EW Quantum Numbers of BSM Particles at 100 TeV Collider

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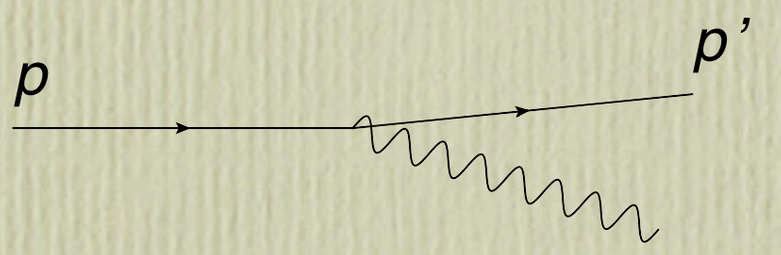
based on 1407.2607 (w/ A. Hook)

Basic Idea: EW Radiation

At the low energies EM is the only long-range, weakly coupled force.
Sudakov double-log enhancement of photon emission

$$d\sigma(p \to p' + \gamma) \approx d\sigma(p \to p') \times \frac{\alpha}{\pi} \log\left(-\frac{(p-p')^2}{\mu^2}\right) \log\left(-\frac{(p-p')^2}{m^2}\right)$$



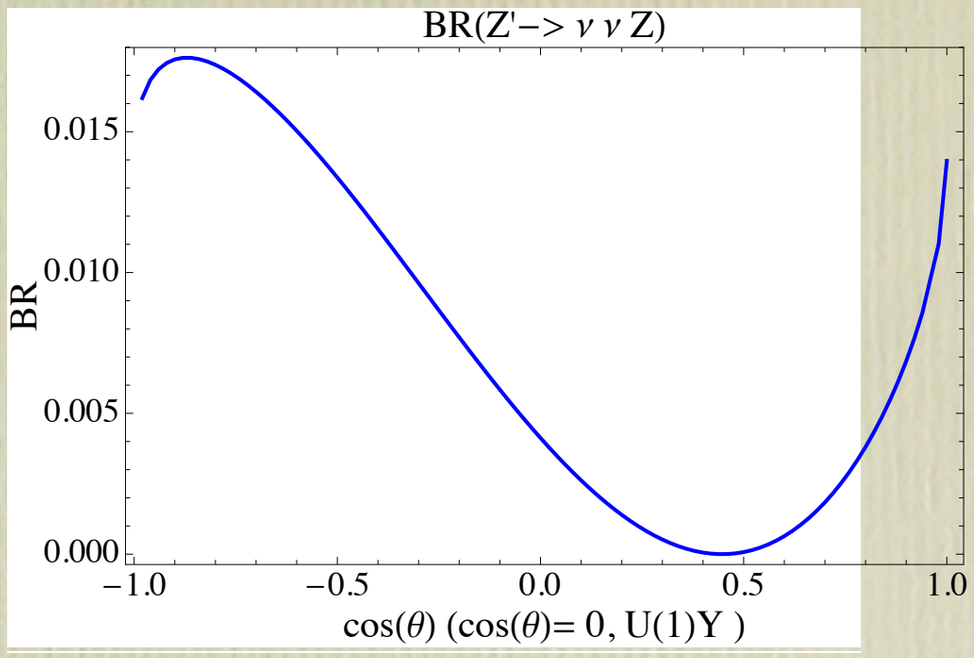
IR divergence
EW radiation -
cut by W/Z mass

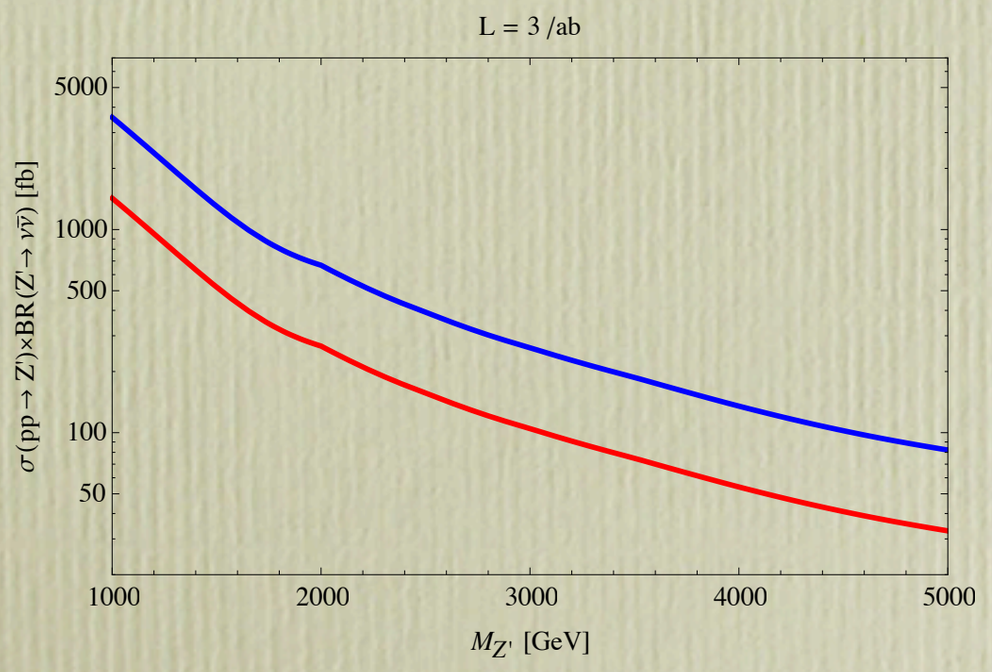
Colinear singularity
Cut by the mass of
the emitting particle

At energies >> EW symmetry breaking W and Z are effectively massless. Expect that very boosted particles radiate W's and Z's.

Example I: Z' invisible mode

Any new Z' is expected to be a linear combination of $U(1)_Y$ and $U(1)_{B-L}$. The size of this mode strongly depends on the mixing angle. Plot: $m_{Z'} = 5$ TeV.

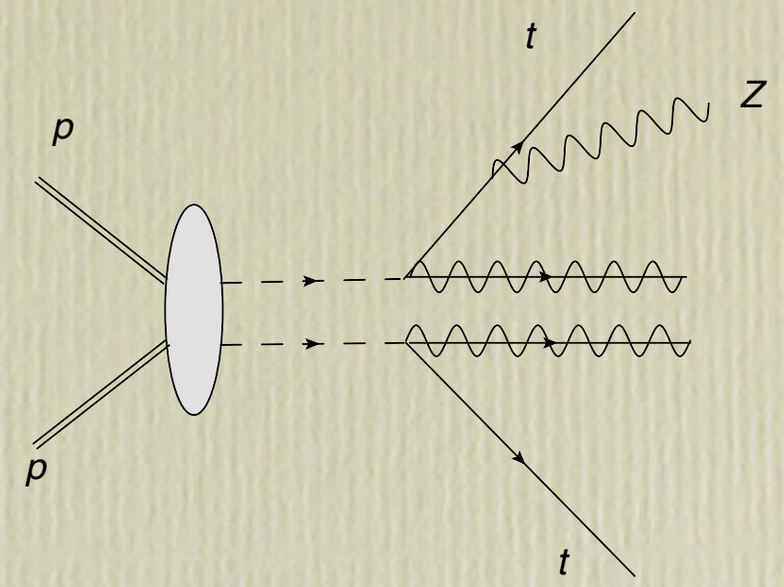




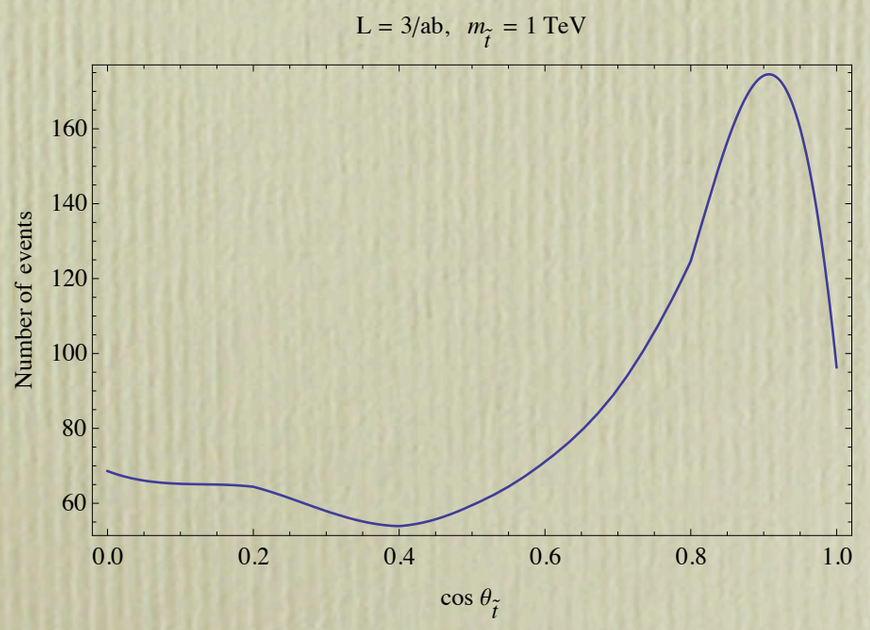
If we just measure the X-section of leptonic Z recoiling against MET, 100 TeV collider can have a very good reach

Example II: Stop Mixing Angle

Basic process:
boosted stops radiate Z's.
Take a look on Z_l and
semileptonic tops.



LH stops tend to radiate more EW bosons:

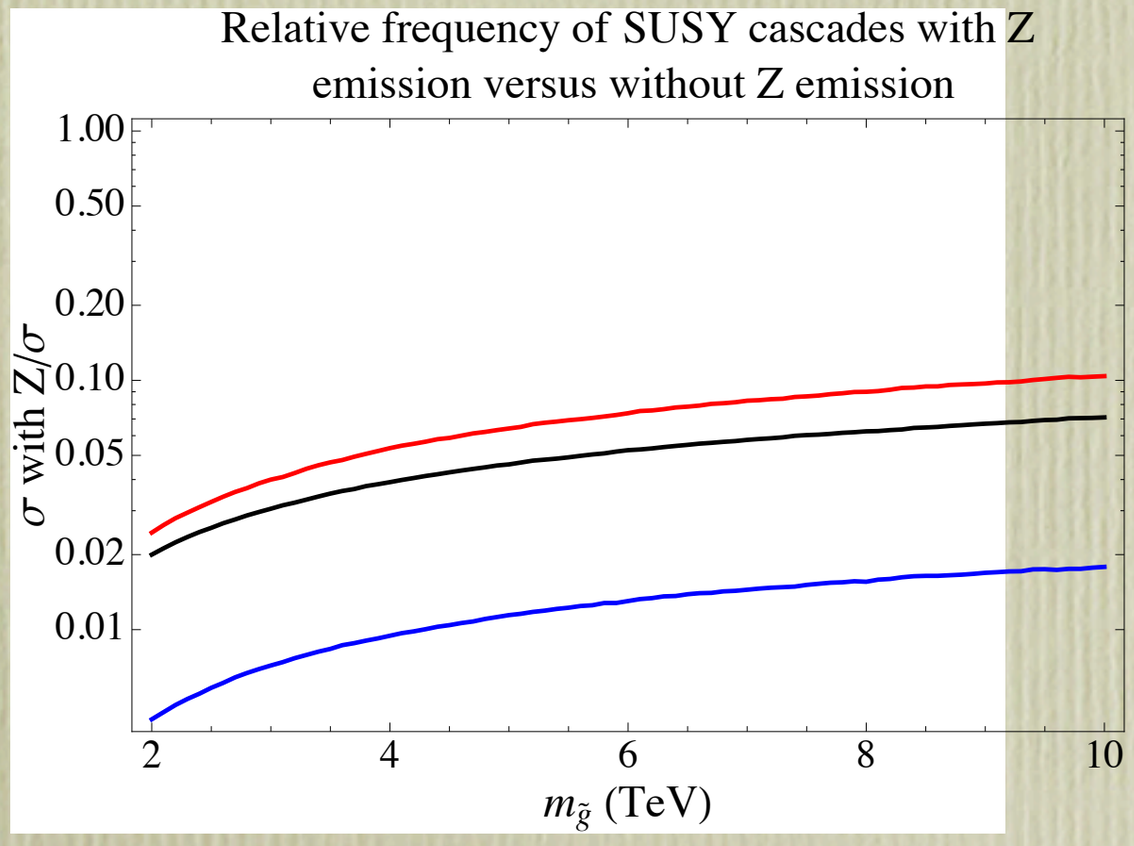


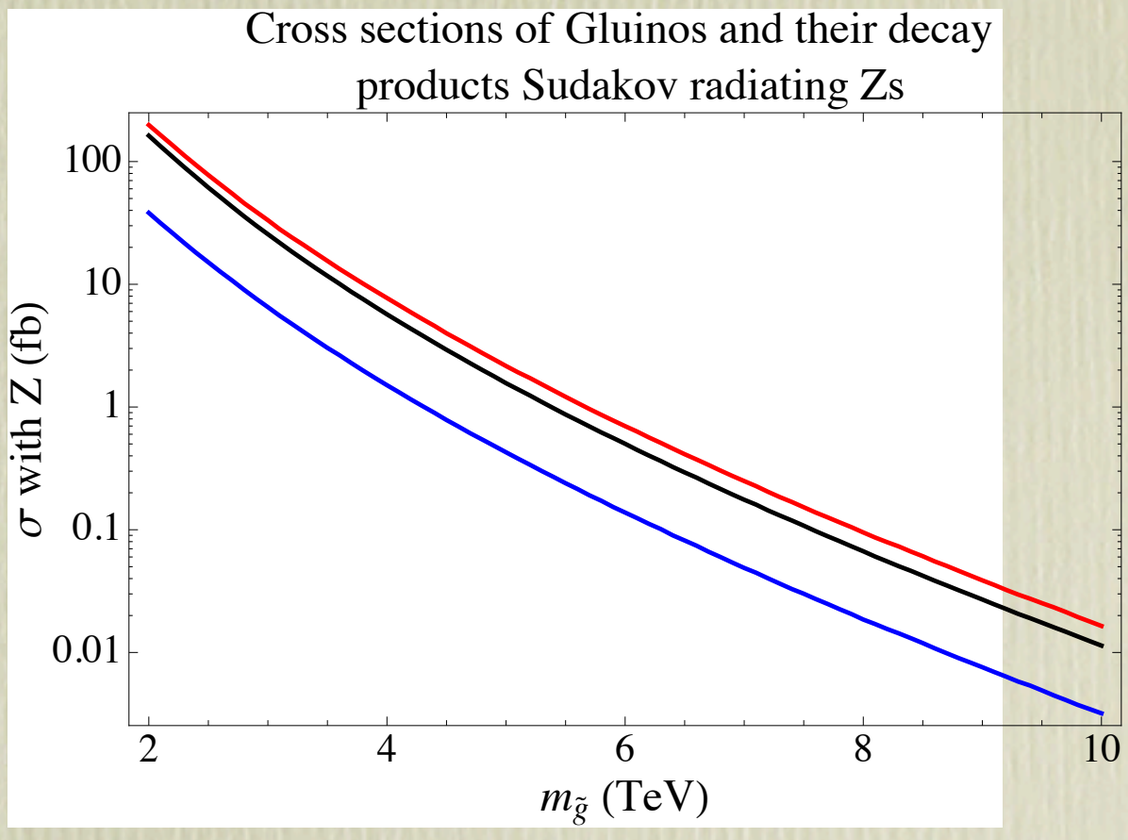
Number of semieptonic events with a leptonic Z.
Acceptance cuts have been applied.

Radiation pattern decays on mixing angle. All BRs have been taken into account.

Example III: SUSY LSP from

Assumption: mini-split motivated SUSY.
Most of the production is due to gluinos, which decay into the lightest neutralino (mostly) via off-shell 3rd generation scalars.





Blue/black/red lines correspond to singlet/dublet/triplet LSP's respectively.

More ideas?

- Quarks vs gluons jet tagging (at least at very high energies) based on EW radiation?
- Quark vs gluon in hadronic decays of heavy Z'?
- Measuring polarized PDFs?
- Top polarization?