ETH Institute for Particle Physics

gg→H for different MC's:

uncertainties due to jet veto, update

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Outline

- **Short summary of last meeting's results**
- **Jet energy smearing : get new uncertainty**
- **New CASCADE version: results**
- **Outlook**

Where we left off

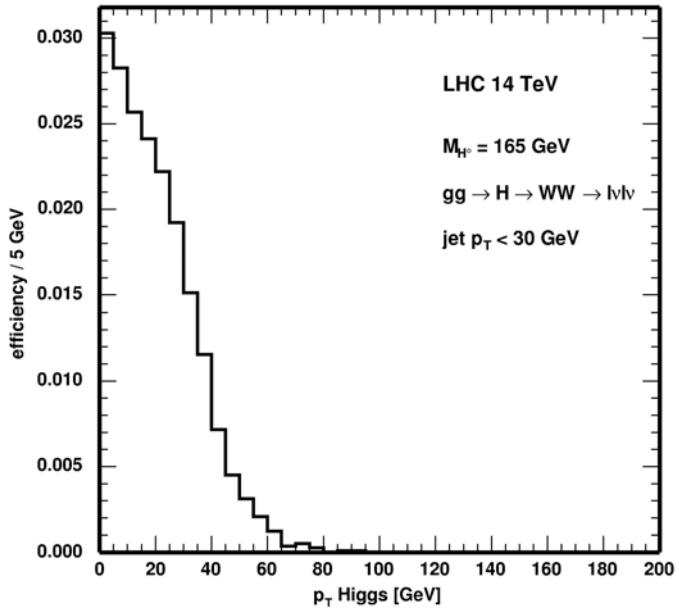
Comparing PYTHIA 6.225, HERWIG 6.505 and MCatNLO 2.31

without underlying events

- **The total efficiencies for HERWIG, MCatNLO and PYTHIA vary by ~ 5%**

	ε
PYTHIA	**0.62**
HERWIG	**0.63**
MCatNLO	**0.59**

- **In the region of interest for the gg→H→WW→lνlν signal selection, the difference is even smaller**



→ for the region where $p_T^H < 80$ GeV,
the 3 MCs vary even less

	ε for $p_T^H < 80$ GeV
PYTHIA	0.72
HERWIG	0.70
MCatNLO	0.69

- Including higher order corrections (by reweighting) leads to about same efficiency uncertainty as the leading order case

	ε	ε reweighted
PYTHIA	0.62	0.56
HERWIG	0.63	0.60
MCatNLO	0.59	0.57

- Including Matrix Element corrections for gg → H in HERWIG leads to an overall efficiency of 0.55 (0.63 without ME corrections), and 0.67 instead of 0.70 for region where $p_T^H < 80$ GeV

Including underlying events:

- **The different PYTHIA tunings for the underlying events lead to about the same efficiency**

- **The difference in the efficiency between PYTHIA with and without underlying events is smaller than 1%**

proceeding: compare new Monte Carlo versions

New versions for HERWIG(6.506) and PYTHIA(6.227):

Matrix Element correction not yet included in new HERWIG version,
PYTHIA now per default Rick's Tune A for underlying events

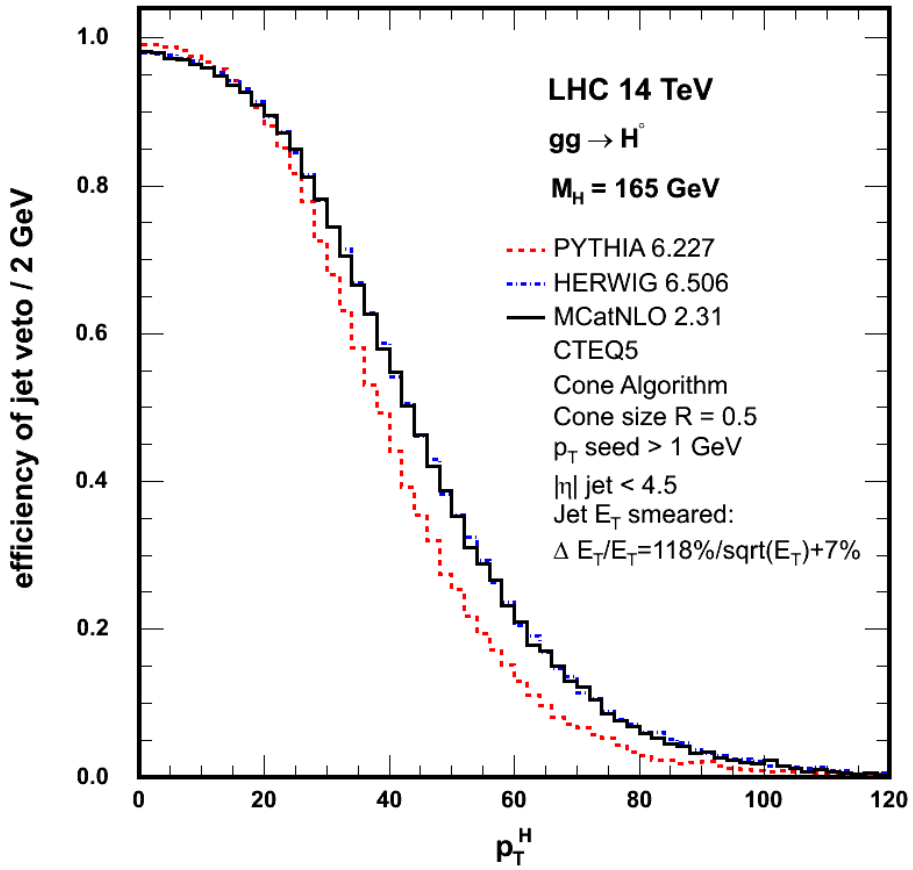
Without underlying events: very small difference in efficiency between old and new versions (≈ 0.01)

With underlying events differences for PYTHIA already shown last time

Efficiency after smearing

Get realistic CMS efficiency for jet veto with smeared Jet Et:

jet resolution: $\Delta E_T / E_T = 118\% / \mathrm{sqrt}(E_T) + 7\%$



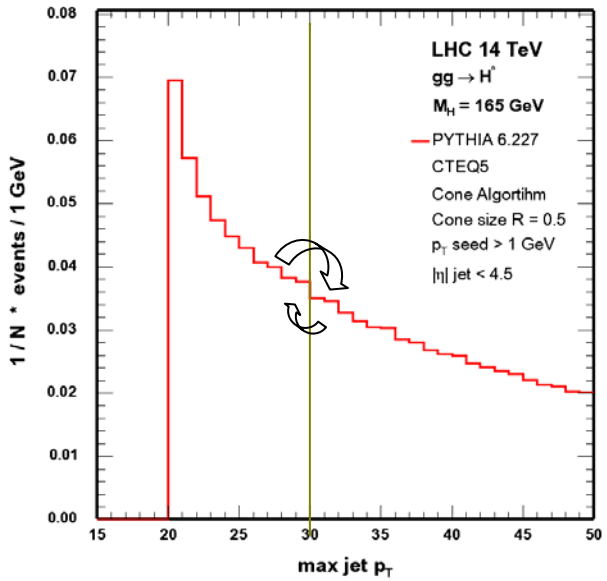
	ε	ε smeared
PYTHIA	**0.61**	**0.61**
HERWIG	**0.62**	**0.61**
MCatNLO	**0.59**	**0.58**

p_T^H < 80 GeV	ε	ε smeared
PYTHIA	**0.72**	**0.72**
HERWIG	**0.70**	**0.70**
MCatNLO	**0.69**	**0.69**

Efficiency after smearing

Smearing: tendency to lower efficiency,
as can be expected:

there are more jets at low pt than high pt
→smearing: more jets which had pt below 30 GeV now have pt above 30 GeV than vice versa



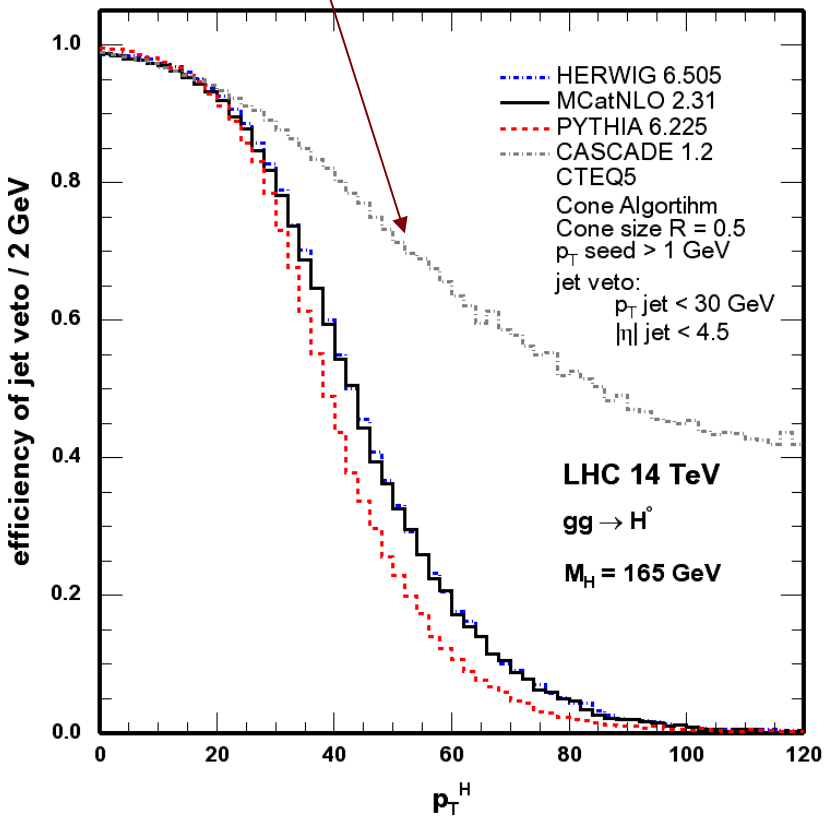
→ jet veto should affect more events after smearing

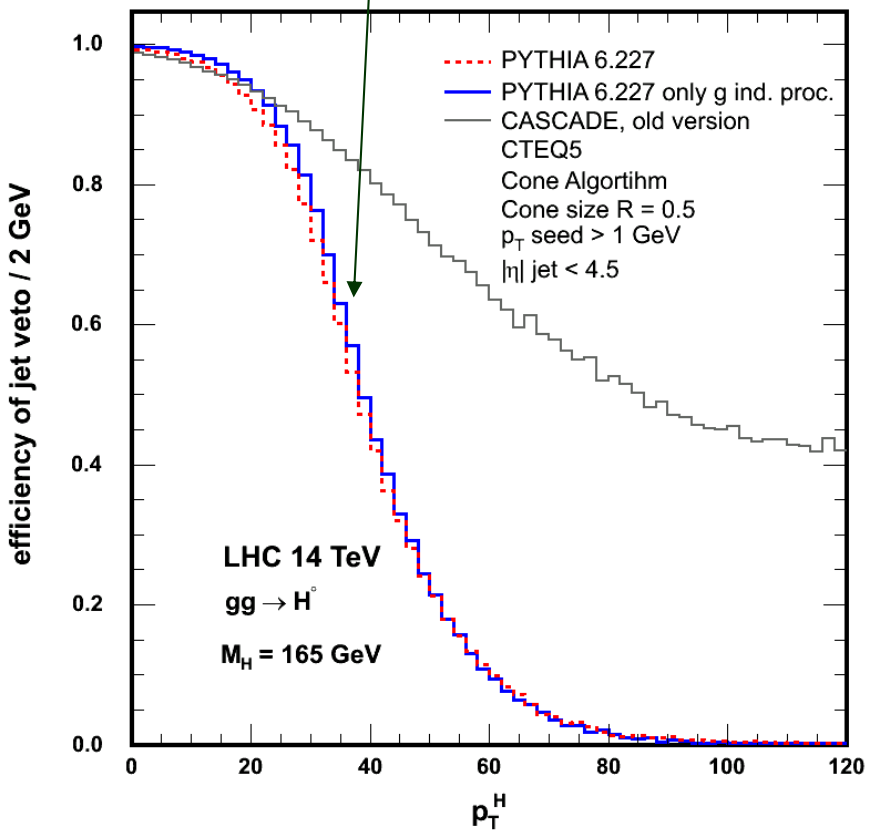
but: effect very small

New CASCADE version

Was different shape of CASCADE due to purely gluon induced processes?

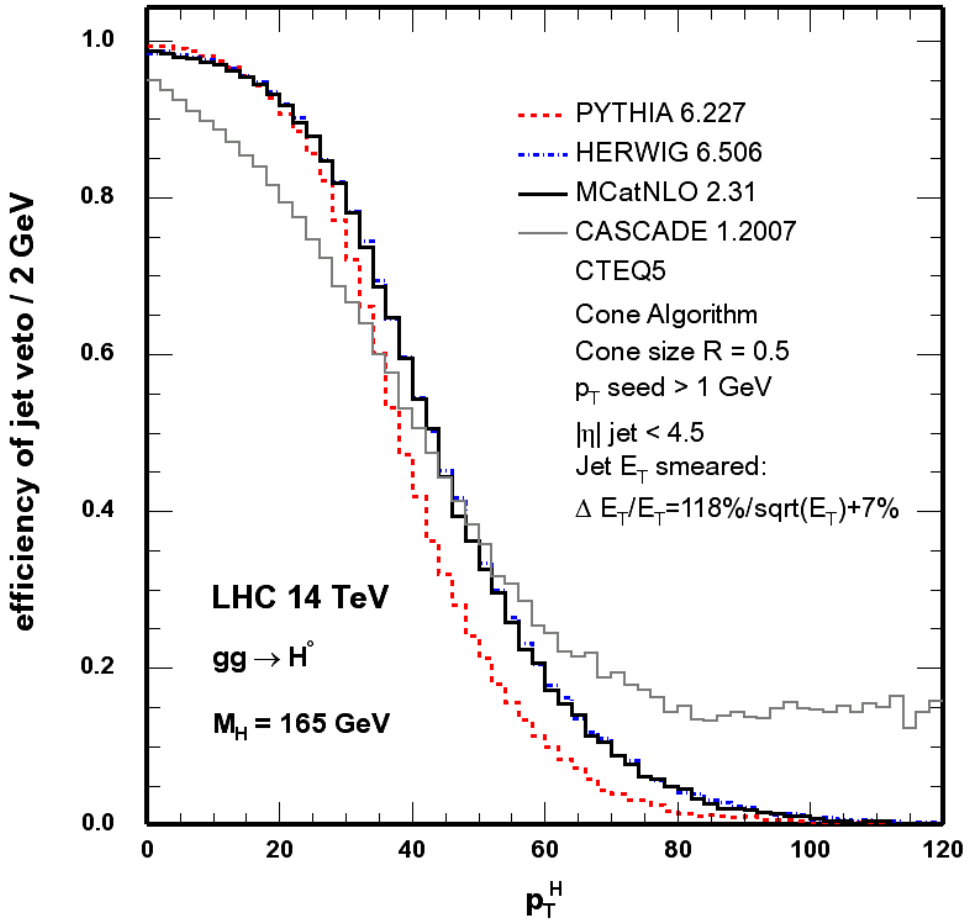
→ simulation with PYTHIA, purely gluon induced processes generated





There was a bug in CASCADE, new version released

CASCADE 1.2007



	ε
PYTHIA	0.61
HERWIG	0.62
MCatNLO	0.59
CASCADE	0.59

p_T^H < 80 GeV	ε
PYTHIA	0.72
HERWIG	0.70
MCatNLO	0.69
CASCADE	0.68

difference per bin is still too big, needs further investigation!

Conclusion and Outlook

- **Smearing jet E_T does not affect uncertainty between PYTHIA, HERWIG and MCatNLO much**

  → don't expect much difference in ORCA simulation!

- **Will run ORCA to see how much the uncertainty will be after full detector simulation**

- **Study with CASCADE needs further improvements**

Special thanks to A.Nikitenko