Comments and Recent results on DPE

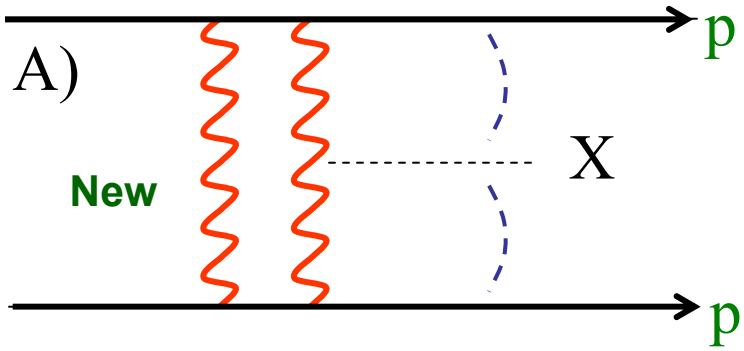
Hera→LHC, Oct.2004

M.Boonekamp
with R.Peschanski, C.Royon

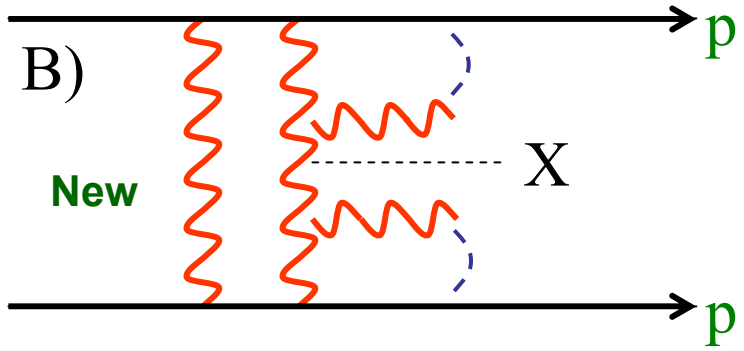
- DPEMC for strong and QED diffraction
- Standard Model Higgs boson sensitivity
- Other physics cases?
- A few personal comments

Models in DPEMC (hep-ph/0312273) :

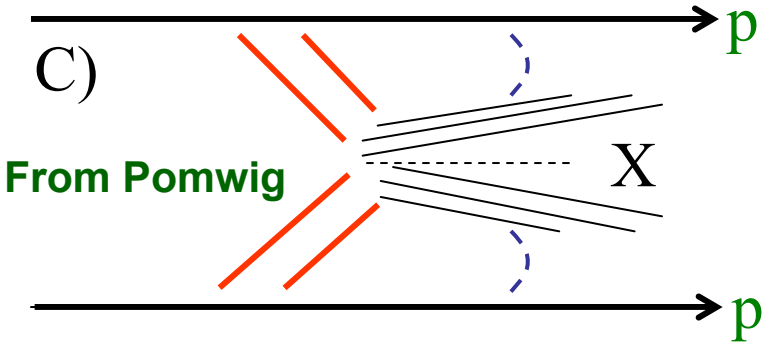
Bialas-Landshoff + Survival



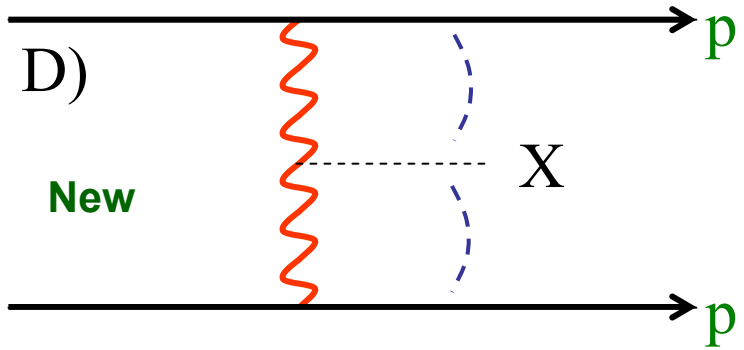
BPR (= inclusive BL) + CDF norm.



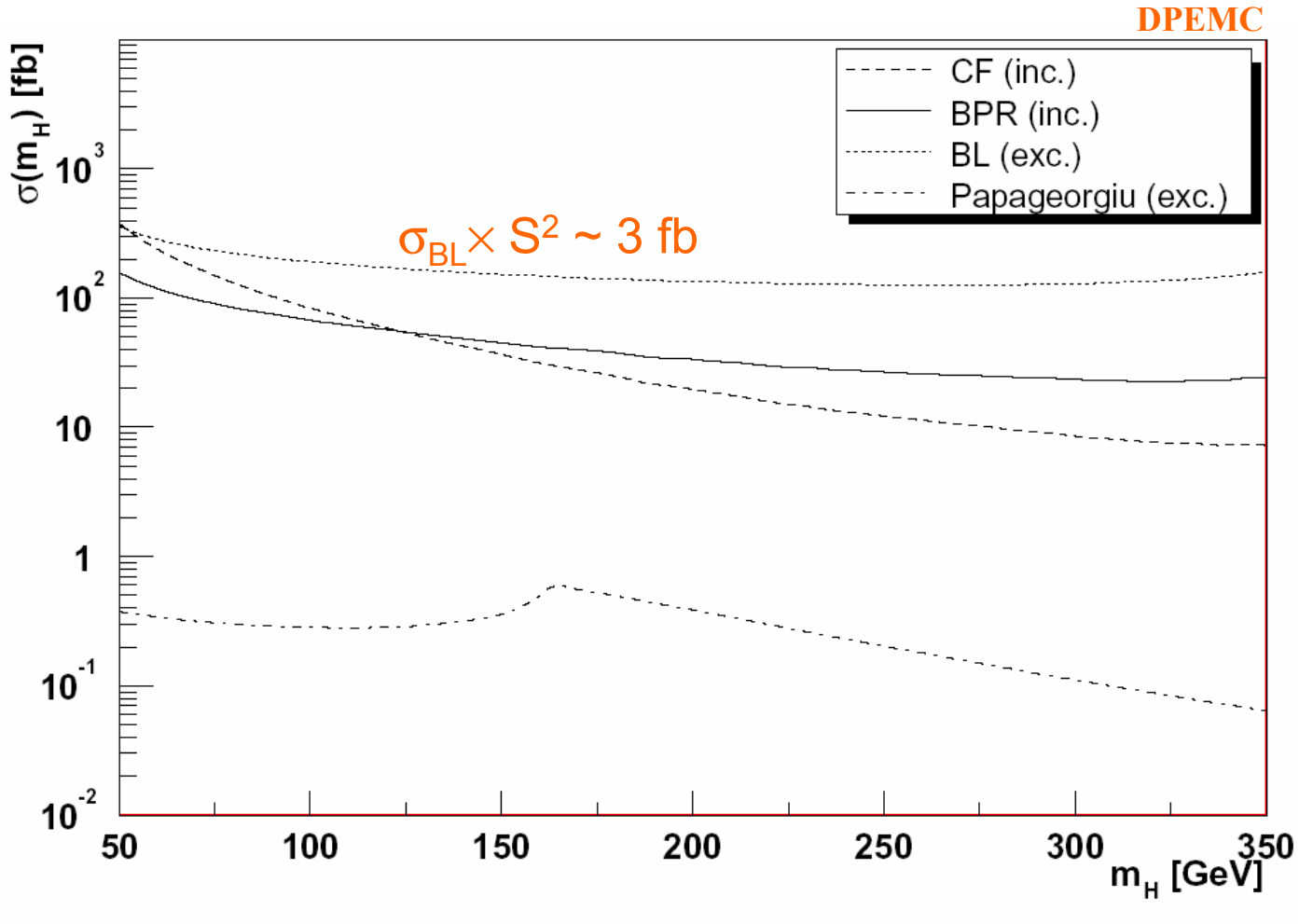
Cox-Forshaw



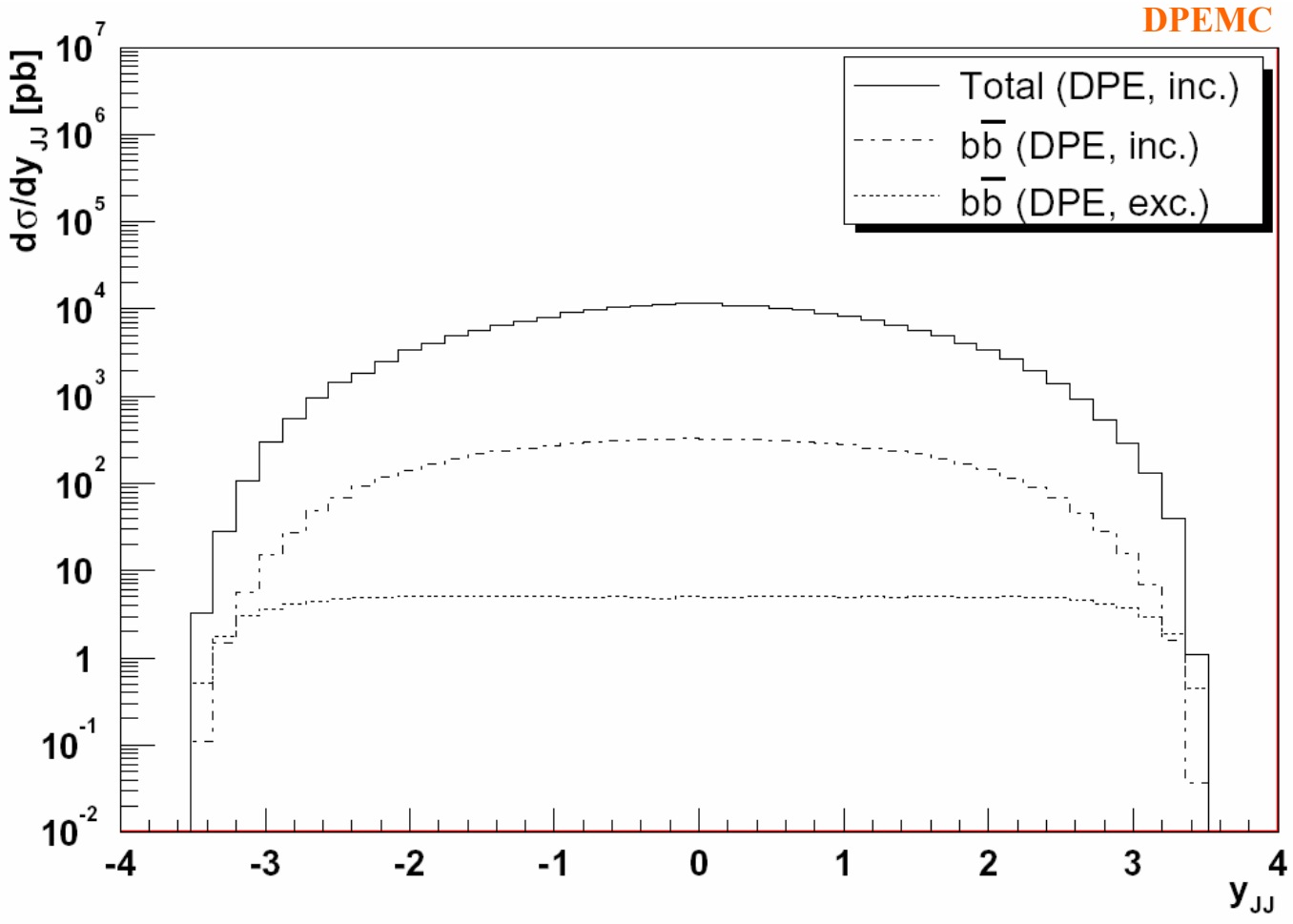
QED



SM Higgs cross-sections

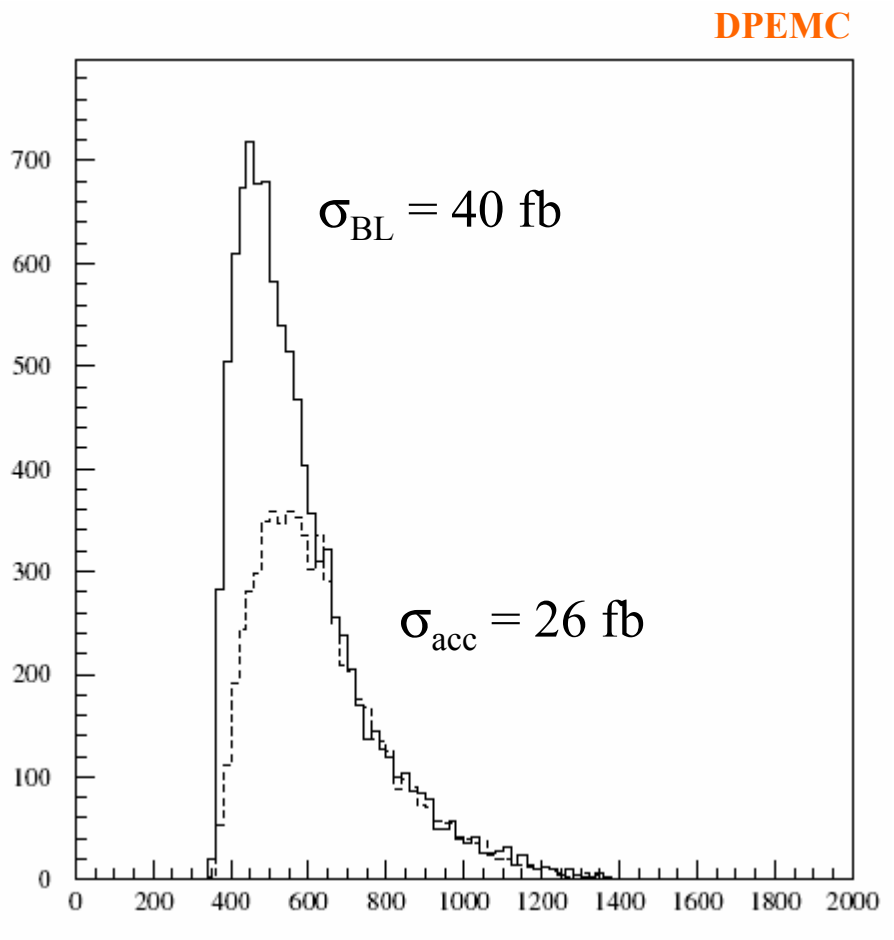


Dijet cross-sections



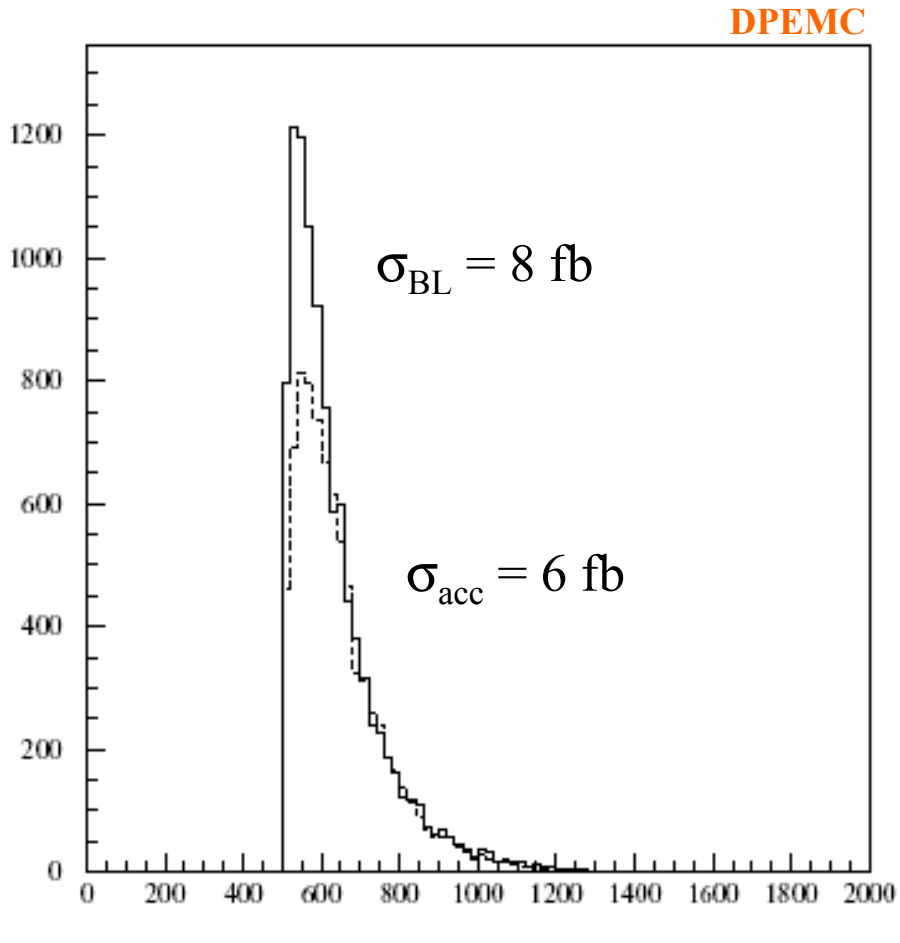
Exclusive top pair production

- Assume Bialas-Landshoff + S^2
- « acc » = 210 m acceptance
- >400 m excellent news!
  (no trigger problems)
- σ_{KMR} = 0.1 fb
- σ_{QED} << 1 fb



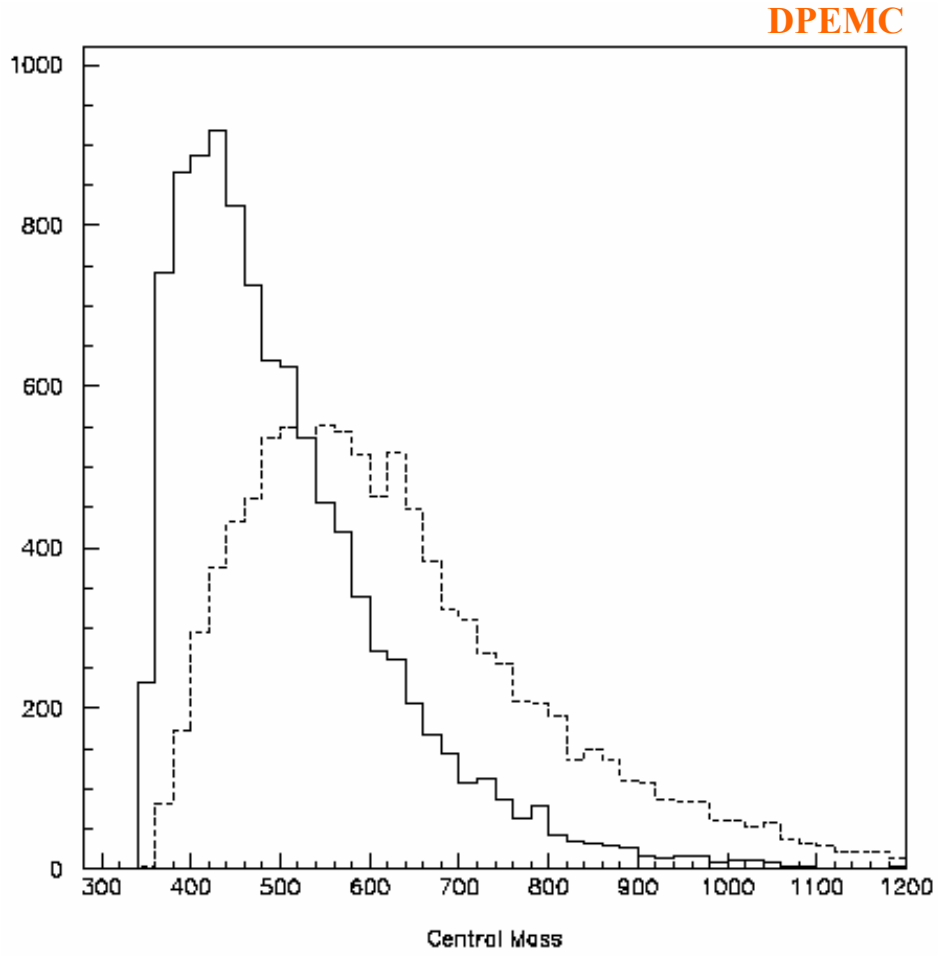
Exclusive Stop pair production

- Assume Bialas-Landshoff + S^2
  m_{stop} = 250 GeV
- gg → stops with J_Z=0 from KMR EPJ C23 p.311, 2002
- σ_{KMR} ~ 0.04 fb
- σ_{QED} << 1 fb



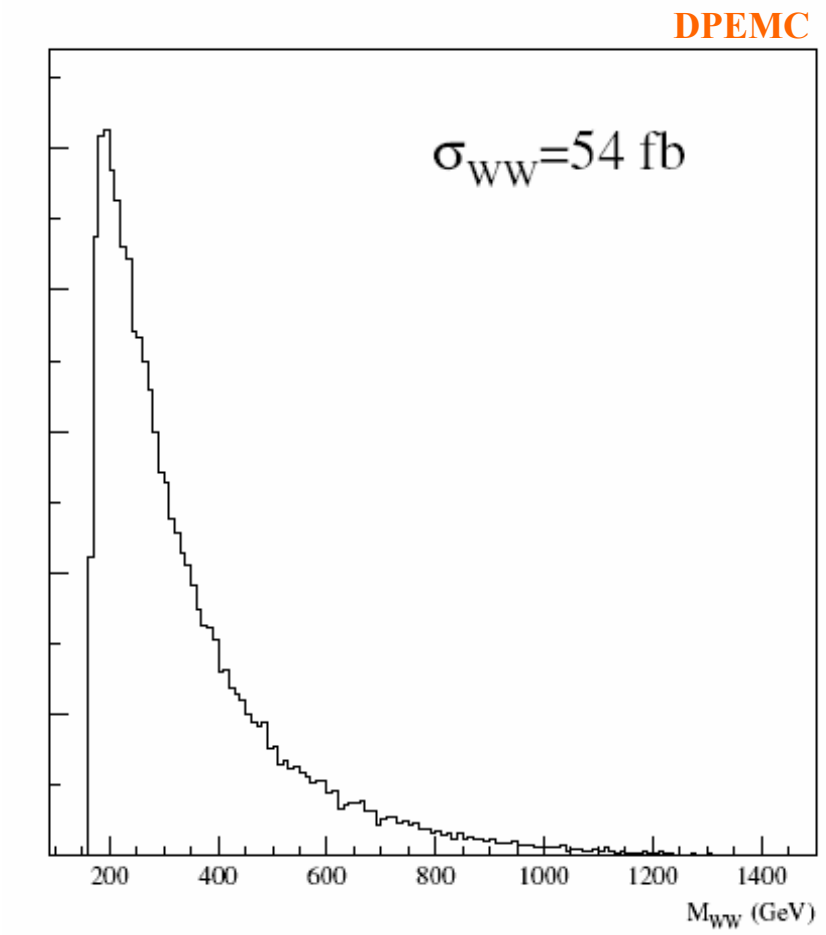
Exclusive Stop pair production

- Distinguish spin 0 from spin ½ at threshold



QED W pair production

- Large cross-section, no trigger problem
- Again, >400 m devices needed
- Robust!!
- Prospects for:
  - Mass measurement at threshold?
  - γWW coupling measurement?



Higgs boson s/b : analysis

- All backgrounds considered, but fast detector simulation
- m_H = 120 GeV

- 2 protons tags
- No Forward E_T (<1 GeV)
- 2 central jets : p_{T1}>45 GeV, p_{T2}>30 GeV, back-to back in ϕ
- B-tagging ($\varepsilon_b \sim 60\%$, $\varepsilon_g \sim 1\%$)
- Central mass fraction : $M_{JJ}/M_{Tot} > 0.75$
- Central to missing mass : $M_{JJ}/(\xi_1\xi_2 s)^{1/2} > 0.8$

Higgs boson s/b : result

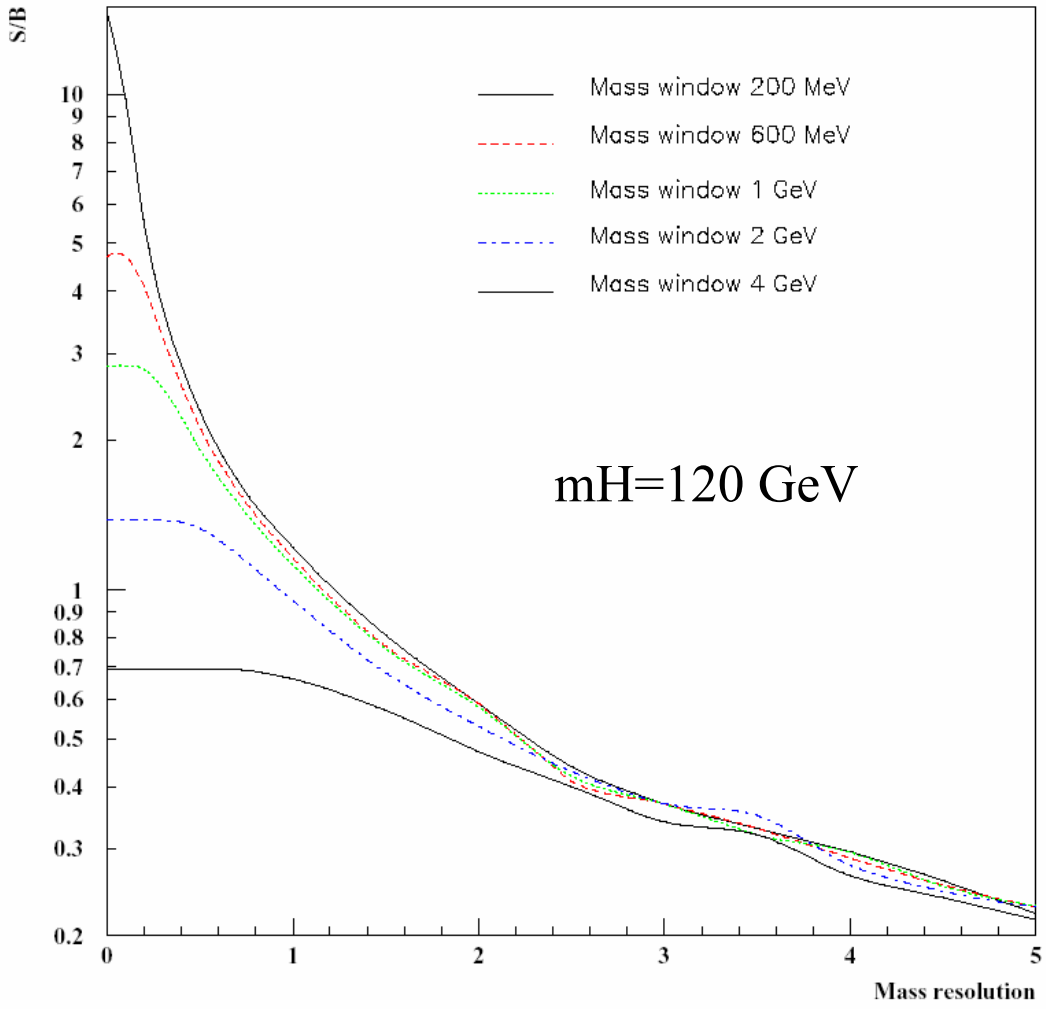
~Model independent :
s/b vs. Resolution. Inject σ,
and read from the plot:

Agrees with KMR estimate
(if $\Delta M \equiv 3\sigma$)

Still optimistic : assumes all
Inclusive background can be
reduced

hep-ph/0406061 and PLB

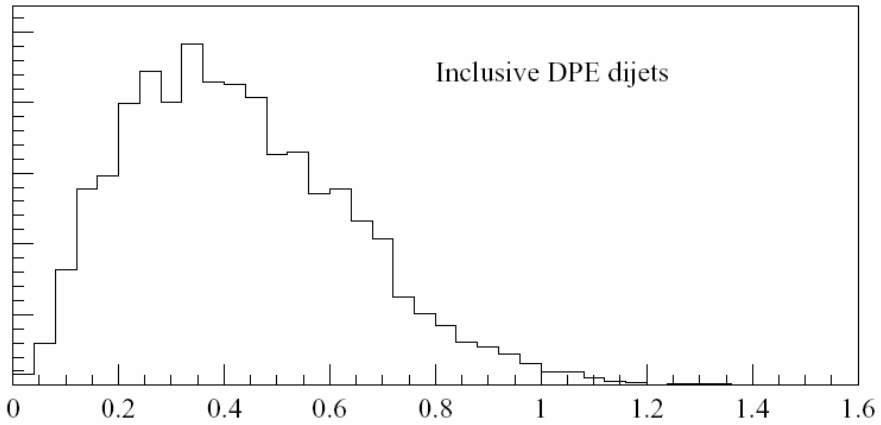
Susy Higgs s/b : multiply plot
by coupling enhancement



(comments) Mass fraction distribution

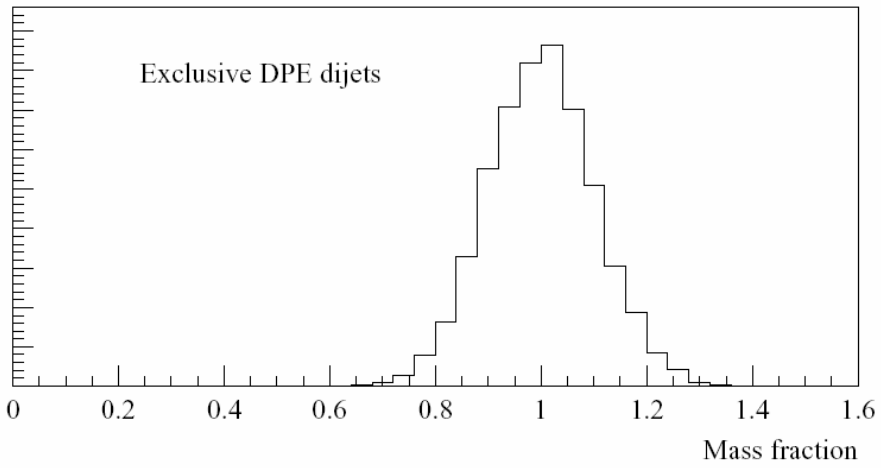
DPEMC

Inclusive (Pomwig ~ DPEMC)
Driven by Pomeron xG



Exclusive
Driven by dijet mass resolution

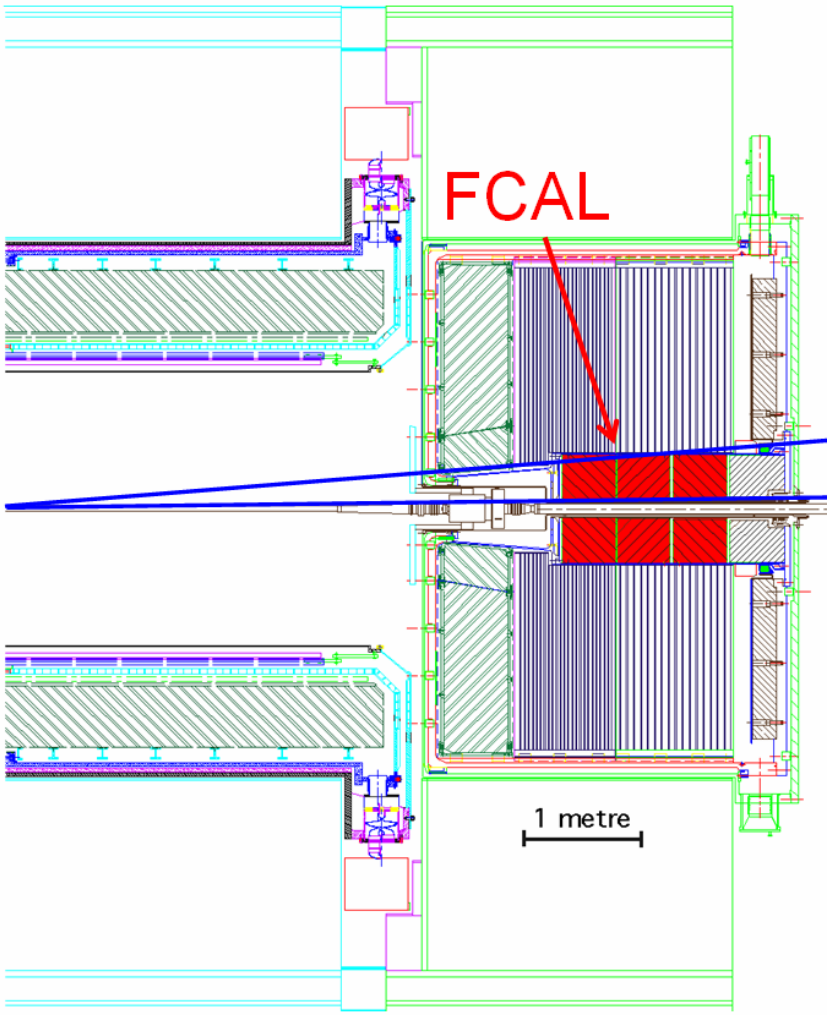
Some overlap!



(comments) L1 trigger : calorimeter gaps

- Trigger on dijets (E_T>20-30 GeV)
- ATLAS cannot do jet topology at L1
  - Only counting
- Forward E_T!
- FCAL : forward calorimeter;

  $3.2 < |\eta| < 4.9$

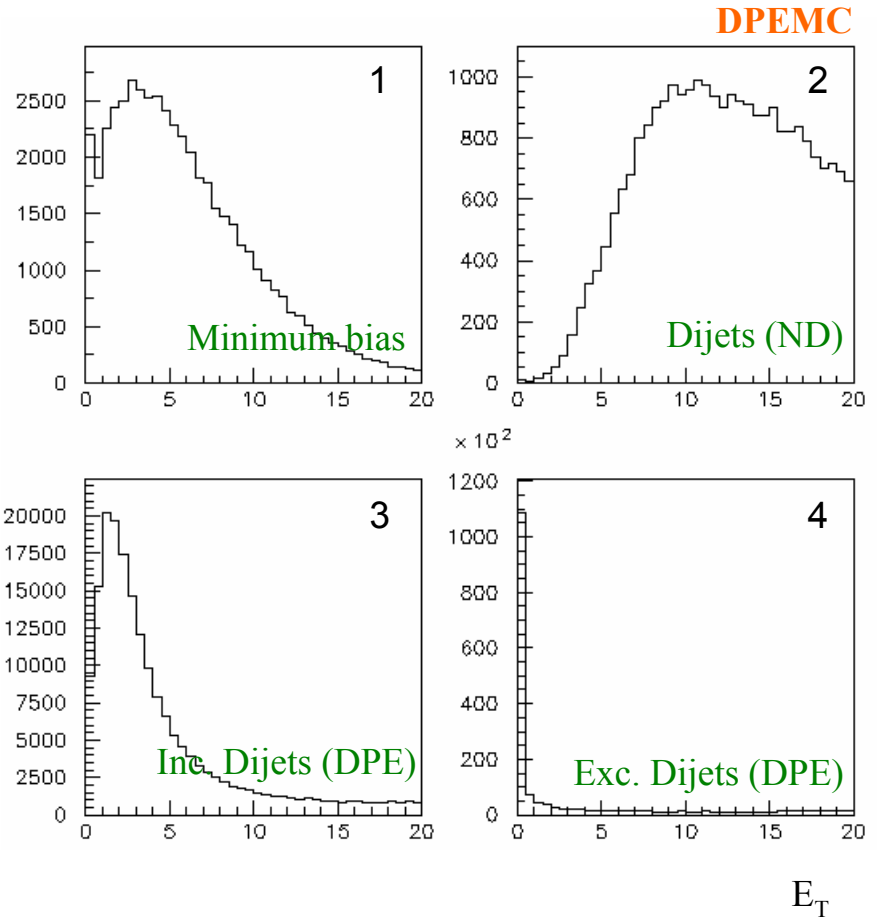


(comments) L1 trigger : calorimeter gaps

- First attempt: veto on total forward E_T
- I do not even consider calorimeter noise…

- Very low lumi : 4 vs 2
  → OK!

- Add 1 minimum bias event : (4+1) vs 2
  There is already ~no discrimination anymore…

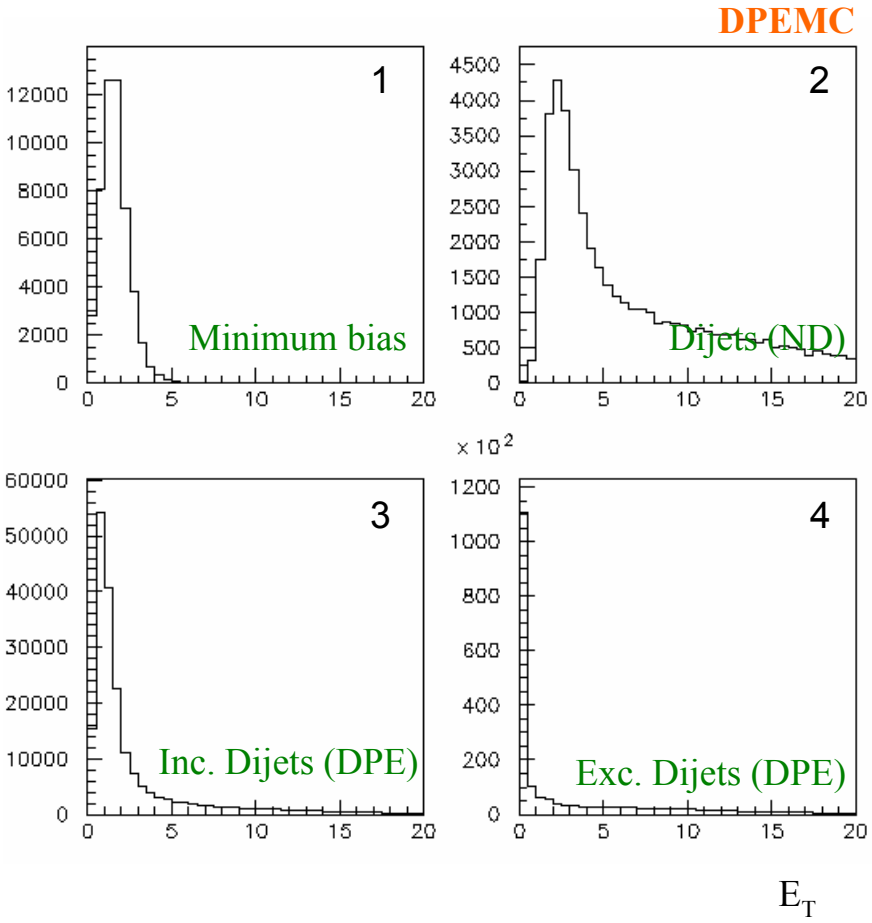


(comments) L1 trigger : calorimeter gaps

- Second attempt: veto on local E_T maximum (FCAL phi-wedge)
- Still no calorimeter noise…

- Very low lumi : 4 vs 2
  → OK!

- Add 1 minimum bias event : (4+1) vs 2
  Clear difference in the tail (resp. absence and presence of hard forwardradiation)
  But the discrimination is insufficient!



(comments) "Optimal luminosity"

- Maximize the probability to have:
  - 1 hard, interesting process per bunch-crossing (small cross-section)
  - 0 overlapping minimum bias events

  → **$P \propto \mathcal{L}.\exp(-\sigma_{mb}\mathcal{L}/f)$**
- σ_{mb} = 55 mb (inelastic)

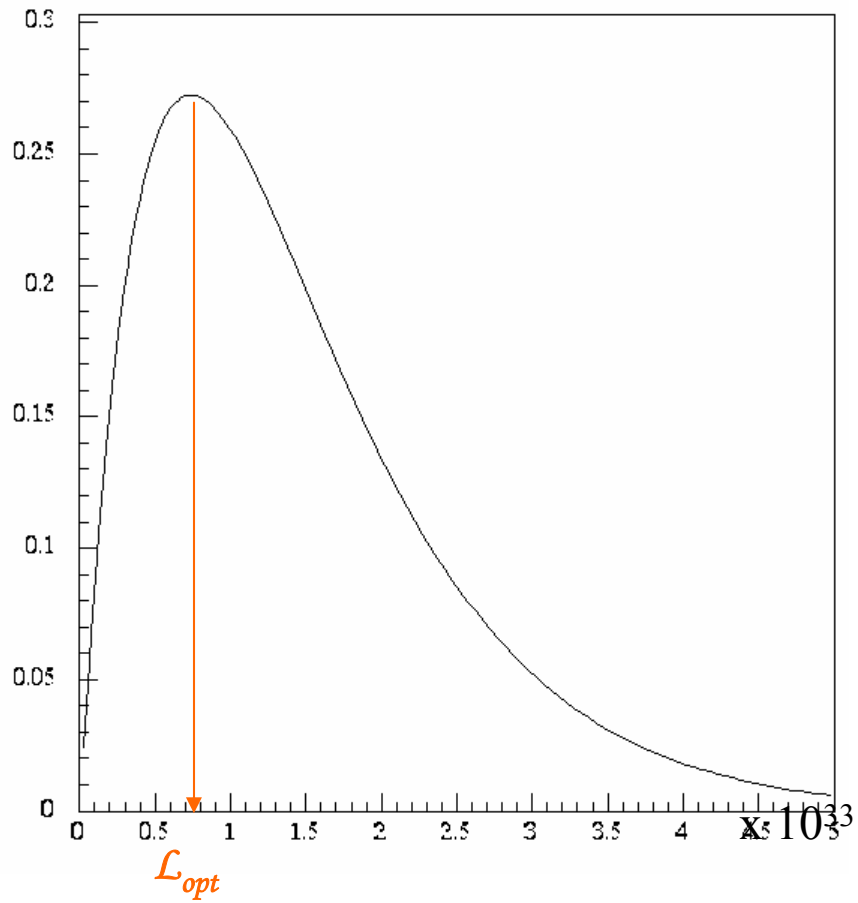
  f = 40 10^6 Hz (25 ns between b.c)

  → $\mathcal{L}_{opt}$ = 7.3 10^{32} /cm^2/s
- Nota bene :

  $\langle N_{mb} \rangle = \sigma_{mb}\mathcal{L}_{opt}/f = \mathbf{1}$

  and $P(0|1) = e^{-1} = \mathbf{0.37}$

- **So : if you need gaps, you lose a lot of time, and 2/3 of the signal**



A few more comments

- BL vs. KMR : coincide at mH~120 GeV, but looks like an accident!
  - m_H : 100 → 200 GeV
    KMR : σ → σ/10
    BL : σ → σ/2 (no Sudakov factor)
  - Tops and stops : factor 100 difference
  - Impact on robustness of physics prospects
  - Actually, KMR and BL look like two extremes. Truth somewhere in between?
- Exclusive vs. Inclusive : similar! Expt says the transition is rather smooth (probably). So would like a common theoretical framework

Conclusions

- DPEMC available:
  cern.ch/boonekam/dpemc.htm
  hep-ph/0312273, with T.Kucs, in print at CPC
  Update soon

- SM Higgs *s/b* : ~3 for ΔM=1 GeV
  ~1 for σ_M=1 GeV
  ~1/3 for σ_M=3 GeV
  Provided all inclusive background can be reduced
  Any Higgs *sensitivity* : Trigger!
  (most plots from hep-ph/0406061)

- Other prospects : tops, stops (BL ≠≠ KMR!!!)
  WW is QED, 50 fb, and certain