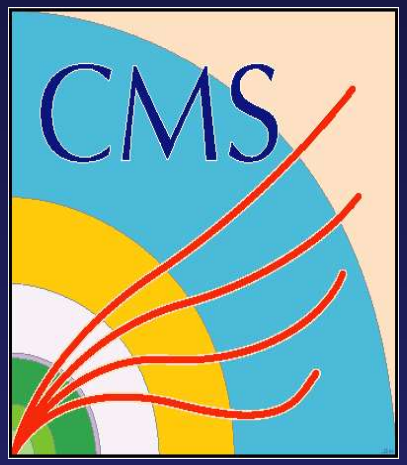


Current Status of the Brussels top quark group

Jan Heyninck,
J. D'Hondt, S. Lowette,
P. Van Mulders, G. Hammad

Outline

CURRENT PHYSICS STUDIES:

- "SAME SIGN" TOP QUARK PAIRS IN m-SUGRA
- tT - RESONANCES (e.g. Z-PRIME)
- B-JET CALIBRATION USING tT EVENTS

MAIN SOFTWARE EFFORT:

- TRANSITION TO THE NEW SOFTWARE FRAMEWORK

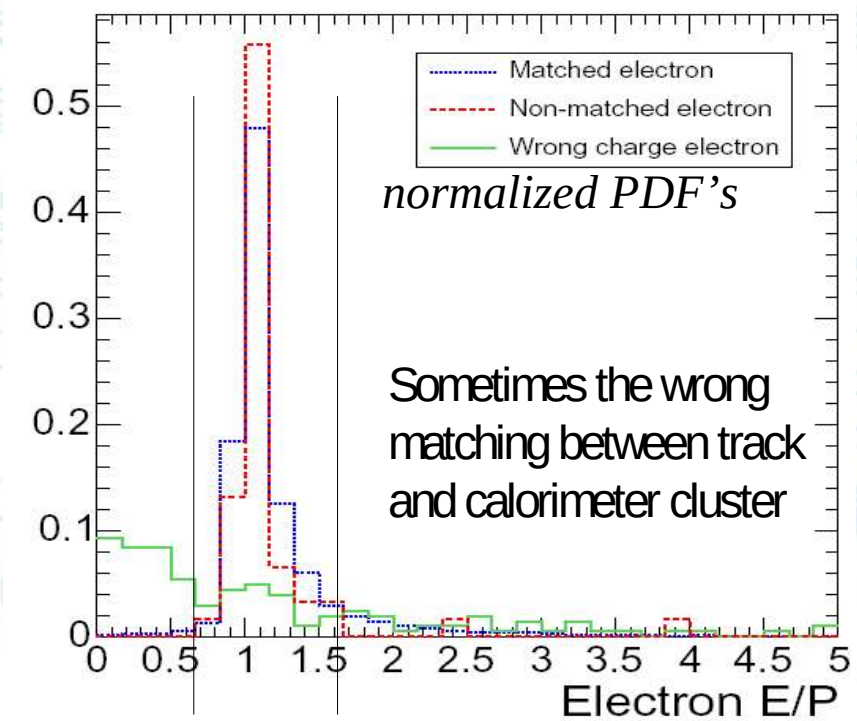
“Same-sign” observability...

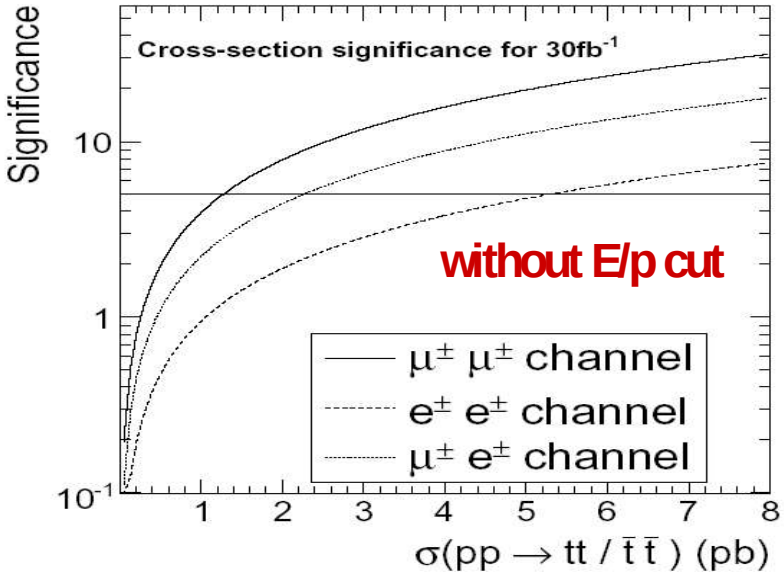
- ✓ ... improved by the use of the electrons E/p ratio

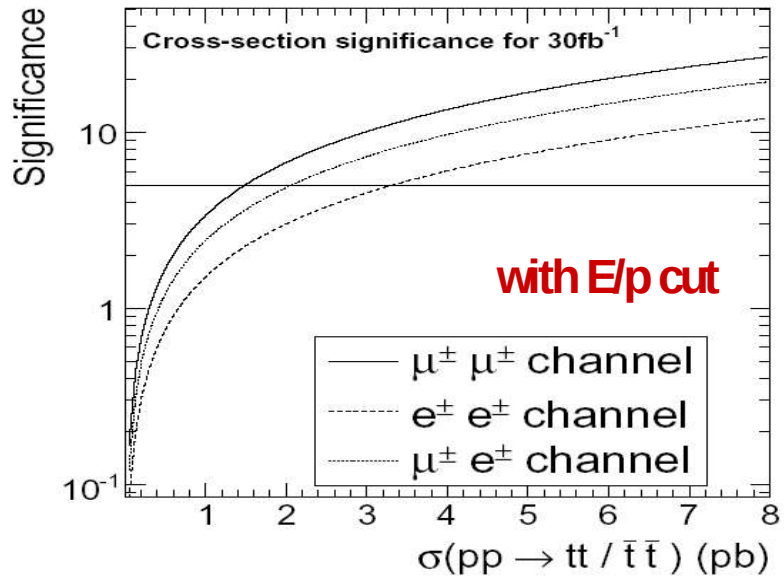
energy of an observed ECAL-tower

= ----------

matched track momentum







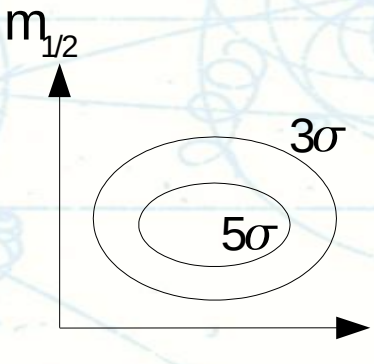
"Same-sign" in m-SUGRA

- ✓ various exotic models predict X→tt: technicolor based, prediction of a new strong interaction or m-SUGRA:
  - possible production of same-sign top pairs via the decay of a gluino pair

$$p\,p \rightarrow \tilde{g}\,\tilde{g} \rightarrow \tilde{t}\,\tilde{t}\,b\,b \rightarrow t\,t\,b\,b + MET$$

  - σ x BR dependent on 5 m-SUGRA parameters tgβ, m_A, sigμ, $m_{1/2}$, m_0 (calculated with ISAJET)

  - First aim: what part of the parameter space is observable?
    Remember, with 30fb^{-1} of statistics, a cross-section of ~1pb was needed to extract new physics from the SM background (assuming same topology)

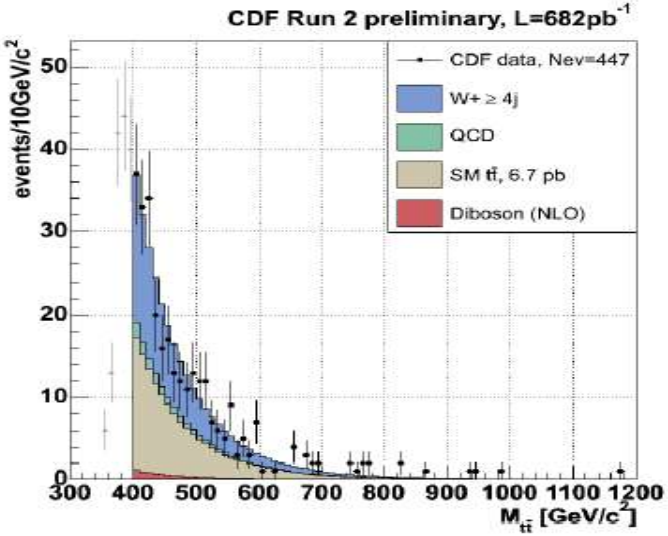


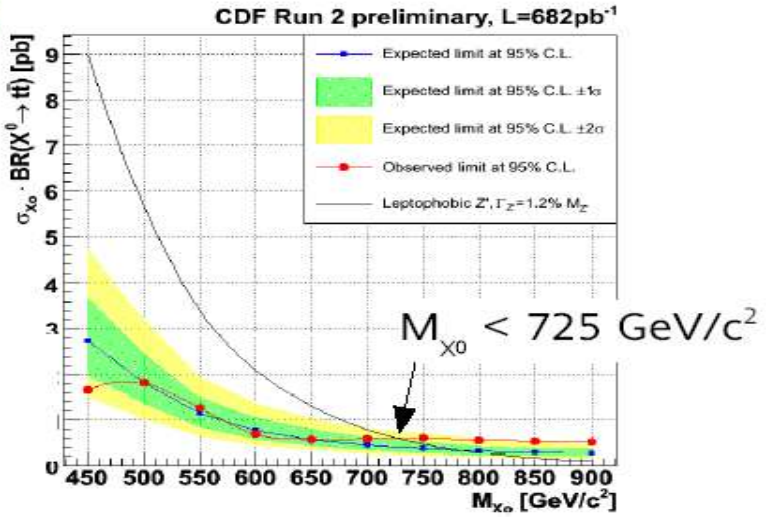
for different tgβ & m_A values

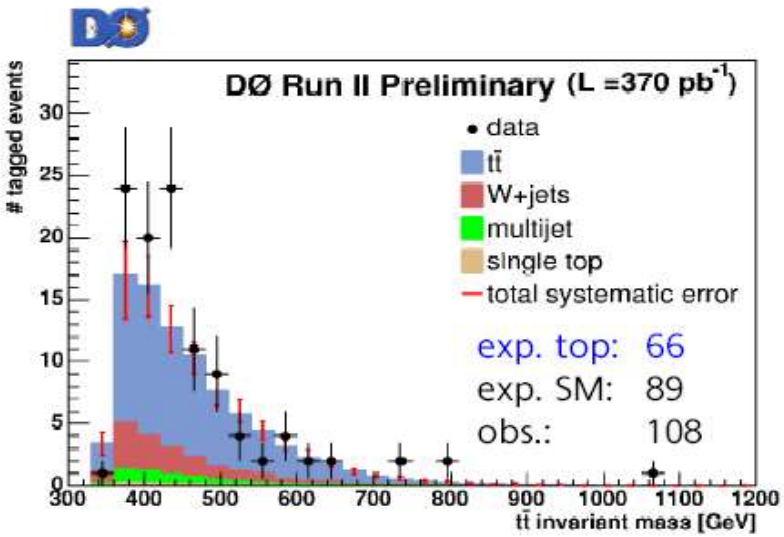
REMARK: further event selection cuts on extra jets or MET might lower the 1pb threshold!

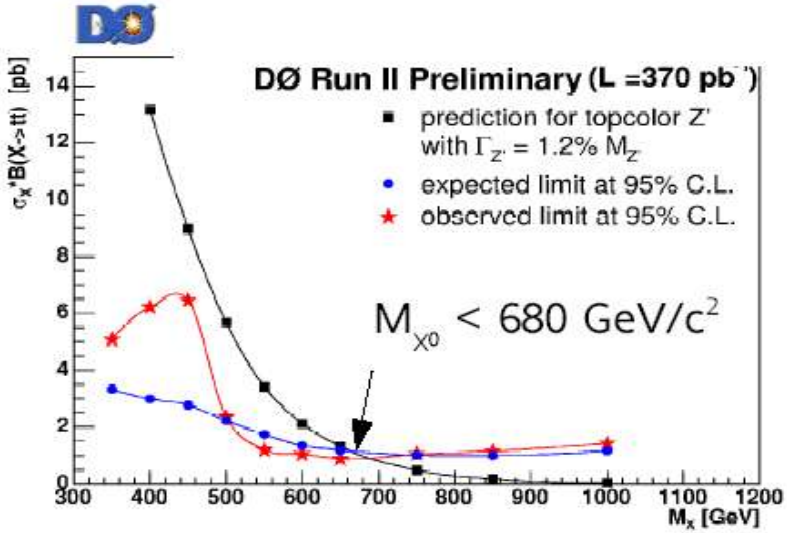
Search for tT-resonances

- ✓ Does something new produce top pairs @Tevatron ($X^0 \rightarrow tT$)?



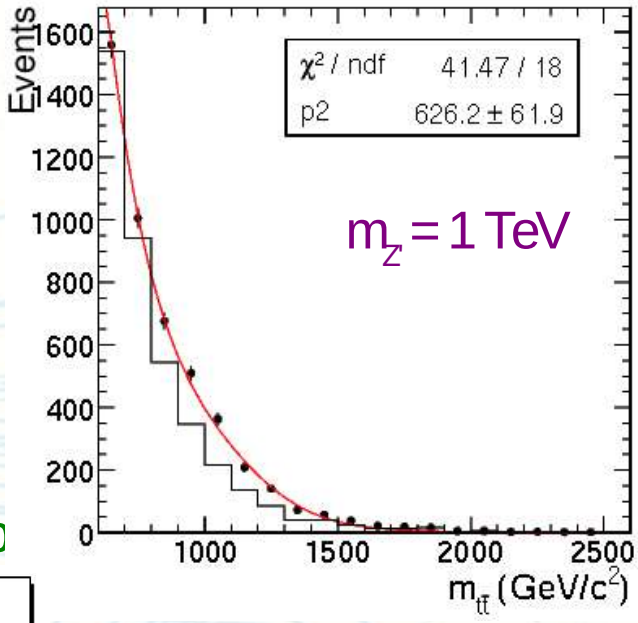


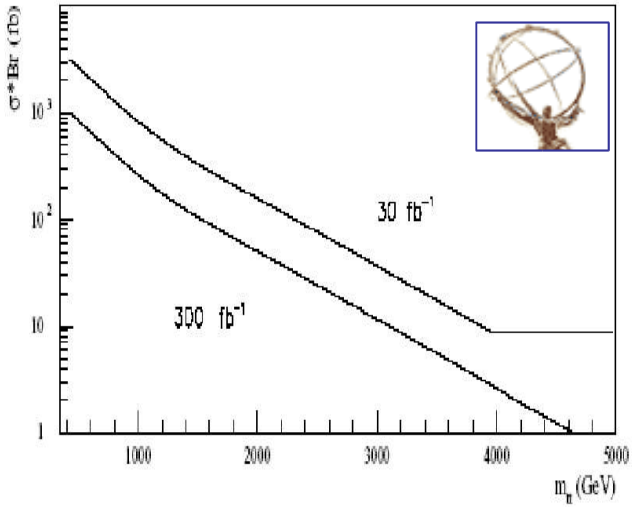


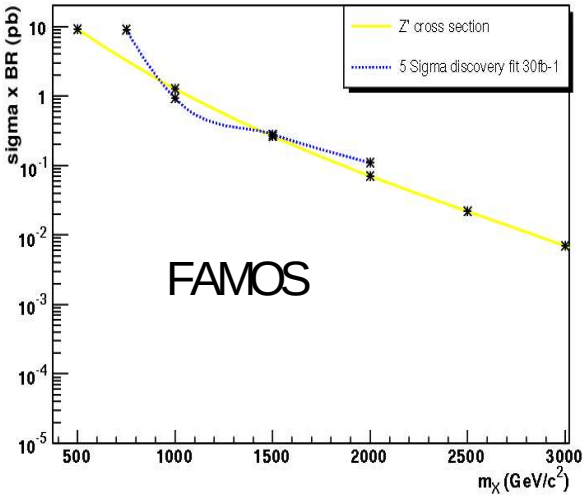


Search for X→tT in Brussels

- ✓ my means of full reconstruction of the tT invariant mass
  making use of all the reconstruction tools described by Steven, except a KinFit (convergence rate too low)
- ✓ use case: Technicolor Z', generated at different masses without $\gamma^*/Z^0/Z'$ - interference
- ✓ method (so far) useful up to $m_z \sim 2$TeV:
  due to the high top boost, the resulting IC-jets will overlap







fitting method, assuming MC knowledge of S and B shape (gauss. & exp.), with only N_S as a free parameter
-> insensitive to background level !

Possible improvements: increase the KinFit convergence rate & exploit other jet clustering algo's

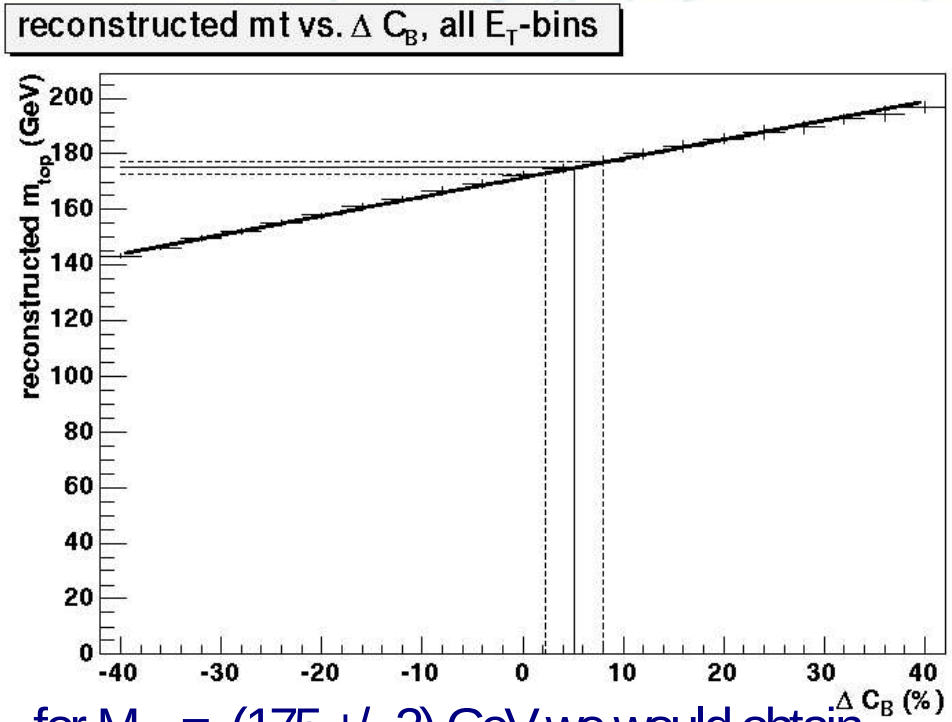
in situ b-JES calibration

Inclusive:

1. first "post-calibrate" light jets using light jet calibration as already mentioned
2. apply relative energy shift ΔC_B on hadronic b-jets, keeping jet mass constant
3. calculate m_{top} for each ΔC_B
4. fit each of the 21 obtained m_{top}-spectra gaussian
5. extract the ΔC_B resulting in a non biased m_{top}-estimate relative to the world average

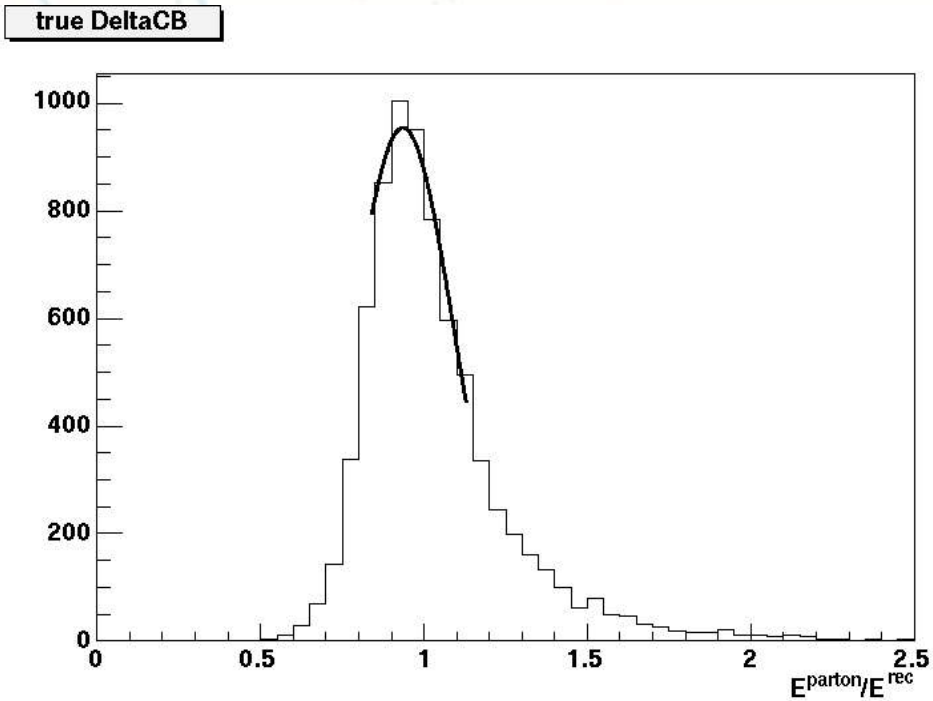
(Analysis already started in ORCA)

in situ b-JES calibration



for M_{top} = (175 +/- 2) GeV we would obtain

ΔC_b^{meas} = (5.14 +/- 3.6)%



true inclusive shift on b-JES (only well matching, non overlapping b-jets):

ΔC_b^{true} = 6.49 %

=> bias of only 1.35%

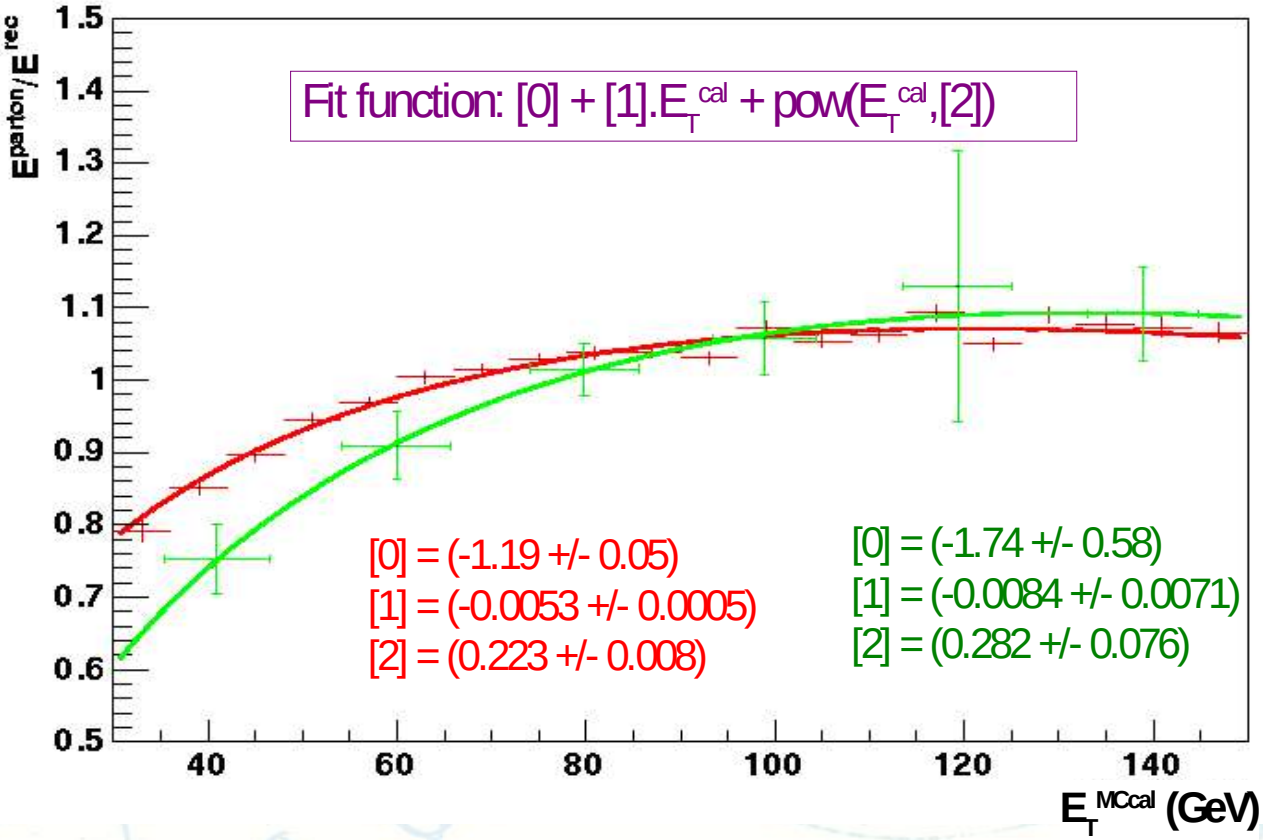
Differentiated vs. E_T

comparison between the true b-jet calibration curve (E^{cal}/E^{parton} vs. E_T^{cal}) with 6 measured ($E_{T,mean}^{i}, \Delta C_b^{meas,i}$) pairs:

we had E^{parton} equal to $(1 + \Delta C_b/100).E^{cal}$

↓

$\langle E^{cal}/E^{parton} \rangle^i = 1/(1 + \Delta C_b^{meas,i}/100)$



=> looks promising, however, still a lot of work to make this method robust to systematics!

Transition to the new framework

- ✓ thanks to our GRID-support (Stijn De Weirdt) we were already able to produce our first 100k of tT-events in the new framework using CRAB and the GRID
- ✓ local samples help us a lot when porting elder code to the new framework
- ✓ already in place:
  - extraction of the MC truth (decay, particles, vertices)
  - jet reconstruction & calibration
  - building of jet matching solutions
  - jet resolutions
  - Kinematic Fit
- ✓ first results...

green: reconstructed
red: calibrated
black: fitted