

Template Bank for binary detection

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Introduction:

What we have (In literature as well as in LAL library):

- 1- Several families of templates(PN, Pade, EOB, BCV...)to mimic real GW signal
- 2- Bank of templates based on SPA
- 3- Pipelines based on matched filtering using items 1 and 2

Problem:

Choice of the template family ? Which one is the “best” one ?

Solution:

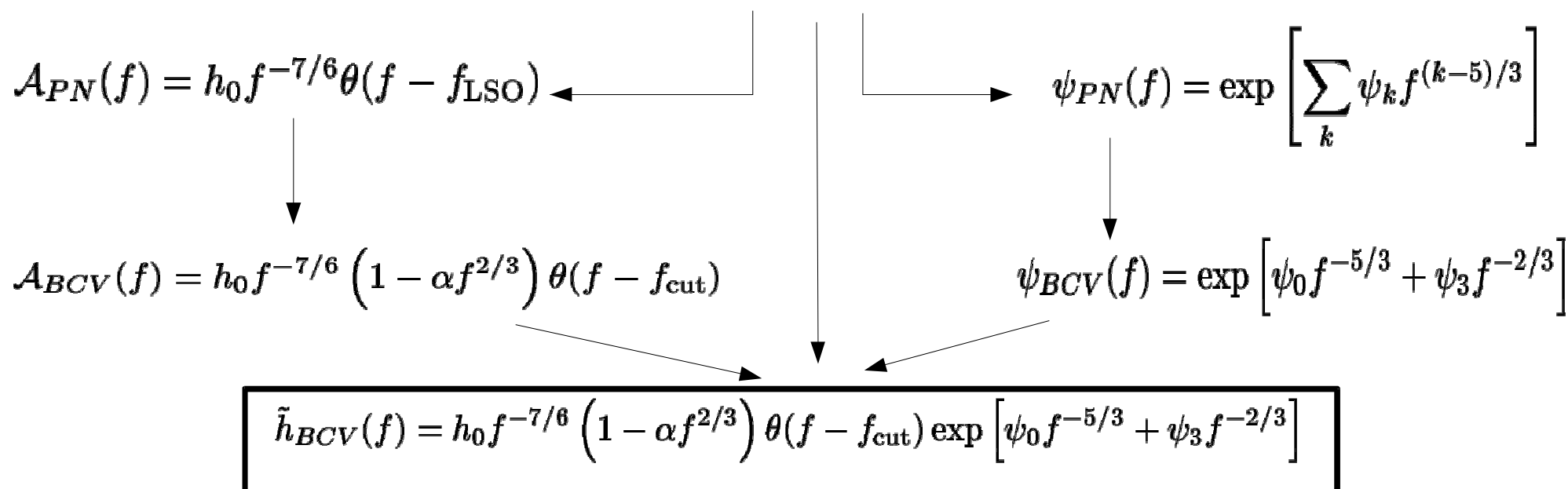
A new family able to catch the others one (like BCV template)?

LALBCV Waveform
in inspiral package

The BCV template

(Buonanno, Chen and Valisneri, Phys Rev D 67)

$$\tilde{h}_{PN}(f) = \mathcal{A}(f)e^{i\psi(f)}$$



Waveform with 4 parameters:

$$\psi_0 = \frac{3.}{128.\eta} \cdot (M\pi)^{-5./3.}$$

$$\psi_3 = \frac{3.}{128.\eta} \cdot 16\pi(M\pi)^{-2./3.}$$

Mass parameters

α — Amplitude correction in [0-1]

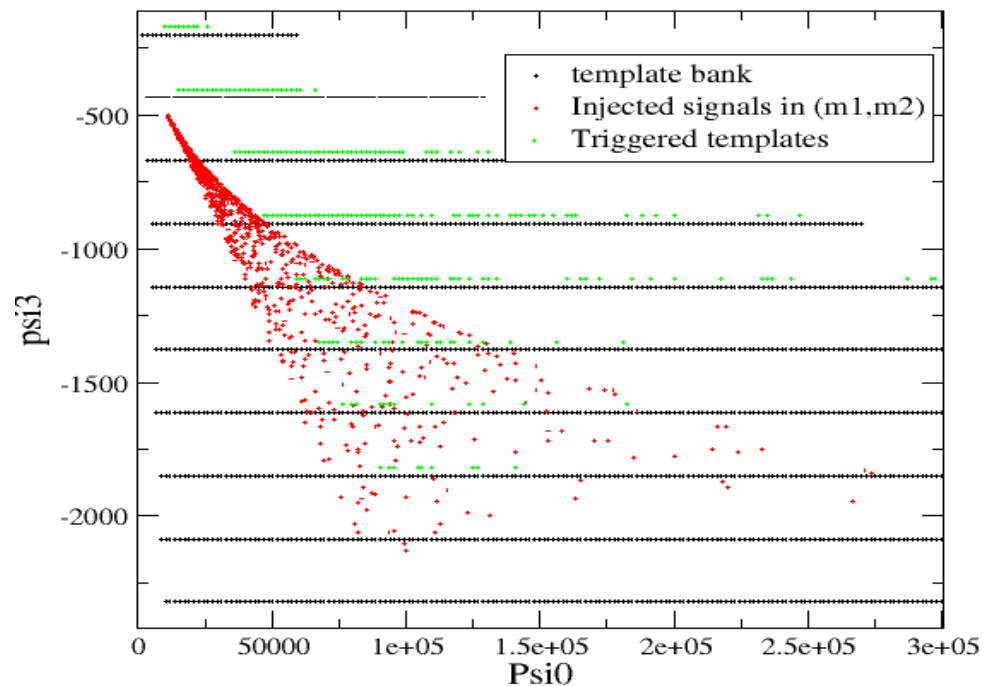
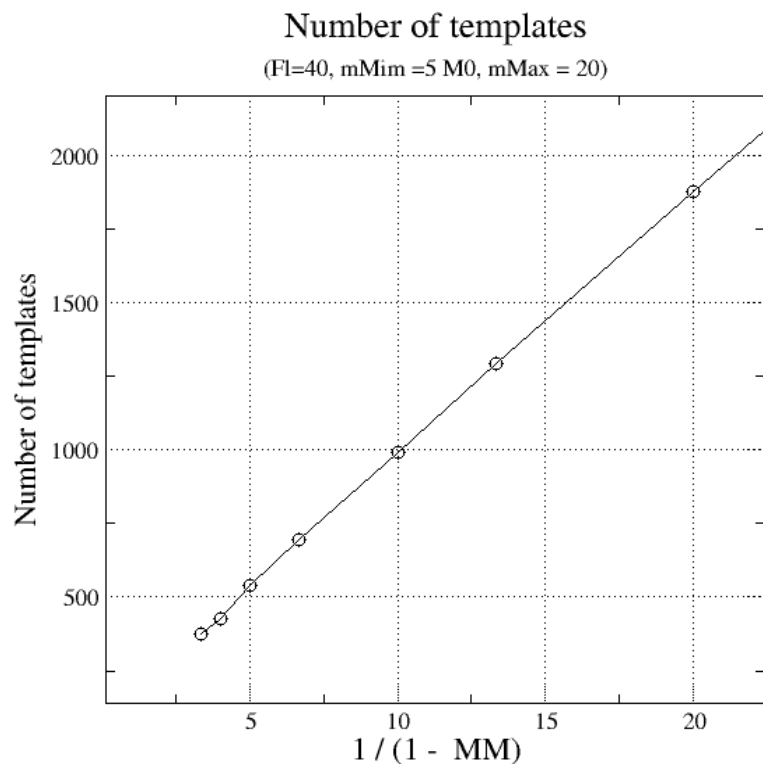
Fcut depending on the total mass of the system

BCV leads to a flat metric useful to compute a regular bank of templates

LALInspiralComputeMetric
in bank package

LALInspiralCreateCoarseBank
in bank package

Bank placement in LALInspiralCreateBank:
SPA as well as BCV bank are available now



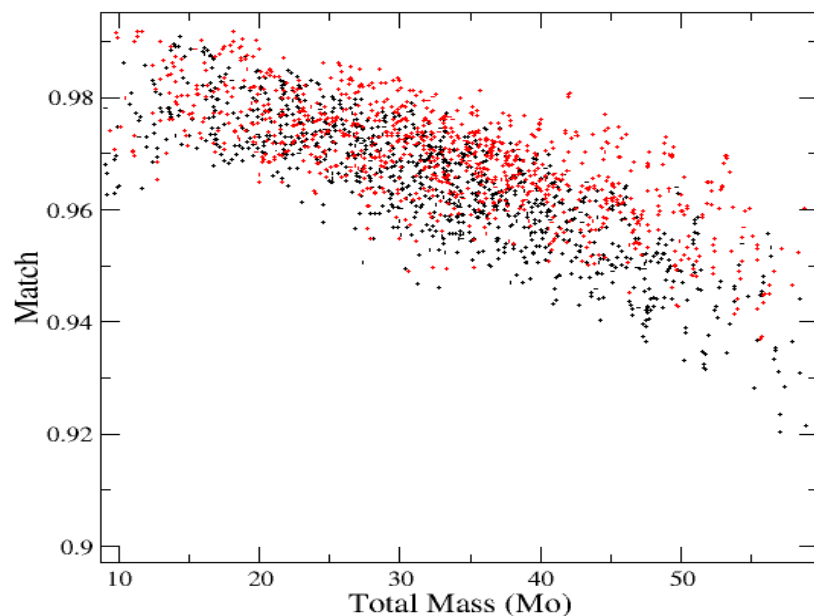
BankEfficiency
in lalapps/findchirp

Preliminary results on Bank Efficiency

Bank = BCV (MM=95%), template = BCV with $\alpha = 0$, and $F_{cut}(M)$ in [6GM-2GM]

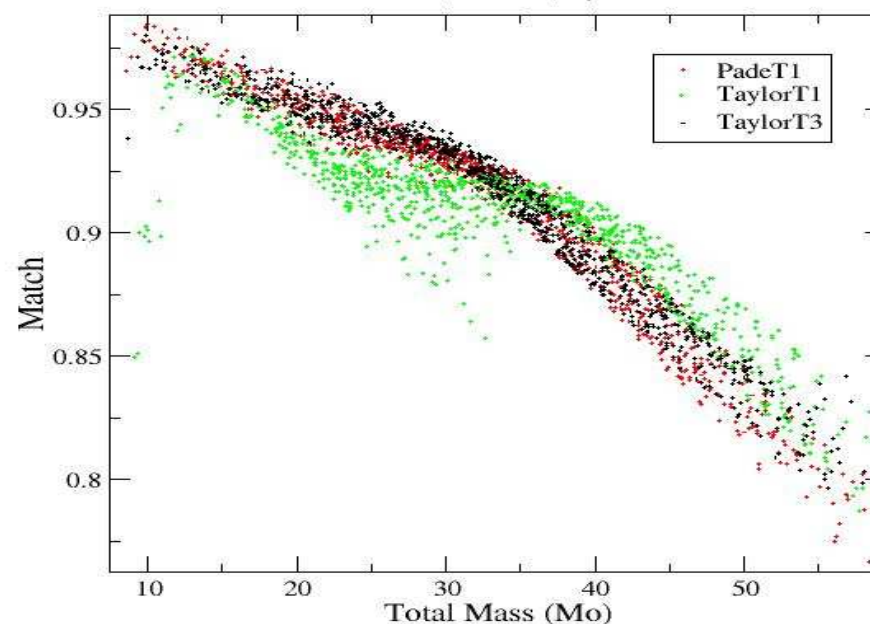
EOB signal and BCV bank

MM = 95%, $F_l=40\text{Hz}$, $\alpha = 0$



PN signal vs BCV bank

MM=95%, $F_l=40\text{Hz}$, $\alpha = 0$



Conclusions and future:

1 -What we have right now:

- Waveforms such as Taylor, Pade, EOB, BCV
- Bank generation for SPA and BCV template
- Code to test Efficiency of the banks with MonteCarlo simulations
- BCV bank already match EOB waveforms

2- What is needed

- alpha maximization of BCV template
- optimization with respect to F_{cut}

3- What we're going to do

- Carry on Bank efficiency test
- Test the Bank efficiency with real data