Yellow report, status and plans
–
Jets and EW bosons group*

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LHCb: S. Farry, W. Barter
TH: MS

Benchmark cross section

Aim: Assess compatibility of different inclusive jet, dijet, W + jets and Z + jets a measurements at 7, 8 and 13 TeV.

Use Monte-Carlo calculations as transfer function to compare consistency of different measurements.

$\Rightarrow$ **since different measurements use different fiducial phase space definitions, differences in description of different measurements may also stem from different levels of mismodelling in different phase space regions**

Benchmark cross section

Availability of RIVET analyses

		ATLAS	CMS	LHCb
7 TeV	incjets/dijets	✓	✓	–
	W + jets	✓	✓	✗
	Z + jets	✓	✓	✓
8 TeV	incjets/dijets	✗*	✓	–
	W + jets	✗*	✓	✗
	Z + jets	✗	✗	✗
13 TeV	incjets/dijets	✗	✓	–
	W + jets	✗	✓	–
	Z + jets	✓	✗	–

- in principle, at least ATLAS and CMS have policies in place preventing this sorry state
- situation worse in HF production

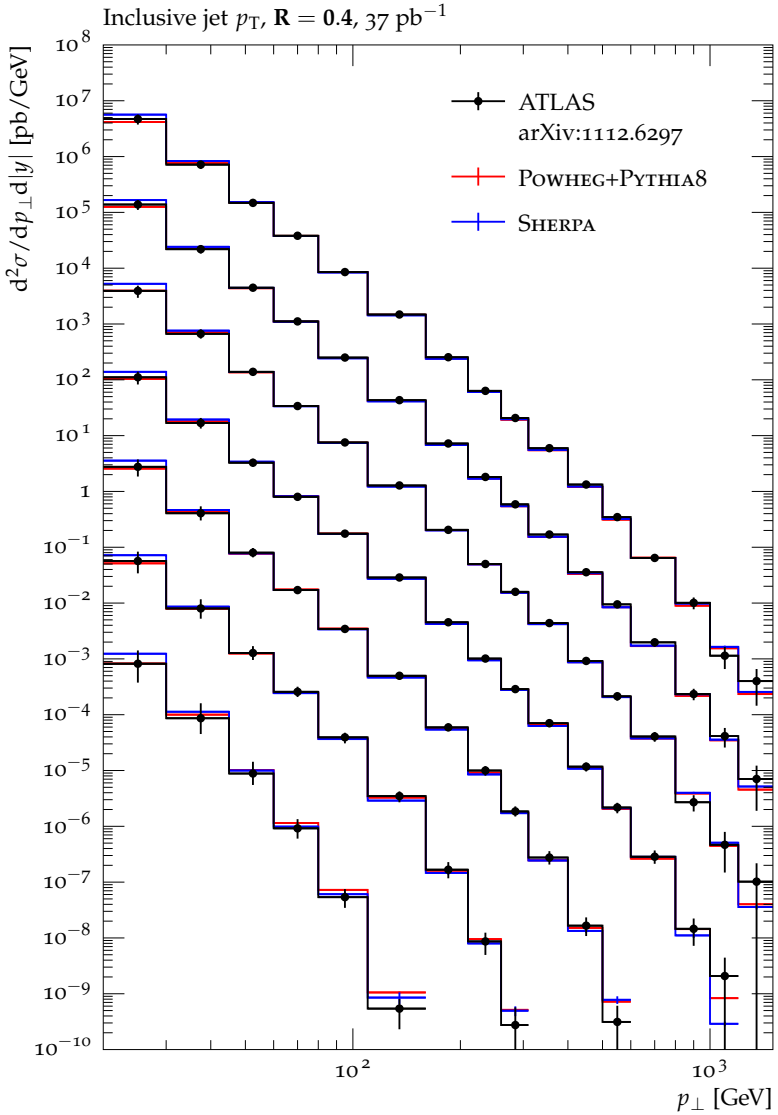
Benchmark cross section

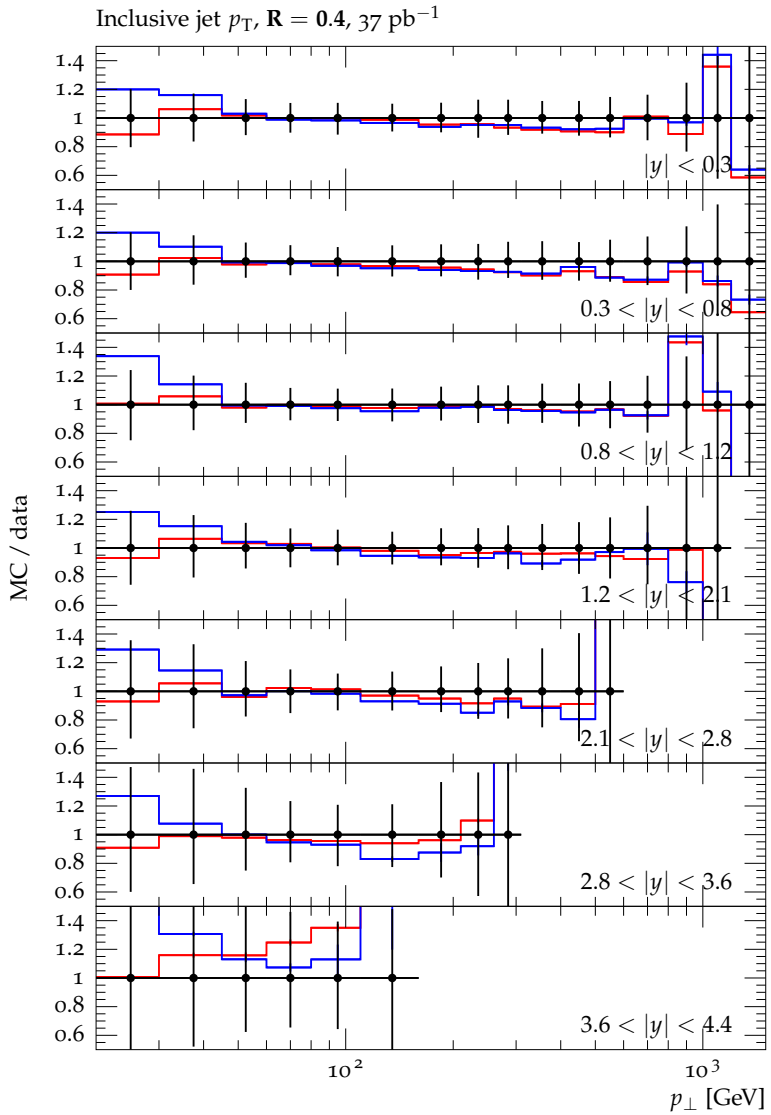
	7 TeV	8 TeV	13 TeV
POWHEG+PYTHIA8			
dijet POWHEG	✓	✗	✗
$W + 2j$ POWHEG MiNLO	✓	✓	✓
$Z + 2j$ POWHEG MiNLO	✓	✓	✓
SHERPA			
dijet S-MC@NLO	✓	✗	✗
$W + 0, 1, 2j$@NLO $+ 3, 4, 5j$@LO	✗	✓	✓
$Z + 0, 1, 2j$@NLO $+ 3, 4j$@LO	✗	✗	✓

HERWIG7 +MADGRAPH +OPENLOOPS

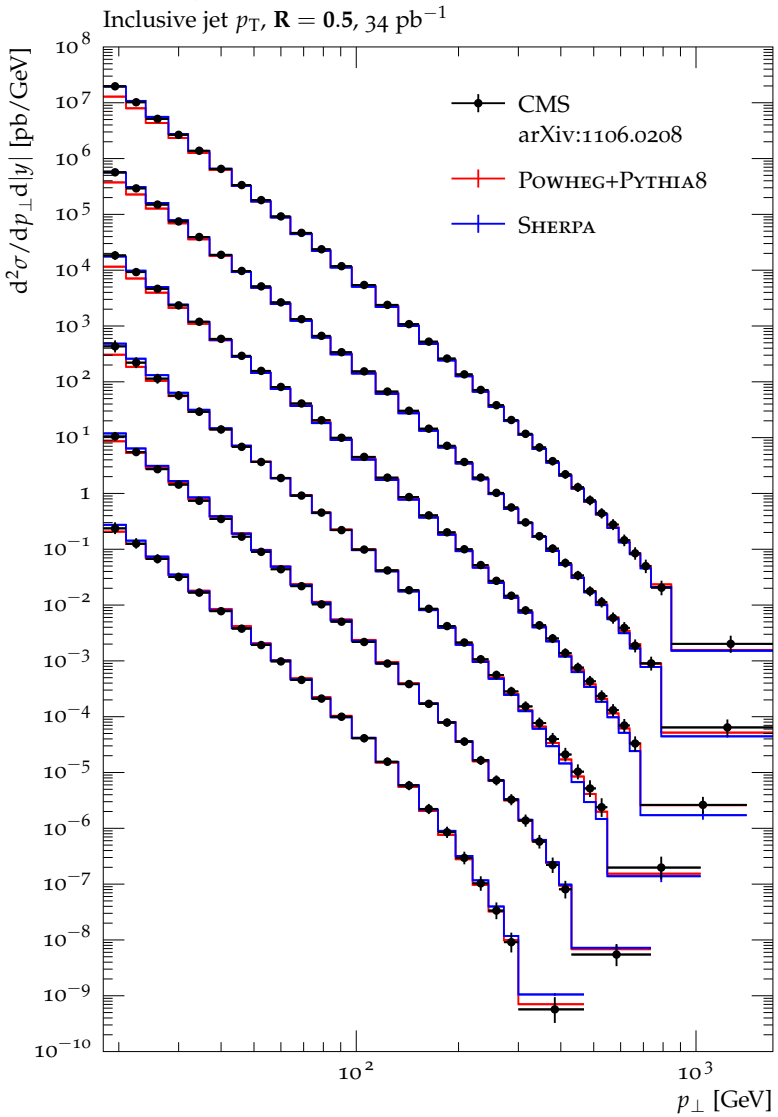
in the process of finalising the setups

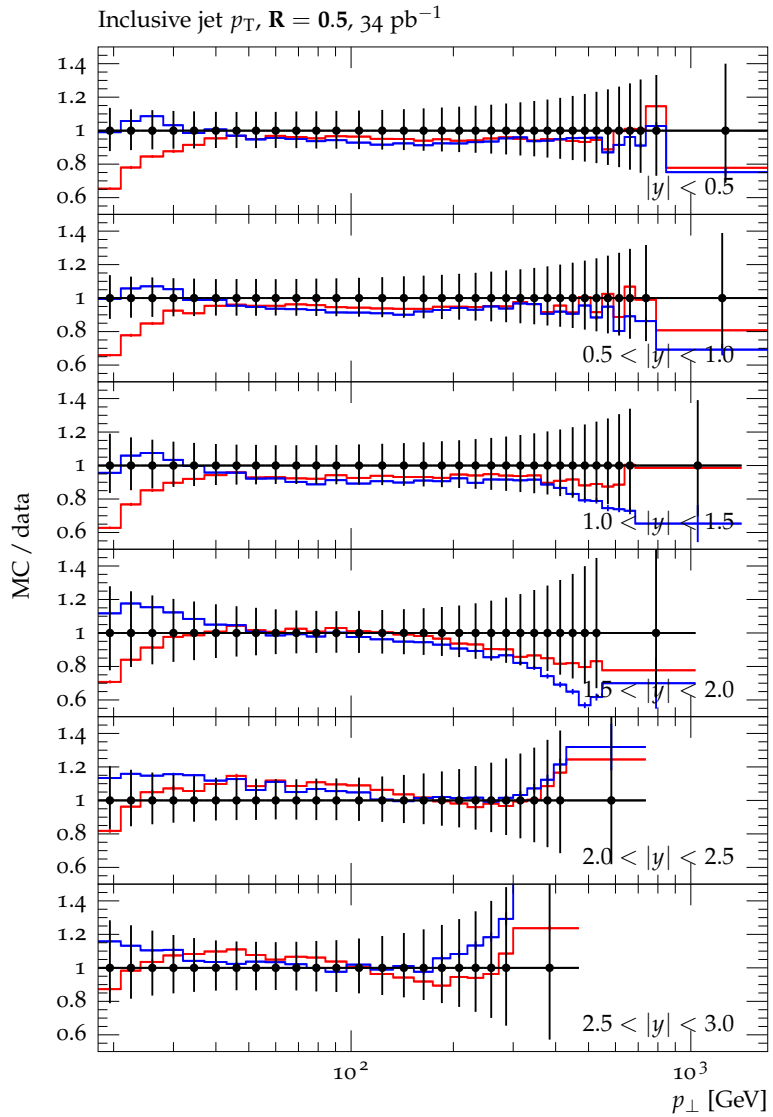
Inclusive jets



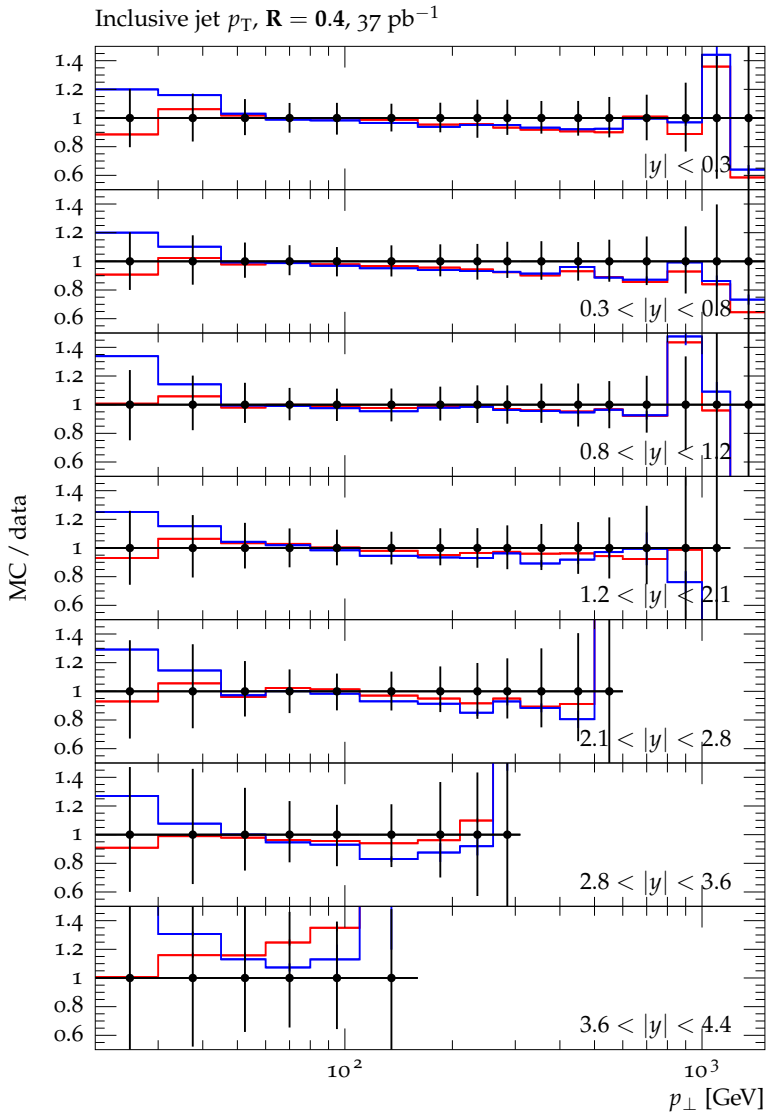


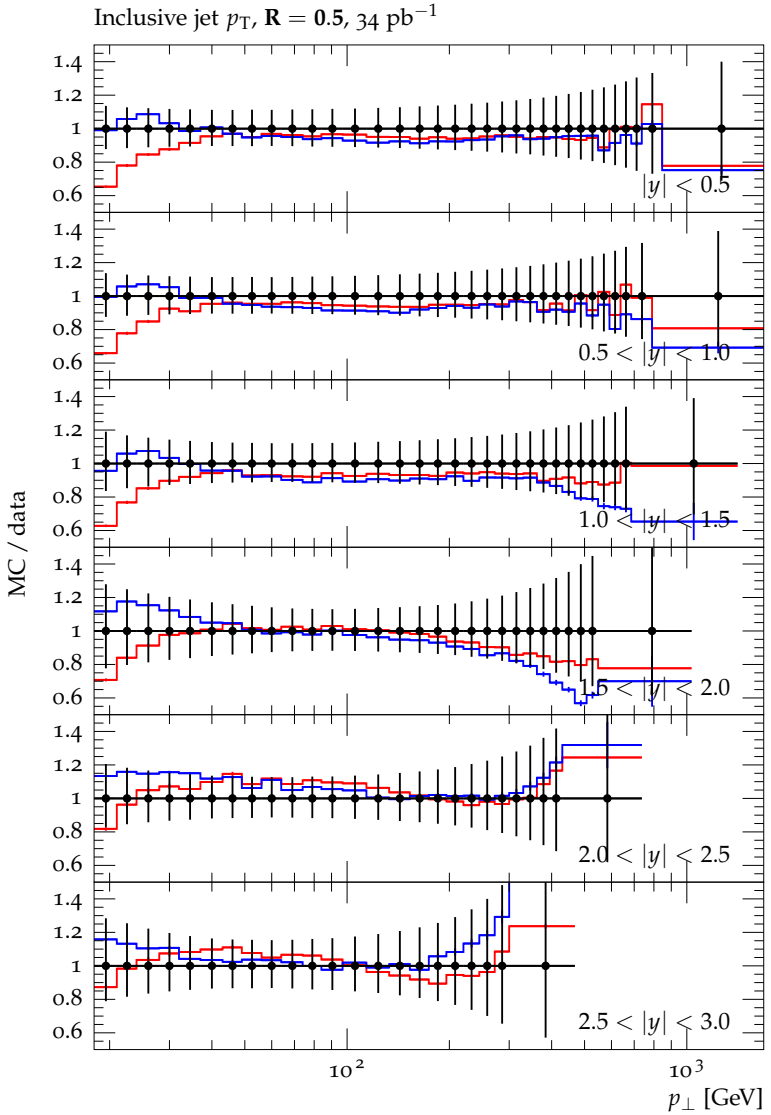
Inclusive jets



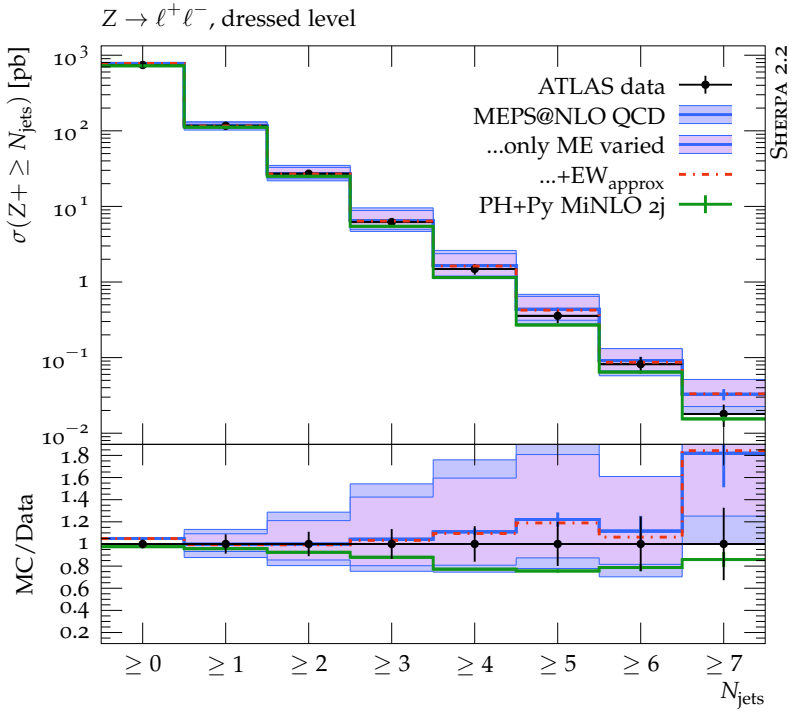


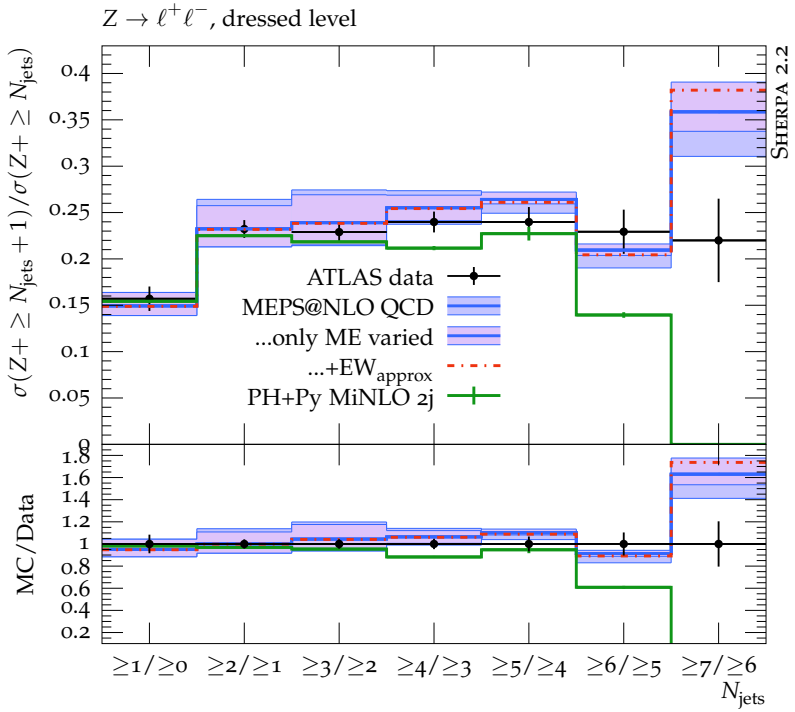
Inclusive jets





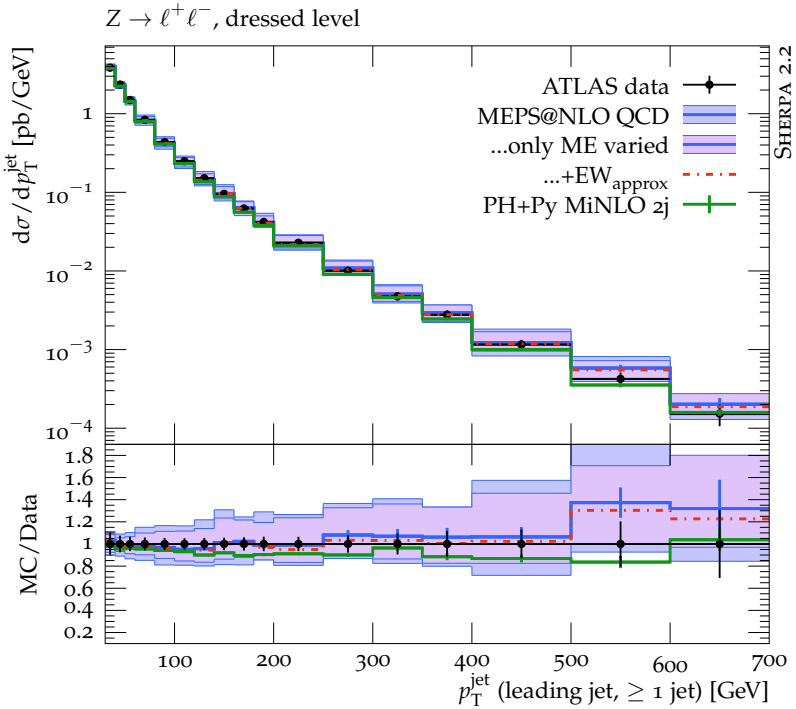
Z + jets

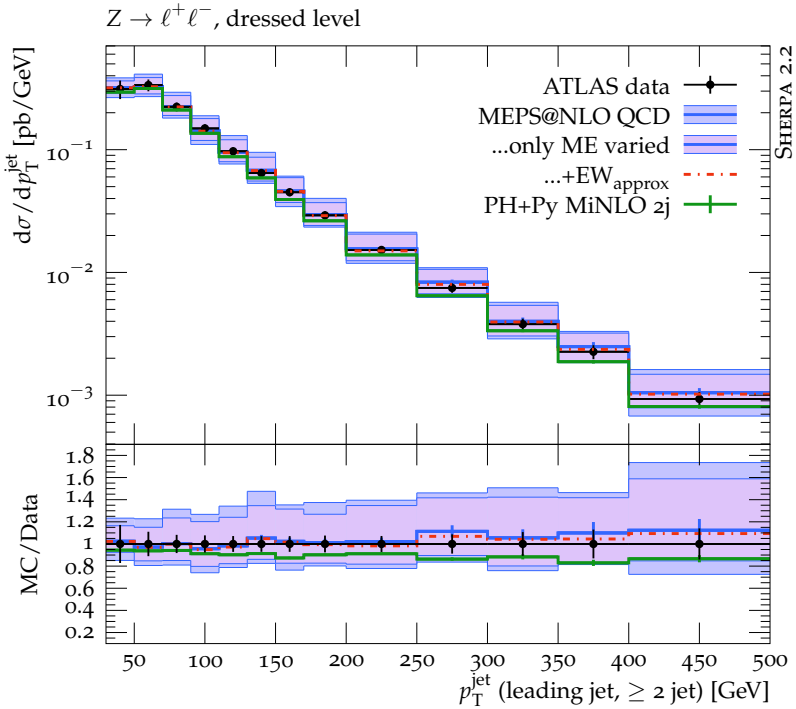




details: E. Bothmann's talk Jun'19

Z + jets





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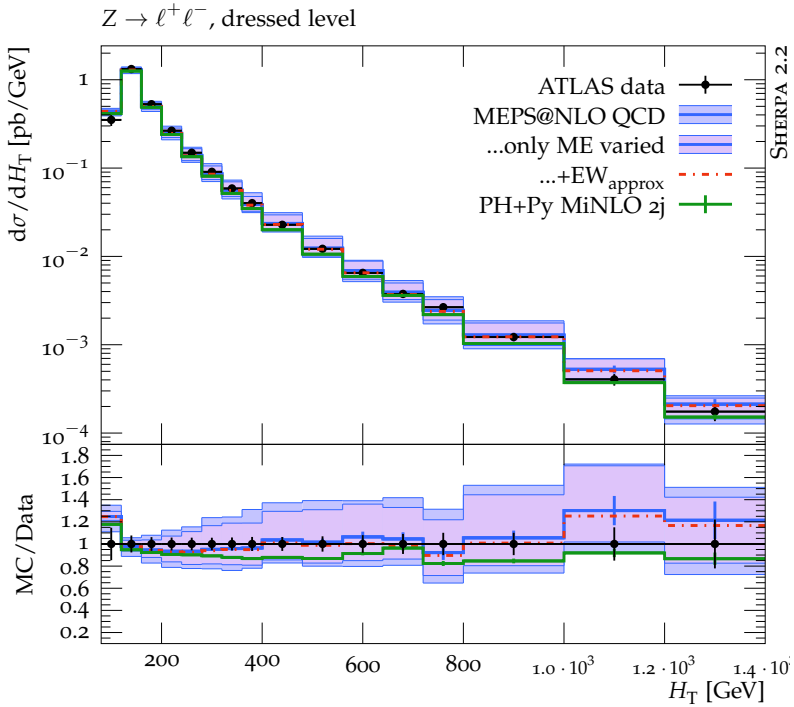

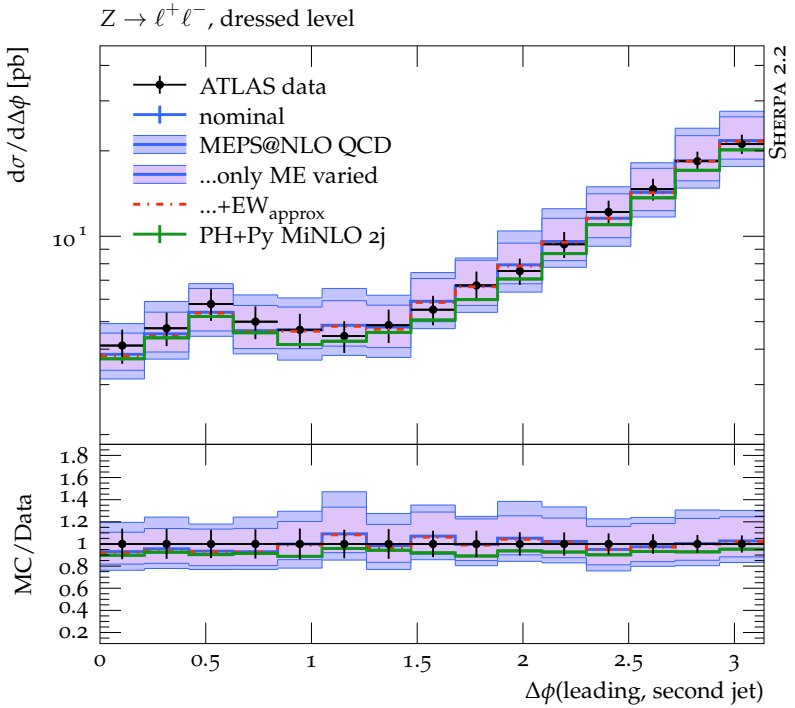

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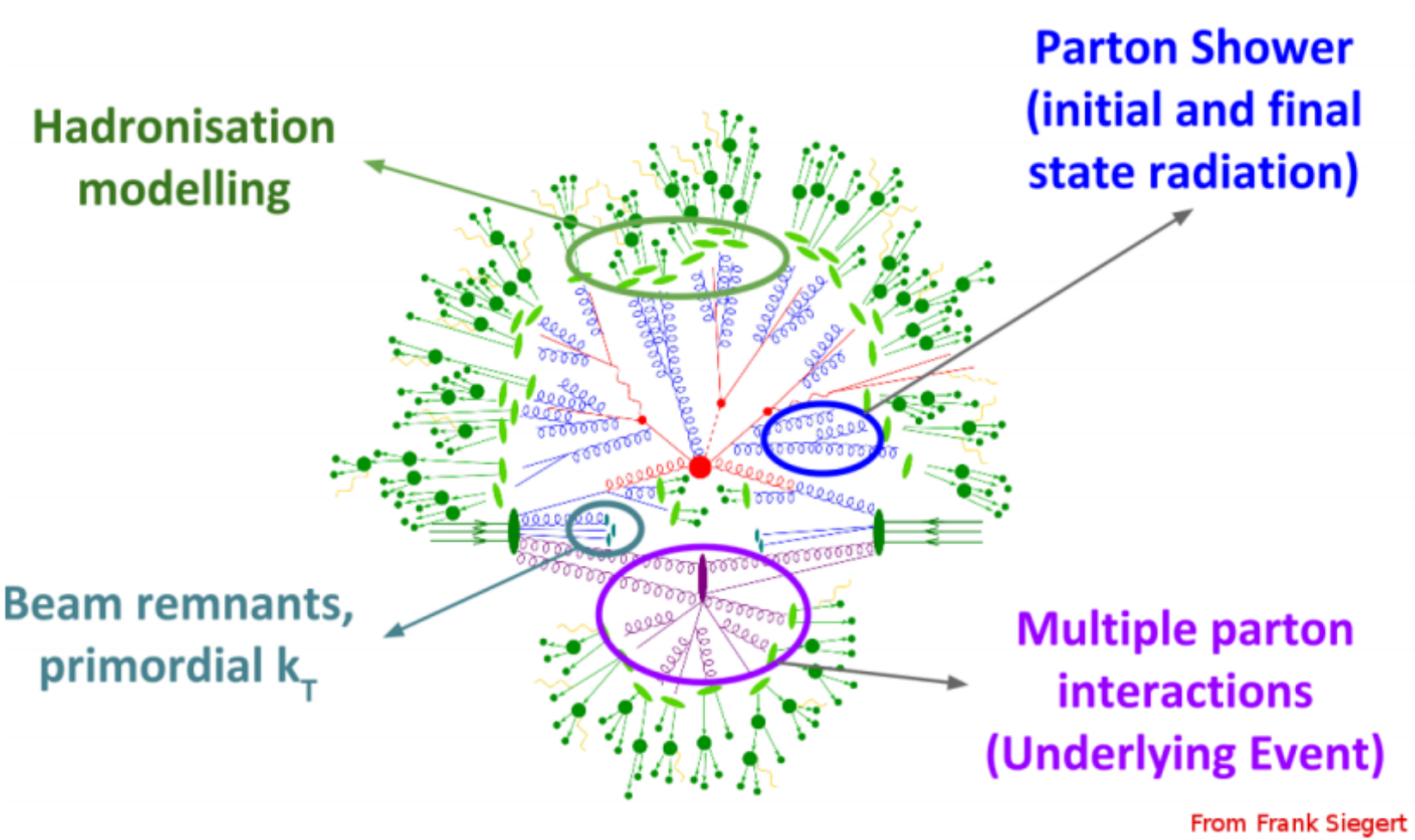
Benchmark cross sections

- MC sample production and storage progressing, as LHEF or HepMC `/eos/project/l/lhc-ewwg-eos/public`
- a good range already available, cf. TWiki page
- HepMC does not allow to store corresponding cross section variations, will have to be recomputed for each variation for correct normalisation
  - for RIVET-2: a small tool to read in event, filter for all requested weights, recompute the requested cross section for each and communicate this to RIVET
  - for RIVET-3: this should work directly
- **need more RIVET plugins**
- ideally combine with LHCTune and Correlations to get a universally tuned prediction, and assessing the statistical significance of deviations and data consistency

LHC tune

In addition to the single hard interaction with large p_T:



LHC tune

- Aim: to test the global understanding of the LHC data we need a universal tune of the non-perturbative models
  - keep hadronisation model tunes to e^+e^--machines
  - include selected Tevatron (maybe DIS) data
  - define a pan-experiment list of input data
  - take particular care to not mingle hard and soft physics
    i.e. make the tunes suitable for NLO matched and multileg merged calculations
- benefit to experiments as their theory predictions would be more meaningful as opposed to using an experiment specific tune

$\Rightarrow$ severely lacking person-power
(possibility to assign service points within experiments?)

Correlation propagation

- Data/MC comparison in the presence of correlated systematic uncertainties is an increasingly important topic
  $\rightarrow$ need access to systematic correlation information from measurements
  - Which format should be used (covariance matrix, replicas, . . .)?
  - Where should correlations be available from?
  - Which data format should we use?
  - Are further technical developments needed?

Correlation propagation

- recommendation on how to store (and make usable) correlations of experimental uncertainties
- details: Louie's talk yesterday,
  dedicated meetings within the WG Dec '18, Feb '19
- already have implemented the proposed format for seemless propagation of uncertainty breakdown from HEPdata to RIVET through YODA
- expect to have a functional proposal and some tests in RIVET for YR
- need proposal to be adopted by experiment such that error breakdown is uploaded to HEPdata in a usable format
- circulate proposal within EW WG and experiments

Correlation propagation

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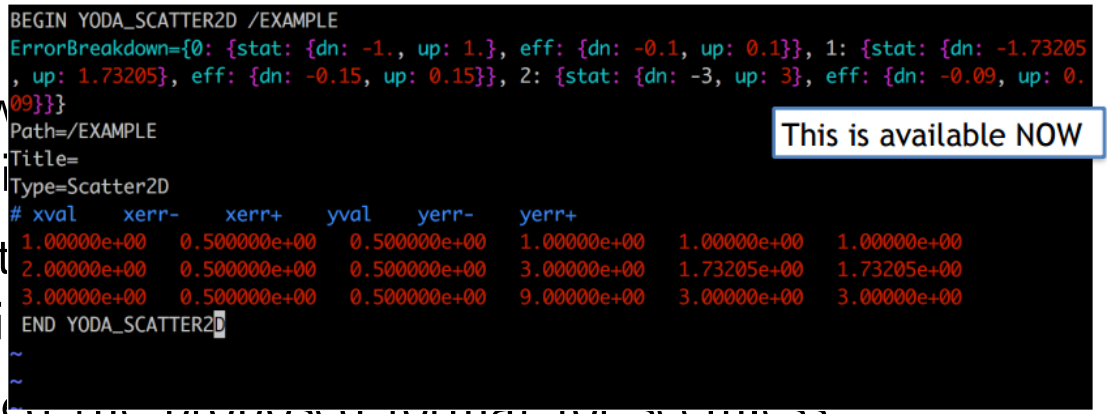

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Correlation propagation

- recommendation on how
  experimental uncertainti
  yest
  meeti
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```
BEGIN YODA_SCATTER2D /EXAMPLE
ErrorBreakdown={0: {stat: {dn: -1., up: 1.}, eff: {dn: -0.1, up: 0.1}}, 1: {stat: {dn: -1.73205
, up: 1.73205}, eff: {dn: -0.15, up: 0.15}}, 2: {stat: {dn: -3, up: 3}, eff: {dn: -0.09, up: 0.
09}}}
Path=/EXAMPLE
Title=
Type=Scatter2D
# xval    xerr-    xerr+    yval    yerr-    yerr+
 1.00000e+00   0.500000e+00   0.500000e+00   1.00000e+00   1.00000e+00   1.00000e+00
 2.00000e+00   0.500000e+00   0.500000e+00   3.00000e+00   1.73205e+00   1.73205e+00
 3.00000e+00   0.500000e+00   0.500000e+00   9.00000e+00   3.00000e+00   3.00000e+00
 END YODA_SCATTER2D
~
~
```

This is available NOW

```
dependent_variables:
- header:
    name: $(1/\sigma)(d\sigma/d\Delta R(J/\psi,\mu))$
    units: ''
  values:
  - errors:
    - label: sys,Double_Exp_Jpsi_tau
      symerror: 0.0076807
    - label: stat,Stat
      symerror: 0.0047191
    - label: sys,DS_Bkg_Exp_mass
      symerror: 0.00021959
    - label: sys,Trigger
      symerror: 4.4163e-05
    - label: sys,Bc
    (...)
    value: 0.10247
  - errors:
    - label: sys,Double_Exp_Jpsi_tau
      symerror: 0.036689
    - label: stat,Stat
      symerror: 0.0051165
    - label: sys,DS_Bkg_Exp_mass
      symerror: 1.6783e-05
    - label: sys,Trigger
      symerror: 1.7375e-05
    - label: sys,Bc
      symerror: 0.0035781
    (...)
    value: 0.21703
  - errors:
    - label: sys,Double_Exp_Jpsi_tau
      symerror: 0.0042903
    - label: stat,Stat
      symerror: 0.0049166
    - label: sys,DS_Bkg_Exp_mass
      symerror: 0.0033137
```

- nctional proposal and some tests in RIVET for YR
- e adopted by experiment such that error
  ded to HEPdata in a usable format
- within EW WG and experiments

Precision Jet Substructure in the LHC EW WG

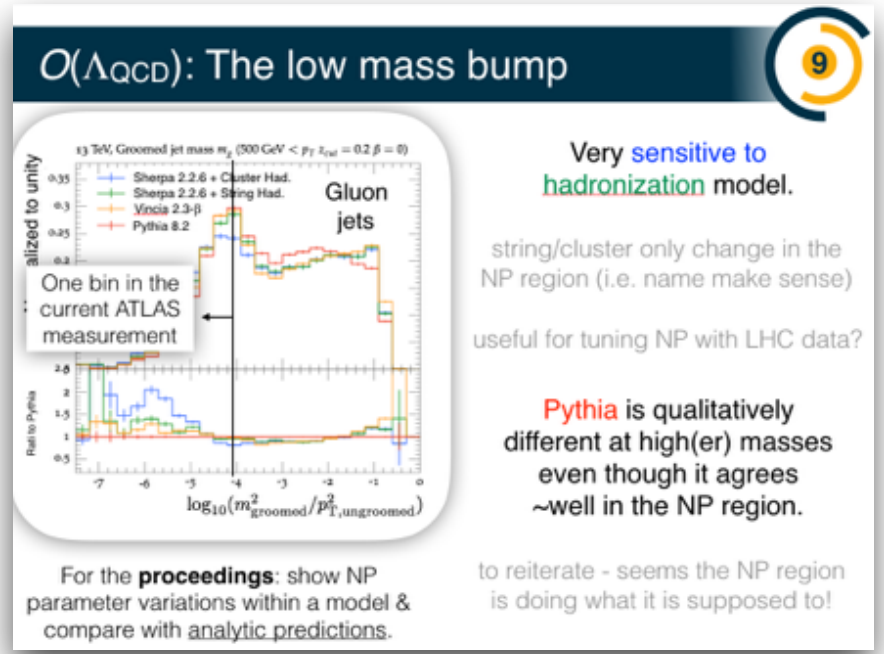
Goal #1: maintain a database of measurements, encourage HepData + Rivet routines, and common observable definitions / binnings:

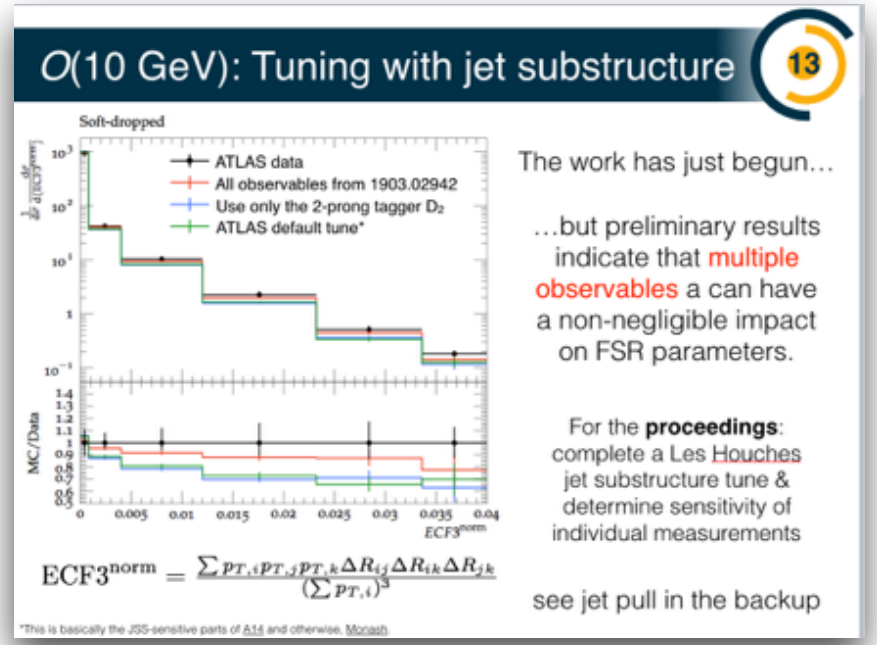
https://twiki.cern.ch/twiki/bin/view/LHCPhysics/LHCJetSubstructureMeasurements

Work to do: ensure we have Rivet routines and HepData for our analyses. This is becoming more of a requirement in ATLAS and CMS, but is less so for LHCb and ALICE. We have recently added new routines from old(er) measurements to do MC comparisons with state-of-the-art PS MC setups.

Precision Jet Substructure in the LHC EW WG

Goal #2: study the impact of jet substructure measurements on FSR and NP PS MC tuning.

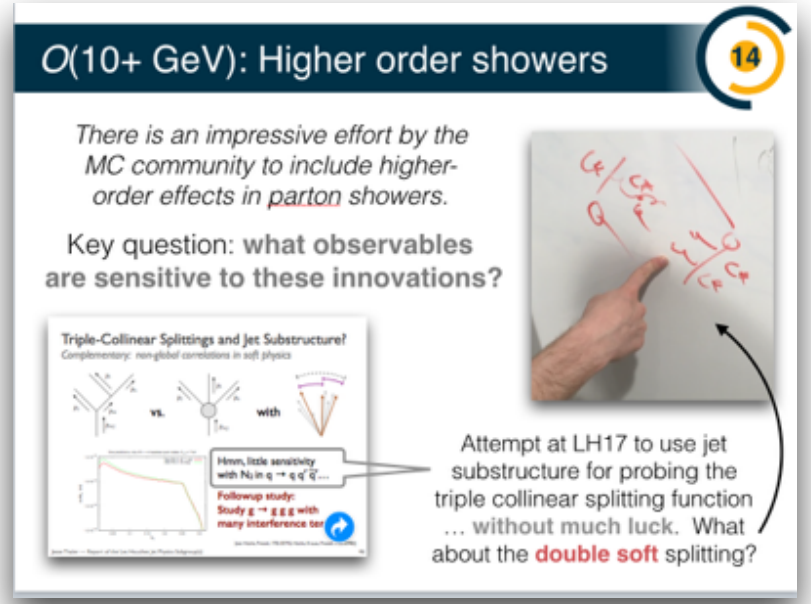


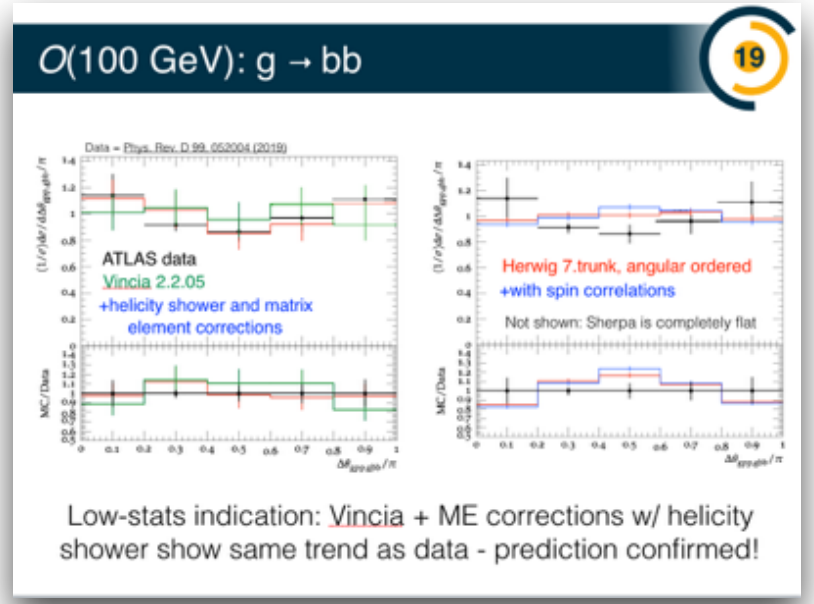


This was started as part of the jet working group at Les Houches 2019.

Precision Jet Substructure in the LHC EW WG

Goal #3: study the impact of jet substructure measurements on higher order effects in PS MCs.





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Conclusions

- we need more time to prepare the YR
- benchmarking to continue, comparing experiment and theory
- LHCTune needs to speed up
- inclusion of correlations well progressing
- jet substructure just started, but moves at good pace