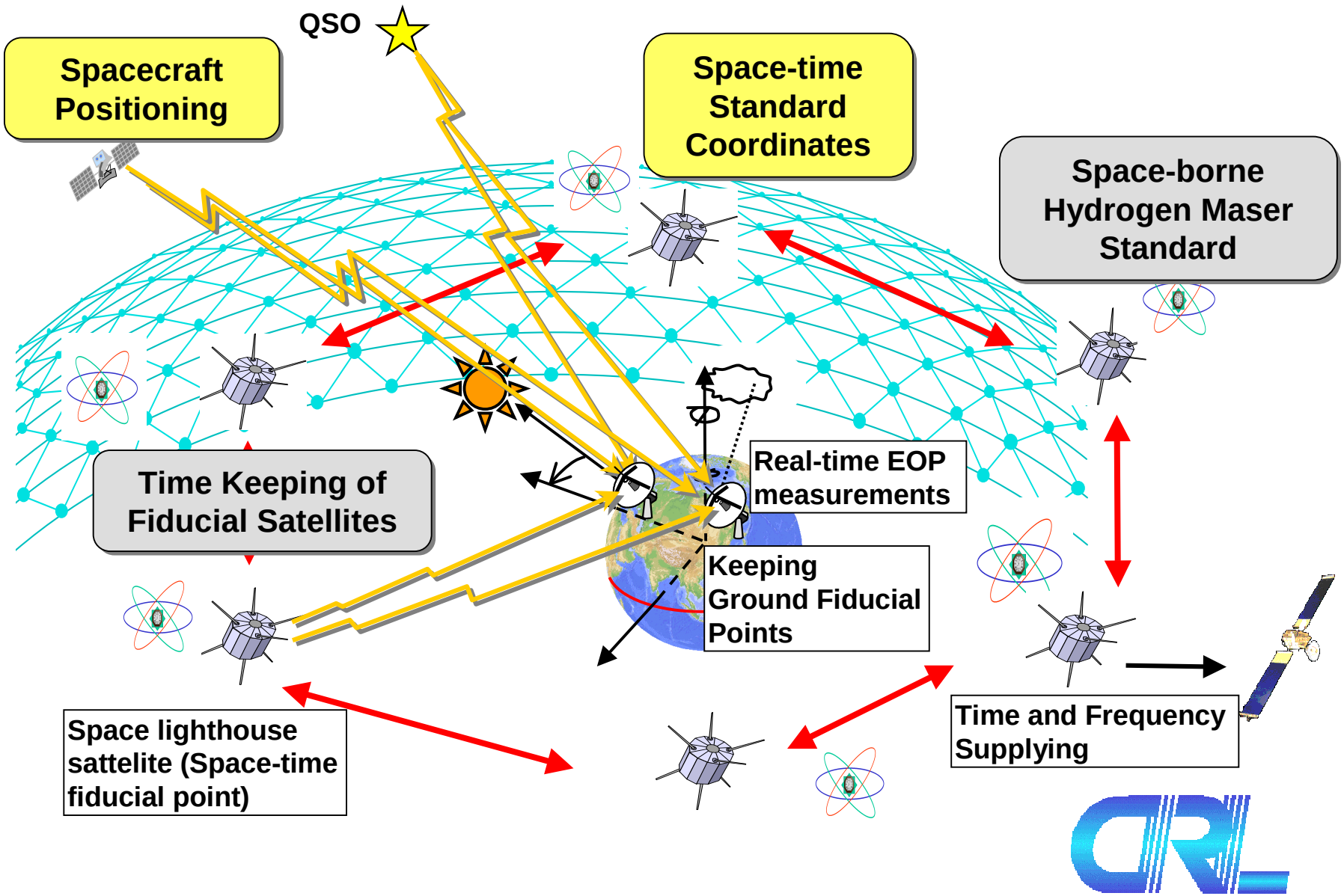
# Real-time Gigabit VLBI System and Internet VLBI System

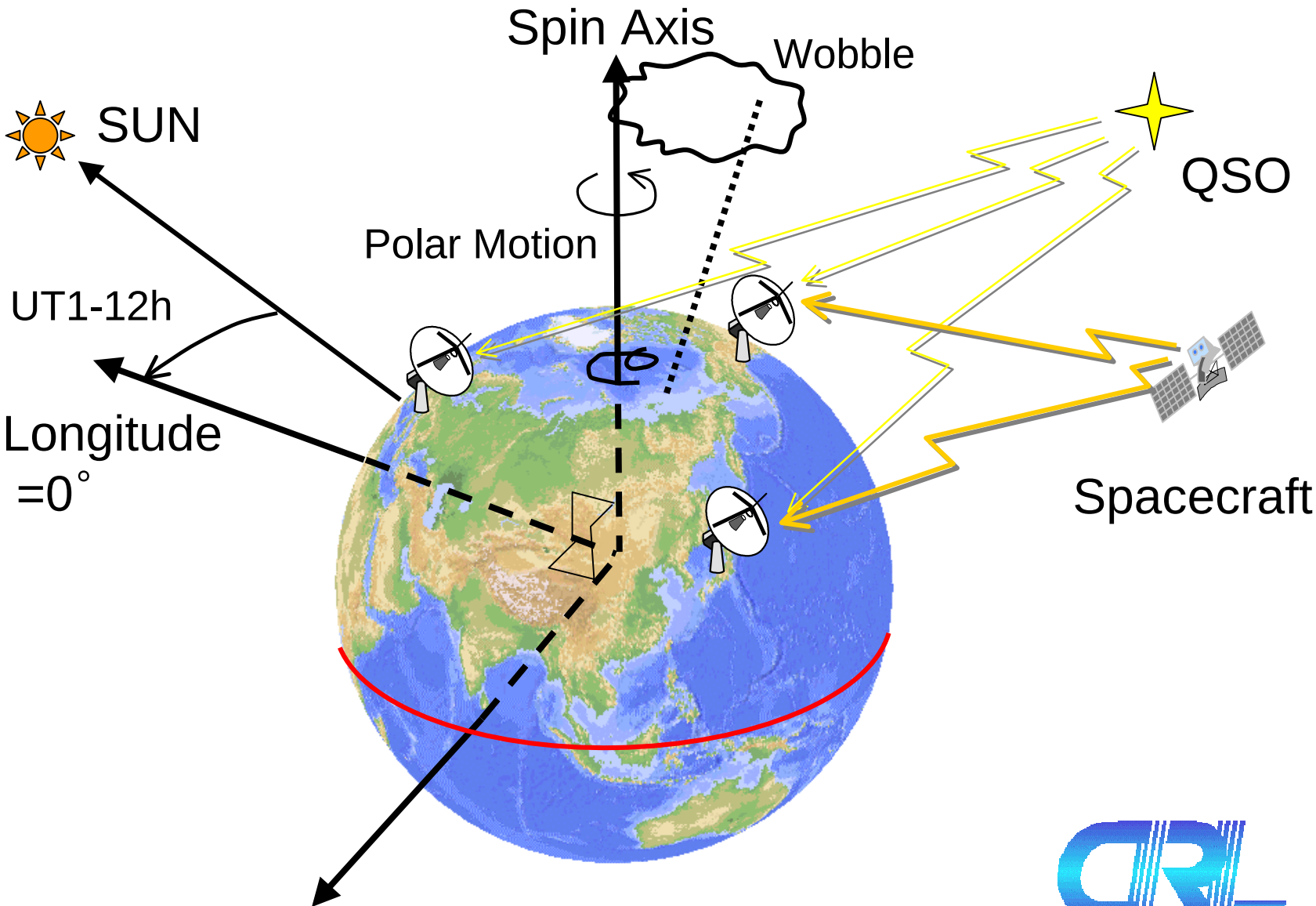
T.Kondo, Y.Koyama, J.Nakajima, M.Sekido,
R.Ichikawa, E.Kawai, H.Okubo, H.Osaki,
M. Kimura,Y. Ichikawa*,and GALAXY Team**

Communications Research Laboratory
*Nihon Tsushinki Co.Ltd.
**CRL, NAOJ, ISAS, and NTT joint project

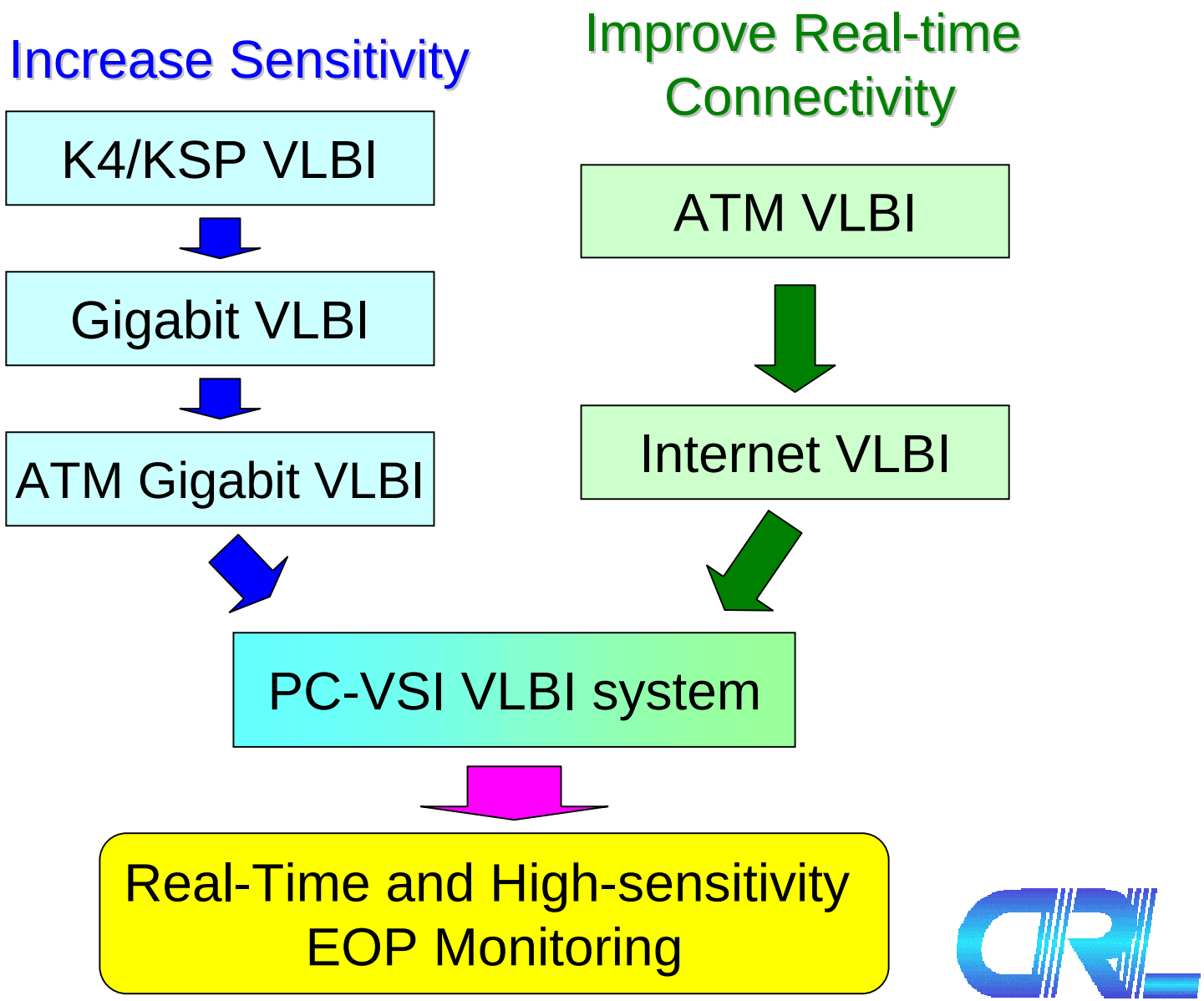
# Key Technology for Establishing Space-Time Infrastructure in Space



# Real-time EOP Monitoring and Spacecraft Positioning



# Development Plan



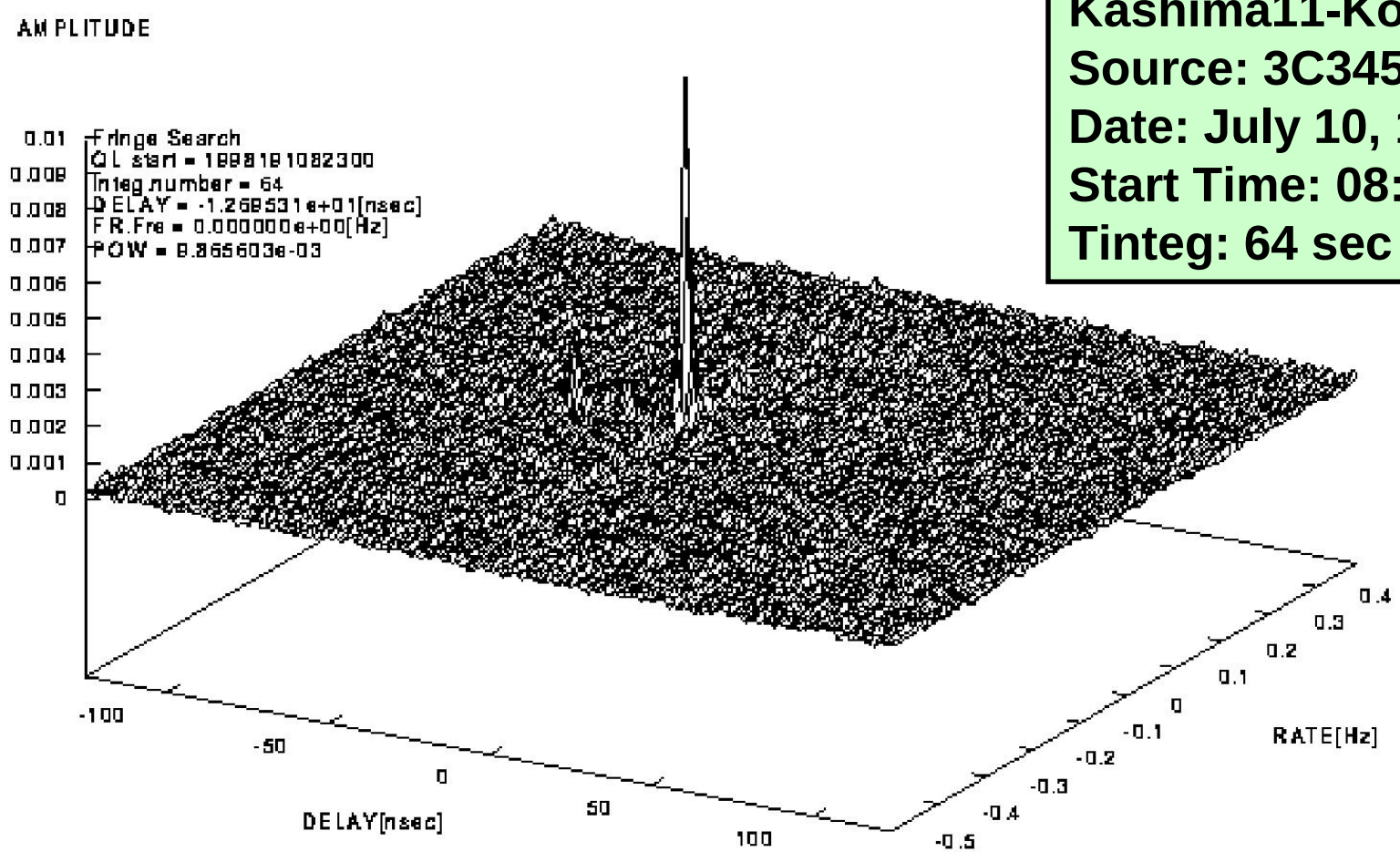
# Giga-bit VLBI

# Giga-bit VLBI System

## as of 2000

KASHIM1-KOGANEI 3C345

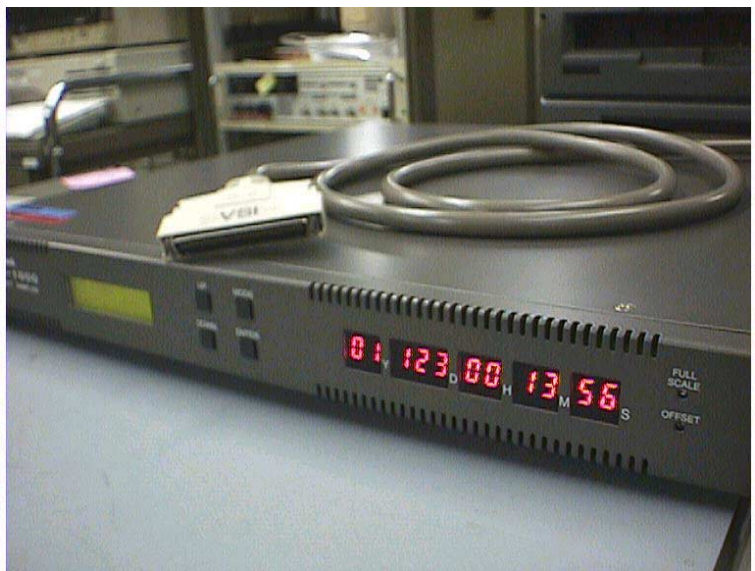
# The First Fringes




**Kashima11-Koganei**
**Source: 3C345**
**Date: July 10, 1998**
**Start Time: 08:20:00**
**Tinteg: 64 sec**

# VSI AD sampler

- ADS1000 Small 2 Gbps AD sampler (VSI-DAS)
- 1/10 size,  1/5 cost,  reduced AD jitter by PLO



# VSI Gbit recorder

VSI interface in it!

# Large Virtual Telescope (GALAXY)

**Connected by high-speed (2.4Gbps) network**

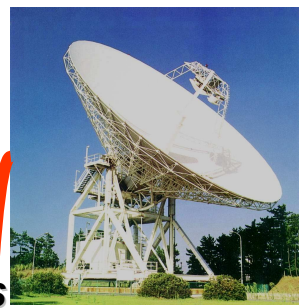
ISAS
USUDA DEEP SPACE CENTER

USUDA 64m

208km

NTT
MUSAHINO R&D CENTER

CRL
KASHIMA
SPACE
RESEARCH
CENTER



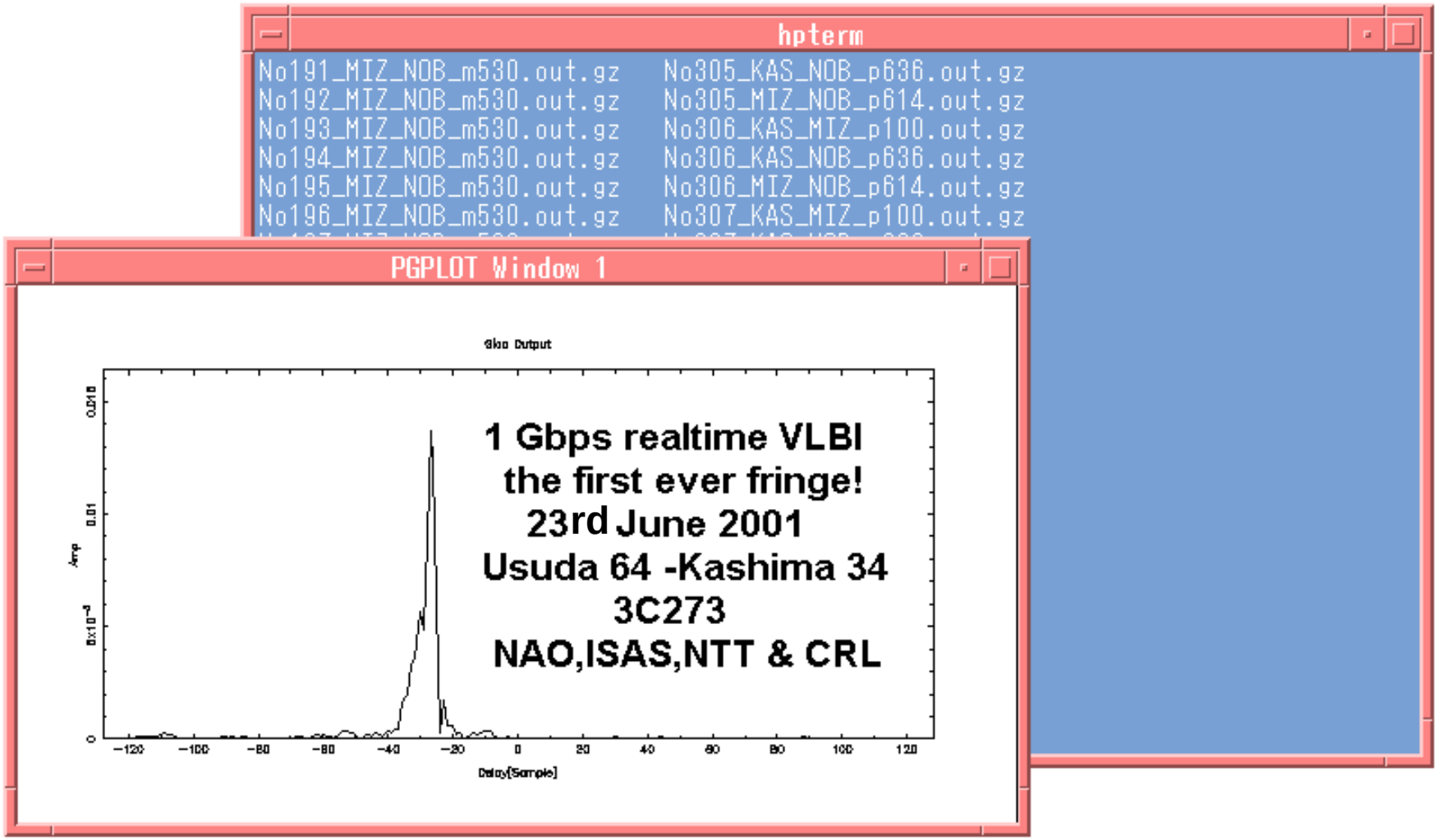
KASHIMA 34m

*1Gbps*

Real-time
Correlator

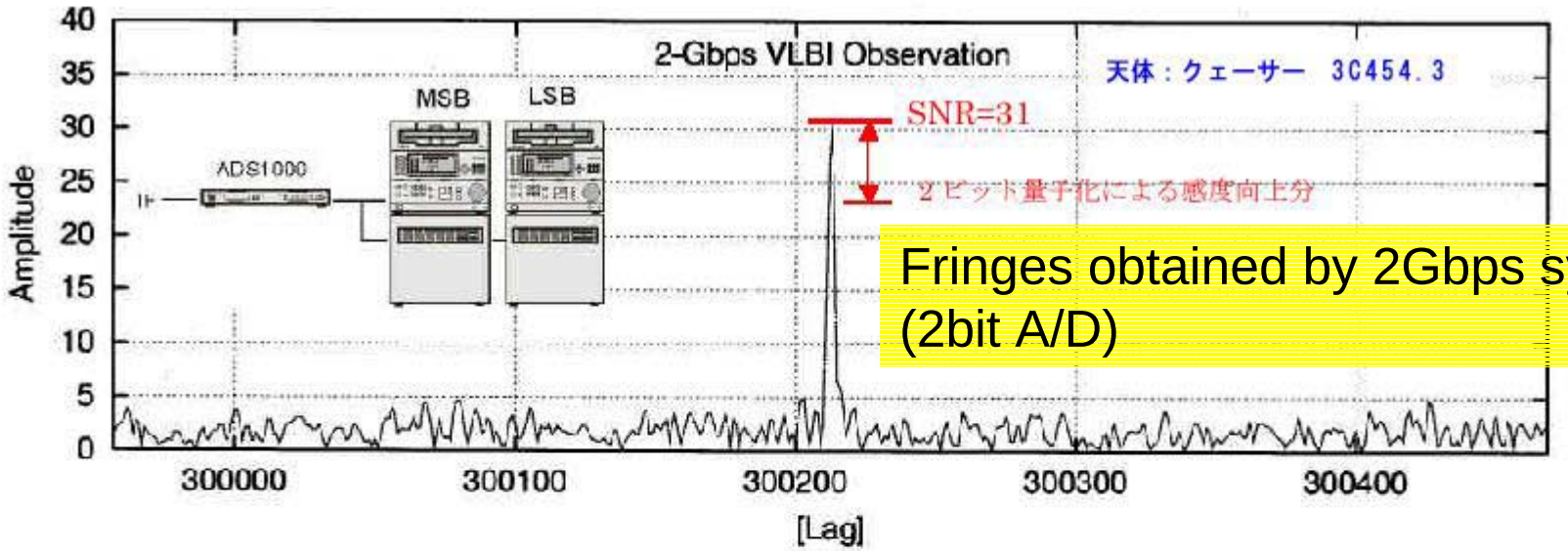
NAO, ISAS, NTT & CRL

# Successful Detection of 1Gbps real-time VLBI fringes

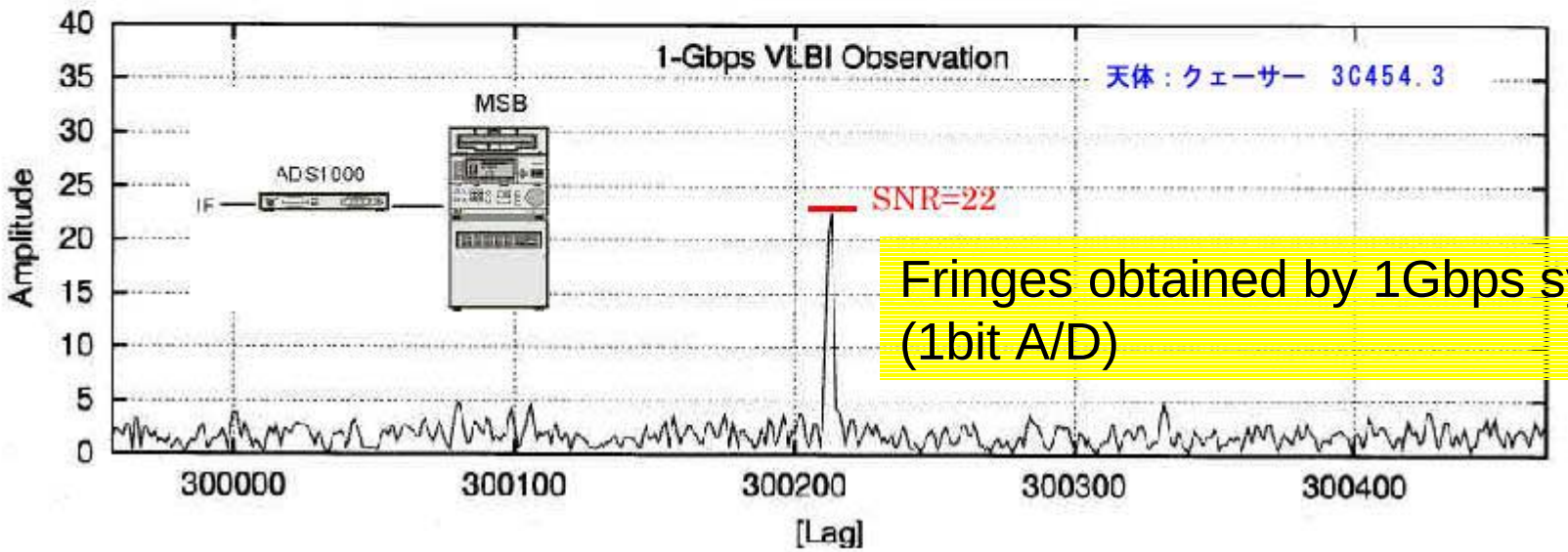


# Success in 2Gbps VLBI (tape based)

(Kashima-Koganei Dec.12, 2001)



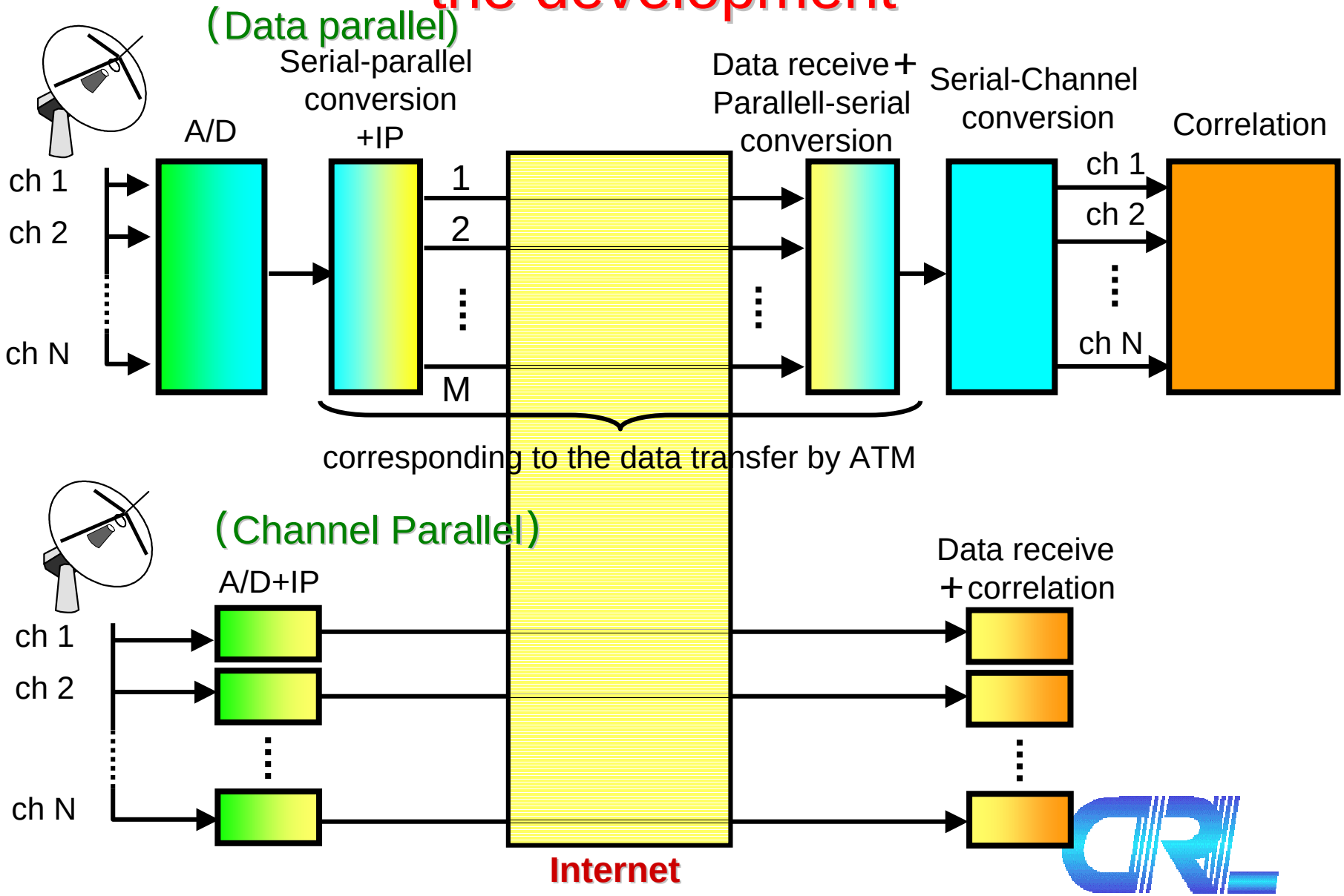

Fringes obtained by 2Gbps system (2bit A/D)




Fringes obtained by 1Gbps system (1bit A/D)

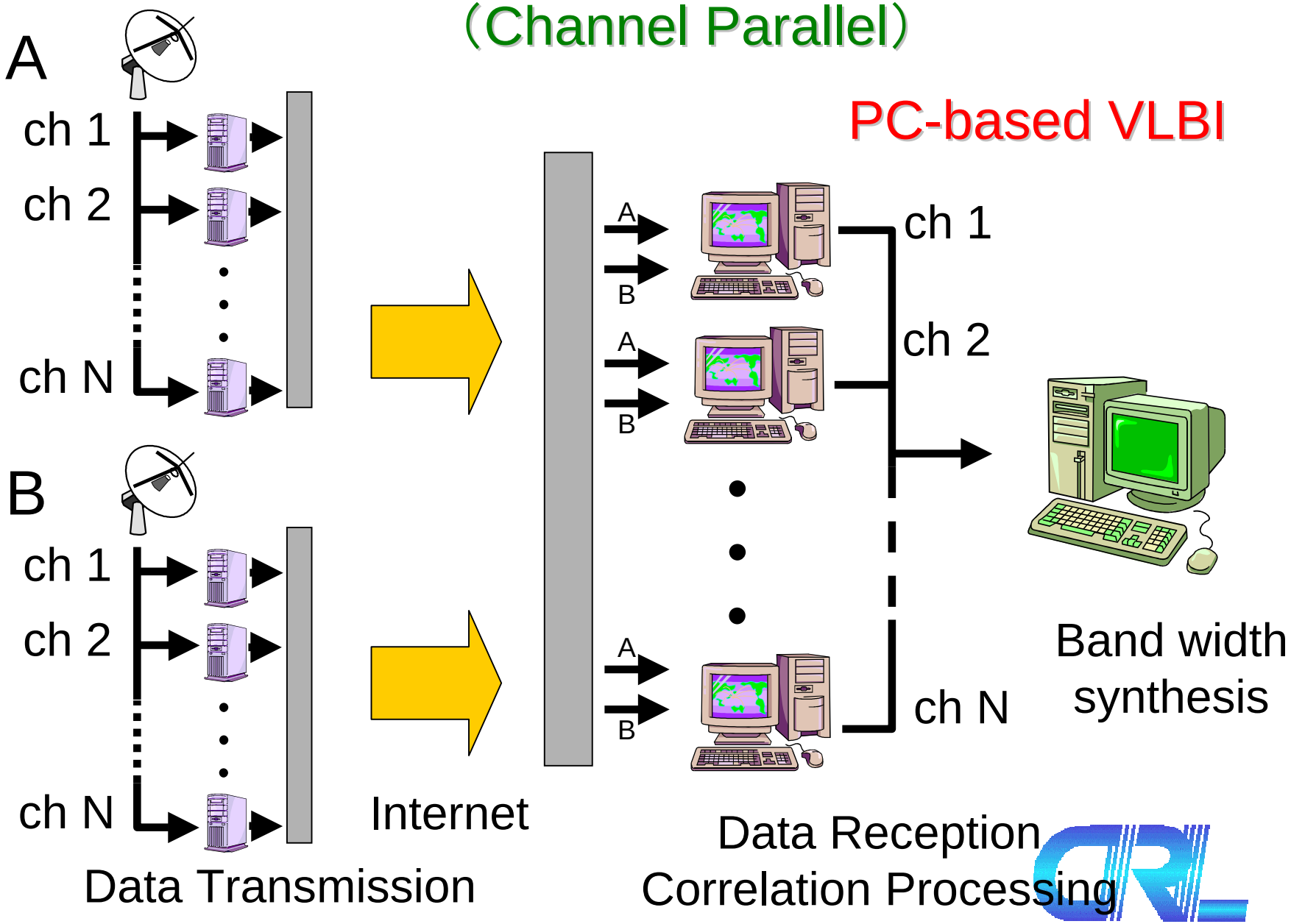
# Internet VLBI

# Two kinds of Internet-VLBI system under the development



# Internet-VLBI for Geodetic Use

## （Channel Parallel）

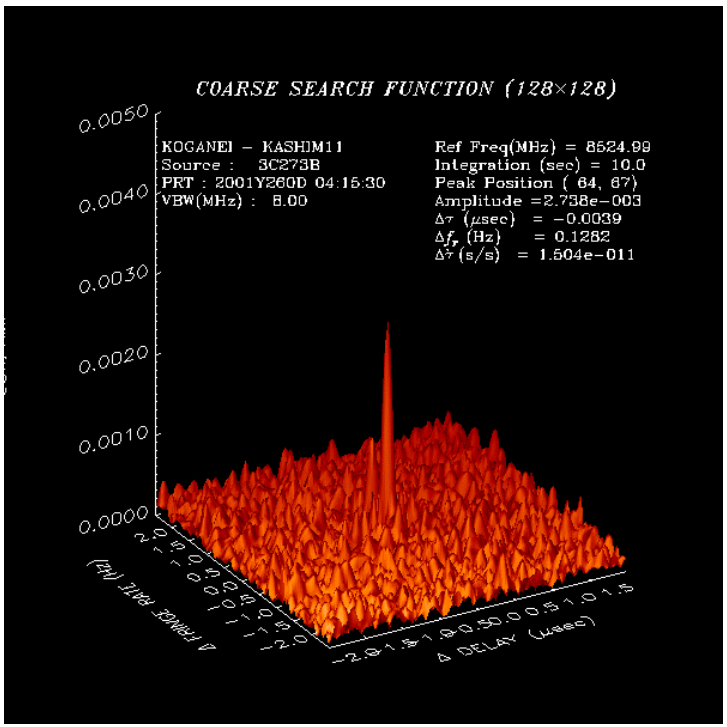


# Specifications of Sampler Board

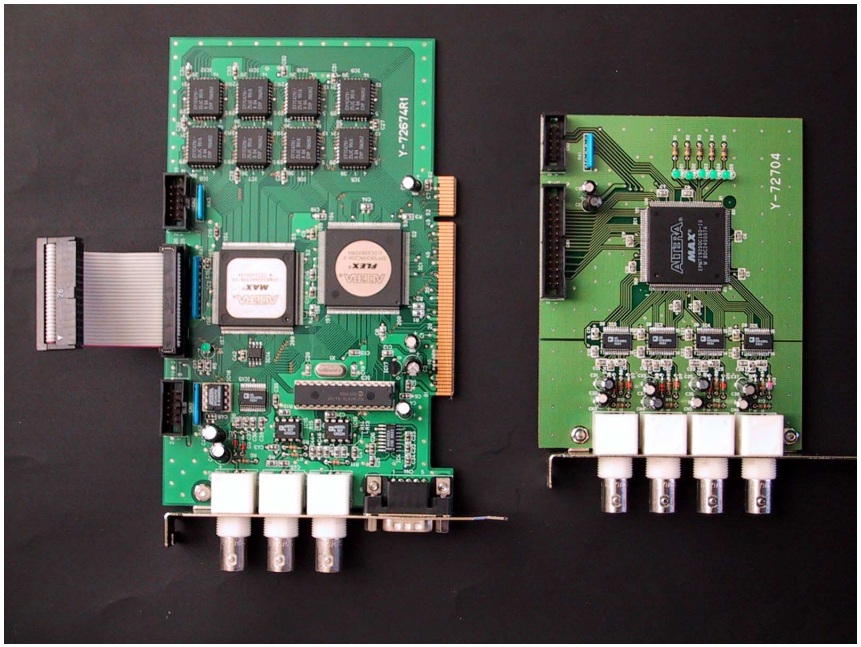
| | |
|---|---|
| Reference signals | 10MHz (+10dBm), 1PPS |
| Number of INPUT CH | 1 : main board only<br>4 : with auxiliary boad |
| A/D | 1, 2, 4, 8 bits |
| Sampling Freq. | 40kHz, 100kHz, 200kHz, 500kHz,<br>1MHz, 2MHz, 4MHz, 8MHz, 16MHz |

# Internet-VLBI System

## First Fringe on Kashima-Koganei Baseline




16MHz sampling

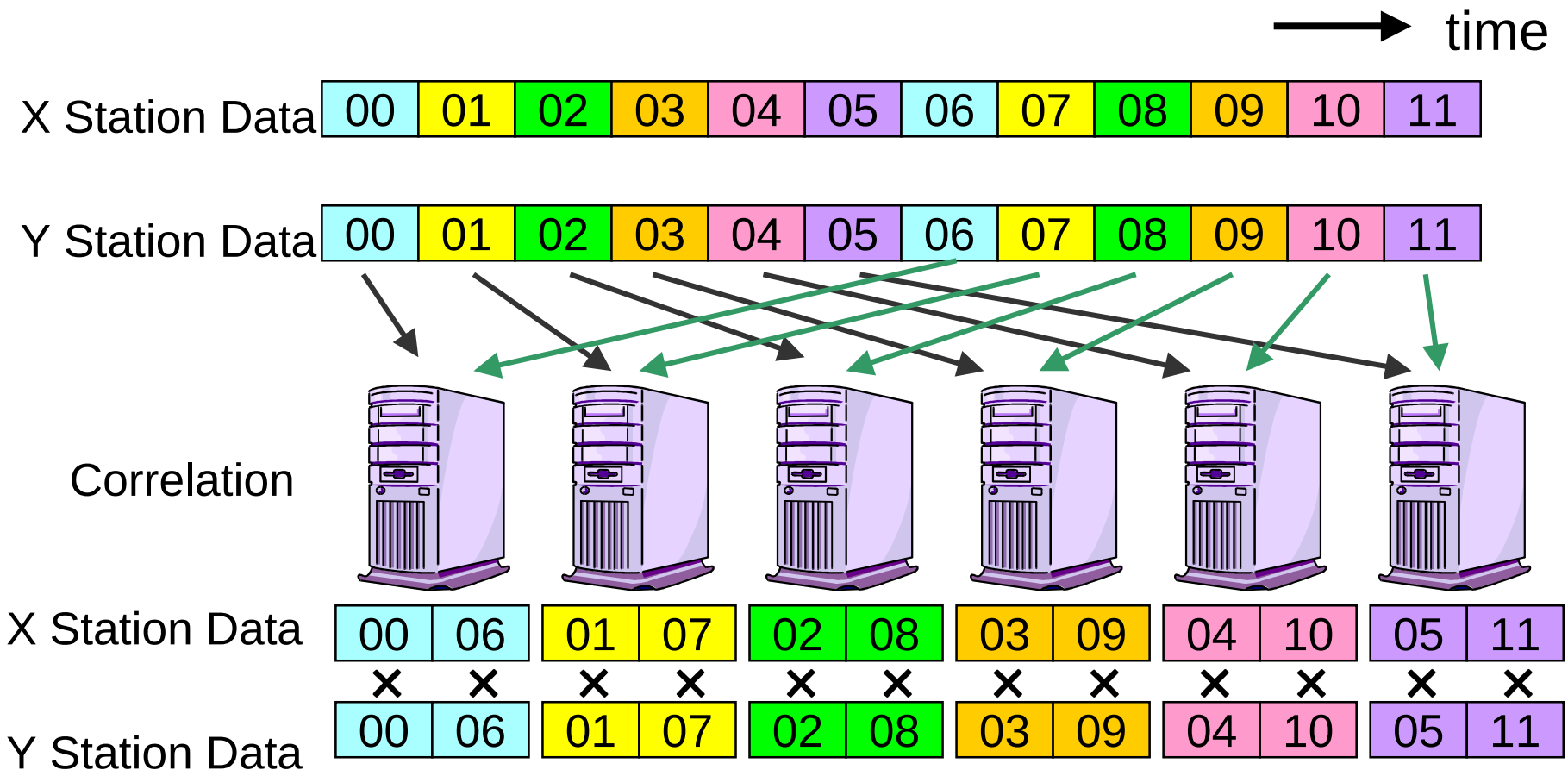


PCI Sampler board

Sept.17, 2001
3C273B
10sec integration

(Note : This is offline processing!)

# IP-VLBI Time Distributed Processing

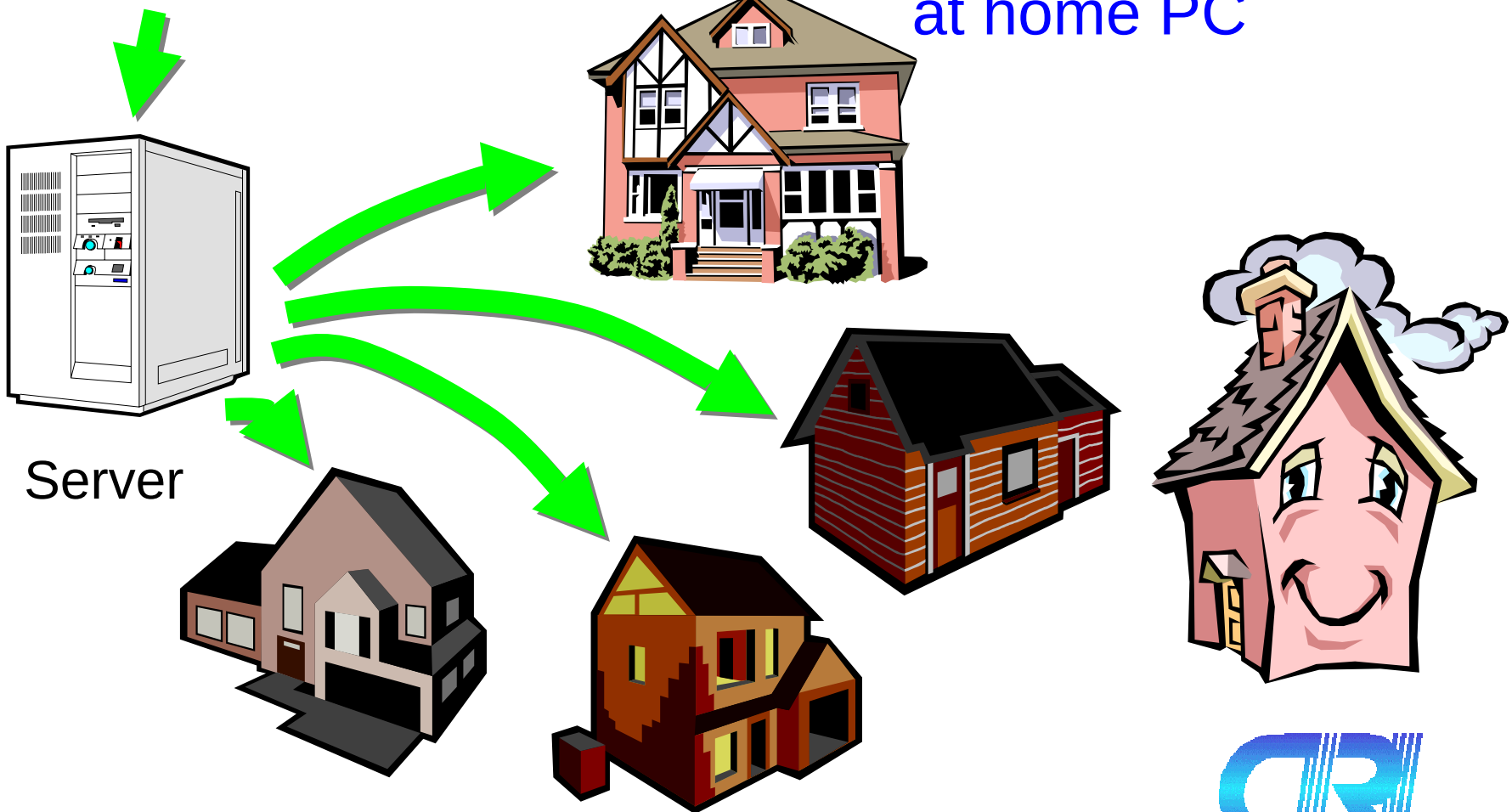



If proceesing time for 1sec data requirs 5 seconds, use of more than 6 PCs enables us to process in quasi real-time.

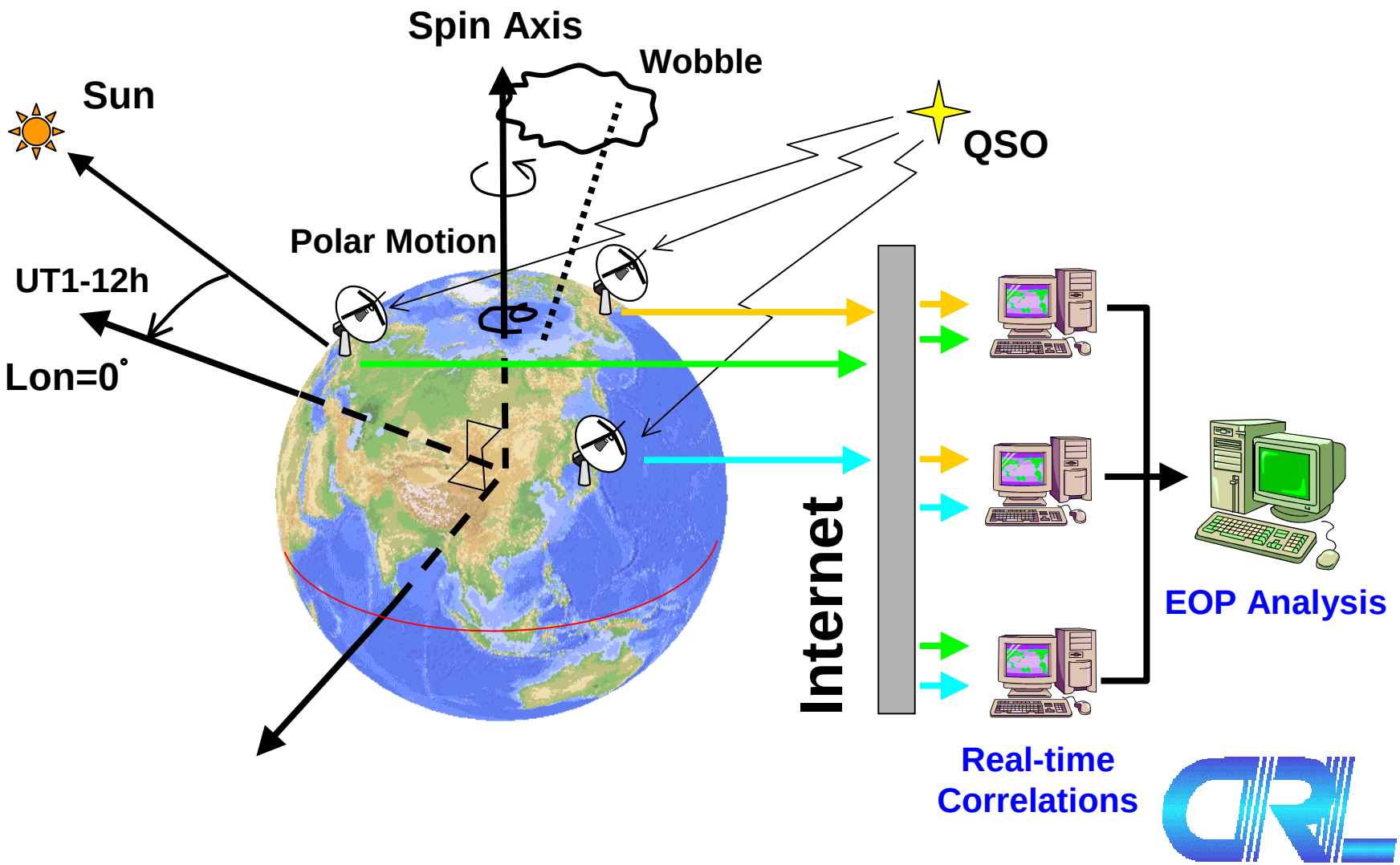
# VLBI@home

huge VLBI data

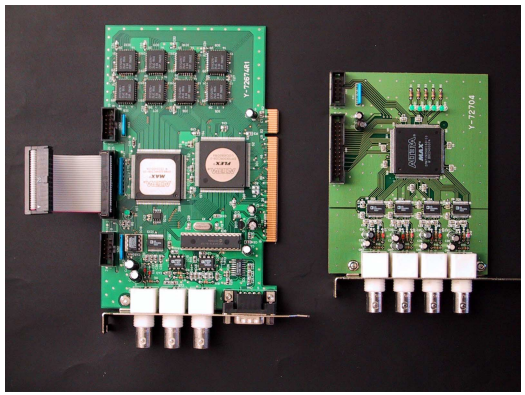
Correlation Processing at home PC



# Real-time monitoring of Earth Orientation Parameters



# Future Plan



IP-VLBI

Gigabit VLBI

PC-VSI