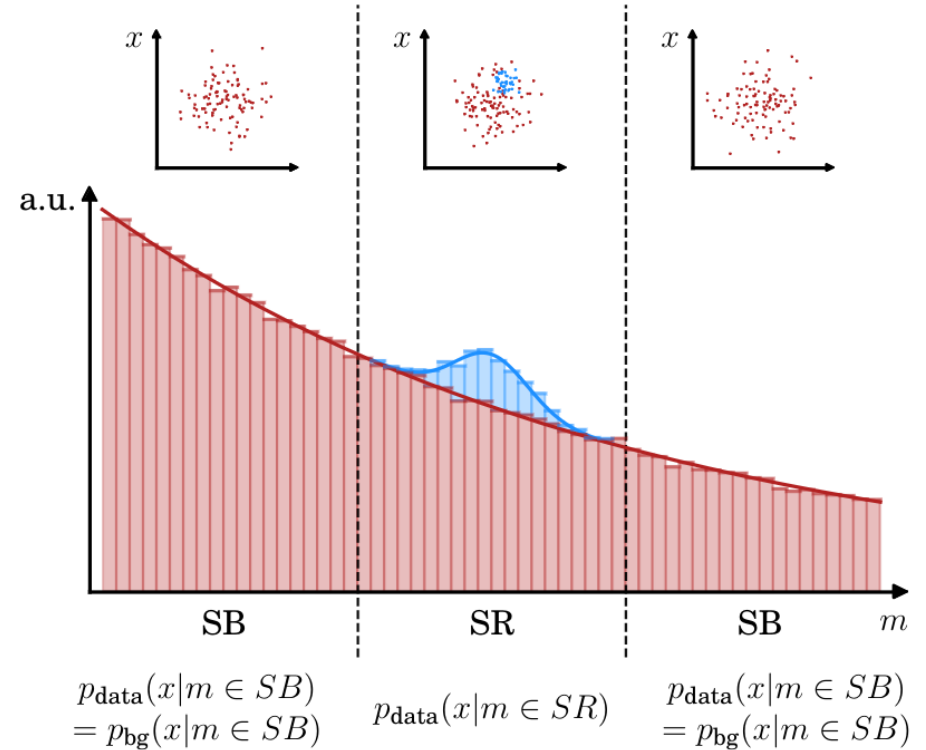


Anomaly Detection using CATHODE

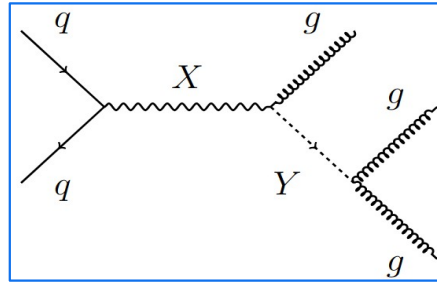
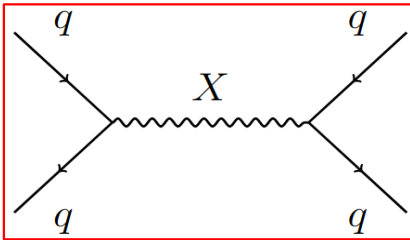
- New physics may not follow any existing signal model
- Model-agnostic, resonant anomaly detection helps uncover local excesses with minimal assumptions
- CATHODE learns the background from sidebands using a conditional model
- Compares background and data and flag signal-like deviations



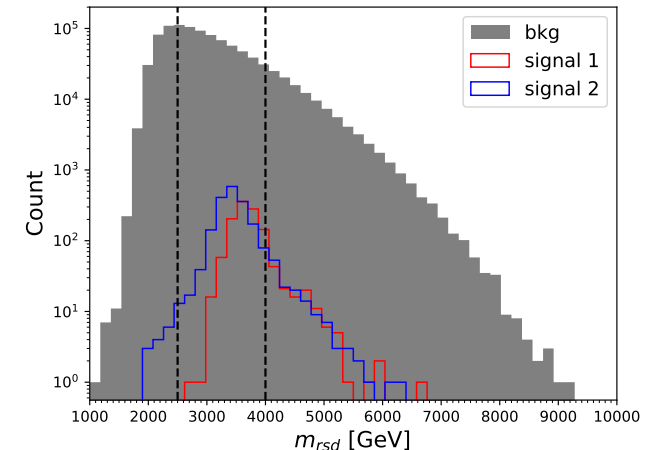
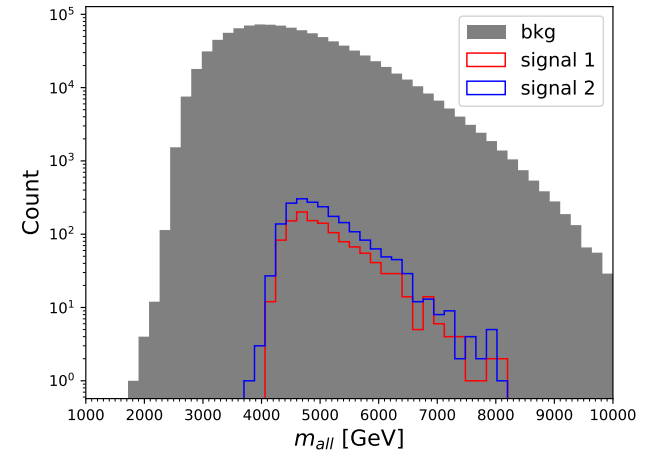
Upgrades:

Generalizing to Signal Topologies

- CATHODE was originally applied to dijet signals
- We now test signals with two decay modes:



- Standard invariant mass yields broad signal peaks
 - Recursive soft drop mass gives narrower peaks
- **Allows definition of tight signal region**



Upgrades: Improving the Generative Model

- CATHODE's performance depends on how well background is modelled
- Replaced normalizing flow with conditional flow matching
- Flow matching reproduces data distributions more accurately

→ Better sensitivity to rare signals

