1. Please refer to the experimental precisions as stated in the TLEP paper
and future upgrades.

2. these are goals that everyone should strive to achieve.

3. If you dont believe them, please protest (butplease use them until we all agree to change)

4. the whole lot of precise measurements is essential
-- however some combinations of measurements can be useful to eliminate certain uncertainties.
e.g. the relationship between m_Z and the $Z \rightarrow$ ee partial width
m_W and $\sin^2\theta_W^{eff}$
contain no uncertainties related to $\Delta\alpha_{QED}$ and α_s

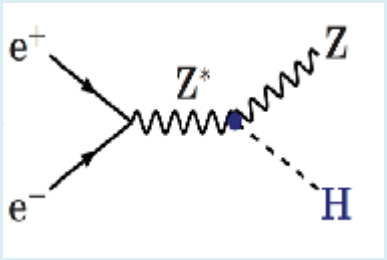
-- No just S & T!

FCC-ee as Higgs factory

<10^{-3} cross-section meast

(constrained fit including 'exotic')

	4 IPs TLEP (2 IPs)	
g_{HZZ}	0.05%	(0.06%)
g_{HWW}	0.09%	(0.11%)
g_{Hbb}	0.19%	(0.23%)
g_{Hcc}	0.68%	(0.84%)
g_{Hgg}	0.79%	(0.97%)
$g_{H\tau\tau}$	0.49%	(0.60%)
$g_{H\mu\mu}$	6.2%	(7.6%)
$g_{H\gamma\gamma}$	1.4%	(1.7%)
BR_{exo}	0.16%	(0.20%)



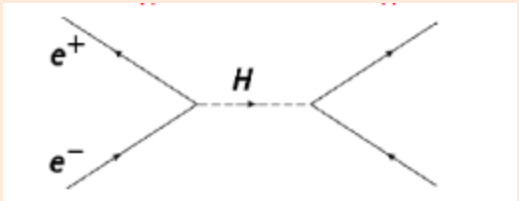
2 10^6 ZH events in 5 years

«A tagged Higgs beam».

sensitive to new physics in loops

incl. invisible = (dark matter?)
NB leptonic tag only.
Will improve with Hadronic Z tag

A big challenge, but unique:
Higgs s-channel production at $\sqrt{s} = m_H$



10^4 events per year. limits or signal?
monochromators?
Aleksan, D'Enterria, Woijcik
e+e- → H+γ will be background.

→ *total width* <1%

HHH (best at FCC-hh) 28% → from HZ thresh

H*tt* (best at FCC-hh) 13% → from tt thresh

Best-of ee-FCC/TLEP #2: Precision EW measts

Assets: -- high luminosity ($10^{12/13}$ Z decays + 10^8 WW + 10^6 top pairs)

-- exquiste energy calibration up to WW threshold

target FCC-ee precisions

Quantity	Present precision	Measured from	Statistical uncertainty	Systematic uncertainty
m_Z (keV)	91187500 ± 2100	Z Line shape scan	5 (6) keV	< 100 keV
Γ_Z (keV)	2495200 ± 2300	Z Line shape scan	8 (10) keV	< 100 keV
R_ℓ	20.767 ± 0.025	Z Peak	0.00010 (12)	< 0.001
N_ν	2.984 ± 0.008	Z Peak	0.00008 (10)	< 0.004
N_ν	2.92 ± 0.05	$Z\gamma$, 161 GeV	0.0010 (12)	< 0.001
R_b	0.21629 ± 0.00066	Z Peak	0.000003 (4)	< 0.000060
A_{LR}	0.1514 ± 0.0022	Z peak, polarized	0.000015 (18)	< 0.000015
m_W (MeV)	80385 ± 15	WW threshold scan	0.3 (0.4)MeV	< 0.5 MeV
m_{top} (MeV)	173200 ± 900	$t\bar{t}$ threshold scan	10 (12) MeV	< 10 MeV

Also -- $\Delta\sin^2\theta_W$ eff $\approx 510^{-6}$ from $A_{FB}^{\mu\mu}$ at the Z pole.
-- $\Delta\alpha_S$= 0.0001 from W and Z hadronic widths
-- $\Delta\alpha_{QED}(Mz)$= 0.00002 from Z line shape extended scan
-- precision top couplings from running at 350-365 GeV
-- orders of magnitude on FCNCs and rare decays etc. etc.

Design study to establish possibility of corresponding precision theoretical calculations.

Study of Precision theoretical calculations are integral part of the Design Study

Final report in 2018 should include a statement on

➔ achievable precisions from experiment

➔ this sets the required precision on theoretical calculations and Monte-Carlos

➔ State the **feasibility** (or limitation) of precision calculations and requested Monte Carlos.

➔ provide an estimate of **required manpower** to achieve the goal

➔ also define a set of additional experimental input that would be needed

Overall time scale :

2018/19 Next update of European Strategy.

2019/2020 possible decision for FCC

-- start construction (about 10 years)

Typical start date assumed for FCC-ee is **~2035** (with error bar)

(cannot be much earlier than end of HL-LHC

A somewhat earlier starting date could be assumed for CEPC)

HOW ABOUT A H2020 ITN?

My favorite quote:

Theorists should not be blamed for limiting the experimental uncertainties