# Physics with calibration data

*Gudrid Moortgat-Pick*

- **Idea**
- **Thoughts**
- **Physics**
- **Questions**

# Idea

- **Triggered by assumption that one calibrates data on the Z-pole after each detector change (push-pull scenario):**
  - **Z-pole luminosity: 7-8 x $10^{32}$cm$^{-2}$ s$^{-1}$**
  - **factor 10 more zees / day than in 100 days of SLD data taking**
- **Even if no Z-run per pull was needed:**
  - **using the calibration data for physics may be advantageous**
- **Questions:**
  - **can we use these data already for physics ew measurements?**
  - **which physics gain could we achieve?**
  - **what do we need for 'using' them? (polarimeter?)**

# Thoughts

- **GigaZ option allows ew measurement with unprecedented precision**
  - **solves existing discrepancies between AFB and ALR**
  - **important for consistency tests at quantum level already now**
  - **delivers precise measurement of ALR, but also other observables**

    **⟶ it is not only ALR that we need!**
- **GigaZ only discussed as option after the run -- late anyway**
  - **requires changes in the machine**
  - **either via bypass or via deceleration or via drift (@half rep. rate)**

# Physics

- **Accuracy in $\sin^2\Theta_{eff}$**

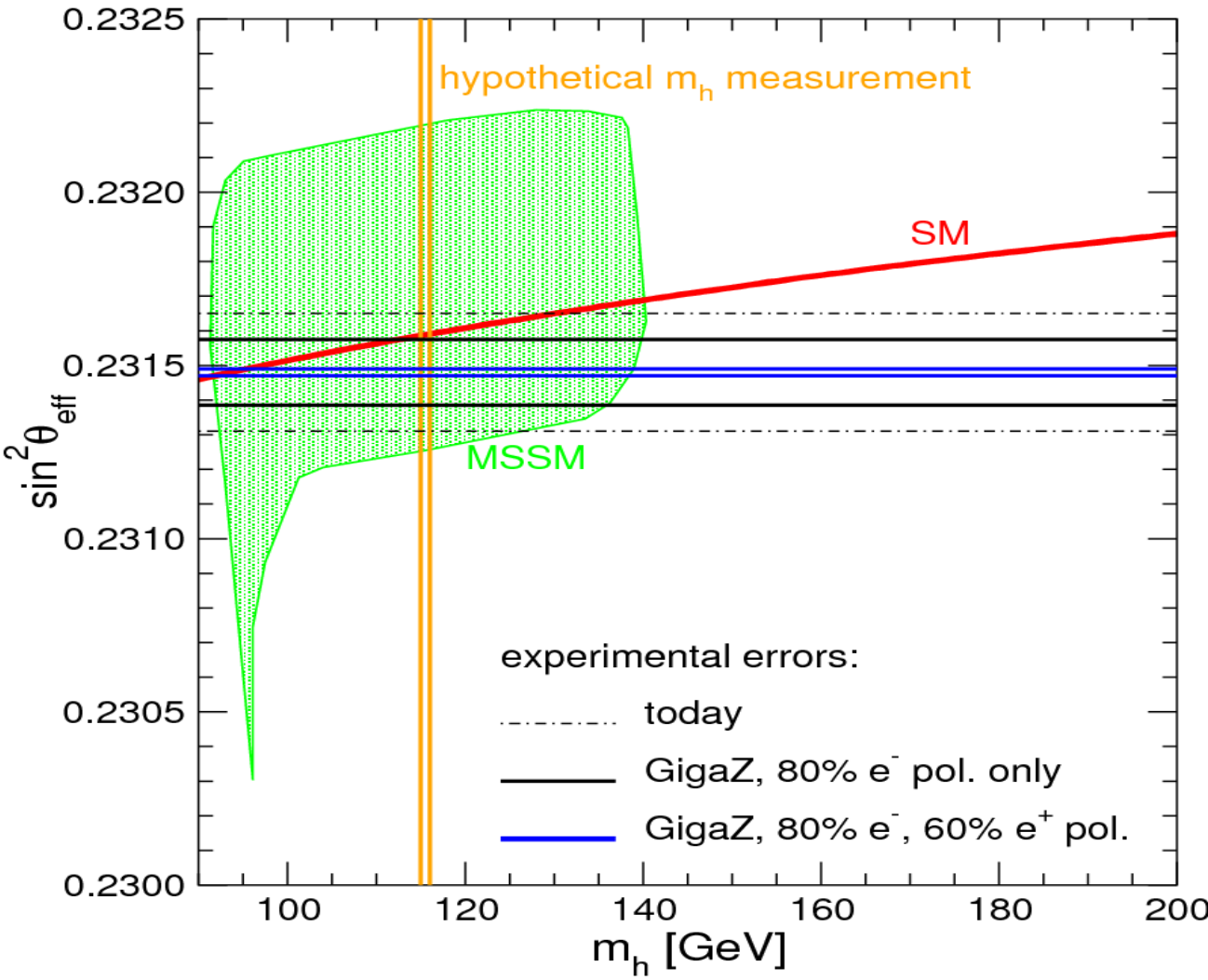
$$A_{LR} = \frac{2(1 - 4\sin^2\theta_W^{eff})}{1 + (1 - 4\sin^2\theta_W^{eff})^2}$$

  - **precision in ALR directly transferred to $\sin^2\Theta_{eff}$**

  - **GigaZ will provide $\Delta \sin^2\Theta_{eff}$ ~1.3 x $10^{-5}$ (if Blondel scheme)**
  - **only electron polarization at GigaZ: ~9.5 x $10^{-5}$**
  - **current value: 16 x $10^{-5}$**
  - **What could we gain with a 'fraction' of GigaZ ?**

# Constraints on the Higgs mass

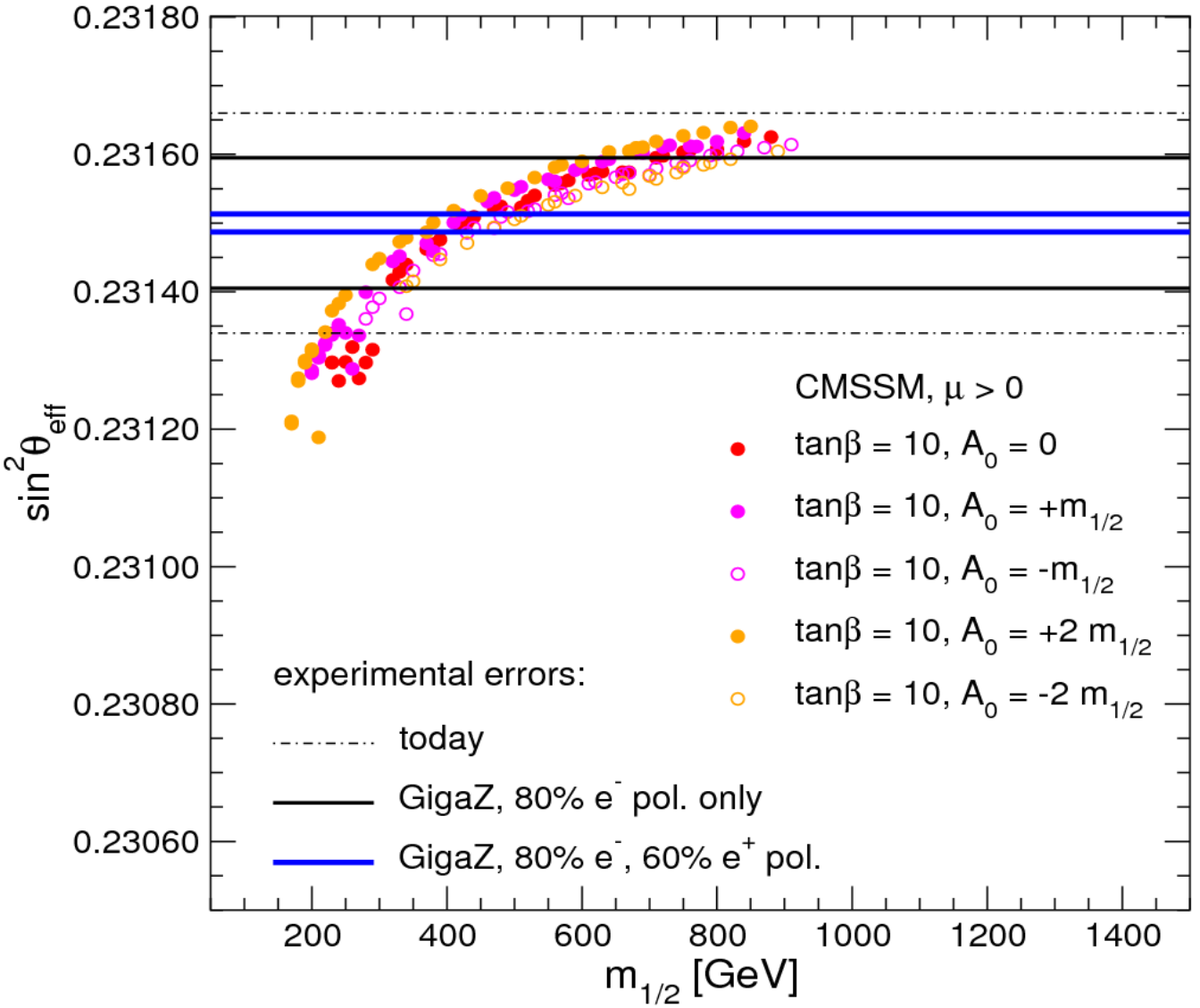
- **Distinction between SM and SUSY Higgs**
  - obviously distinction between Higgs in SM and Susy needs GigaZ accuracy
  - even GigaZ with only e- Pol. not enough
  - but 3 x $10^{-5}$ from calibration could help



# Constraints on SUSY parameters

- **Prediction of gaugino parameter in CMSSM**

  - every little helps
  - if $3 \times 10^{-5}$ achievabl
    with 70-100 days
    of calibration
  - already excellent!

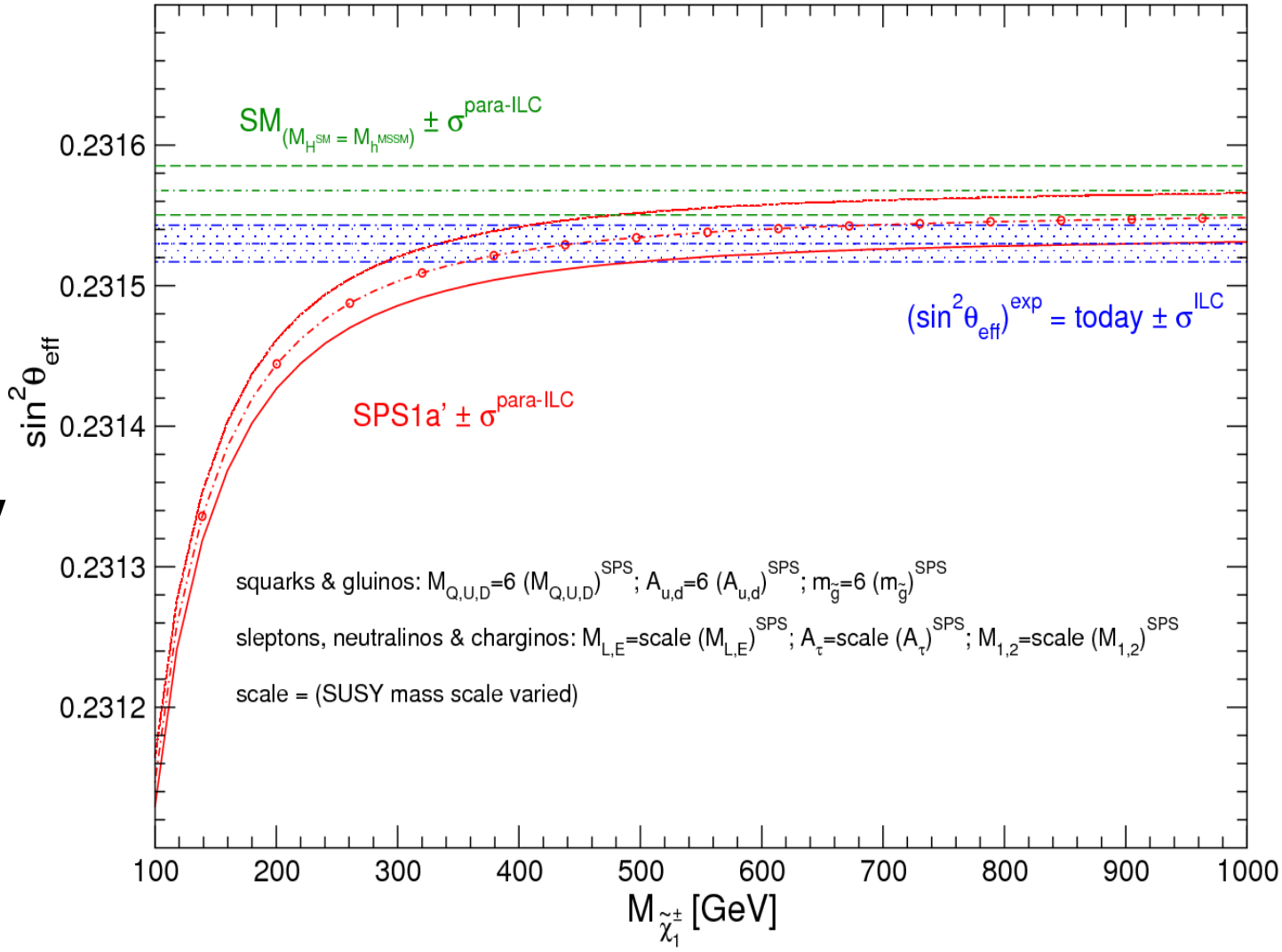


# SUSY constraints in worst scenarios

- **Case: light Higgs, but squarks in multi-TeV -> nothing@LHC!**

- **with current accuracy no sensitivity !**

- **GigaZ accuracy needed, but $3 \times 10^{-5}$ better than nothing**



# Questions

- **Can we control the systematics if we combine calibration data from many different runs?**

- **Do we have to flip the polarity?**
  - **for e-?  for e+?**

    **(remeber: baseline undulator source is already slightly polarized!)**
  - **if flipping: within one calibration run?**
  - **to which accuracy do we have to keep  the polarization degree?**

- **Which technical features do we need?**