

SUSY parameter determination @ ILC

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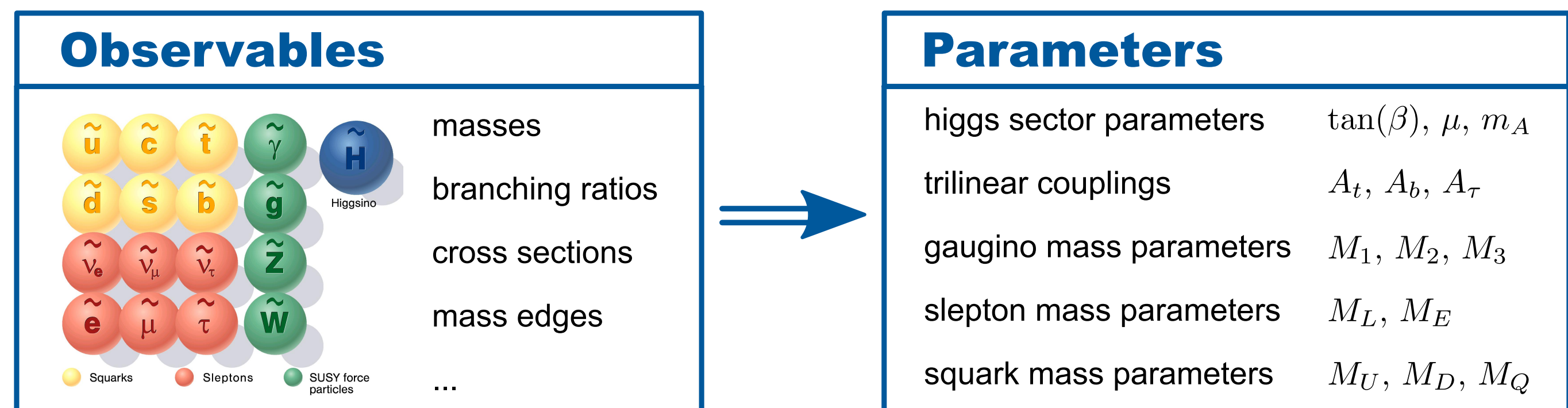
Motivation

There are many reasons to search for physics beyond the Standard Model. One prominent theory is Supersymmetry.

- Parts of SUSY parameter space excluded
- Many possibilities for light SUSY remain

If SUSY is observed:

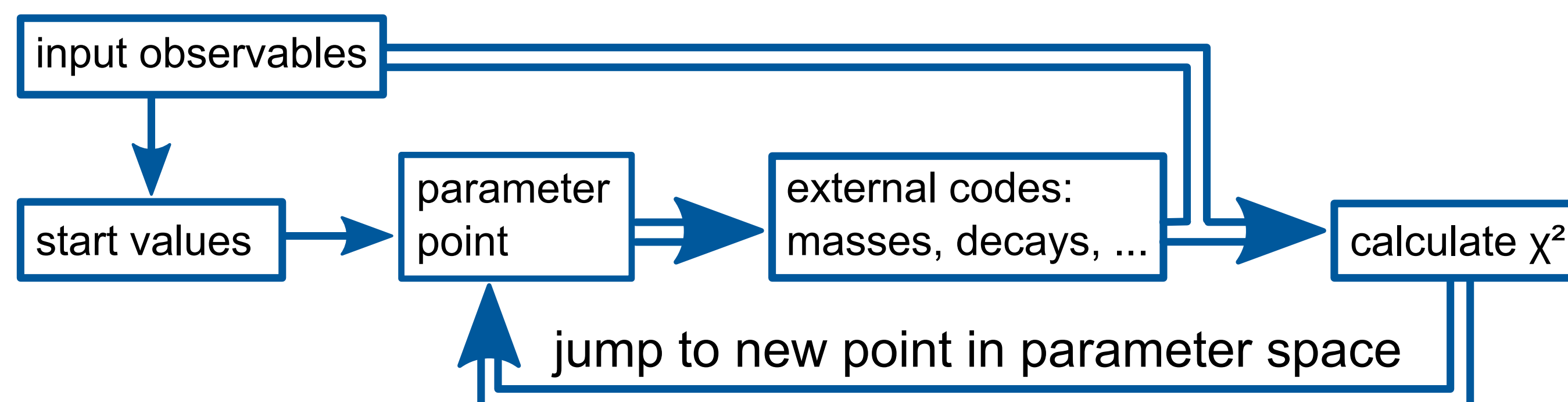
➔ **Can we determine the underlying model's parameters?**



Parameter reconstruction with Fittino

To determine the model parameters from measured quantities, the fit program Fittino [arXiv:0412012] can be used to

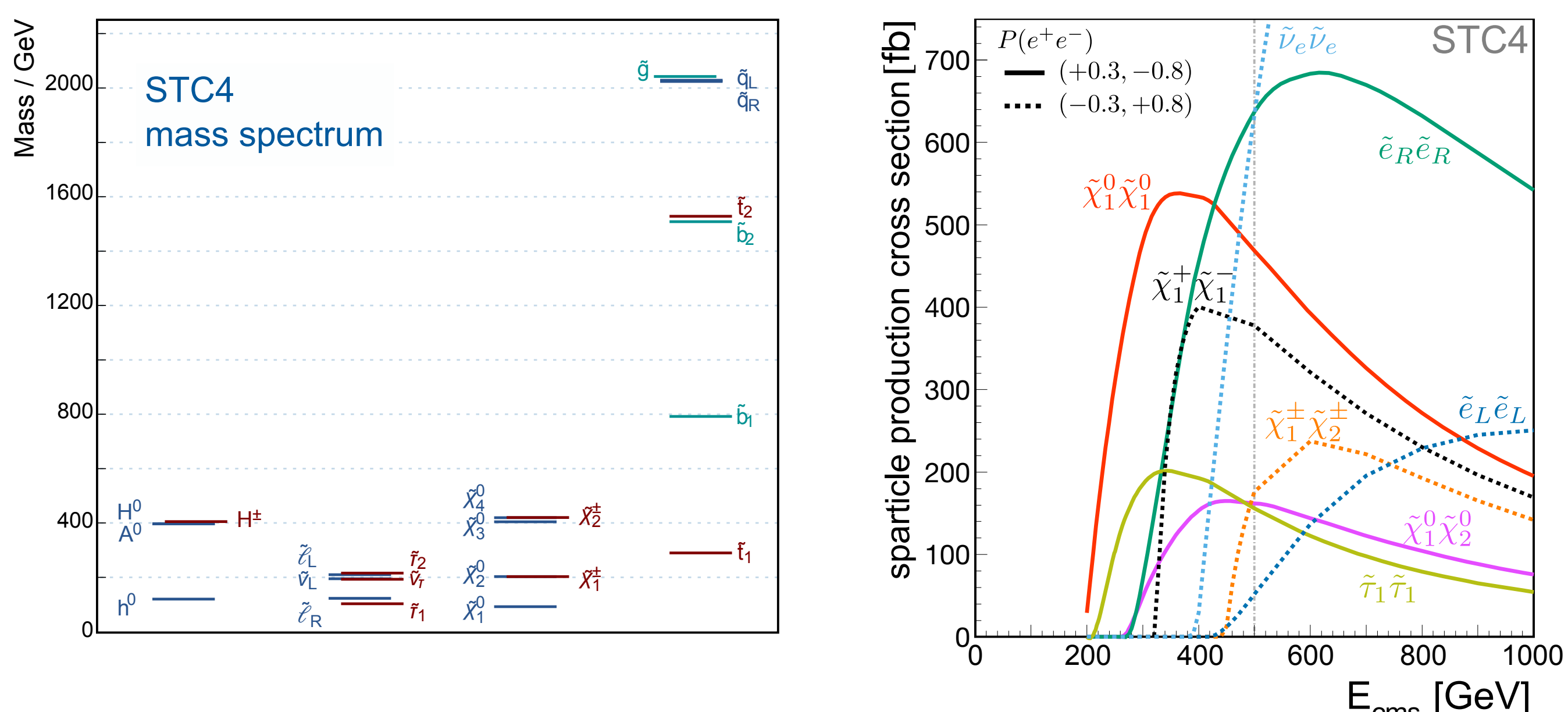
- Find a starting point using tree level estimates,
- Find the central values of the parameters,
- Evaluate the parameter correlations and uncertainties.



The new STC4 benchmark point

Features of the "STC4" (for $\tilde{\tau}$ co-annihilation model 4) pMSSM benchmark model [arXiv:1307.0782]:

- consistent with current LHC limits
- $\tilde{\tau}$ not degenerate with \tilde{e} and $\tilde{\mu}$, small mass difference between $\tilde{\tau}_1$ and lightest SUSY particle
- predicted relic density agrees with observed value

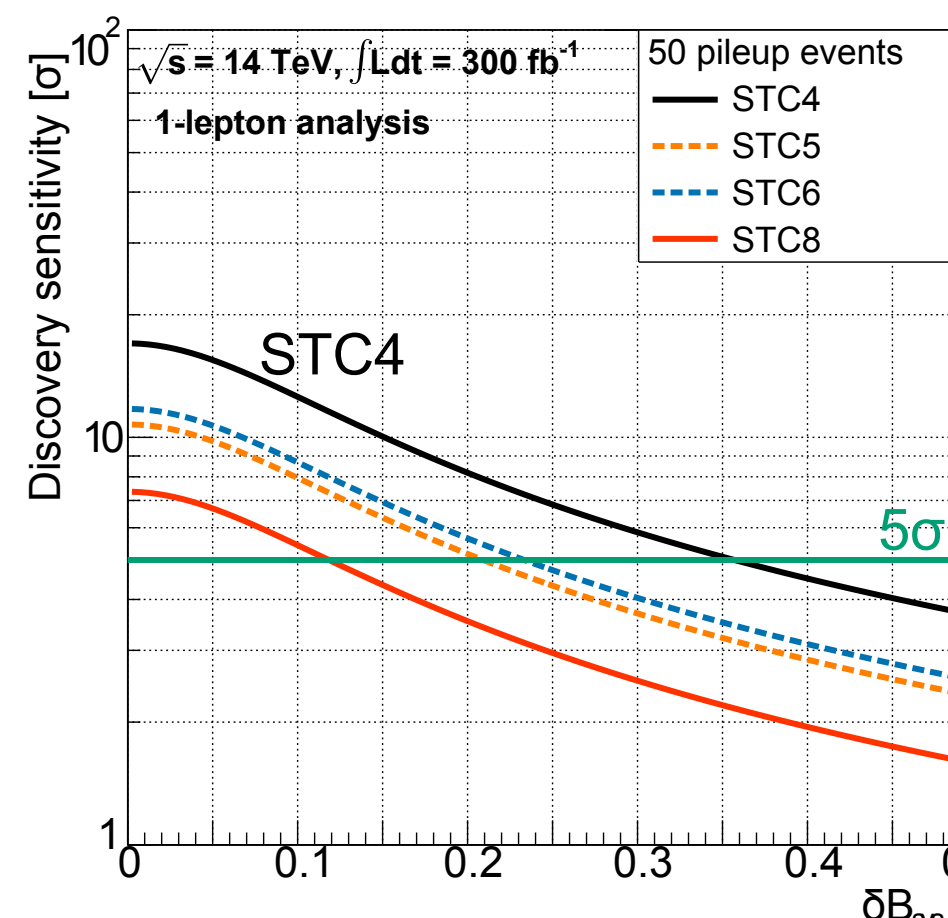


STC4: discovery and measurements

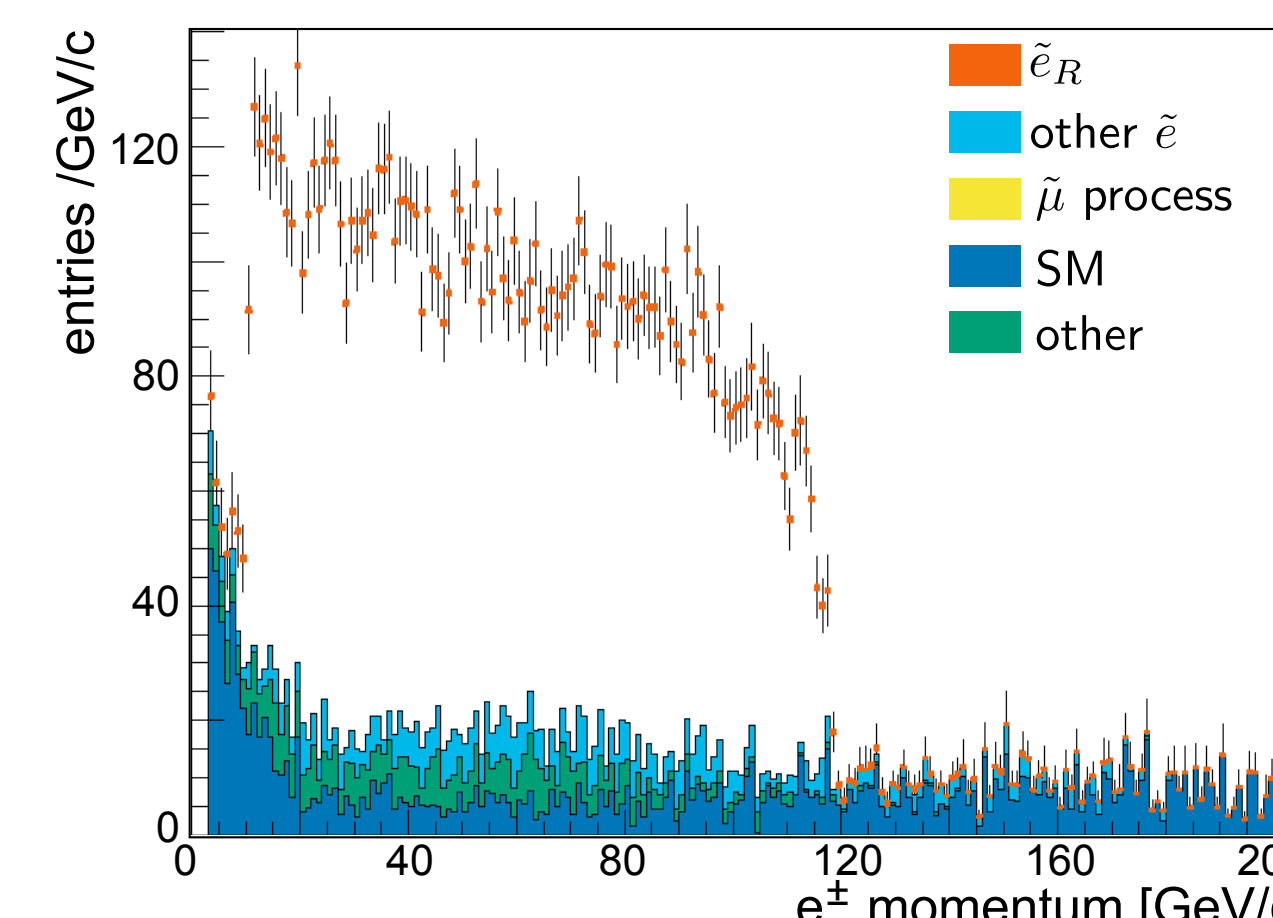
Capabilities for discovery & identification of STC4 [arXiv:1307.8076]:

- **LHC14**: possibility to observe STC4 depends strongly on systematic uncertainty on the background
- **ILC**: all sleptons and light electroweakinos are accessible

Which precision would allow to determine the model parameters from the measurements?



LHC14: Discovery sensitivity with 300 fb^{-1} . The green line marks the $5\text{-}\sigma$ -level.

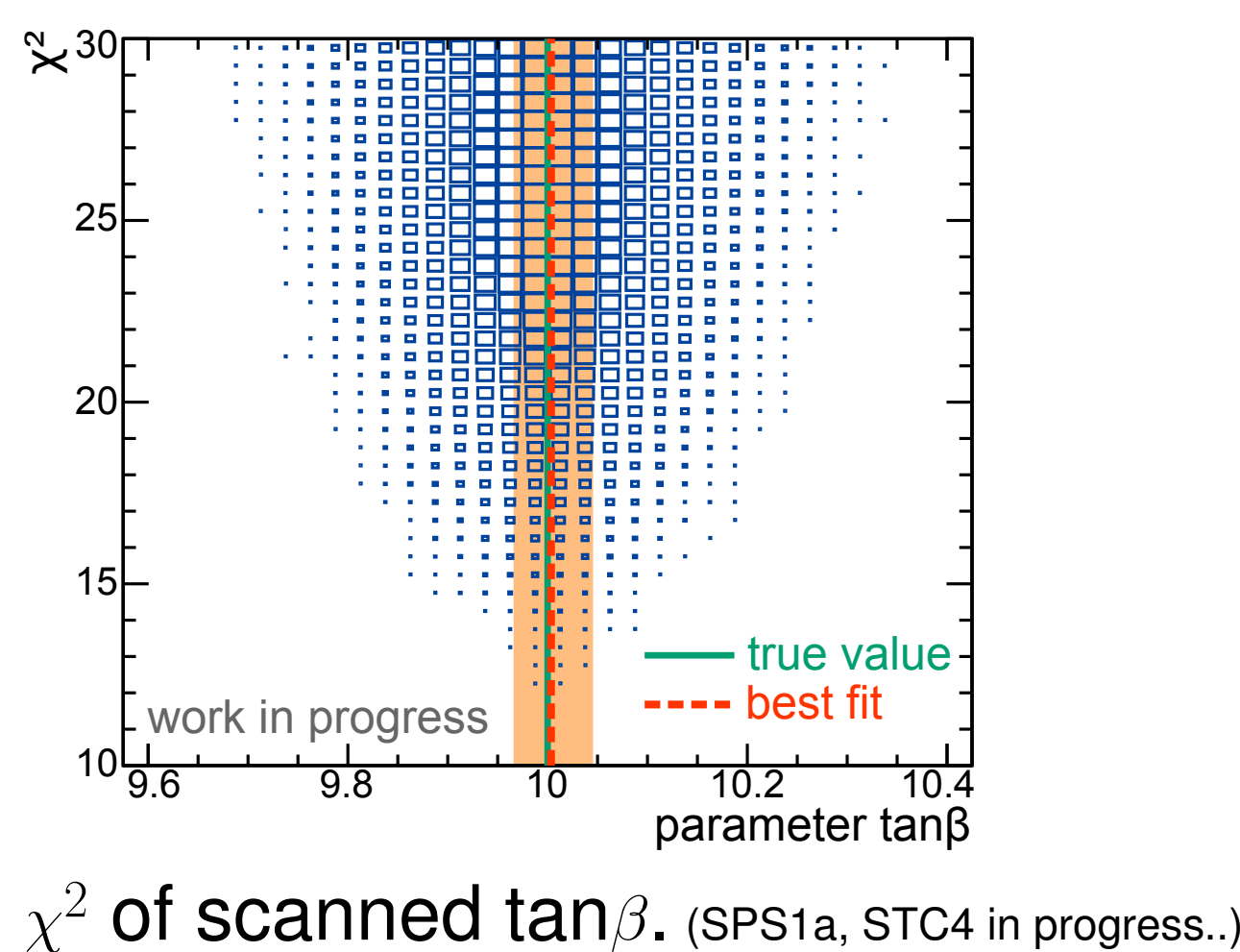


ILC500: Contributions to $e^+e^- \rightarrow 4\text{-momentum}$ signature with 10 pb^{-1} (one week at design luminosity).

STC4 Fittino analysis

To study the feasibility of parameter reconstruction, a global fit is done with Fittino, using LHC + ILC observables.

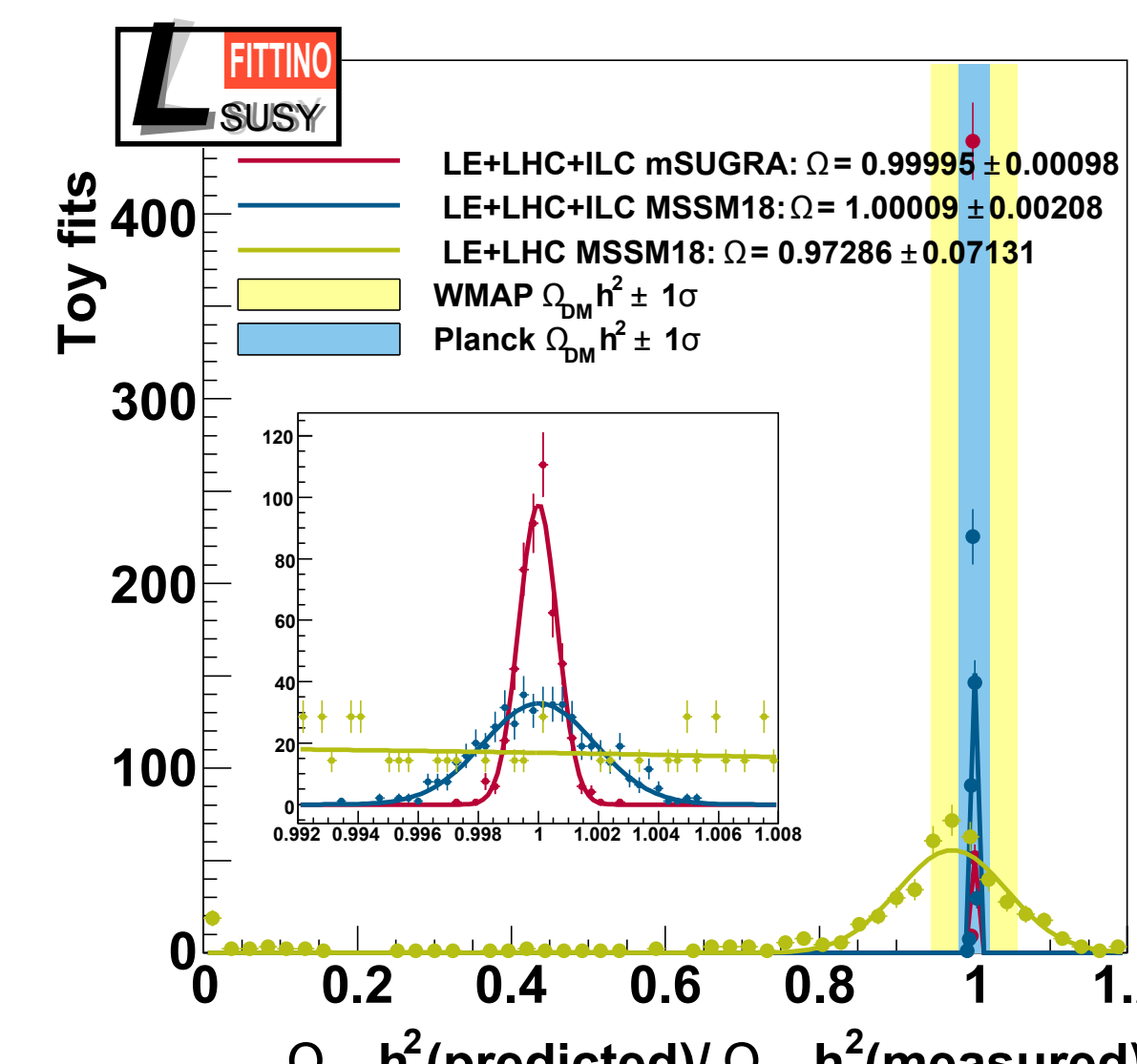
- Similar analysis for another model in the past [arXiv:0907.2589]
- Fit to reconstruct STC4 parameters currently in progress
 - ➔ determine best fit parameter values
- Which observables and precisions are needed?
- Conclude **necessary luminosities** at different ILC energies / threshold scans



Connection to cosmology

Parameter determination based on collider measurements can also improve the accuracy on the relic density:

- Agreement of $\Omega_{CDM}h^2$ predictions from fitted parameters with cosmological measurements:
 - ➔ dark matter consists primarily of lightest SUSY particles
- **High precision predictions** for direct detection experiments possible



Ratio of predicted to nominal value of Ωh^2 (SPS1a scenario, [arXiv:0907.2589]).

