

# LHC Timing and Time Stamping

- What do the users want?
- Where do they want it?
- How to provide it?
- Planning
- Conclusions

# What do the users want?

- 1) 40MHz LHC bunch frequency, BA3 RF via PCR.
- 2) 11.7 kHz LHC rev. frequency, BA3 RF via PCR.
- 3) Beam Synchronous Timing, PCR.
- 4) SPS fast extraction pre-pulses, BA3 RF via PCR.
- 5) LHC fast injection pre-pulses, SR4 via PCR.
- 6) SPS slow timing, SPS MTG in PCR.
- 7) LHC slow timing, LHC MTG in PCR.
- 8) Timing receivers.
- 9) Time of day and events.

# Where do they want it?

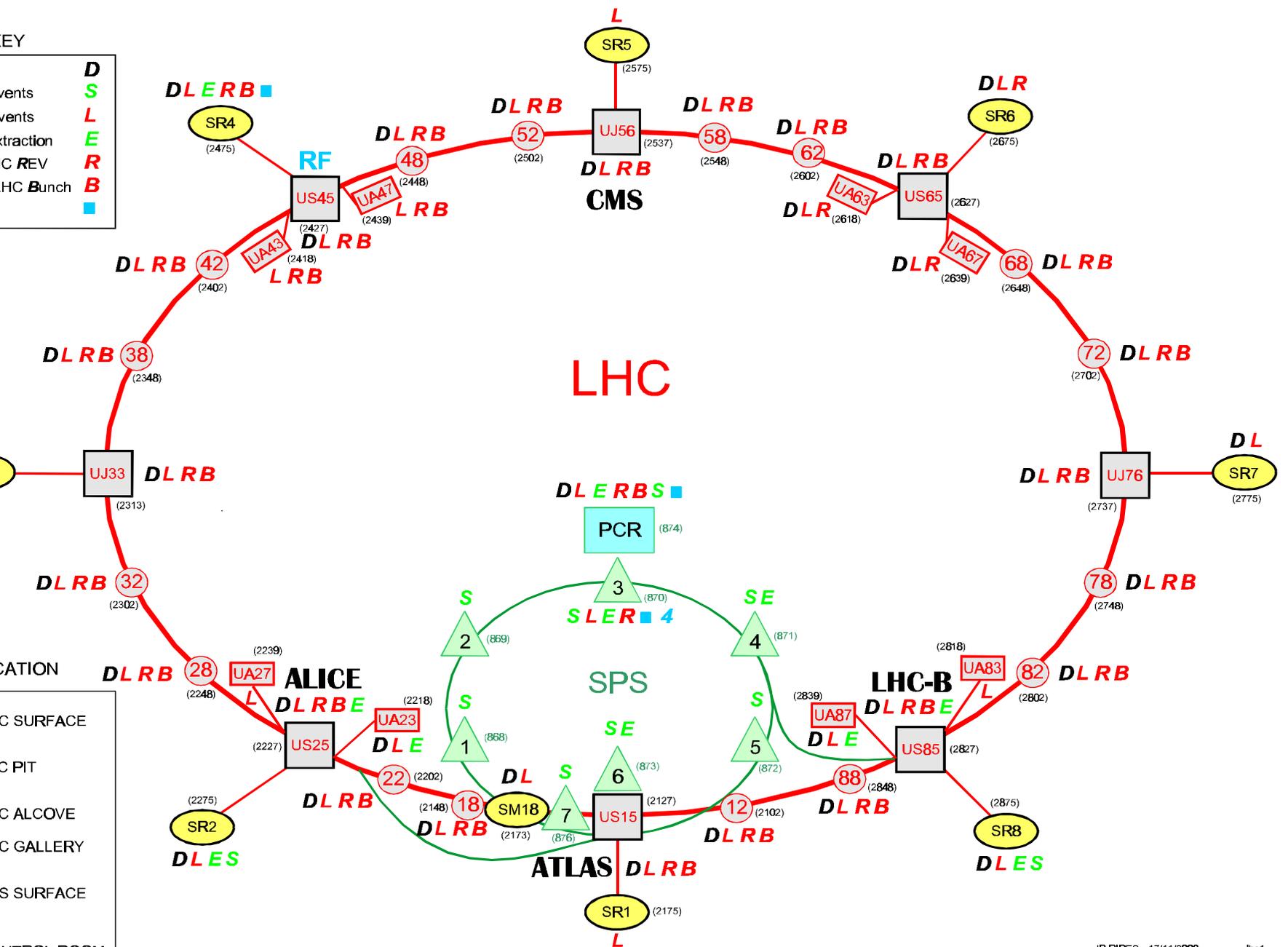
- See next slide
  - Note, at the moment it has not been decided whether the 40MHZ, 11.7kHz and BST are required in all the alcoves and pits. Depends upon the results of the radiation tests currently in progress.
  - Hopefully a decision before end 2001.

KEY

Date	<b>D</b>
1mS SPS Events	<b>S</b>
1mS LHC Events	<b>L</b>
SPS Fast Extraction	<b>E</b>
11.2 Khz LHC REV	<b>R</b>
40.08 Mhz LHC Bunch	<b>B</b>
10 Mhz	<b>■</b>

LOCATION

	SR8 LHC SURFACE
	US45 LHC PIT
	48 LHC ALCOVE
	UA23 LHC GALLERY
	6 SPS SURFACE
	PCR CONTROL ROOM



LHC TIMING REQUIREMENTS  
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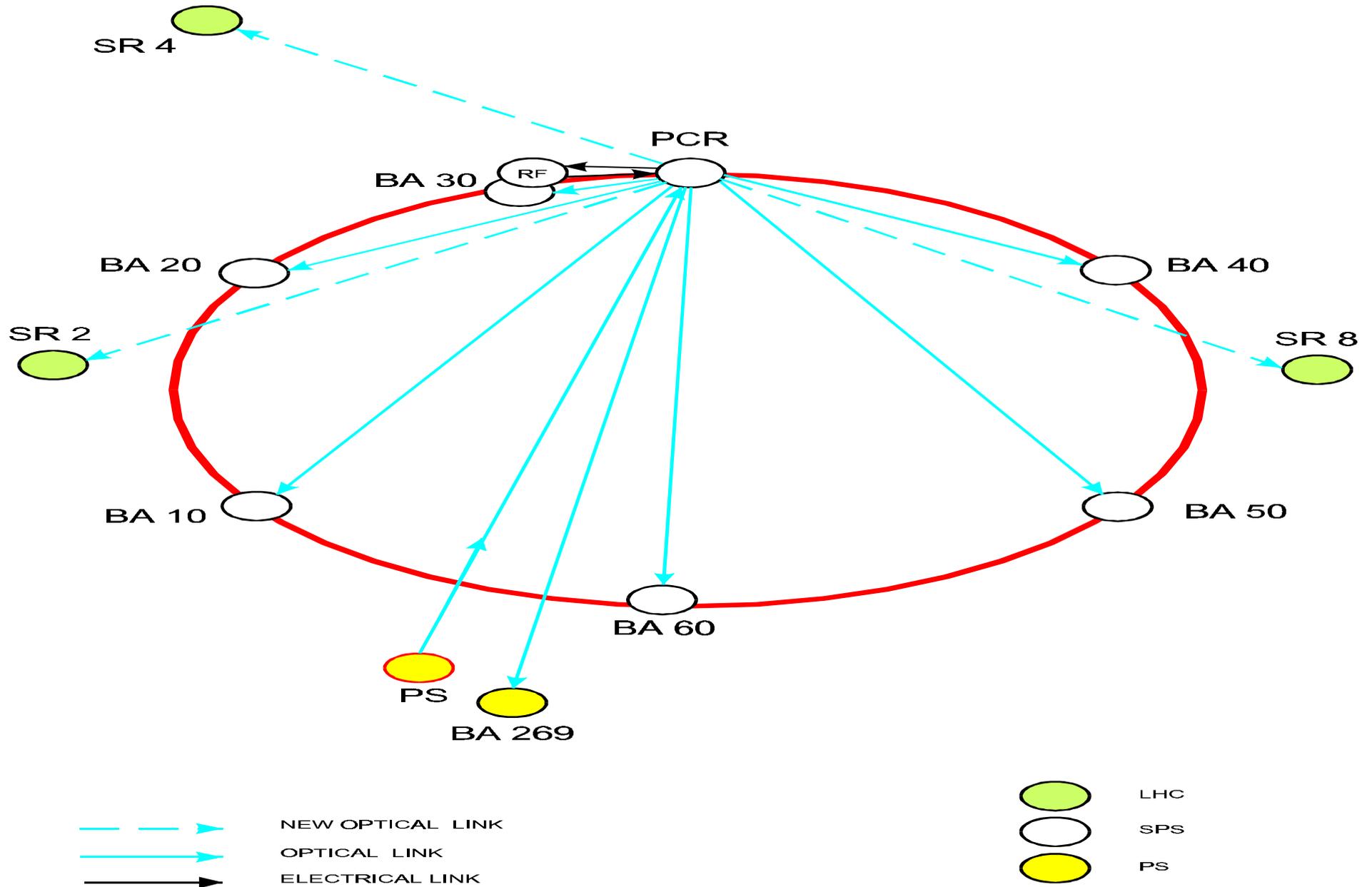
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# 40MHz, 11.7kHz, BST

- 40MHz LHC bunch frequency.
- 11.7 kHz LHC revolution frequency.
  - Use standard TTC channel “A” transmission system to the experiments and other LHC users. Already tested with beam.
- BST for beam instrumentation.
  - Use TTC channel “B” as a carrier for the BST signal, being developed by SL/BI (j-j)\*2.

# SPS Extraction Pre-Pulses

- SPS fast extraction pre-pulses required in points SR2, SR4 (RF) and SR8 for SPS extraction to LHC.
  - Extend standard SPS star configured optical system from PCR.
- See following slide



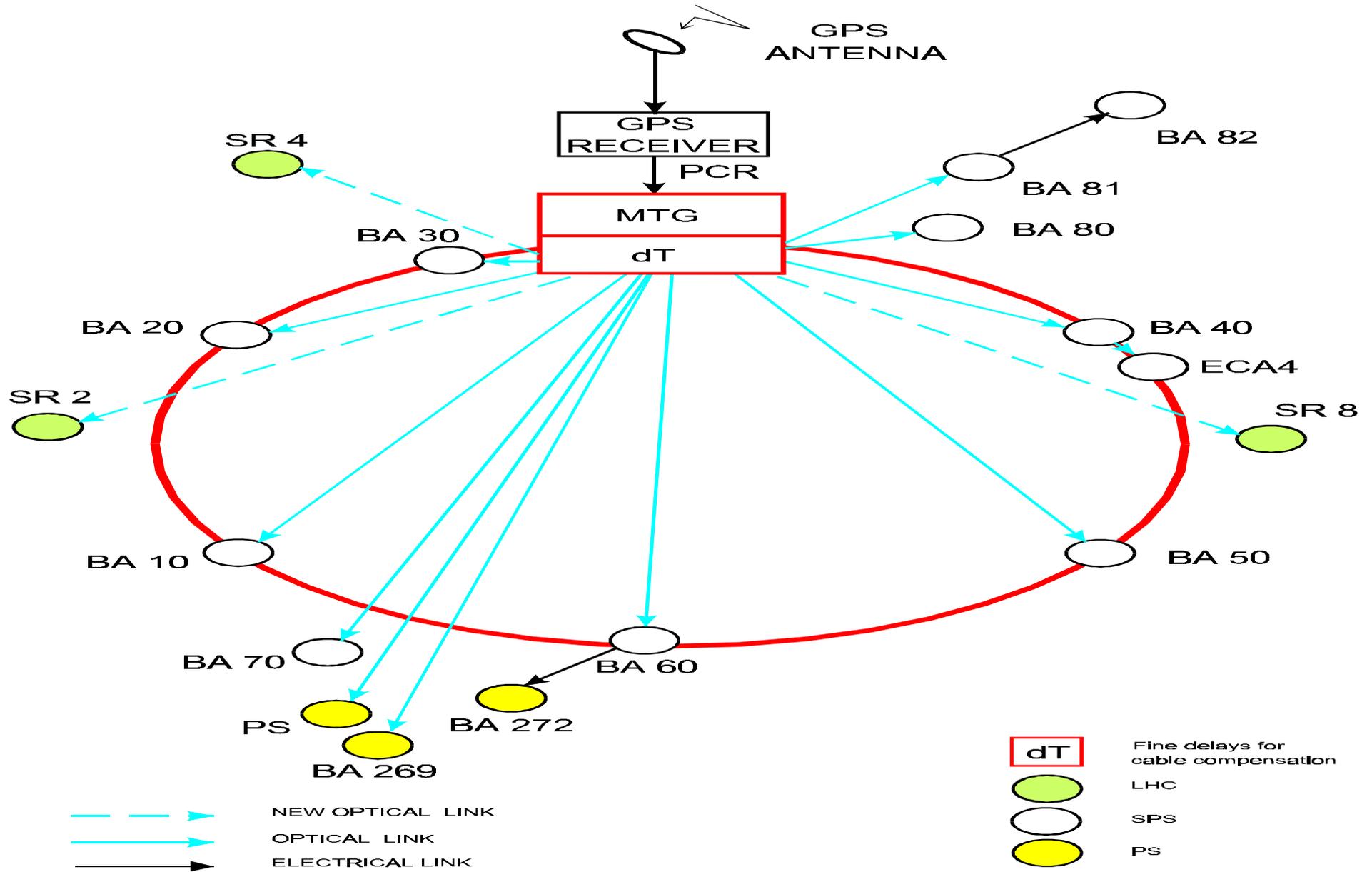
## SPS PREPULSE NETWORK

# LHC Injection Pre-Pulses

- Required in points SR2 and SR8 for LHC Injection Kickers.
- Generated by RF in SR4.
- Transmitted to PCR via optical fibre and then distributed from PCR by point-to-point optical fibre links.
- Extraction generated by SPS RF system, injection generated by LHC RF system.

# SPS Slow Timing

- SPS Slow timing.
  - Required for MUGEF systems which will be installed in SR2 and SR8.
  - Extend standard SPS optical transmission system from PCR.
  - May well use ‘bog standard’ TG8s.
  
- See next slide



## SPS OPTICAL TIMING NETWORK FOR GMT

# LHC Slow Timing

- LHC slow timing.
  - Generated from LHC MTG located in PCR.
  - Synchronised to SPS MTG, or to PS MTG,
  - to be decided.
  - Use the same VME MTG cards.
  - Transmit PS and SPS events and if so how?
  - Event based

## SPS Events, a reminder

Reserved	Event	Cycle Type	Cycle Type
SPS	Extraction	Proton	1
SPS	Transition	Proton	2

## LHC Events, a proposal

Ring	Event	Mode	Batch
Ring 1	Set Bunch Clock	Filling	3
Ring 2	Dump	Adjusting	-
LHC	Start Ramp	Ramping	-
LHC	Post Mortem	Physics	-

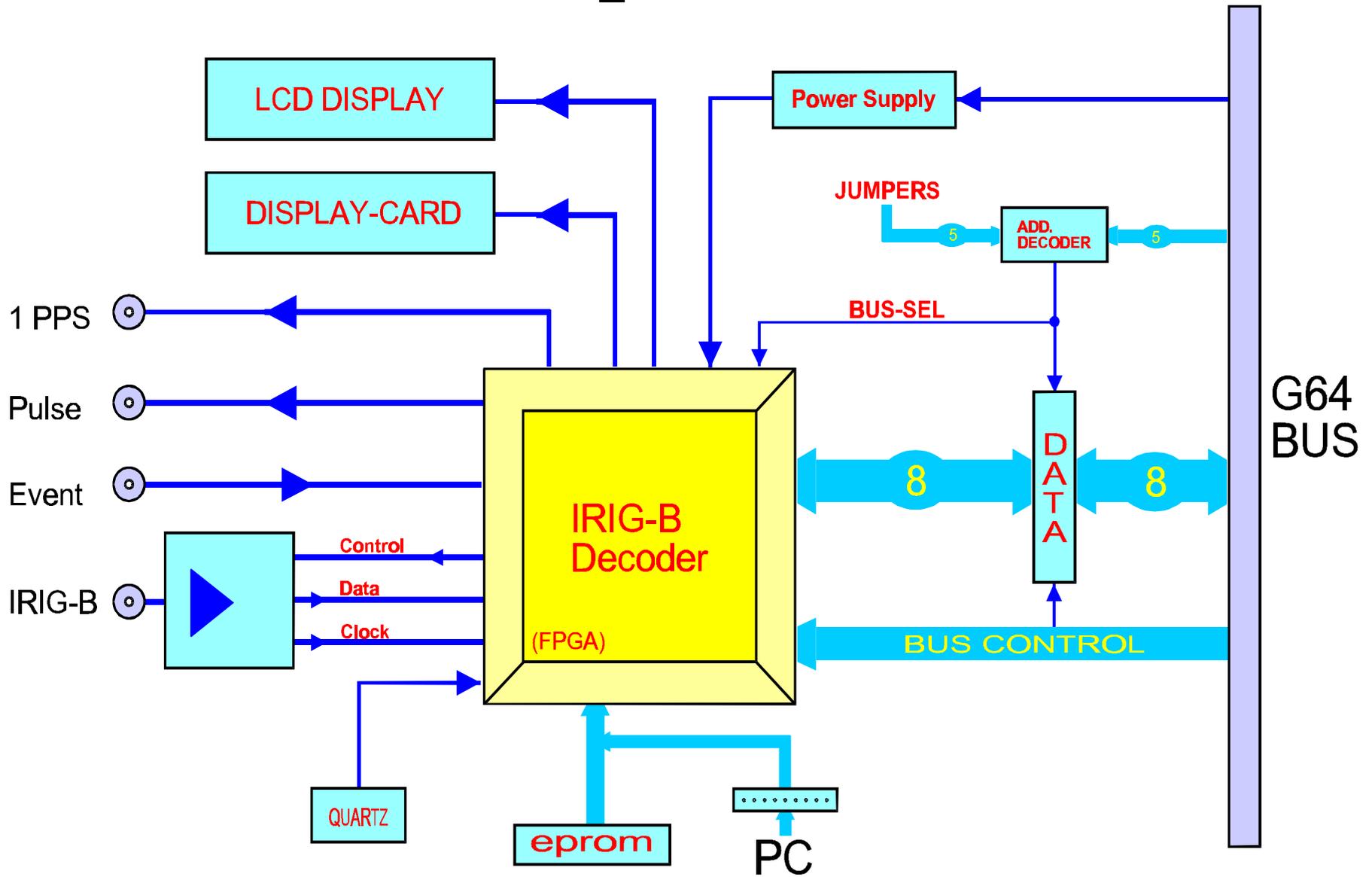
## And what about?

SPS	Start T12 Mugef	Proton	1
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# Timing Receivers

- New hardware required.
  - To enable WorldFiP segments to be synchronised across the machine referenced to the the MTG clock and UTC.
  - WorldFiP IRIG-B module based on the CERN/SCHNEIDER collaboration project.
  - New “TG8” module to receive events.
  - Based on VHDL technology introduced by PS timing section (Javier).
  - Two student examples, (Christoph, Pablo).

# G64\_IRIG-B

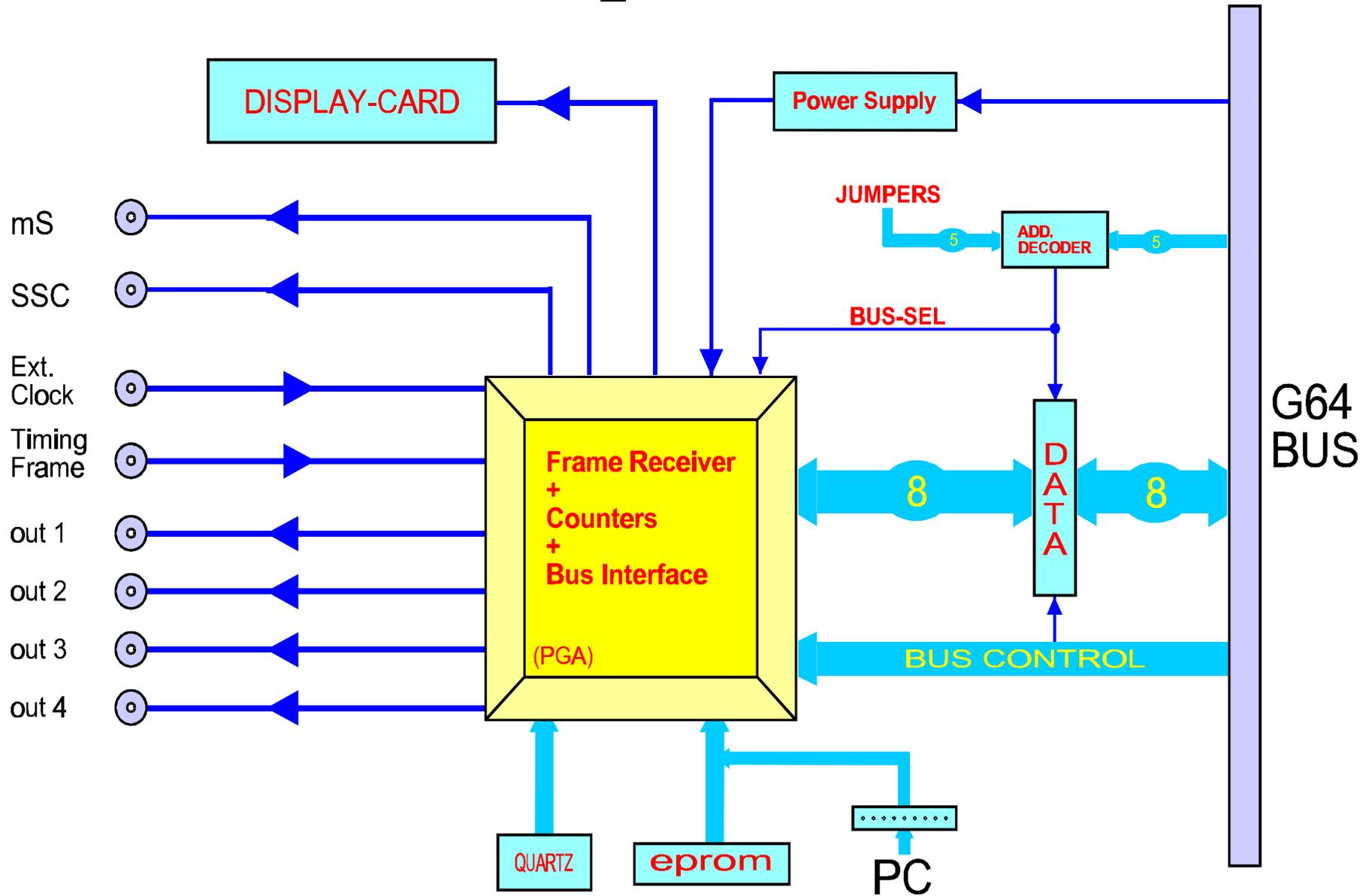


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# G64\_Tx4



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# Time of Day

- Time of day
  - Coordinated Universal Time (UTC).
  - Includes Leap Seconds, approx. every 18 months.
  - Software drivers convert UTC time to the format preferred by individual users.
  - Resolution provided to users, 1 $\mu$ s to 1ms, depending on their system requirements.

# Planning

- LHC sector tests start beginning 2004.
  - This will be the final LHC solution. Requires RF signals from SR4 via optical fibres.
- User interface specification finalised 2001.
- Overall design must be frozen by 2002.
  - Includes generation, transmission & reception.
- Waiting for more details from LHC-CP planning initiative.

# Conclusions

- Propose a classic deterministic timing system for LHC which will be compatible with the SPS.
- Must freeze the user interface, i.e. output pulses and data formats, by end 2001.
- Final decision on long distance transport mechanism late 2001.
- Ignore possibility of a “real-time” network.