EXTRAGALACTIC POINT SOURCE DETECTION IN WMAP-7yr DATA AT 61 AND 94 GHz.

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SUMMARY

- Introduction
- Method
- Results

INTRODUCTION

The observation of the Cosmic Microwave Background (CMB) provides us very useful information about the origin of the Universe.

But the observation of this radiation is not easy because another radiations are detected simultaneously.

There are several techniques that are able to separate the different components.

GALACTIC EMISSIONS
- Synchrotron
- Free-free emision
- Dust
- ...

EXTRAGALACTIC EMISSIONS
- Sunyaev-Zel'dovich
- Point sources
- ...

INTRODUCTION

We use a method that has been tested with simulations: the matched multifilter, MMF (Herranz et al., 2002, MNRAS, 336, 1057; Lanz et al., 2010, MNRAS, 403, 2120), to filter WMAP-7yr images at 61 and 94 GHz and therefore to reduce the deteccion flux density threshold of the point sources.

MMF takes into account in **a simultaneous way** the statistics information of the noise (every signal that is not a point source) and the spectral behaviour of the sources, but without any a priori assumption about it.

METHOD

Let us suppose a set of images that correspond to the same sky region at N different frequencies:

$$y_\nu(\mathbf{x}) = f_\nu s_\nu(\mathbf{x}) + n_\nu(\mathbf{x})$$

where: $s_\nu(\mathbf{x}) = A\tau_\nu(\mathbf{x})$, and n is a homogeneous and isotropic random field with mean value equal to zero and cross-power spectrum: $\langle n_\nu(\mathbf{q}) n^*_{\nu'}(\mathbf{q}') \rangle = P_{\nu\nu'}\delta^2_D(\mathbf{q}-\mathbf{q}')$.

METHOD

Let us define a set of N linear filters ψ_ν applied to the data:

$$w_\nu(\mathbf{b}) = \int d\mathbf{x}\, y_\nu(\mathbf{x})\psi_\nu(\mathbf{x};\mathbf{b})$$

where ***b*** is a translation. Total filtered field is:

$$w(\mathbf{b}) = \sum_\nu w_\nu(\mathbf{b})$$

This total filtered field is obtained as the result of **filtering** and **fusioning**.

METHOD

Conditions to be satisfied by the MMF:

- Minimum variance of the total filtered field.
- The value of the total filtered field in the position of the source is equal to the amplitude of the source (before filtering).

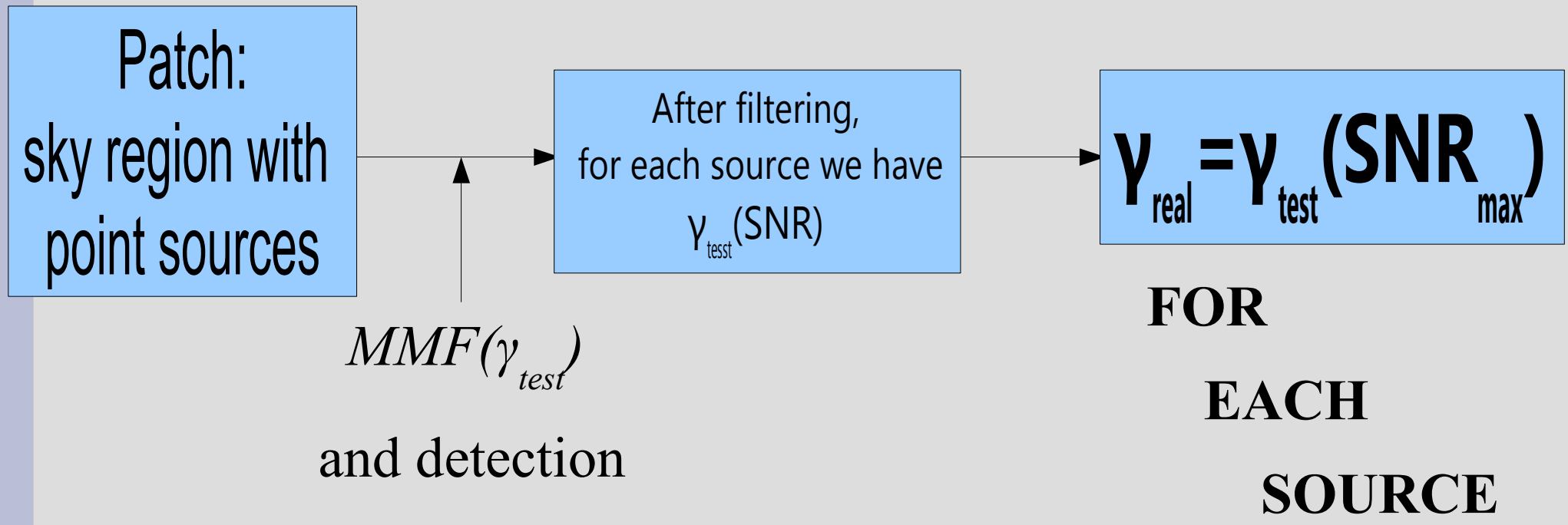
$$\boldsymbol{\Psi}(q) = \alpha\, \mathbf{P}^{-1}\, \mathbf{F}$$

$\mathbf{F}=[f_\nu \tau_\nu]$

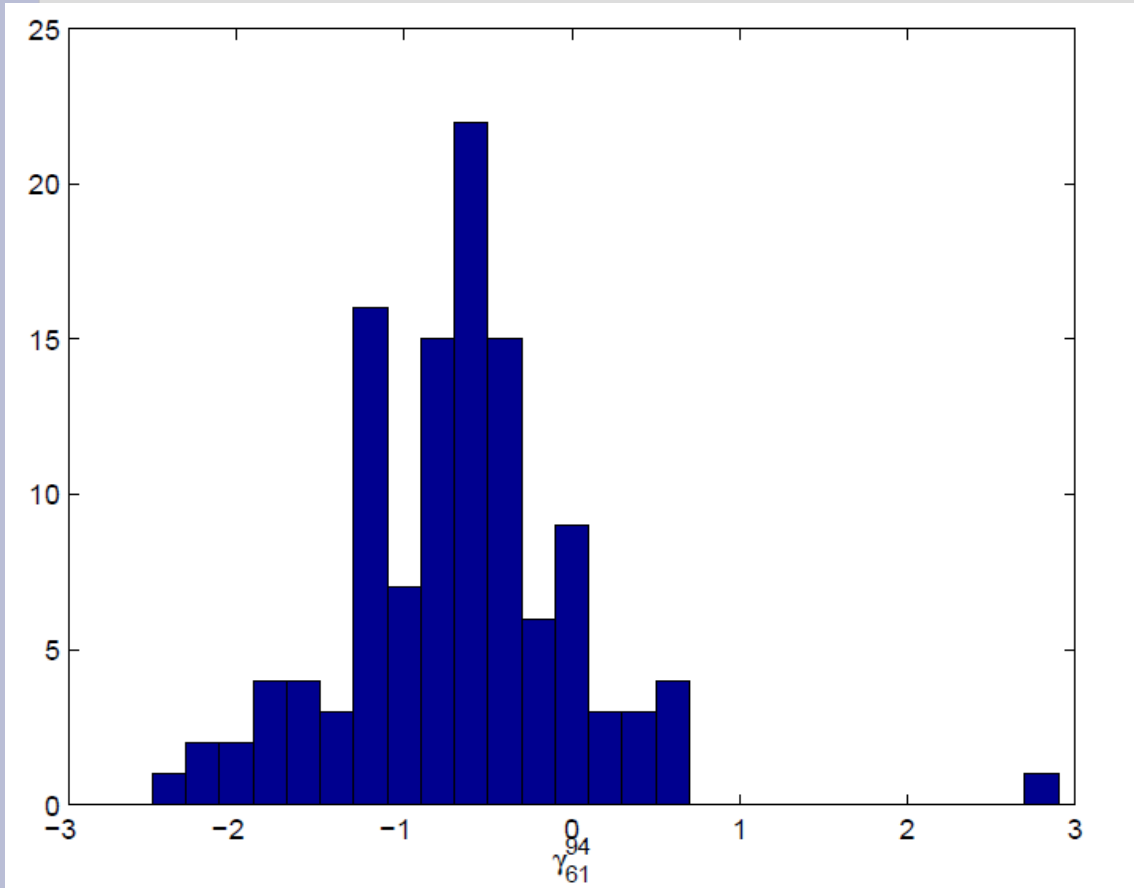
spectral index

$$I = I_o \left(\frac{\nu}{\nu_0} \right)^{-\gamma}$$

METHOD

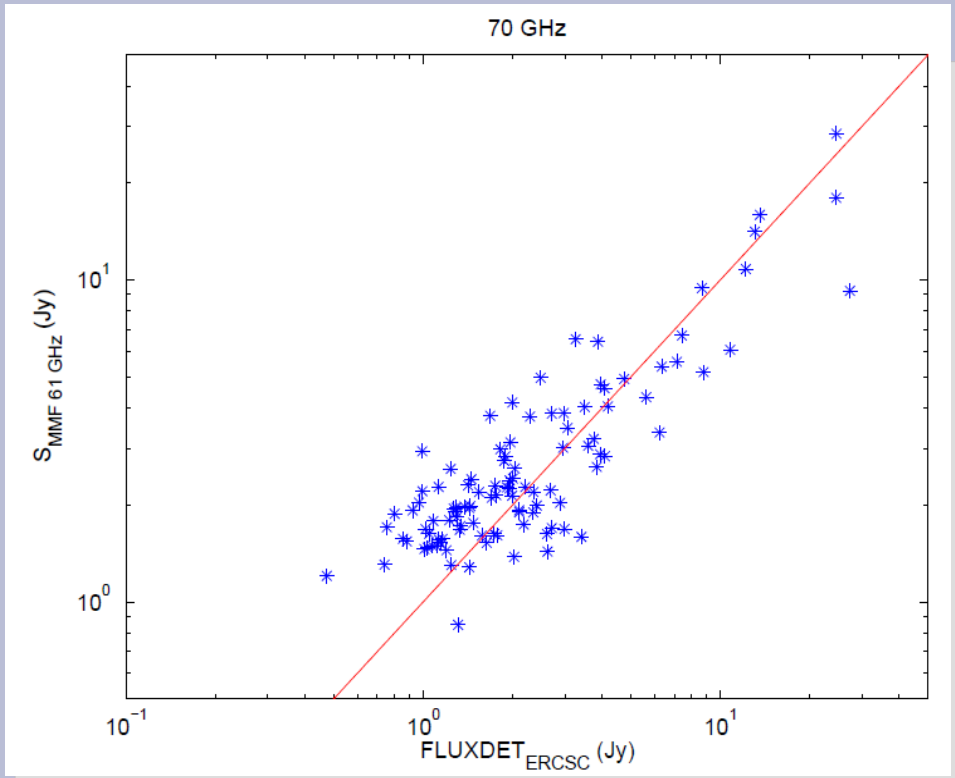

Patch:
sky region with
point sources
After filtering,
for each source we have
γ_{tesst}(SNR)
$\gamma_{real} = \gamma_{test}(SNR_{max})$
$MMF(\gamma_{test})$
and detection
FOR
EACH
SOURCE

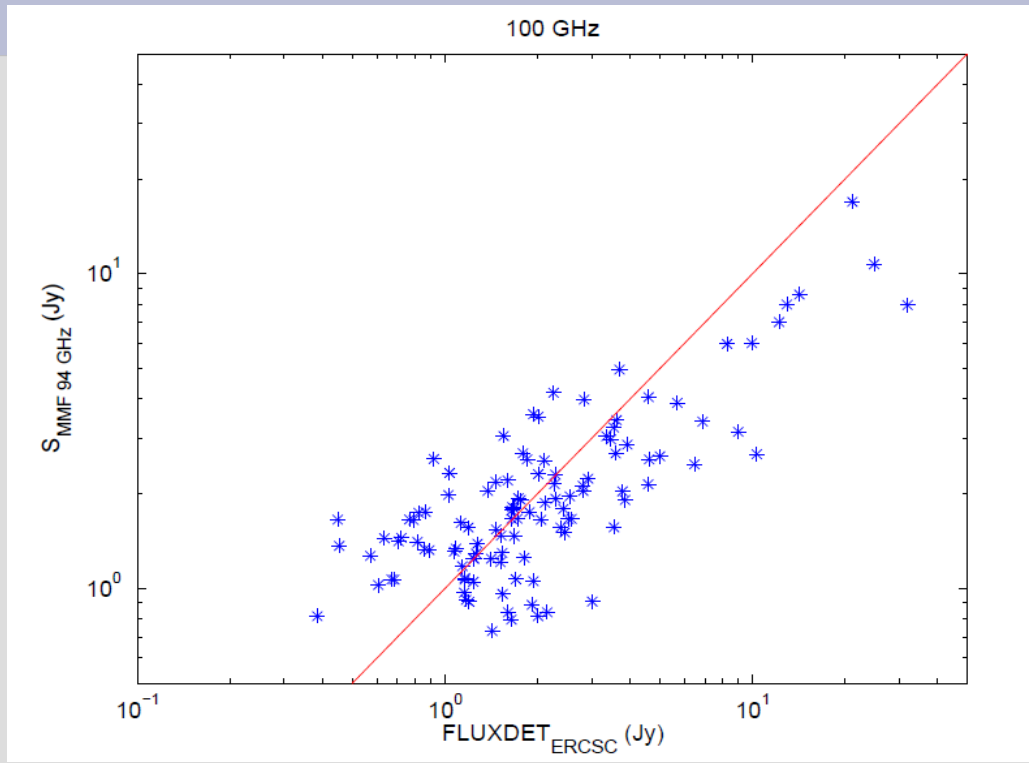
RESULTS



The median value of the spectral index is equal to -0.65, with a dispersion equal to 0.71, confirming the *steepening* trend above ~70 GHz (Sadler et al., 2008, MNRAS, 385, 1656; Marriage et al., arXiv:1007.52256; Massardi et al, 2010, MNRAS, 404, 352; Planck Collaboration, 2011, A&A, 536, A13).

RESULTS

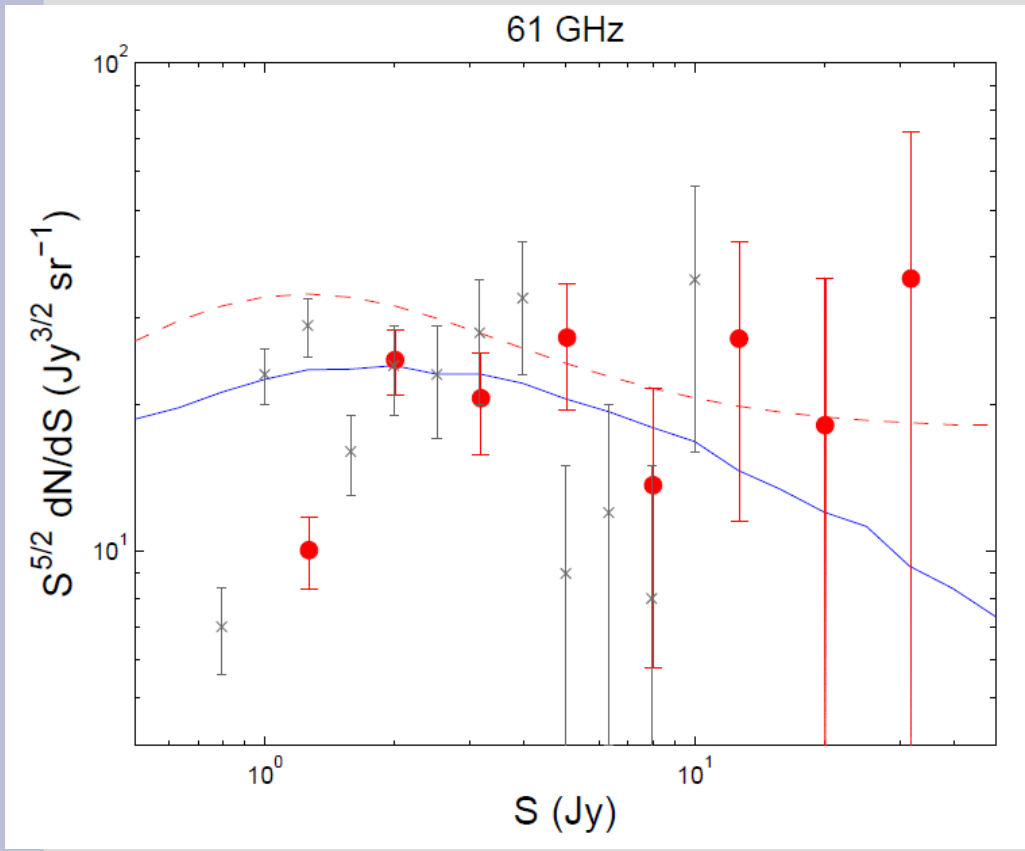


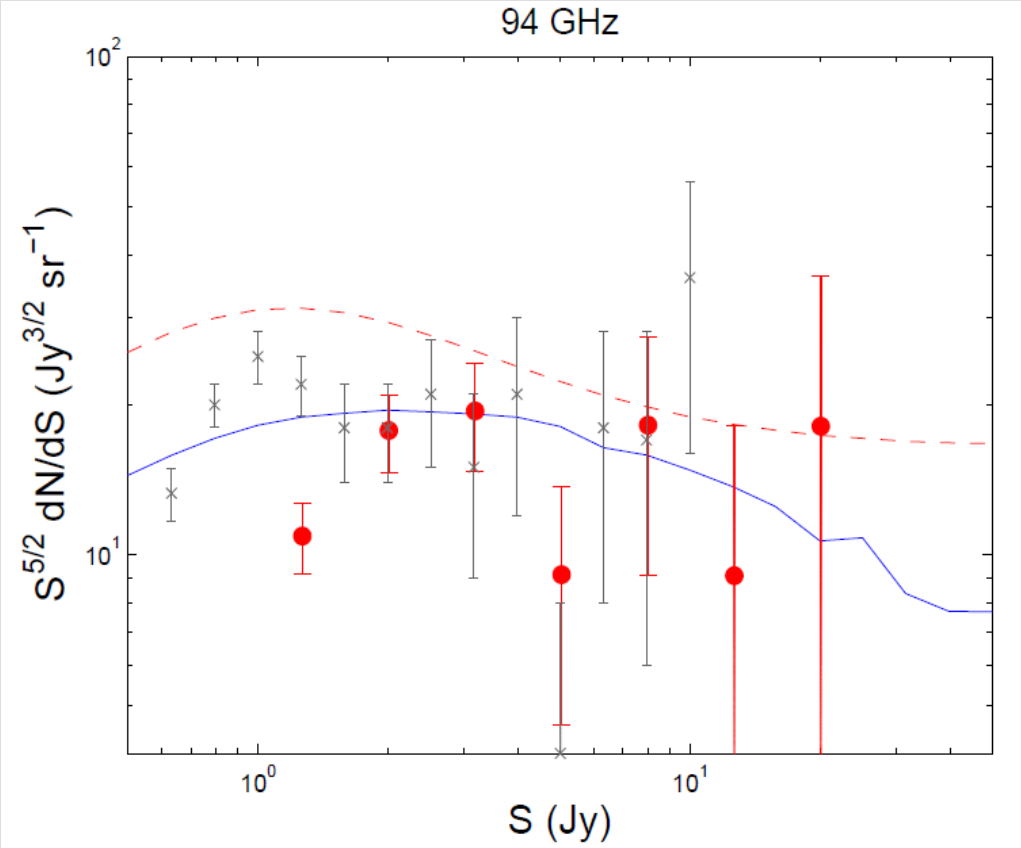


-119 extragalactic objects detected with the MMF by using the WMAP-7yr data.

- 22 detections at 94 GHz in NEWPS-3yr (Massardi et al., 2009, MNRAS, 392, 733) in a blind catalogue.

RESULTS


61 GHz
10^2
10^1
$S^{5/2}$ dN/dS (Jy$^{3/2}$ sr^{-1})
10^0
10^1
S (Jy)


94 GHz
10^2
10^1
$S^{5/2}$ dN/dS (Jy$^{3/2}$ sr^{-1})
10^0
10^1
S (Jy)

THANK YOU VERY MUCH
FOR YOUR ATTENTION!