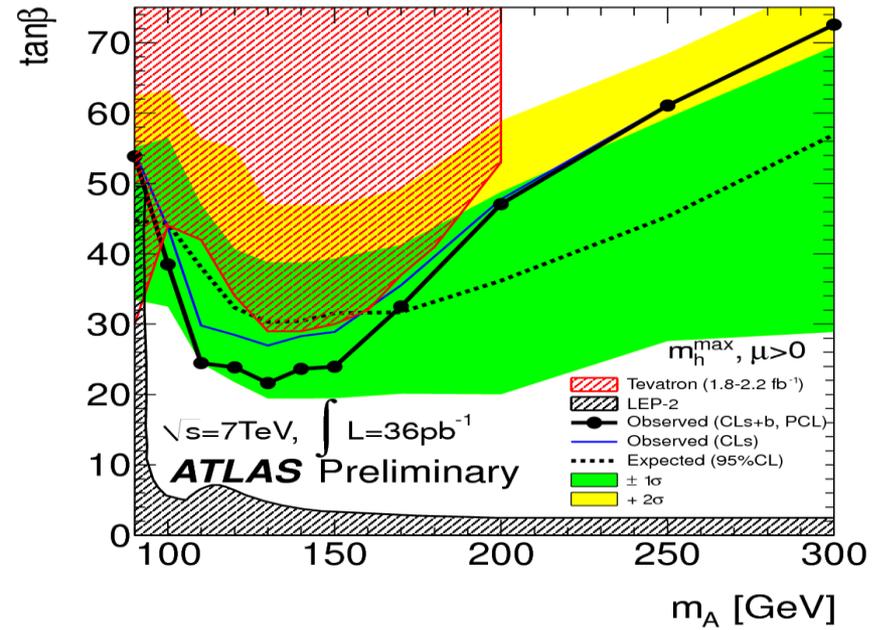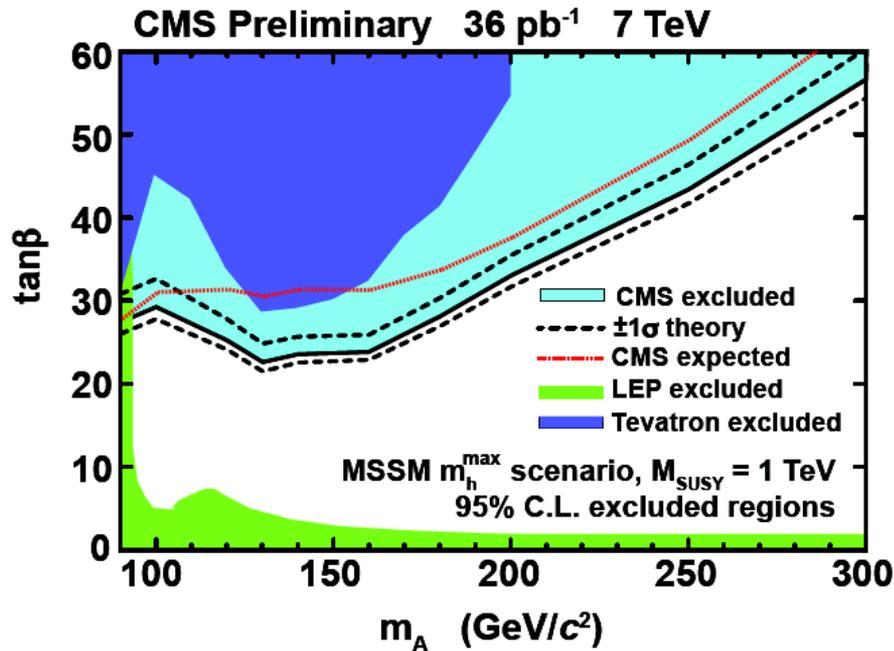
CMS Monte-Carlo	ATLAS Monte-Carlo
gg->H	
PYTHIA6	MC@NLO
pp->bbH	
PYTHIA6, 2->3: pp->bbH	SHERPA
5f calculations	4f calculation

Both will use Santander matched numbers in future
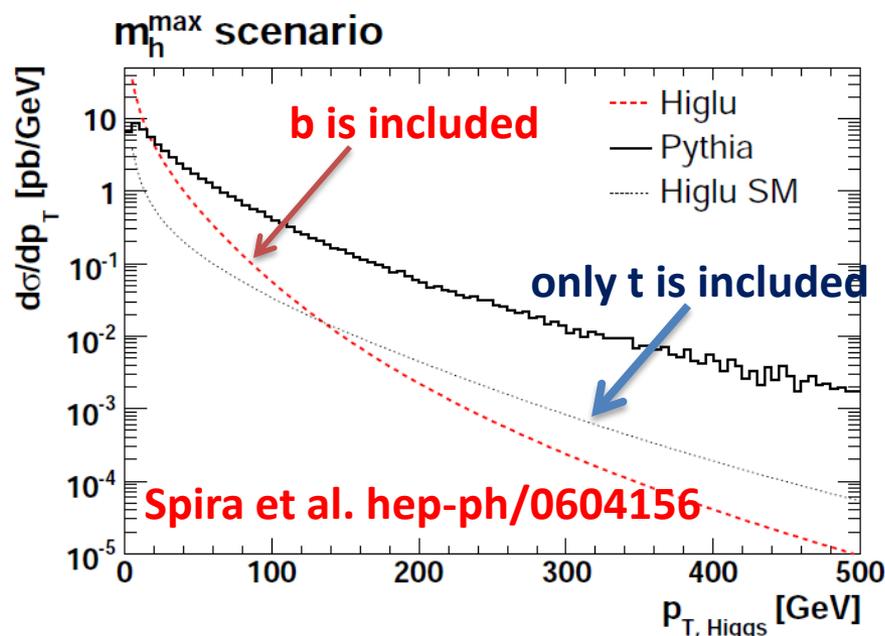
First LHC results for SUSY H->ττ and MCs (II)
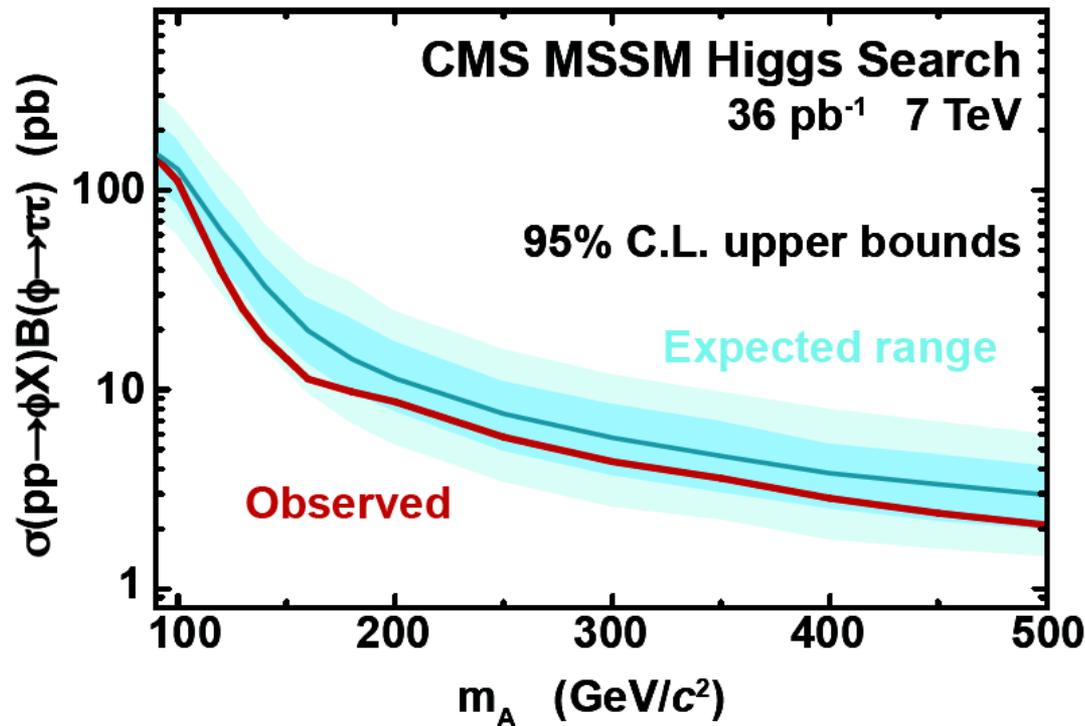
- **It was possible to do this plot since**
  - $\varepsilon^{gg->A}_{select} = \varepsilon^{bbA}_{select}$,**which is true within 2-10 % using PYTHIA MC**

- **Comments to LHC analyses**
  - gg->H MC used (both PYTHIA6 and POWHEG) is not quite correct, since does not have b loop, which make p_T^H softer

m_h^{max} scenario

b is included

only t is included

Spira et al. hep-ph/0604156

Higlu
Pythia
Higlu SM

$d\sigma/dp_T$ [pb/GeV]

$p_{T, Higgs}$ [GeV]

  - How well pp->bbH kinematics is described by PYTHIA or SHERPA MC ?

So far inclusive analysis

ATLAS: 1 tau (pt>20 GeV) + 1 e (pt>20 geV) or 1 mu (pt>15GeV)

E_T^{MISS}>20 GeV, M_T<30 GeV

CMS: 1 tau (pt > 20 GeV) + 1 e/μ (pt > 15 GeV) + M_T < 40;

e+μ final state is also used

Next steps: more exclusive analysis

single b-tagged versus b-vetoed

branching according to jet multiplicties

→ Need central values for fraction of cross-sections

in each final state and their uncertainties

→ *First results see in talk by Marius Wiesmann*

Some ideas on next steps

- **Wish list for SUSY H->$\tau\tau$:**
  - **gg->H: need NLO MC with b included in the loop**
    maybe get SHERPA implementation for this before autumn?
    or in other codes/ event generators?
  - **pp->bbH: need NLO MC**
    (implementation in POWHEG and MC@NLO for autumn?)
- **What should be done before NLO pp->bbH is implemented in MC**
  - **compare NLO and LO MC distributions and assign corrections (reweighting)/ uncertainties on Higgs acceptance due to the difference found**
    - **compare first basic distributions: p_T^H, η^H, p_T^b, η^b**
      Hb(b): MCFM for gb$\rightarrow$bH (p_T^b > cut), 4FS NLO programs with massive b (with and w/o cut on p_T^b), SHERPA, PYTHIA,
      gg->H: HqT, HNNLO, POWHEG, MC@NLO (t-quark is dominated for low tanβ)
  - **cross-check MCs with Z+b data. It will be relevant for low mass Higgs, $M_H \sim M_Z$ (question to theorists: how Z+b data can help for Higgs ?)**

CMS: Z+b with 36 pb^{-1} at 7 TeV

- **First observation of Z+b at LHC**
  - **65 evens with single b-tag jet p$_T$>25 GeV, |η|<2.1 (~ 83 % of Z+b)**
- **Good agreement with theory/MC for Z+b/Z+j**
- **Reasonable agreement so far for kinematics between data and MC (MadGraph)**
  - **Expect ~ 2 K Z+b selected events this Summer11**
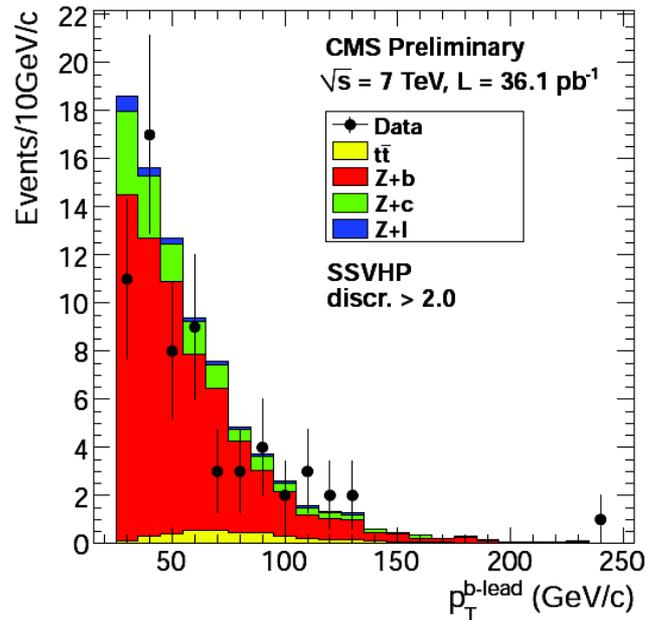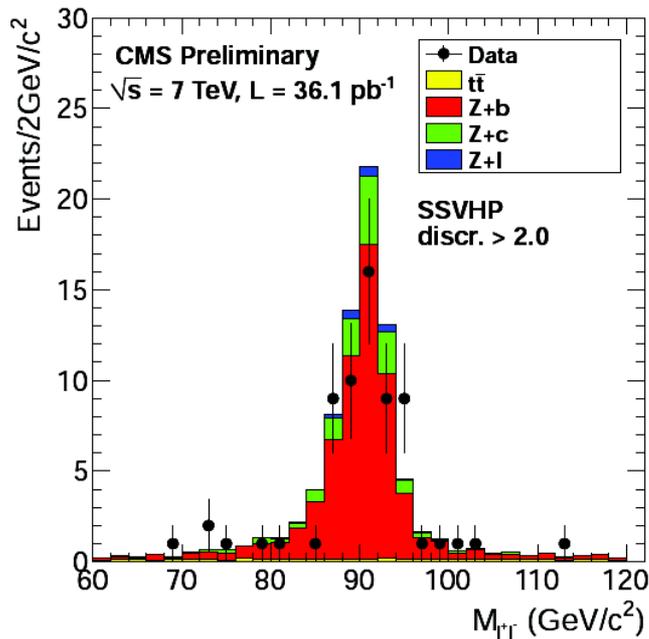
VBF H->$\tau\tau$

- **Not of central interest currently**

- **Compare distributions / acceptances**
  - **with HAWK (v1.1 has decay to H→2 photons), VBF@NLO, HERWIG++, POWHEG**
    - **determine contribution from t(+u) channel and s channel (Z/W->jj + H)**

- **Reweight MC to best known corrections?**