

P
L
A
N
C
K

Dark Ages

Recombination

Inflation

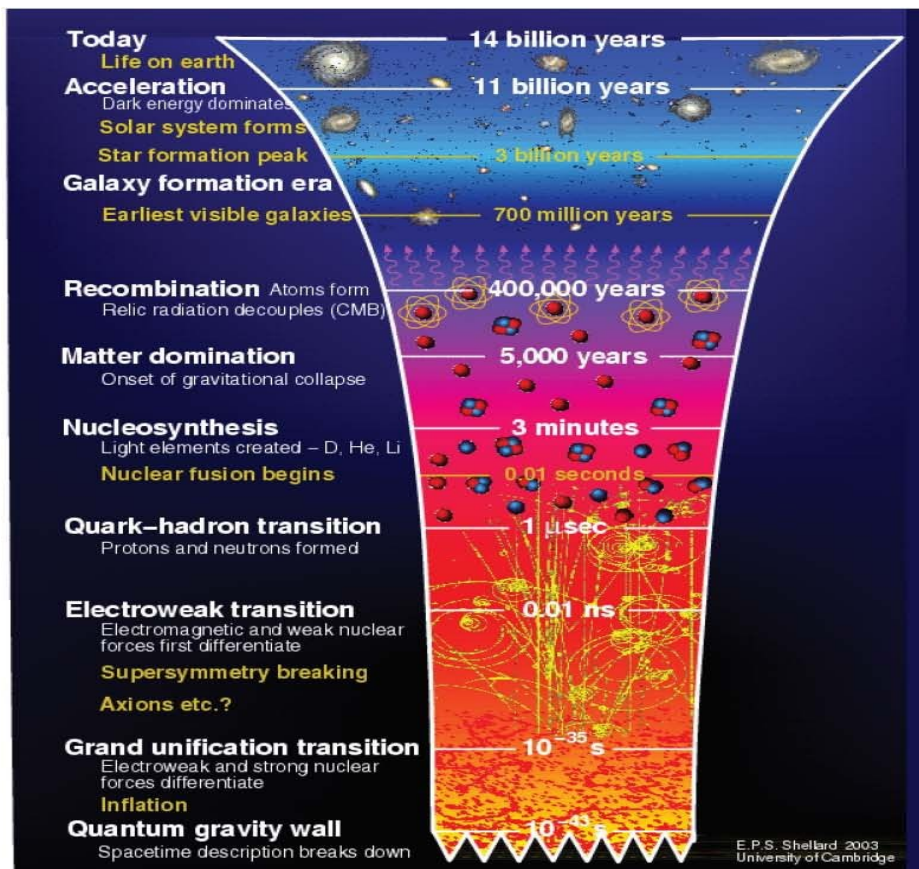
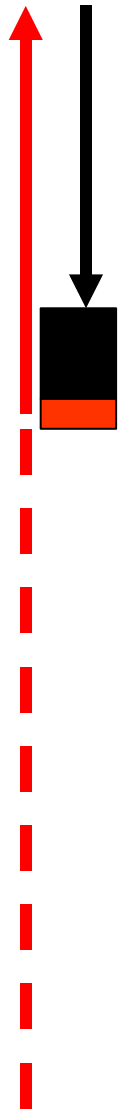


FIG 2.20.—Schematic diagram of the history of the Universe from the Planck time to the present.

- such as the fine structure constant α , vary with time? Are there deviations from the usual Friedmann equations as predicted in some brane-world scenarios?
- What is the physics behind inflation? Are the initial perturbations purely adiabatic, or are there isocurvature perturbations as well? Are cosmic defects produced at the end of inflation? Can inflation be realised in string theory? Is inflation eternal?
 - Are there signatures of physics at the Planck scale or beyond imprinted on the fluctuation spectra?
 - How did the Universe begin? Can string theory resolve the problem of the initial Big Bang singularity? Can we probe through the Big Bang to a previous phase of the Universe's history?
 - What physics selects the vacuum solution for our Universe? String theory appears to have an



Dark Ages
Recombination

Inflation

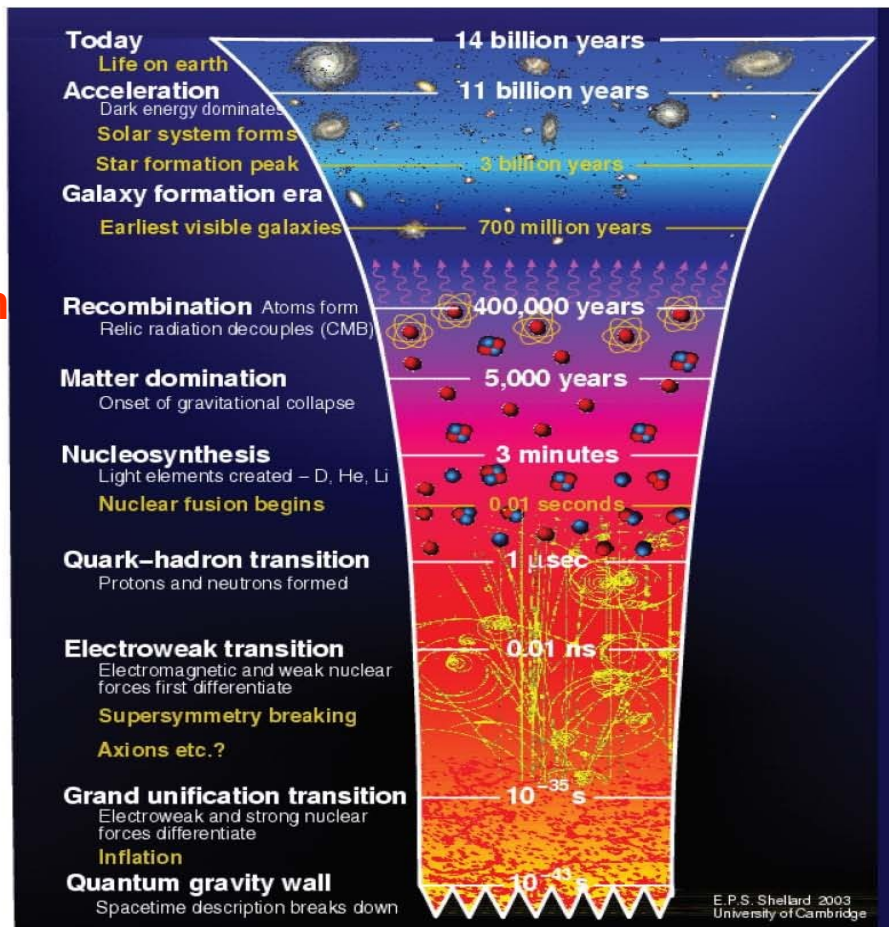
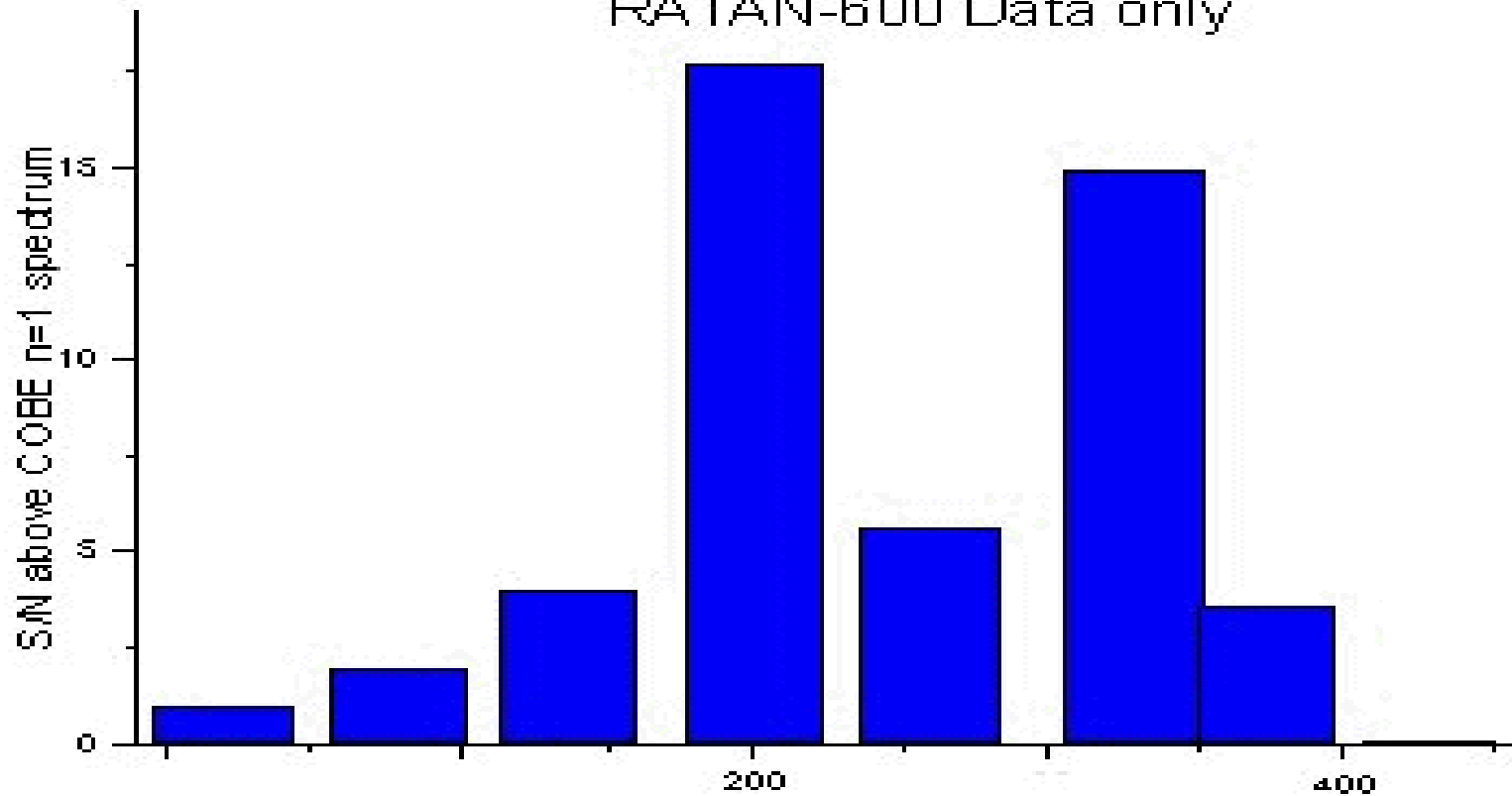


FIG 2.20.—Schematic diagram of the history of the Universe from the Planck time to the present.

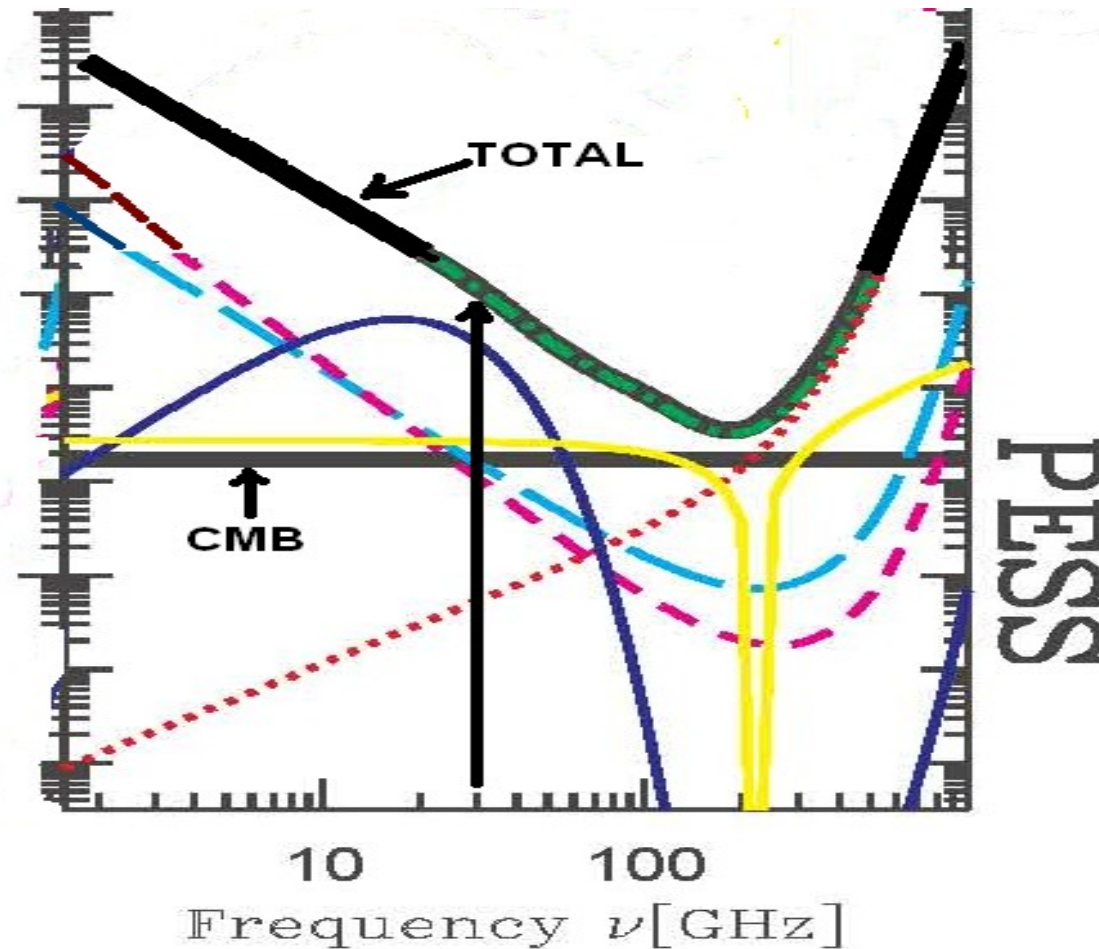
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РАТАН-600 и первые указания на градусную анизотропию СМВ, 1984

Extra Noise at "Sakharov Oscillations" Scales
RATAN-600 Data only



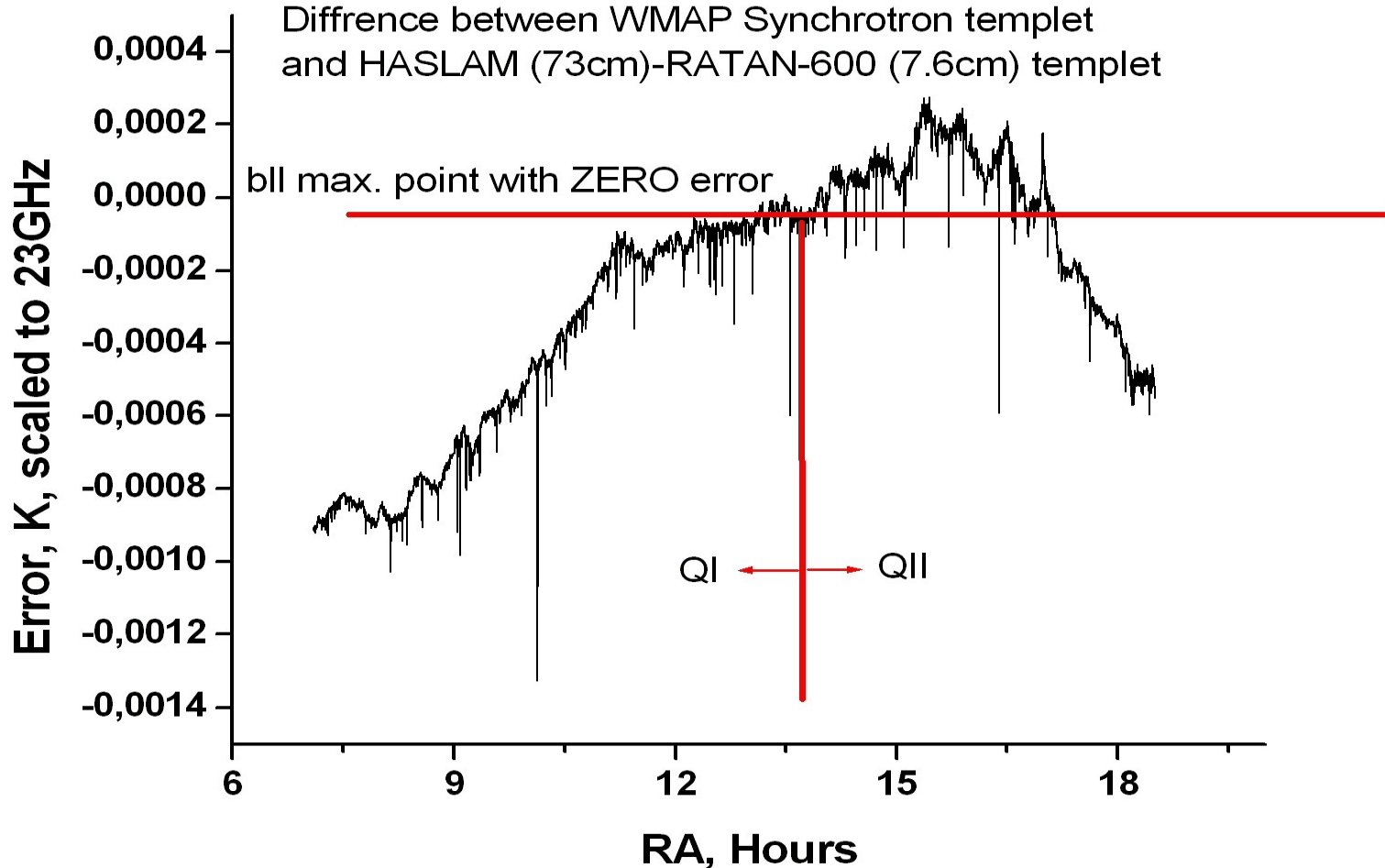
Mark Tegmark, 1999 Screens predictions



RATAN-600 and WMAP

Example of possible WMAP correction and Z reionization interpretation

RZF very deep Galaxy cut at 3C84 Dec and WMAP DATA
"Quadrant" asymmetry in Synchrotron radiation effect
Difference between WMAP Synchrotron templet
and HASLAM (73cm)-RATAN-600 (7.6cm) templet



WRONG Synchrotron and no problem with POPULATION III

Standard Cosmology

New Cosmology

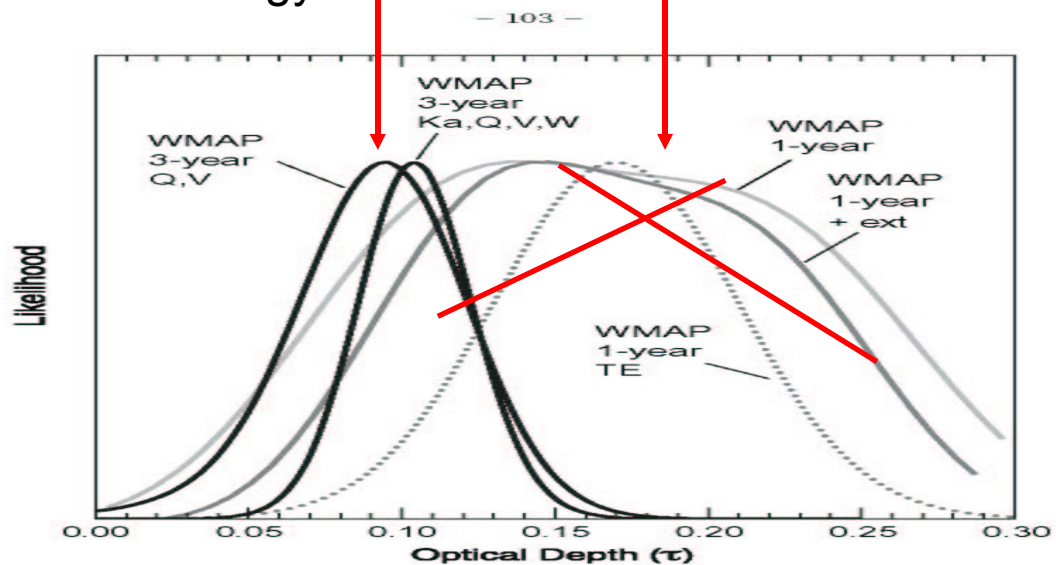


Fig. 26.— The relative likelihoods of τ from the stand alone exact likelihood code and the first-year analysis. For the three-year results, all parameters except τ and the scalar normalization, A , were held fixed as described in the text. The solid curves (labeled “WMAP 3-years”) show the exact likelihood for the QV and KaQVW combinations for the combined EE & TE data. If the K-band directions had been used for the dust polarization template (§4.3), leading to inferior cleaning, the likelihood curve would peak where the KaQVW does and have the width of the QV curve. The similarity indicates that any foreground contamination is small. The two broadest curves are from Spergel et al. (2003) and show the first-year likelihood for the WMAP data alone and for WMAP in combination with other data sets. The dotted line is τ likelihood for the first-year TE data as reported in Kogut et al. (2003). The curve has a mean of $\tau = 0.17$ and width $\sigma = 0.04$.

Новые виды мешающих экранов

- “Spinning Dust” и Поляризация
- Реликтовое магнитное поле и Деполяризация
- Шум «прото-войдов»
- Альфвеновский шум эпохи рекомбинации
- SZ- шум и CBI эксперименты
- Синхротрон между скоплениями галактик

Первая попытка уточнить SZ-шум по данным RZF обзора

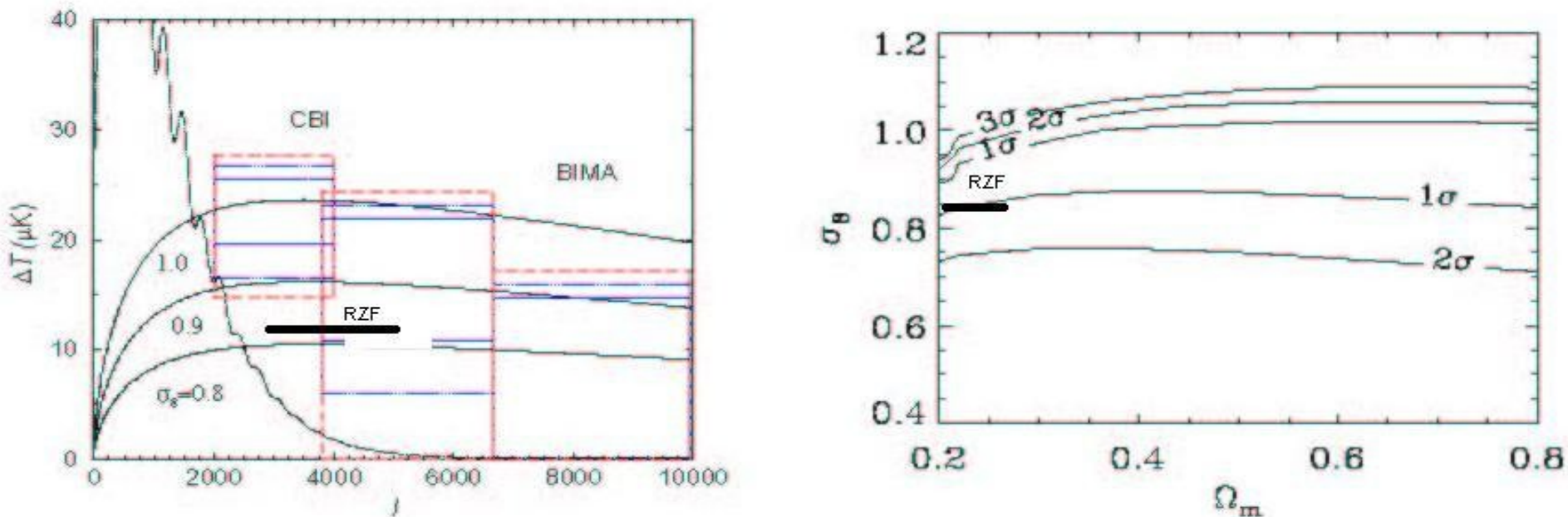


Fig. 4. – (a) Small-scale CMB anisotropies as observed by the CBI and BIMA experiments. The three solid lines show predictions for the SZ effect for varying σ_s : 1.0 (upper), 0.9 (middle), and 0.8 (lower). For reference we show the predicted CMB primary anisotropies for our fiducial model. The solid error boxes show the published Gaussian errors, while the dotted boxes include the non-Gaussian trispectrum. When comparing data to predictions, we account for the full window function of these observations. (b) Constraints on cosmological parameters. We consider constraints on Ω_m and σ_s using small-scale power and show 68%, 95%, and 99% confidence limits.

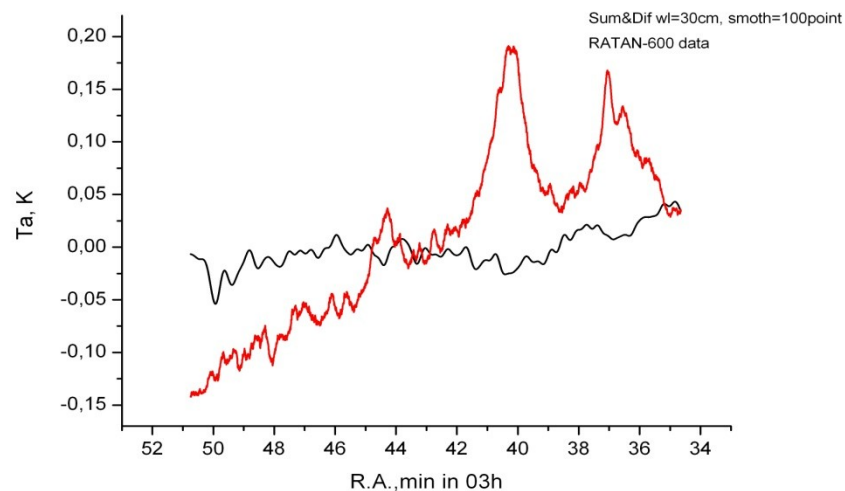
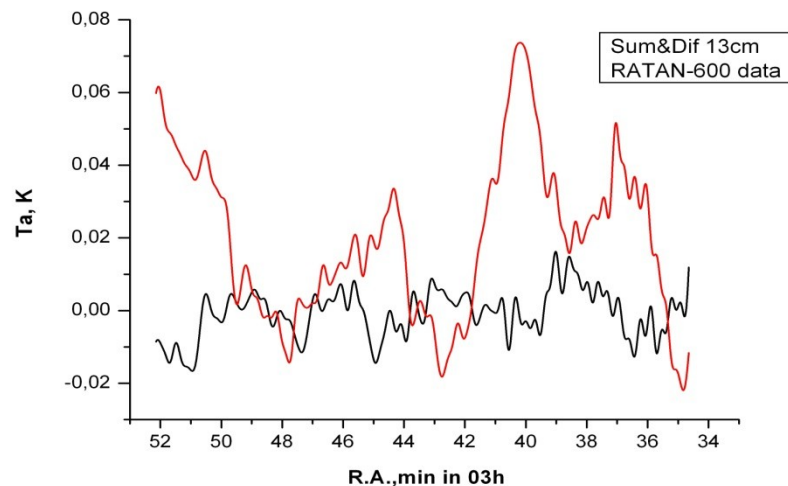
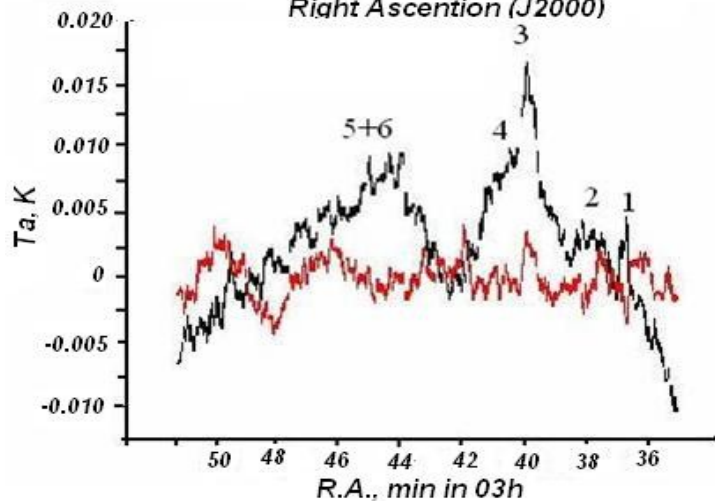
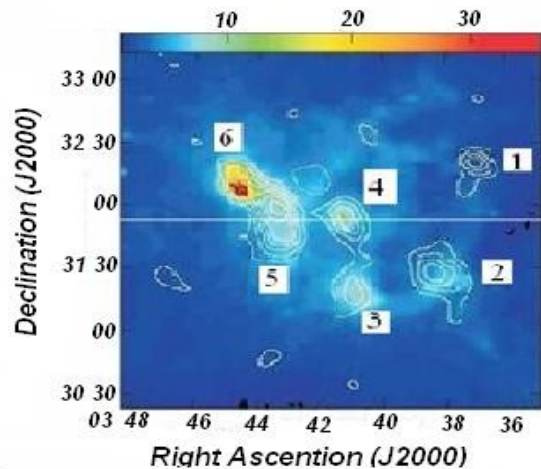
Результаты РАТАН-600 на волнах 6.2см, 13см, 30см

Grey scale flux range=1,39 38,58M Jy/SR

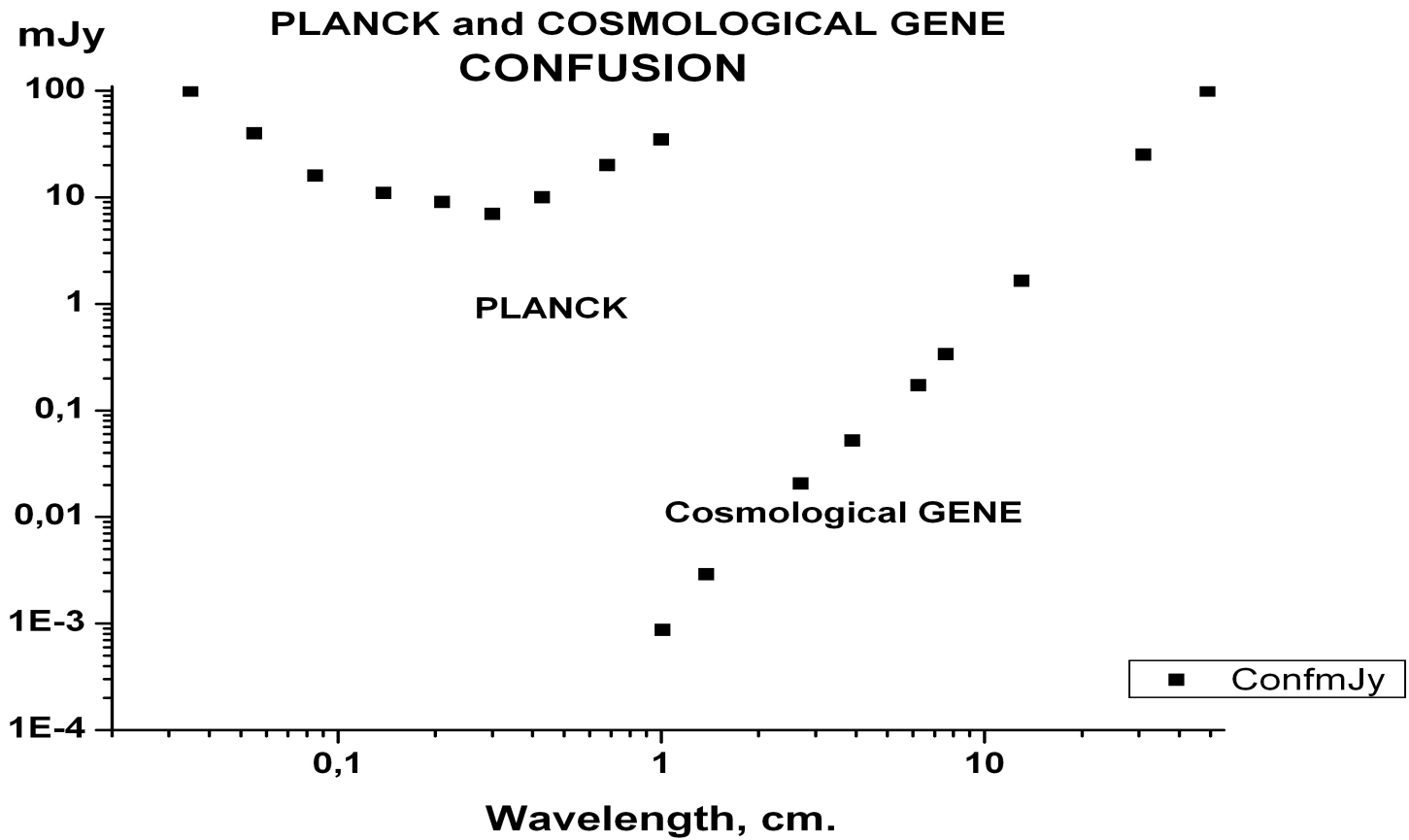
Peak contour flux=1,4948E-01 Jy/Beam

Grey: NONE IRAS 12um.HGEOM.1

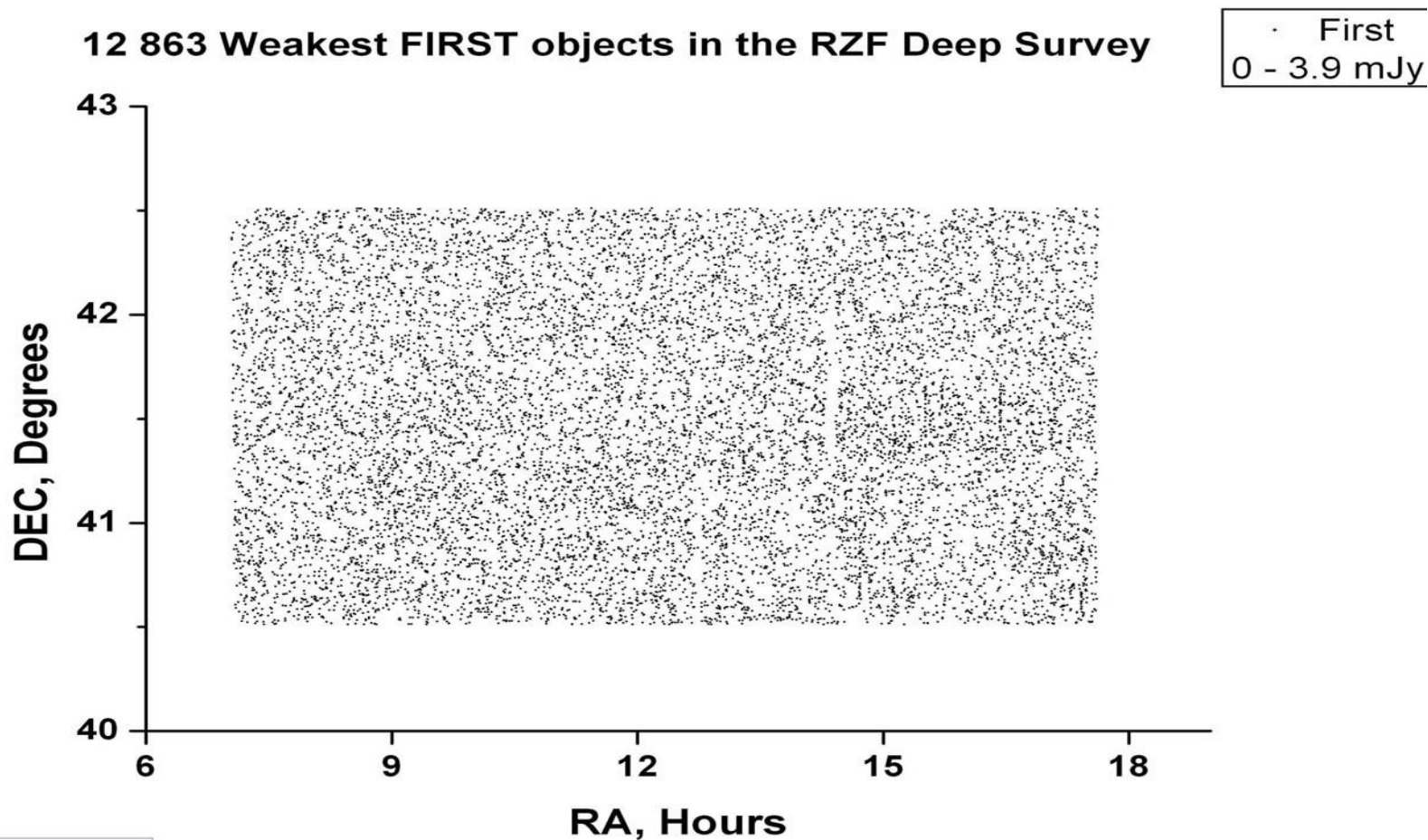
Cont: Perseus IPOL 83000.000MHz Perseus ICL001.2



ГЕН и ПЛАНК: Шум фоновых радиоисточников

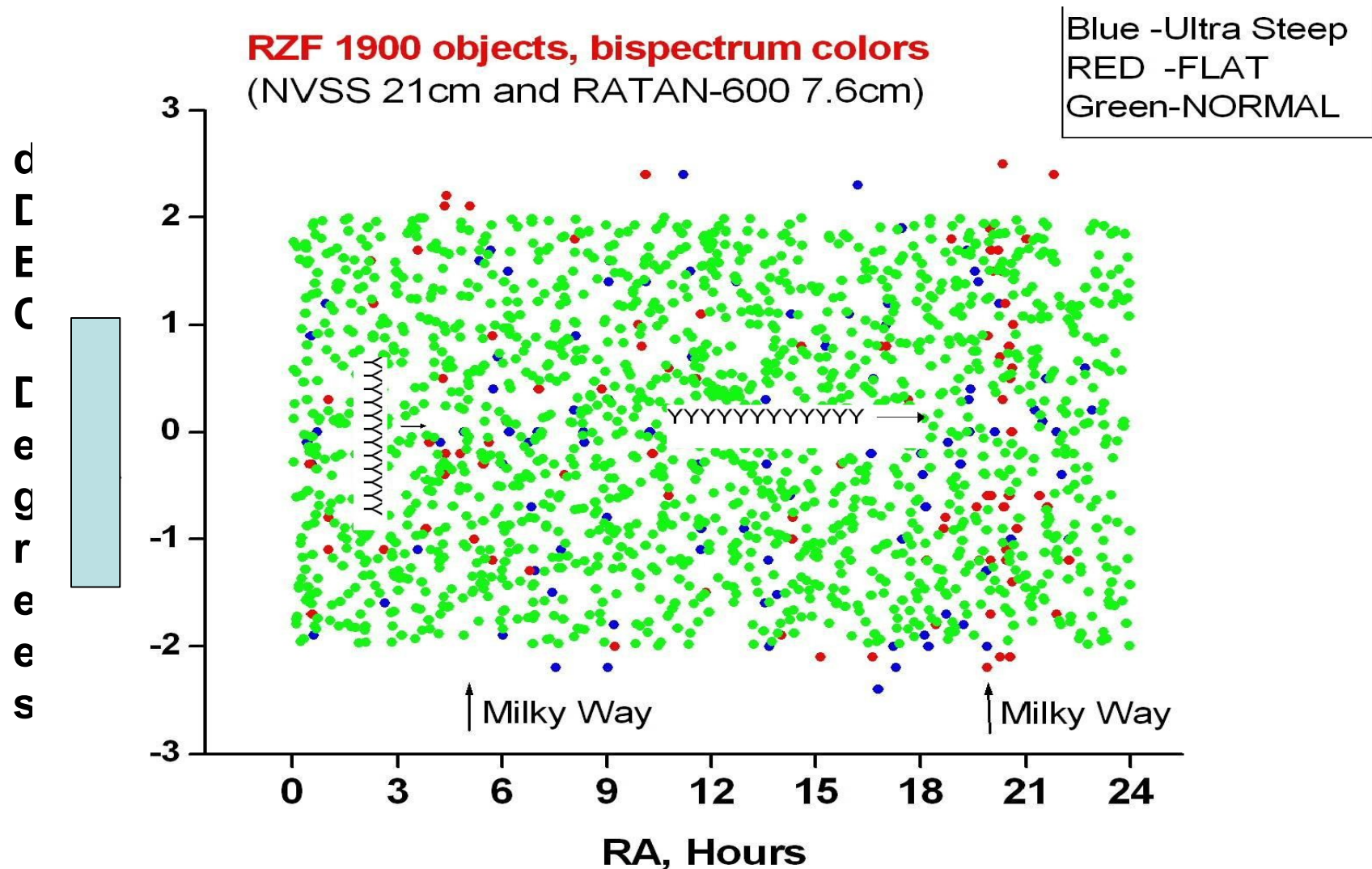


Исследован спектр всех FIRST объектов в RZF обзоре на PATAH-600

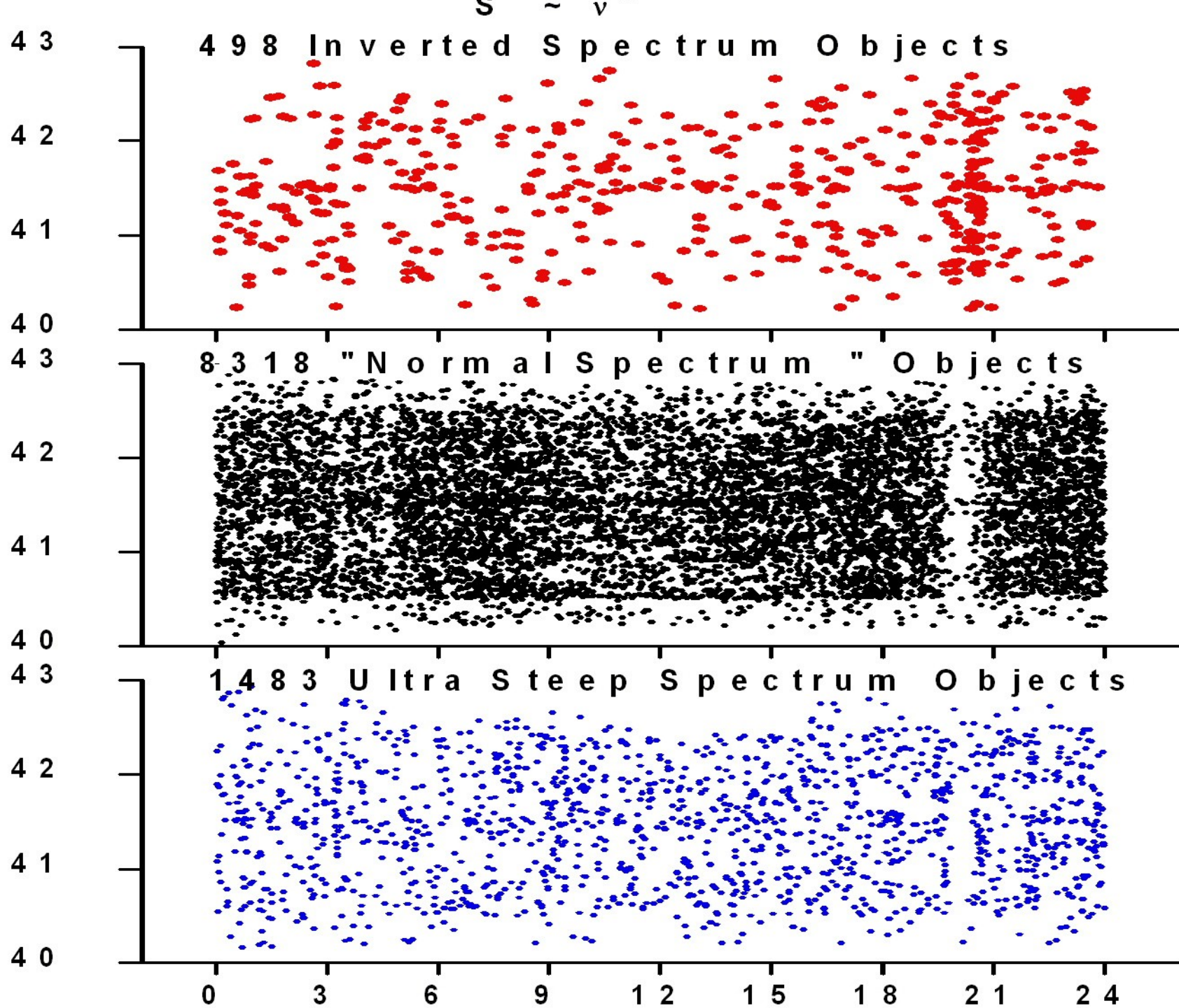


H:\PARnew\RZF2D\F.0-3.9-map

RZF field in two receivers array modes: “for DEPTH” and for WIDTH”



Ultra Steep, $a < -1.1$ "Normal", $0 < \alpha < 1.1$ Inverted, $\alpha > 0$

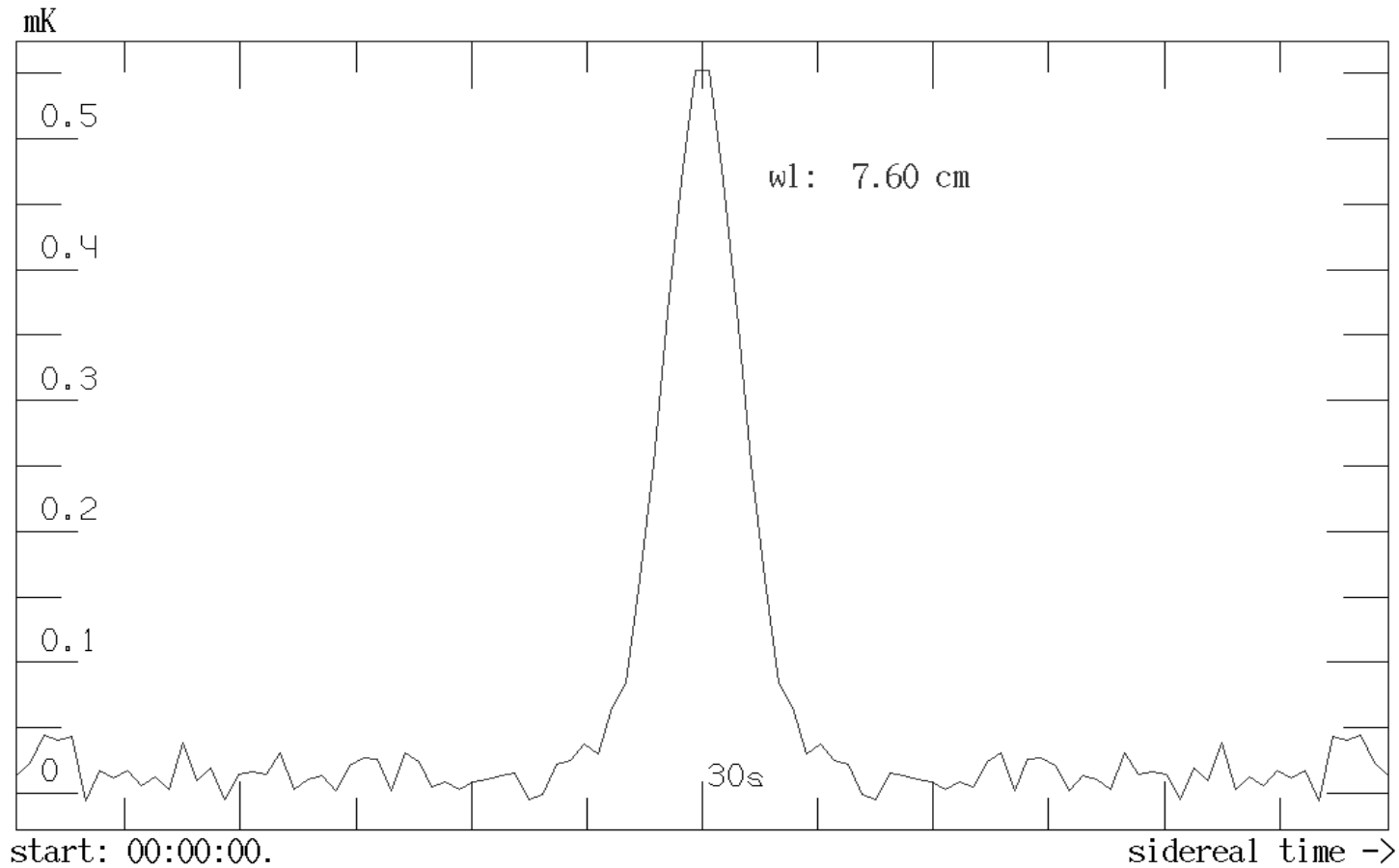


«Break galaxies» candidates

- $Z=4.4$? $N= 19$ ($g-r>2m$)
- $Z=5.94$? $N= 4$ ($r-i >2m$)
- $Z=7.55$? $N= 3$ ($i-r >2m$)

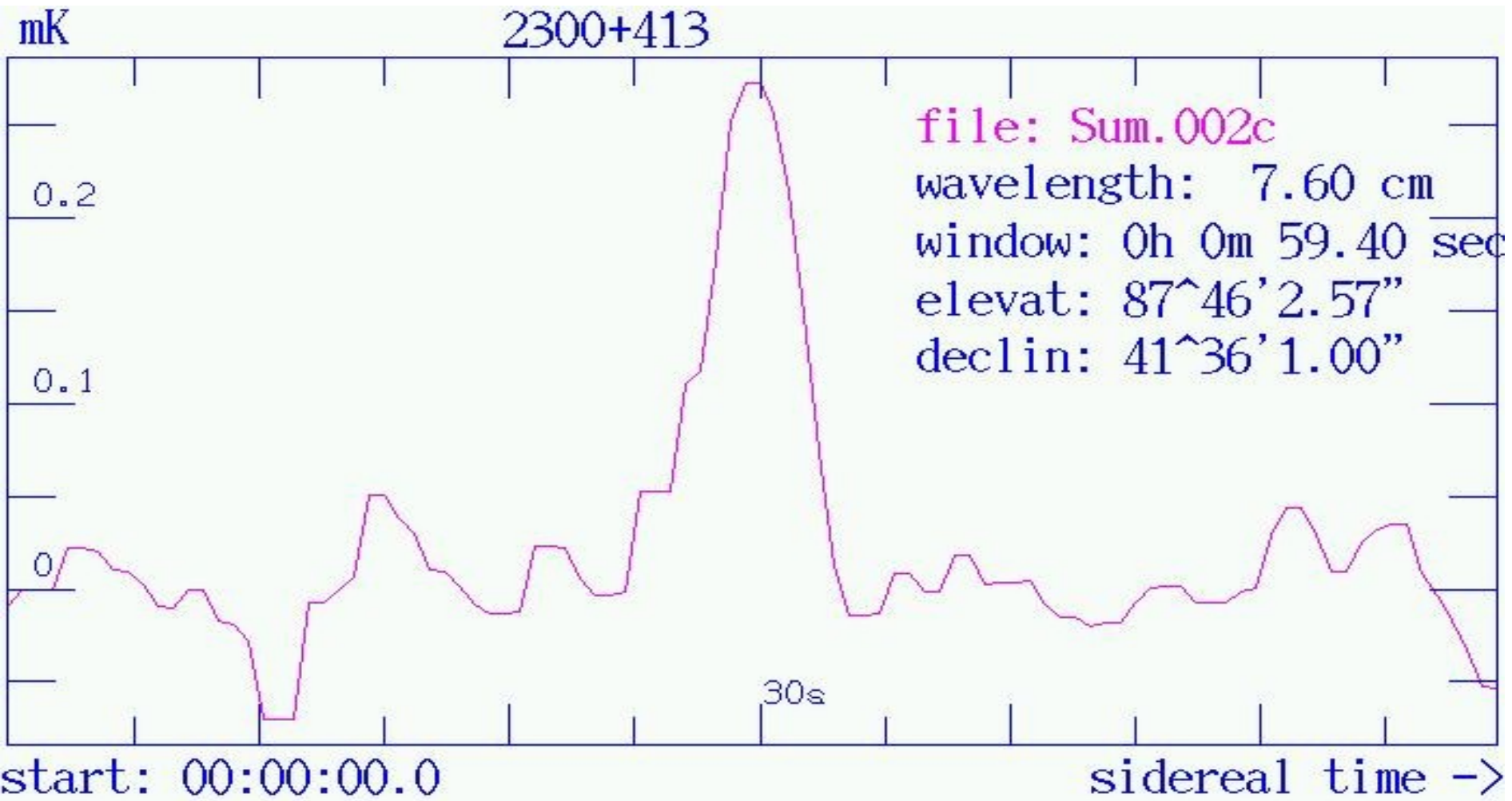
- All data at the SDSS limit, and need in confirmation at 6m. Telescope!

Weakest NVSS population at RATAN-600



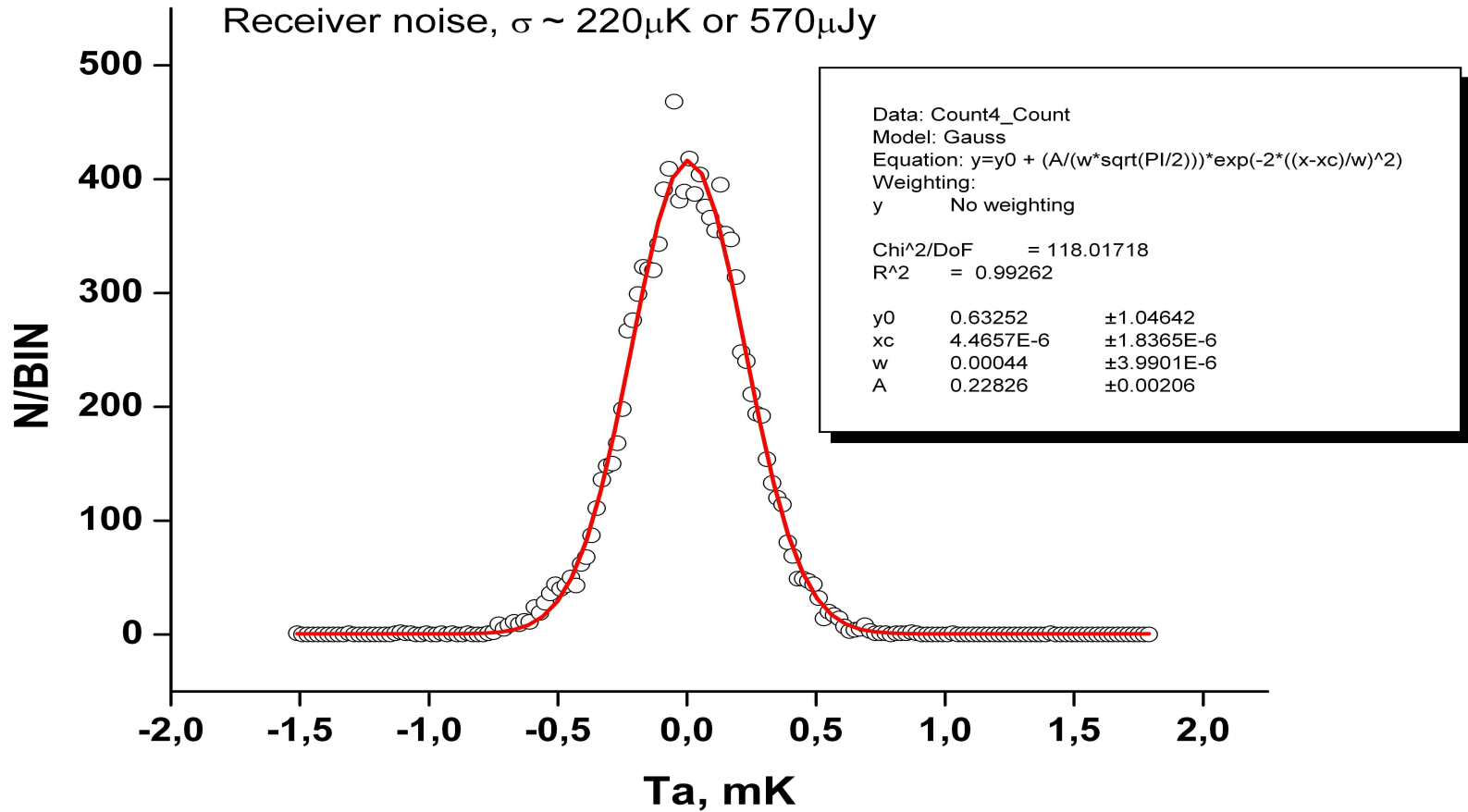
Weakest NVSS population at RATAN-600

Smean 600micro-Jy, r.m.s~60micro-Jy

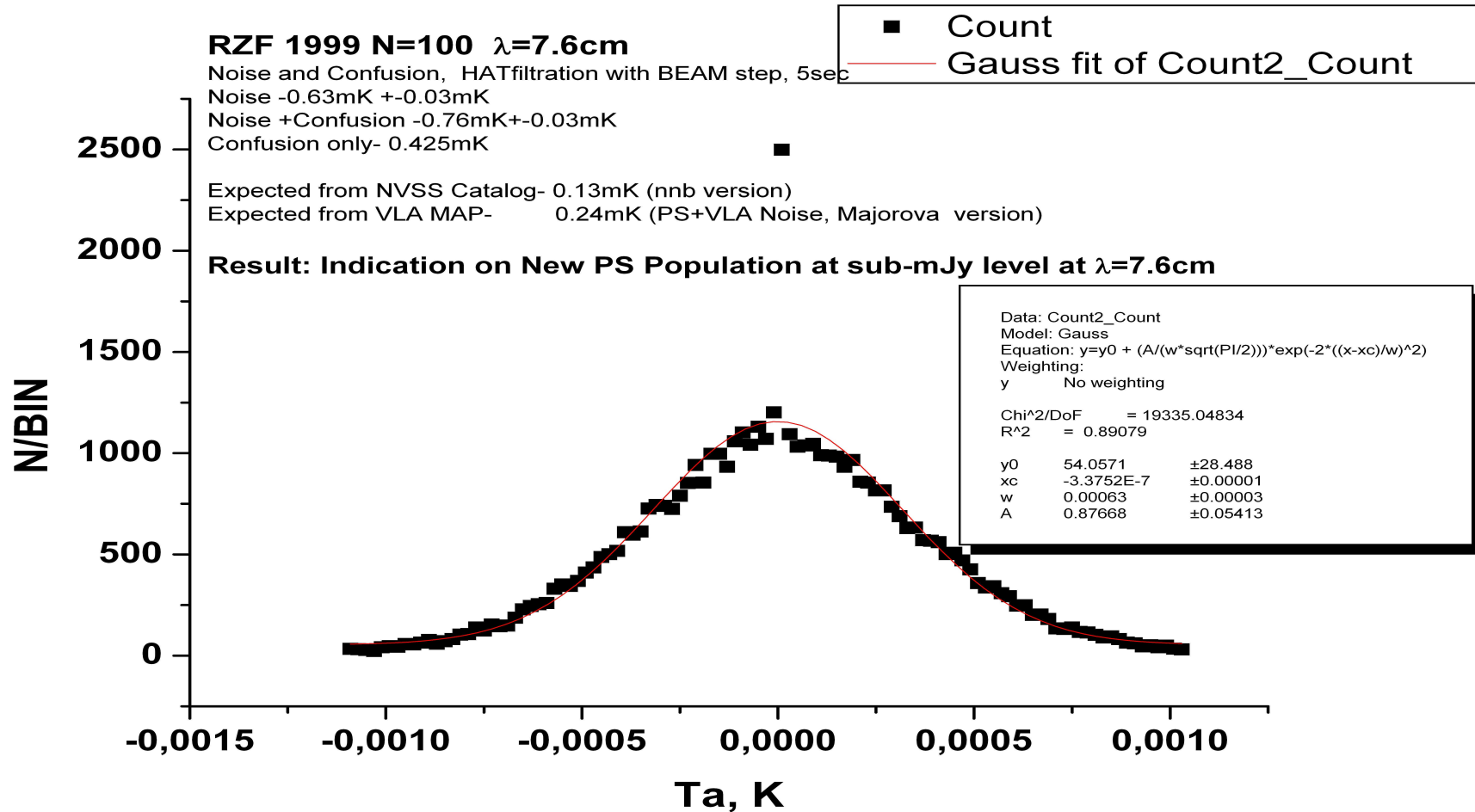


- Шум радиометра, 7.6см, определенный по «полуразности» крупных циклов наблюдений одной и той же области Неба

RZF, $0h < RA < 1h$ $\lambda = 7.6\text{cm}$, 400 days,
half-difference between 2 groups
Receiver noise, $\sigma \sim 220\mu\text{K}$ or $570\mu\text{Jy}$



К поиску НОВОЙ ПОПУЛЯЦИИ радиоисточников

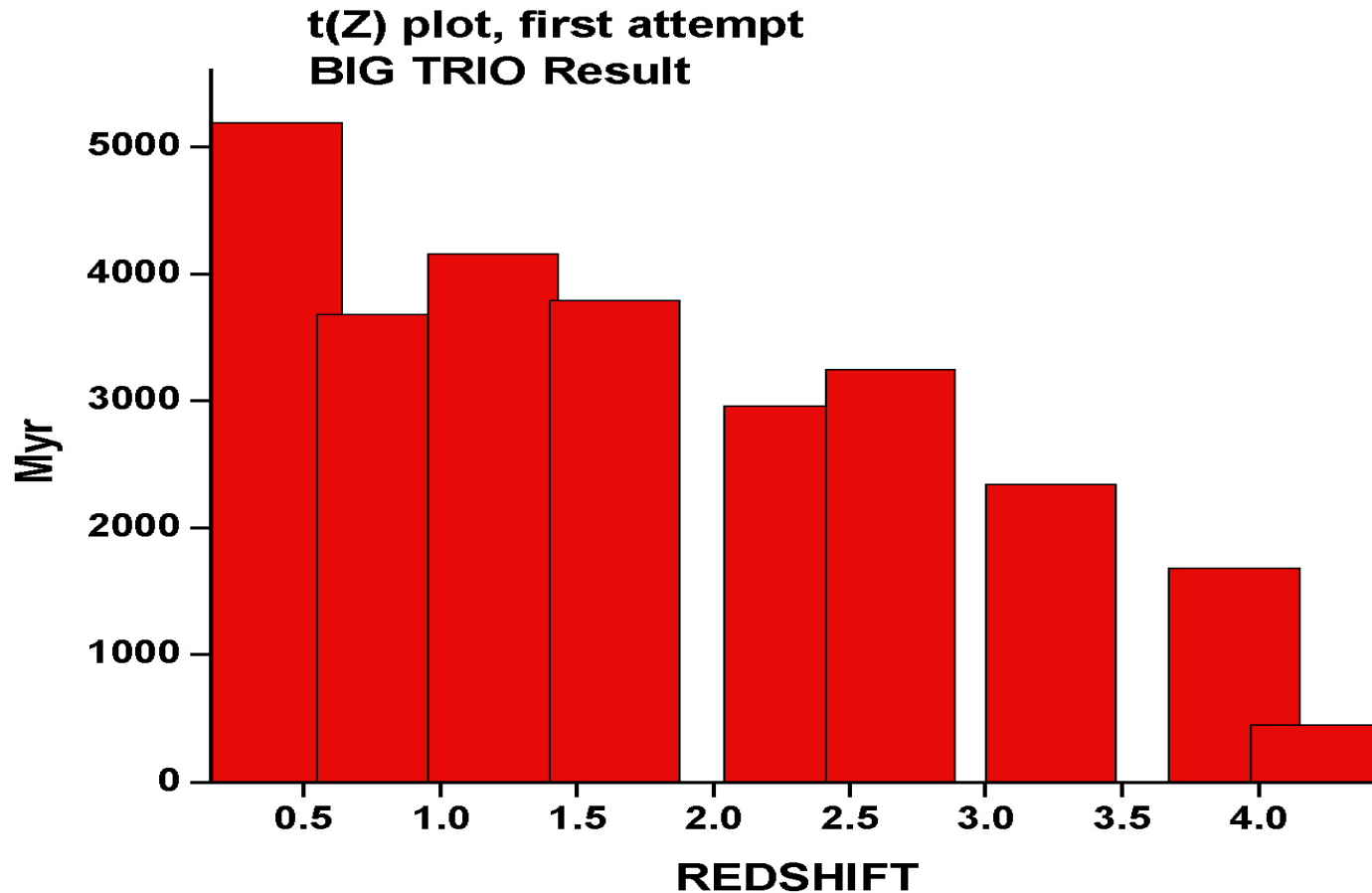


Проблема PS на см.

$$t \sim \nu^3$$

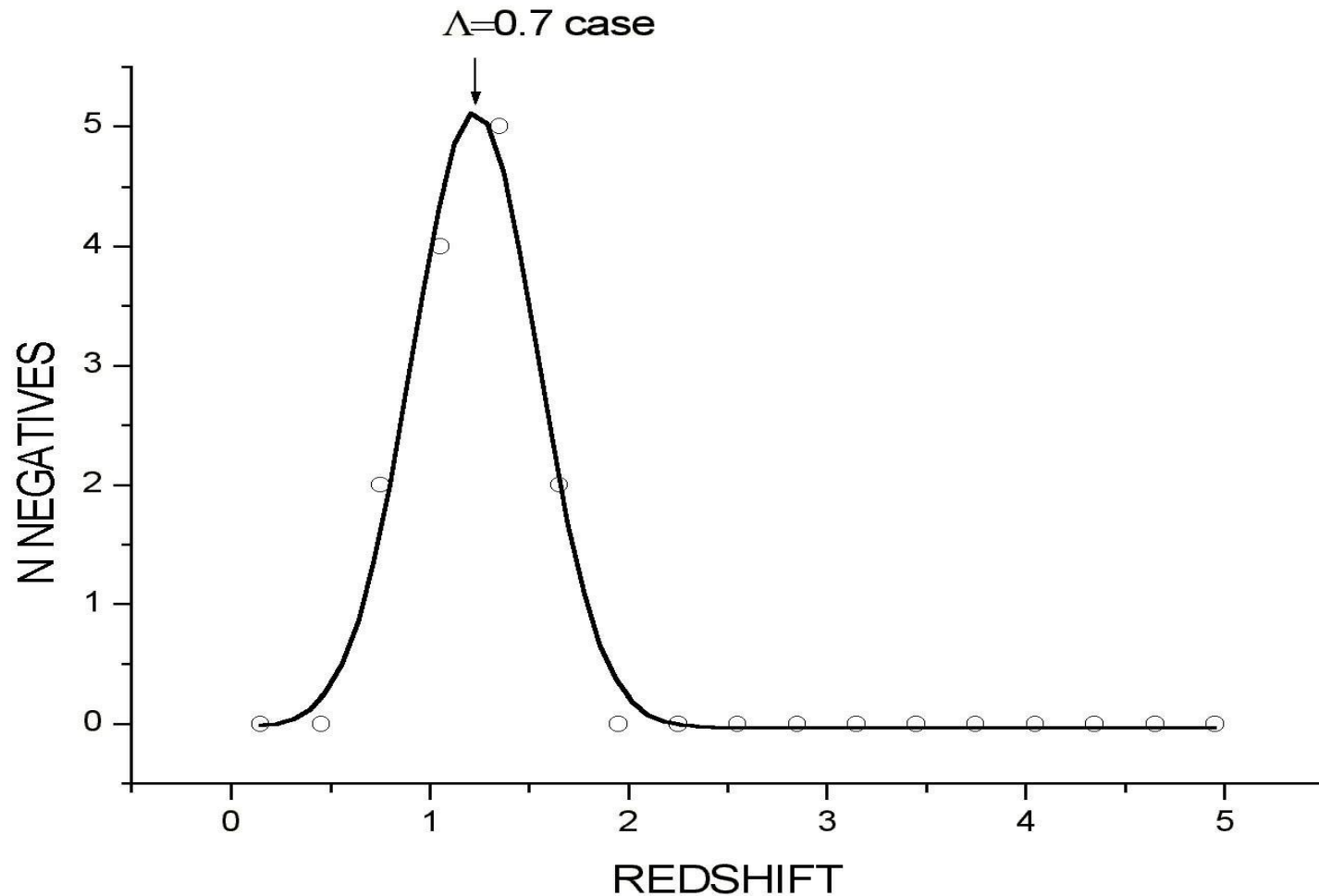
- PS каталоги, «Ширина» или «Глубина»?
- Слепые обзоры или «по списку»?
- От Каталогов к P(D) анализу?
- Корреляционные решения для суб-мЯн. Популяций?

Сравнение $t(z)$ с «Ядерной Хронологией»



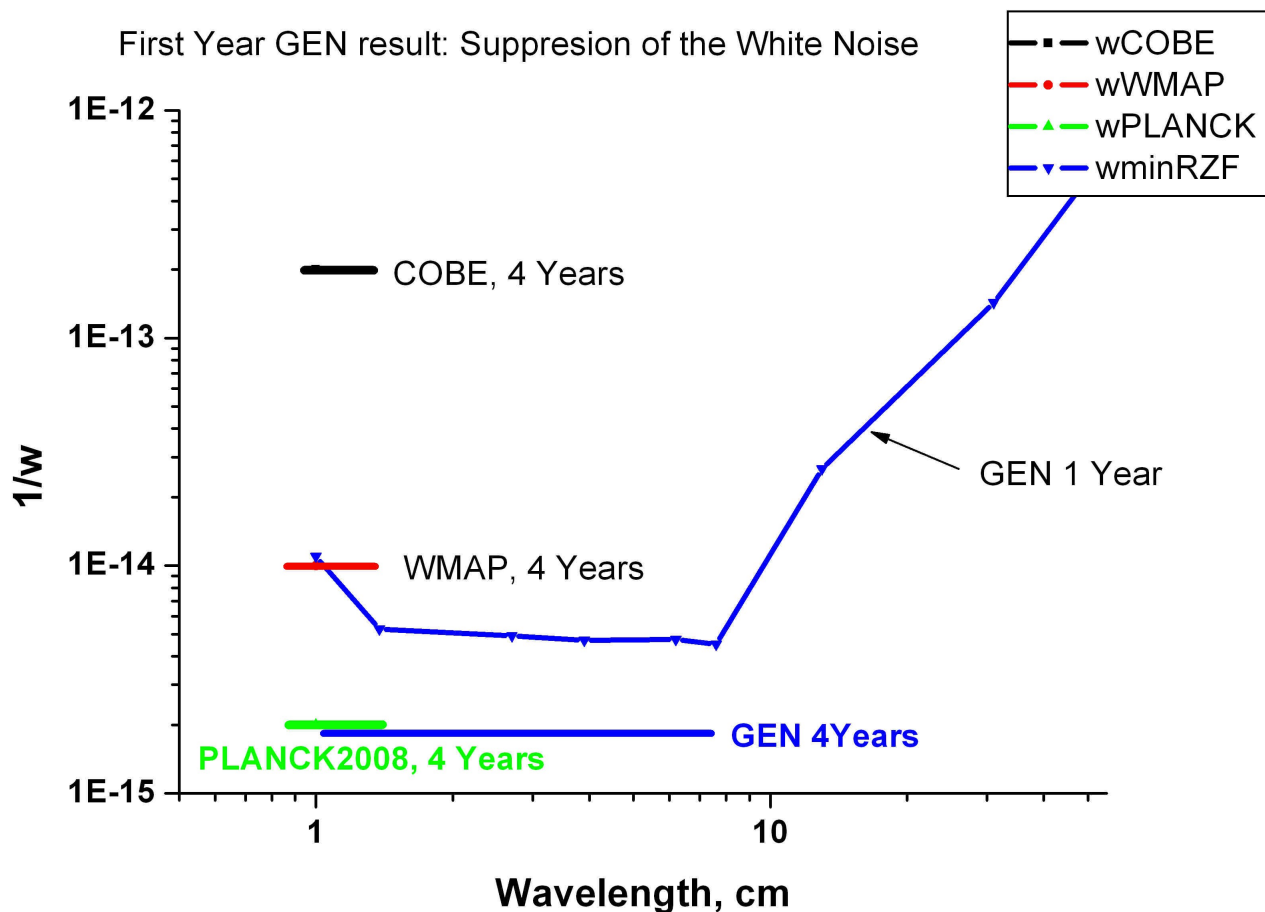
Темная Энергия и далекие радиогалактики

"BIG TRIO" DATA and Λ -CDM



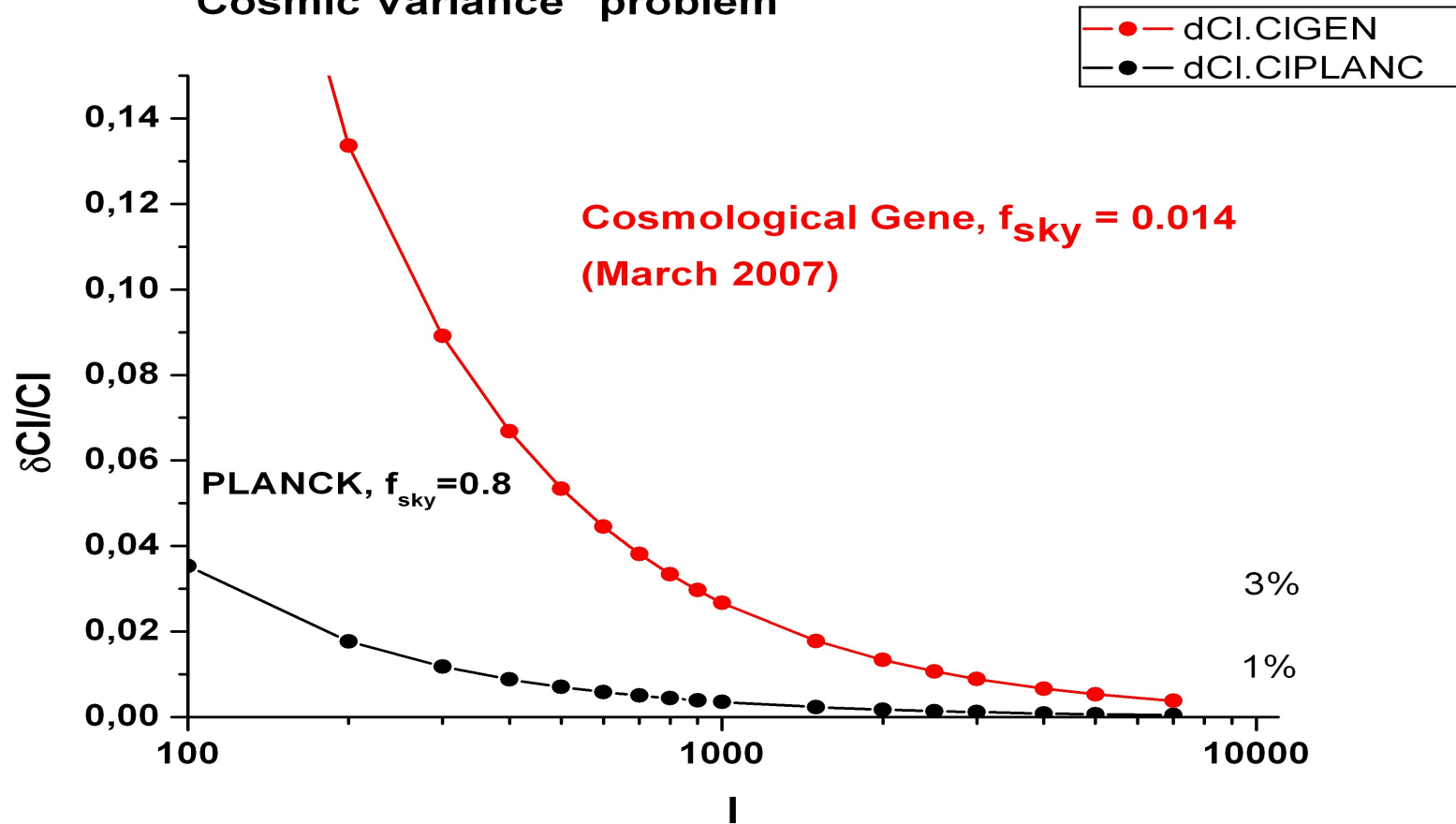
Итоги Первого Года проекта ГЕН

Основной параметр: $1/w=4\pi s^2/T_{tot}$

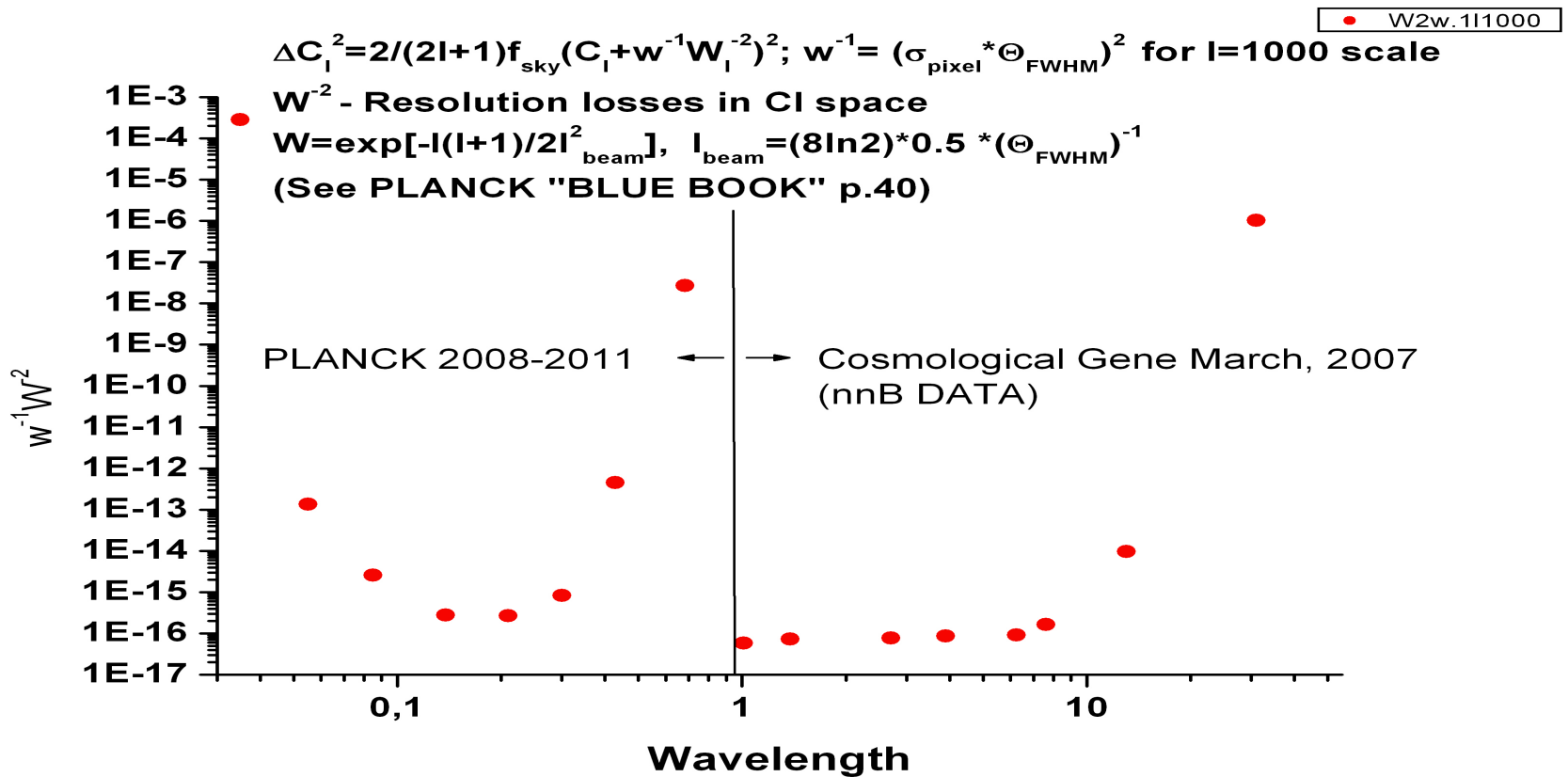


Цена малого f_{sky}

"Cosmic Variance" problem

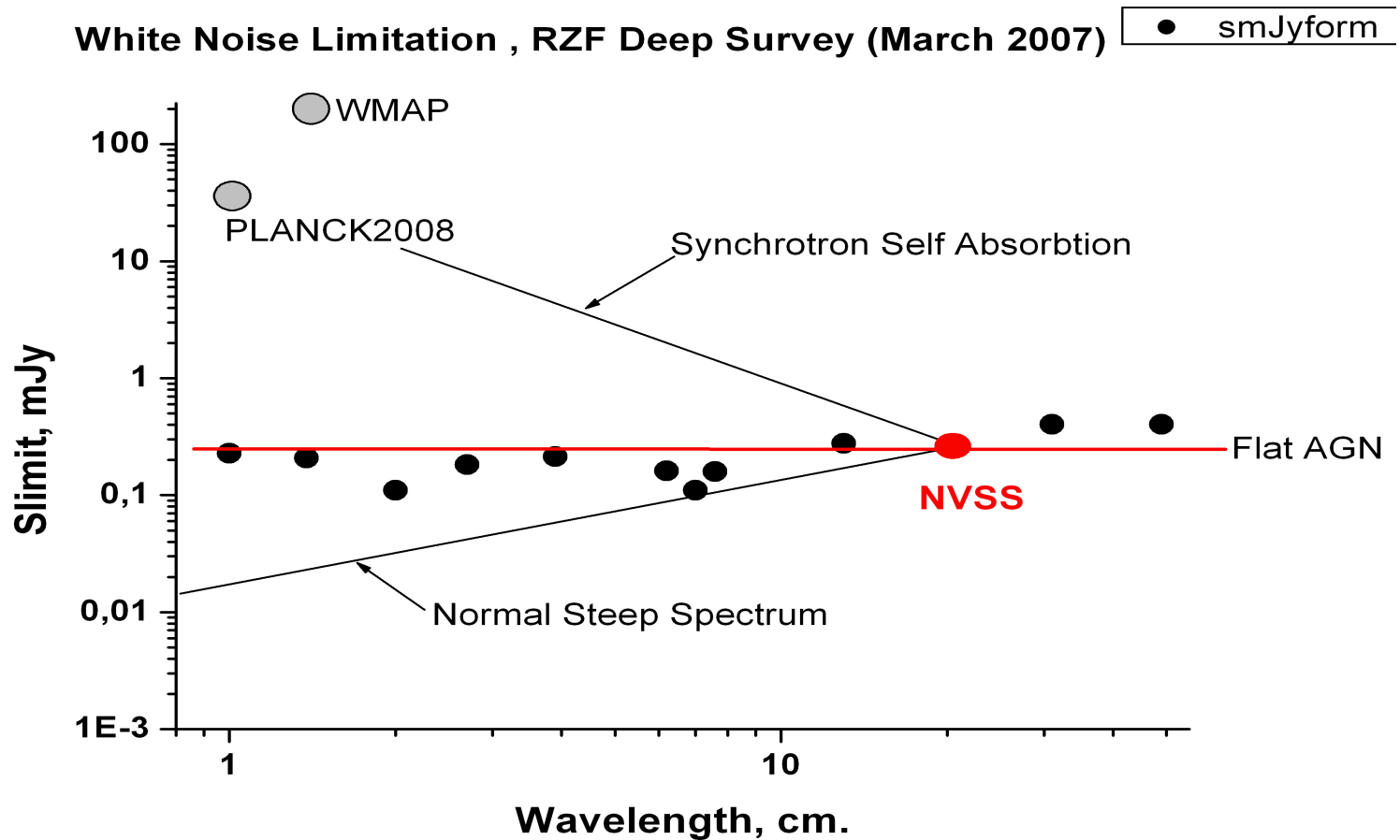


ГЕН и ПЛАНК. Проблемы чувствительности и разрешения



ГЕН

Роль БЕЛОГО ШУМА сегодня на ЧУВСТВИТЕЛЬНОСТЬ ПО ПЛОТНОСТИ ПОТОКА



Sensitivity (w) and Resolution (W)

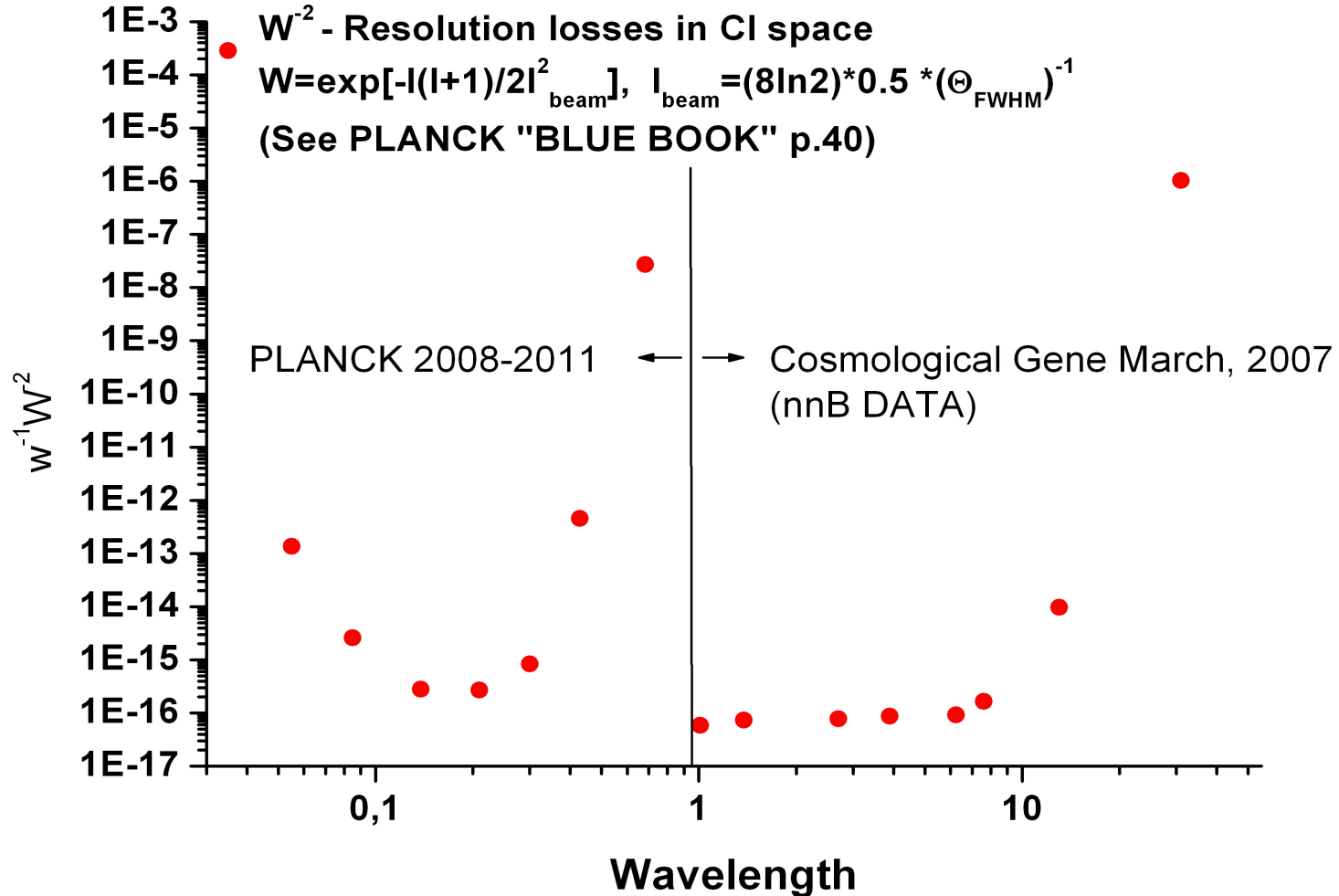
• W2w.111000

$$\Delta C_l^2 = 2/(2l+1) f_{\text{sky}} (C_l + w^{-1} W_l^{-2})^2; w^{-1} = (\sigma_{\text{pixel}} * \Theta_{\text{FWHM}})^2 \text{ for } l=1000 \text{ scale}$$

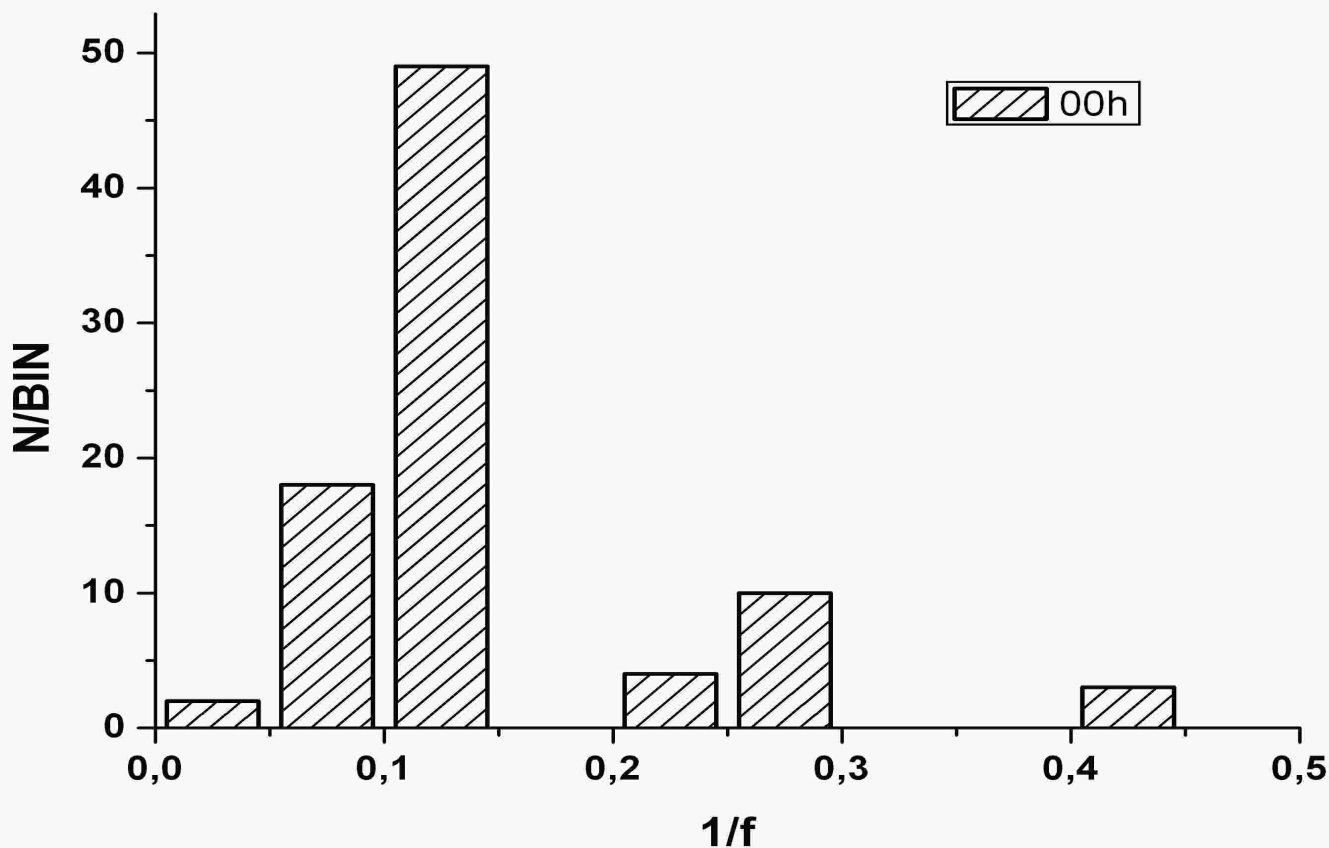
W^{-2} - Resolution losses in Cl space

$$W = \exp[-l(l+1)/2l_{\text{beam}}^2], l_{\text{beam}} = (8 \ln 2) * 0.5 * (\Theta_{\text{FWHM}})^{-1}$$

(See PLANCK "BLUE BOOK" p.40)



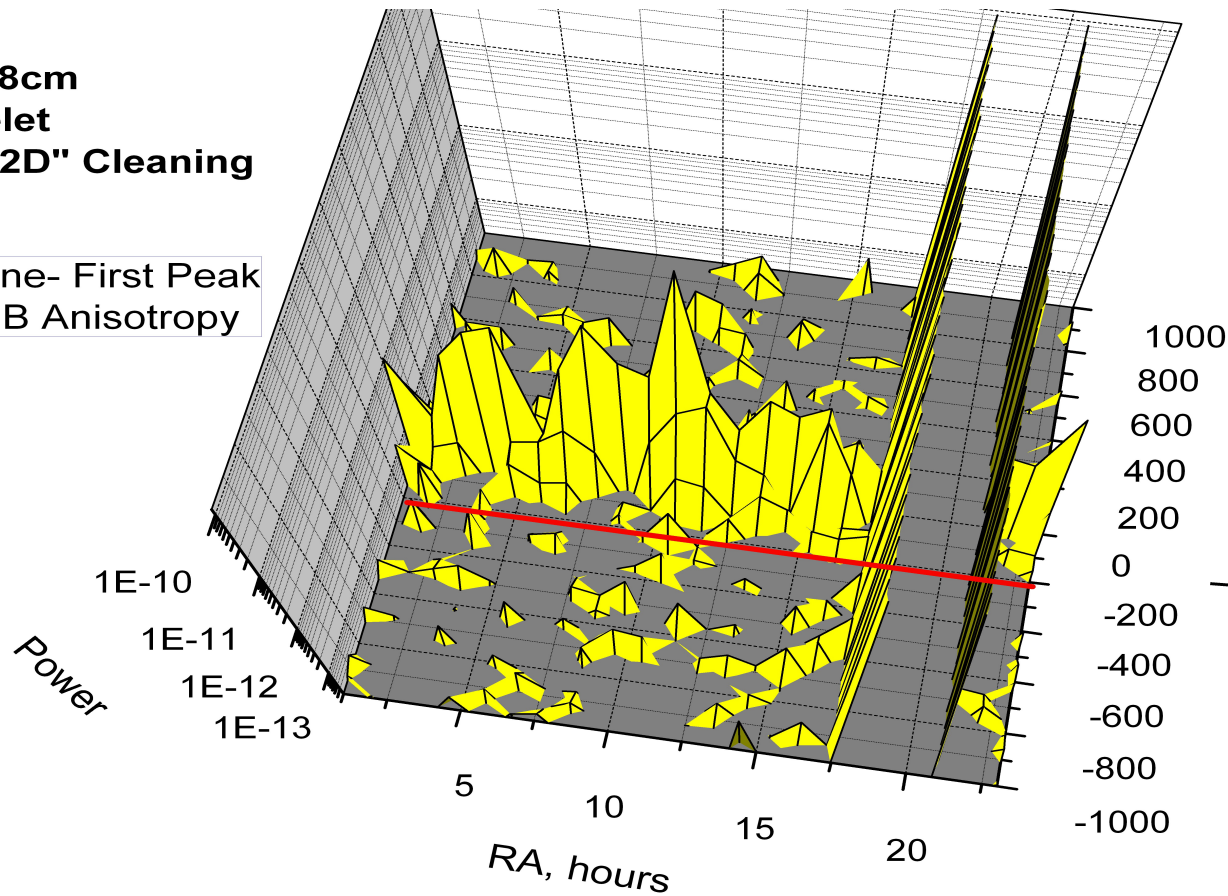
Пример разброса качества данных по положению атмосферного «Колена» на шкале частот (Гц)



От «одномерной» к «двумерной» ЧИСТКЕ ДАННЫХ

$\lambda=1.38\text{cm}$
Wavelet
and "2D" Cleaning

Red line- First Peak
in CMB Anisotropy

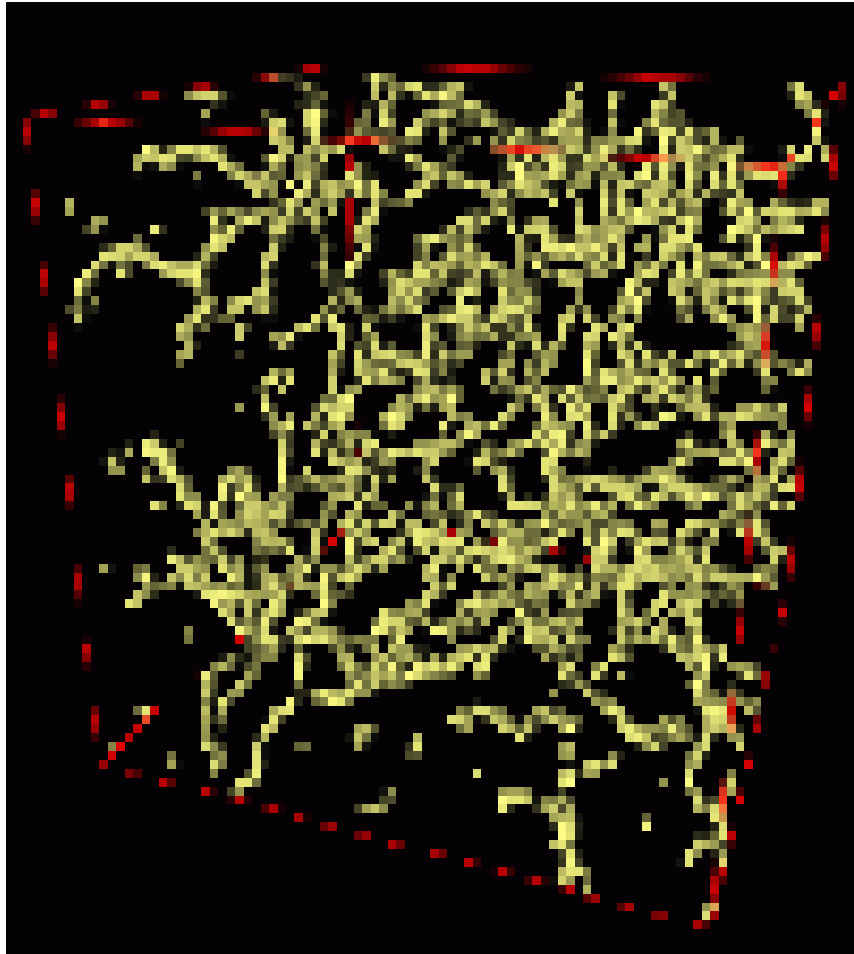


STRINGS, M-Theories

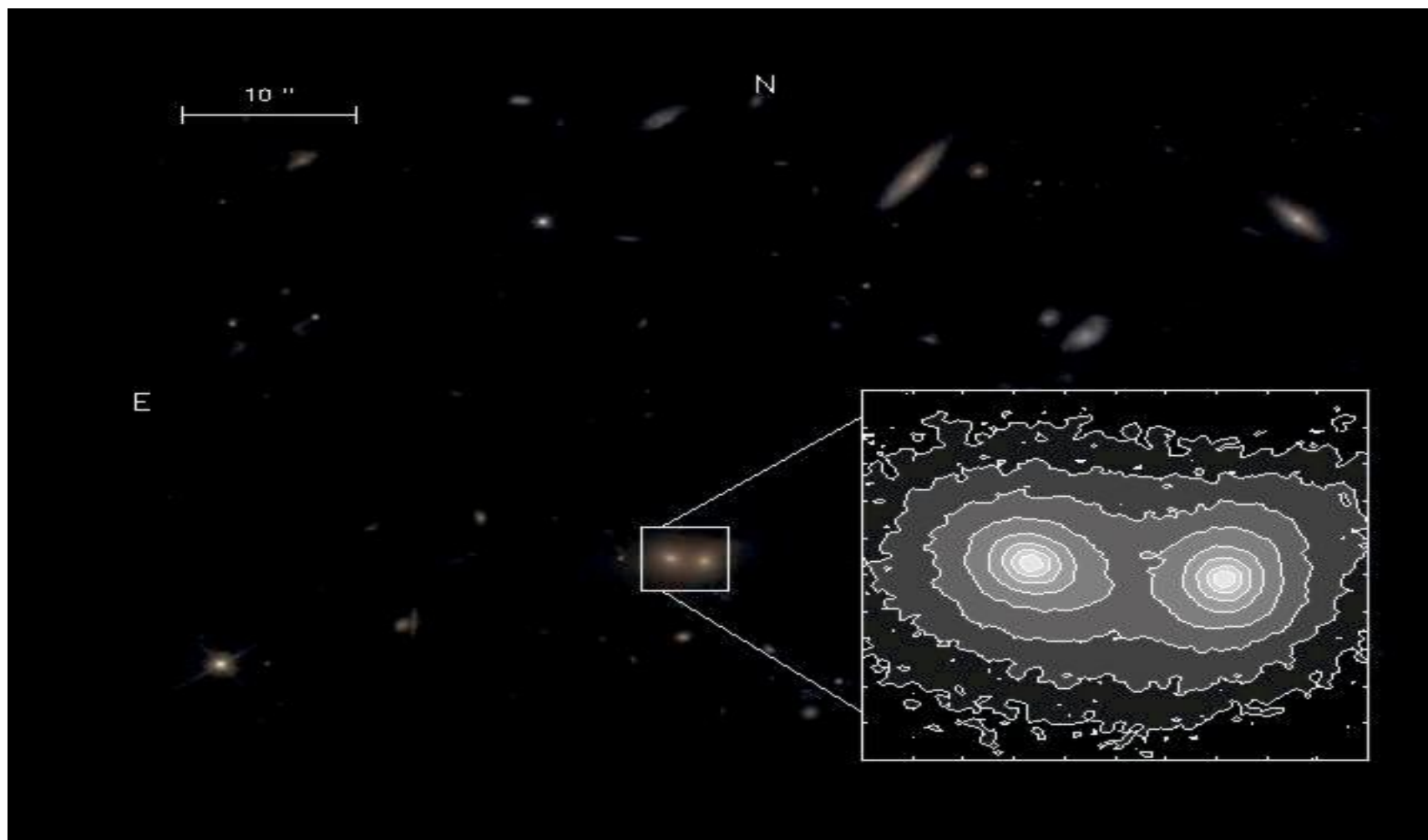
M-Theories and RATAN-600

- Magic
- Mystery
- Membranes

One of the Strings MODEL



Ажиятаж со “STRINGS”, 2003



STRINGS and CMB

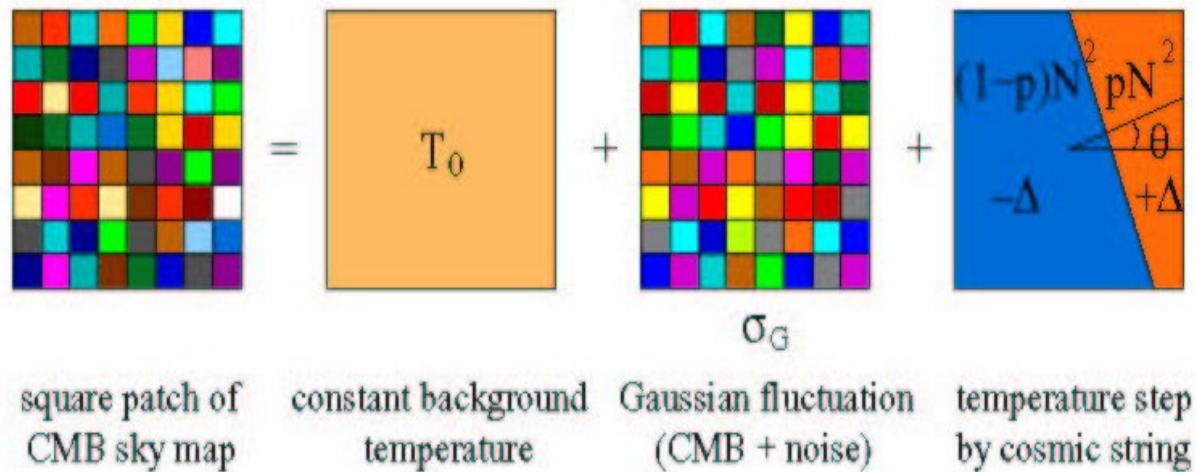
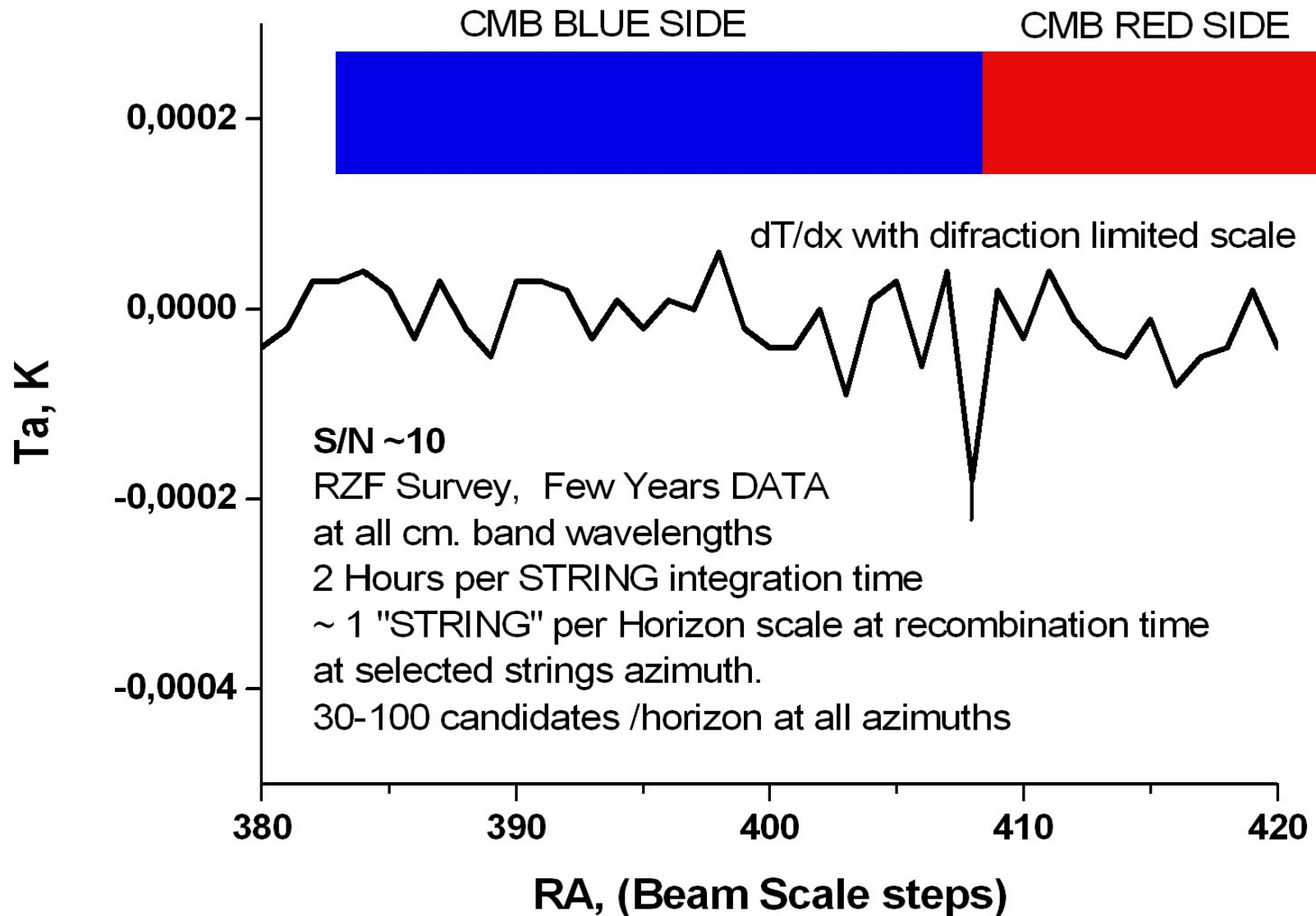
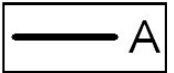
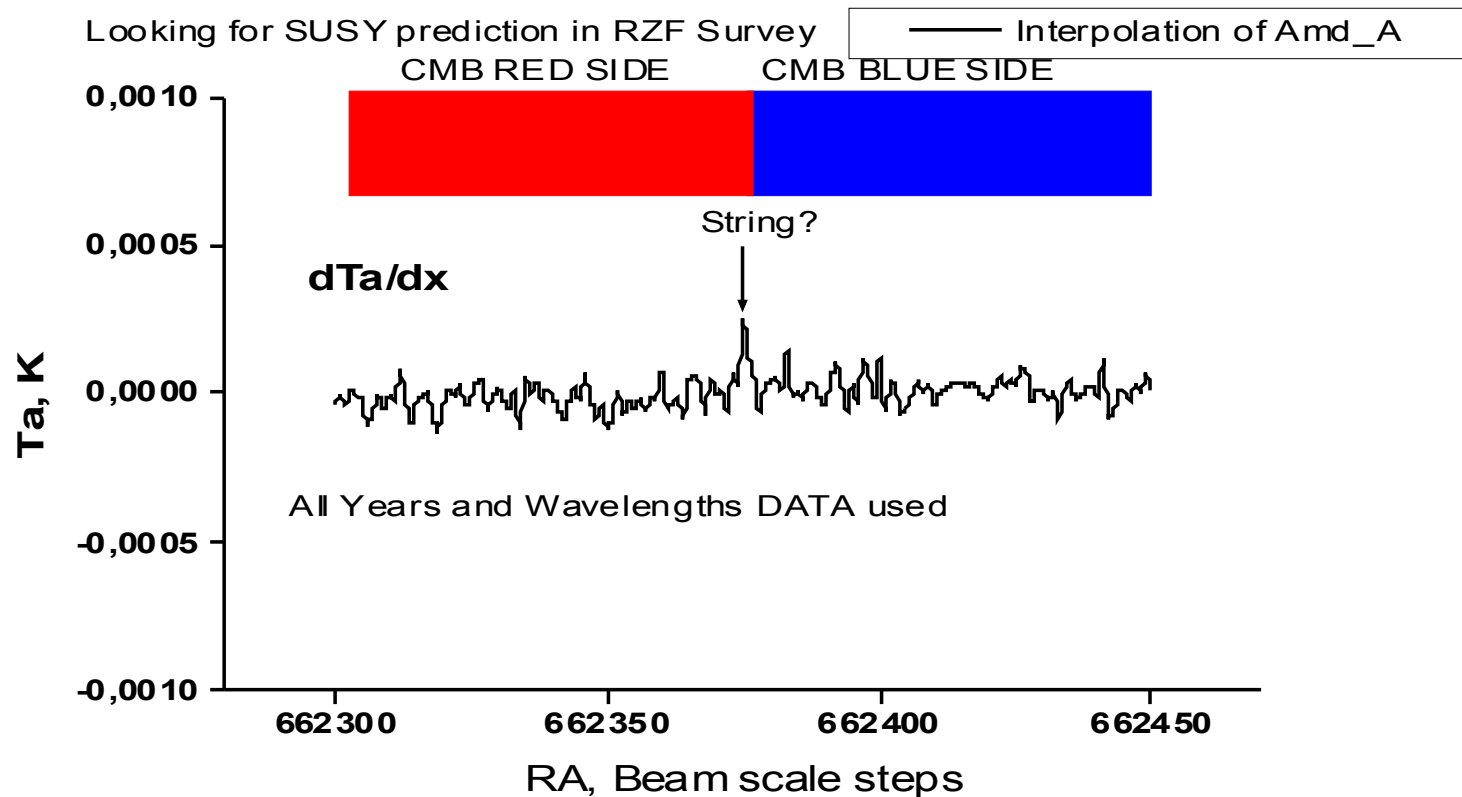


FIG. 1: A decomposition of sky map patch. The square patch is decomposed into uniform background temperature (T_0) + Gaussian fluctuation + discrete temperature step. The number of pixels in a patch is N^2 .

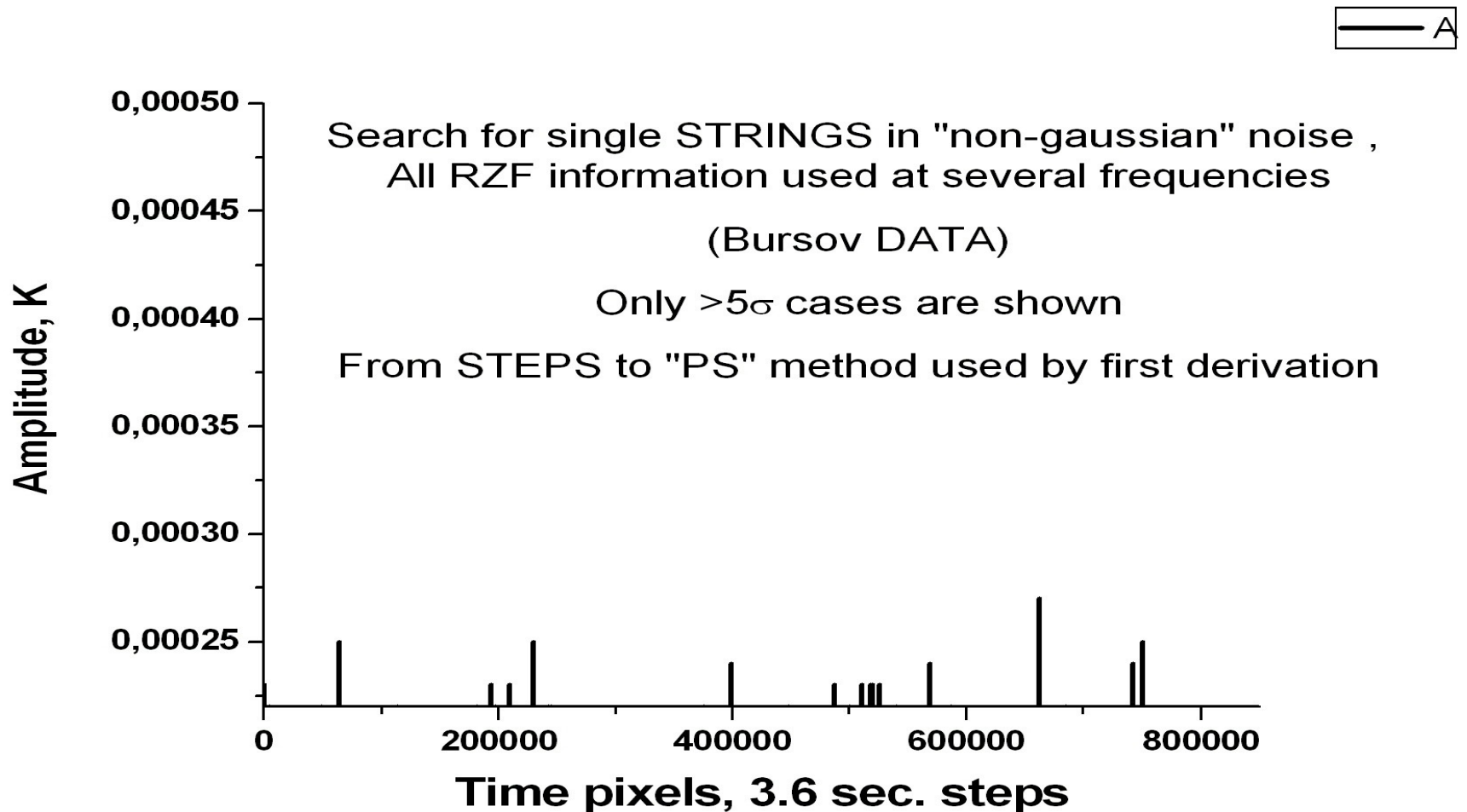
CMB "STEP" in T_b due to GRAV. LENSING on the Cosmic String



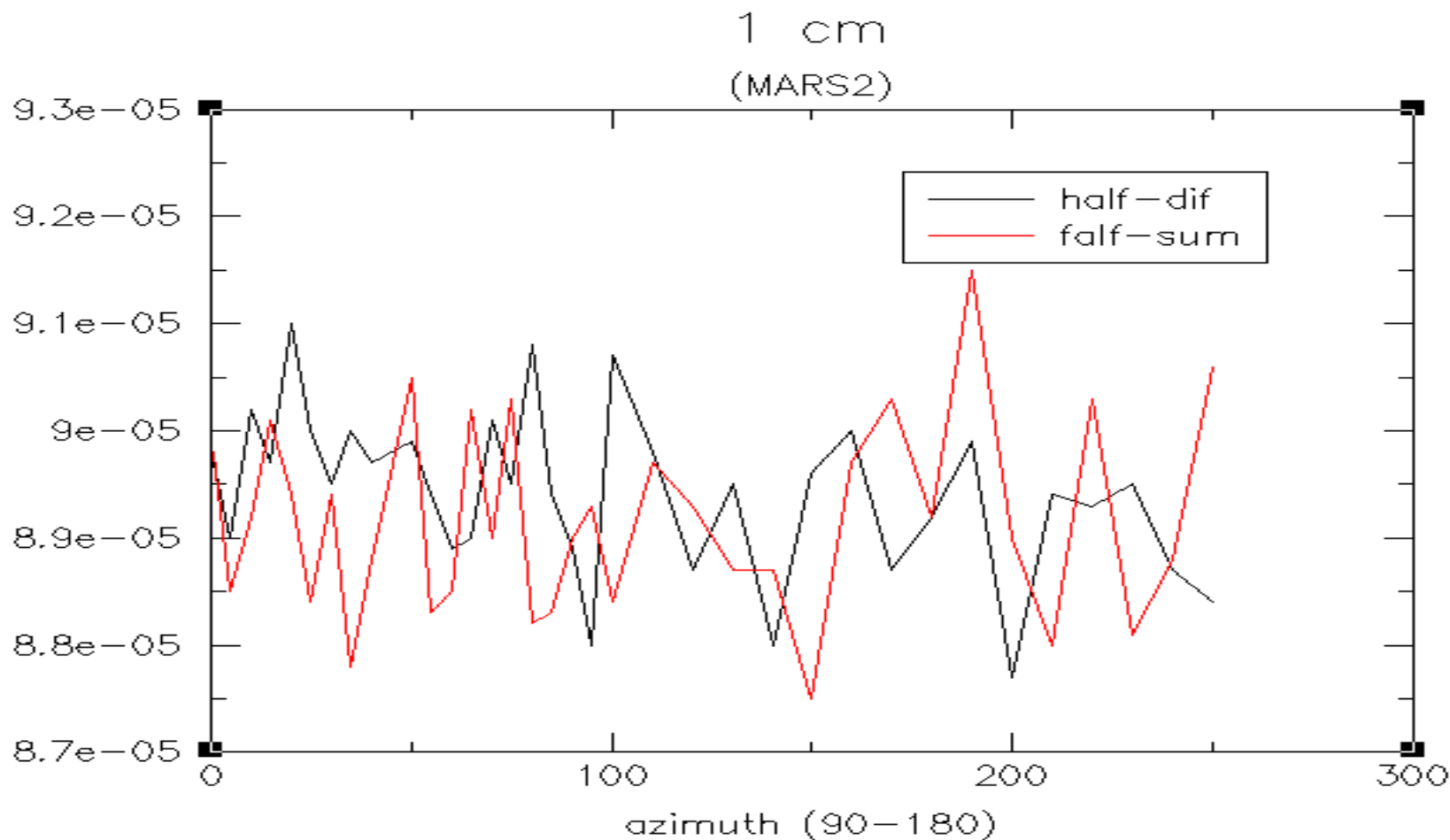
Поиск «СТУПЕНЕК» через производную разрезов неба



Детали, ярче 5- в интервале $0h < RA < 24h$, Азимут 0 град.



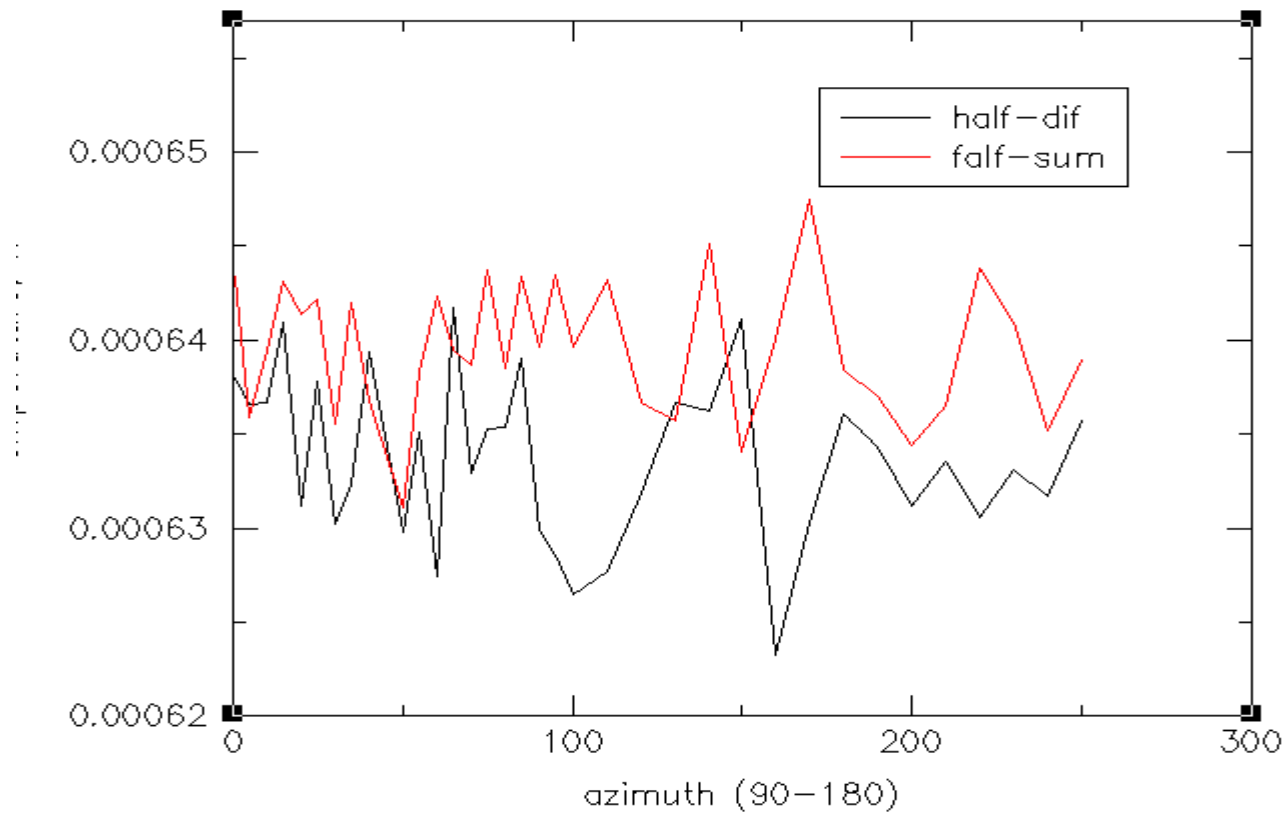
Матричный радиометр (МАРС-2) и поиск грав. Шума от “STRINGS”



=1.38cm

поиск грав. Шума от “STRINGS”

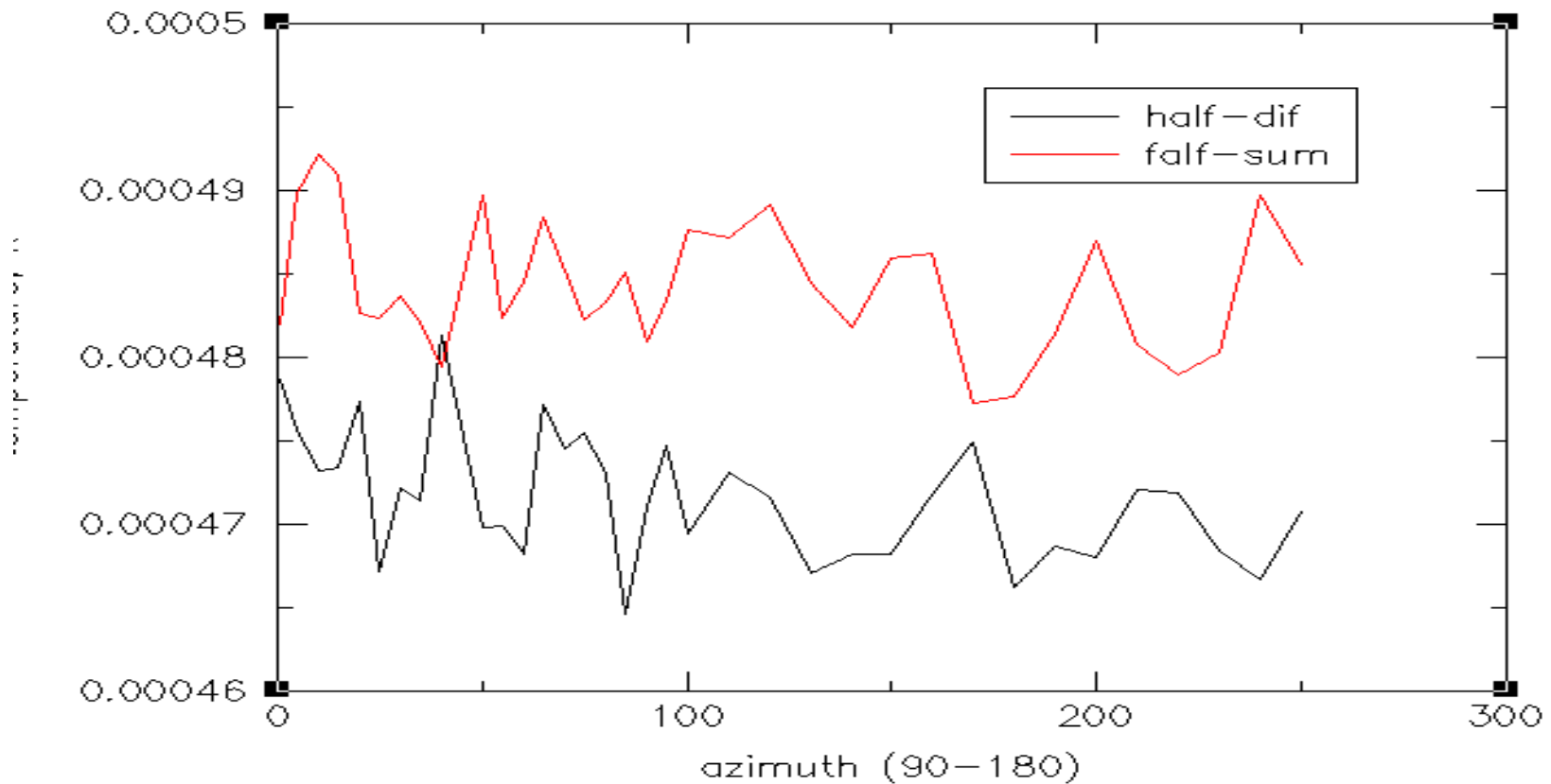
1.38 cm



=2.7cm

поиск грав. Шума от “STRINGS”

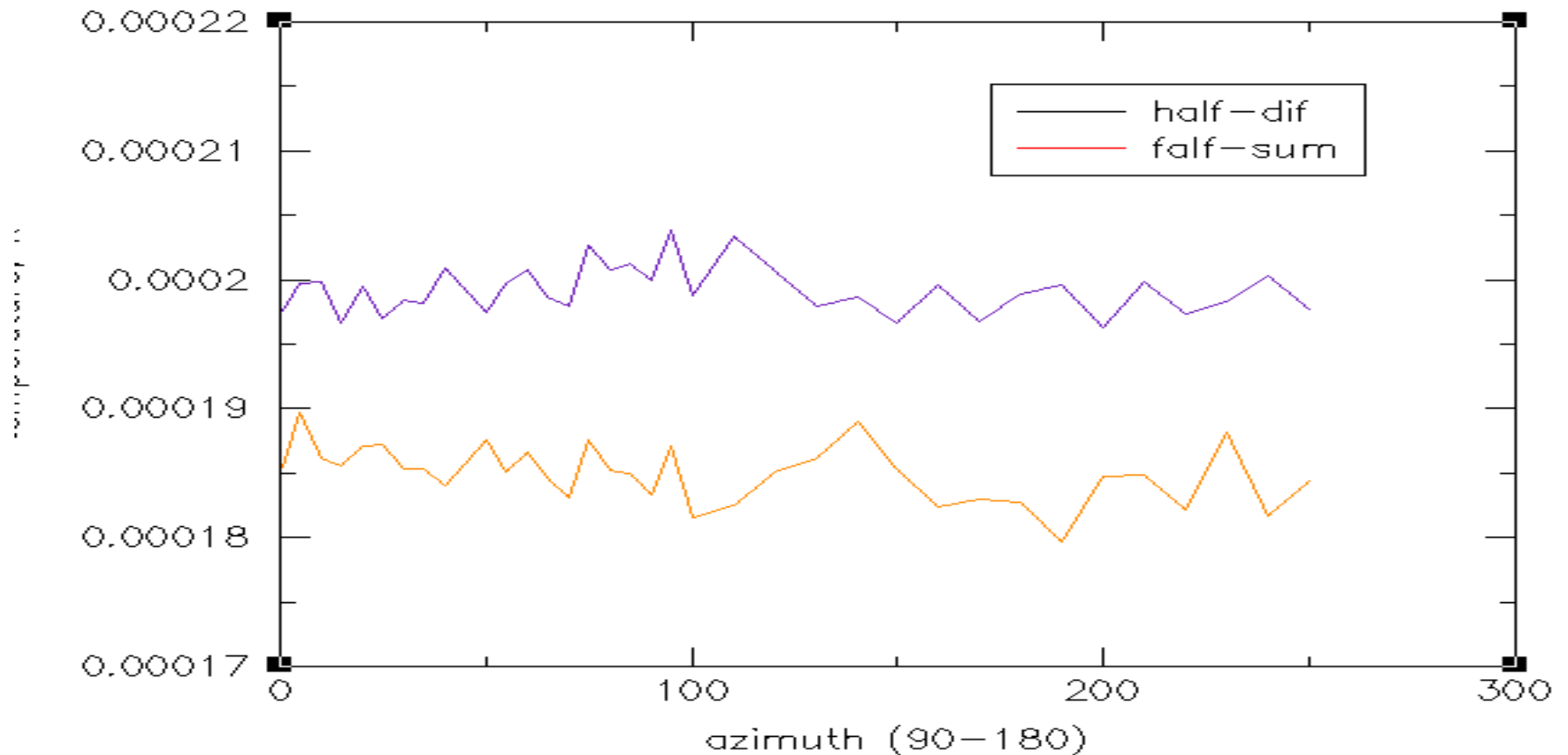
2.7 cm



=6.2cm.

поиск грав. Шума от “STRINGS”

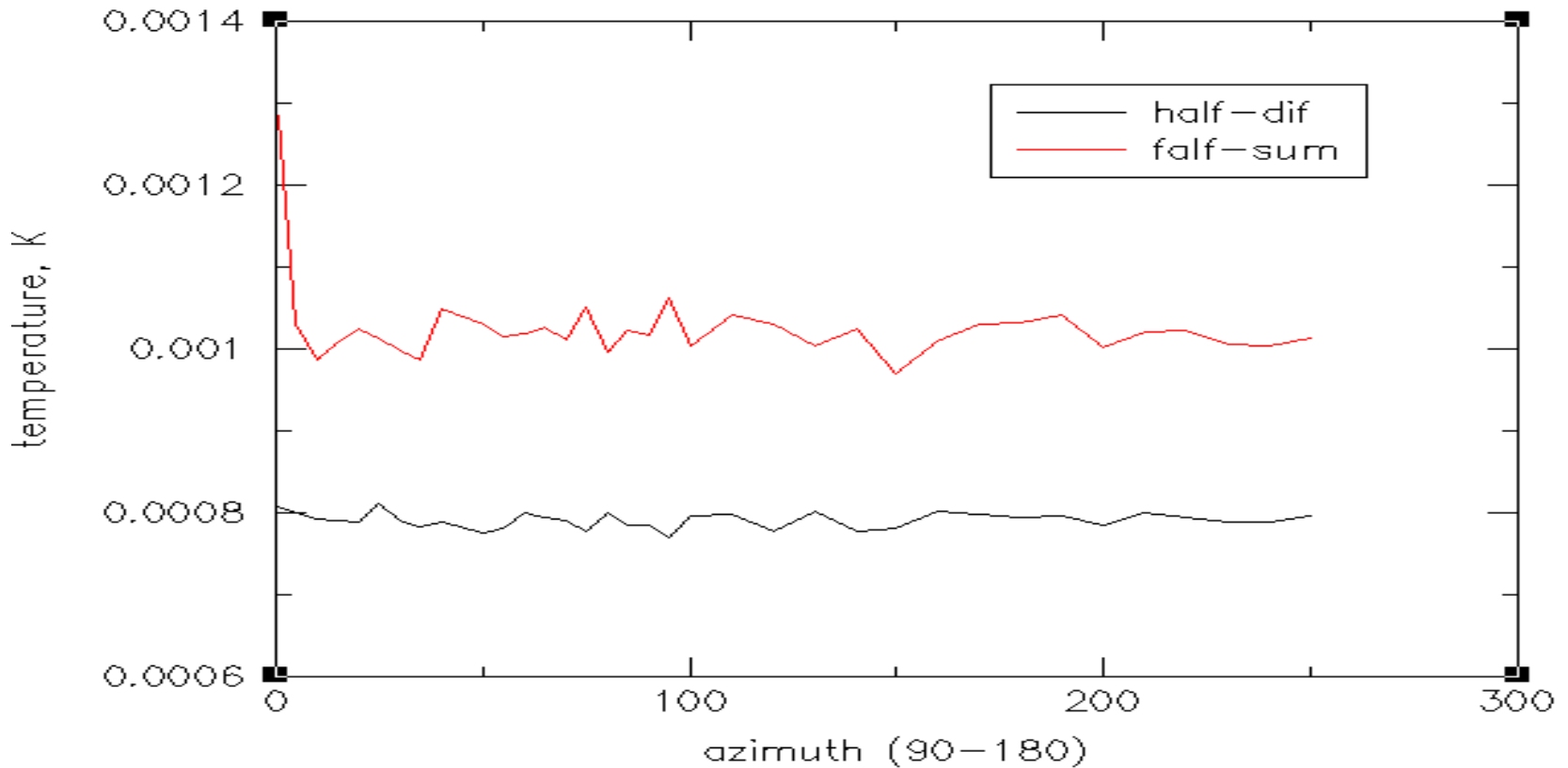
6.2 cm



=13cm

поиск грав. Шума от "STRINGS"

13 cm



Результат сегодня

1. Поиск **ОДИНОЧНЫХ СТРУН** пользуясь высоким разрешением

r.m.s <1-3 K

2. Поиск STRINGS CONFUSION

r.m.s <70 K

(сравни WMAP, <176 K)

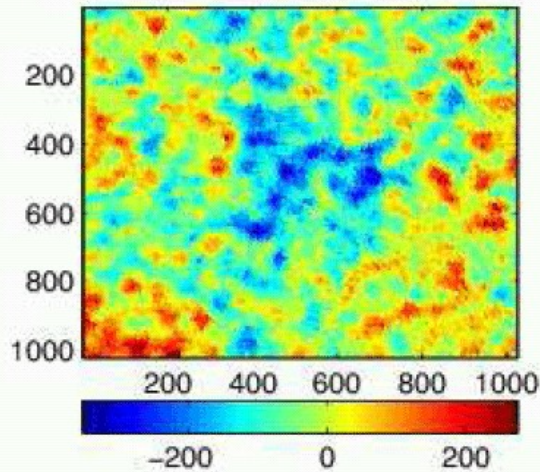
ПОИСК «Dark Spots» (ISW)

Идеология

1. Искать проявление M-теорий там, где мал вклад от “CONCORDANCE Model”
(**область «Силковского затухания»,**
 $I \gg 200$)
2. Увеличить **статистическую значимость:**
От Каталогов к “Confusion”

A Closer Look

WCM 3- year, real space



WCM 3- year, scale R_9

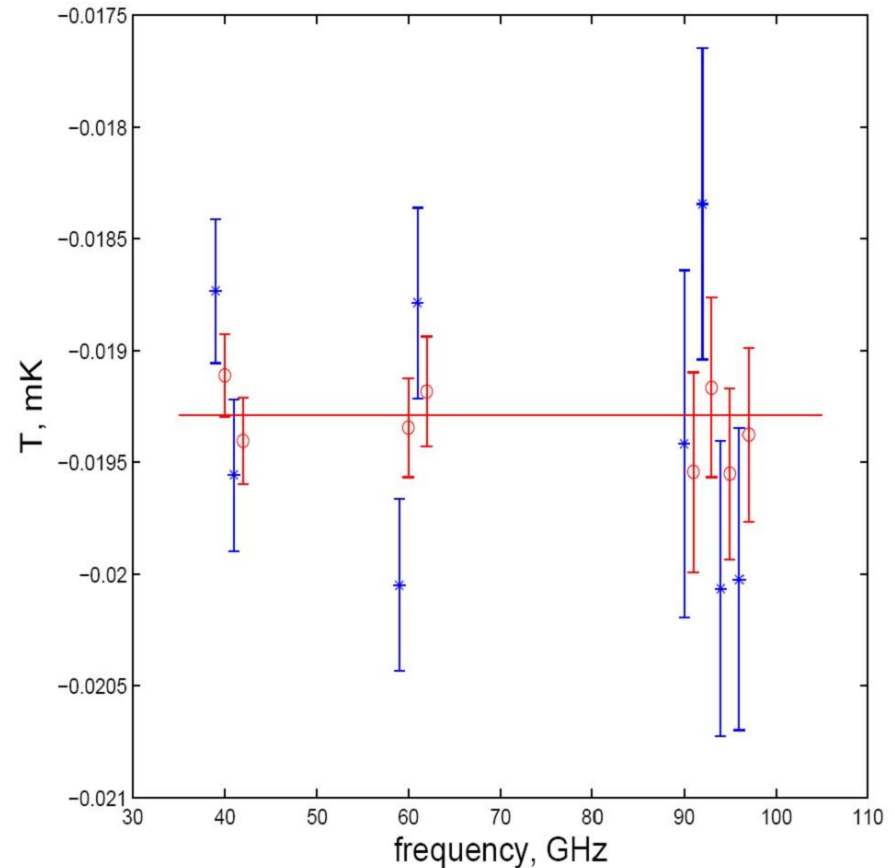
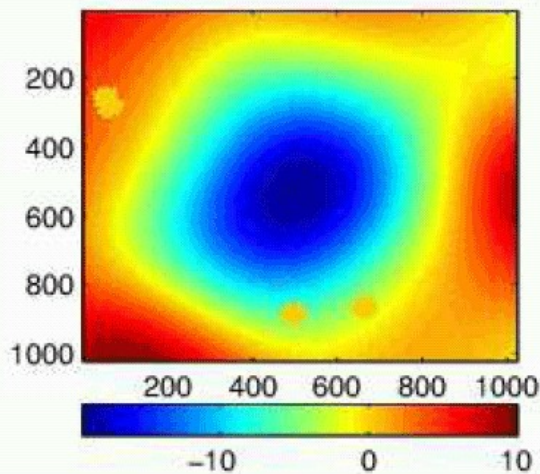
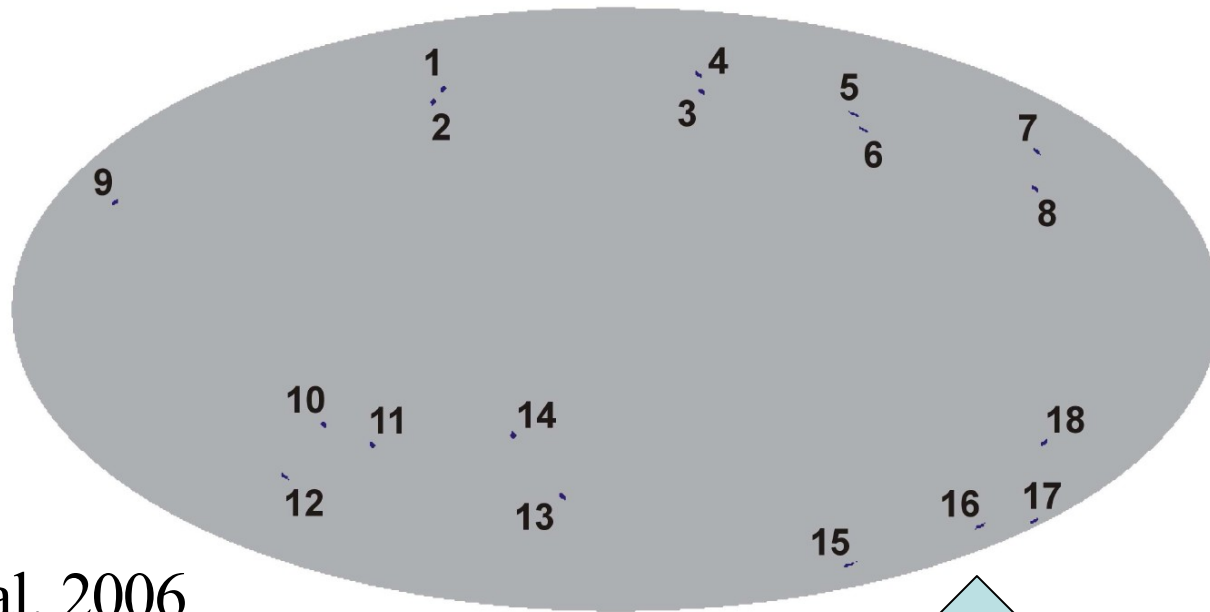


FIG. 10.— Frequency dependence of the temperature at the center of the Spot at scale R_9 . Again the asterisks represent the 1-year data and the circles the 3-year data. The horizontal line shows the value of the 3-year WCM. The data at the same frequency have been slightly offset in abscissa for readability.

Isolated Regions of Strong Correlation

Figure 11. Approximate localised regions flagged for closer examination (see Table 2 for more details).



McEwen et al. 2006

- In effect, a detection of the ISW effect has already been made in this region

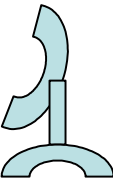
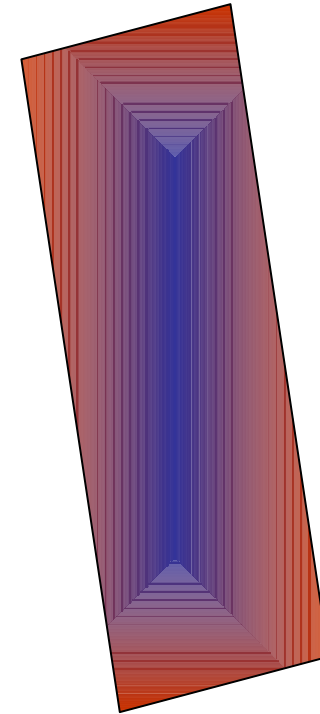
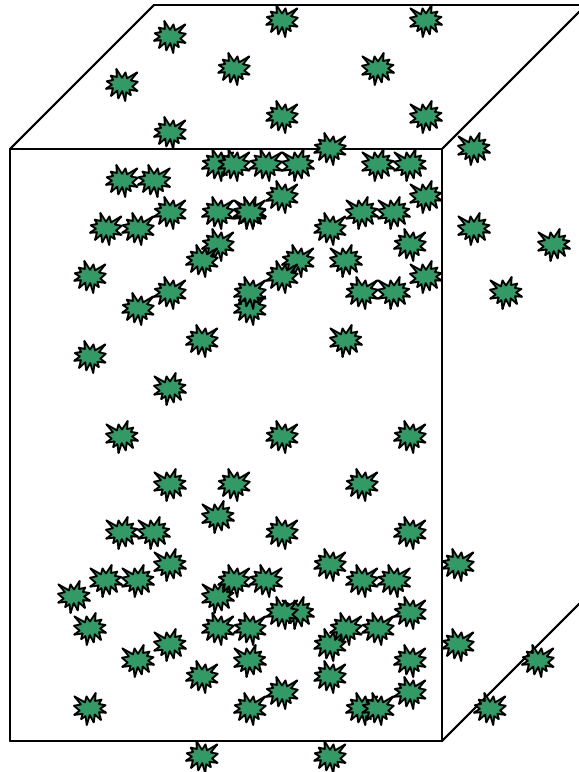
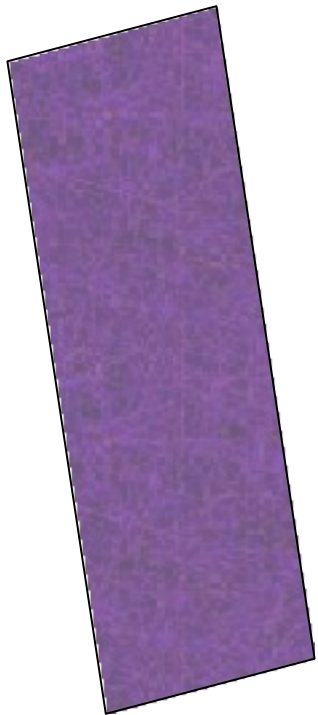
“Cold Spot”

Simple Picture for the Cold spot

CMB

Mass distribution at $z < 1$

Observed CMB at $z=0$



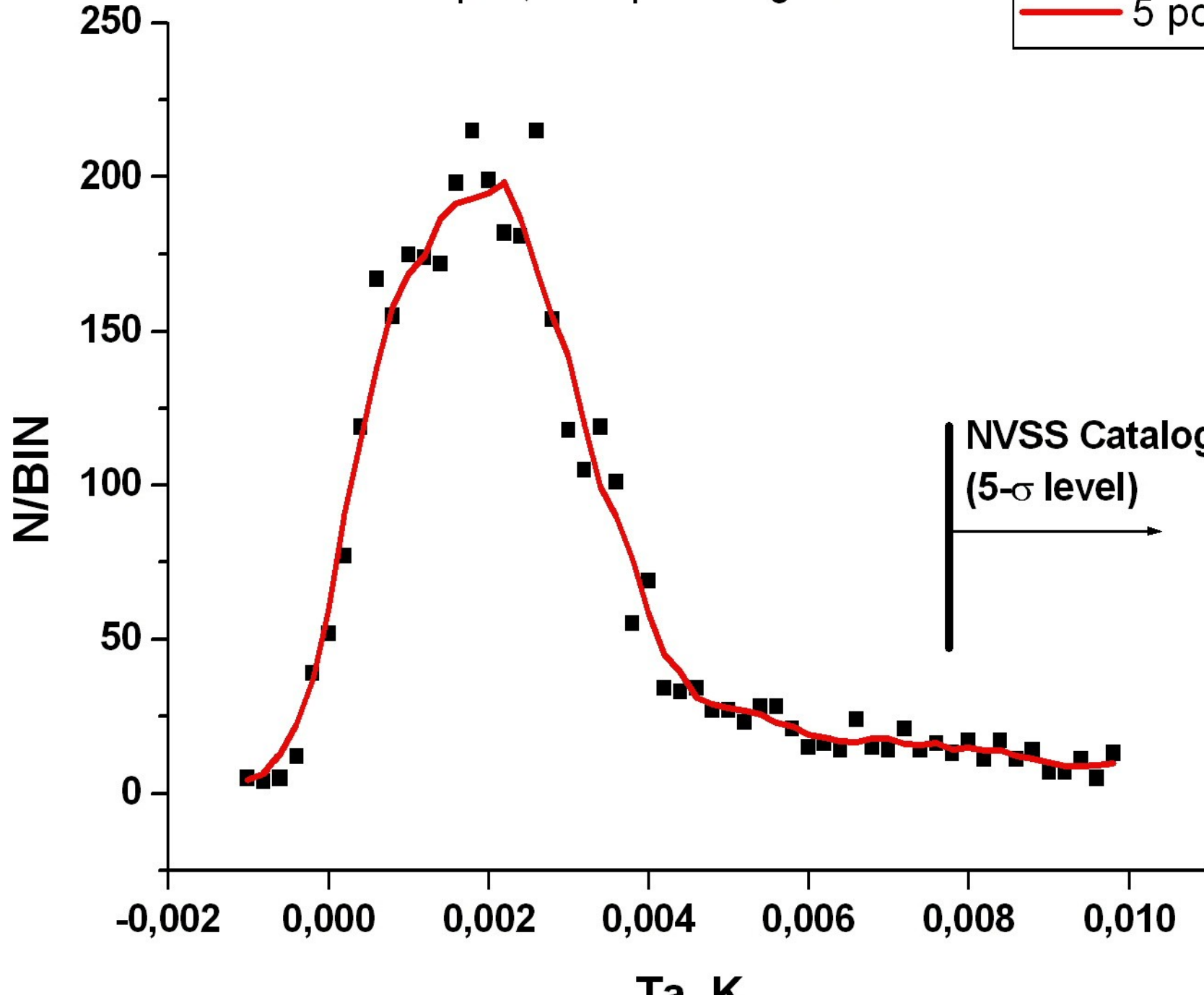
NVSS survey – traces mass distribution
WMAP- CMB anisotropies



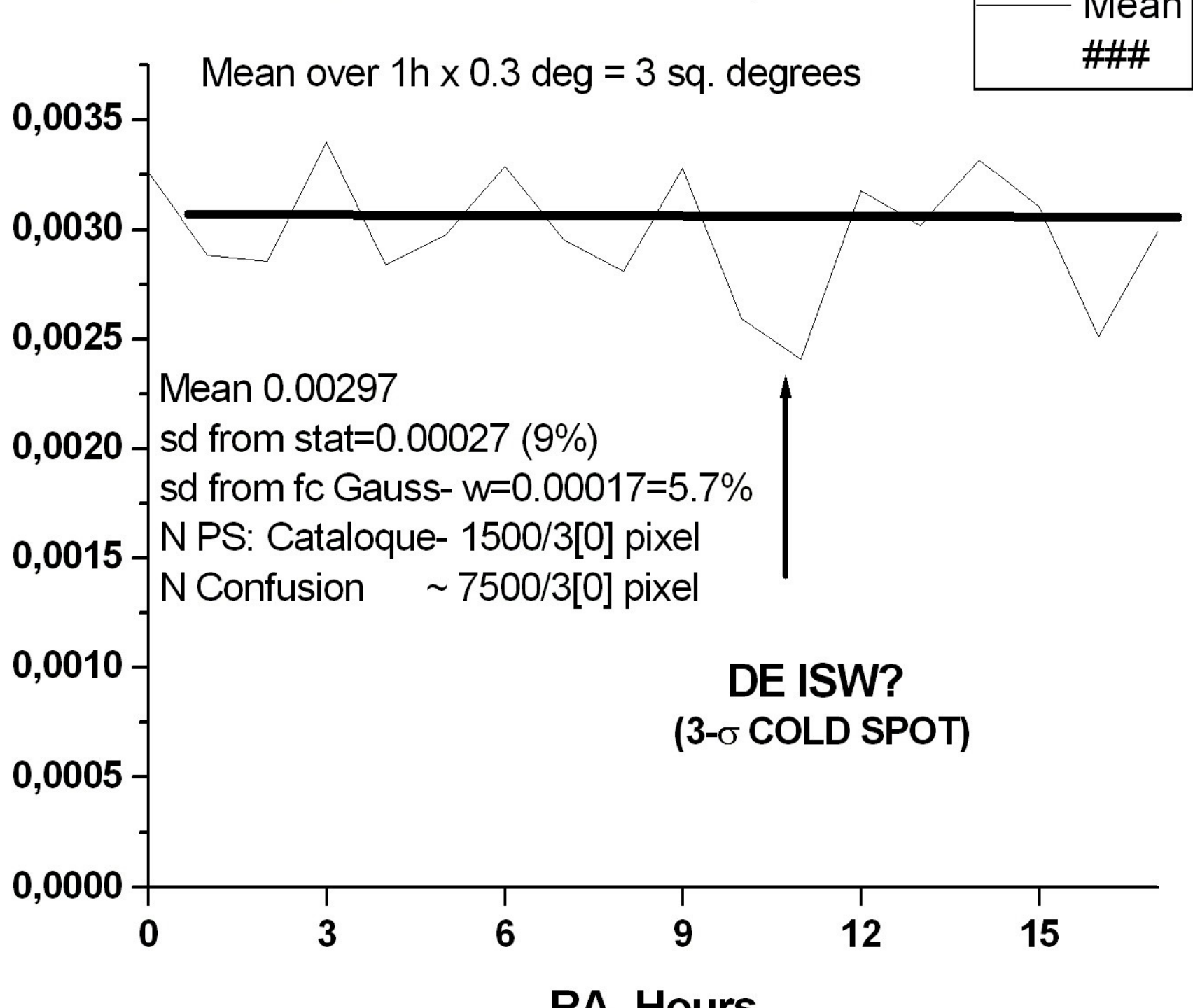
Should be correlated

1h < RA < 2h part, ~3 square degrees area

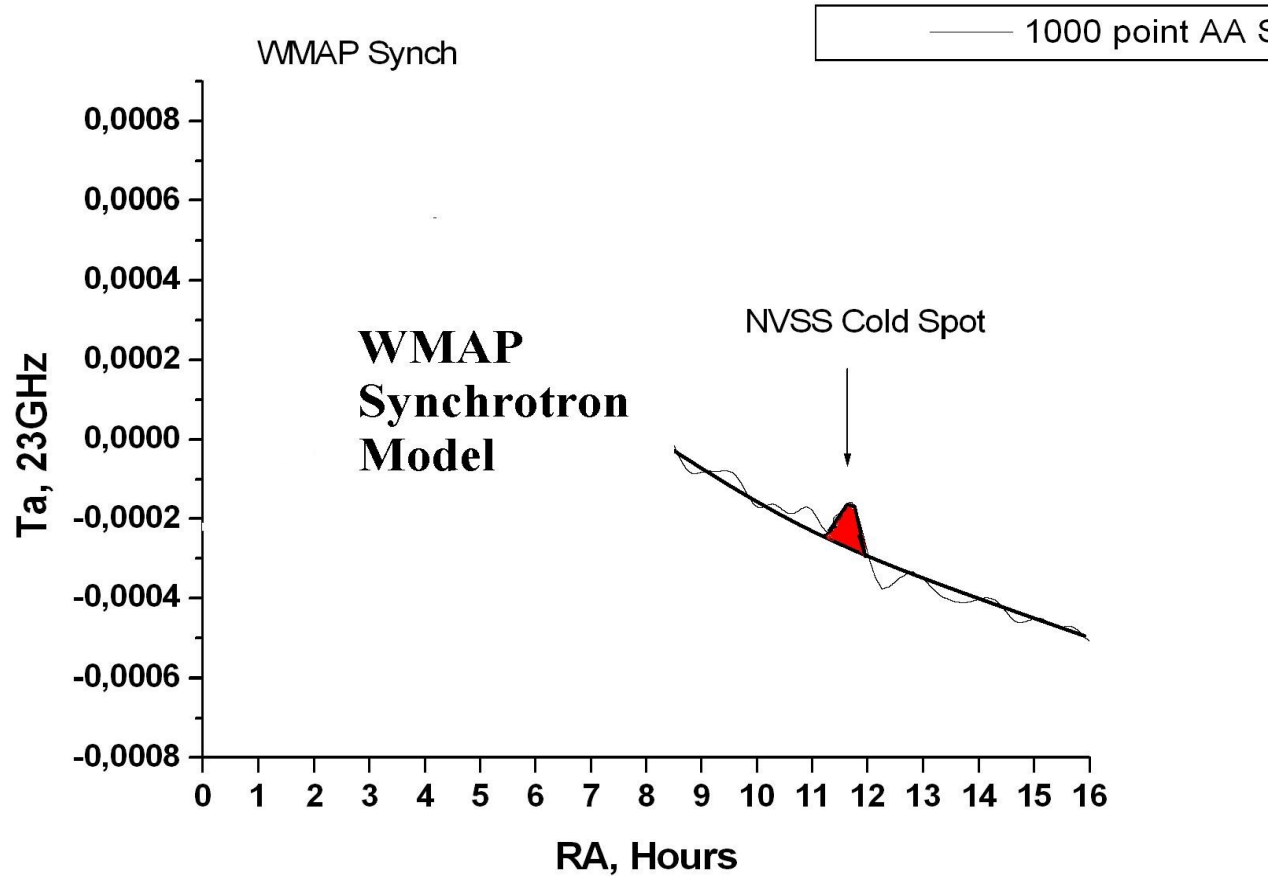
■ Count2h
— 5 point AA S

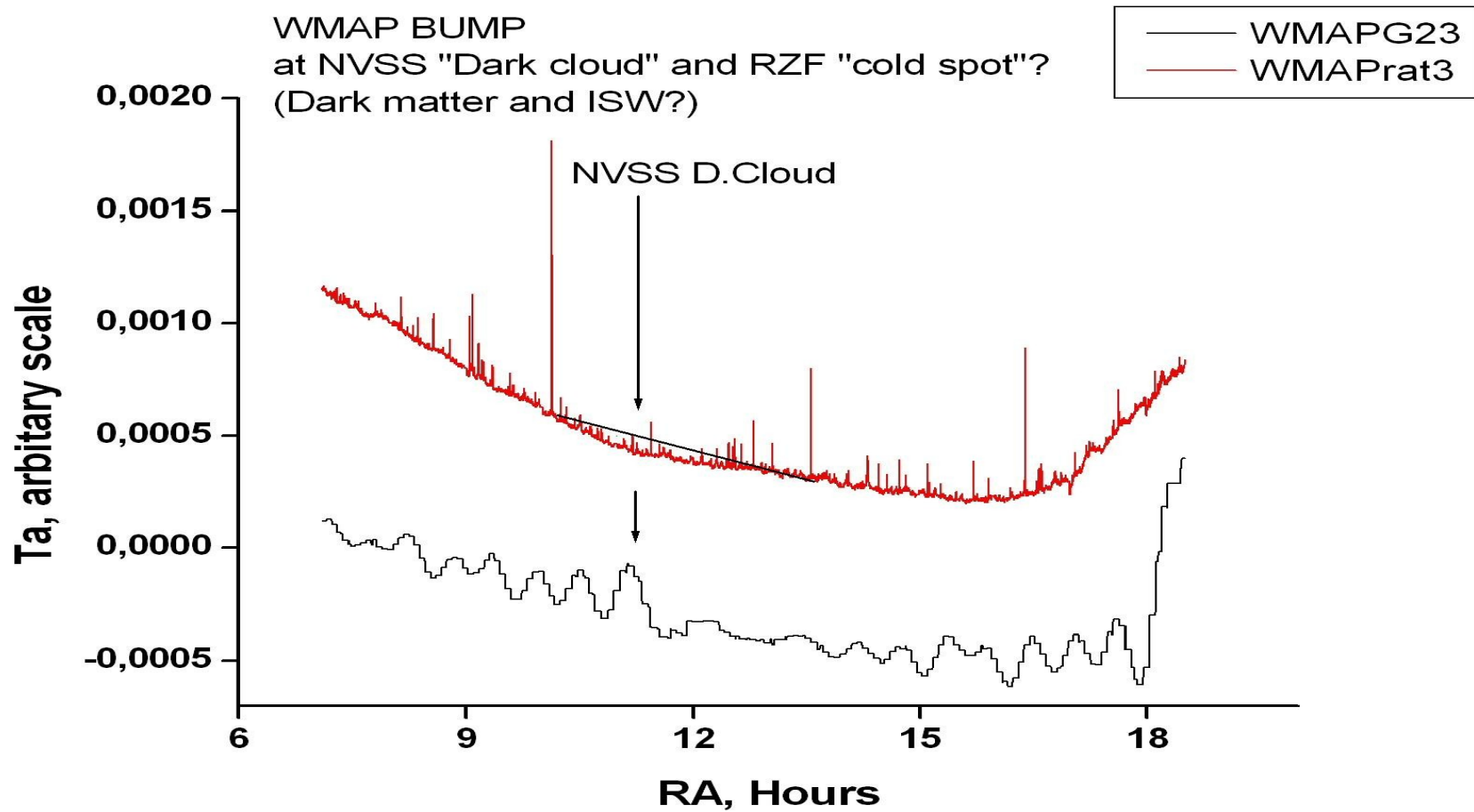


NVSS MAP, convolved with RATAN-600 BEAM



“Cold Spot” and WMAP Sychrotron





О Поляризации

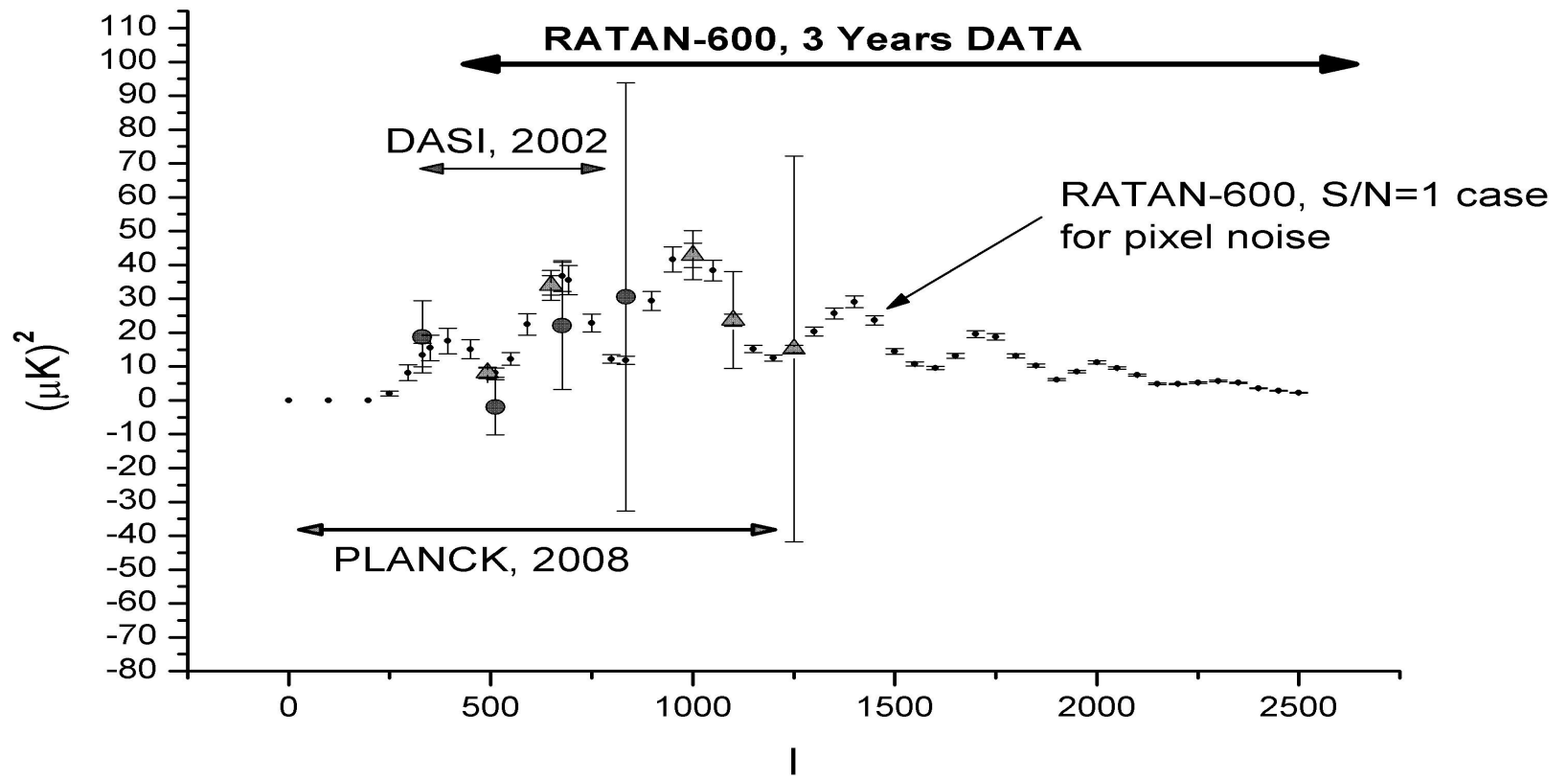
1. Процесс накопления идет, но **надо втрое поднять чувствительность**

Надежда на новую фокальную матрица (32 волновода)

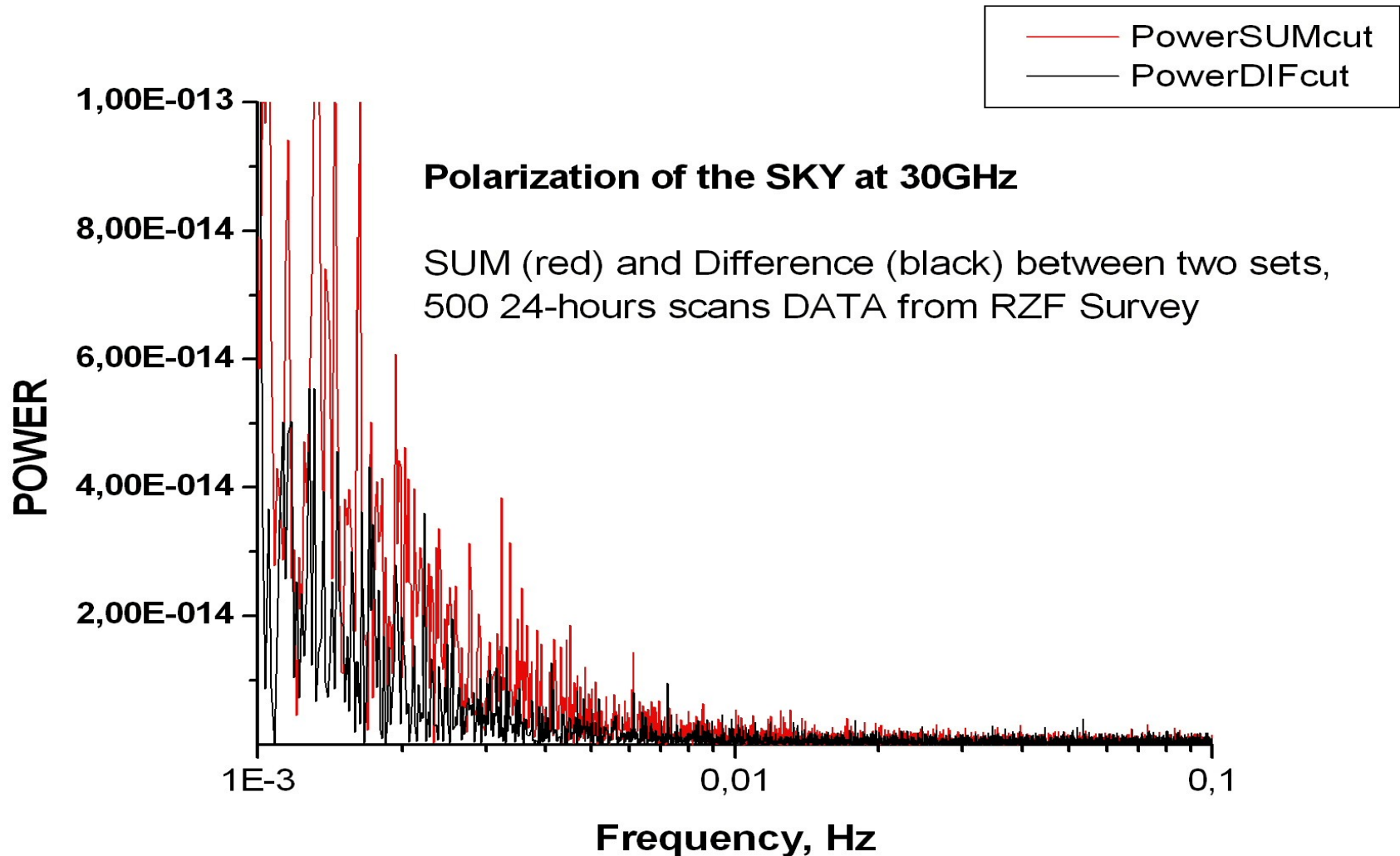
2. Поляризация Галактики на масштабах В-моды от линзирования на реликтовых Грав. волнах. **Есть результат**

ГЕН И ПОЛЯРИЗАЦИЯ СМВ

CMB "Sakharov Oscillations",
Polarization, E component



Discovery of the Sky polarization at 30GHz with up to 0.1 arcmin resolution



Новые акценты

от

" $l=200$ "

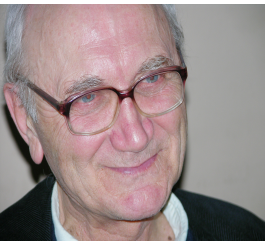
L50, Grav.w. Bpol

L1000, Epol

$2 < l < 8$
Проблема
РОР III

$l > 2000$
«Запретный шум»

CMB group



N. Bursov

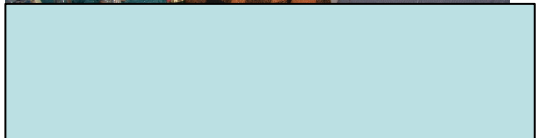


G. Ghekanis

S. Trushkin

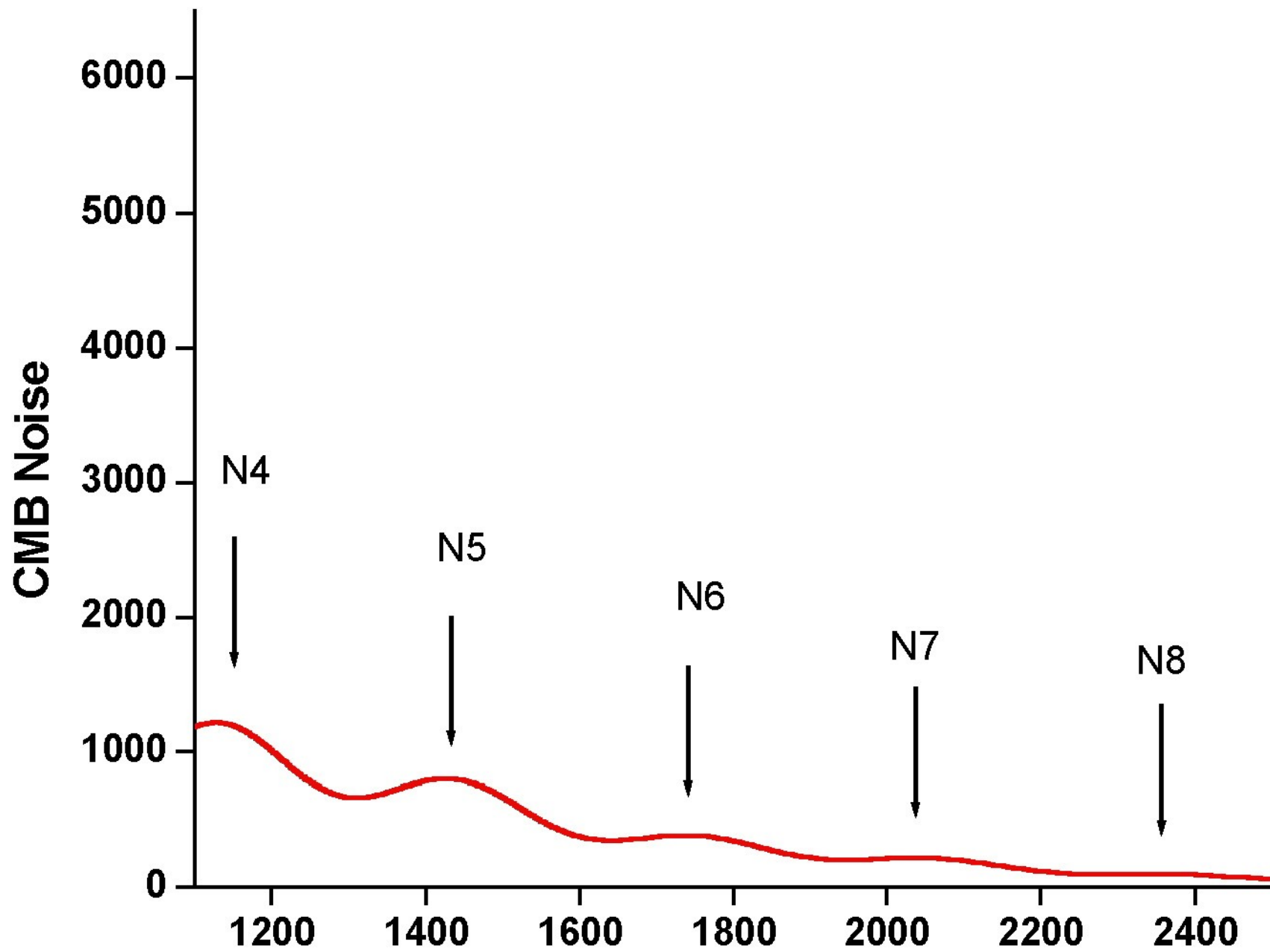


M. Mingaliev

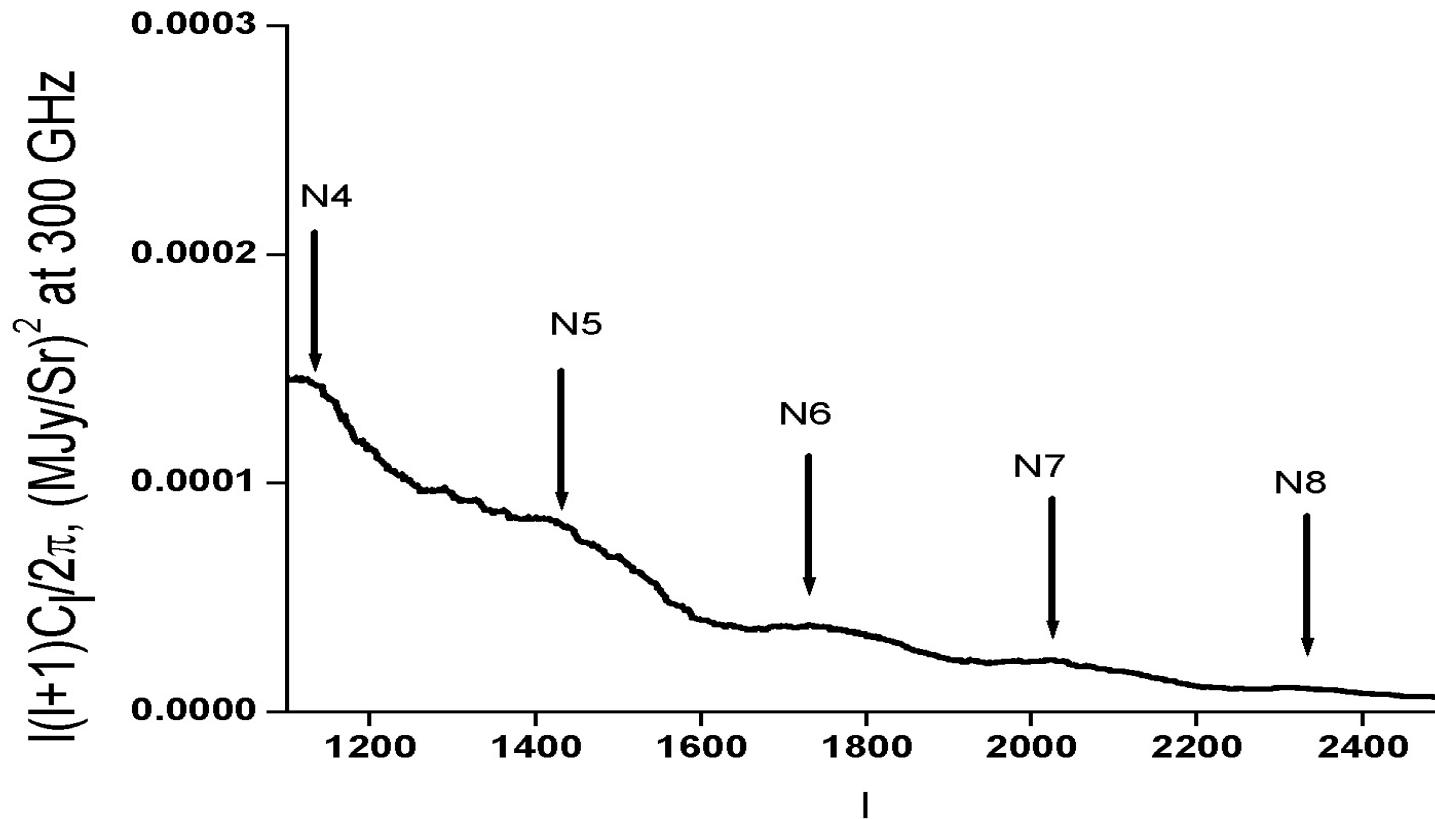


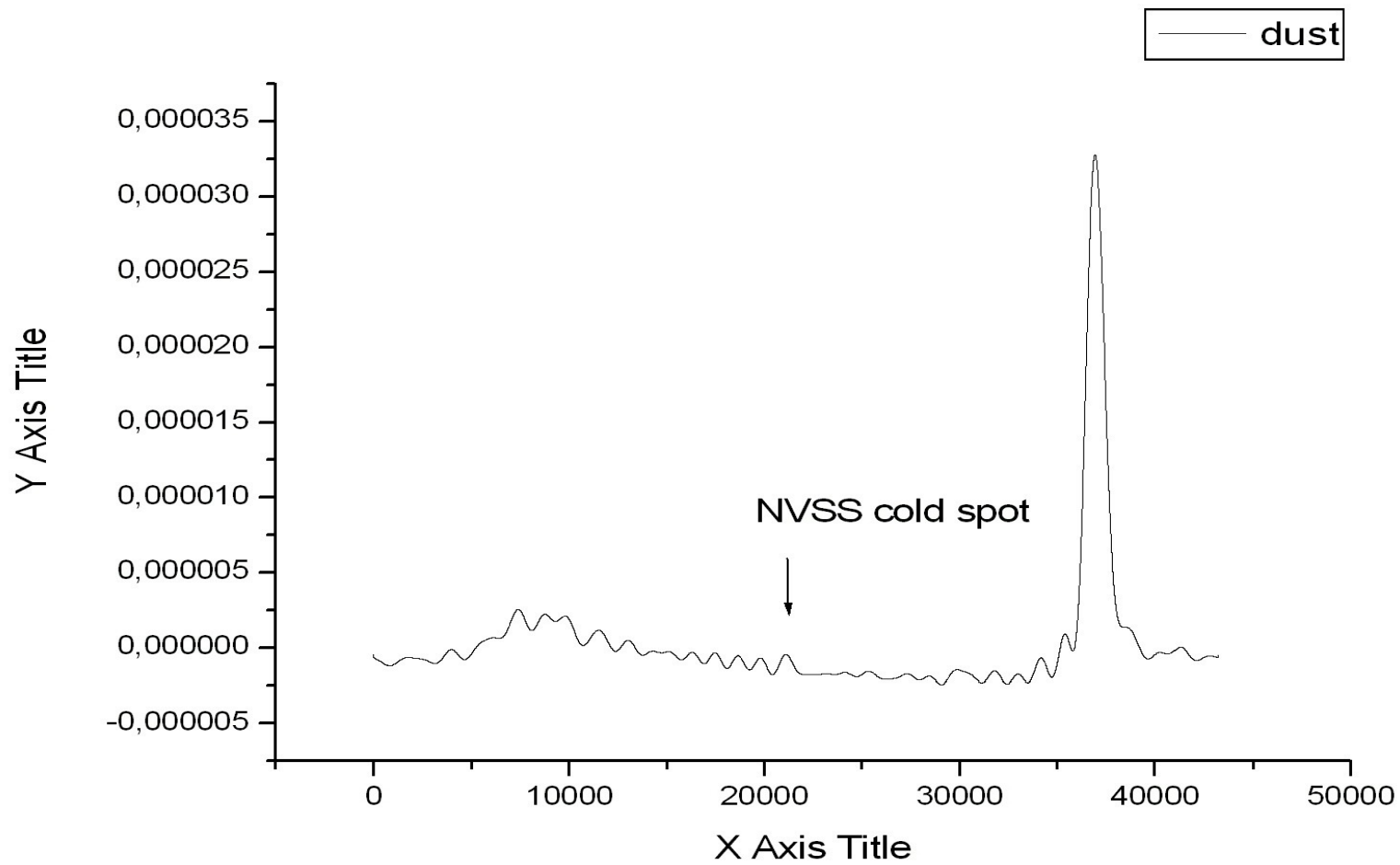
Конец

- **Спасибо ВСЕМ!!**



VLAD Model, "Cosmic Variance" suppression at high l
Smoothed by $\delta l=100$ window





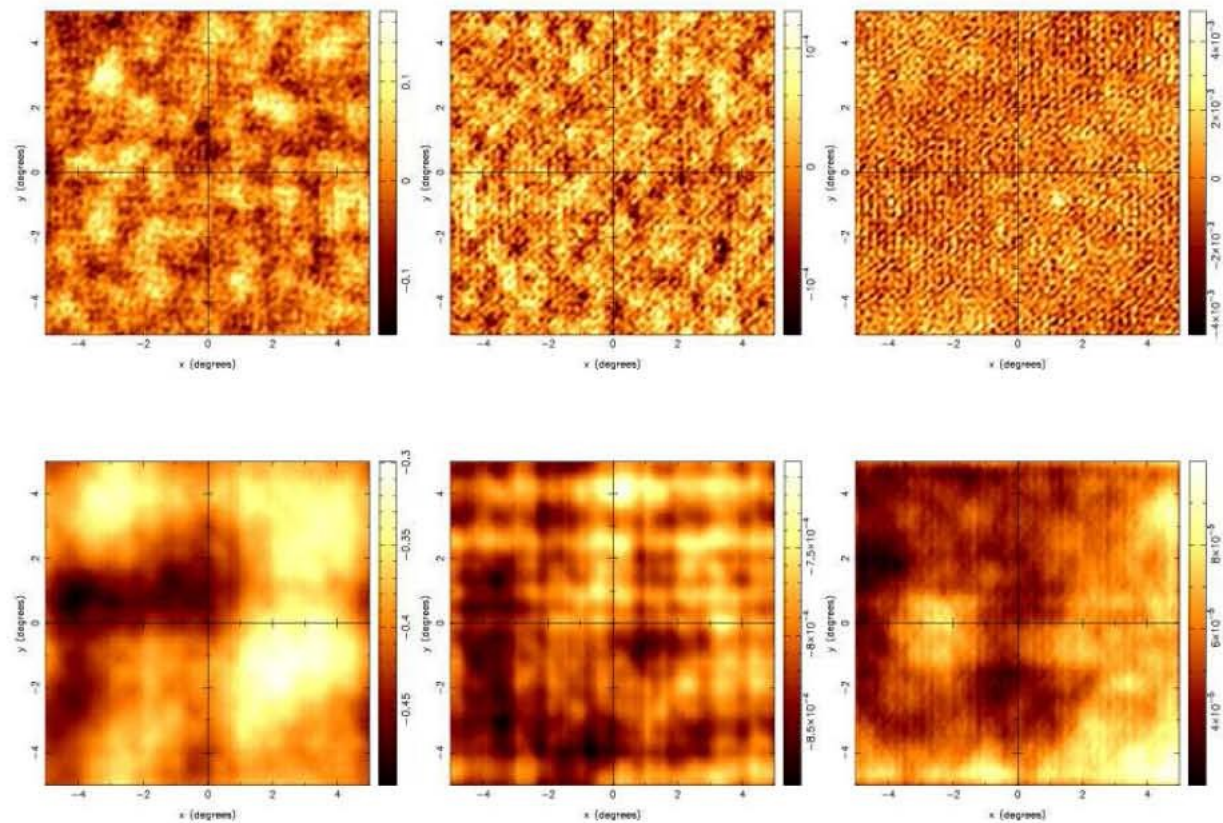


Рис. 3. Восстановление компонент в режиме одного скана на опорной частоте 300ГГц, единицы Мжy/Sr. Порядок компонент то же, что и на Рис. 1.

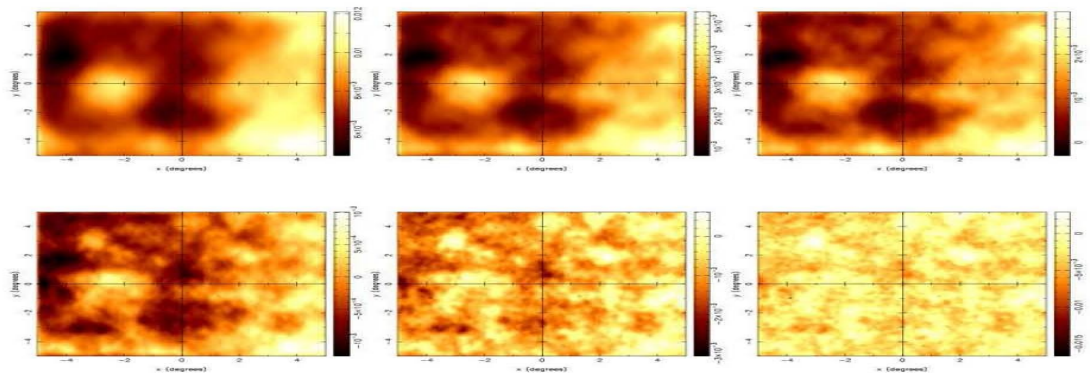
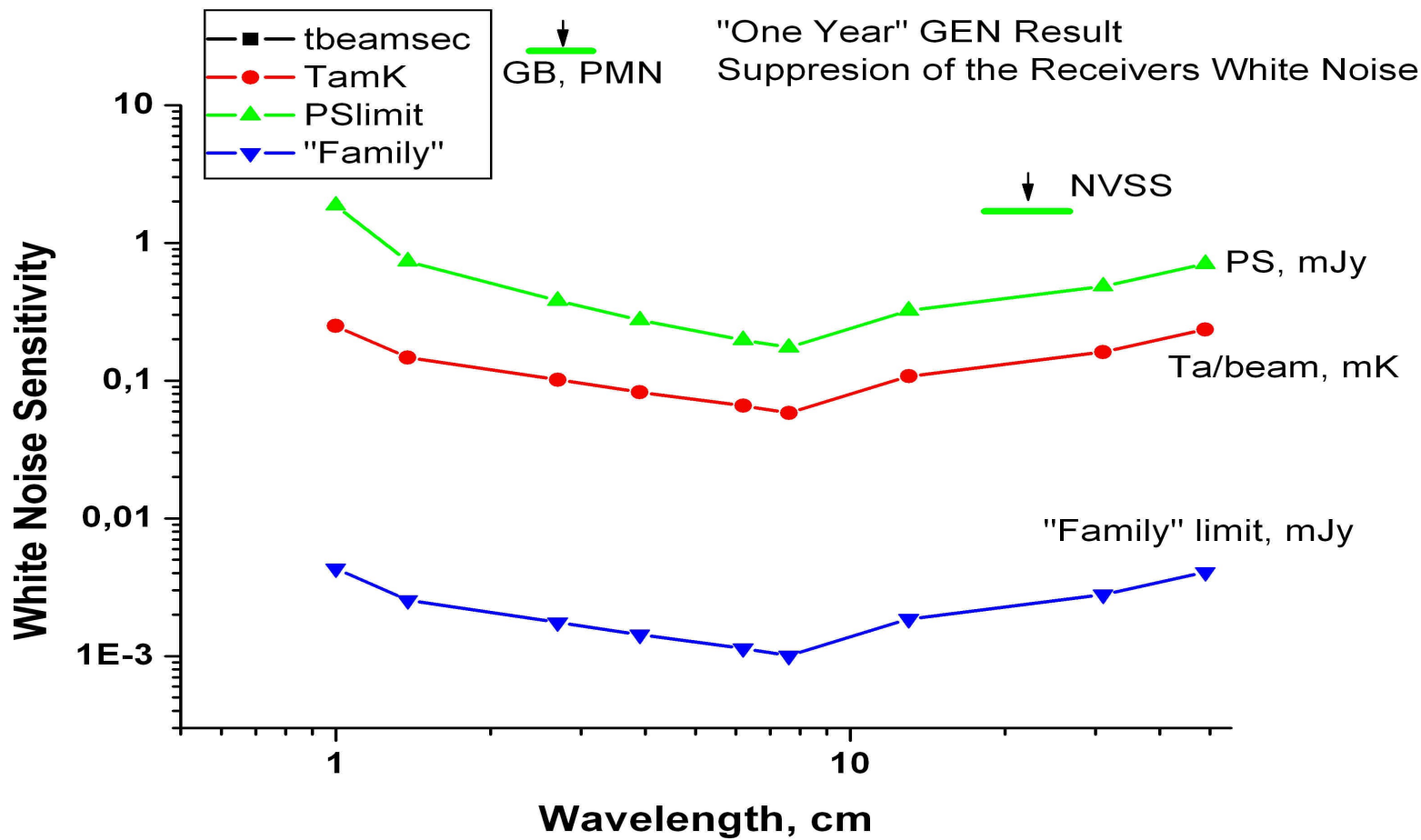


Рис. 7. Модельные карты на частотах 0.96 – 21.85 ГГц в единицах интенсивности MJy/Sr свёрнутые с диаграммами без добавления шума.

Первый год: подавление белого шума на элемент разрешения



Погрешность в оценки СПЕКТРА МОЩНОСТИ, C_l

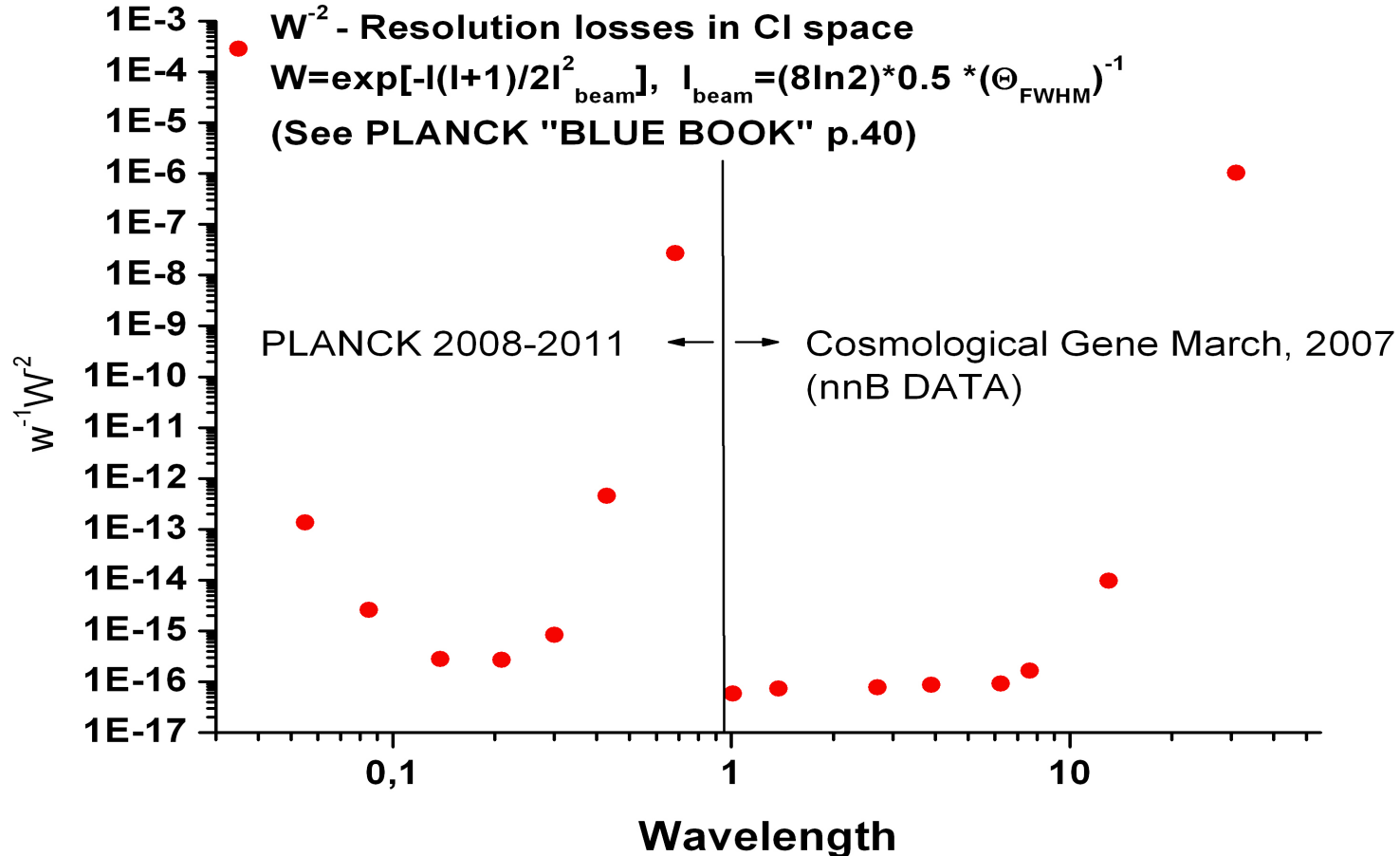
• W2w.111000

$$\Delta C_l^2 = 2/(2l+1) f_{\text{sky}} (C_l + w^{-1} W_l^{-2})^2; \quad w^{-1} = (\sigma_{\text{pixel}} * \Theta_{\text{FWHM}})^2 \text{ for } l=1000 \text{ scale}$$

W^{-2} - Resolution losses in C_l space

$$W = \exp[-l(l+1)/2l_{\text{beam}}^2], \quad l_{\text{beam}} = (8 \ln 2) * 0.5 * (\Theta_{\text{FWHM}})^{-1}$$

(See PLANCK "BLUE BOOK" p.40)



CMB поляризация СЕГОДНЯ

– 99 –

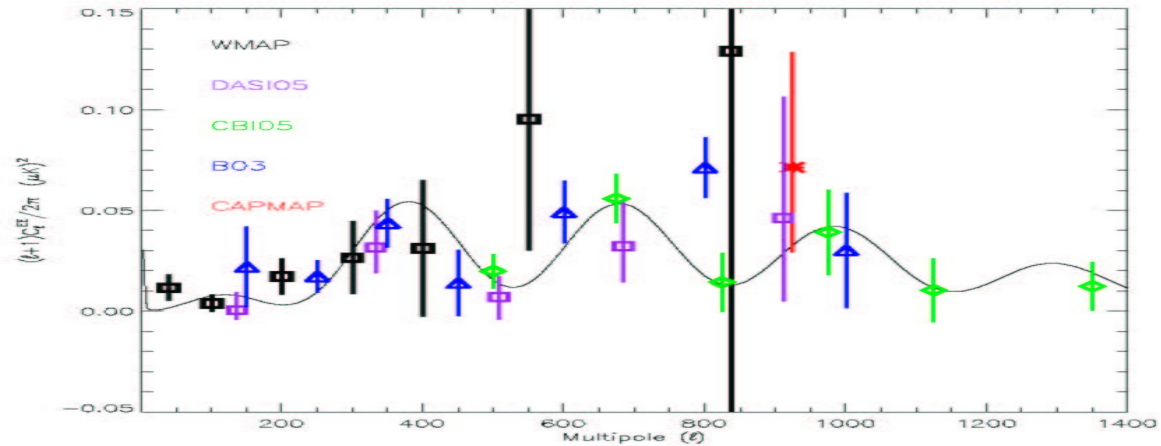
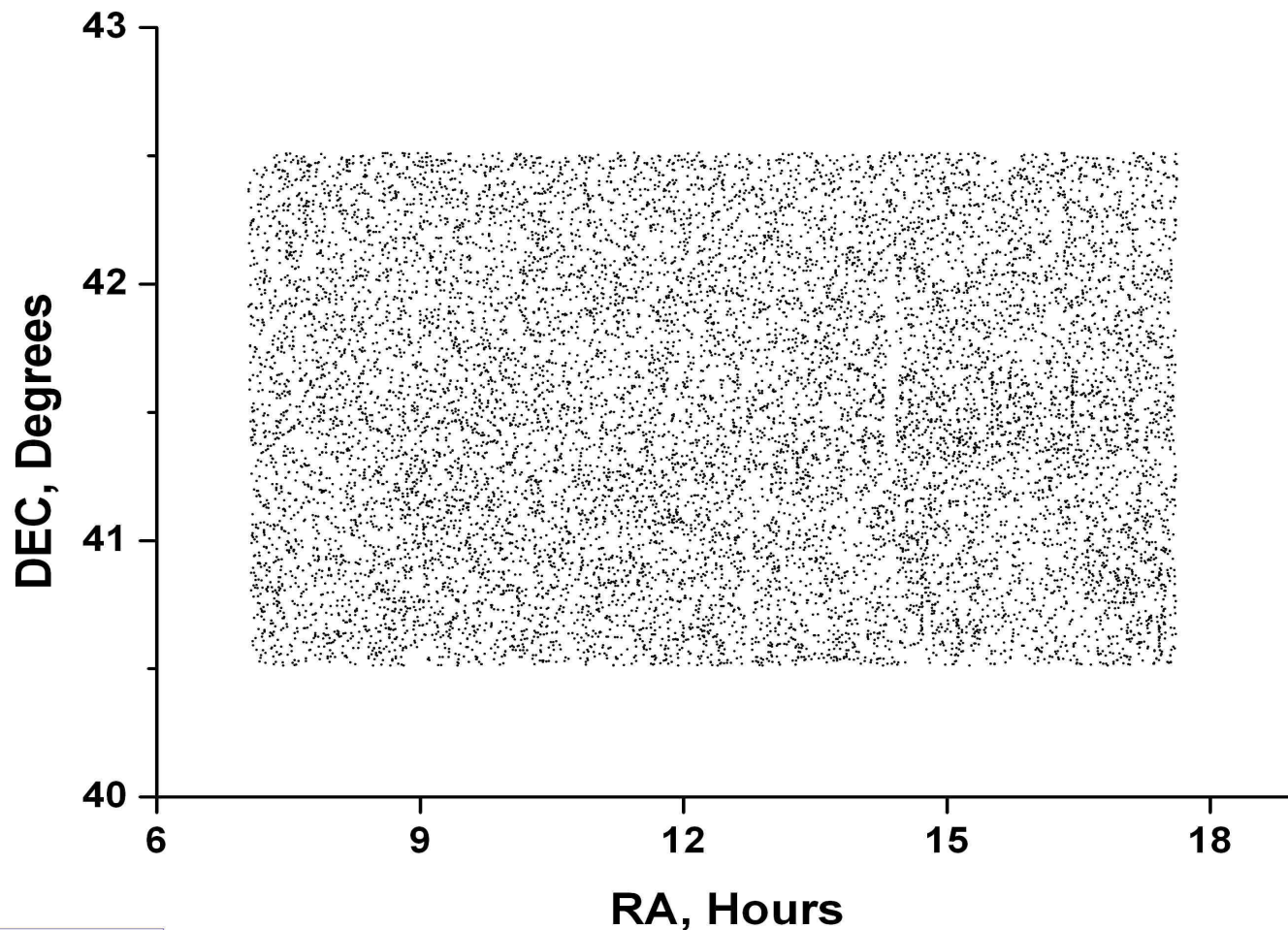


Fig. 22.— The EE spectrum at $\ell > 40$ for all measurements of the CMB polarization. The curve is the best fit EE spectrum. Note that the y axis has only one power of ℓ . The black boxes are the *WMAP* data; the triangles are the *BOOMERanG* data; the squares are the *DASI* data; the diamonds are the *CBI* data; and the asterisk is the *CAPMAP* data. The *WMAP* data are the QVW combination. For the first point, the cleaned value is used. For other values, the raw values are used. The data are given in Table 8

Unexplored FIRST population in RZF Field

12 863 Weakest FIRST objects in the RZF Deep Survey

· First
0 - 3.9 mJy



Проект ГЕН

и

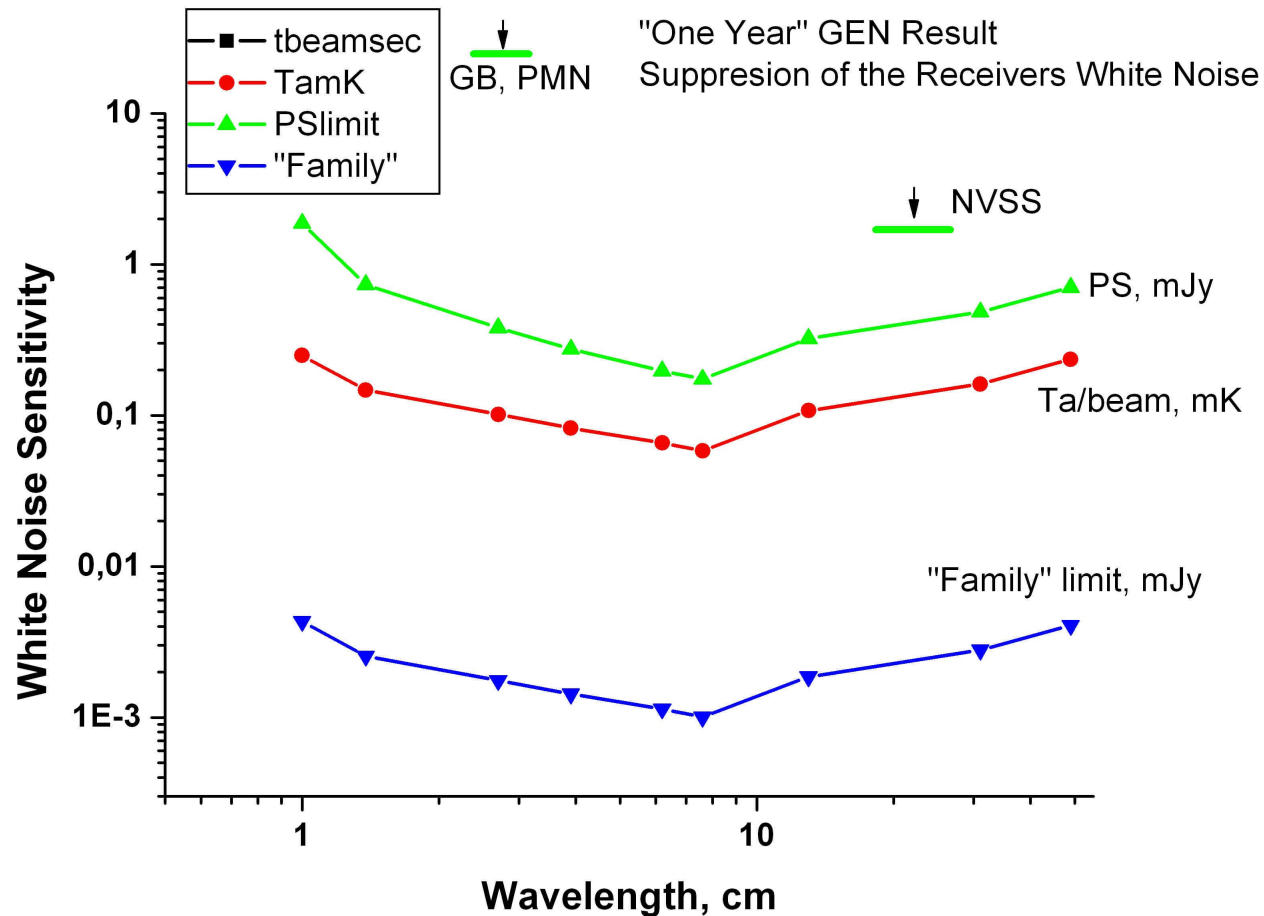
Космология и Микрофизика

Завершен Первый Год
накопления данных по
фооновым излучениям Неба

Результаты

- 1. Подавлен белый шум радиометров до уровня ниже достигнутого в эксперименте WMAP
- 2. Показано, что поляризация фоновых излучений Галактики (синхротронная компонента, ионизированные макромолекулы) не препятствует глубоким исследованиям 3К анизотропии скалярной и вихревой компоненты поляризации Ранней Вселенной
- 3. Уточнена роль фоновых радиоисточников в общем шуме Вселенной на неисследованном ранее уровне плотностей потока

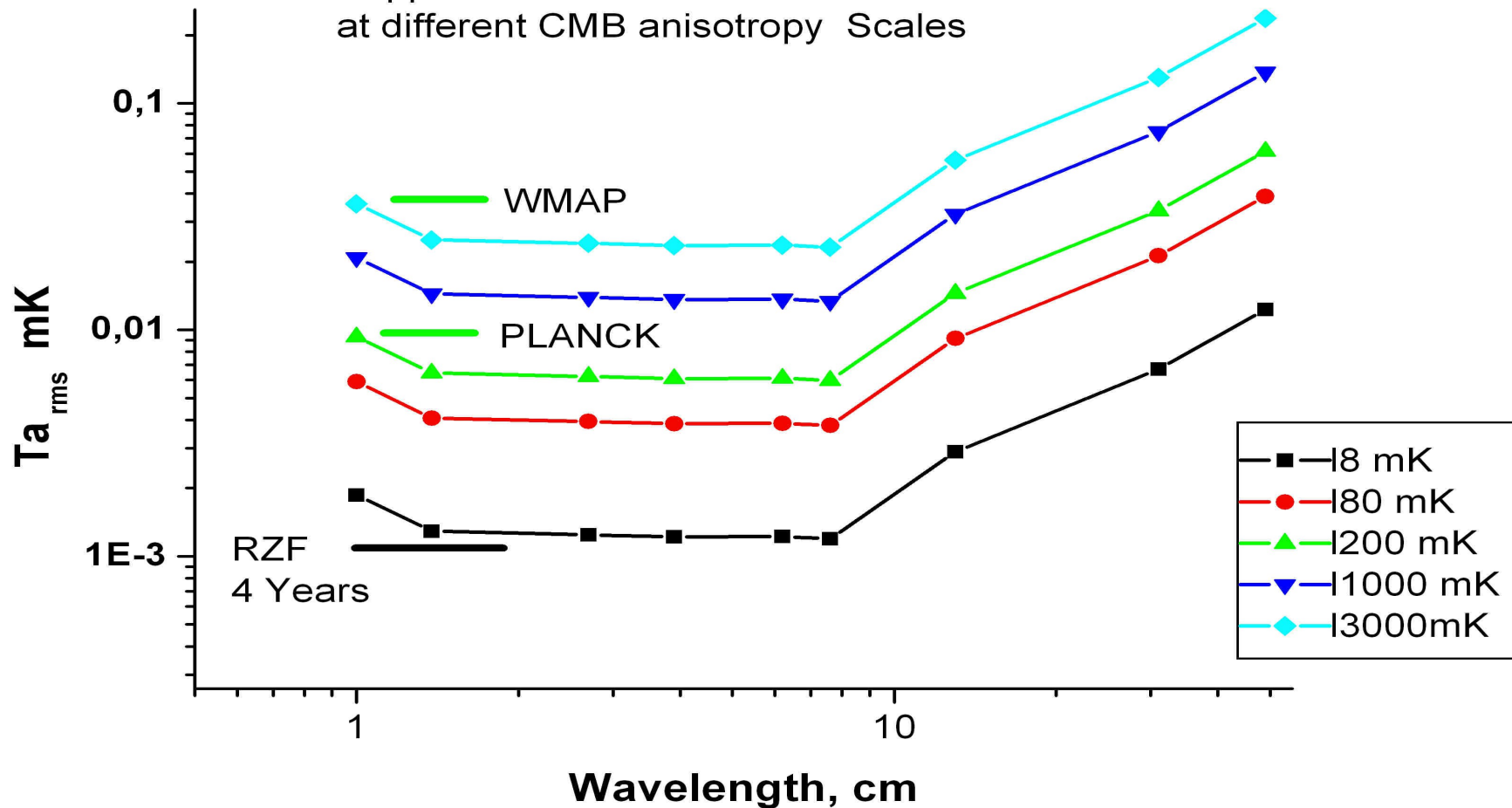
Результаты Первого года проекта ГЕН: проблема фоновых радиисточников



К результатам Первого Года проекта ГЕН Подавление шума радиометров на различный угловых масштабах ($8 < l < 3000$)

"1 Year" GEN Result.

Suppression of the Receivers White Noise
at different CMB anisotropy Scales



ИТОГИ

- Создан не имеющий аналога БАНК ДАННЫХ фоновых излучений Неба на многих волнах в диапазоне 1см-50см
- Полное использование его ожидается после публикации всех данных WMAP с полным разрешением и поляризацией.
- БАНК данных по проекту Генетический Код Вселенной («Ген-фонд») будет основой для глубокой интерпретации эксперимента ПЛАНК

ГЕН и ПЛАНК: проблемы РАЗРЕШЕНИЯ

Beam filtration in Cl space. PLANCK and GEN

