Existence of exclusive events?

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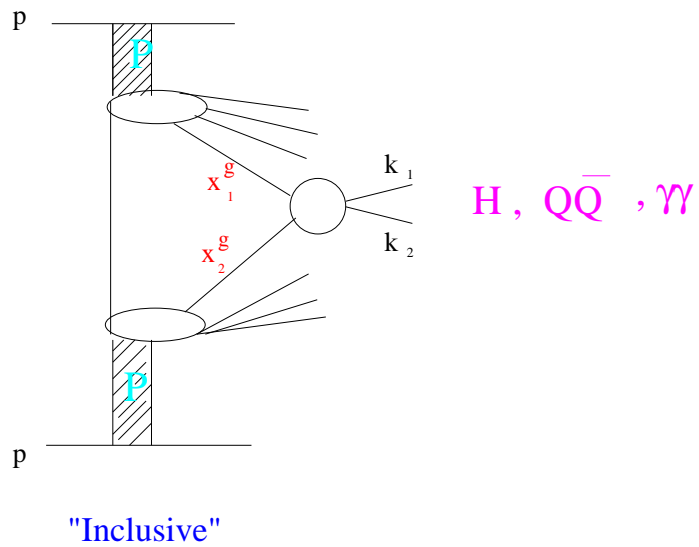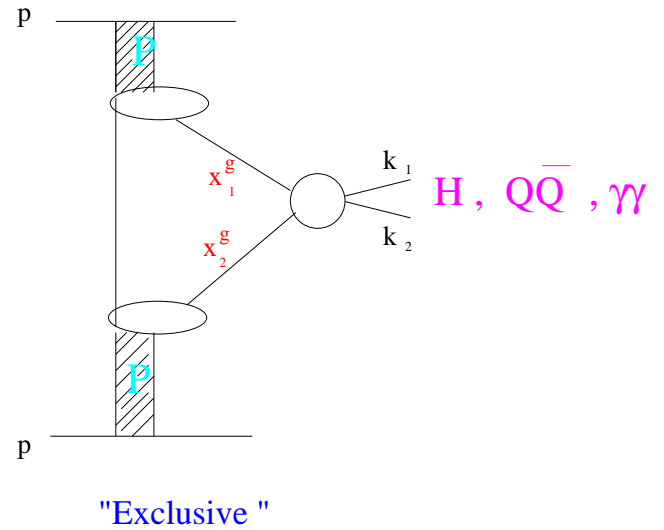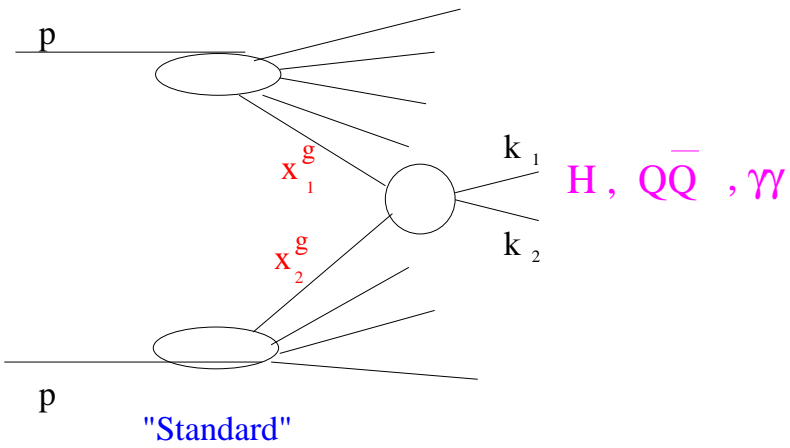
TeV4LHC Workshop, Brookhaven, February 2005

Work done in collaboration with R. Peschanski, M. Boonekamp, A. Kupco

Contents:

- Exclusive events

- Observation of exclusive events at the Tevatron?

- Exclusive Higgs production: S/B

"Exclusive models"

"Standard"

H, $Q\overline{Q}$, $\gamma\gamma$

"Exclusive "

H, $Q\overline{Q}$, $\gamma\gamma$
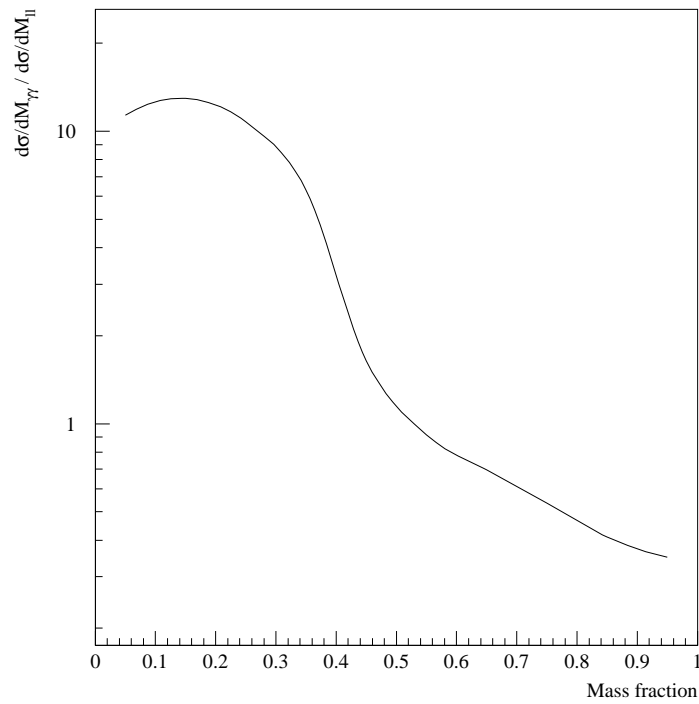

"Inclusive"

H, $Q\overline{Q}$, $\gamma\gamma$

All the energy is used to produce the Higgs (or the dijets), namely $xG \sim \delta$

Remarks on quasi-exclusive events

- Quasi-exclusive events: events for which the pomeron remnant energy is very small and cannot be measured experimentally (cannot be distinguished experimentally from pure exclusive events)

- Cross section: about the same as exclusive events ($xG > 0.95$), their existence is certain (tail of inclusive distributions but not well constrained yet)

- Quasi-exclusive b-jet background: to be added for exclusive background to exclusive signal, Can we apply the $J_z{=}0$ rule to those events?????

- Quasi-exclusive and exclusive events: How to measure them at the Tevatron

Existence of exclusive events

Test of the existence of exclusive events

Dilepton and diphoton cross section ratio as a function of the diphoton/dilepton mass: no dilepton event for exclusive models: change of slope of ratio if exclusive events exist
Other methods: ratio b-jets / all jets, compare $log(1/\xi)$ computed using roman pots and size or rapidity gap since the gap is larger for exclusive events
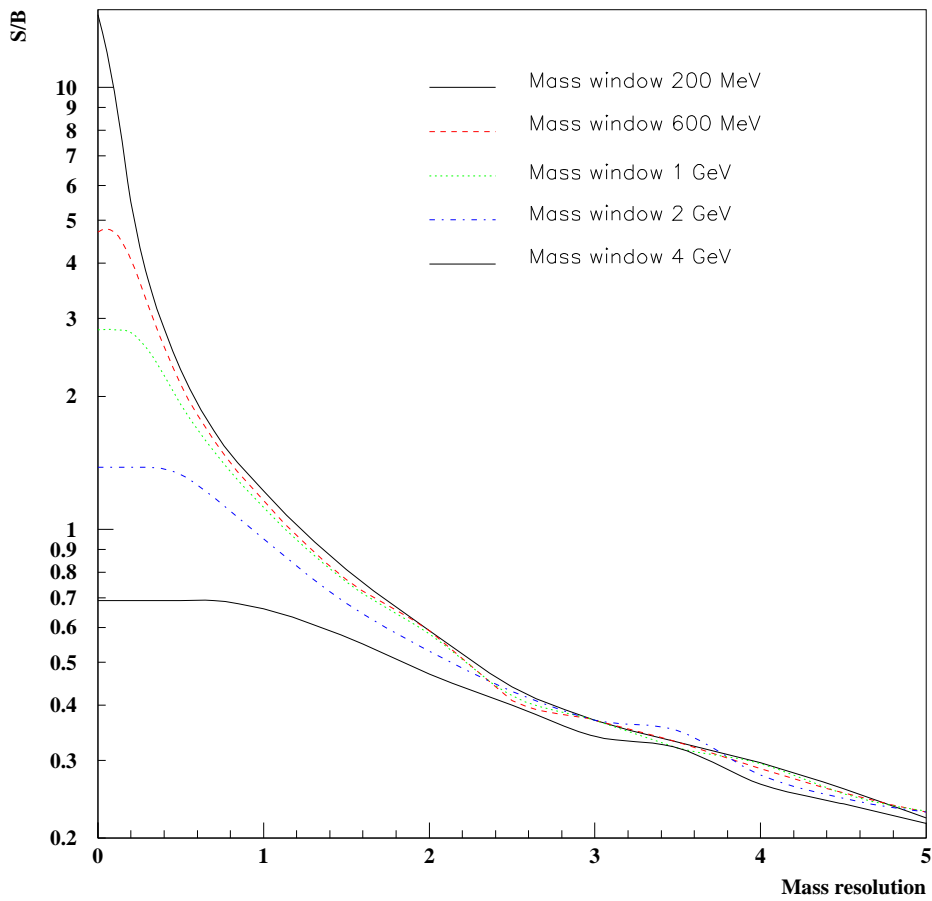
Existence of exclusive events

Correlation between size of rapidity gap and $log 1/\xi$ for inclusive and exclusive (or quasi-exclusive) events

gap eta % log (1/xi)
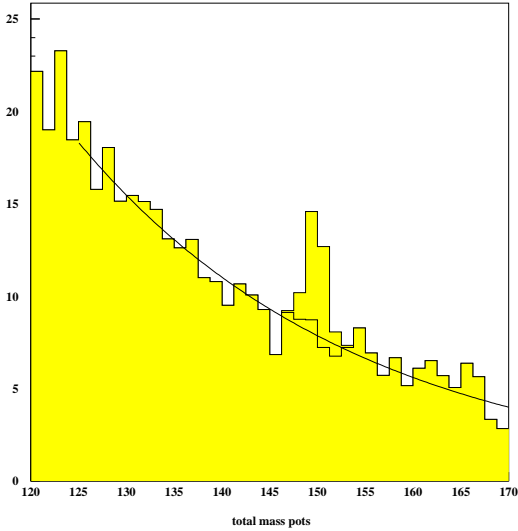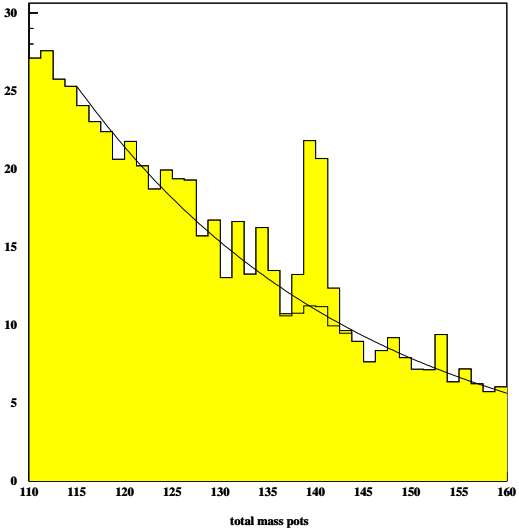
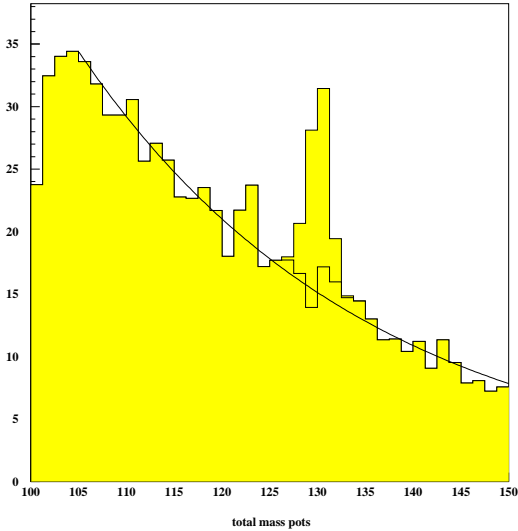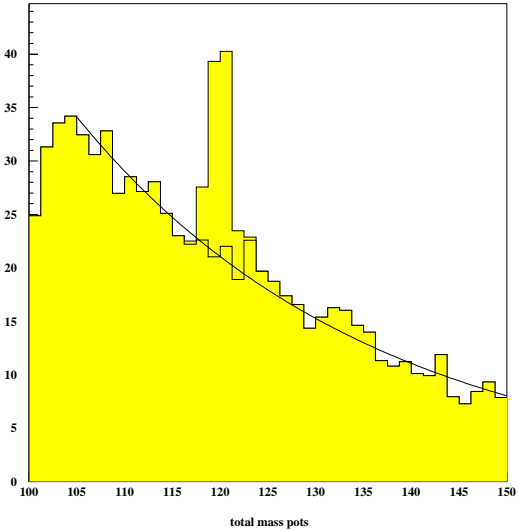gap eta % log (1/xi) excl.
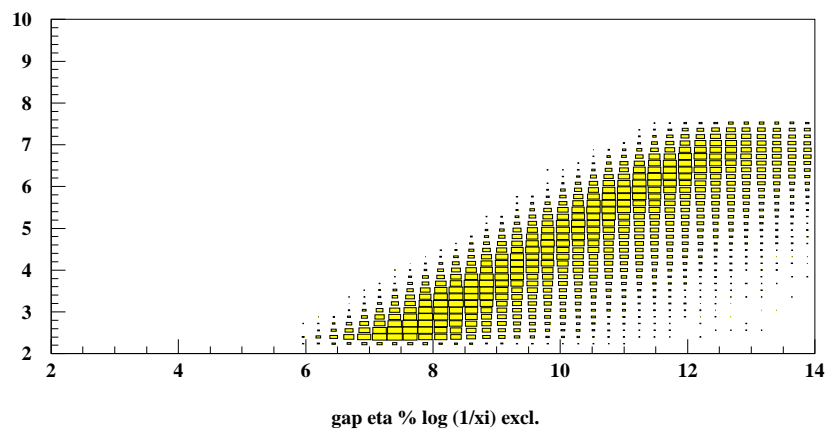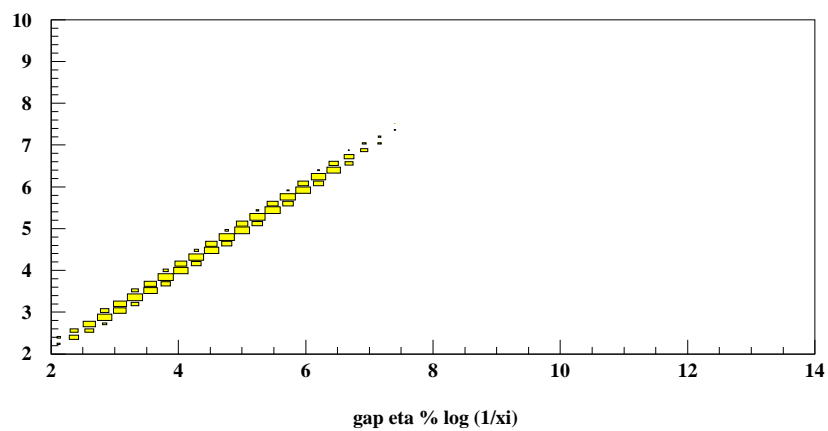
Signal over background

For a Higgs mass of 120 GeV and for different mass windows as a function of the Higgs mass resolution

Signal and background

Signal and background for different Higgs masses for 100 fb^{-1}

Signal over background

Signal over background for 1 mass window (2 GeV wide) for 100 fb^{-1} assuming a Higgs mass resolution of 1 GeV

M_{Higgs}	signal	background	S/B	σ
120	27.1	28.5	0.95	5.1
130	20.6	18.8	1.10	4.8
140	12.6	11.7	1.08	3.7
150	7.0	8.9	0.69	2.3

NB: numbers assuming pots at 200m and 420m, if only tags at 420 m, numbers have to be divided by about 50%

Conclusion

- Key issue: existence of pure exclusive events: Difficult to demonstrate, difficult to distinguish from pure exclusive events

- Experimental observables:
  - ratio of dilepton to diphoton cross section as a function of dijet mass (very clean but needs high lumi)
  - ratio of b-jet to inclusive jet cross sections
  - size of rapidity gapa vs $log 1/\xi$

  does not allow to distinguish between quasi-exclusive and exclusive events

- $J_z{=}0$ suppression rule? Valid for quasi-exclusive events for soft gluon emission?

- Background to diffractive Higgs: also consider quasi-exclusive background...