

PRESENTATION

# Causal knowledge graphs for risk interpretation using LMM: A new tool for insurers

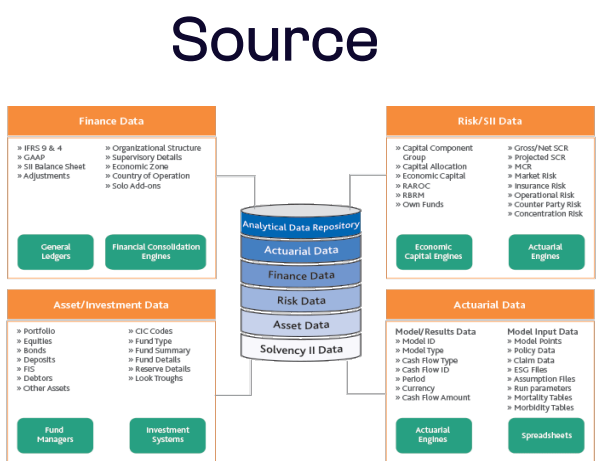
London 20/06/2025

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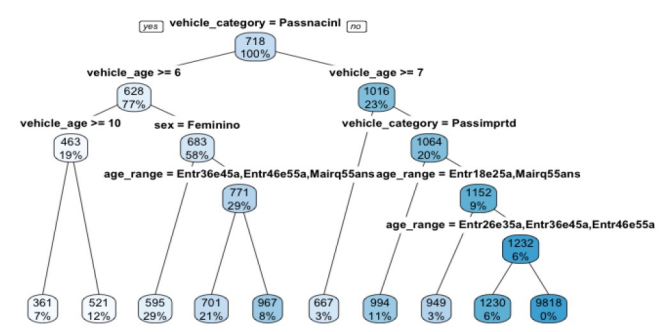
# 1. Context & Approach

## Several factors limit a proper understanding of risks

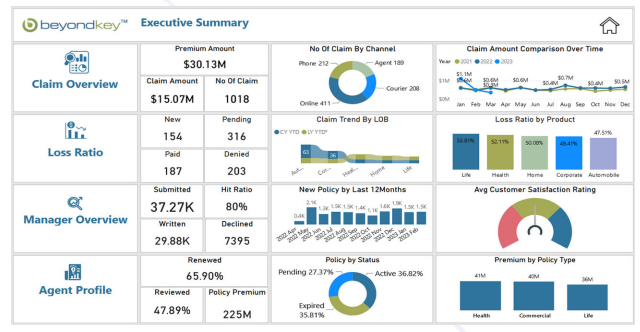
- + The organisation of knowledge
- + Its use in actuarial tools
- + Its interoperability between teams



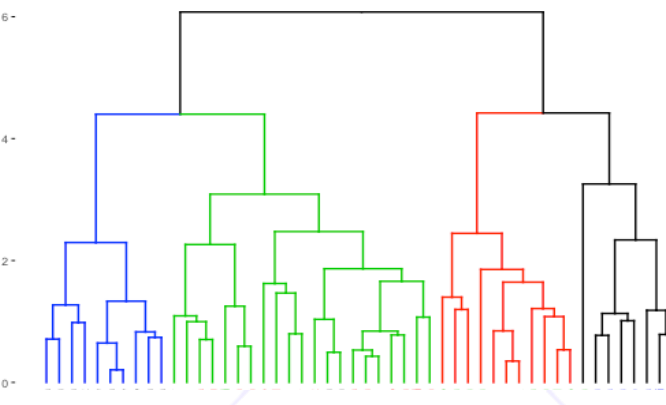
## Multi-dimensionality



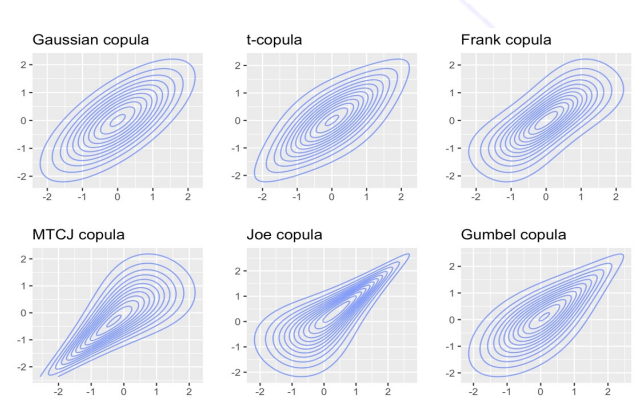
## Visualisation



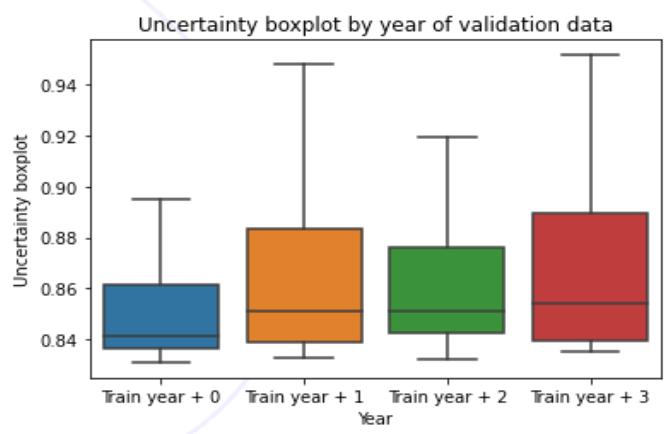
## Aggregation



## Correlation & chronology

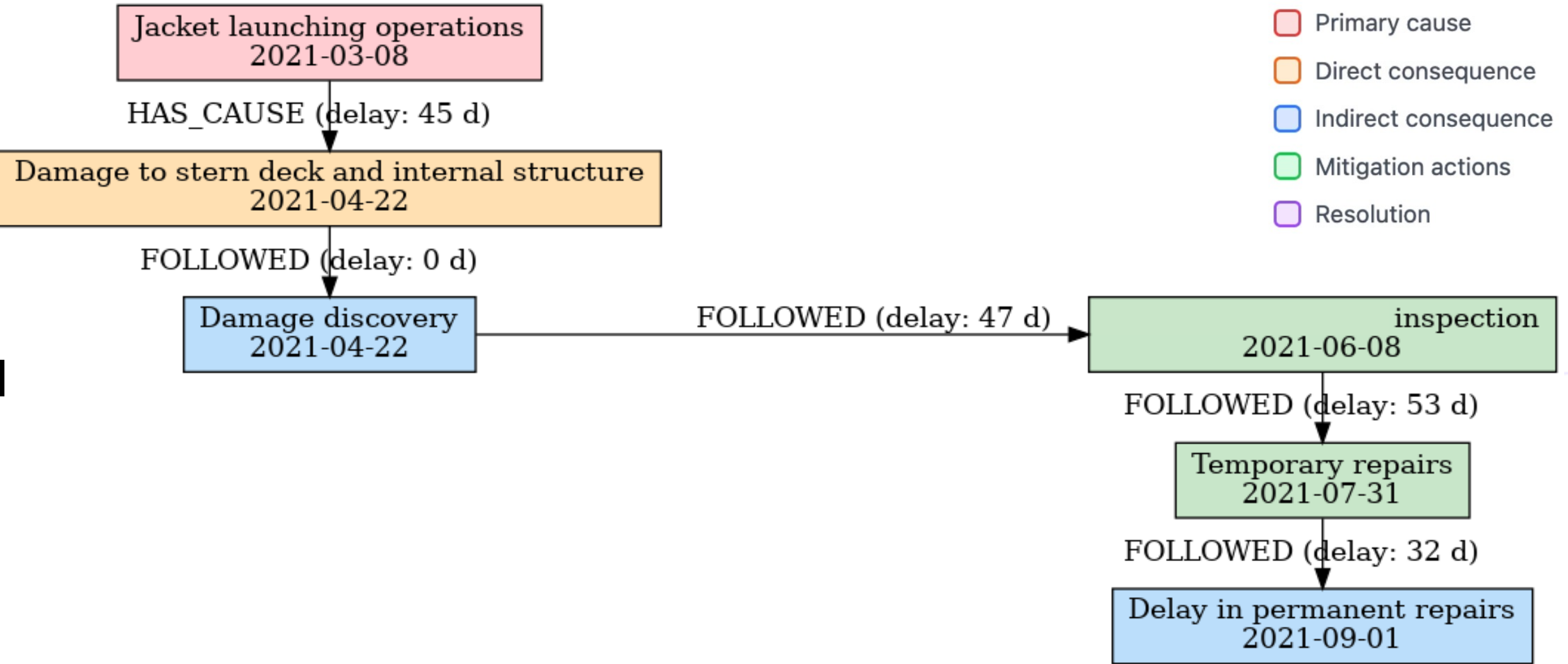


## Inalterability



## The use of Gen AI allows for better

- + Data: multimodal processing of document corpora
- + Preparation: standardised, typed, scalable data model
- + Processes: sequenced LLMs to structure in DAGs





2.Results

Time

+ 1min / ref

Cost

+ 1 to 5€ / ref

Graphs

- + 1- 5 graphs / ref
- + Metadata graphs twins
- + 30 to 90 event type
- + Attribute distributions

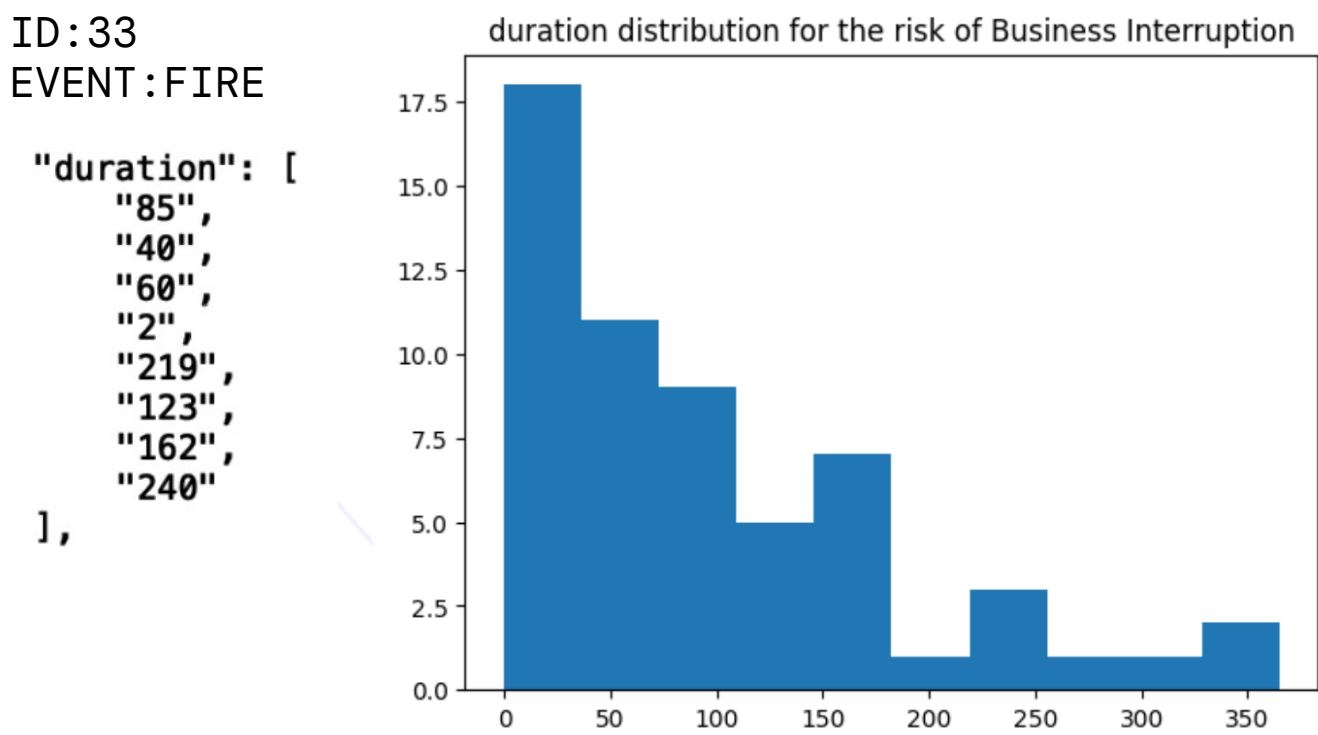


Figure: Example of attribute distribution

Evaluation

- + Few errors
- + 30 attributes on average
- + 4-10 node per graph
- + Aggregation by ref limited to 2 or 3 given the size of the chunks
- + Very good extraction quality (+80%)

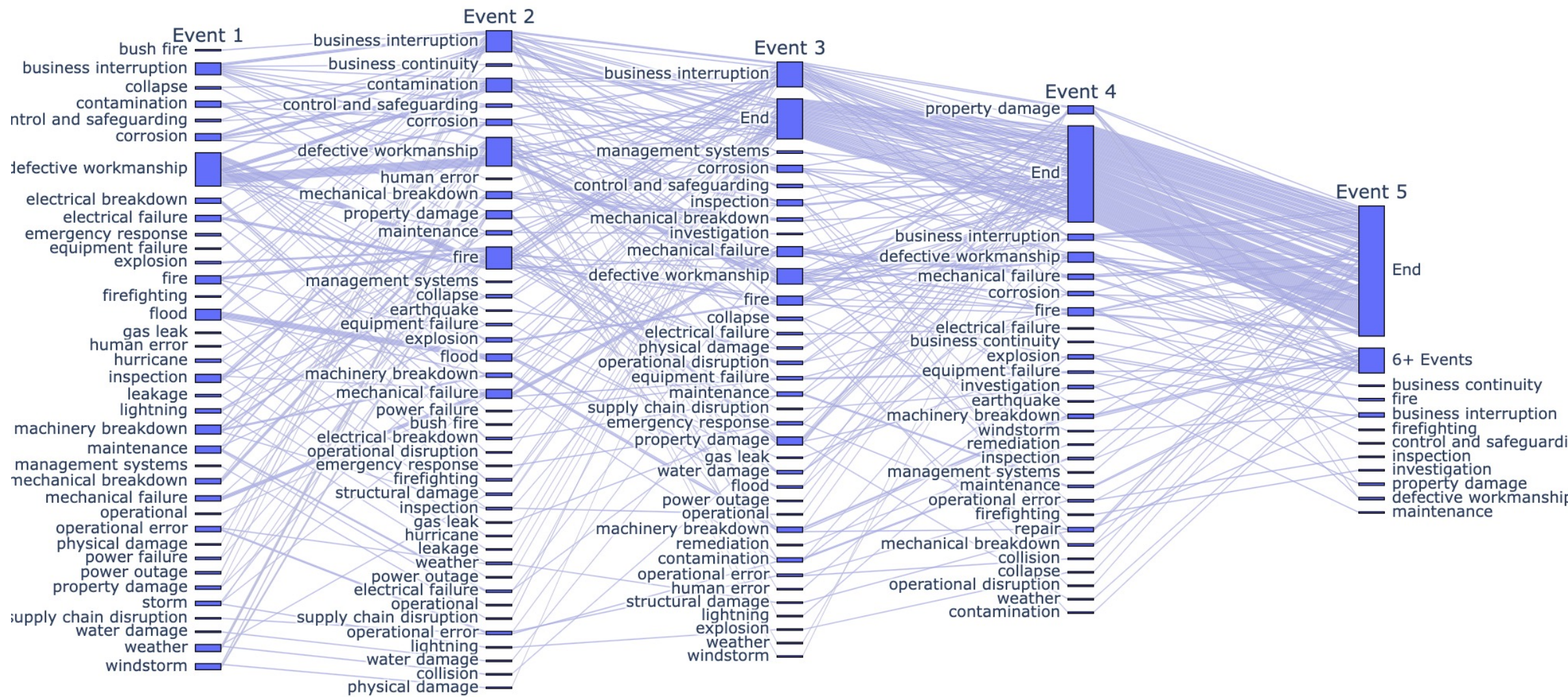


Figure: Example of parallel chart to represent co distribution of events

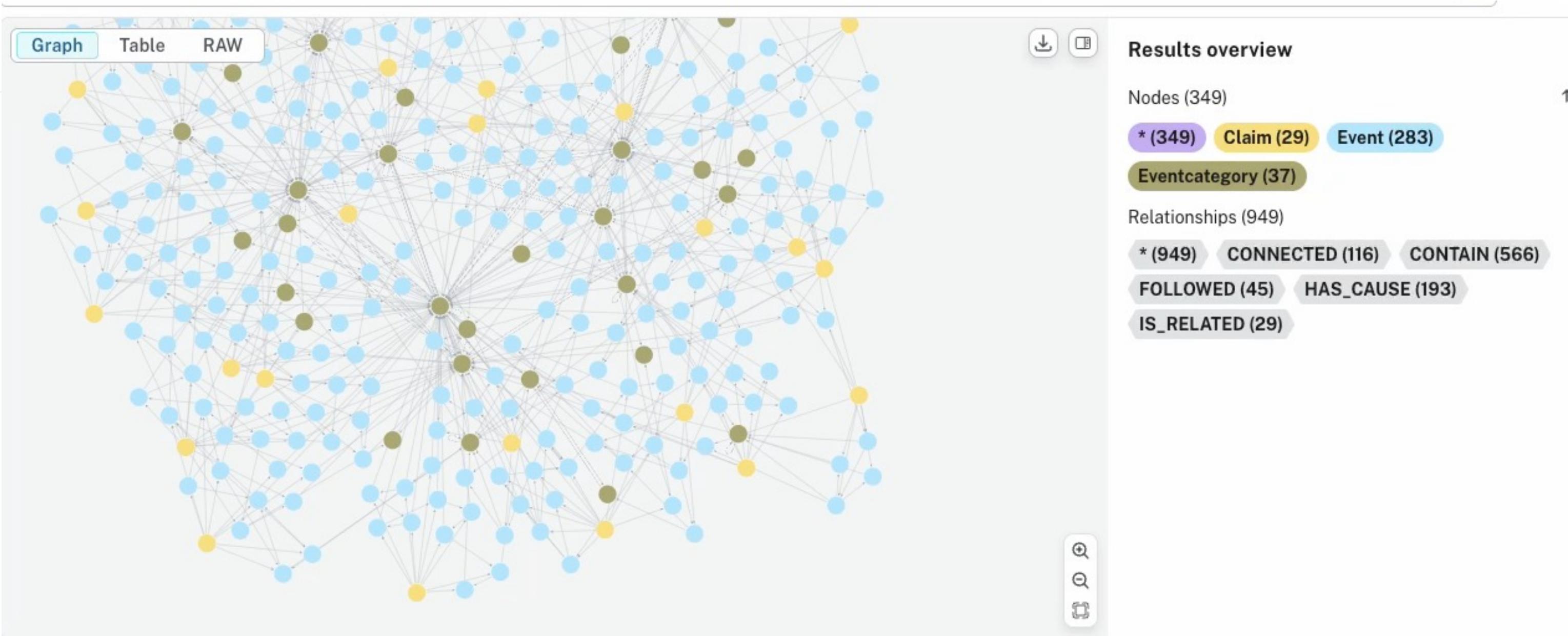


Figure: Example of aggregated graph



3. Usages

Consultation & visualisations

+ App for organizing ref and making graphs readable

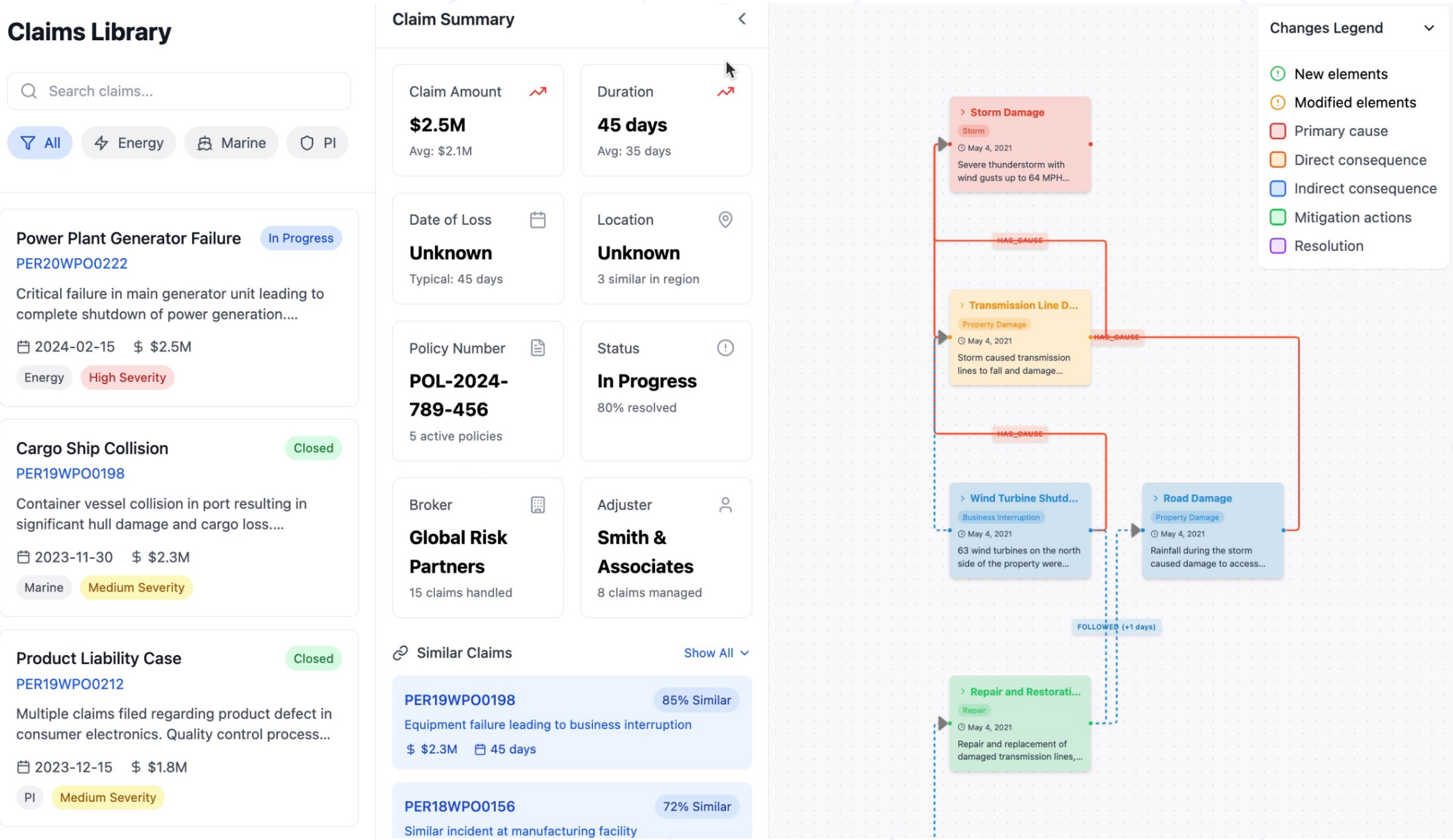


Figure: App to get access to claims graphs

Requests & agents

+ Natural language query to Cypher query to LLM

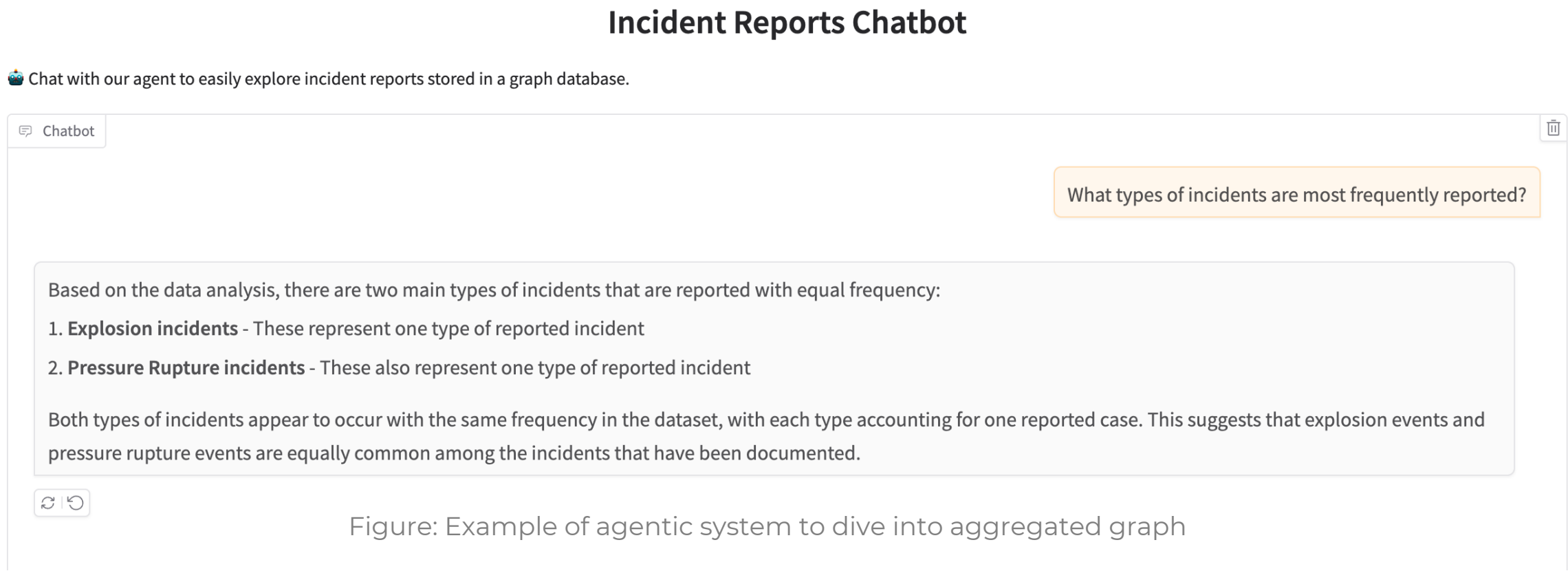


Figure: Example of agentic system to dive into aggregated graph

References

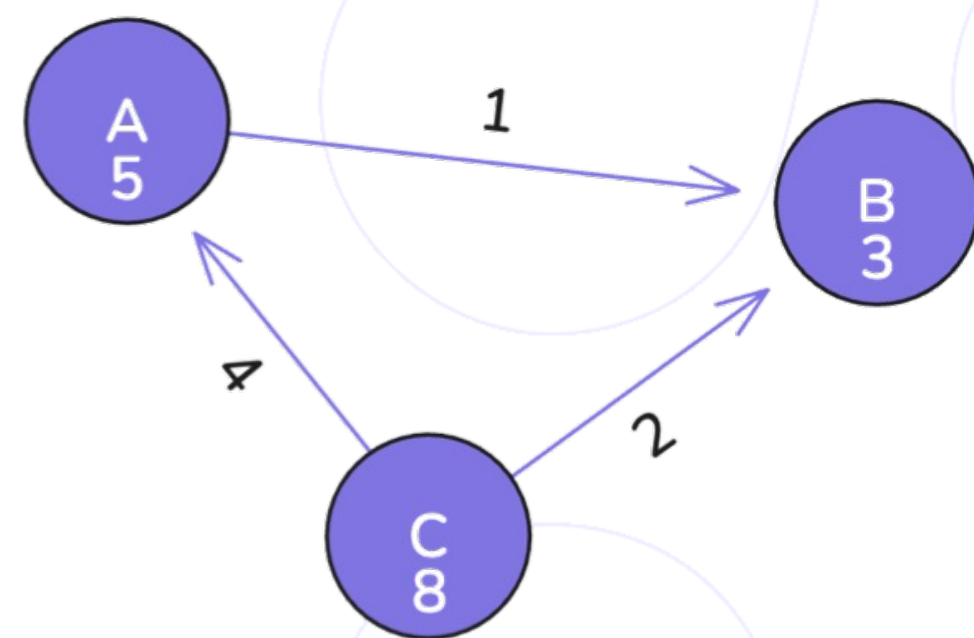
+ Creation and updating of classes based on free attributes

```
{
  "node__properties__eventCategory": {
    "Abnormal or Unplanned": "Abnormal or Unplanned",
    "Anchor Drag": "Anchor Drag",
    "Assessment": "Assessment",
    "Assignment": "Assignment",
    "Authorization": "Authorization",
    "Blowout; no fire": "Blowout; no fire",
    "Bodily Injury": "Bodily Injury",
    "Burglary": "Burglary",
    "Bush Fire": "Bush Fire",
    ...
  }
}
```

# 4. Business applications

## Pricing

- + Estimate average cost/occurrence using Markov techniques
- + If NA, set up a clustering system

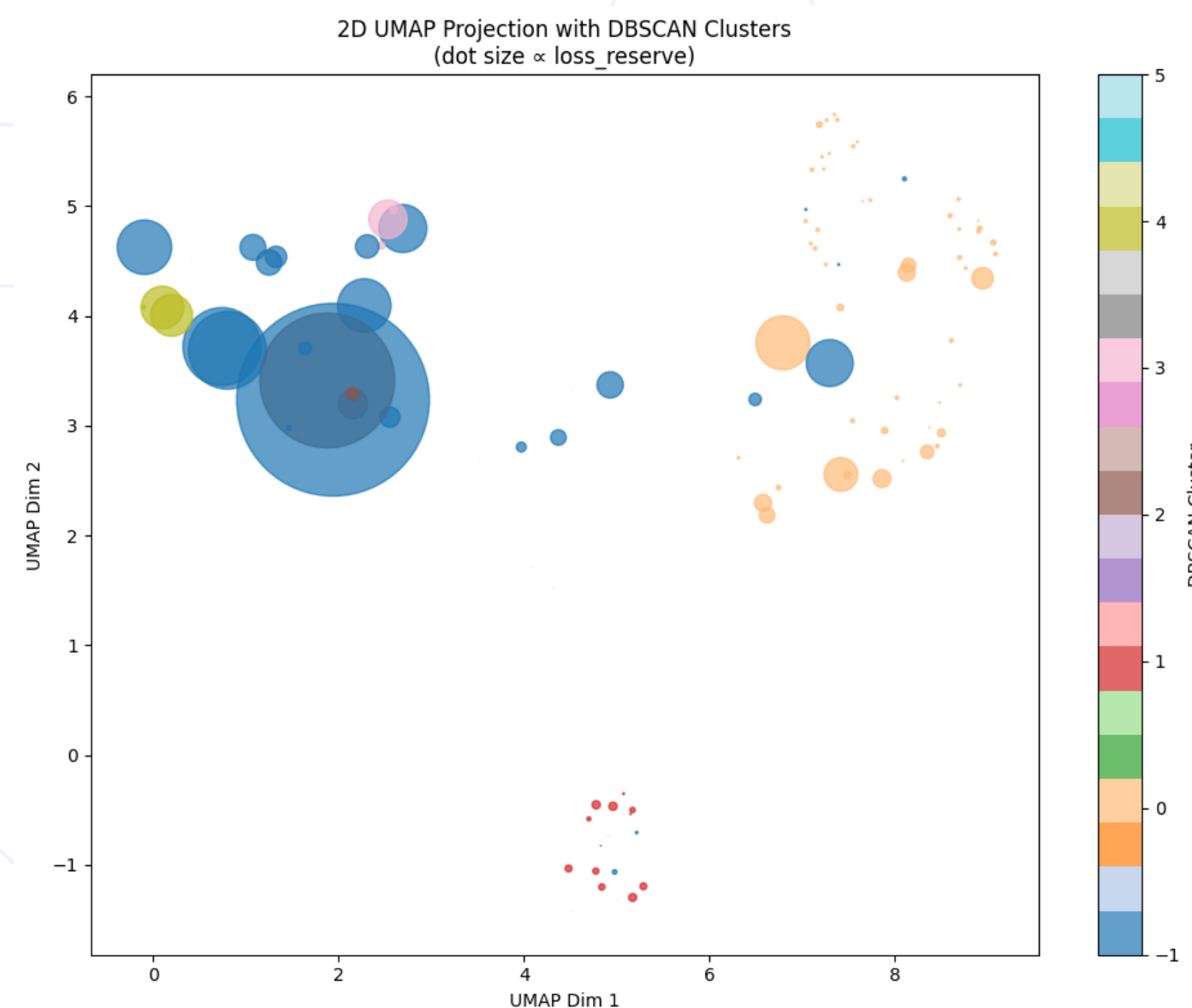


$$M_{i \rightarrow j} = \begin{pmatrix} & A & B & C & \emptyset \\ A & 0 & \frac{1}{5} & 0 & \frac{4}{5} \\ B & 0 & 0 & 0 & 1 \\ C & \frac{4}{8} = \frac{1}{2} & \frac{2}{8} = \frac{1}{4} & 0 & \frac{2}{8} = \frac{1}{4} \\ \emptyset & \frac{1}{9} & 0 & \frac{8}{9} & 0 \end{pmatrix}$$

Figure: exemple de matrice de proba de passage

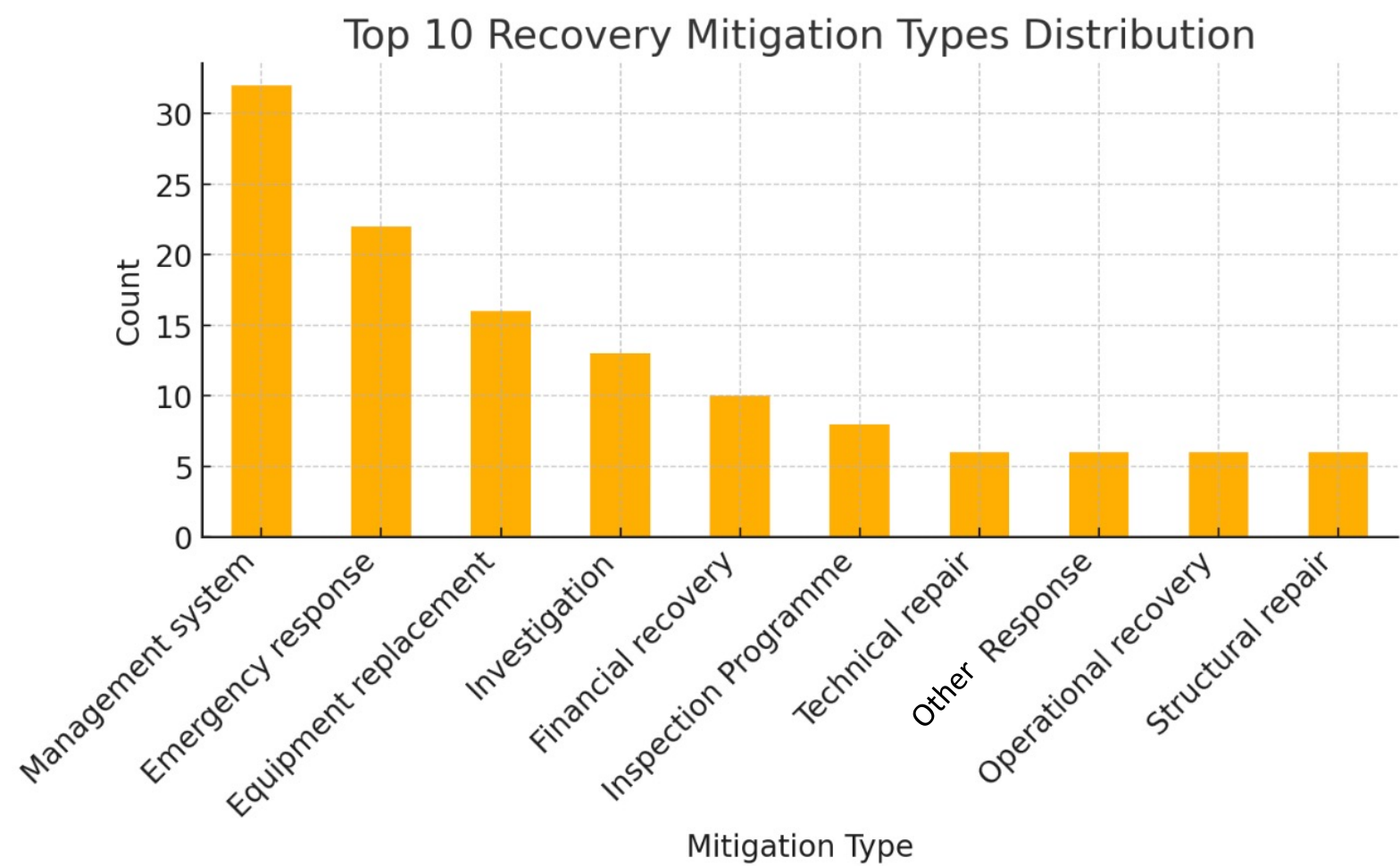
## Reserving

- + Suggest other segmentations
- + Identify developments losses
- + Assess impacts of changes in DAG
- + Identify causes leading to no costs



## Prevention

- + Observe common root causes, deduce preventive actions
- + Identify secondary causes or consequences to limit transmission
- + Suggest methods to minimise costs in the long term





# Thank you for your attention



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