

# Status of Time Scale of NPL, New Delhi, India

## UTC(NPLI)

**P.Banerjee**

**NPL, New Delhi, India**

**[pbanerjee@nplindia.ernet.in](mailto:pbanerjee@nplindia.ernet.in)**

# ORGANIZATION

**Infrastructure**

**Scheme**

**Current Status**

**Future Plan**

## Main Instruments

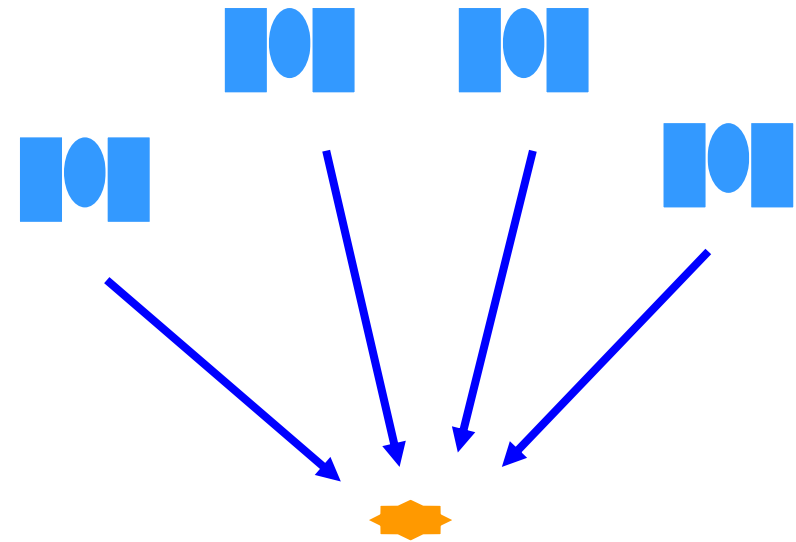
<b>Cesium Clock (HP5071A)</b>	<b>5 units</b>	<b>(94-06)</b>
<b>GPS receiver (TTS2-A)</b>	<b>2 units</b>	<b>2005</b>
<b>Freq. &amp; Phase Offset Generator (HROG-5 Spectra Dynamics)</b>	<b>1 unit</b>	<b>2006</b>
<b>Universal Counter(HP53131/32) 300ps</b>	<b>2units</b>	<b>1997</b>
<b>Universal Counter (SRS)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

# GPS RECEIVER FOR TIMING

## MULTICHANNEL(sat) RECEIVER

Unknown: 4 parameters  
(3 coordinates and time)

4 satellites to be tracked

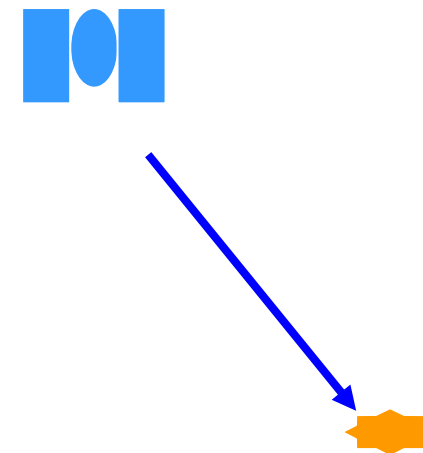


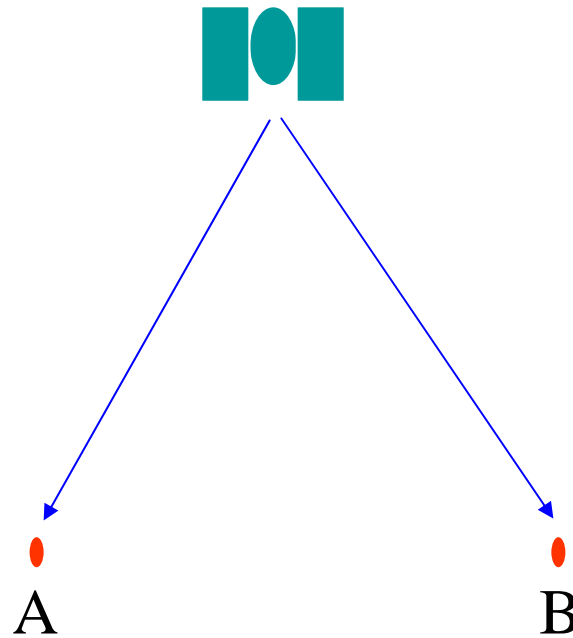
## SINGLE CHANNEL(SAT) RECEIVER

Known: 3 coordinates of Receiver

Unknown: (One parameter) TIME

1 satellites to be tracked





$$\text{ClockA} - \text{ClockB} = (\text{ClockA} - \text{GPSTime}) - (\text{ClockB} - \text{GPSTime})$$

## GPS Common View for Timing

## Each Measurement of 13-minute Track

**Single Channel Receiver  
(BIPM Tracking Schedule)**

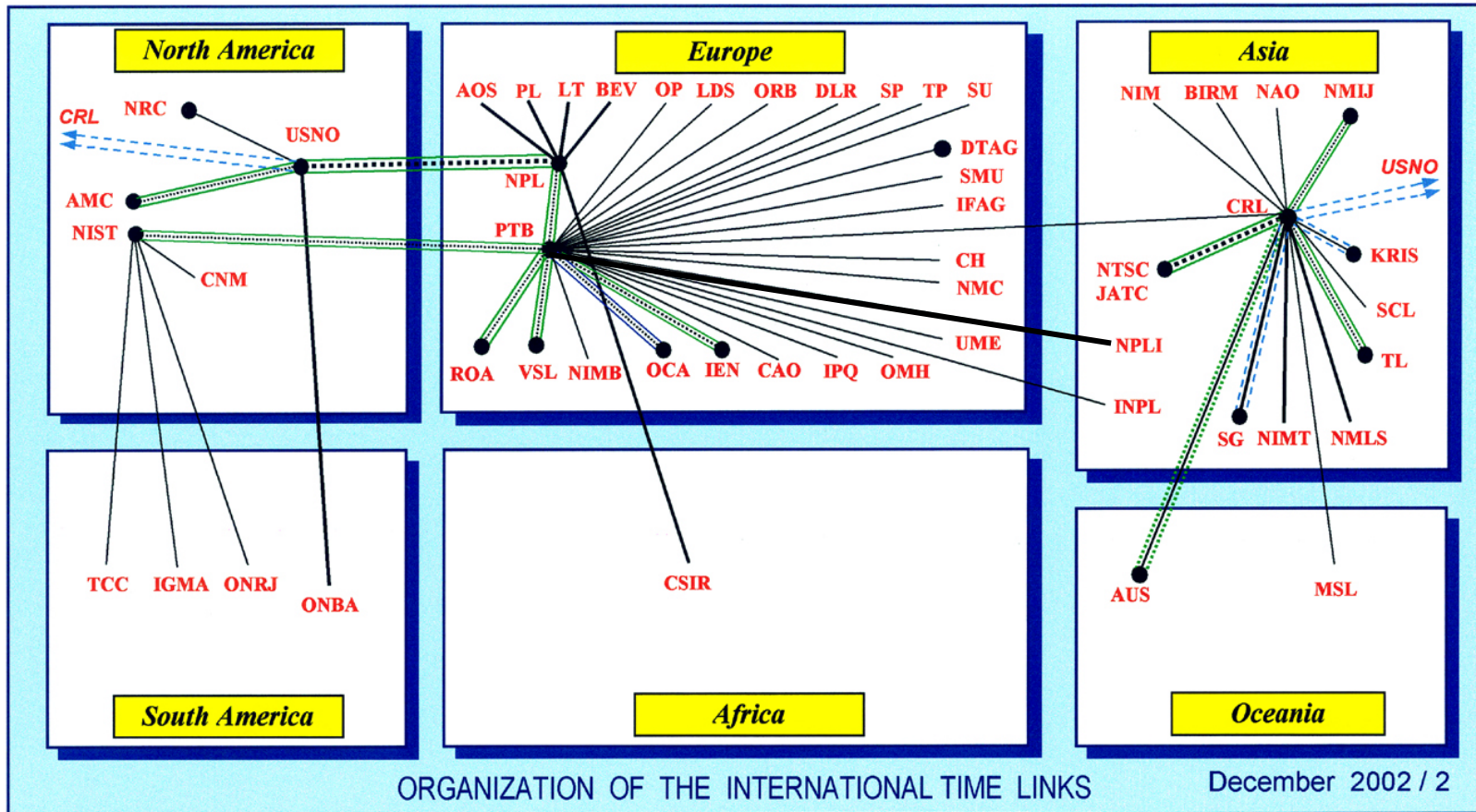
**TTR6**

**till 2005**

**Multi Channel Receiver**

**TTS-2**

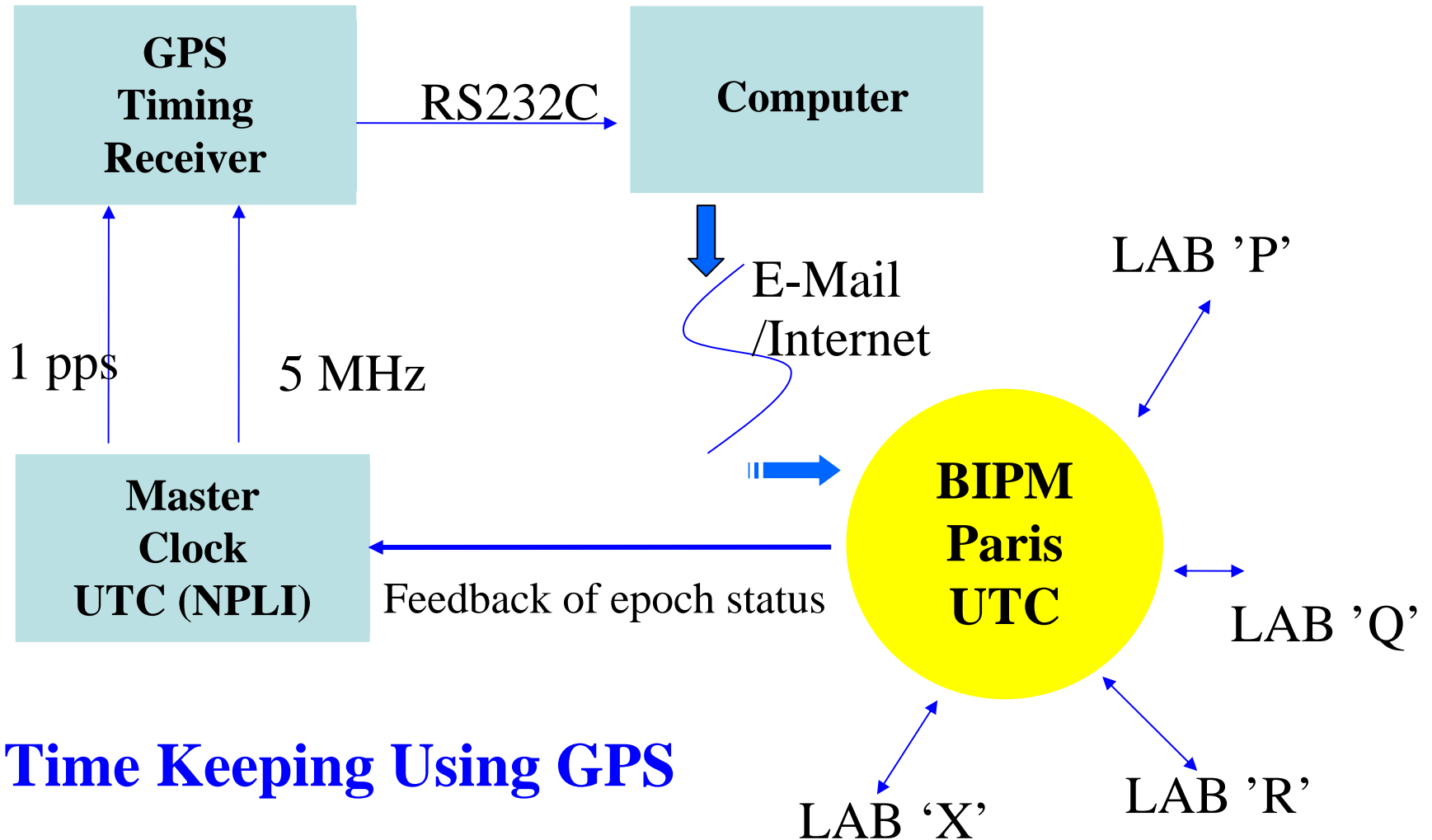
**since 2005**



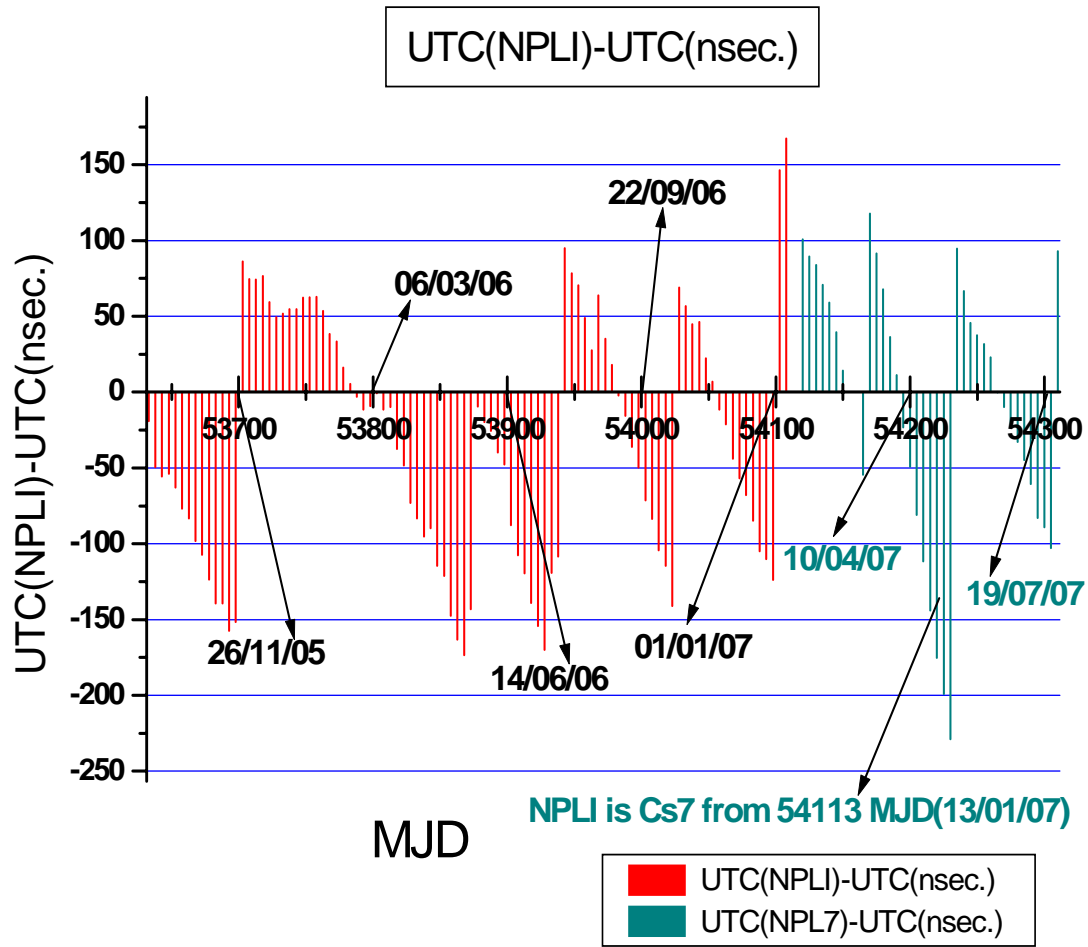
	TWSTFT		GPS CV single-channel
	TWSTFT back-up link		GPS CV single-channel back-up link
	TWSTFT link in preparation		GPS CV multi-channel
	OCA/PTB link not used for computation of TAI		GPS CV multi-channel back-up link
	Laboratory equipped with TWSTFT		



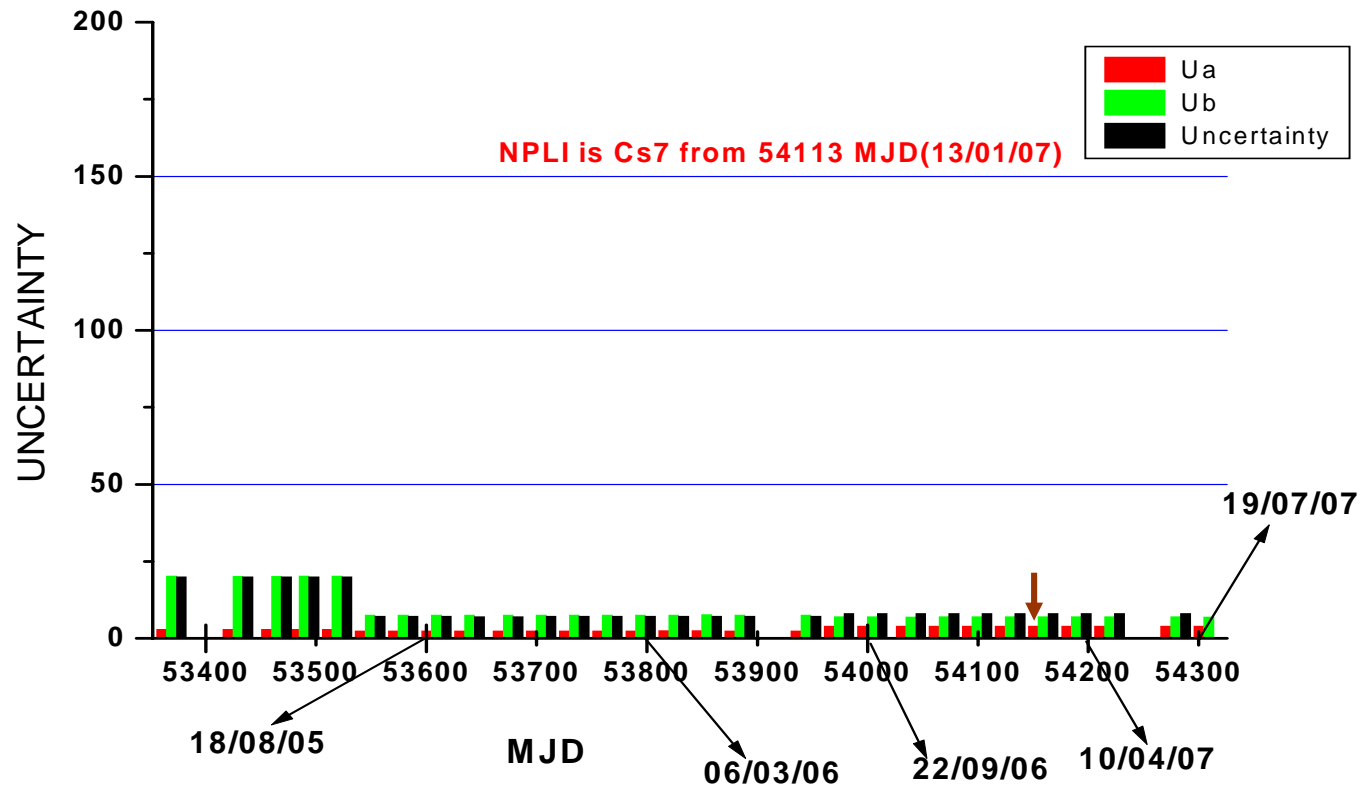
Antenna location  
pre-determined by  
NGRI

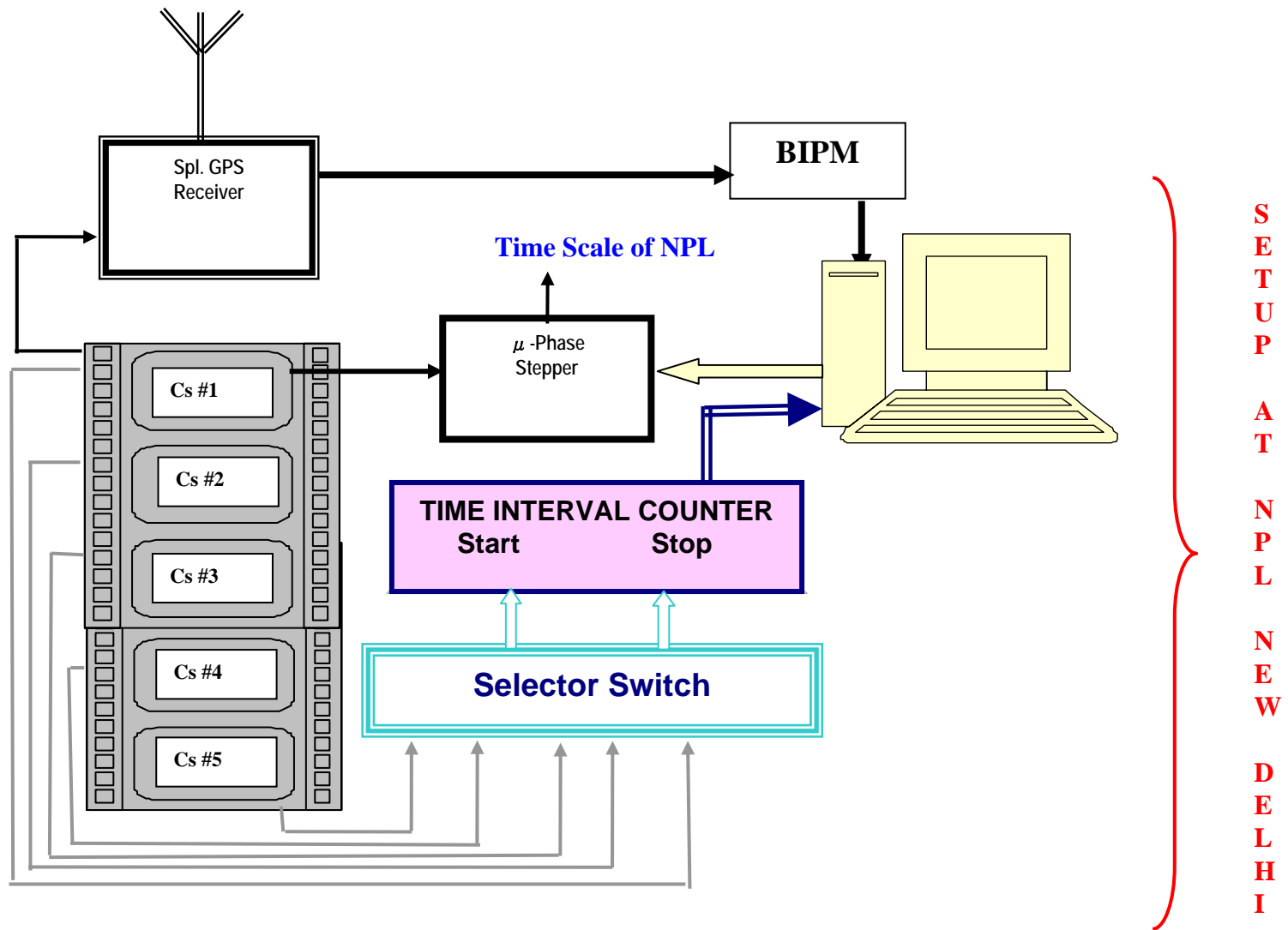






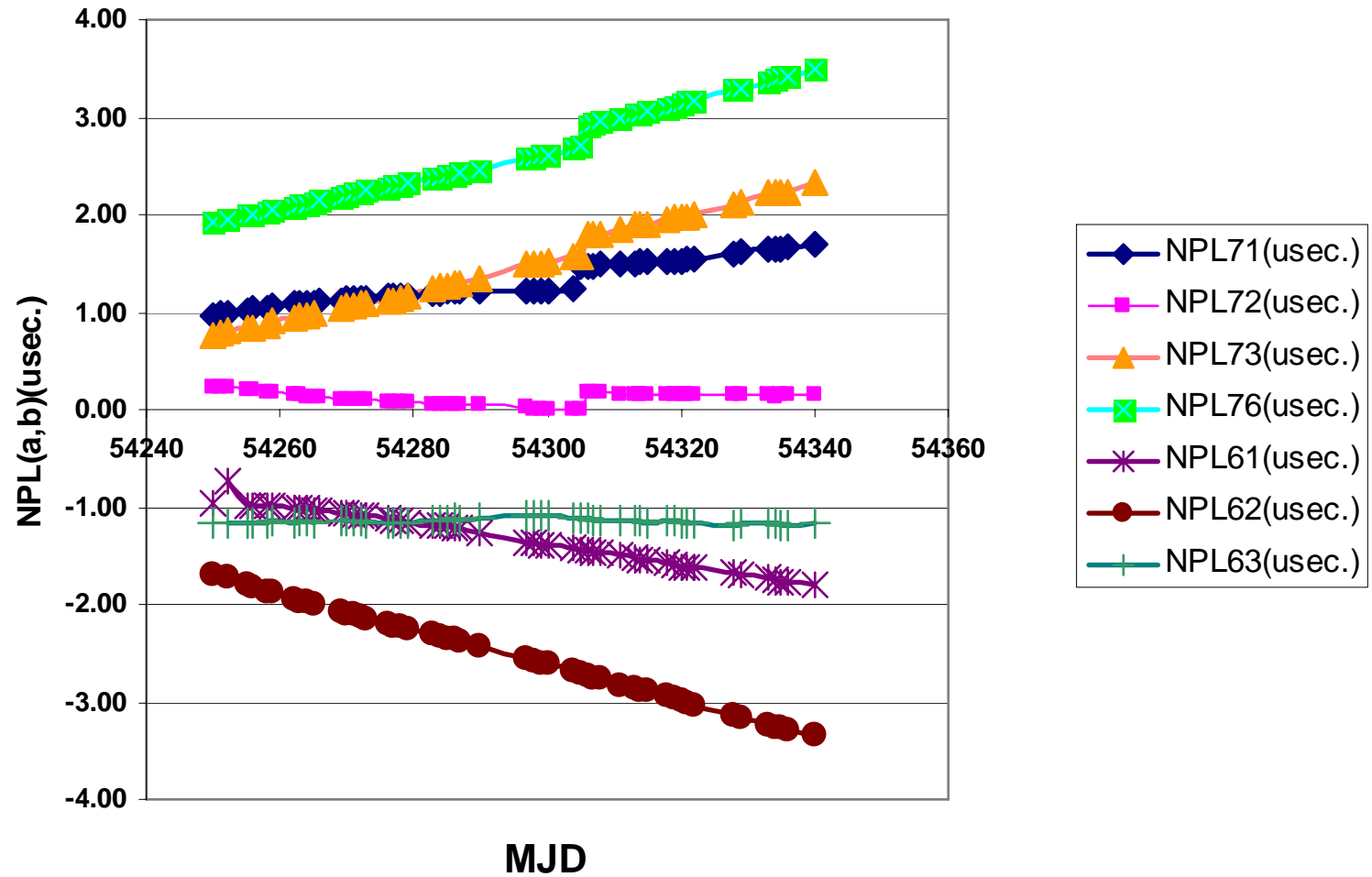
## UNCERTAINTY OF UTC(NPLI) FROM CIR. T

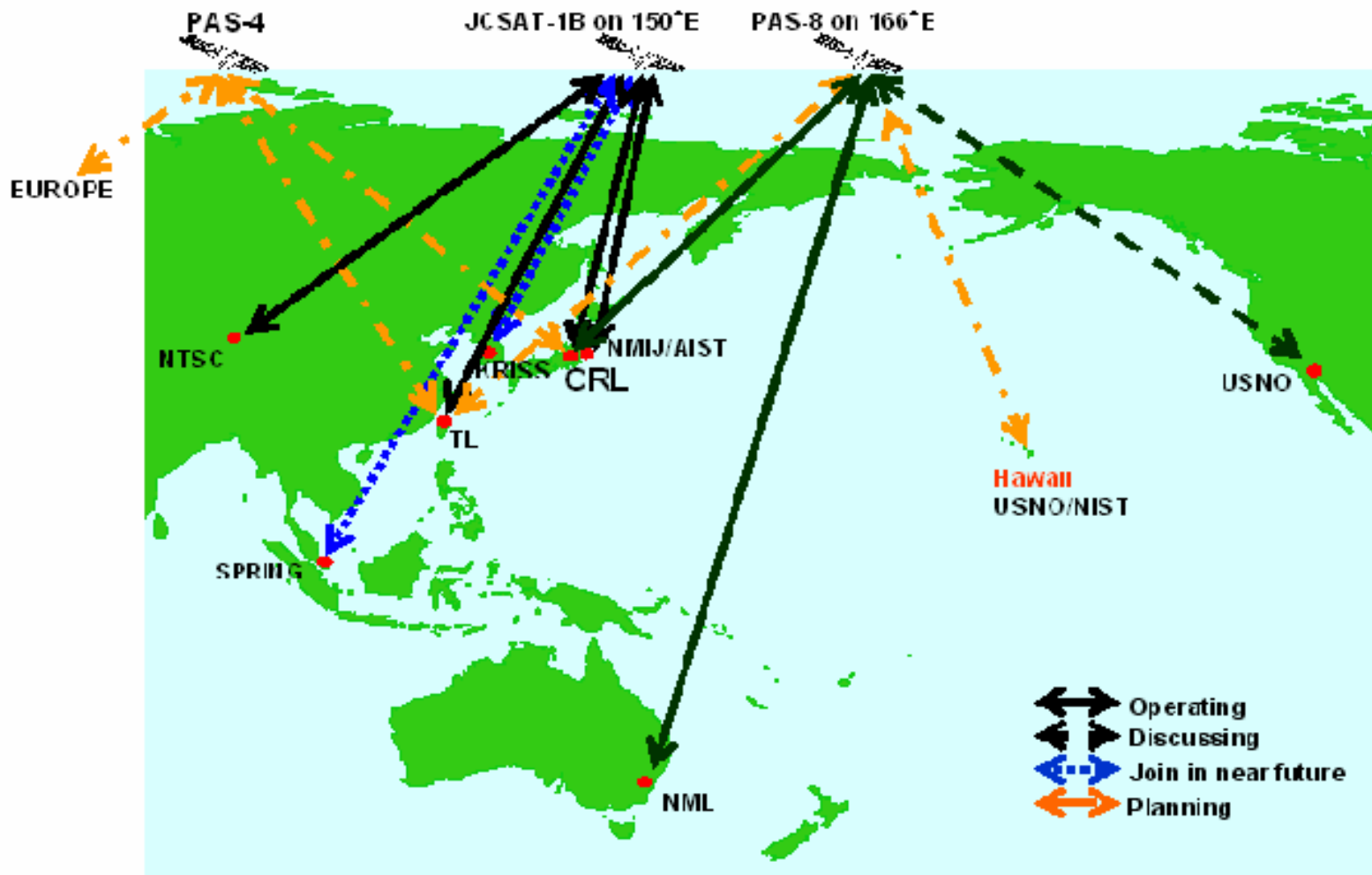




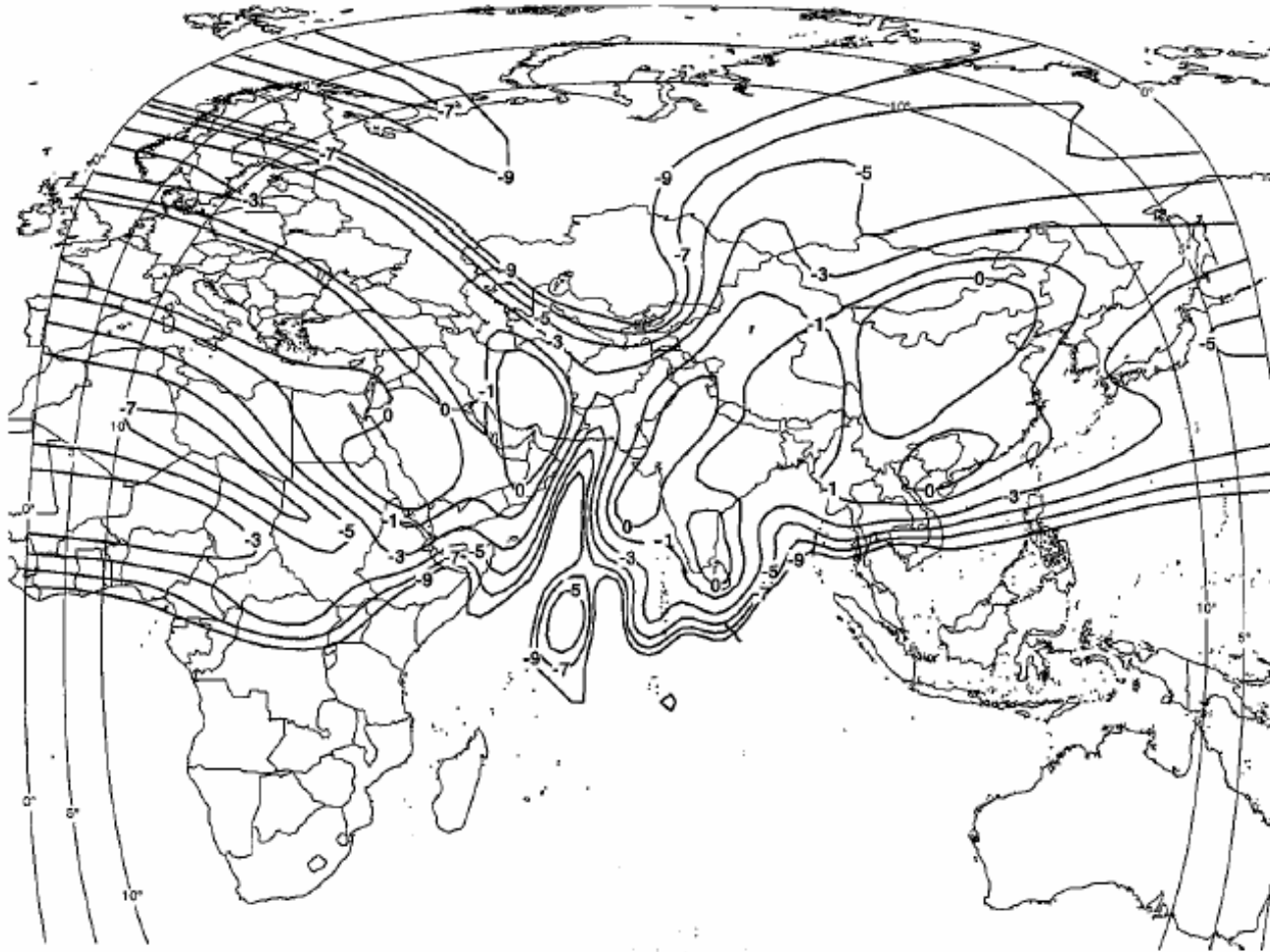
## Proposed Plan for Time Scale

### Cs INTERCOMPARISON DATA



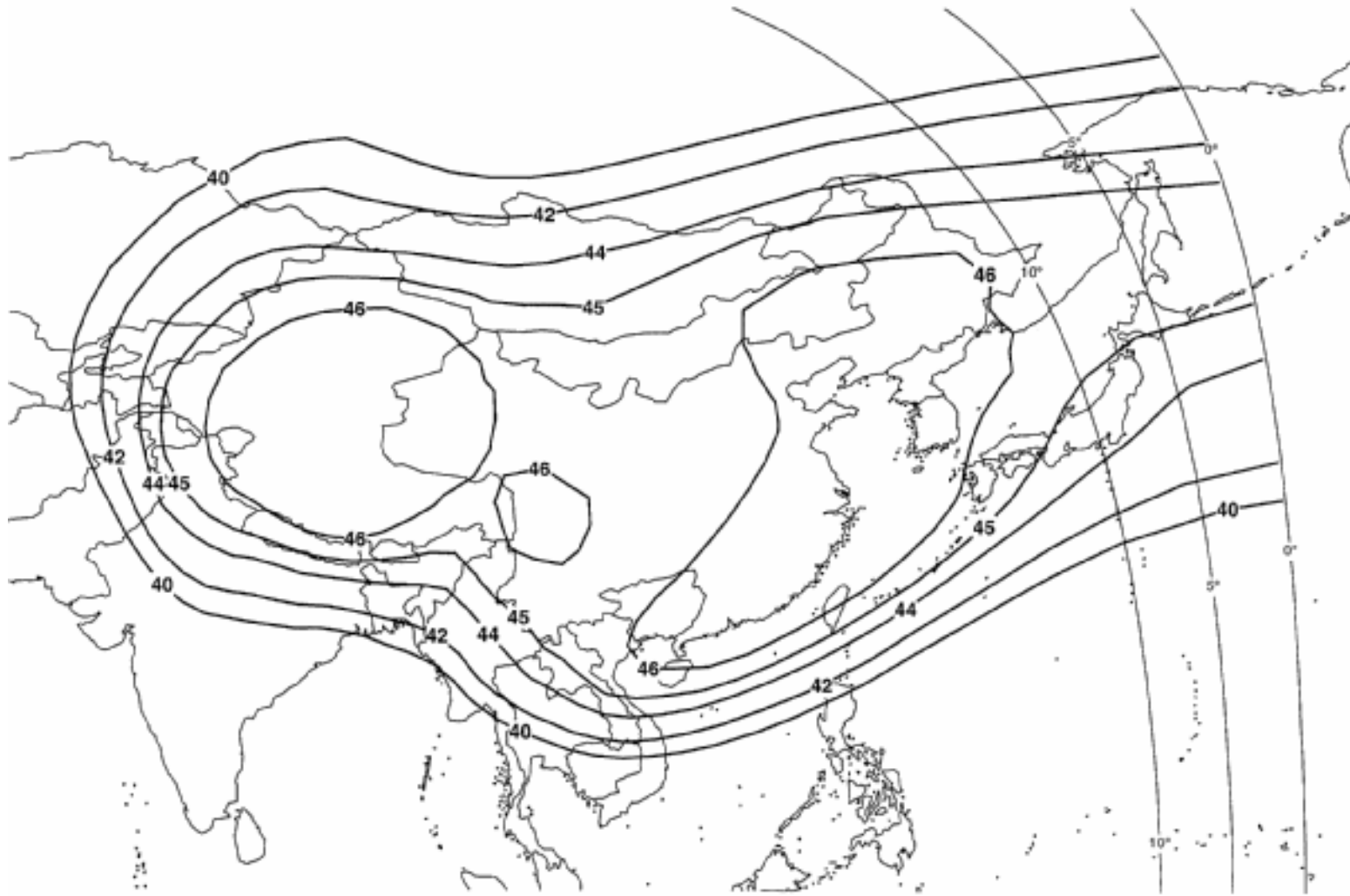


## Planned Two Way Satellite Time and Frequency Transfer (TWSTFT) Link for NPLI



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

ICG-02  
Bangalore Sept. 4-7,2007



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°E**

***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**

**Thank You**

## UTC(NPLI)-UTC(nsec.)

