Hi!

Progress Report from SModelS and Aachen

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People involved
   1) D. Proschofsky, S. Kraml, U. Laa, A. Lessa, W. Magerl, W. Waltenberger
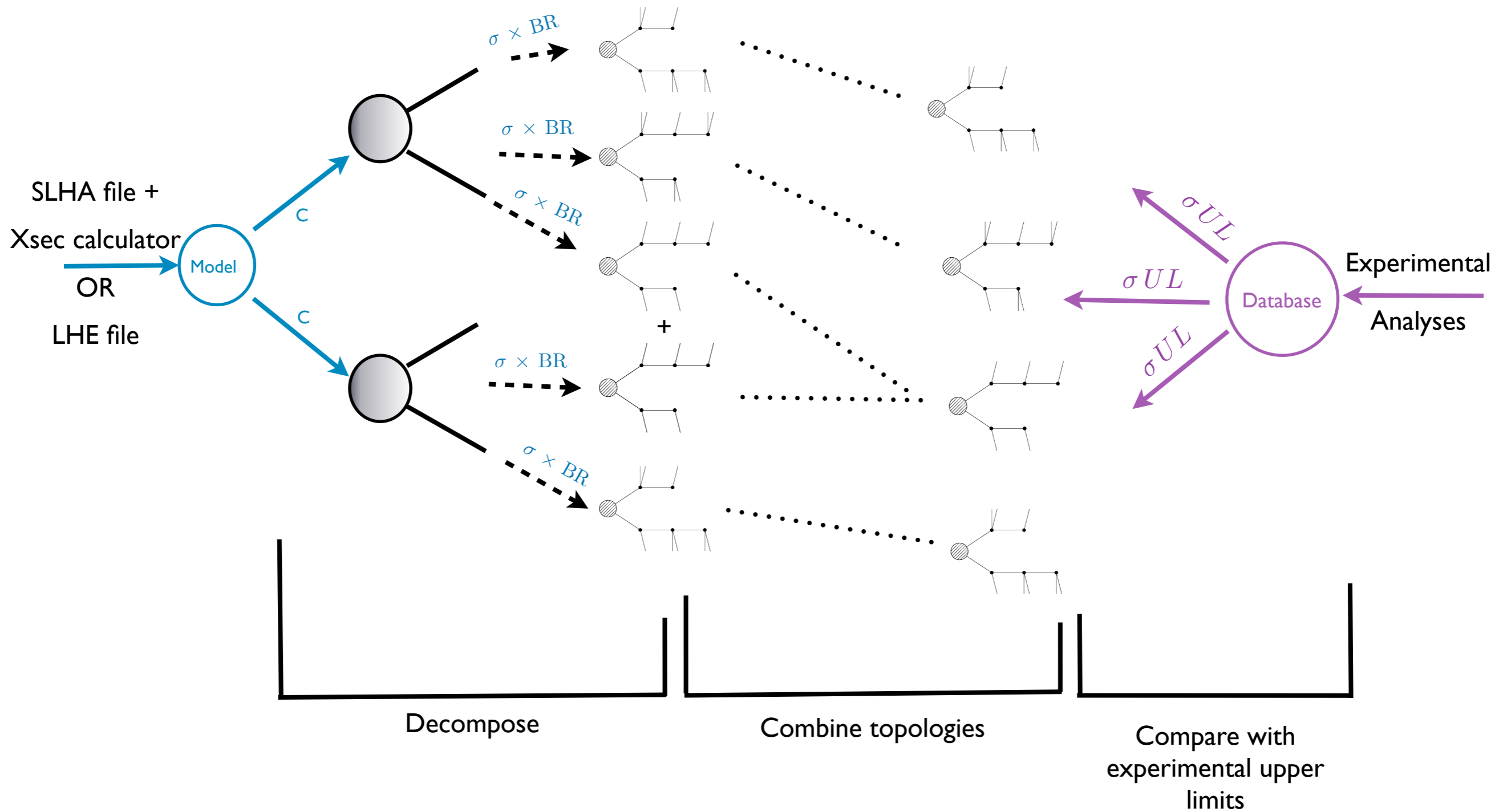   2) Lisa Edelhaeuser, Jan Heisig, Lennart Oymanns, Jory Sonneveld and Michael Kraemer

Can we have a centralized database of all the SMS results given by ATLAS and CMS to check a given BSM point in parameter space by decomposing it into SMS topologies?

Central concept of

Principle

SModelS framework

Decompose
Store final states, masses and sigma X BR for
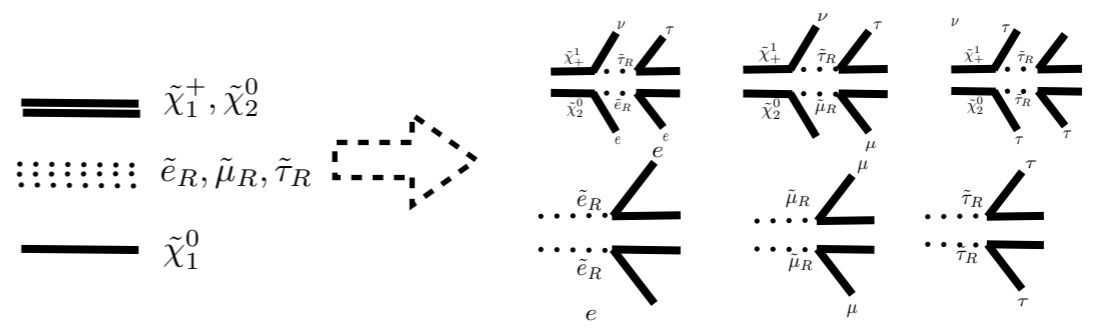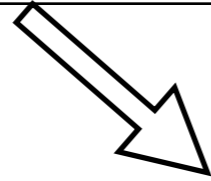each topology

ν τ

SModelS framework

Decompose
Store final states, masses and sigma X BR for each topology

SModelS framework

Decompose
Store final states, masses and sigma X BR for each topology

Cluster masses
Cluster masses if they can not be distinguished experimentally
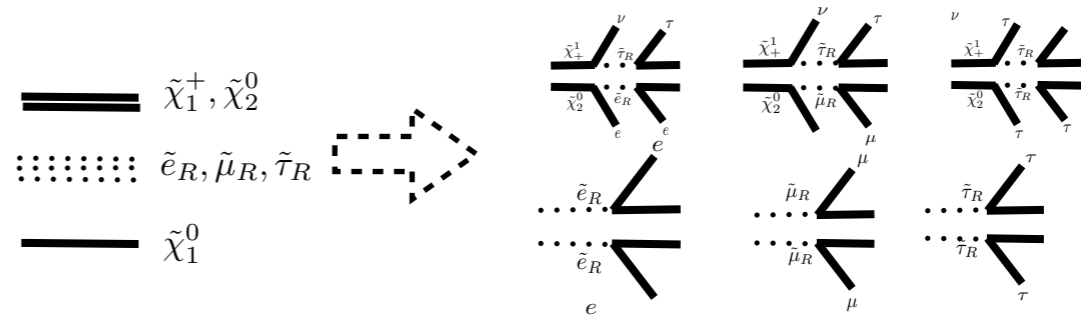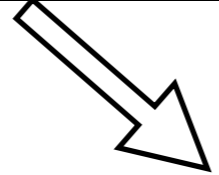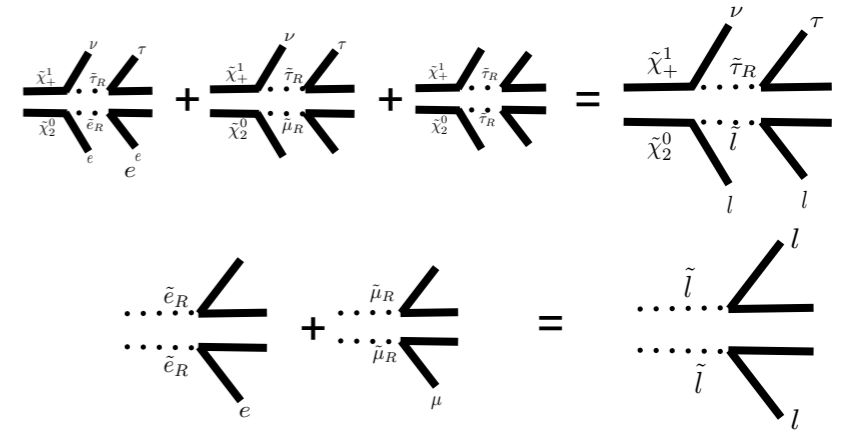
SModelS framework

Decompose
Store final states, masses and sigma X BR for
each topology

Cluster masses
Cluster masses if they can not be distinguished
experimentally

SModelS framework

Decompose
Store final states, masses and sigma X BR for each topology

Cluster masses
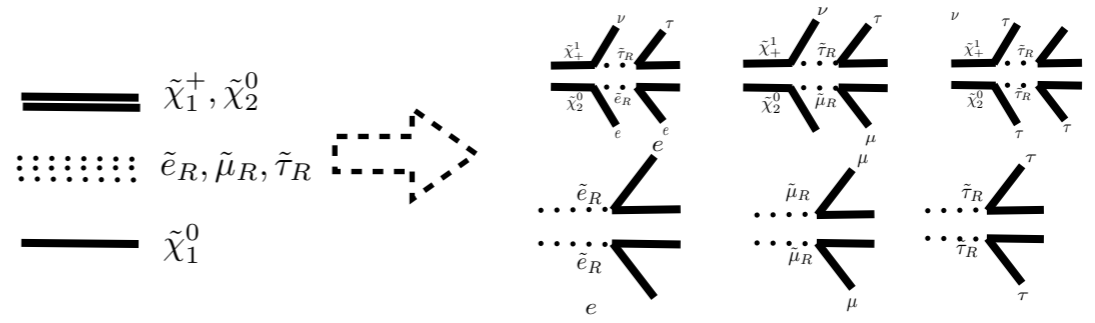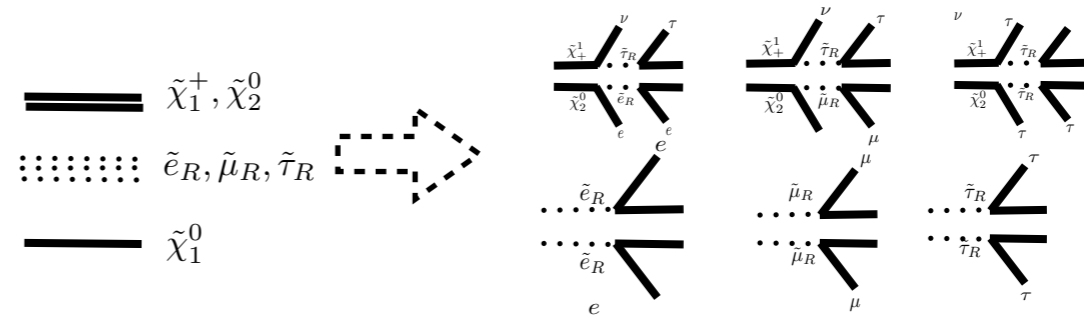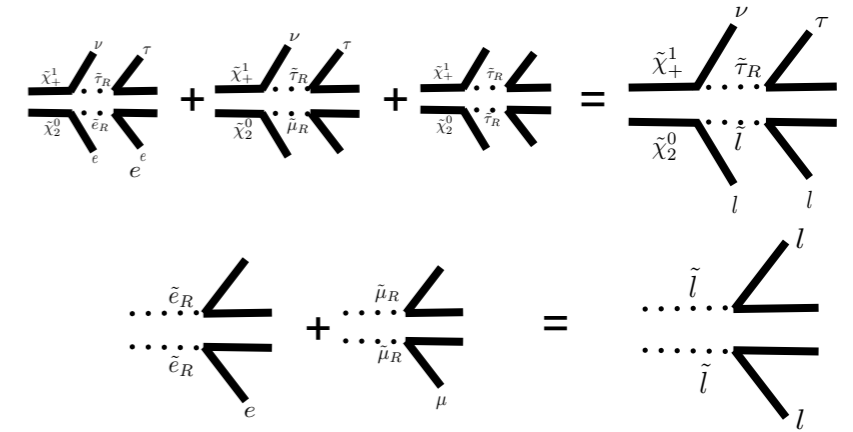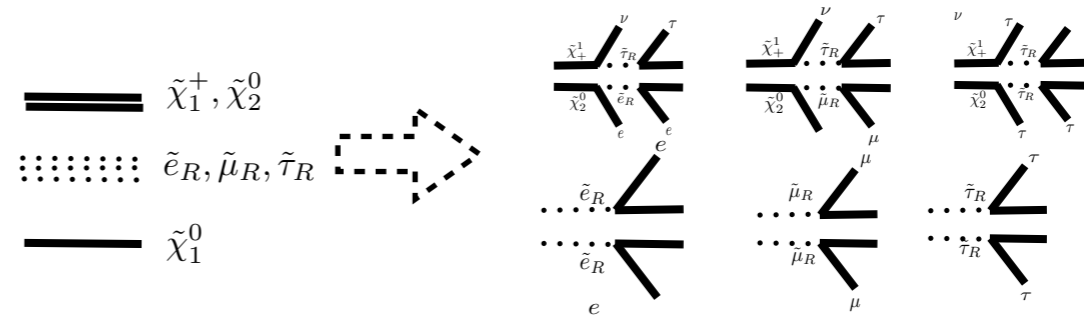Cluster masses if they can not be distinguished experimentally

Check for upper limits
Linear interpolation between bins and intermediate masses
Estimate violation of experimental conditions

SModelS framework

SModelS framework

- Consider:

$$\tilde{\chi}_1^+, \tilde{\chi}_2^0$$

$$\tilde{e}_R, \tilde{\mu}_R, \tilde{\tau}_R$$

$$\tilde{\chi}_1^0$$

Decompose

Element

description
masses
$\sigma \, \mathrm{BR}_{th}$

Constraint

[[[nu],[tau]],[[L],[L]]] >
3* [[[nu],[tau]],[[tau],[tau]]]

Look up upper limit if

Condition

$$\big[[[nu],[tau]],[[L],[L]]\big]$$
$$\big[[300,200,100],[320,220,100]\big]$$
$$\sigma \, \mathrm{BR}_{th}$$
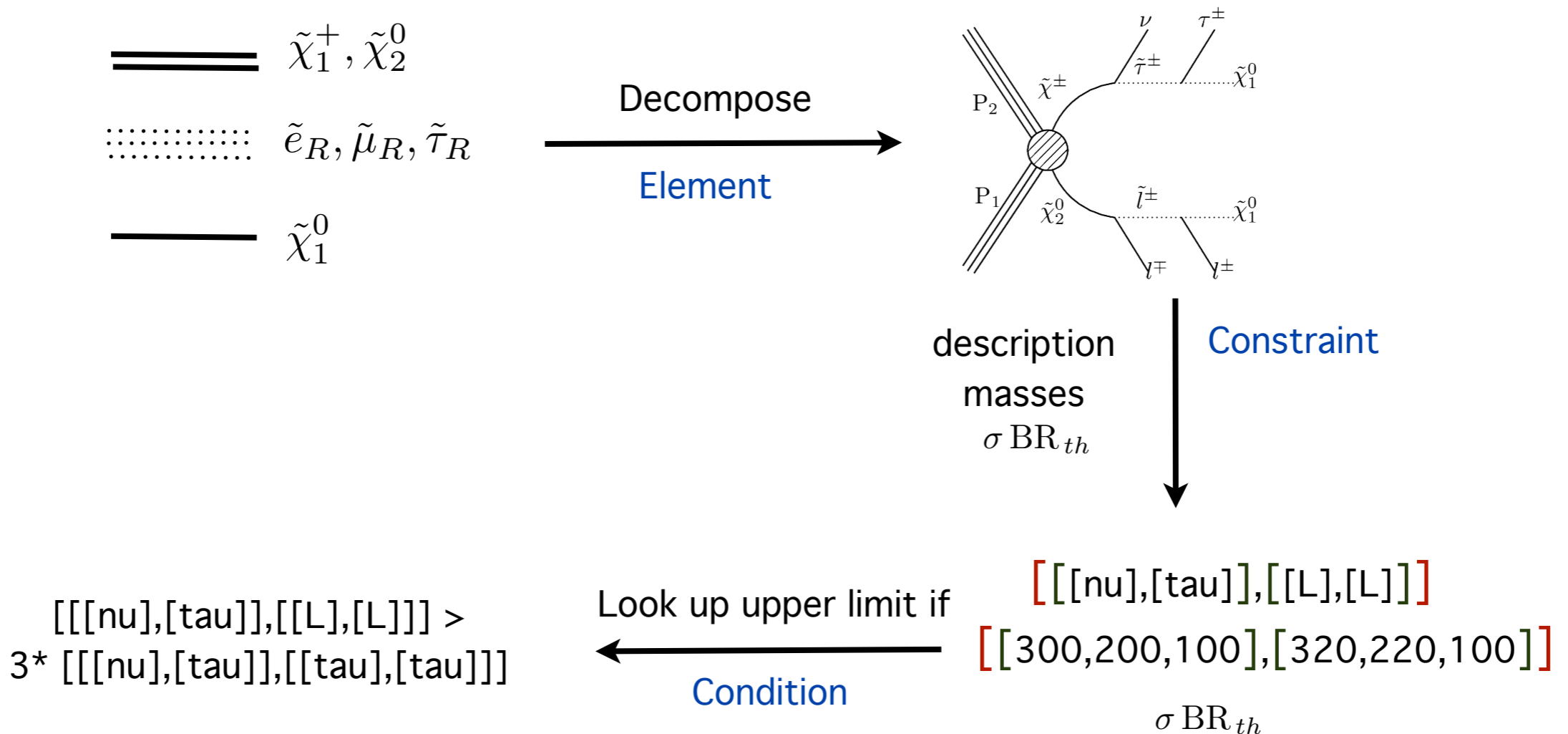
- The framework does not depend on characteristics of SUSY particles, can also be applied to decompose any BSM spectra of arbitrary complexity

SModelS language

Current status

- The code offers a possibility of either SLHA or LHE based decomposition

- It can decompose any model with a Z2 symmetry

- It is a generic formalism for decomposition for any BSM spectra

- Compressed spectra and topologies containing invisible decays can also be handled

- It has the most comprehensive database of available SMS results

- 14 CMS, 22 ATLAS SUSY analyses are already implemented

- Code validation has been done through reproduction of several SMS exclusion curves

Current status

- The code has very flexible formalism, can be extended easily

- The code can be used to look up upper limits from all available results for a single topology

- It can also be used to characterize parameter space by identifying relevant analyses

- It can be used to identify holes in analysis or topologies which do not have any SMS result

For a real-life application of the code see A.Lessa's talk

Current status from Aachen

- **Team:** Lisa Edelhaeuser, Jan Heisig, Lennart Oymanns, Jory Sonneveld and Michael Kraemer

- Efforts towards testing validity of SMS approach for various SUSY and other BSM scenarios

- Three different aims:

  - Detailed comparison of efficiencies in simplified models and in the cMSSM and UED models

  - Simplified models for long-live SUSY particles

  - Global fits of SUSY models using simplified model

Limitations

- Current limitations partially arise from taking 95% C.L. U.L. approach

- The decomposition procedure itself is very generic

- Can not constrain a model point if the assumptions of experimental analysis are not obeyed e.g. if lepton (e/mu) flavor universality is not satisfied

Limitations

- Can not claim a point being excluded <u>at 95% C.L.</u> as long as there is no mechanism to identify the most sensitive topology

- Can not combine topologies with different kinematics but same final states as long as we stick to 95% C.L. U.L. approach

Conclusions

- SModelS decomposes any BSM spectra into SMS topologies

- The code contains a comprehensive database of SUSY SMS results

- Current implementation is restricted to models with a Z2 symmetry

- The formalism is flexible and can be extended easily

- Efforts are underway at Aachen to understand the validity of SUSY SMS results to UED, cMSSM models among various other goals