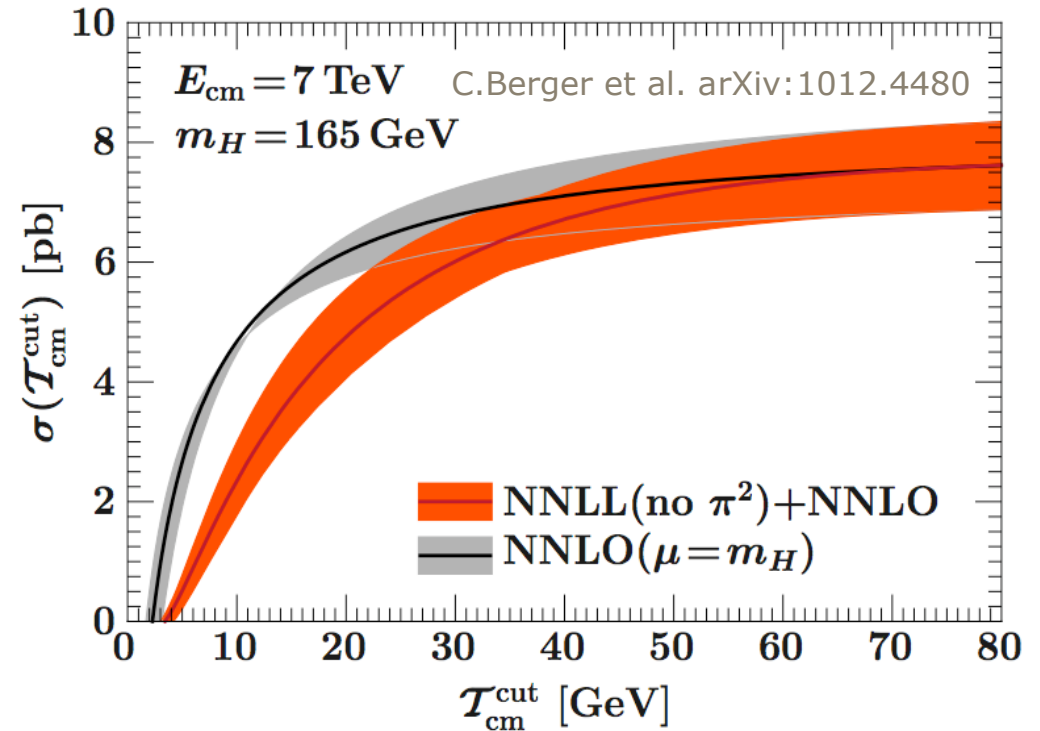


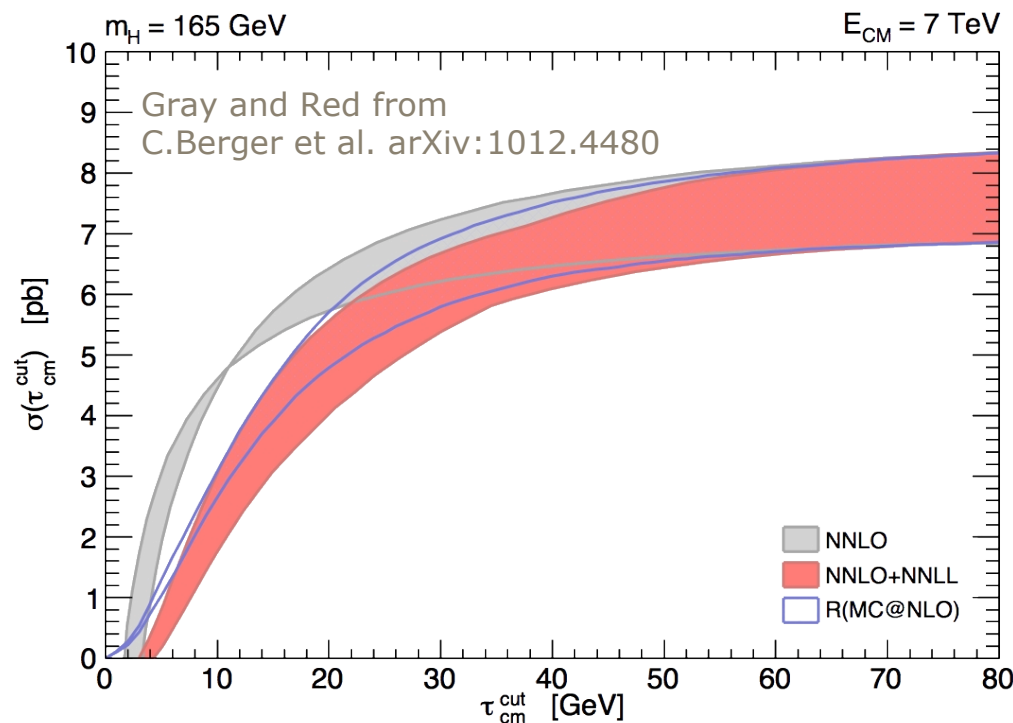
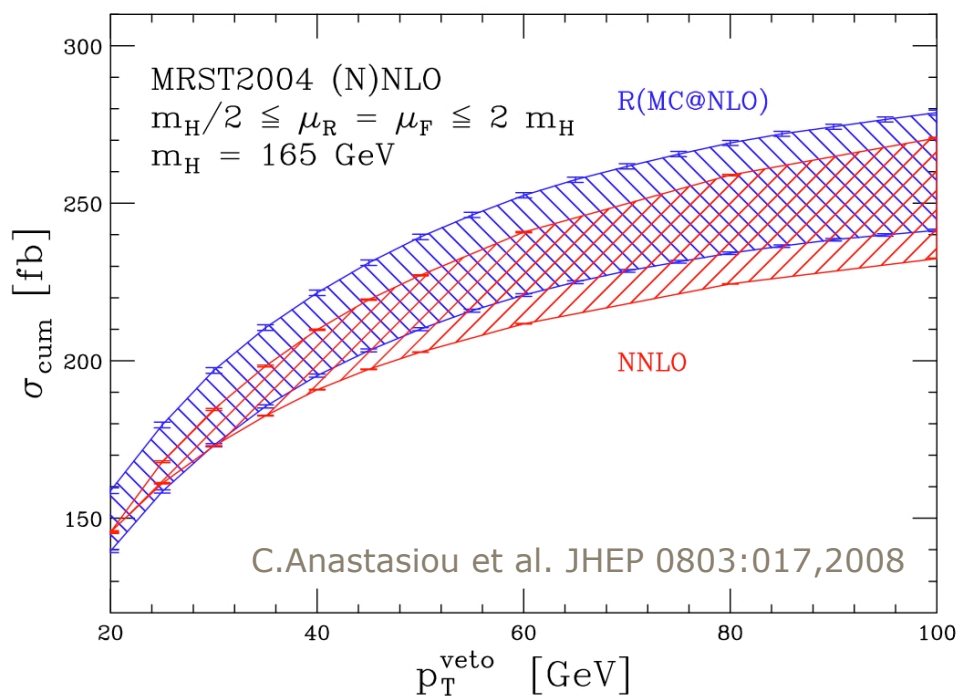
Jet-Veto vs Beam-Thrust

Fabian Stöckli
Feb 22nd, 2011

- When cutting **below ~ 40 GeV** the NNLO (gray) and NNLO+NNLO (red) are **very different**
- This means that there are **large logs** that need to be re-summed
- Typical MC event generators re-sum logs up to (N)LL
- First we test if this re-summation **is enough** to describe the picture using MC@NLO

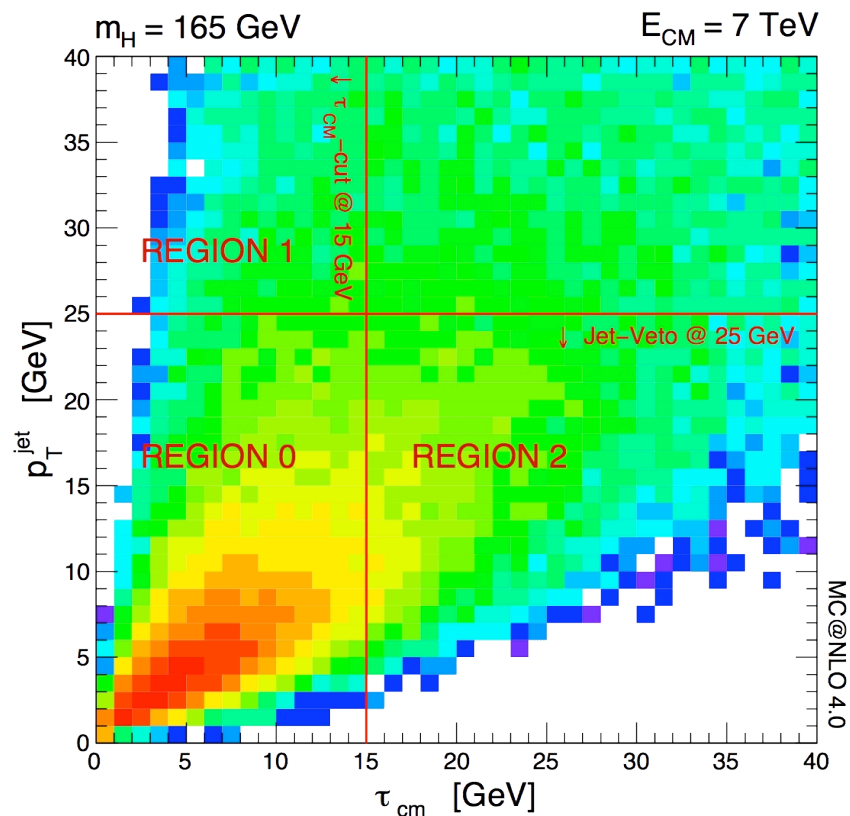


- MC@NLO agrees **reasonably well** with the re-summed result
- Especially in the region of interest ~ 15 GeV



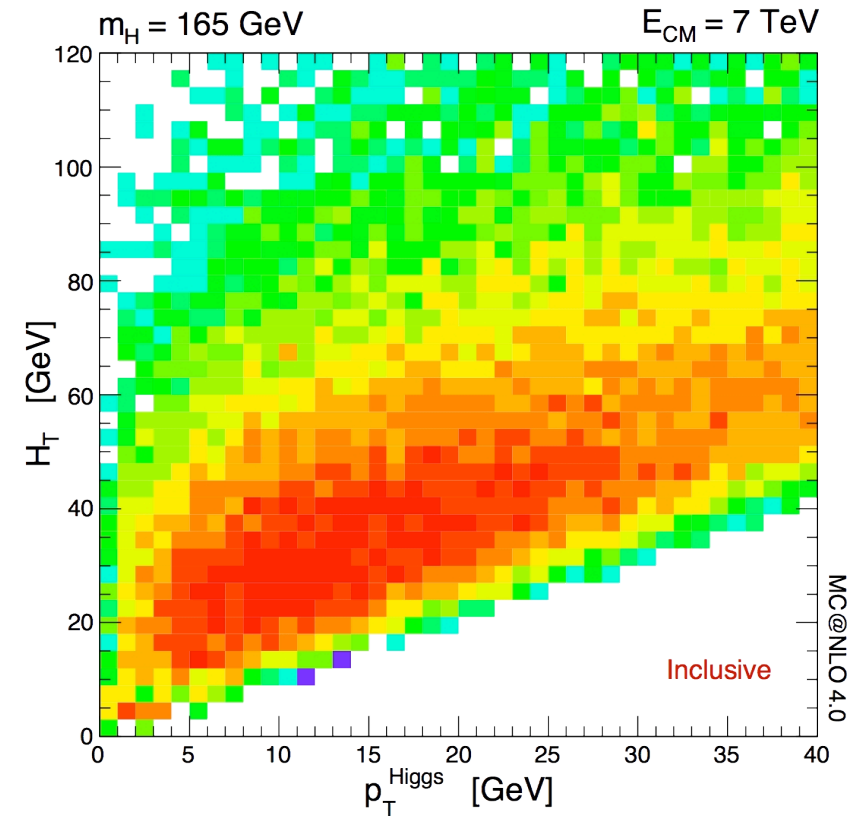
- But MC@NLO also agrees with the fixed-order result in the for a jet-veto cut...
- There must be large logs appearing when cutting on tau, that DO NOT appear when doing a Jet-Veto

- Look at **double differential** cross-section in tau and leading jet p_T
- When a **tau-cut** (@ 15GeV) is applied we integrate over **regions 0 and 1**
- When a **jet-veto** (@ 25GeV) is applied we integrate over **regions 0 and 2**
- While the integral in regions 1 and 2 are roughly the same, the **selected (excluded) phase-space is different**

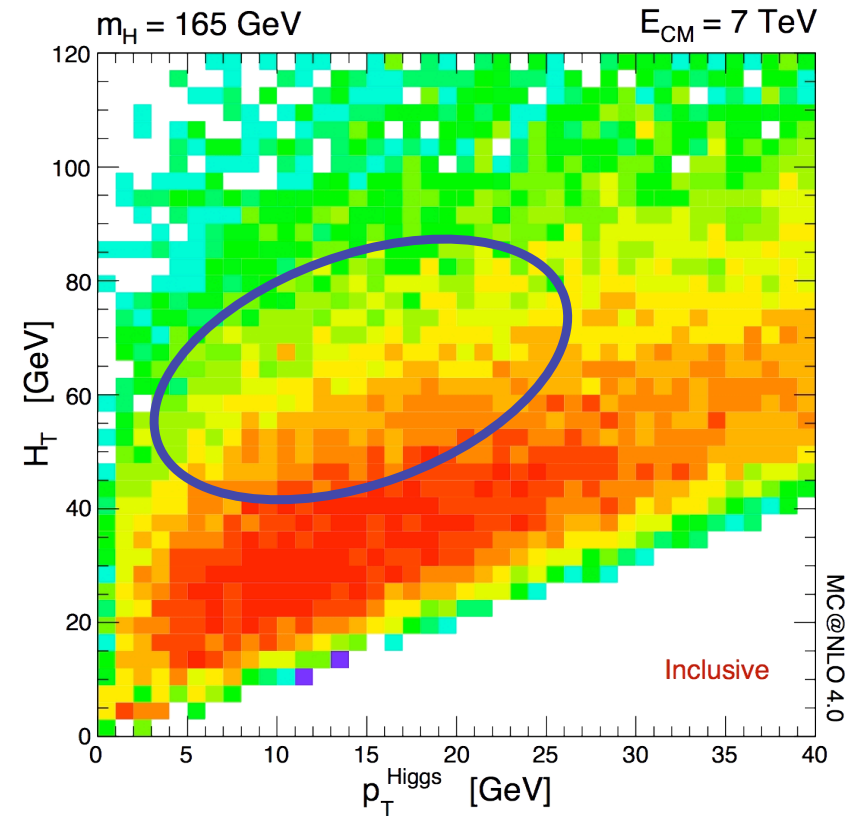


- We're trying to understand the **kinematics** of the events in region 1 and region 2 to understand the **origin of the large logs...**

- Look at **double differential cross-section** in
 - p_T Higgs and
 - HT (scalar sum of all particles p_T)
- There is a **strong correlation** (as expected)
- However, there are events with
 - $HT > \text{Higgs } p_T$
- In this region the **multiple-radiation particles** are (partially) **balancing** each other

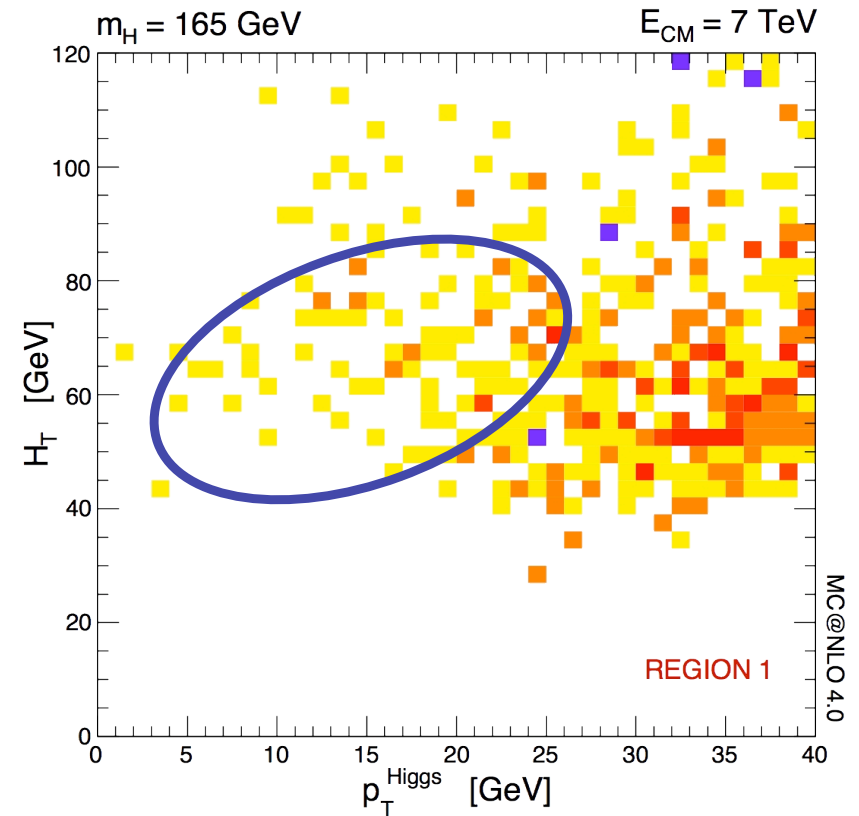


- Look at **double differential cross-section** in
 - p_T Higgs and
 - H_T (scalar sum of all particles p_T)
- There is a **strong correlation** (as expected)
- However, there are events with
 - $H_T > \text{Higgs } p_T$
- In this region the **multiple-radiation particles** are (partially) **balancing** each other

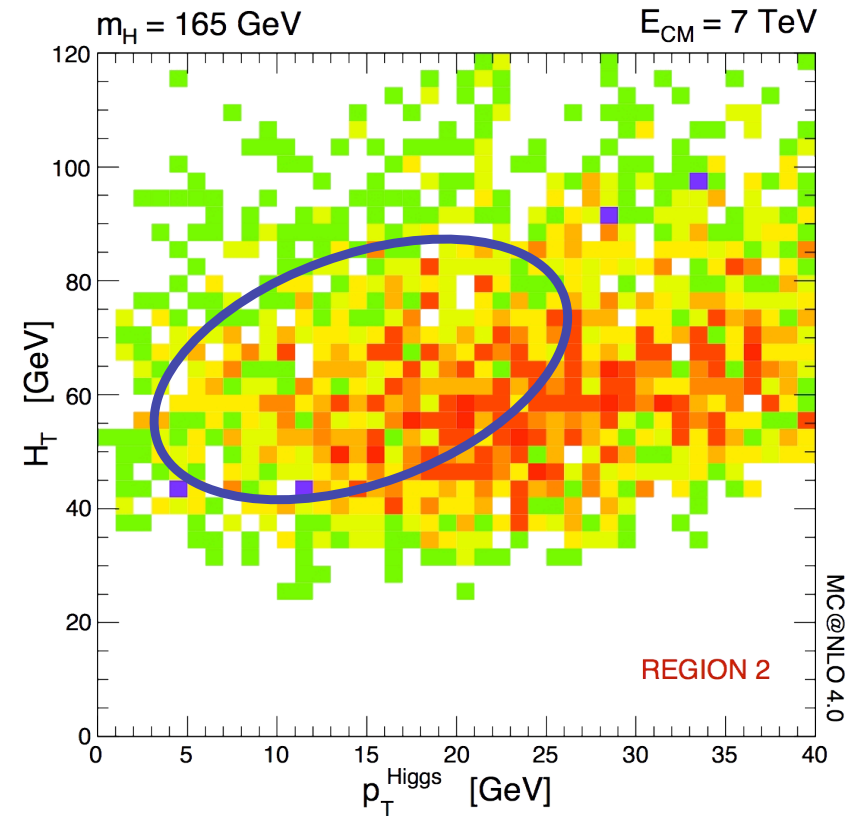


- We should **NOT** cut into this region if we want to **trust the fixed-order prescription**, since **cutting on multiple, balancing radiation** leads to **large logs** that need to be re-summed
 - In other words, the **fixed order calculation can not** describe this region well (NNLO has at MOST 2 additional particles)

- Double-differential cross-section in HT and pt Higgs in REGION 1
 - I.e. the region that is INCLUDED when cutting on tau, but EXCLUDED when vetoing jets
- There is no substantial large HT/small Higgs pt phase-space cut away -> we don't expect large logs
- This explains why in the case of the jet-veto the fixed-order result agrees well with the MC@NLO result.



- Double-differential cross-section in HT and pt Higgs in REGION 2
 - I.e. the region that is EXCLUDED when cutting on tau, but INCLUDED when vetoing jets
- There is substantial large HT/small Higgs pt phase-space cut away -> we expect large logs



- This explains why in the case of the tau-cut the fixed-order result does not agree well with the MC@NLO (and the re-summed) result. We need to re-sum the large logs.

- We cannot conclude from the disagreement between the fixed-order (NNLO) prediction and the re-summed (and MC@NLO) prediction in the Beam-Thrust variable, that the prediction of the fixed-order calculation for the jet-veto is inaccurate.
- The two cuts cut away different phase-space,
 - In particular the tau-cut removes phase-space with multiple, partially balancing radiation, which is not described well in fixed-order
 - The jet-veto does not cut into this region