Status of Time Scale of NPL, New Delhi, India

UTC(NPLI)

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ICG-02
Bangalore Sept. 4-7,2007

ORGANIZATION

Infrastructure

Scheme

Current Status

Future Plan

Main Instruments

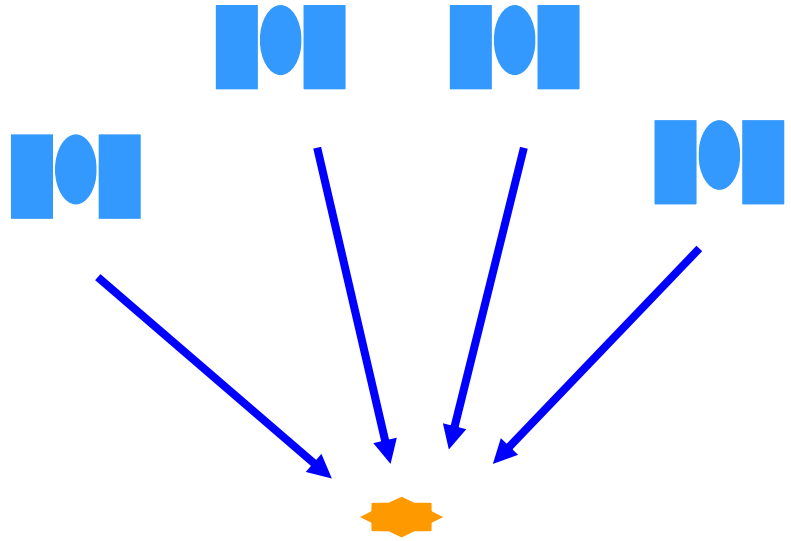
Cesium Clock (HP5071A)	5 units	(94-06)
GPS receiver (TTS2-A)	2 units	2005
Freq. & Phase Offset Generator (HROG-5Spectra Dynamics)	1 unit	2006
Universal Counter(HP53131/32) 300ps	2units	1997
Universal Counter (SRS) 50ps	1unit	2007

GPS RECEIVER FOR TIMING

MULTICHANNEL(sat) RECEIVER

Unknown: 4 parameters
(3 coordinates and time)

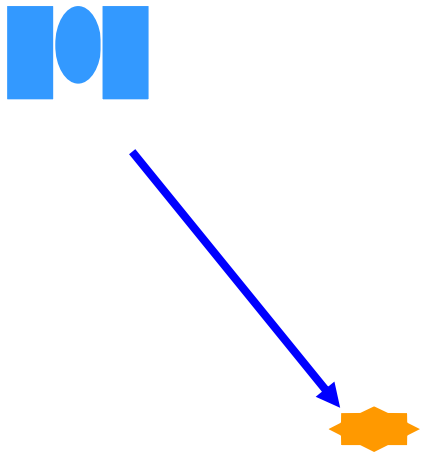
4 satellites to be tracked

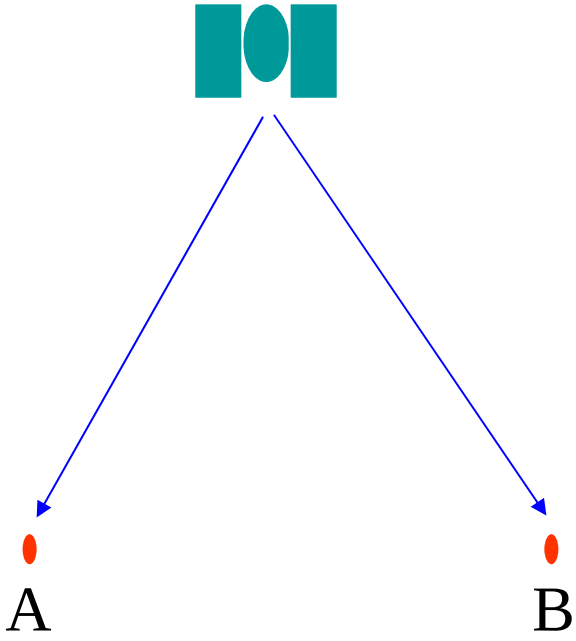


SINGLE CHANNEL(SAT) RECEIVER

Known: 3 coordinates of Receiver
Unknown: (One parameter) TIME

1 satellites to be tracked



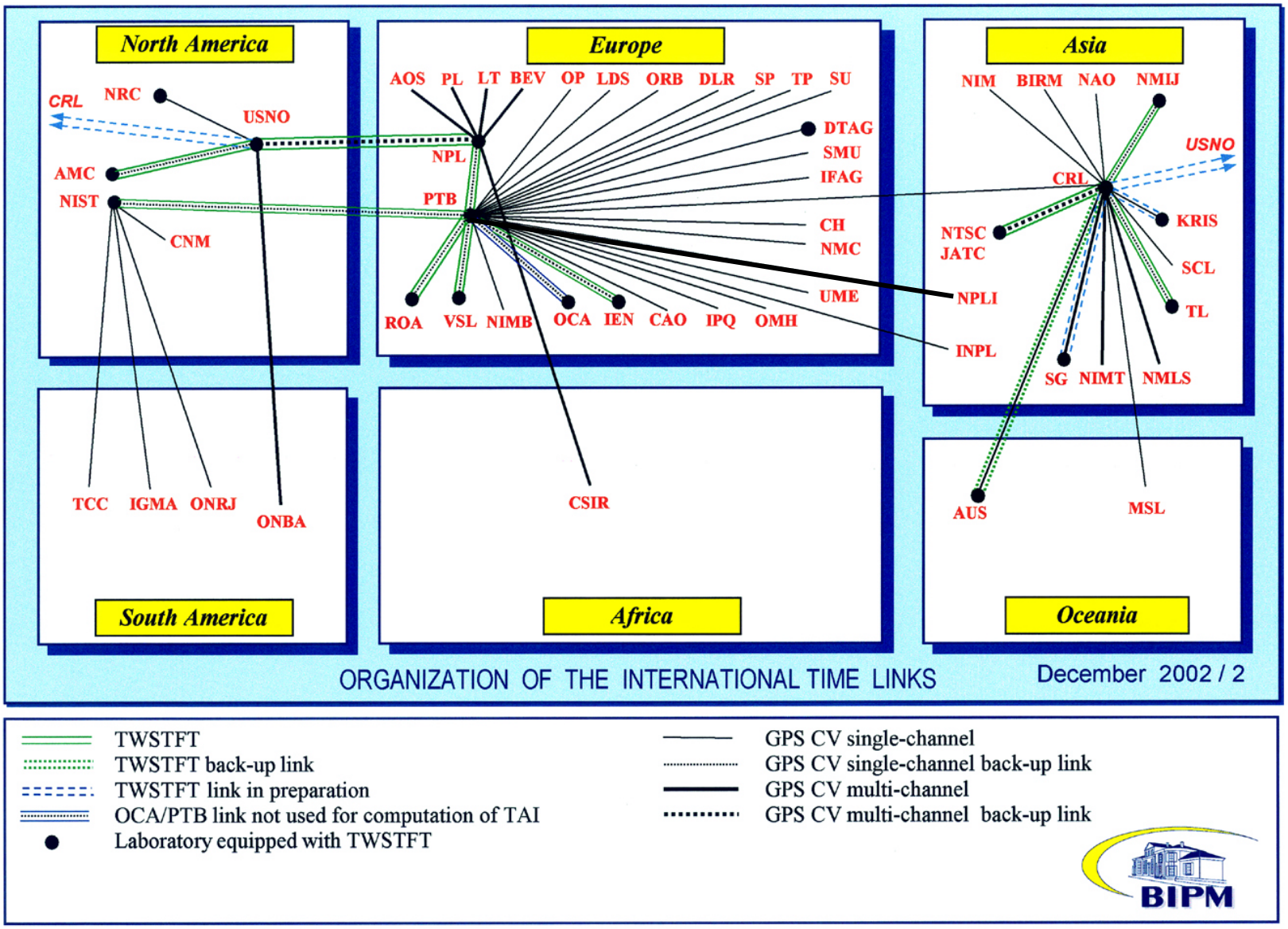


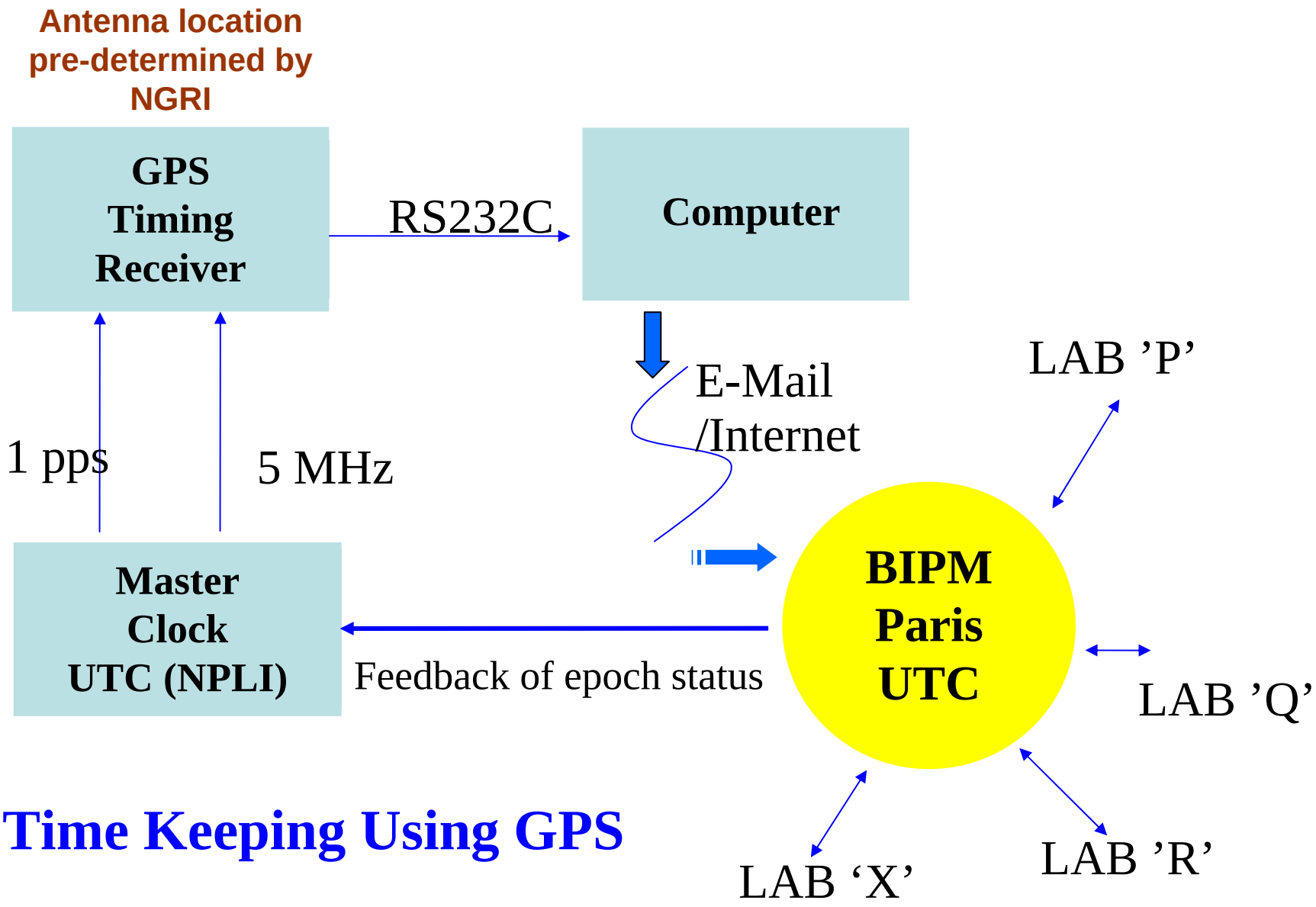
ClockA - ClockB = (ClockA - GPSTime) - (ClockB - GPSTime)

GPS Common View for Timing

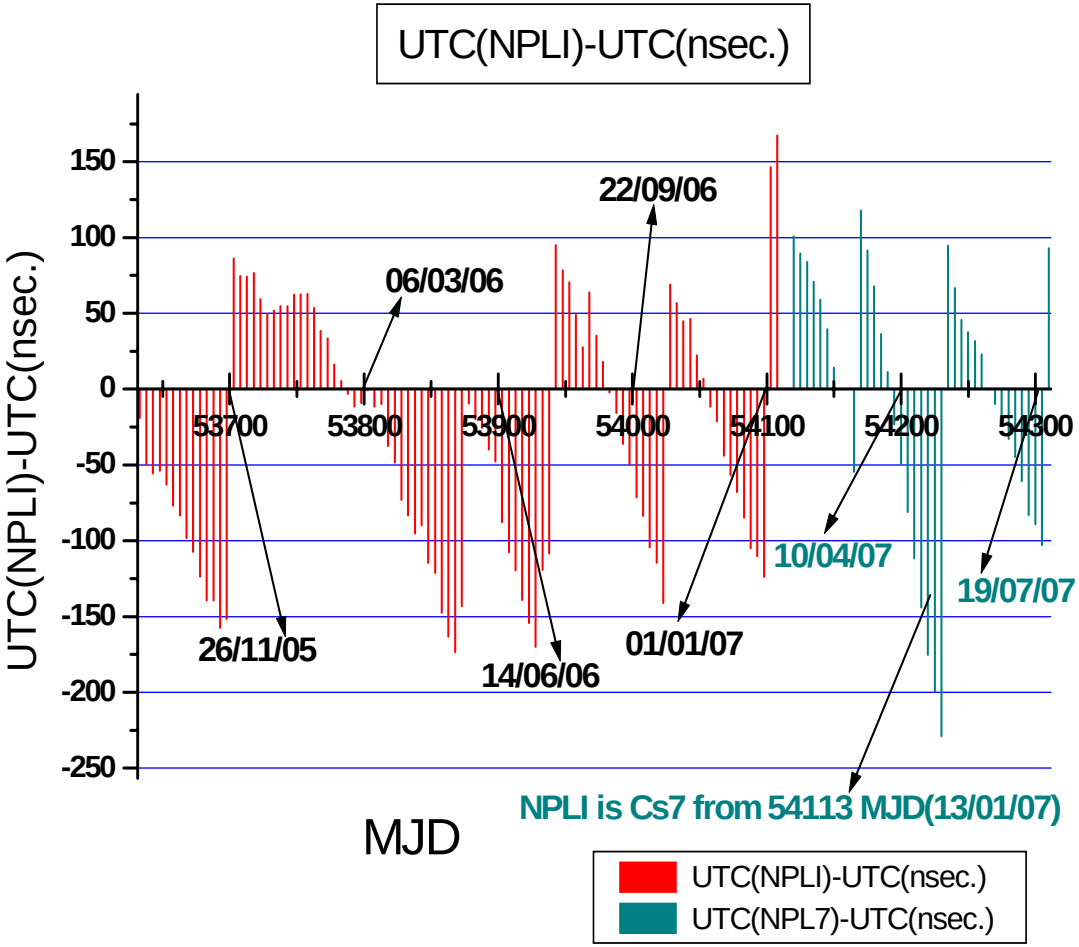
Each Measurement of 13-minute Track

Single Channel Receiver	**TTR6**	**till 2005**
(BIPM Tracking Schedule)		
Multi Channel Receiver	**TTS-2**	**since 2005**

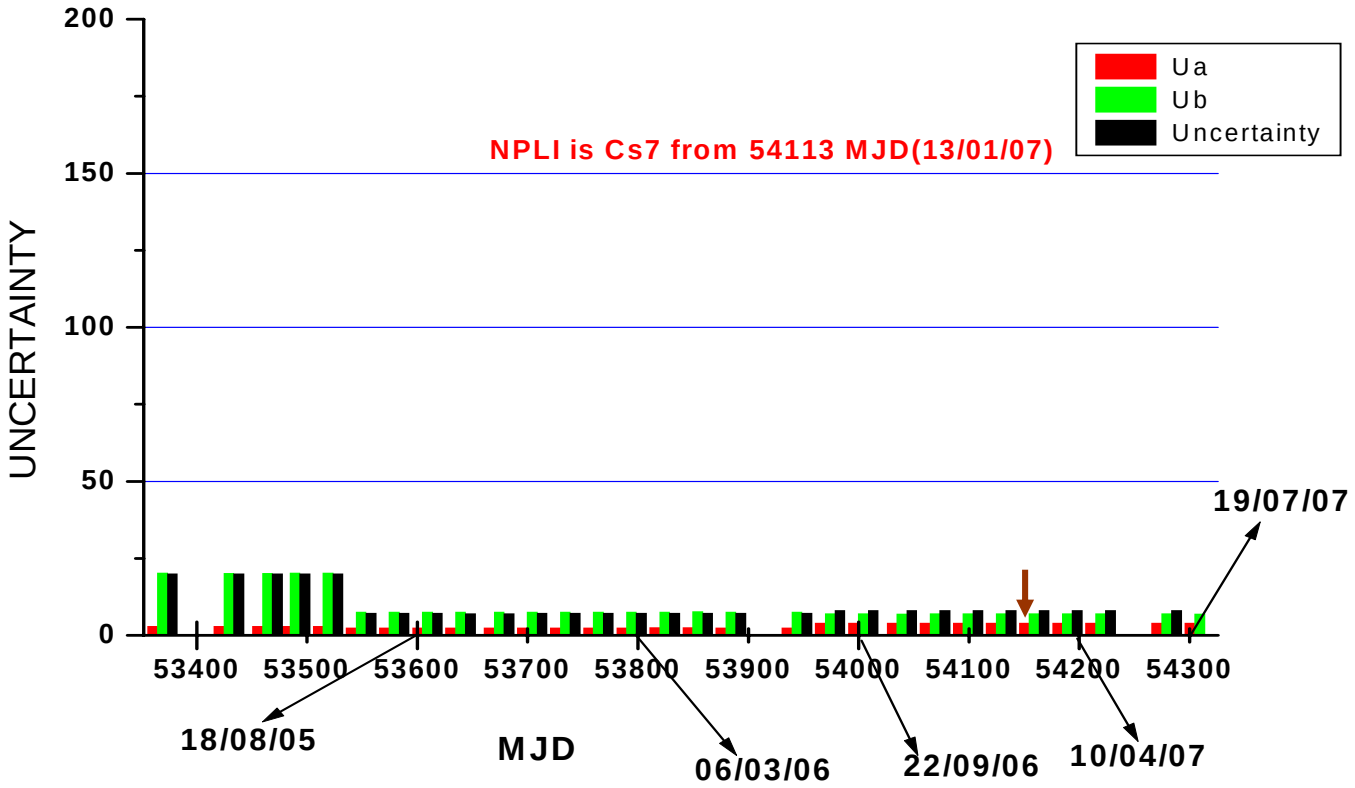

North America
CRL
NRC
USNO
AMC
NIST
CNM
TCC
IGMA
ONRJ
ONBA
South America
Europe
AOS
PL
LT
BEV
OP
LDS
ORB
DLR
SP
TP
SU
DTAG
SMU
IFAG
NPL
PTB
CH
NMC
UME
ROA
VSL
NIMB
OCA
IEN
CAO
IPQ
OMH
CSIR
Africa
Asia
NIM
BIRM
NAO
NMIJ
USNO
CRL
KRIS
NTSC
JATC
SCL
TL
NPLI
INPL
SG
NIMT
NMLS
AUS
MSL
Oceania
ORGANIZATION OF THE INTERNATIONAL TIME LINKS
December 2002 / 2
TWSTFT
TWSTFT back-up link
TWSTFT link in preparation
OCA/PTB link not used for computation of TAI
Laboratory equipped with TWSTFT
GPS CV single-channel
GPS CV single-channel back-up link
GPS CV multi-channel
GPS CV multi-channel back-up link
BIPM

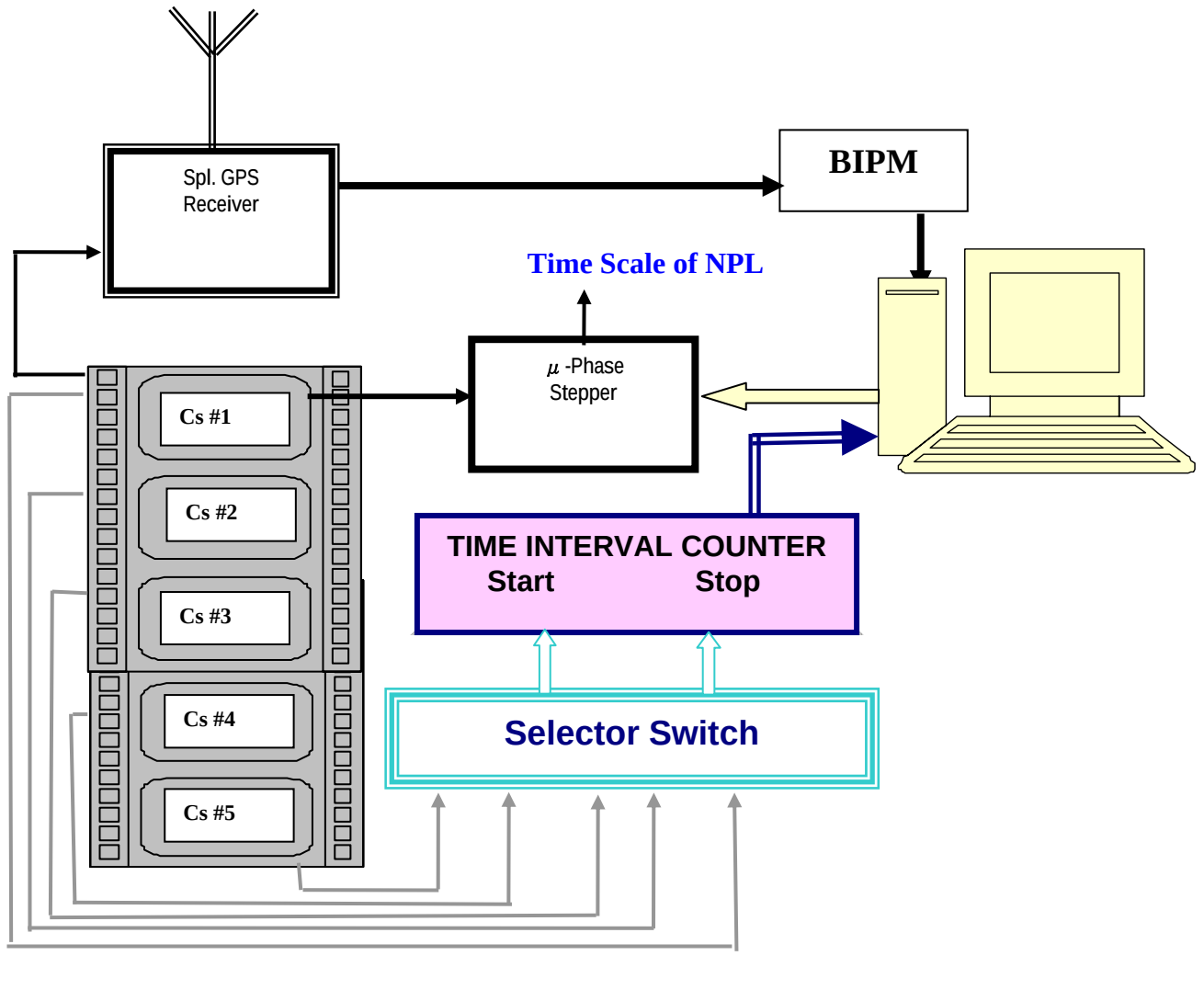


Time Keeping Using GPS

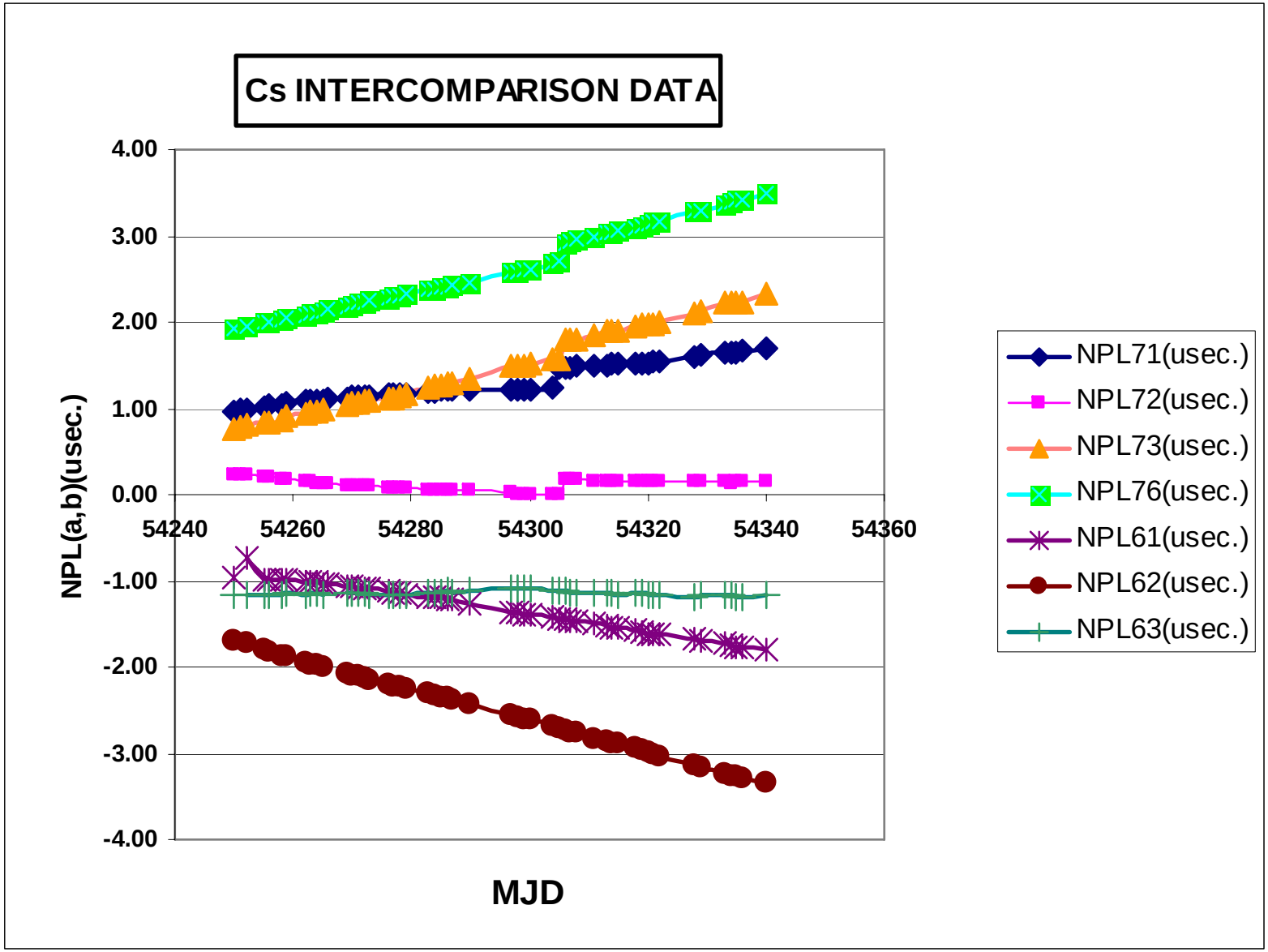

UTC(NPLI)-UTC(nsec.)
UTC(NPLI)-UTC(nsec.)
150
100
50
0
-50
-100
-150
-200
-250
53700
53800
53900
54000
54100
54200
54300
22/09/06
06/03/06
26/11/05
14/06/06
01/01/07
10/04/07
19/07/07
NPLI is Cs7 from 54113 MJD(13/01/07)
MJD
UTC(NPLI)-UTC(nsec.)
UTC(NPL7)-UTC(nsec.)

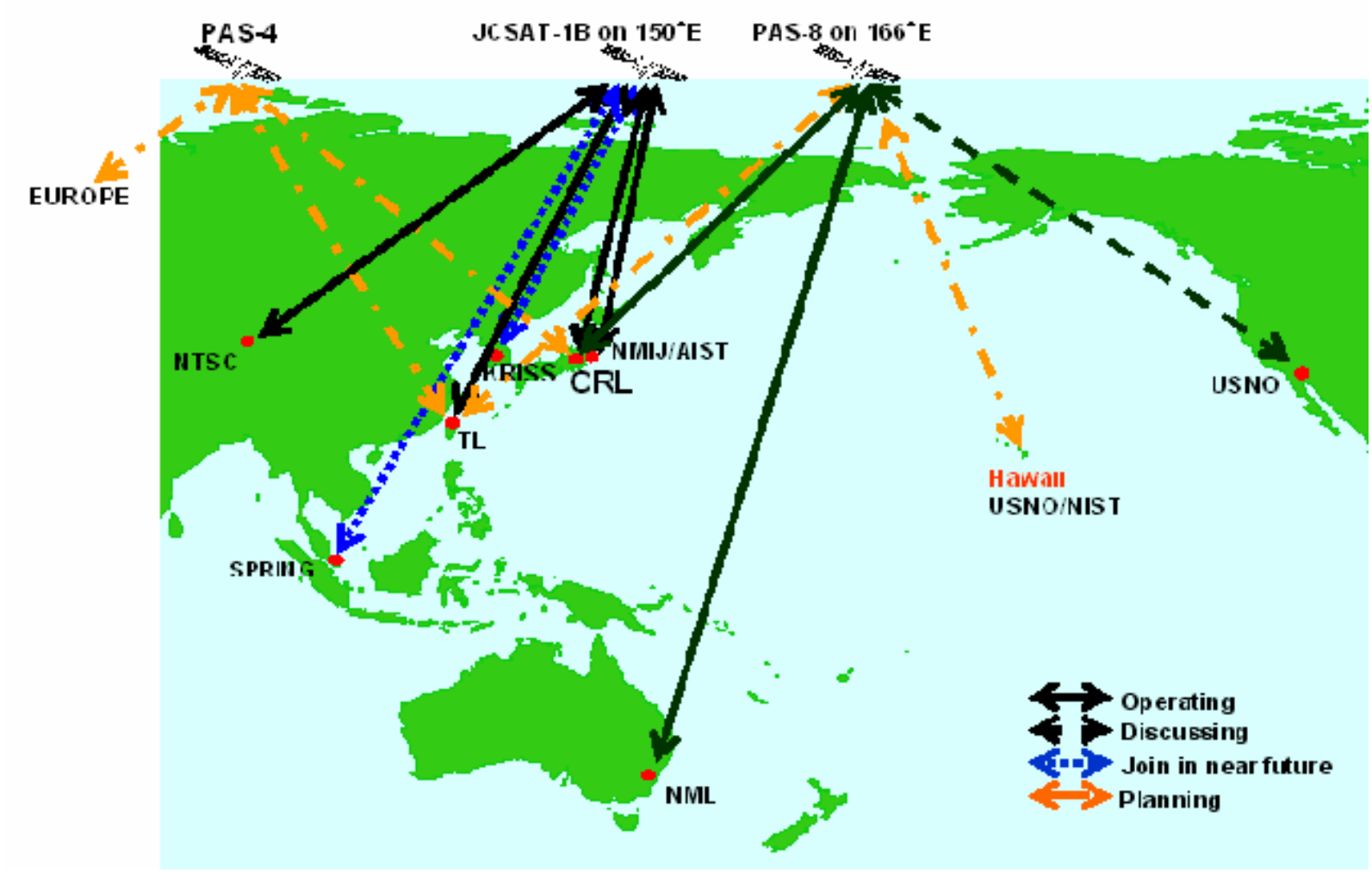
UNCERTAINTY OF UTC(NPLI) FROM CIR. T





Proposed Plan for Time Scale


Cs INTERCOMPARISON DATA
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
54240
54260
54280
54300
54320
54340
54360
NPL(a,b)(usec.)
MJD
NPL71(usec.)
NPL72(usec.)
NPL73(usec.)
NPL76(usec.)
NPL61(usec.)
NPL62(usec.)
NPL63(usec.)



Planned Two Way Satellite Time and Frequency Transfer (TWSTFT) Link for NPLI

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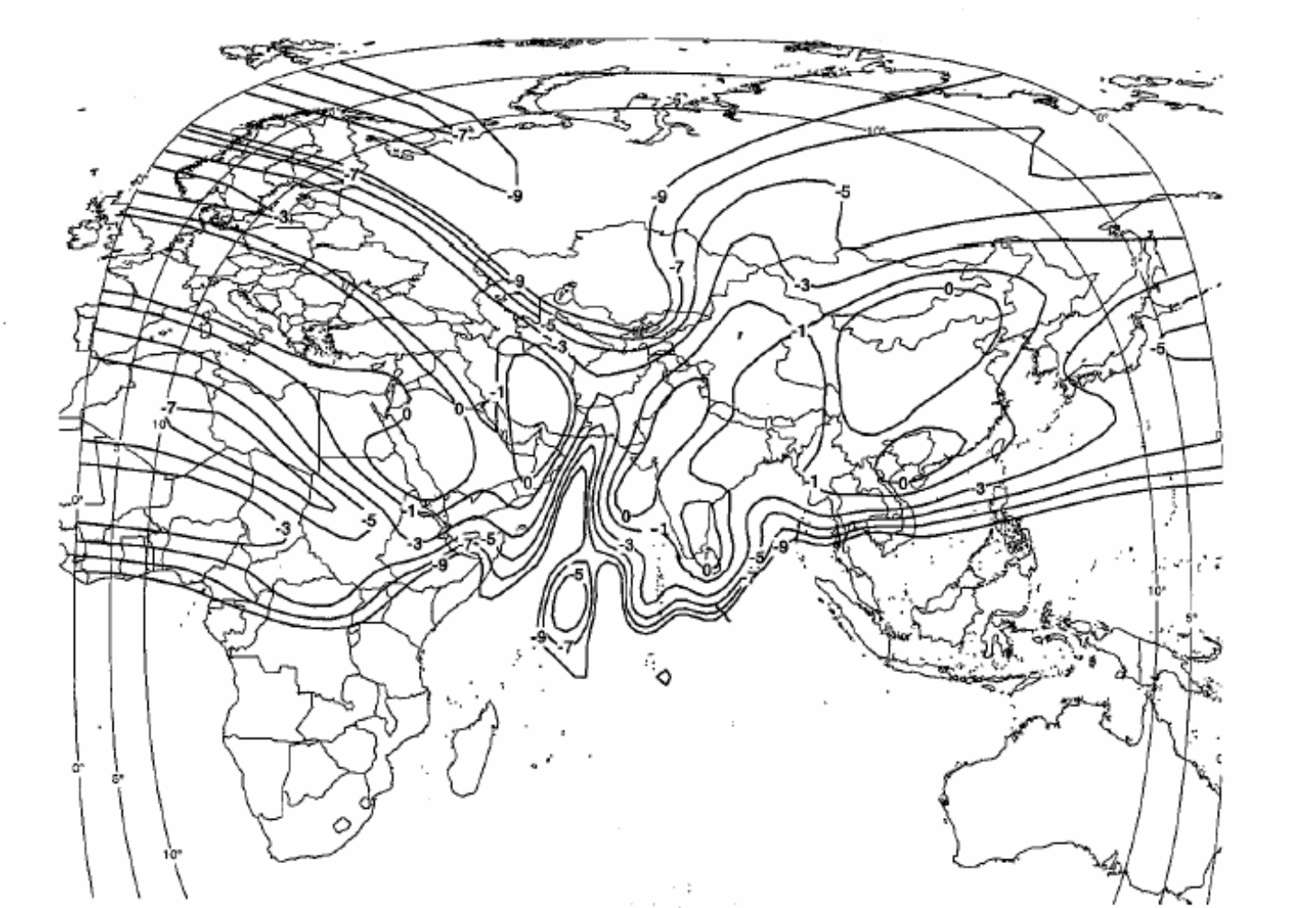
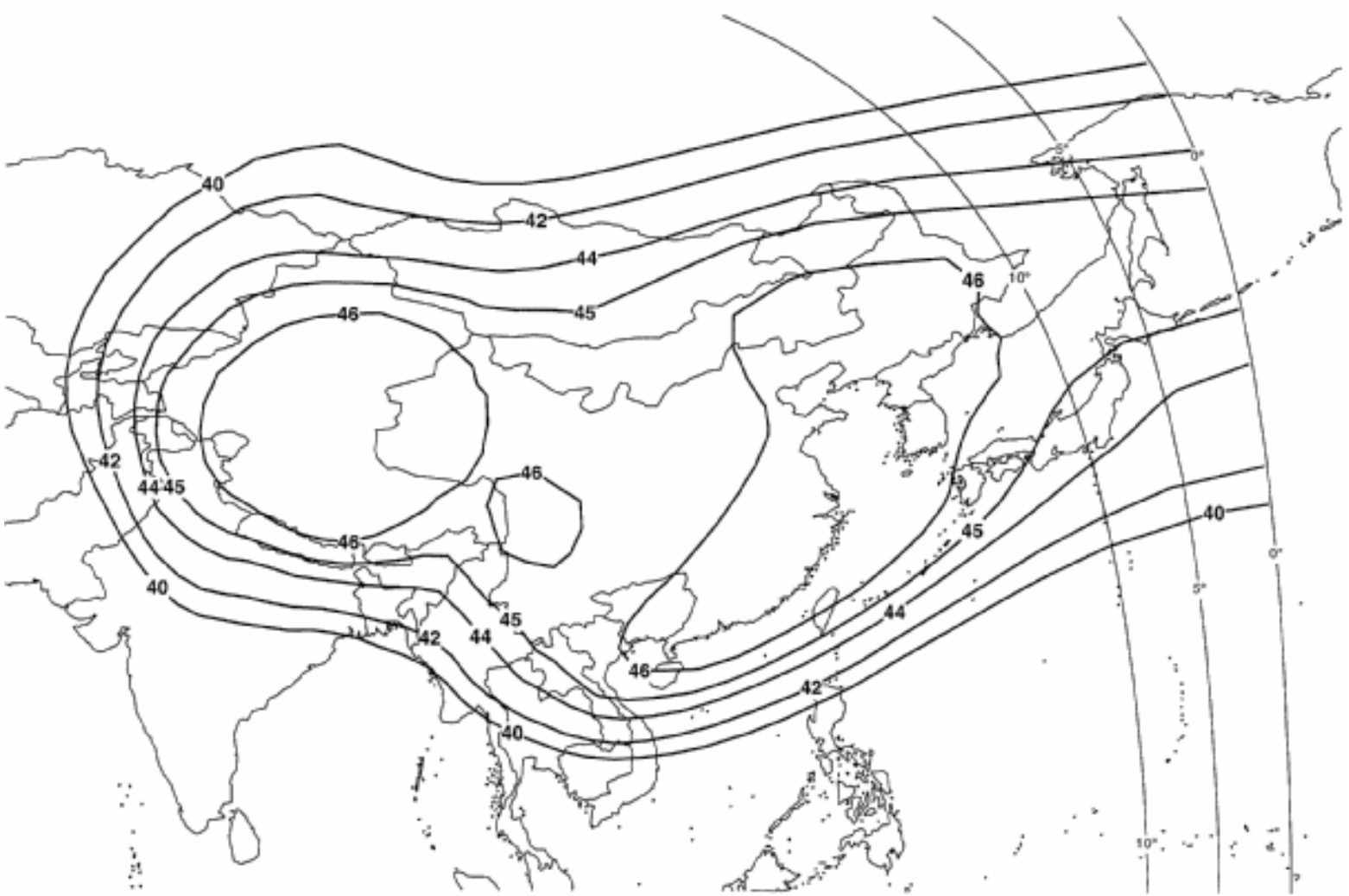


PAS-4 @ 72º E.L., Ku-Band Europe/Middle East/India/Asia Horizontal Uplink Beam
(side 1of 3)
(Contour 0, -1, -3, -5, -7, -9 dB/K)



PAS-4 @ 72o E.L., Ku-Band Northeast Asia Horizontal Downlink Beam
(Contour 46, 45, 44, 42, 40, 40 dBW)

Satellite: PanAmSat PAS-4 at 72^0E

Only one Transponder (18K, 20K, 22K or 24K named as TR-I) is required for **India/ Japan Up and Down Link**. The transponder TR-I may be used also only for uplink from Europe to Japan/India. But ***another transponder*** (5K, 6K, d7K or 8K named as TR-II) is required for Down Link to Europe from India/Japan and this necessitates uplink **from India/Japan to Europe** through the transponder TR-II.

Proposed Joint Collaboration with ISRO for Time Scale

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Thank You

UTC(NPLI)-UTC(nsec.)