

# A comparison of geometric and exact match coincidence in gravitational wave searches from binary black holes

[\[https://dcc.ligo.org/P1600224\]](https://dcc.ligo.org/P1600224)

Gurudatt Gaur, Anand Sengupta, P. Ajith

# Background

- Coincidence is an important stage in a CBC pipeline.
  - Triggers from network of detectors are compared to find the consistent candidates.
  - Coincidence analysis potentially reduces the background rate.
- Geometric Coincidence:
  - Single IFO triggers are modeled as error ellipsoids with the help of a **metric**.
  - Coincidence is determined by checking overlap of ellipsoids.
  - Coincidence window, by definition, is parameter space dependent.

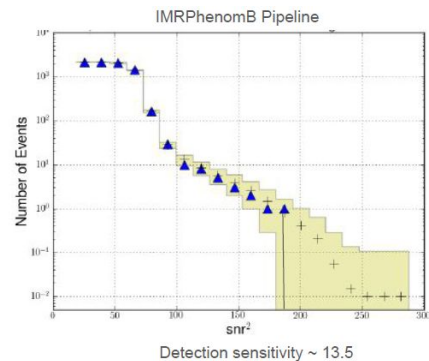
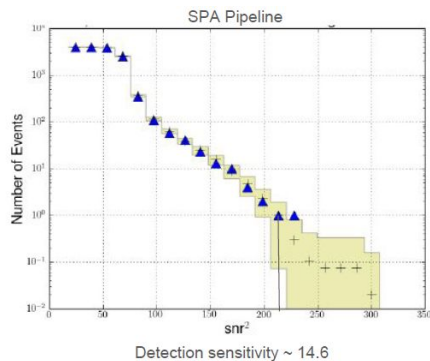
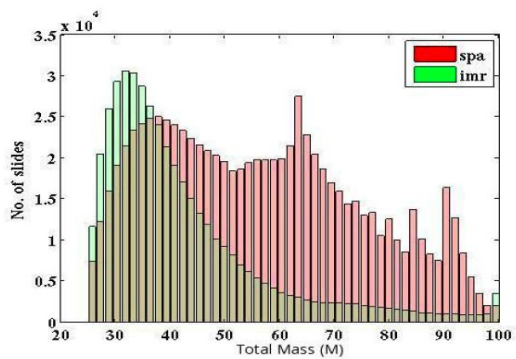
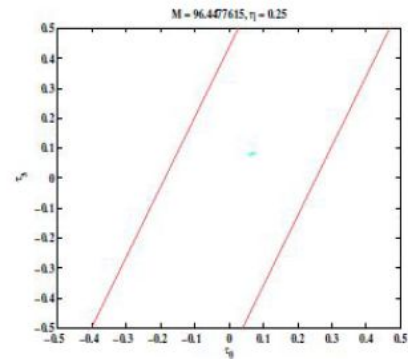
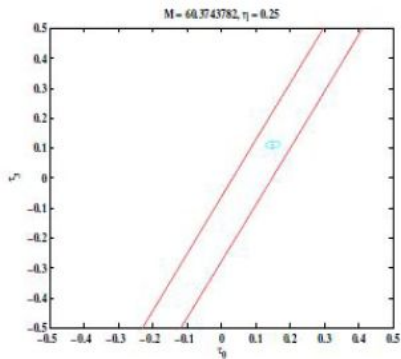
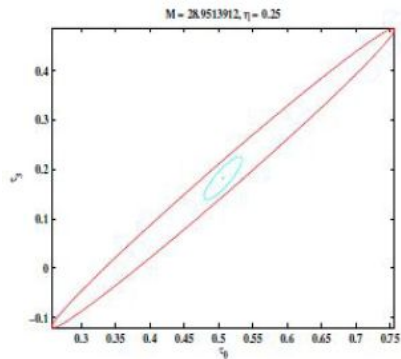
$$\mathcal{E}(\mathbf{p}_A, \bar{g}) = \{\mathbf{p}_A \in \mathcal{S}_n | (\mathbf{p}_A - \mathbf{q}_A)^T \bar{g} (\mathbf{p}_A - \mathbf{q}_A) \leq 1\},$$

Ellipsoidal region around trigger  $\mathbf{q}_A$

$$\bar{g}_{\alpha\beta} = \mu^2 g_{\alpha\beta},$$

Shape Matrix      Numerical Scaling Factor / E-thinca parameter

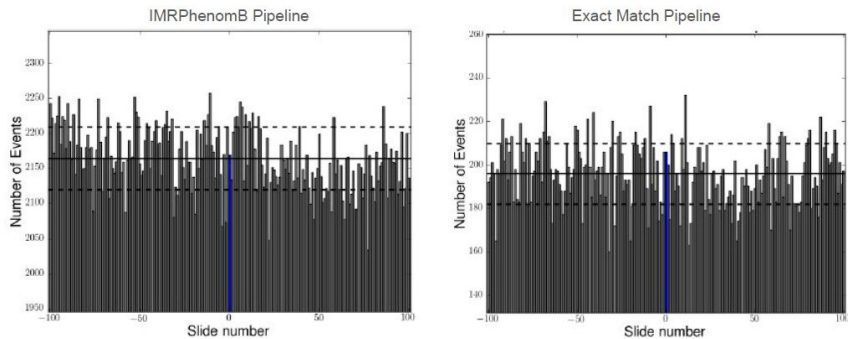
# Use IMRPhenomB metric for Geometric Coincidence



# Comparison with Exact Match Coincidence

- Exact match has been used in recent searches.
- Demands the parameters of the triggers to be exactly same.
- Time window: as there is time-of-flight difference between the detectors.

About an order of magnitude less background in Exact Match pipeline.



Exact Match pipeline is about 100% more sensitive.

