Z’ at 100TeV: update

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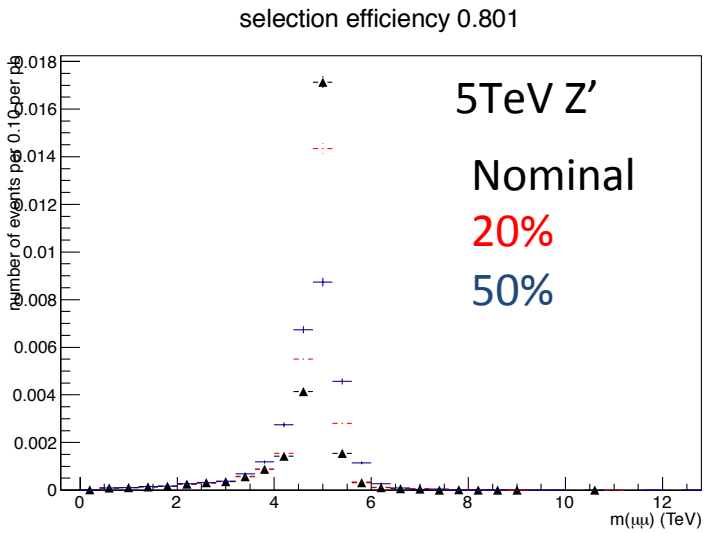
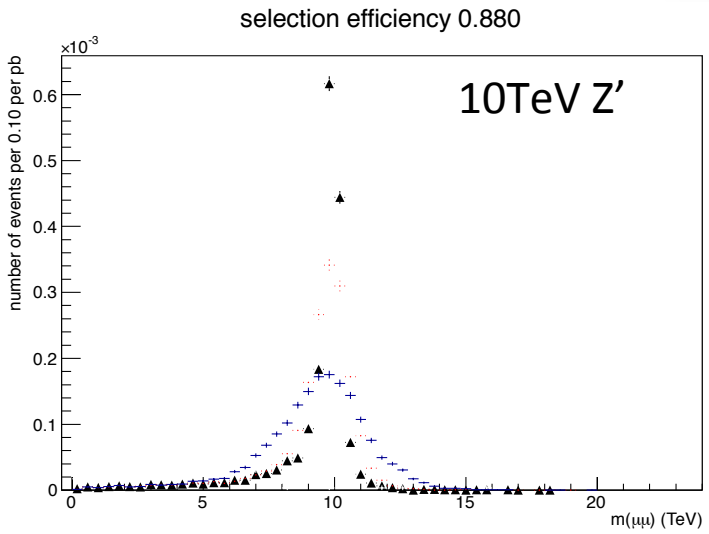
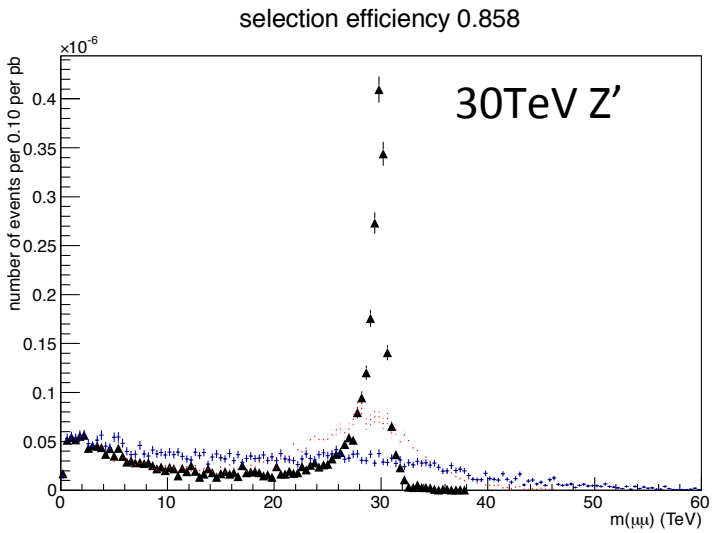
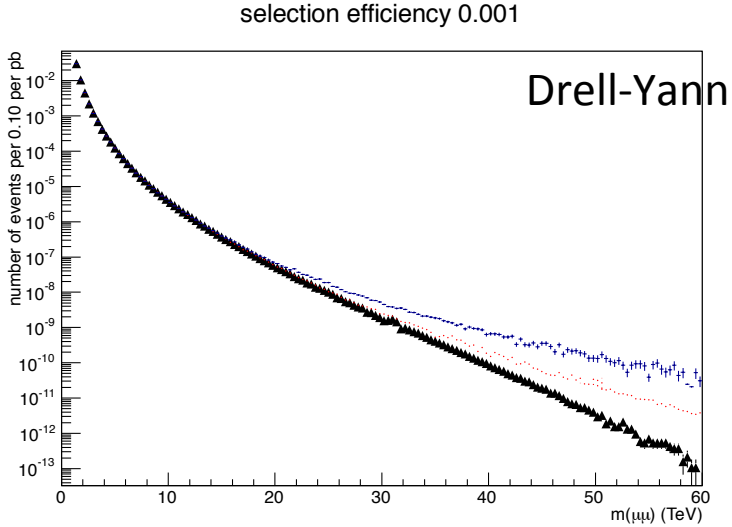
News

- Follow up since last talk:
  - https://indico.cern.ch/event/297201/contribution/2/material/slides/0.pdf
- Including resolution effect:
  - Muon resolution parameterized as: $\frac{\sigma(p)}{p} = \frac{\sigma_0}{p_T} \oplus \sigma_1 \oplus \sigma_2 p_T$
  - Eloss = σ_0
  - Multiple scattering = σ_1
  - Intrinsic resolution = σ_2 -> consider this one only
- X% at 10TeV means σ_2 = X/10 (in TeV) with X=[0.1,0.2,0.3,0.4,0.5]
- Define p_T(smear) = p_T*(1+*p_T*σ_2Gaus(0,1))


selection efficiency 0.801
5TeV Z'
Nominal
20%
50%
number of events per 0.10 per pb
m(μμ) (TeV)


selection efficiency 0.880
10TeV Z'
number of events per 0.10 per pb
m(μμ) (TeV)

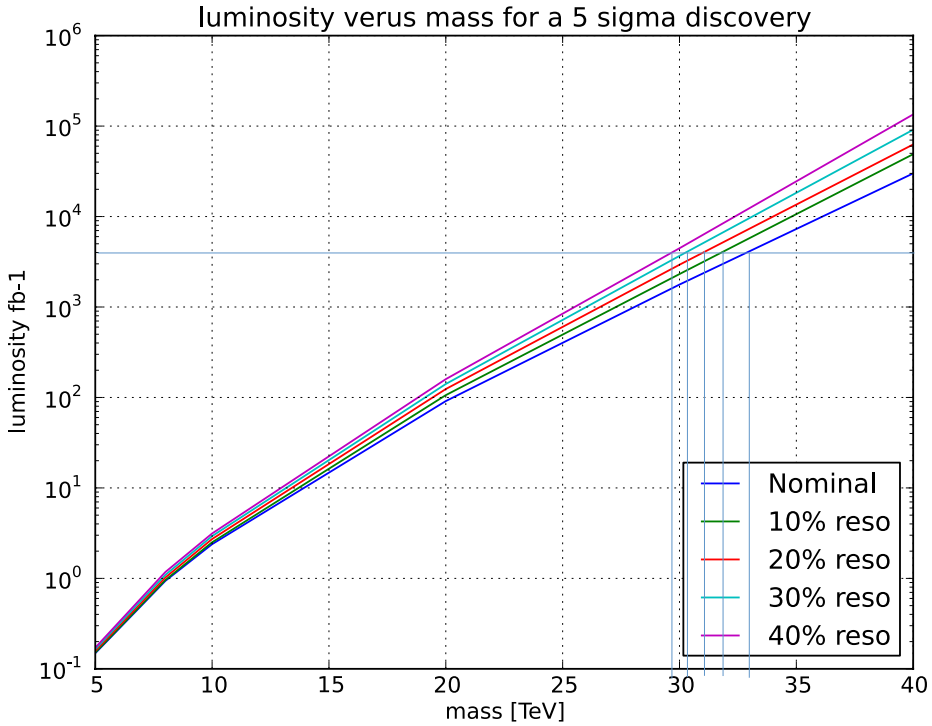

selection efficiency 0.858
30TeV Z'
number of events per 0.10 per pb
m(μμ) (TeV)


selection efficiency 0.001
Drell-Yann
number of events per 0.10 per pb
m(μμ) (TeV)

Sensitivity

Luminosity (fb^{-1}) to discover at 5sigma

	5TeV	8TeV	10TeV	20TeV	30TeV	40TeV
Nominal	0.15	0.93	2.39	91.2	1770	29983
10%	0.15	0.96	2.51	106.1	2312	48914
20%	0.16	1.02	2.72	123.9	2932	62653
30%	0.16	1.09	2.93	140.9	3674	91116
40%	0.17	1.18	3.14	159.4	4462	134534



Conclusion

- For a 20TeV Z' where muons have peaks at p_T of 10TeV, the increase in luminosity needed to discover at 5sigma is:
  - 10% resolution -> 1.16 times more luminosity than nominal
  - 20% resolution -> 1.36 times more luminosity than nominal
  - 30% resolution -> 1.55 times more luminosity than nominal
  - 40% resolution -> 1.75 times more luminosity than nominal
- For $3ab^{-1}$ the discovery reach from 33TeV to 29.5 from nominal to 40% resolution at 10TeV:
- So it is indeed not well motivated to aim at 10% resolution at 10TeV only in terms of high di-muon narrow resonance discovery potential