

# Data-Mining Approach for Validation of PSA Models

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# Use of PSA Models in Decision Making

- High confidence in PSA results is crucial
  - Low uncertainty is required
- Relative importance of modeled initiating events shall be as realistic as possible
  - Assumptions used for modelling different events must be consistent
- Relative importance of modeled safety functions and systems shall be as realistic as possible
  - Assumptions used for different parts of the model must be consistent

# Validation of PSA Models

Validation is required to ensure quality of the PSA model.

Problem areas:

- Huge volume of data to validate
- Uncertainty in the plant response to an initiating event (timings, etc.)
- Uncertainty in criteria for safety functions in different accident sequences
- Uncertainty in failure data

# Existing techniques for PSA model validation

- Comparison of calculated frequencies to expected ones
  - Require definition of *expected values*, which are external to the model to be validated
- Analysis of top N dominating minimal cutsets (MCS)
  - Are top N MCS really representative for the result?
  - How to find model errors resulting in non-minimal cutsets identified as minimal?
- Validation using results of importance analysis
  - Require definition of *acceptance limits*

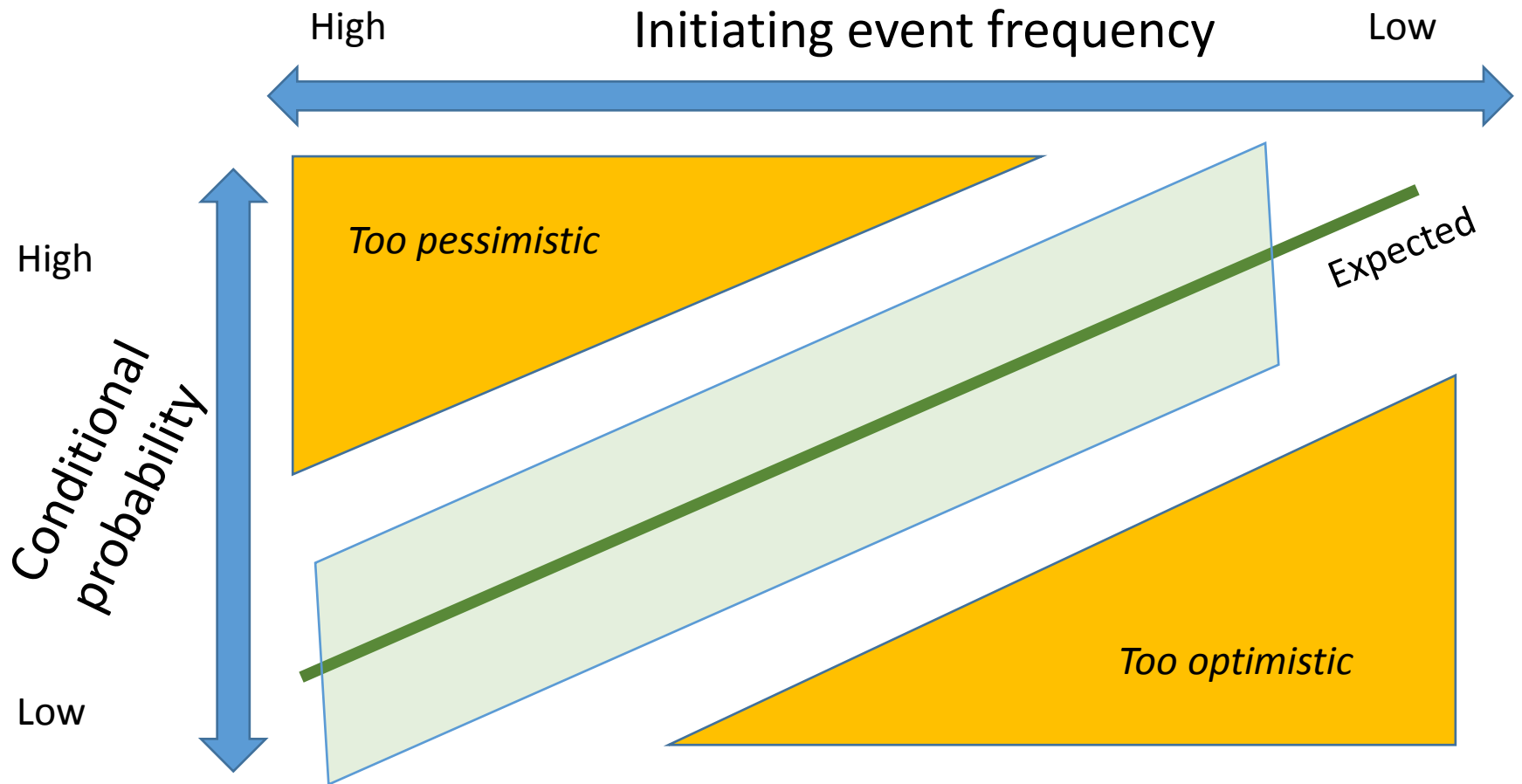
# Problem definition

- Is it possible to validate a PSA model without definition of acceptance criteria external to the model?
  - Should be based on comparison of the PSA results to each other
    - A criterion for detailed validation can be defined as:  
*It **may** be something wrong with an analysis, if its result deviates too far from the results of a group of comparable analyses*

# Problem definition (cont.)

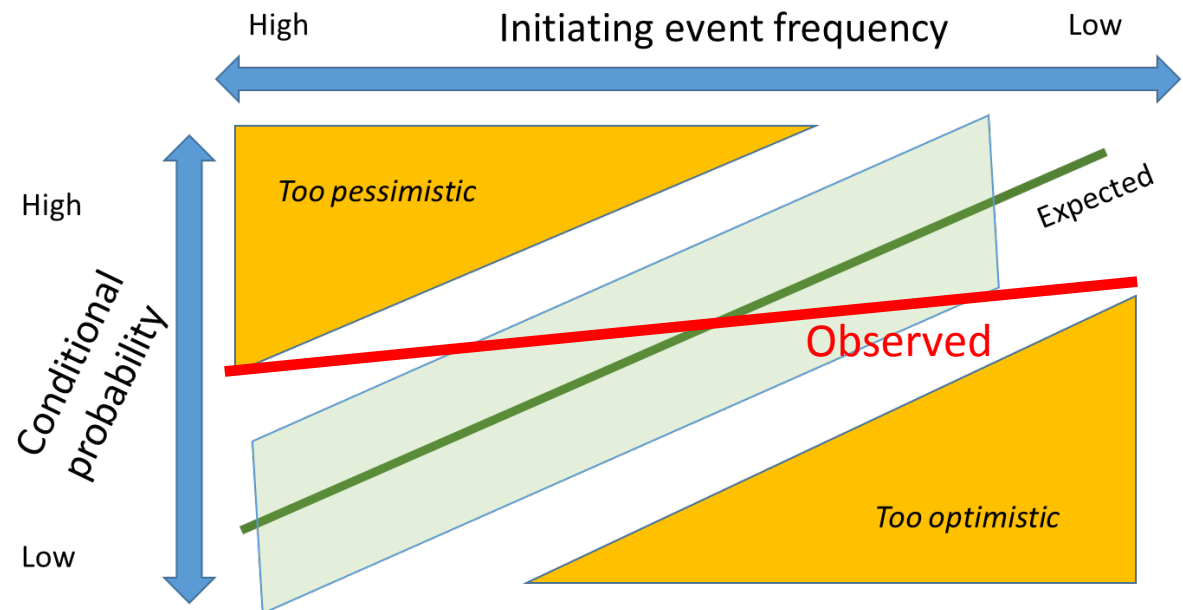
- Is it possible to define some generic rule for results to observe?
  - Accepted risk is more or less constant (*optimum level*)
  - Relation between initiating event frequency and conditional core damage probability is reciprocal to keep the risk on the accepted level

# Validation Diagram



# Validation Cases

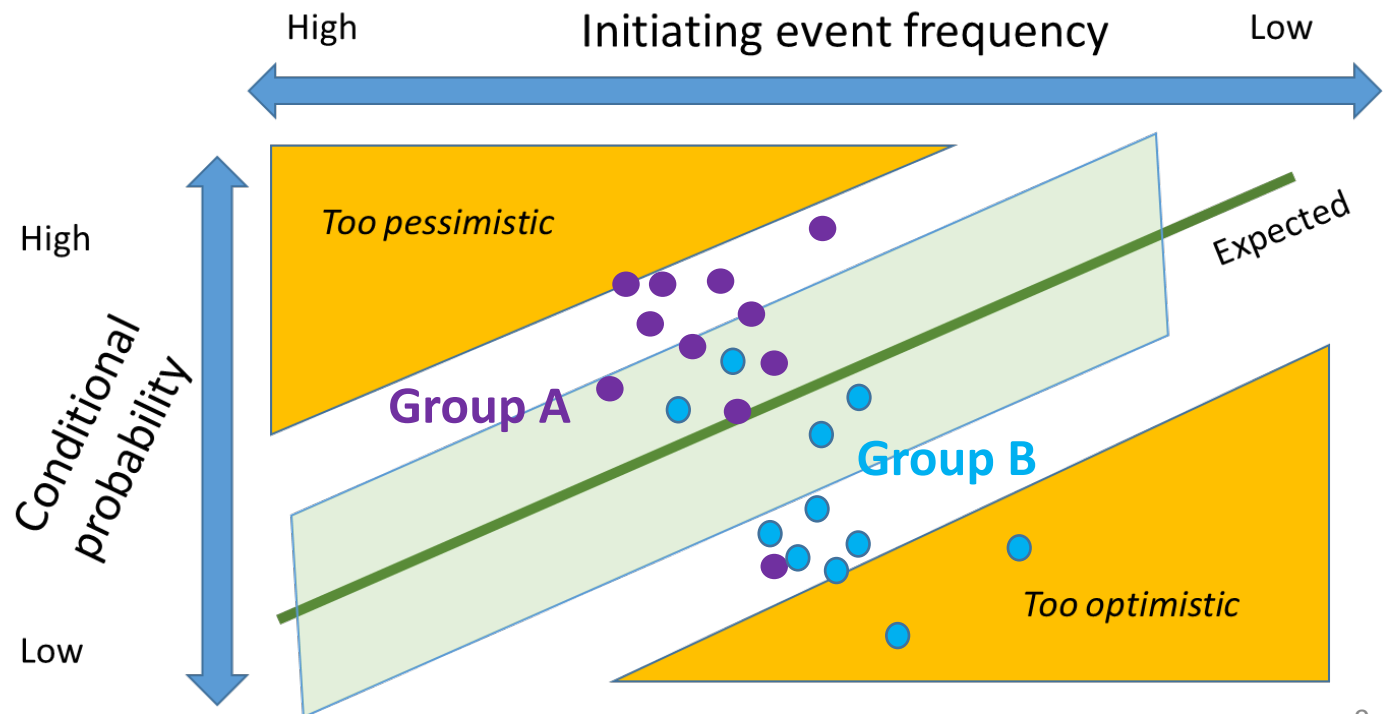
- No change in conditional probability with regard to initiating event frequency for a group of events
  - *Modelling is too simplified?*





# Validation Cases

- Comparison between two groups of events
  - *Group A is modelled too conservatively compared to the group B?*



# Conclusions

The proposed method:

- accelerates validation of a PSA model by showing potentially weak areas in the analysis
- allows comparison between groups of analyses using group trends or distance between the groups
- allows identification of outliers as candidates for more detailed validation
- can be extended by using other relations than between event frequencies and conditional probabilities