AzTEC/ASTEによる *AKARI* Deep Field South サブミリ銀河サーベイ

東大・天文センター D1 **廿日出 文洋**

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Outline

- Introduction
  - (Sub)Millimeter-bright Galaxies (SMGs)
  - SMG Surveys

- ASTE / AzTEC *AKARI* Deep Field South (ADF-S)
  - 202 arcmin^2, 1 σ ~0.9 mJy
  - 43 (>3 σ), 39 (>3.5 σ) sources
  - Number Counts
  - Comparison with *AKARI* data
  - Angular Correlation Function

Submillimeter Galaxies (SMGs)

- Thermal dust emission is dominant
  - $L_{bol} \gtrsim 10^{12\text{-}13}\ L_{sun}$
  - Star Formation Rates (SFRs) ~ 100-1000 M_{sun} / yr
- High-redshift
  - $z \sim 2\text{-}3$ ($z_{median} \sim 2.2$)
- Massive
  - $M_{dyn} \sim 10^{11}\ M_{sun}$, $M_{gas} \sim 10^{10\text{-}12}\ M_{sun}$
- Clustering Properties
  - Progenitors of present massive ellipticals?
  - Key to understanding galaxy evolution & cosmic star formation history

SMG Surveys

- 850 μm (SCUBA)

Field	SHADES (SXDF, LH)	8-mJy Survey (ELAISE N2, LH E)	HDF-N
Area (arcmin^2)	720	260	~10-100
1 σ (mJy)	~2	~2.5	~0.6-5
N_{source}	~120	38	19
Ref.	Coppin+06	Scott+02	Borys+03

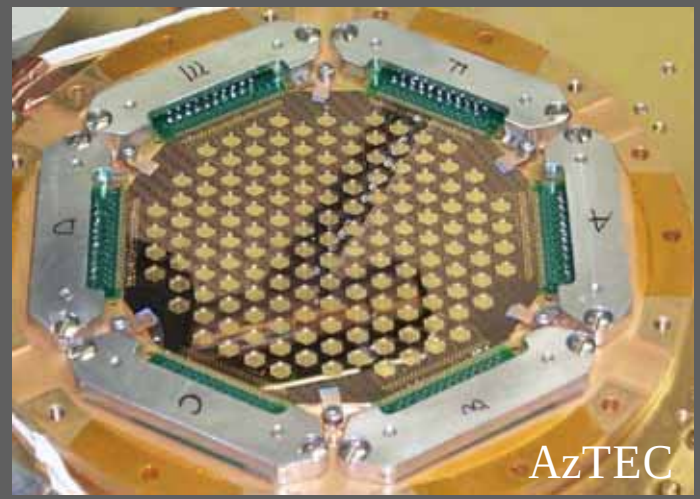
- 1 mm

Field	Lockman Hole (Bolocam)	Lockman Hole (MAMBO)	ELAISE N2 (MAMBO)	COSMOS (MAMBO)
Area (arcmin^2)	324	197	160	~400
1 σ (mJy)	~1.4	~0.6	~0.65	
N_{source}	17	14	16	~15-30
Ref.	Laurent+05	Greve+04	Greve+04	Bertoldi+07

AzTEC / ASTE
AKARI Deep Field South
SMG Survey

AzTEC on ASTE

- AzTEC
  - 1.1mm 144-elements Bolometer Array
  - ’05-’06: JCMT, ’09: LMT
- ASTE
  - 10-m Submillimeter Telescope
  - Chile, Atacama Desert, 4860m
  - 345GHz 2SB receiver
- AzTEC on ASTE
  - 2007 Jun.-Oct., 2008 Jul.-Nov.
  - FOV = 8 arcmin Φ
  - FWHM = 30 arcsec
  - confusion limit = 0.5-0.7 ? mJy

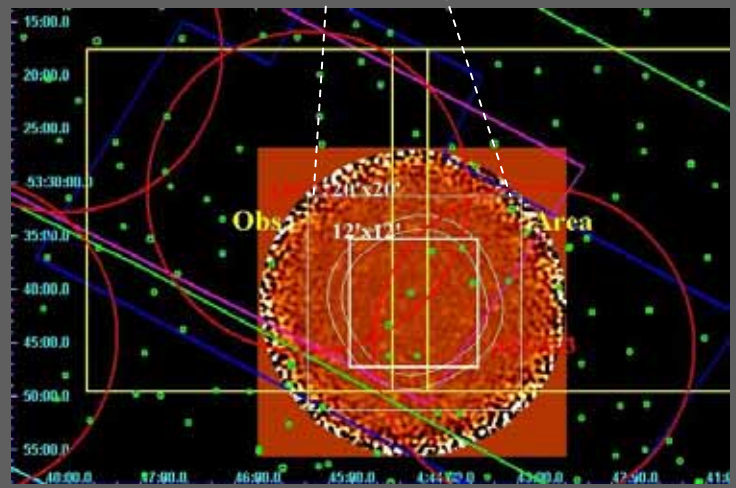

AzTEC


ASTE

AKARI Deep Field South (ADF-S) Observations

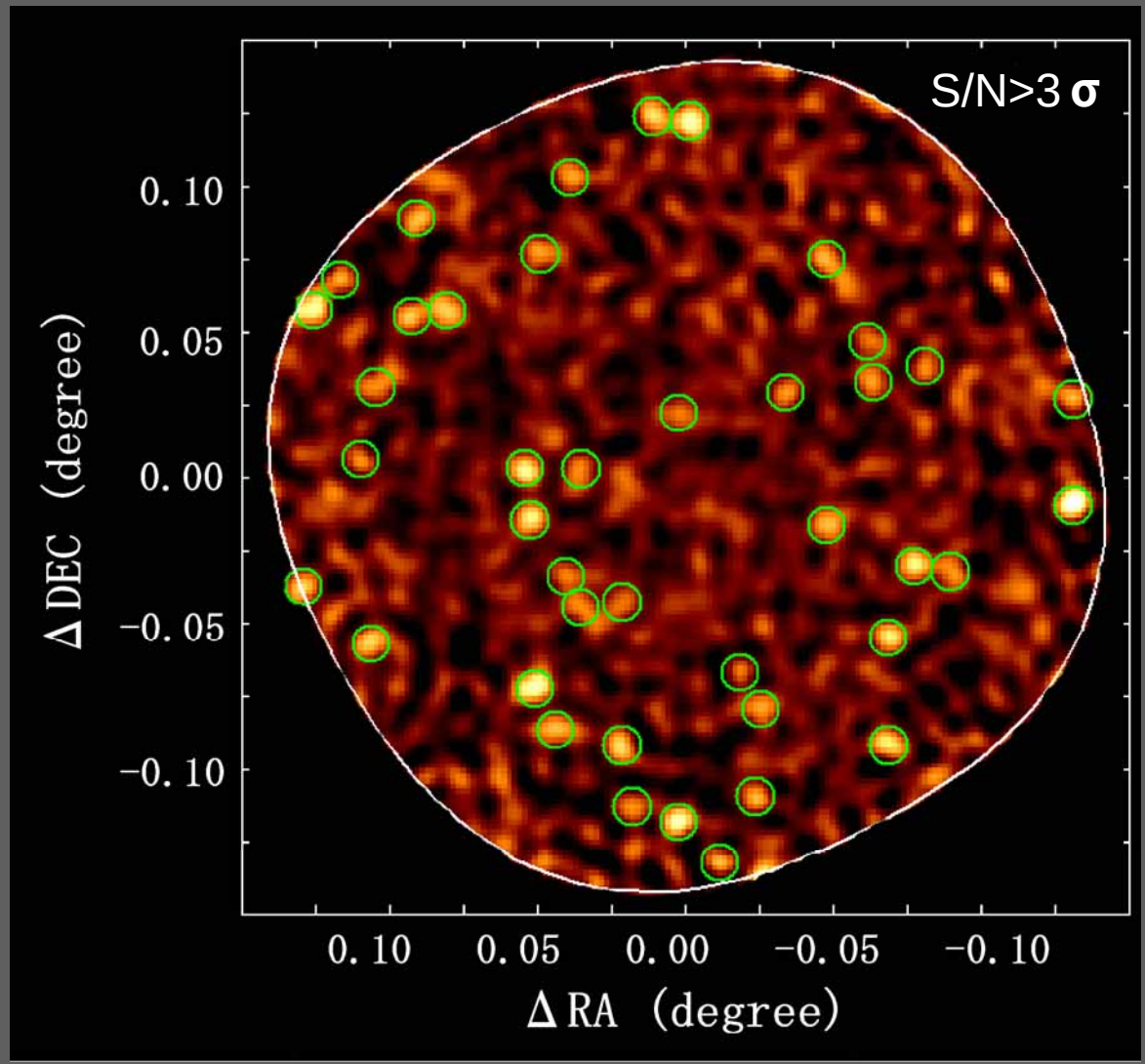
- ADF-S
  - near South Ecliptic Pole (SEP)
  - Lowest cirrus region
  - Multi-wavelength Campaign
  - +04:44:00, -53:20:00

- AzTEC/ASTE Observations
  - 2007 Sep. 16 – Oct. 14
  - 20'x 20' (low noise 12'x 12')



Results

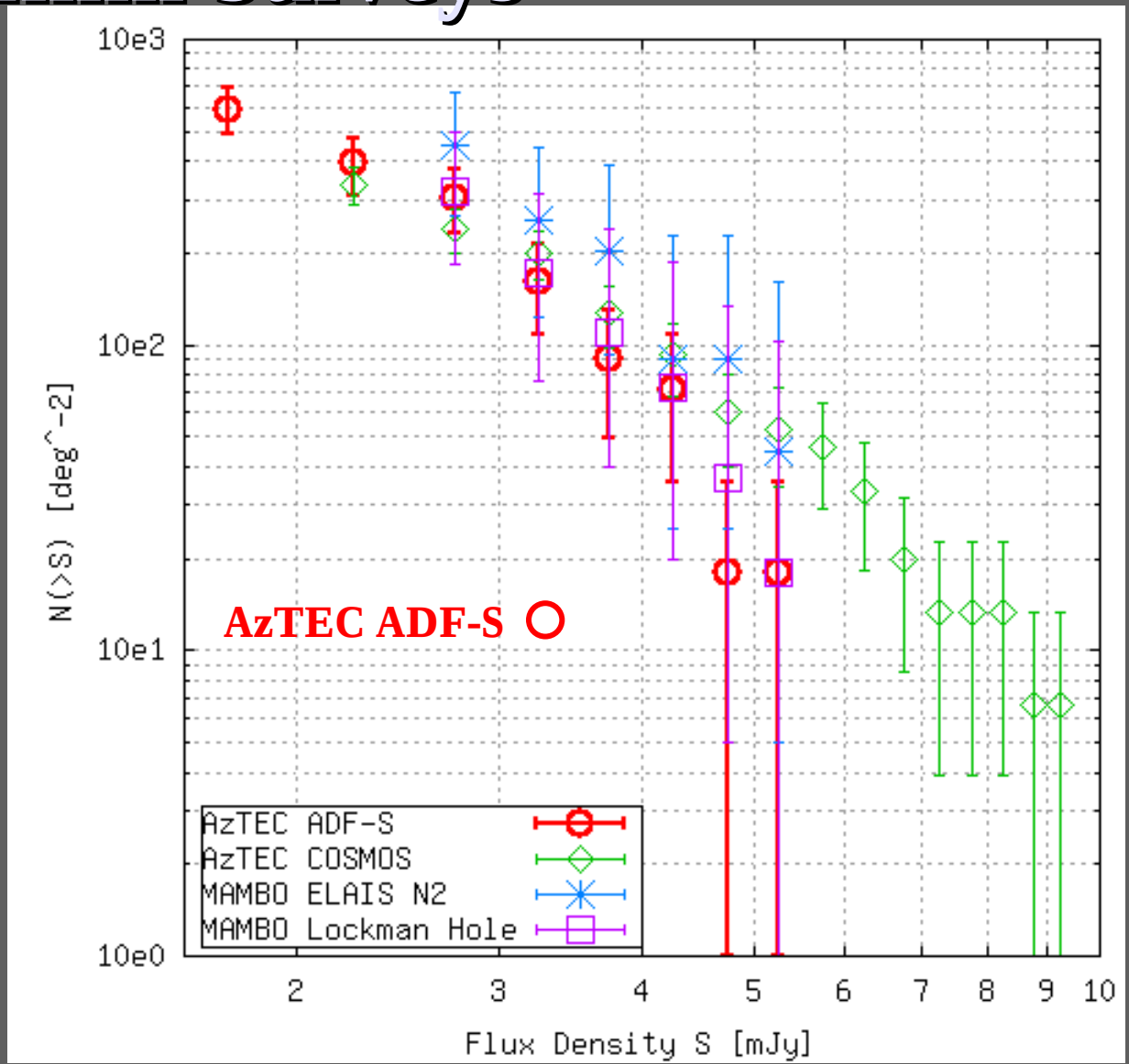
- on-source 42 hr
  ($\tau_{220GHz} < 0.1$)
- 202 arcmin^2
  (50% coverage)
- 1 **σ** ~ 0.8 mJy
- Source detection
  - 43 (>3 **σ**)
    - 2.1 – 7.2 mJy
  - 33 (>4 **σ**)



Cumulative Number Counts of 1mm Surveys

- >3.5σ source
- flux de-boosted

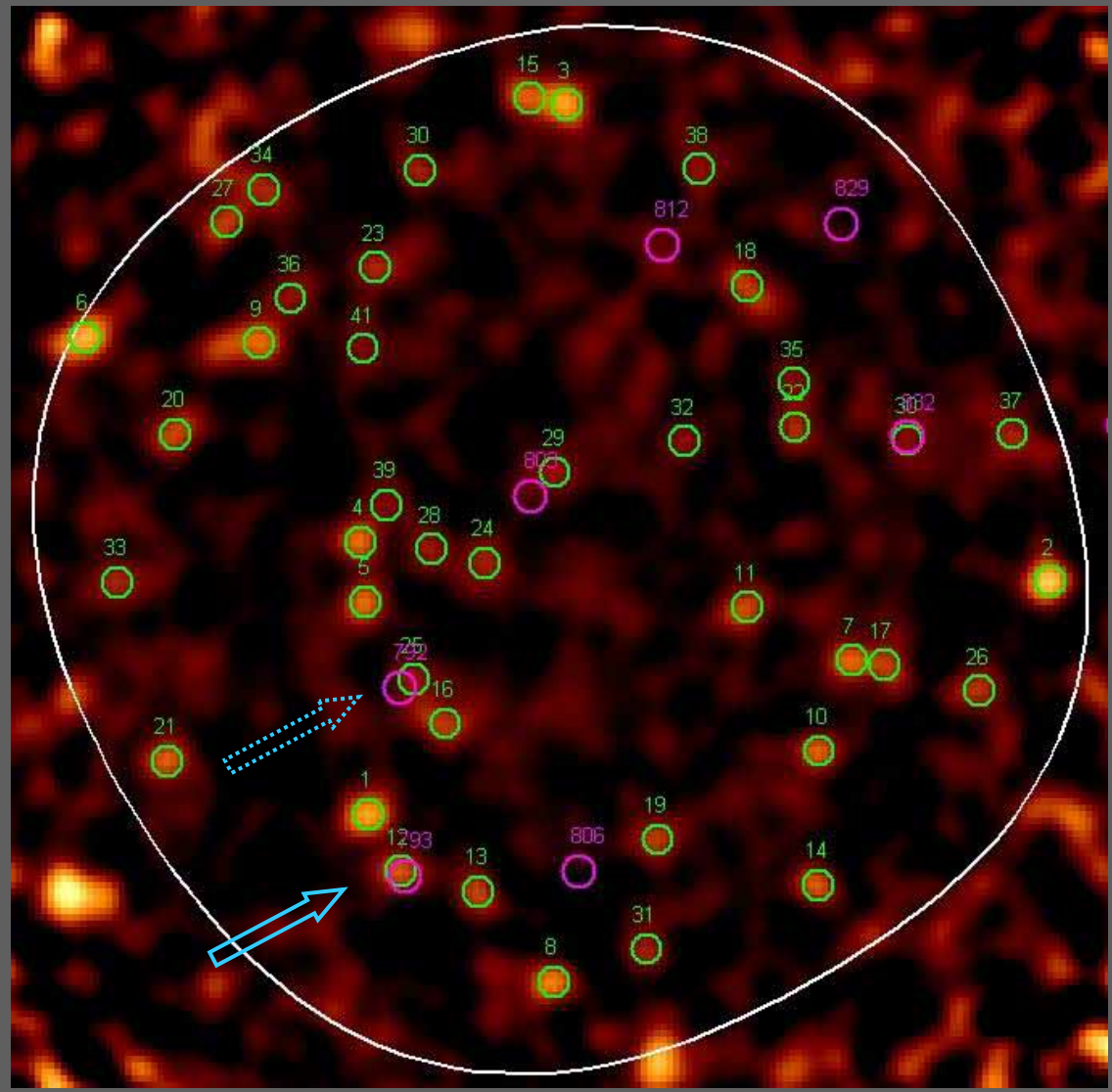
- 他の Blank Field と consistent



Comparison with AKARI FIS

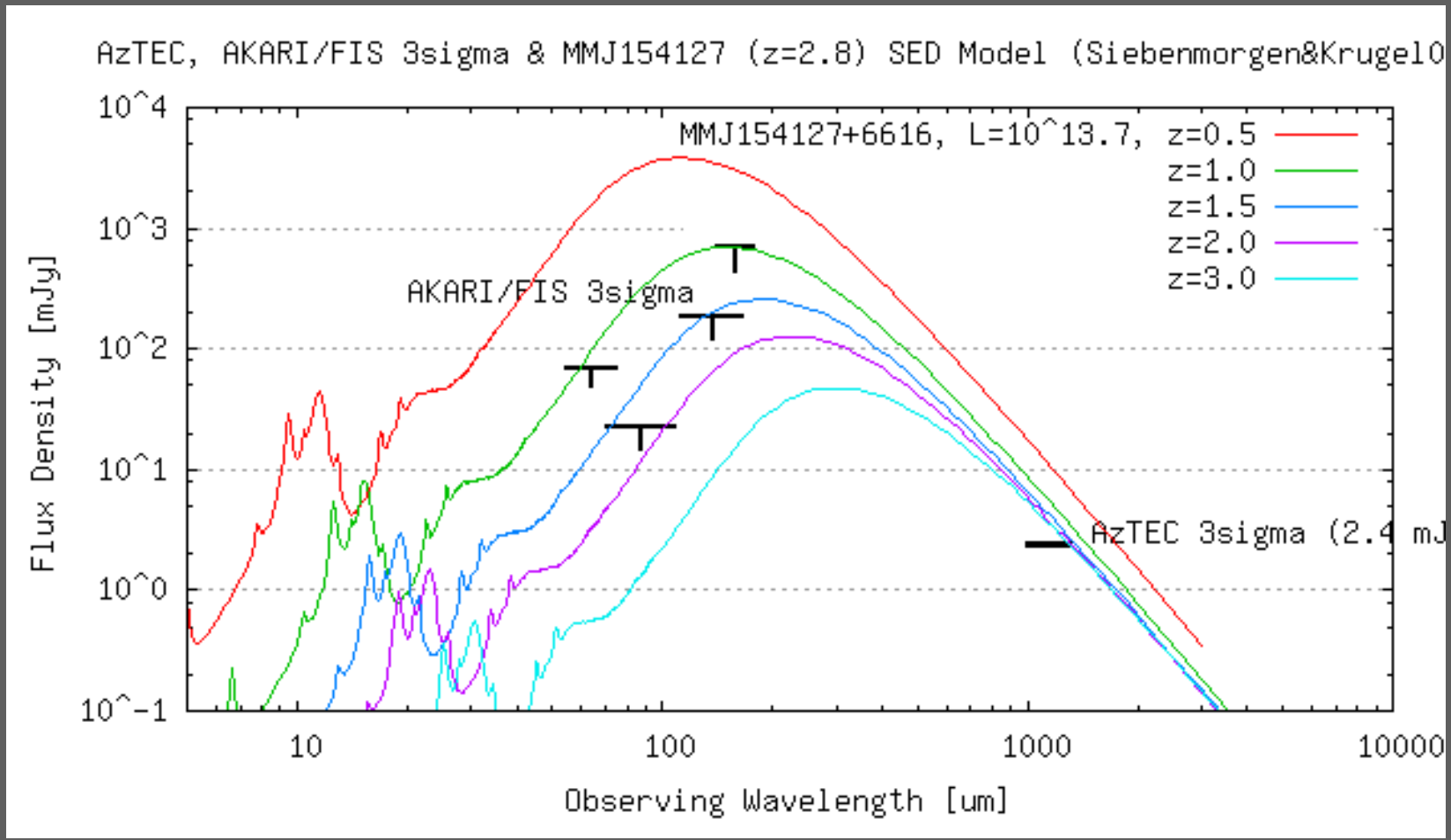
- green: AzTEC 3 **σ**
- magenta: FIS 3 **σ** (Wide-S 90um)

- 7 FIS sources are detected in this map
- Only 1 (or 2) source coincides with AzTEC sources
  - AzTEC#12-FIS#793
  - AzTEC#25-FIS#792 ??



Comparison with SED Models

- AKARI/FIS non-detection
  --→ AzTEC sources are at z ≳ 2 ??



Clustering of AzTEC Sources

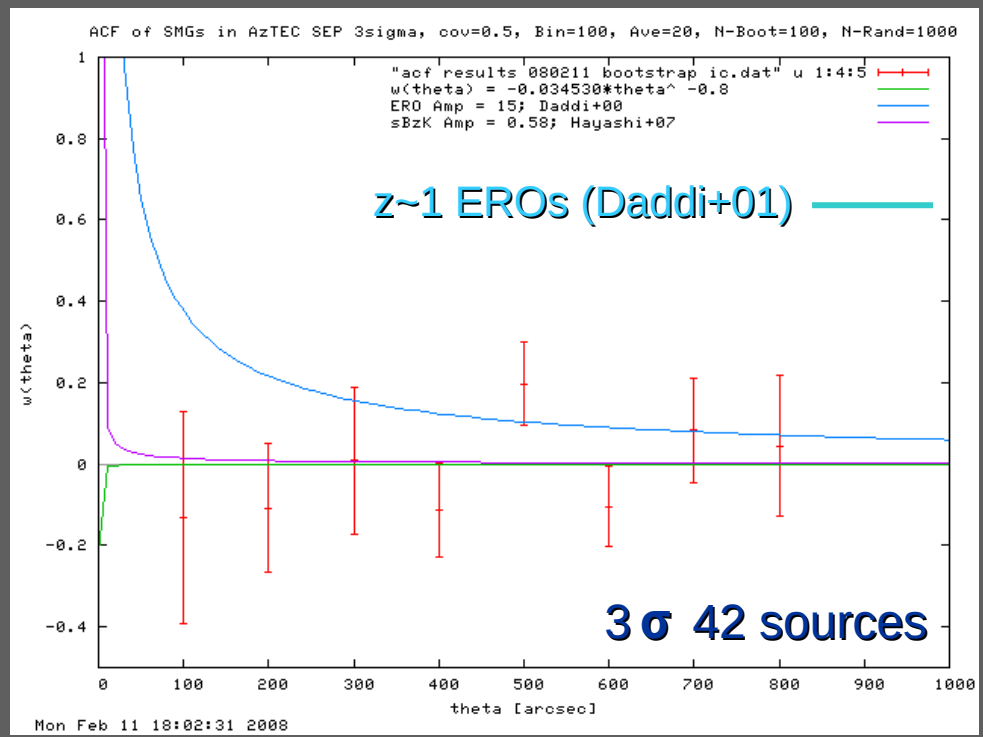
- Angular Correlation Functions
  - excess probability of finding a source

$$\delta P(\theta) = N^2[1 + w(\theta)]\delta\Omega_1\Omega_2$$

$$w(\theta) = \frac{DD - 2DR + RR}{RR}$$

(Landy & Szalay 1993)

- no clear positive correlation



Contribution to Cosmic Infrared Background (CIB)

- Sum of flux densities of >3.5 **σ** AzTEC sources
  = 1.9 Jy/deg^2

- CIB = 18-24 Jy/deg^2 at 1.1 mm wavelength

(Puget+96 AA 308 L5; Fixsen+98 ApJ 508, 123)

→ ~8-11% of CIB

Summary

- AzTEC/ASTE 1.1-mm ADF-S Survey
  - 1 **σ** ~ 0.8 mJy (low noise 202 arcmin^2)
  - detected sources: 43 (>3 **σ**), 39 (>3.5 **σ**)
- Number Count
  - consistent with other 1-mm blank-field surveys
- Comparison with *AKARI* FIS
  - One FIS source is coincide with an AzTEC source
  - Most AzTEC sources are not detected with FIS

    → AzTEC sources are at high-z ($z \gtrsim 2$) ?
- Clustering
  - No clear positive correlation
- Contribution to CIB
  - We resolved ~10% of CIB into point sources