Threshold scan

- The uncertainties of m_{top}, α_s can be extracted from the dependence of production cross section on beam energy.
- Determining from a 2D maximum-likelihood fit(or chi2 fit) to top pair cross section MC simulation .

- Expected #events
  - $N = (\varepsilon * B * \sigma_{signal} + \sigma_{bkg}) * \text{lumi}$
  - ε : total efficiency = acceptance * select efficiency
  - B : branch ratio of $t\bar{t} \to WbWb \to qqbqqb(46\%)\ or\ t\bar{t} \to WbWb \to qqblvb(30\%)$
  - $\sigma_{signal} = \mathrm{f}(\mathrm{m_{top}}, \alpha_s, E_{cms})$: signal cross section. Patten of analytical relation?
  - σ_{bkg}: bkg(QCD process of diboson or triboson) cross section

type	final state	σ 500 GeV	σ 352 GeV
Signal (m_{top} = 174 GeV)	$t\bar{t}$	530 fb	450 fb
Background	WW	7.1 pb	11.5 pb
Background	ZZ	410 fb	865 fb
Background	$q\bar{q}$	2.6 pb	25.2 pb
Background	WWZ	40 fb	10 fb

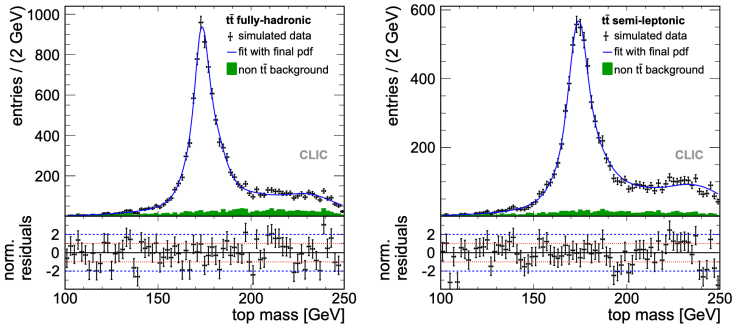
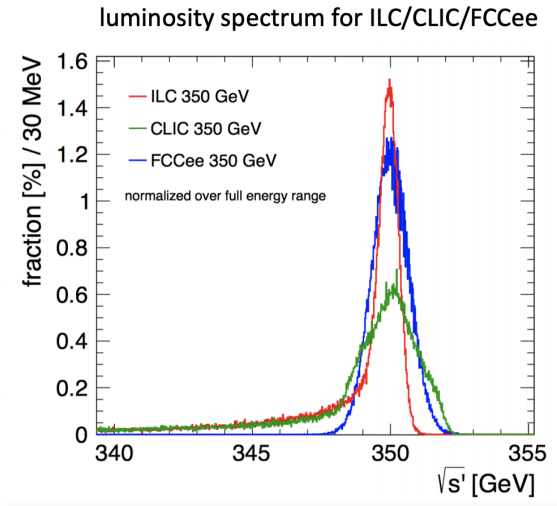


Fig. 3 Distribution of reconstructed top mass for events classified as fully-hadronic (left) and semi-leptonic (right). The data points include signal and background for an integrated luminosity of 100 fb^{-1}. The pure background contribution contained in the global distribution is shown by the green solid histogram. The top mass is determined with an unbinned likelihood fit of this distribution, which is shown by the solid line.

Top mass

Polarized beam

	CLIC	ILC	CEPC
$\sqrt{s}$[GeV]	380	500	350
Luminosity $10^{34}cm^{-2}s^{-1}$	1.5	2[peak]	0.38?
Integrated lumi fb-1	100	100	200~400 [2 year?]
Energy spread %	0.35	0.15	0.15?
Energy measurement		10-4	10-4, 5*10-5
Expected m_{top} resolution MeV	50MeV	50MeV	Aim for 15MeV?



Extract short-distance mass with rigorous interpretation and competitive precision:

CLIC380 (1/ab): 50 MeV (theory), 110 MeV total

ILC500 (4/ab): 50 MeV (theory), 150 MeV total

IAS

- Reference
  - https://arxiv.org/pdf/1812.07987.pdf
  - https://indico.ihep.ac.cn/event/11160/contribution/0/material/slides/0.pdf
  - https://arxiv.org/pdf/1306.6329.pdf

Table 2: Key parameters of the CLIC energy stages.

Parameter	Symbol	Unit	Stage 1	Stage 2	Stage 3
Centre-of-mass energy	$\sqrt{s}$	GeV	380	1500	3000
Repetition frequency	f_{rep}	Hz	50	50	50
Number of bunches per train	n_{b}		352	312	312
Bunch separation	Δt	ns	0.5	0.5	0.5
Pulse length	τ_{RF}	ns	244	244	244
Accelerating gradient	G	MV/m	72	72/100	72/100
Total luminosity	$\mathscr{L}$	$10^{34}\,\text{cm}^{-2}\,\text{s}^{-1}$	1.5	3.7	5.9
Luminosity above 99% of $\sqrt{s}$	$\mathscr{L}_{0.01}$	$10^{34}\,\text{cm}^{-2}\,\text{s}^{-1}$	0.9	1.4	2
Total integrated luminosity per year	$\mathscr{L}_{\text{int}}$	fb^{-1}	180	444	708
Main linac tunnel length		km	11.4	29.0	50.1
Number of particles per bunch	N	10^9	5.2	3.7	3.7
Bunch length	σ_z	μm	70	44	44
IP beam size	σ_x/σ_y	nm	149/2.9	$\sim$ 60/1.5	$\sim$ 40/1
Normalised emittance (end of linac)	$\varepsilon_x/\varepsilon_y$	nm	900/20	660/20	660/20
Final RMS energy spread		%	0.35	0.35	0.35
Crossing angle (at IP)		mrad	16.5	20	20