

# Precision bounds on composite Higgs models at the FCC-ee

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- In composite models, the Higgs boson is a bound state of a new strong force with confinement scale  $\sim 1\text{TeV}$ .
- The CHM provides an interesting phenomenology that could be tested at future colliders.

! The FCC-ee will be a goldmine to study the TeraZ phase with around  $10^{12}$  visible Z bosons.

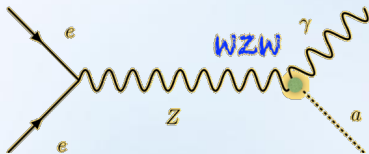
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! The Electroweak precision tests (EWPTs) could shed some light in the nature of the new particles either composite models or elementary models (Work done).



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- 1 Extension of the SM by adding a complex scalar field (cxSM).
- 2 Connect the new particles with the electroweak (EWK) sector by analyzing the decays with the Partial Widths (PWs).
- 3 Looking for signs of new physics in the EWPTs (oblique parameters) in the cxSM for the FCC-ee.

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- 3 The third scenario provides non-zero PWs but depends on the VLFs hypercharges.

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! The  $cxSM$  provides two mixed states that can contribute to  $S$  and  $T$ .

! The VLF does not contribute to the oblique parameters but the mixed states do, therefore,

$$T_{\text{el}} = \frac{3}{8 \cos^2 \theta_W} (1 - \cos^2 \theta) \log \frac{m_{H_2}}{m_{H_1}};$$

$$S_{\text{el}} = \frac{1}{6} (1 - \cos^2 \theta) \log \frac{m_{H_2}}{m_{H_1}};$$

where  $\theta$  is the mixing angle,  $m_{H_1} = 125 \text{ GeV}$  and  $m_{H_2} = \tan^2 \theta m_{H_1}$ .

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where  $\theta$  is the mixing angle,  $m_{H_1} = 125 \text{ GeV}$  and  $m_{H_2} \gg m_{H_1}$ .

! If we consider the scalars as a composite state, we have,

$$T_{\text{co}} = \frac{3}{8 \cos^2 \theta_W} (1 - \cos^2 \theta) \log \frac{\Lambda}{m_h};$$

$$S_{\text{co}} = \frac{1}{6} (1 - \cos^2 \theta) \log \frac{\Lambda}{m_h} + 2 \sin^2 \theta;$$

where  $\theta$  is the compositeness angle,  $\Lambda$  the energy cut-off and  $m_h = 125 \text{ GeV}$ .

(a) Elementary model

(b) Composite model





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- The different scenarios proposed are able to provide partial widths that depend on the hypercharge values.
- The oblique parameters could shed some light on the nature of the pseudo-scalar for the elementary or composite models.
- The greater the mass of the second mixed state, the less is the mixing between the new complex field particles and the SM-Higgs boson.