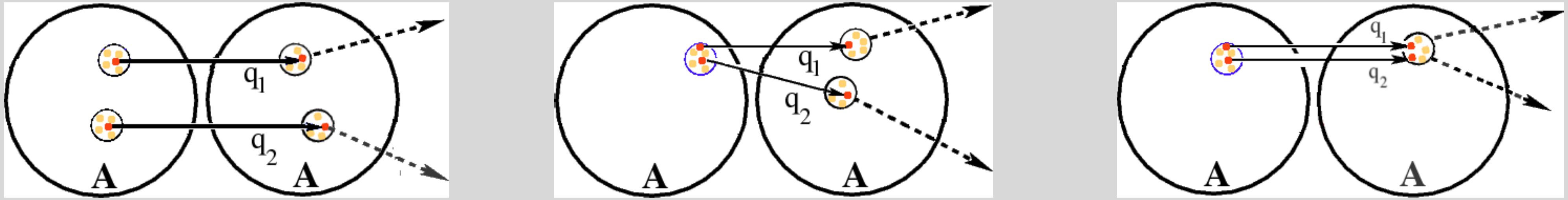
DOUBLE QUARKONIUM MONTE CARLO

Single Quarkonium

- In one nucleus nucleus collision, there is a chance that an Upsilon can be made.
  - At 200 GeV
  - pp inelastic cross section: 42 mb ~ prop. to probability of one nucleon-nucleon collision
  - Upsilon (1S+2S+3S) cross section (with BR into dielectron): ~100 pb
  - Ratio: 100 pb / 42 mb : ~ $2 \times 10^{-12} / 10^{-3} = 2 \times 10^{-9}$
  - Guesstimate at 5.02 TeV
    - pp inelastic cross section: ~70 mb (uncertainty ~ 5mb).
    - Upsilon (1S+2S+3S) cross section (BR into dimuons): ~ 1nb
    - Ratio: 1 nb / 70 mb : $1/7 \times 10^{-9} / 10^{-2} = 1.4 \times 10^{-8} = 14 \times 10^{-9}$
- Probability of finding one Upsilon in a single proton-proton collision.
- For A+A collisions, there are Ncoll proton-proton collisions, so the chances of finding one Upsilon are multiplied by Ncoll in one Nucleus-Nucleus collision

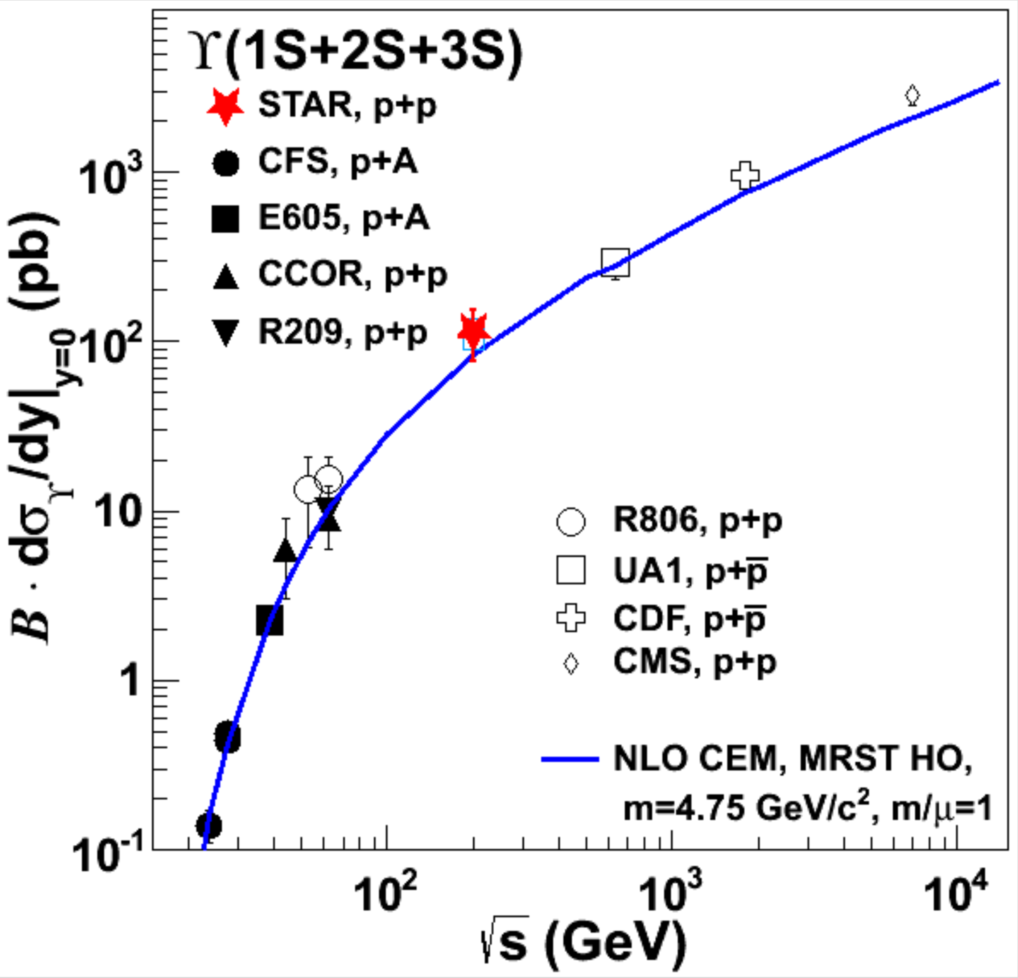
Double Quarkonium

- What are the chances of finding TWO Upsilons in the same Nucleus-Nucleus Collision?



- Given 100 M PbPb events, how many events with TWO Upsilons can we expect?

Upsilon Cross Sections



Leading order: Treat as Binomial Experiment

- Success: A binary collision produces an Upsilon. p= 2 x 10^{-9}
- Failure: A binary collision does not produce an Upsilon q=(1 – p).
- Number of trials: For a given Nucleus-Nucleus collision, the number of binary collisions, N_{coll}, is the number of trials.
- We want to calculate, for every possible N_{coll} value, P(x=0), P(x=1), and P(x=2), where
  - $P(X = x) = \binom{N_{coll}}{x} p^x (1-p)^{N_{coll}-x}$