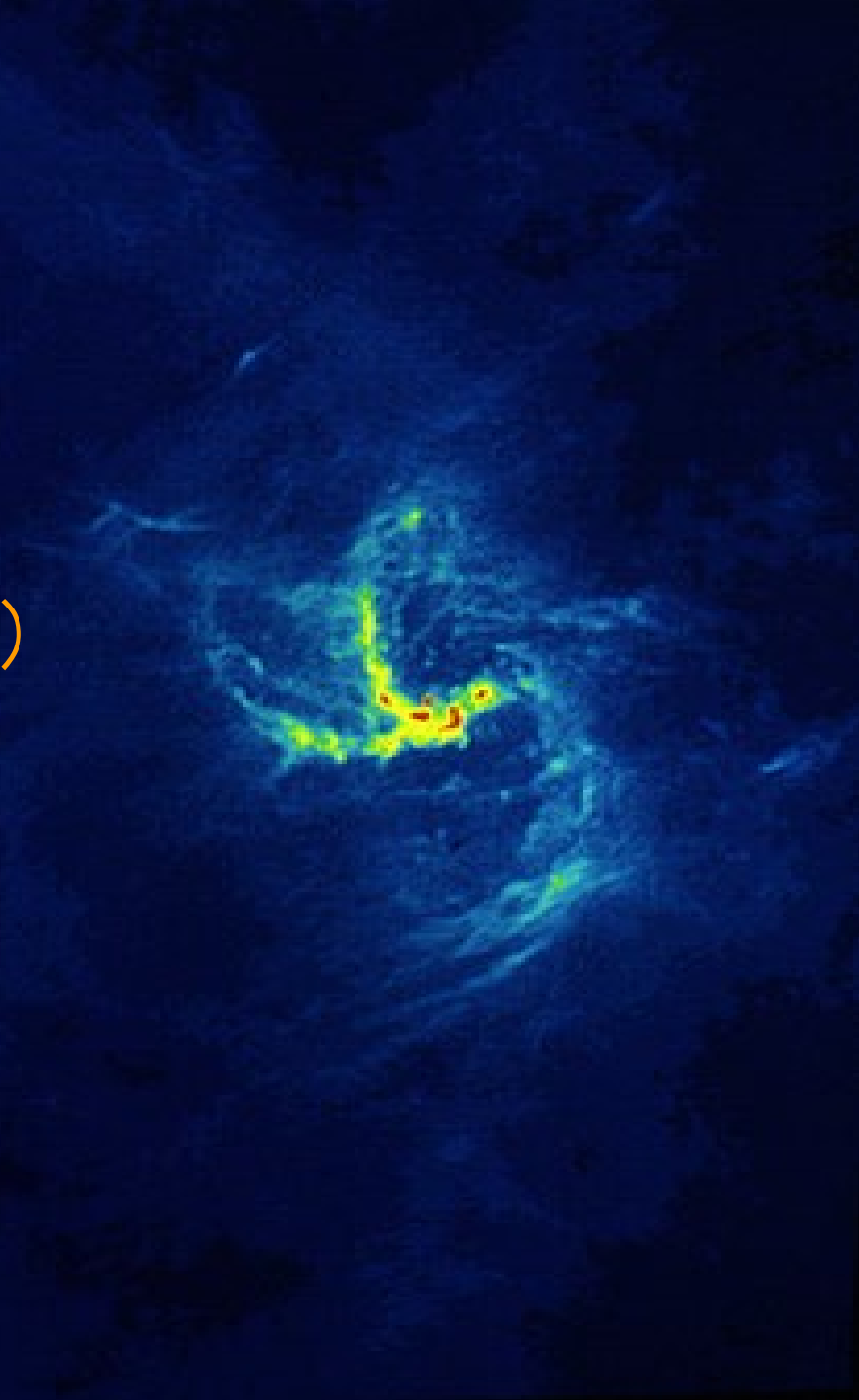


銀河系中心領域 (Sgr A^{*}、Sgr B2、RCW142)

Oyama (SgrB2、RCW142),
Honma (Sgr A^{*}),
Kobayashi 銀河系中心グループ



Science target

- proper motion and distance to Sgr A*
R0, θ_0 : fundamental constants
+ α flux & image monitor, etc

Most difficult source

Large distance

interstellar scattering

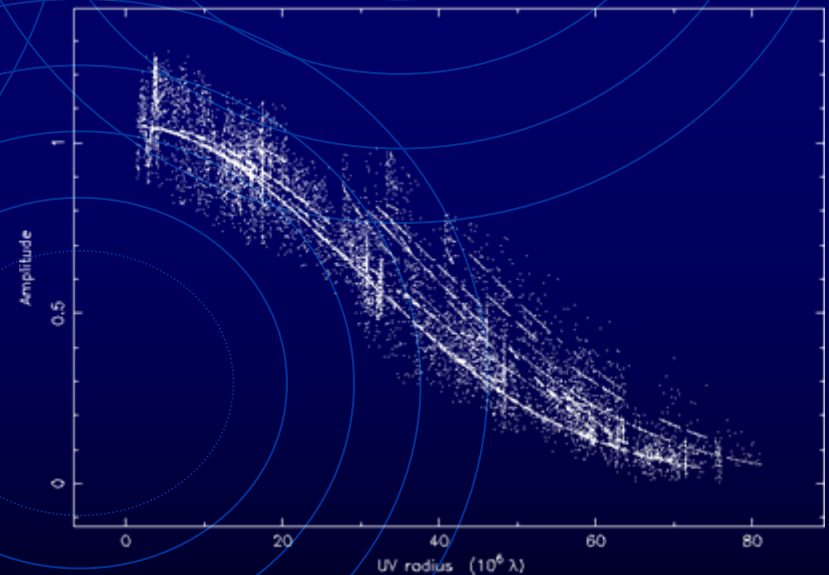
apparent size of Sgr A*

2.5 mas @ 22GHz

0.7 mas @ 43GHz

(Bower, Backer, 1998)

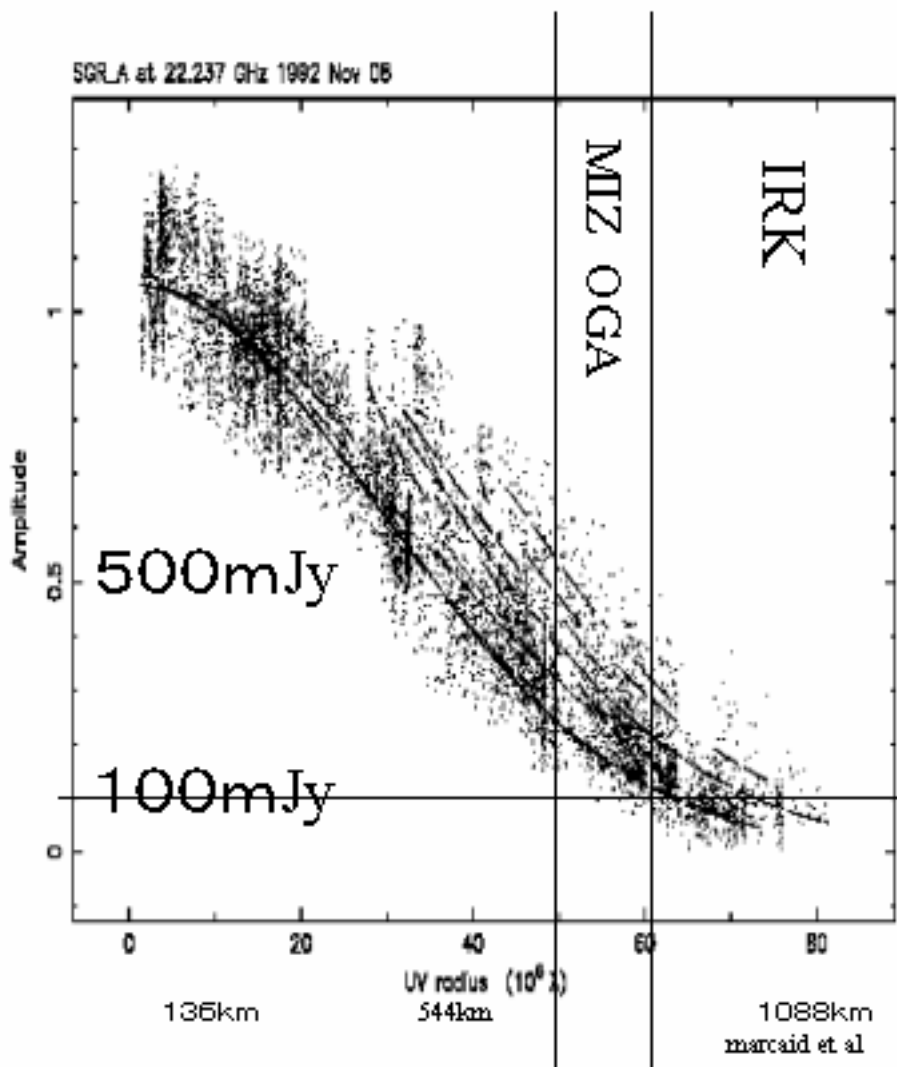
SGR_A at 22.237 GHz 1992 Nov-08



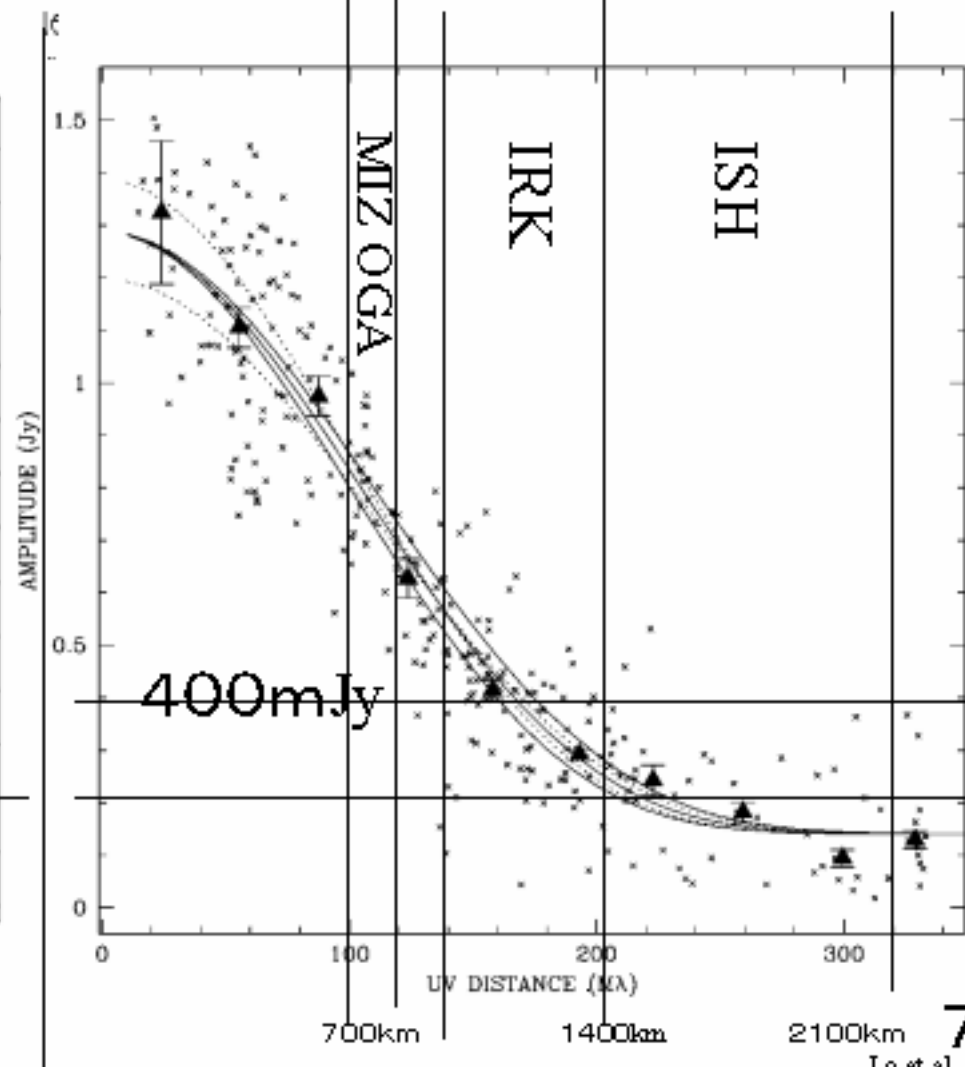
flux vs UV distance @ 22 G

SgrA*の相関フラックス

K band



Q band

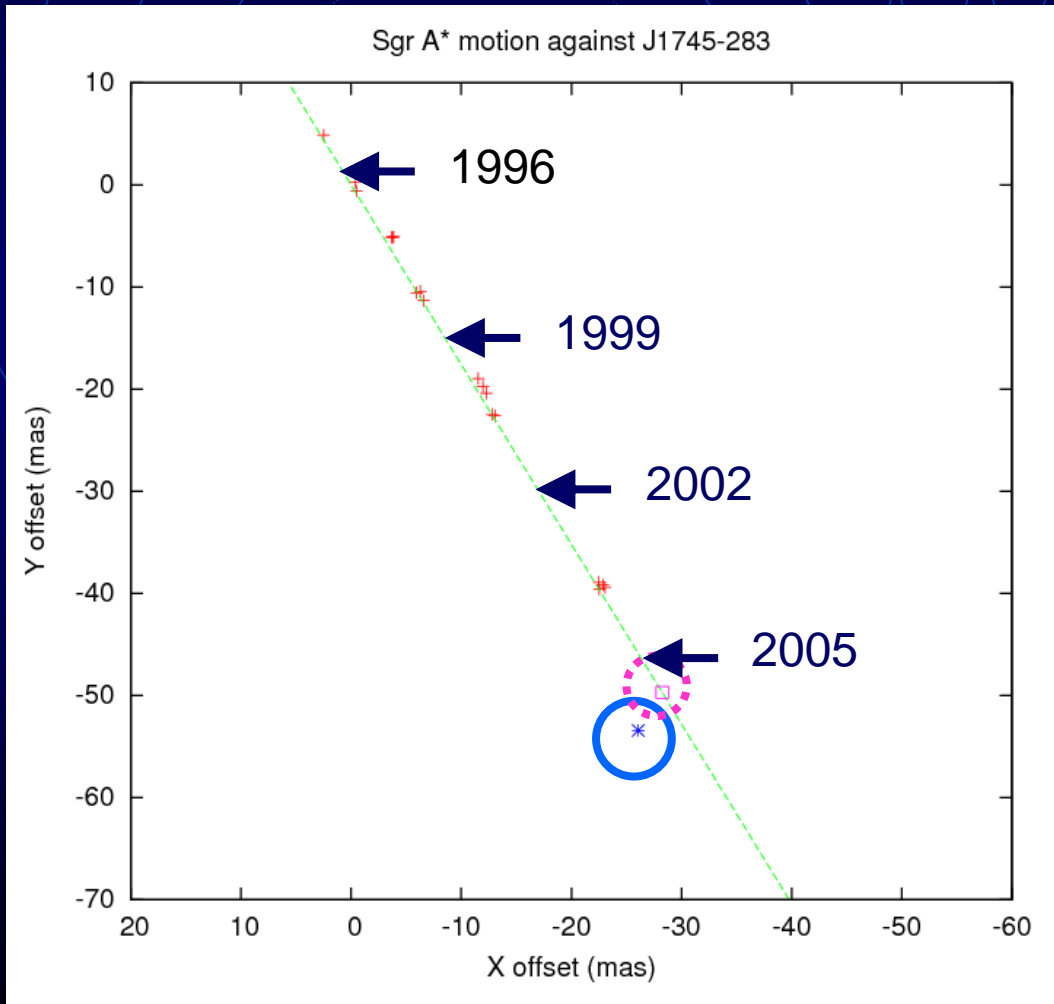


SgrA* with VERA since 2004 fall

- r04318a Pointing error (Sgr A non-detection)
- r05019b Pointing error (Sgr A non-detection)
- r05046a IRK recorder trouble
- r05077c OK (PR map, J1745 detection)
- r05134b MIZ, OGA, ISG bad weather
- r05294a OGA, ISG bad weather J1745 non-detection
- r05332b OK (J1745 very low SN)
- r05359c MIZ bad (Sgr A non-detection)
- r06048b to be done
- r06079c to be done
- r06109a MIZ, OGA, ISG bad
- r06139d IRK bad

Sgr A* motion against J1745-283

- data with Reid & Brunthaler 2004



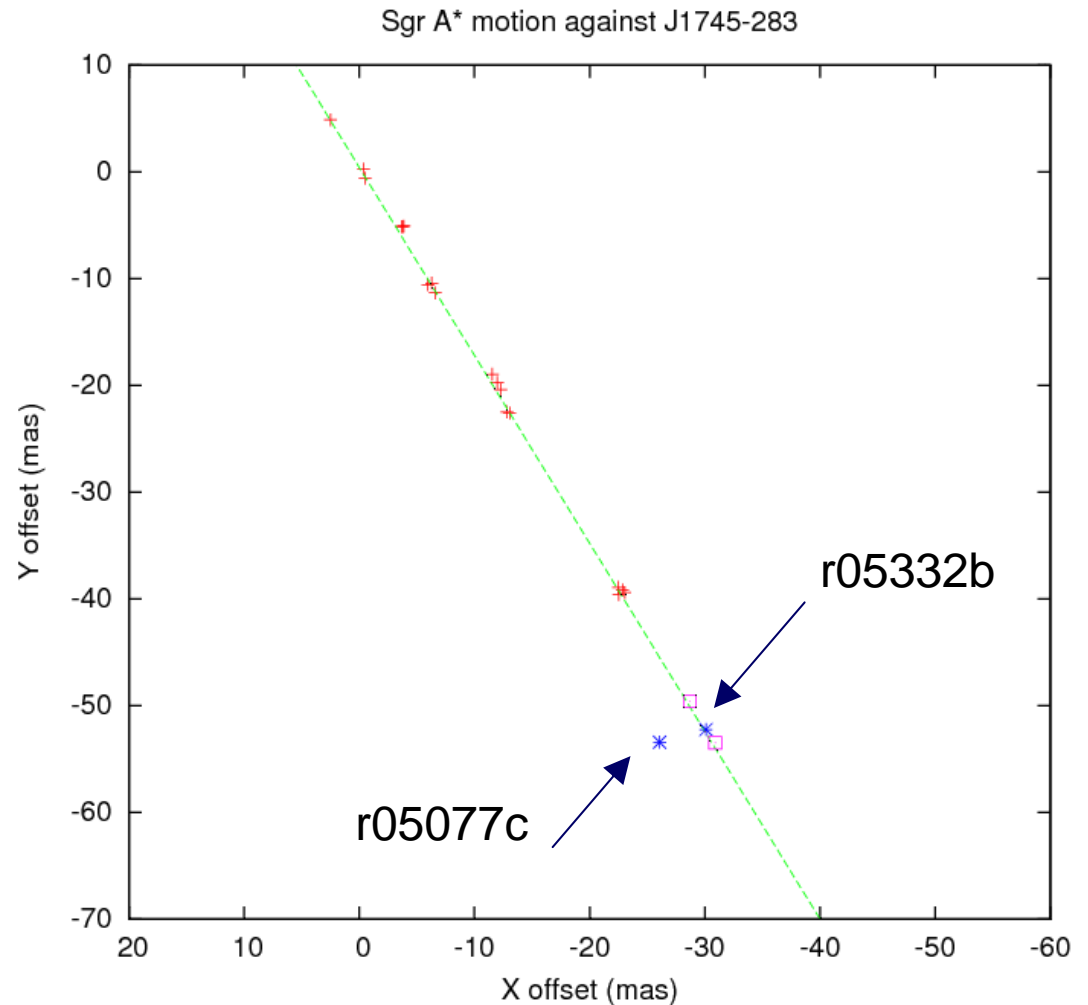
red : VLBA obs
green : VLBA fit
blue : VERA r05077c
pink : expected for r05077c

~3 mas offset

Error in coordinate
transformation ?

r05332b

- J1745 detected, but low S/N ratio
- flux is < 100 mJy ?
- position agrees with expectation



Summary

- If conditions are good, PR astrometry between J1745-283 and Sgr A* can be done with VERA
- Currently J1745-283 is quite faint and close to the detection limit of VERA.
- Detailed analysis are still needed to perform precise astrometry

(c.f. Mark Reid gave up Sgr A* parallax ...)

Future plan

continue the monitor

- J1745 could be brightened up again
- sensitivity improvement at 43G
- Sgr B2 H₂O Maser (Oyama)
(c.f. M. Reid's obs with VLBA since 2006 Apr)

銀河系中心領域 VLBI電波源分布

1745-283 (系外電波源)

Sgr B2 (大質量星形成領域)

1748-291 (系外電波源)

RCW142 (大質量星形成領域)

Sgr A

VERA最小離角=0.3度

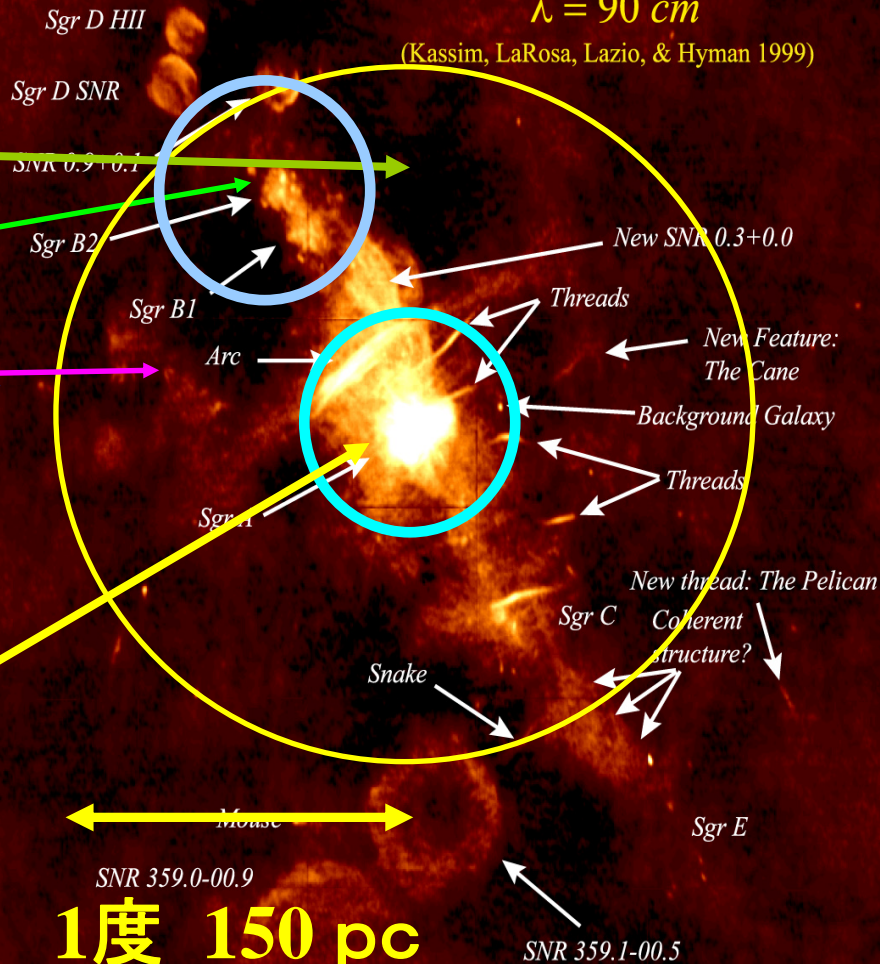


Naval Research Laboratory

Wide-Field Radio Image of the Galactic Center

$\lambda = 90 \text{ cm}$

(Kassim, LaRosa, Lazio, & Hyman 1999)



← Mouse →

SNR 359.0-00.9
1度 150 pc

~0.5°
~75 pc
~240 light years

半径0.3度 (VERA最小離角) from Sgr A*
半径0.3度 (VERA最小離角) from Sgr B2
半径 1度
Tornado (SNR?)

Sgr B2の距離測定

- 三角視差 (銀河系中心までの距離指標としても重要)

IAU 8.5kpc

(平均) → 8 kpc (Reid 1993)

(極近傍星の軌道) → 7.92 kpc (Eisenhauer 2003)

→ 7.62 kpc (Eisenhauer 2005)

→ 8.6 ± 0.3 kpc (2005 Keck)

→ 7.39 ± 0.22 kpc (2006 VLT)、 7.36 ± 0.21 Kpc (2006 Keck)

(Red Clump星) → 7.53 ± 0.45 kpc (Nishiyama 2006)

(Reid 2006年9月よりVLBAでparallax測定開始)

- Sgr A*に対する固有運動を計測



視線速度 + 固有運動で運動学的距離の不定性を解き距離推定

(c.f. XRN Sgr A*の過去の活動性)

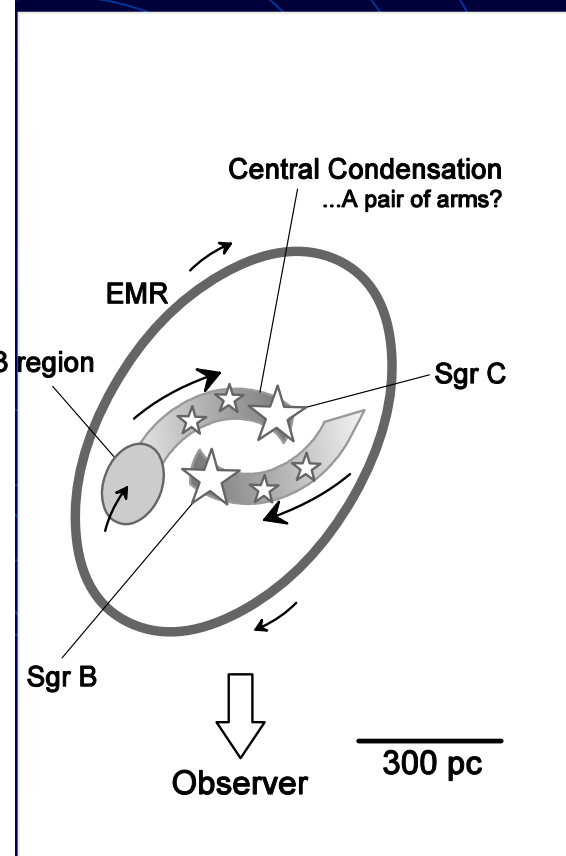
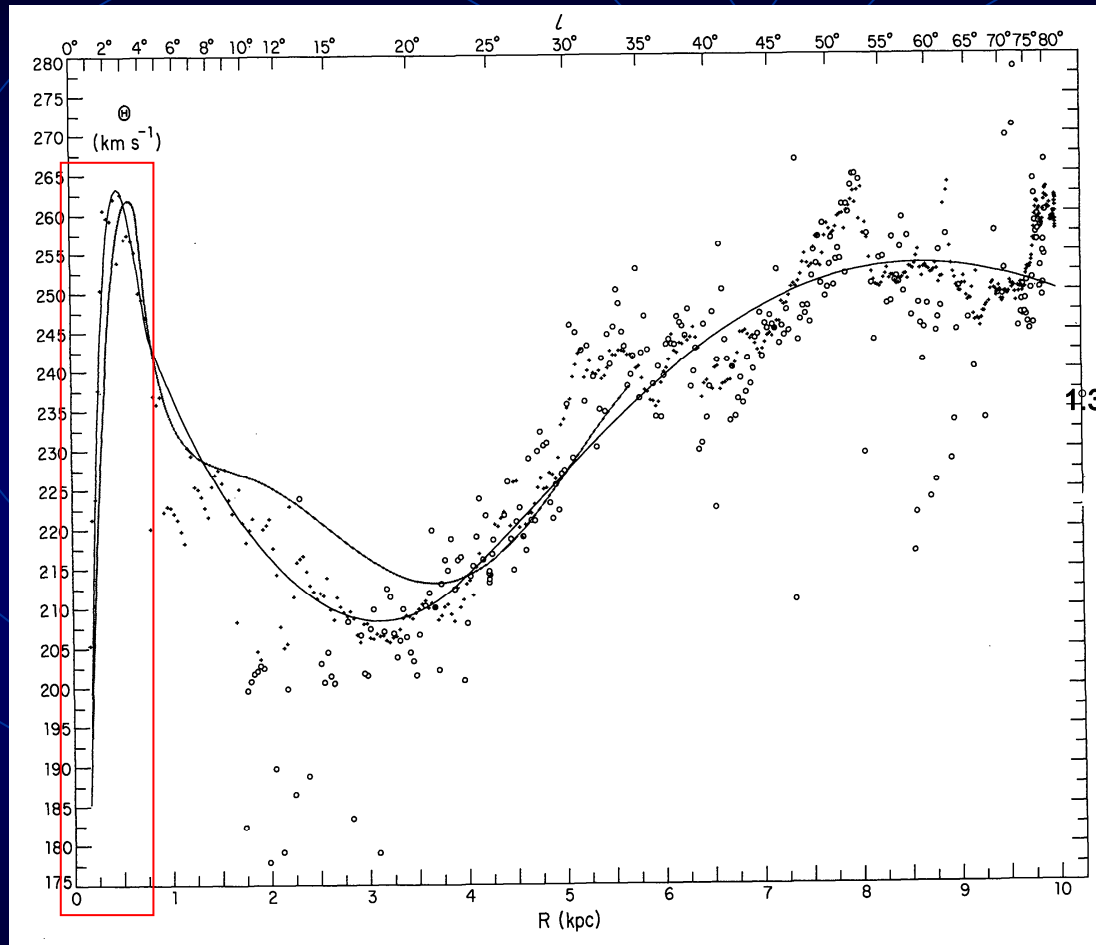
- 3) 統計視差 (Sgr B2 N, M, S 比較)

過去の観測 Sgr B2 (N) (7.1 ± 1.5 kpc)

(銀河中心距離)

Reid et al 1988

銀河系中心部の回転曲線？



Sawada et al. 2004

→ 2 4 8 Kpc
 300pc (2度) Burton et al

260km/s

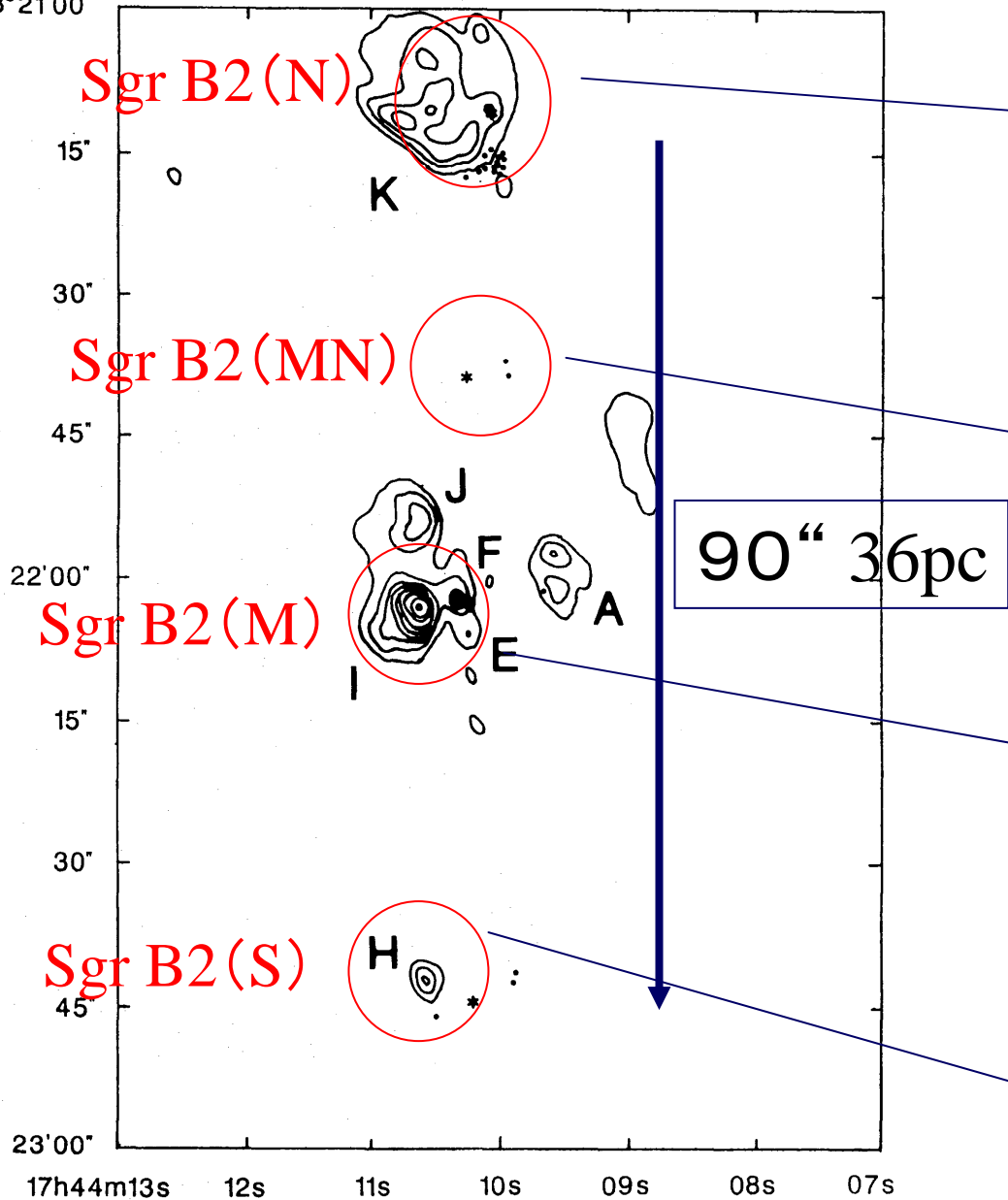
220km/s

観測

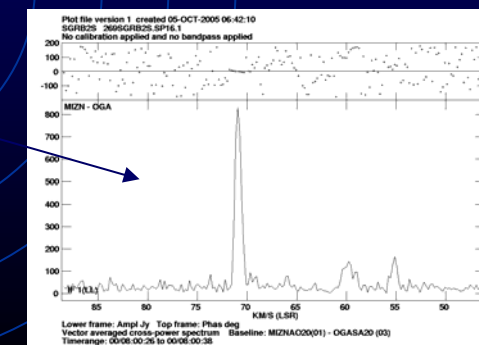
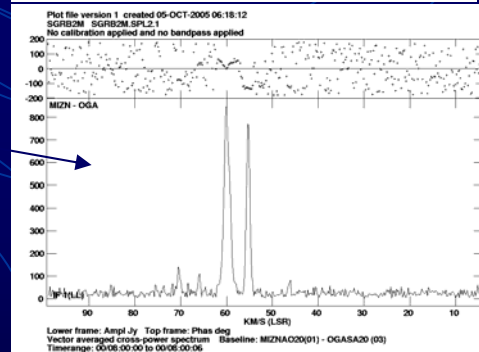
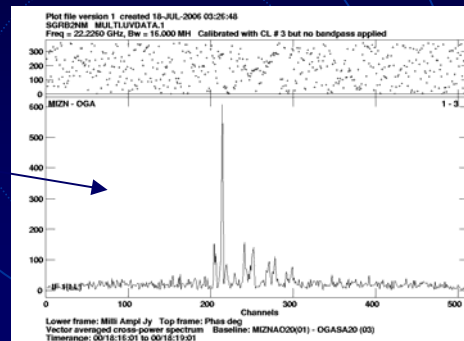
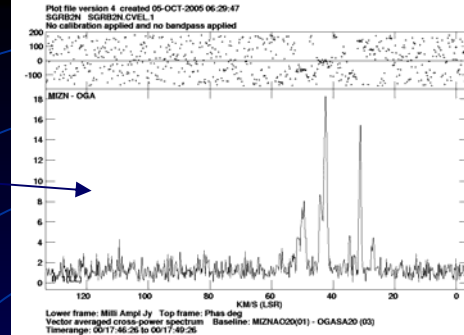
- 2003年3月～2004年8月 (Sgr B2—Sgr A*)
DIR1000、DIR2000 15(5-6)エポック
- 2005年10月～ (Sgr B2/RCW142—J1745-28)
DIR2000 6エポック

Declination(1950.0)

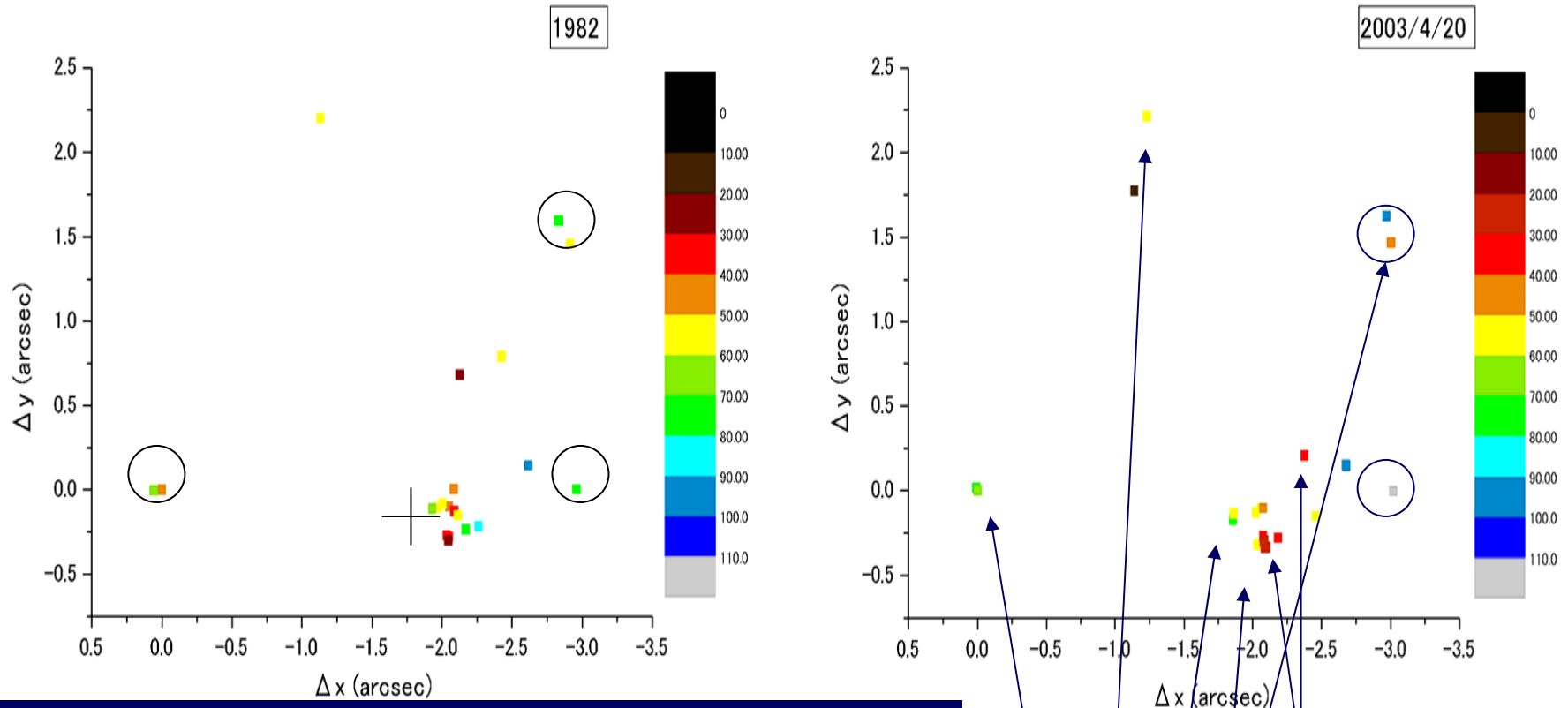
-28°21'00"



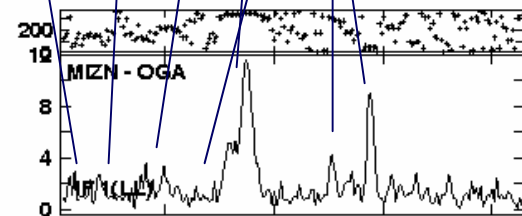
Kobayashi et al. 1989



1ビーム解析 Sgr B2N メーザー分布



- 20年前の分布を再現
- 視線速度30km/sの変化を検出
- 分子雲内部構造

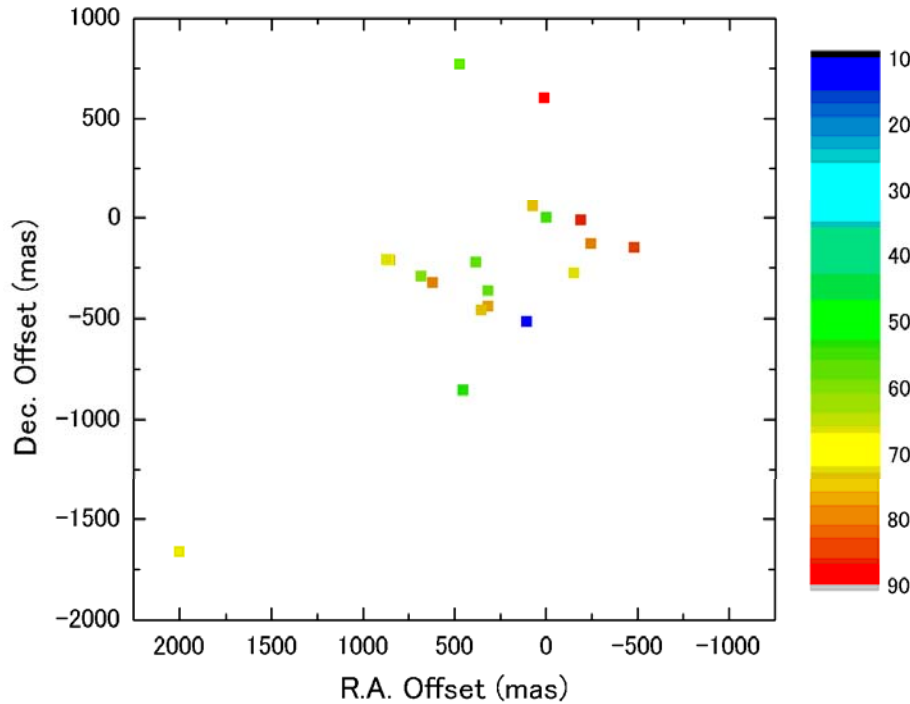


1ビーム解析結果

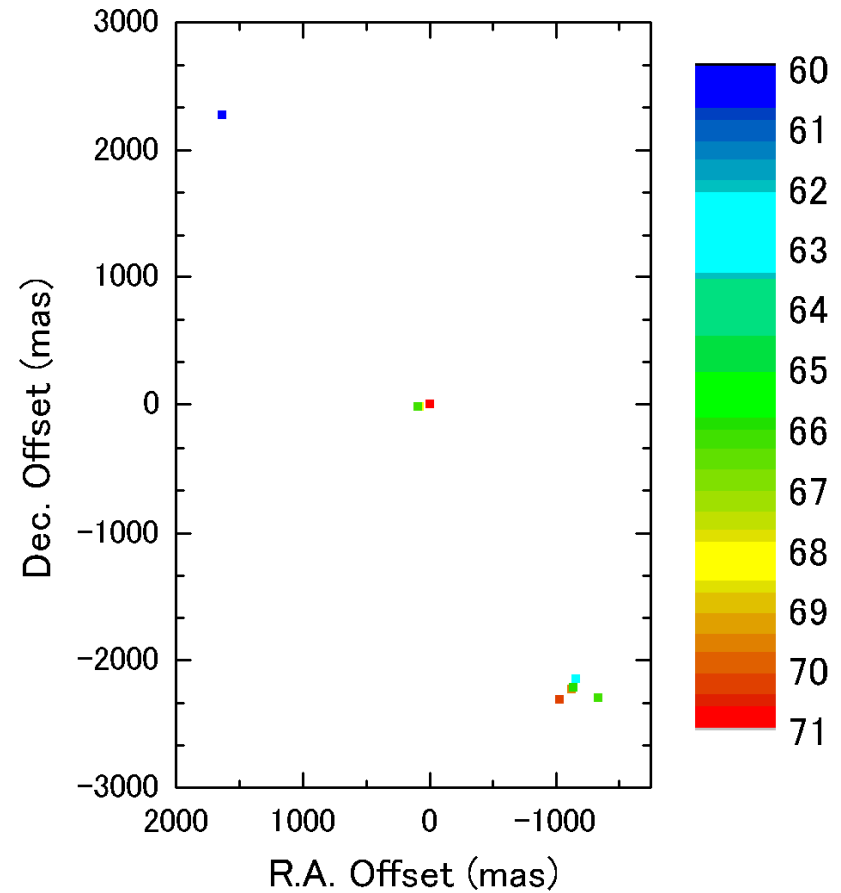
Sgr B2(M)

Sgr B2(S)

Sgr B2(M) (04/09/25)

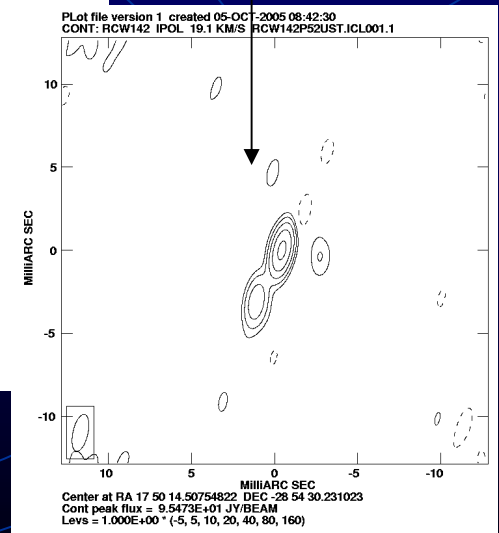
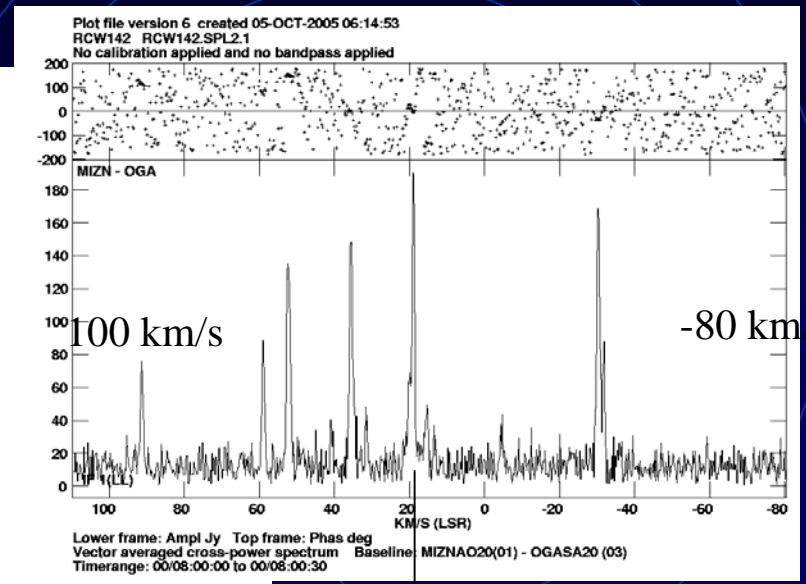
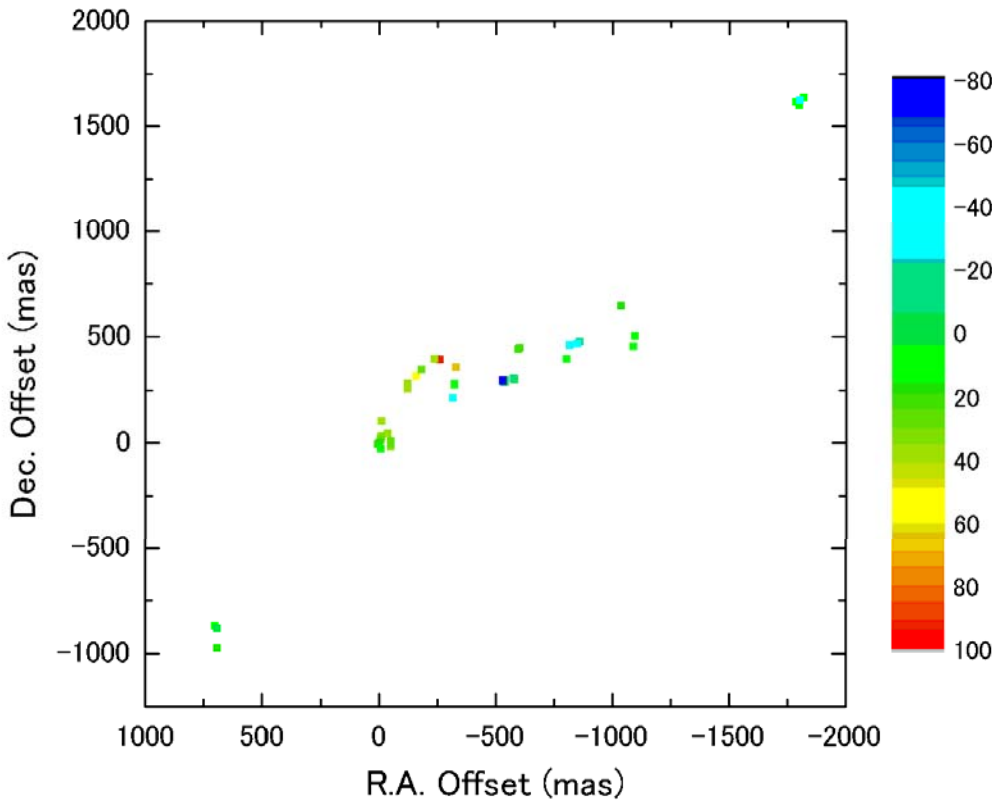


Sgr B2(S) (04/09/25)



RCW142

RCW142 (04/09/25)



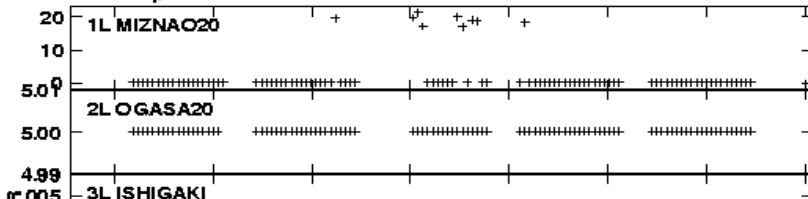
1ビーム解析

2ビーム位相補償解析

2ビーム解析 Sgr B2

- Sgr B2の視差楕円 $250 \mu\text{as}$ (精度検証観測先行)
- Maserを参照源としたバンド幅合成、
長時間積分必須
(Sgr A*、他の参照源も弱い: 100mJy以下)
- 現在は検出のみを目的とした長時間積分
(参照源の解を用いてターゲット天体にて
Fringe Searchを実行)のみ実施

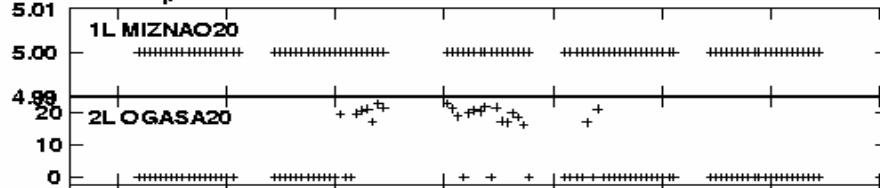
Plot file version 30 created 13-OCT-2003 03:32:05
SNR vs UTC time for 03070BC.UVDATA.1
SN 35 Lpol IF 1



位相補償なし

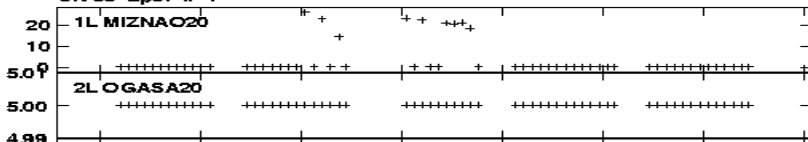
3分

Plot file version 34 created 13-OCT-2003 03:32:52
SNR vs UTC time for 03070BC.UVDATA.1
SN 41 Lpol IF 1



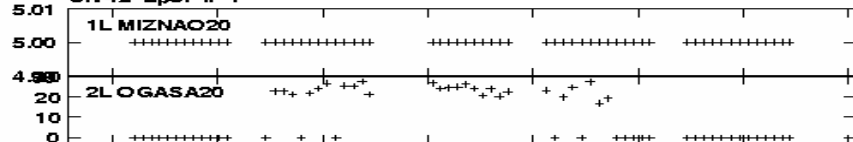
位相補償あり

Plot file version 31 created 13-OCT-2003 03:32:08
SNR vs UTC time for 03070BC.UVDATA.1
SN 33 Lpol IF 1



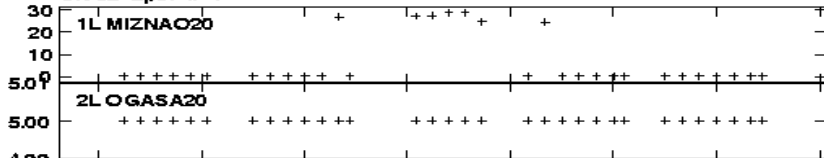
5分

Plot file version 35 created 13-OCT-2003 03:32:55
SNR vs UTC time for 03070BC.UVDATA.1
SN 42 Lpol IF 1



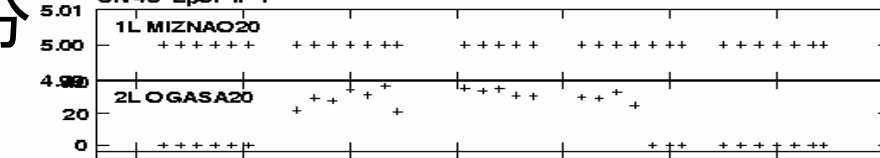
SgrA* (Fring Search Result)

Plot file version 32 created 13-OCT-2003 03:32:10
SNR vs UTC time for 03070BC.UVDATA.1
SN 32 Lpol IF 1

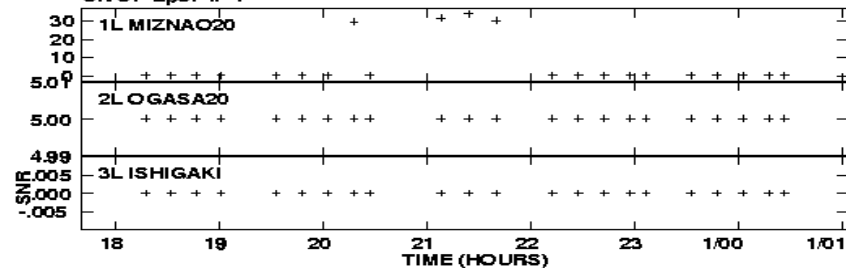


10分

Plot file version 36 created 13-OCT-2003 03:32:57
SNR vs UTC time for 03070BC.UVDATA.1
SN 43 Lpol IF 1

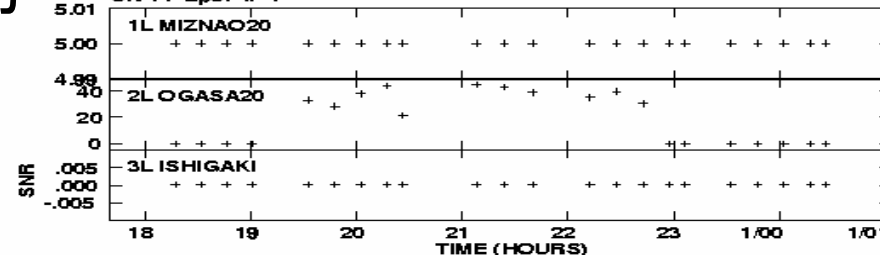


Plot file version 33 created 13-OCT-2003 03:32:13
SNR vs UTC time for 03070BC.UVDATA.1
SN 31 Lpol IF 1

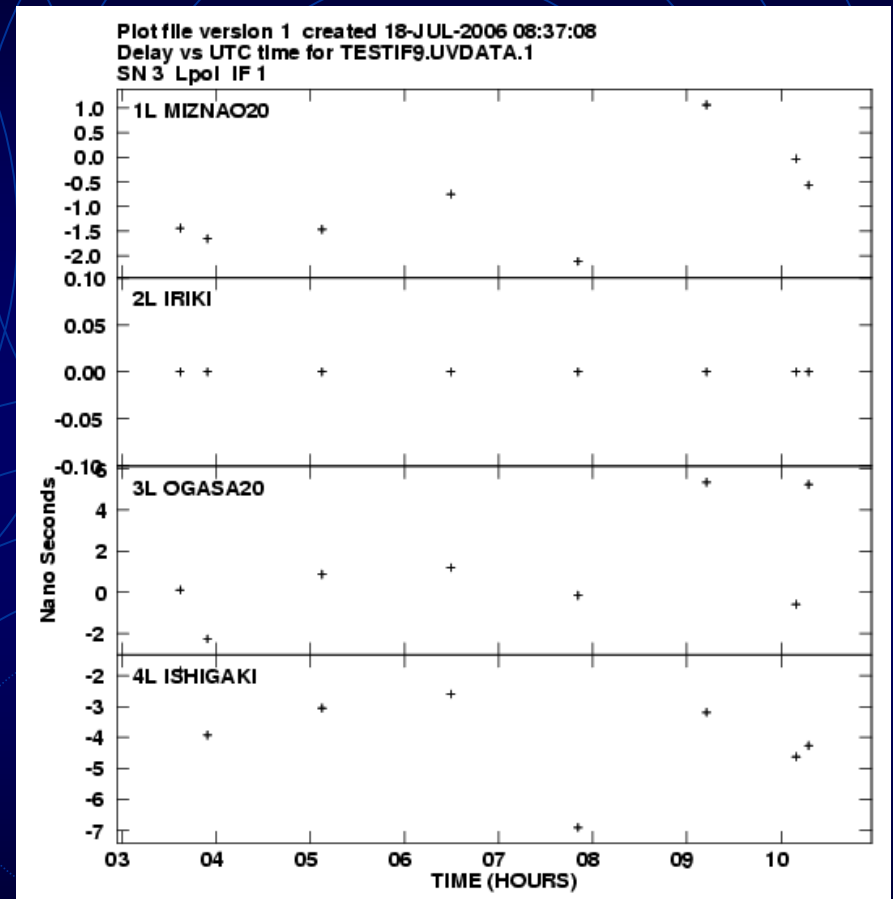
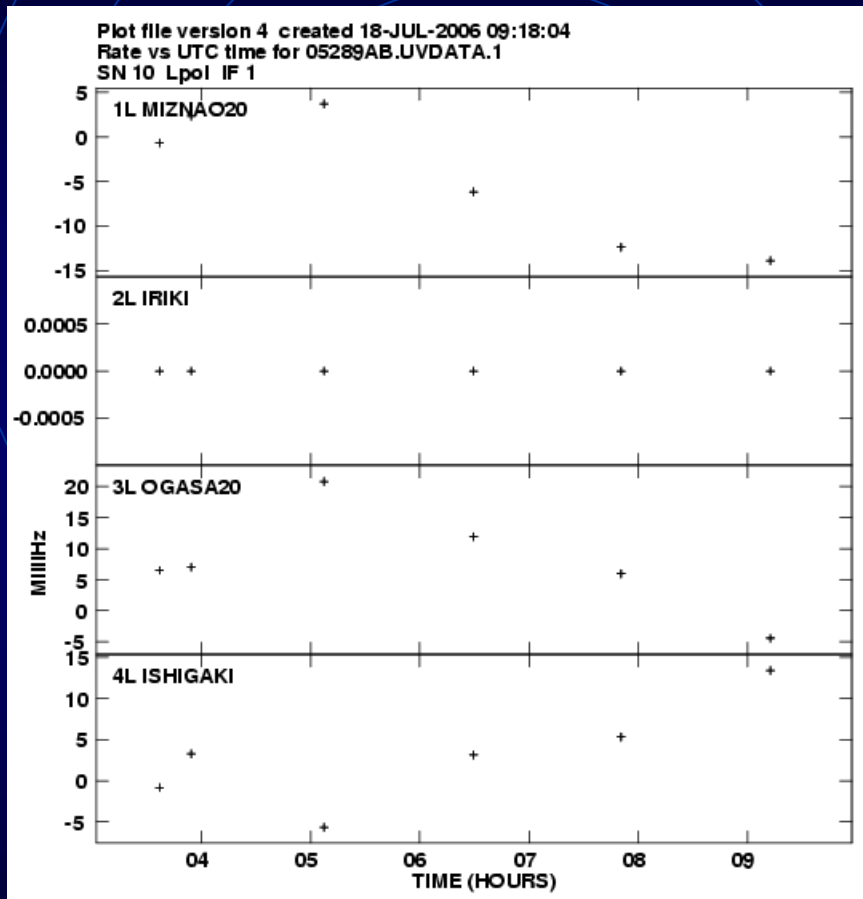


15分

Plot file version 37 created 13-OCT-2003 03:33:01
SNR vs UTC time for 03070BC.UVDATA.1
SN 44 Lpol IF 1



J1745-28 (参照電波源) Fringe Search Results



位相補償+バンド幅合成+10分積分
R05289A (2005年10月)

位相補償+40分積分 (IF 8のみ)

Sgr A, B2、銀河系中心領域の観測に向けて

◇参照源(対象天体)のFluxが低い

- ・Sgr A*でも。。。(分解、0.7mas@Q、3mas@K)
- ・系外参照源も弱い **100mJy以下**
- ・メーザーもSgrB2、RCW142以外はほとんど**1Jy程度以下**、
(SiOメーザーで参照源になるようなものはなし)

1) Maser(SgrB2,RCW142)を参照源とした相対VLBI観測手法確立(AIPS)

バンド幅合成

2) 鹿島、野辺山、山口、筑波、KVN等の短基線追加

(#5記録等)

3) 広帯域、高感度観測(**桁でなく、ファクター!**)

感度2/4倍@K/Q =50 mJy: 連続波

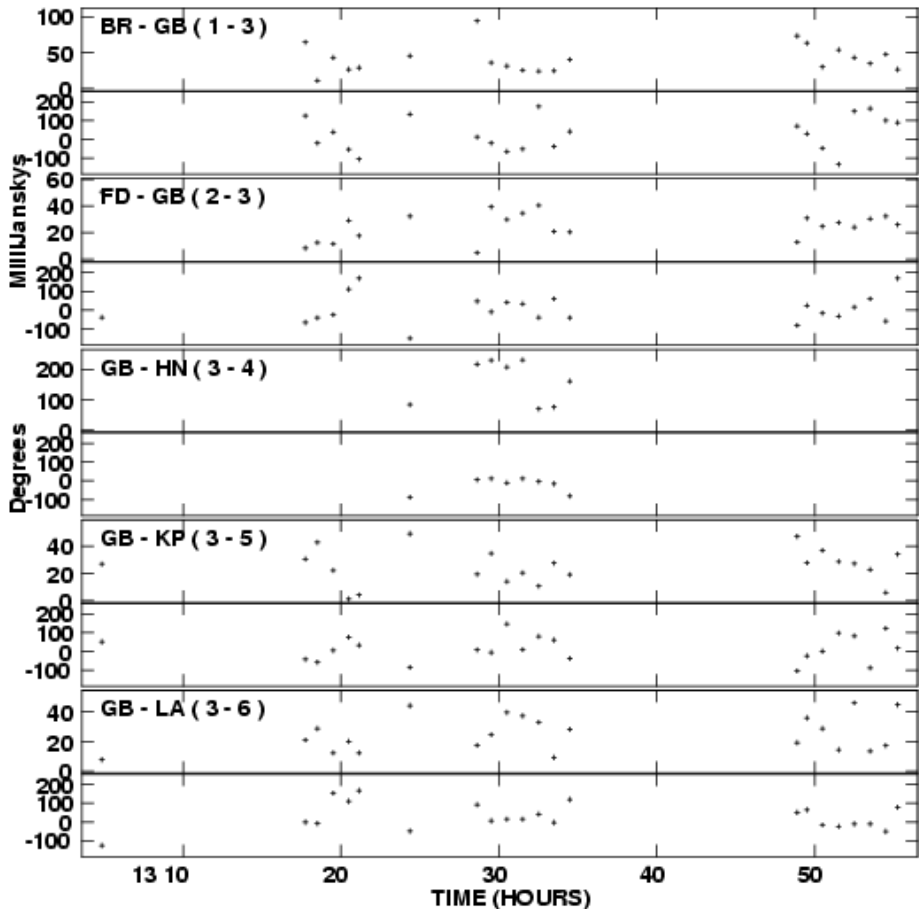
感度2倍@Q=300-600 mJy: メーザー

(超高速サンプラー、光結合(#5含む)、
高密度記録、高感度受信機、両偏波化他)

	基線 (mJy)	Image (mJy)	
K(maser)		500	5 hour 0.1 MHz
Q(maser)		1000	5 hour 0.1 MHz
K(cont)	100	11	180K 3 min 240MHz
Q(cont)	200	21	350K 3 min 240MHz

能率、K=0.43、Q=0.4にて計算

Plot file version 1 created 18-JUL-2006 10:07:57
 Amplitude and Phase vs Time for 131C3SGAAVS.SGRA.1 Vect aver.
 IF 1 CHAN 1 STK LL



Plot file version 1 created 18-JUL-2006 10:07:57
 Amplitude and Phase vs Time for 131C3SGAAVS.SGRA.1 Vect aver.
 IF 1 CHAN 1 STK LL

