Empirical Multi wavelength prediction method for Very High Energy Gamma-ray emitting BL Lacs

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Abstract:

We present the most up-to-date and complete multi-wavelength correlation analysis on luminosity properties of TeV BL Lacs. Correlation function (power law or linear) parameters are calculated based on linear regression method (Figure 2). Using the lower energy luminosities of a sample of 182 non-TeV BL Lacs and the generated functions, minimum level of VHE gamma-ray emission was calculated for each non-TeV BL Lacs. This multi wavelength prediction method gives us a list of best candidates to be observed with current generation of Imaging Air Cherenkov Telescopes.

Method:

• Radio (4.85 GHz), Optical (R-band), X-ray (2-10 keV) and Gamma-ray (1-100 GeV) data are collected from literature and databases for TeV (#53) and non-TeV (#182) BL Lacs.

• VHE gamma-ray flux (>200GeV) are collected for TeV sample by dividing this sample to multiple (Group A) and single detected (Group B).

• Five VHE gamma-ray data sets are formed based on different states of group A (high state and low state), group B and combination of group B with each state of group A.

• Figure 1 shows the distribution of TeV sample in different L-L planes.

• Figure 2 illustrates the approach to check the existence of correlation and calculating the best fitted model parameters.

• The lower energy band luminosities of non-TeV BL Lacs are used as variable input for the prediction functions.

• At least 4 levels of VHE gamma-ray luminosity are calculated for each non-TeV BL Lac.

• The non-TeV BL Lacs with highest predicted VHE gamma-ray flux are selected as the promising TeV candidates.

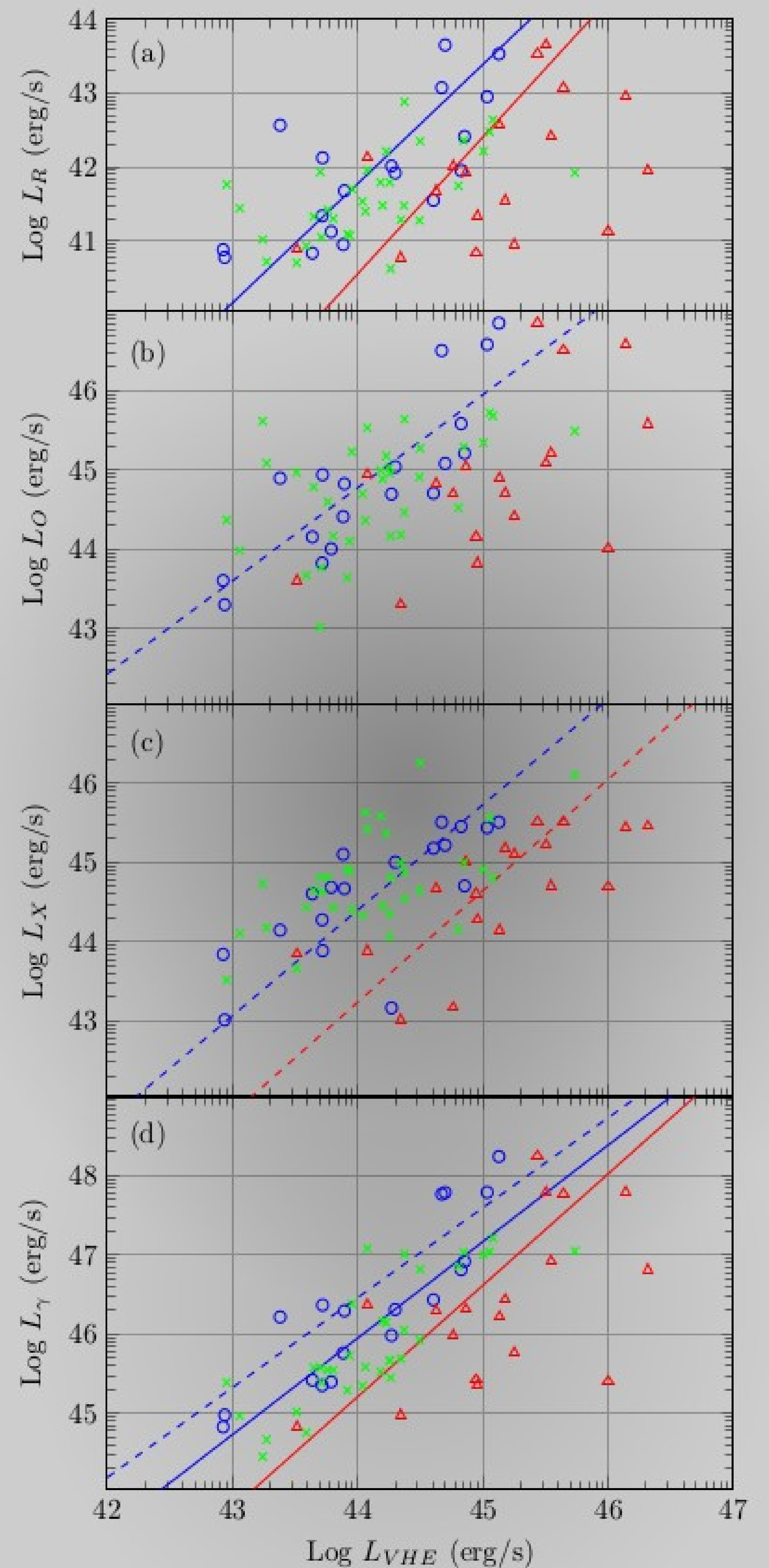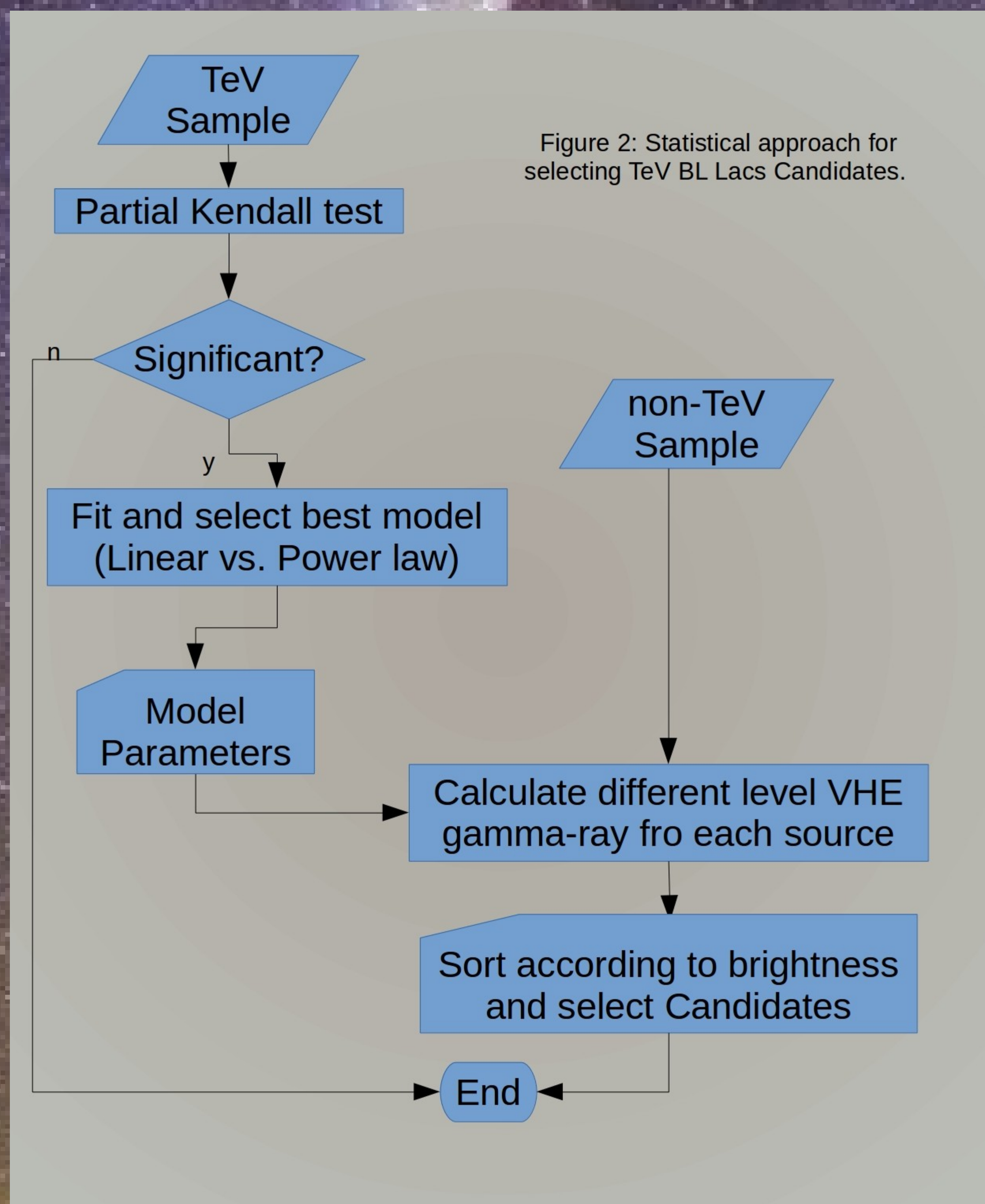Figure 2: Statistical approach for selecting TeV BL Lacs Candidates.

Figure 1: Luminosity in the VHE γ-ray band versus the luminosity in radio (a), optical (b), X-ray (c) and γ-ray (d) bands. The different symbols represent the data of different groups (see text): Low state group A (circle), High state group A (triangle) and Group B (cross). The correlation functions of the different groups are shown with Low state group A (blue dashed line), High state group A (red dashed line) and Group B (green dashed line), the solid lines represent the correlation functions of the combined data sets.

Results:

• There are 8 significant correlations between lower energy bands and TeV band.

• All the significant correlations can be described better with power law model.

• X-ray is the only band which shows correlation to the high state of TeV band.

Candidates:

Source name	F(>200GeV) [Ph/cm²/s]	z
PMN J0444-6014	5.40E-12	0.097
3C 371	5.29E-12	0.046
B2 1811+31	4.96E-12	0.117
1RXS J195815.6-301119	3.33E-12	0.119
1H 1914-194	3.04E-12	0.137
PKS 0829+046	2.98E-12	0.174

Preliminary

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