W mass direct measurement via Single-W process

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—> Updates and current status of my study

Currently working on

- Check Z control samples to estimate N of available Zs to estimate jet energy scale uncertainty
  - some generator level analyses
    - acceptance, selection efficiency, etc.
      - ee —> ZZ
      - ee —> γZ
      - ee —> ννZ
      - ee —> eeZ

Cross sections

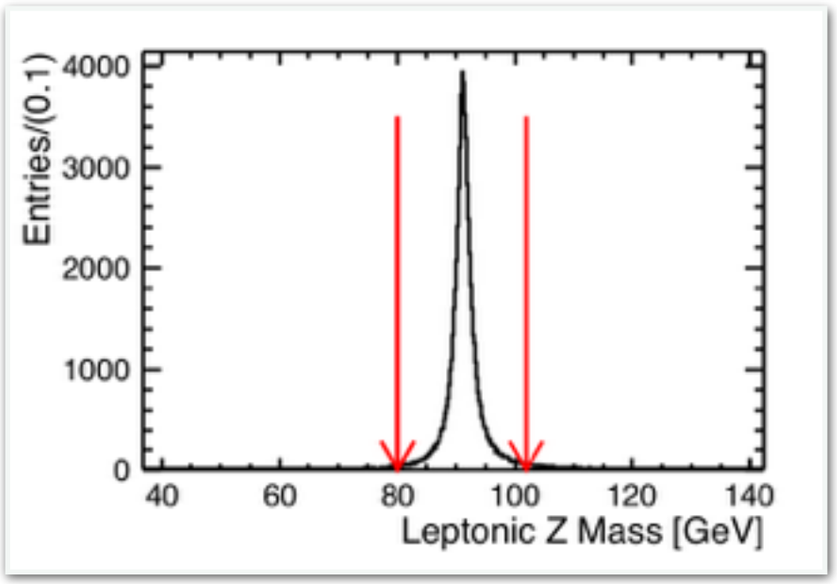
no beamstruhlung, no ISR

x-sec/fb	P(e⁻, e⁺)	(−1, −1)	(−1, +1)	(+1, +1)	(+1, −1)
250GeV	ZZ	2856	–	1171	–
	γZ	26322	–	16853	–
	νν̄Z	146.7	–	–	–
	eeZ	5170	4411	3728	4411
500GeV	ZZ	1323	–	543.5	–
	γZ	7394	–	4734	–
	νν̄Z	1036	–	–	–
	eeZ	8478	8018	6126	8018

all Z decay modes are included

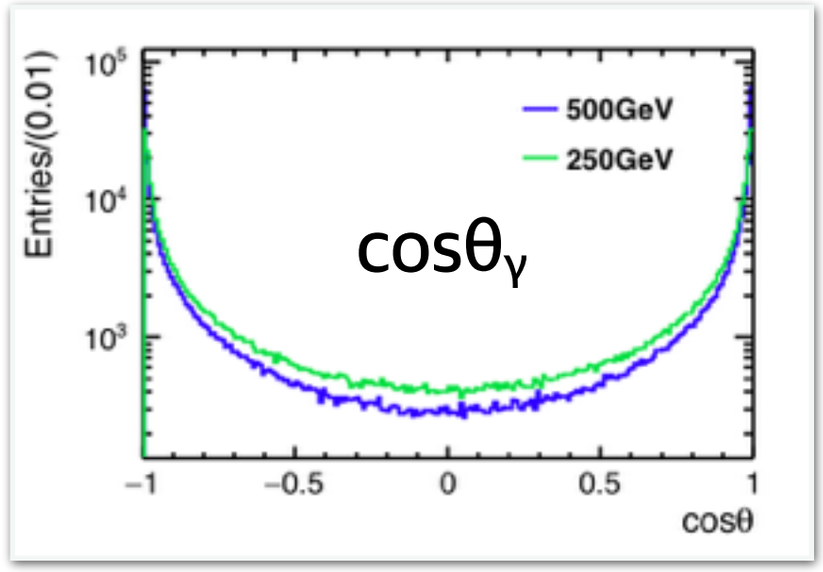
ZZ process

- control Z samples in ZZ are tagged by Z —> ee or μμ
  - ZZ —> llqq (semileptonic mode, ~9% of all)
  - considering isolated lepton tag efficiency (~0.7/lepton)
  - require that the reconstructed leptonic mass must be around Z mass ($80 < M_{ee/\mu\mu} < 102$ [GeV])

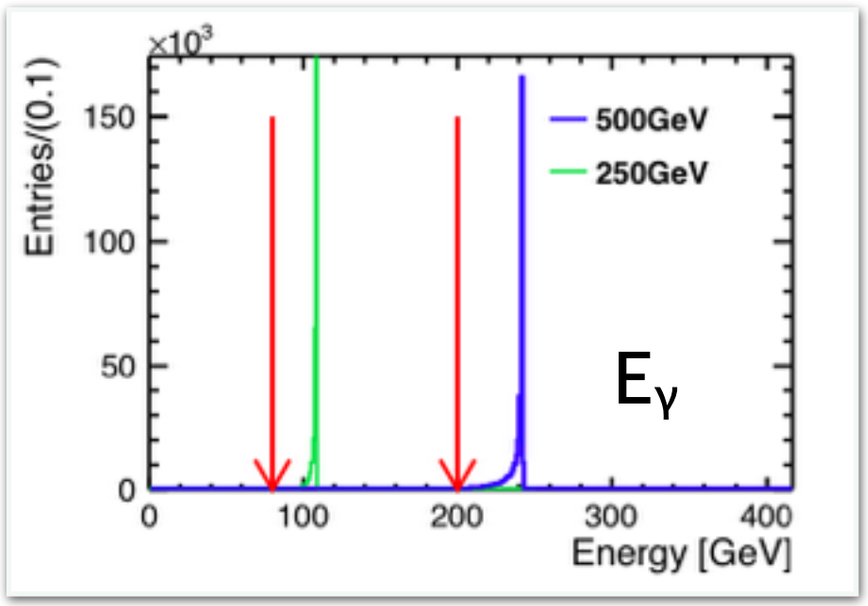


E_{CM}	$P(e^-, e^+)$	all	tagged	efficiency
250GeV	(−1, +1)	298132	12942	4.34%
	(+1, −1)	298031	12775	4.29%
500GeV	(−1, +1)	296288	12328	4.16%
	(+1, −1)	296387	12366	4.17%

γZ process



- tag special γ
  - Z —> hadrons (69.91%)
  - detector acceptance assumed, $|\cos\theta_\gamma| < 0.99$
  - find energetic γ and cut others(ISR photons)

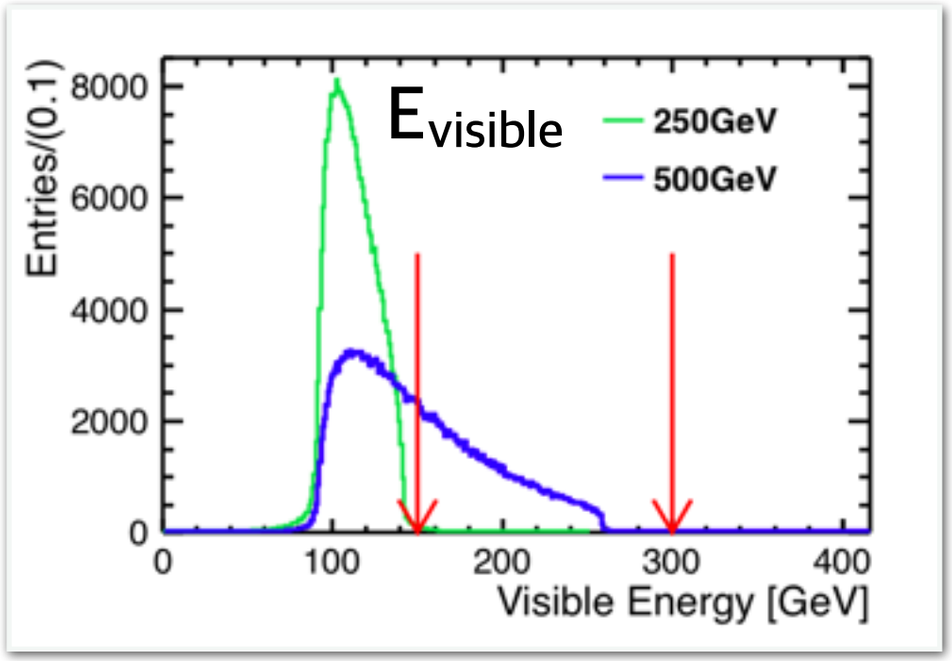


cut out if $E_\gamma < 80$ @ 250GeV
$E_\gamma < 200$ @ 500GeV

E_{CM}	$P(e^-, e^+)$	all	accepted	efficiency
250GeV	(−1, +1)	361029	203626	56.4%
	(+1, −1)	361029	203626	56.4%
500GeV	(−1, +1)	360947	156811	43.4%
	(+1, −1)	360947	156811	43.4%

vvZ process

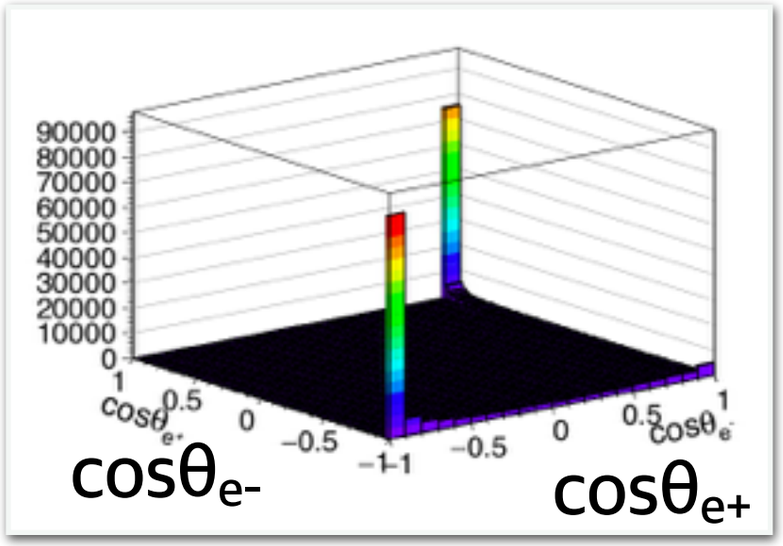
cut out if $E_{visible} > 150$ @ 250GeV
$E_{visible} > 300$ @ 500GeV



- if any ideas . . .
  - Z —> hadrons (69.91%)
  - simply require large missing energy due to 2 neutrinos

E_{CM}	$P(e^-, e^+)$	all	tagged	efficiency
250GeV	(−1, +1)	292624	203453	69.5%
500GeV	(−1, +1)	291583	203500	69.8%

eeZ process



- try to tag 2 electrons
  - Z —> hadrons (69.91%)
  - detector acceptance assumed, $|\cos\theta_{e^-,e^+}| < 0.99$
  - consider isolated lepton tag efficiency (~0.7/lepton)

E_{CM}	$P(e^-, e^+)$	all	accepted	efficiency
250GeV	(−1, +1)	293244	3605	1.23%
	(−1, −1)	292411	2897	0.99%
	(+1, −1)	293225	3441	1.17%
	(+1, +1)	293813	2998	1.02%
500GeV	(−1, +1)	292309	2447	0.84%
	(−1, −1)	292002	1572	0.54%
	(+1, −1)	292959	2225	0.76%
	(+1, +1)	293475	1604	0.55%

Available number of control samples

E_{CM}	Process	N/fb at P(−0.8,+0.3)	Effective N at 500fb^{-1}
250GeV	ZZ	1711.8	366358
	γZ	15988.3	4508701
	νν̄Z	85.8	29816
	eeZ	4831.2	25742
500GeV	ZZ	793.0	164954
	γZ	4491.2	974590
	νν̄Z	606.1	211529
	eeZ	8220.9	29898

Summary

- some Z production processes have high cross sections
- the number of available control Z samples shall reach to a few Mega at P(−0.8,+0.3), 500fb^{-1}
    - ~4.9M at 250GeV
    - ~1.4M at 500GeV
- ee—>γZ process is the most important due to its large cross sections and acceptance
- ee—>eeZ process has large cross section also, but effective number of available control samples in this process is not too much mainly due to its detector acceptance
- for the next; estimate jet energy scale uncertainty