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TimWG Report to PLC Nov. 1999

Tests in Progress

- **SHORT TERM (This year, early next year)**
  - GPS time synchronisation measurements
  - IRIG-B date transmission tests
  - LEP RF post mortem
  - PowerPC, GPS, WorldFIP communication
  - WorldFIP cycle jitter referenced to GPS
- **MEDIUM TERM (Next year)**
  - Connection of GPS time to PROFIBUS
  - String2 tests in SM18
  - CMS, ATLAS, LHC-B, beam tests + BST Transmission tests with TTC System

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Conclusions

- **The TimWG has achieved many of the initial objectives.**
- **The short / mid term tests, should be monitored and their results presented to the TimWG.**
- **The periodicity of the TimWG meetings will be aligned with the test results**
- **To avoid divergence, aim for one “fast” plus one “slow” timing system for all LHC equipment**
- **It was considered too early to define the overall timing philosophy, PS<>SPS<>LHC, require input from operations and the CO-OP forum.**

LHC Timing

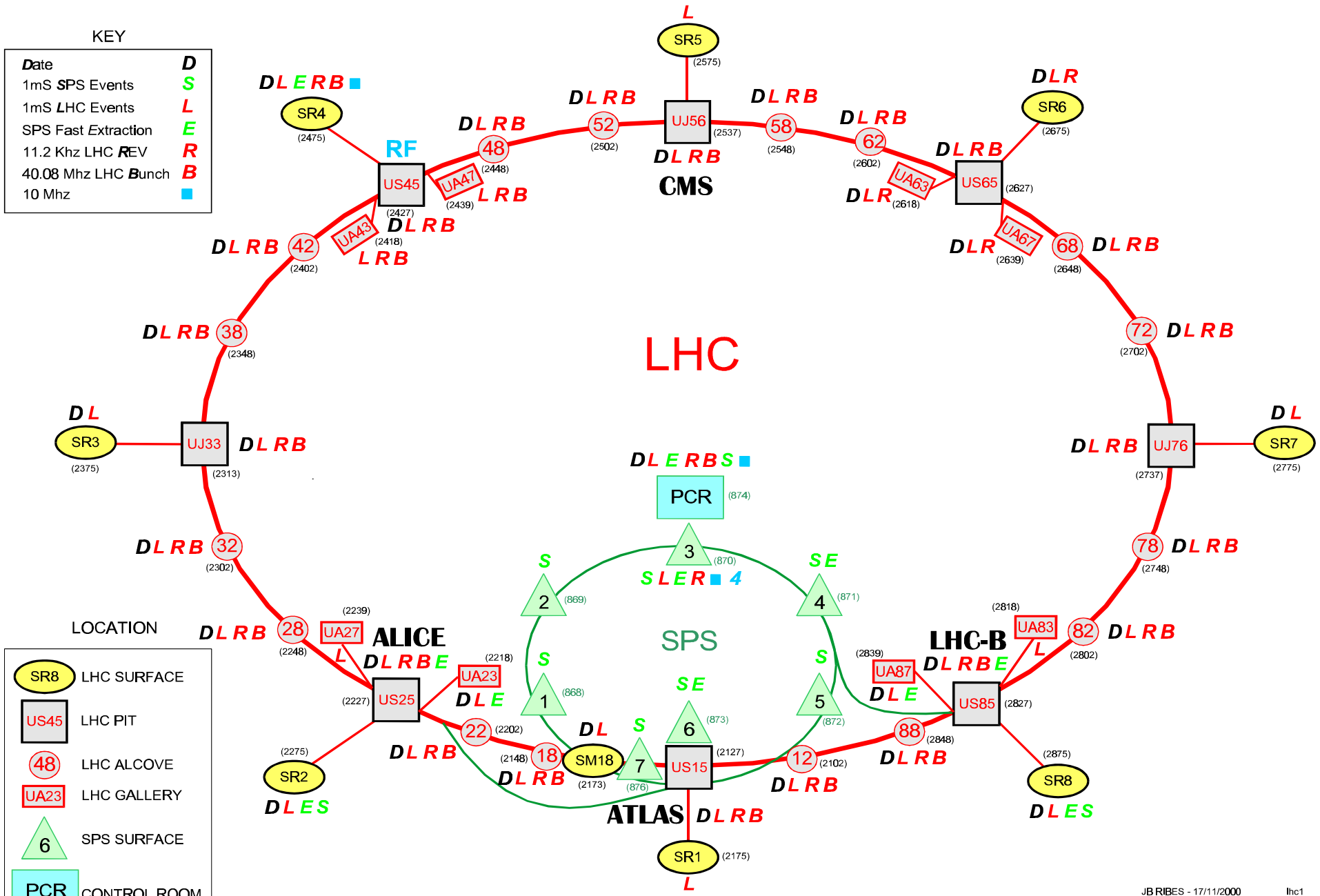
- What do the users want?
- Where do they want it?
- How to provide it? (1-7)
- Planning
- Conclusions

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) SPS slow timing, SPS MTG in PCR
- 6) IRIG-B (for Schneider, WorldFIP and front ends)
- 7) Synchronising pulses for WorldFIP
- 8) Time of day
- 9) LHC slow timing, LHC MTG in PCR

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



LHC TIMING REQUIREMENTS

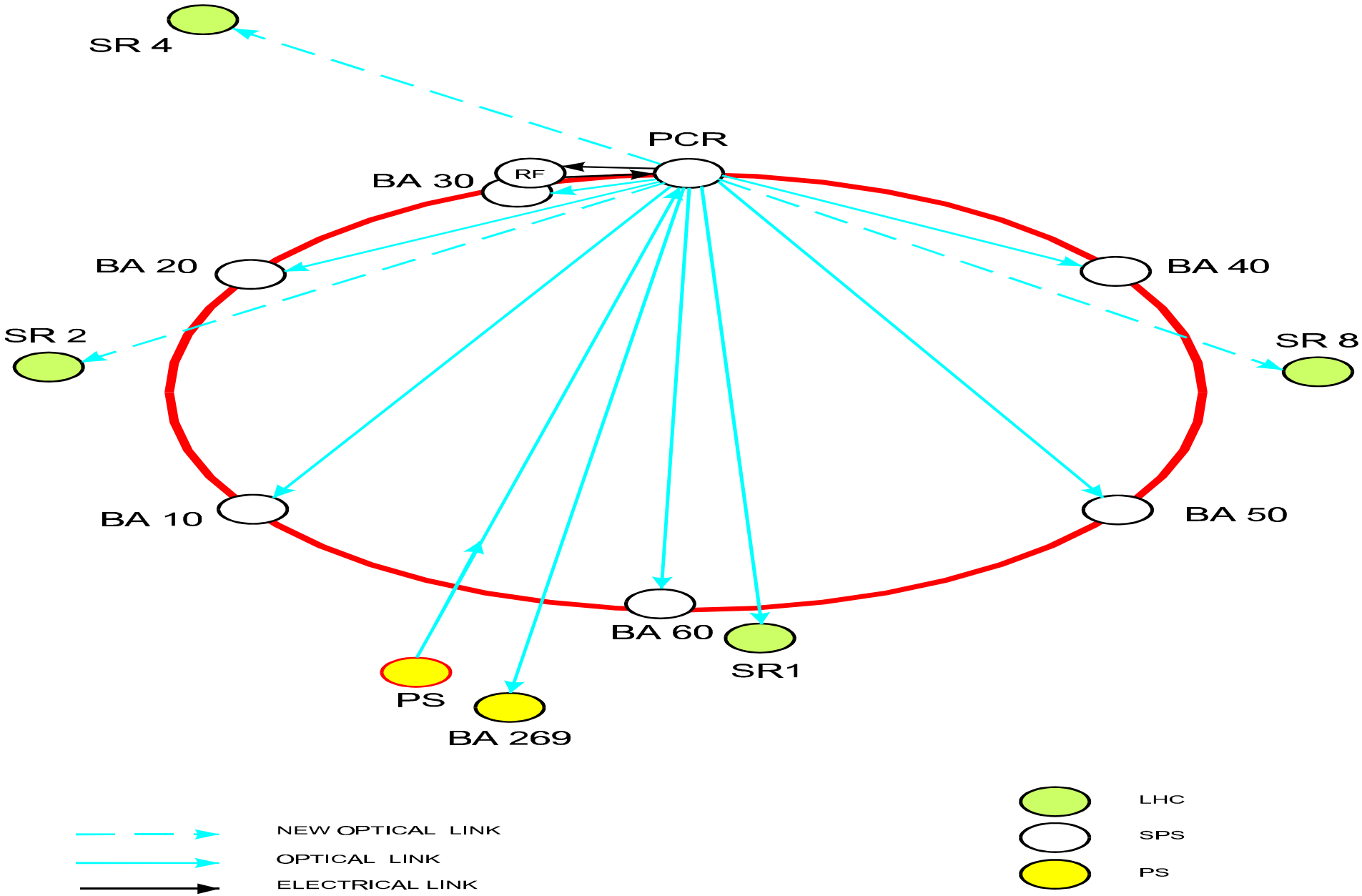
How to provide it? (1)

- 1) 40MHz LHC bunch frequency
- 2) 11.7 kHz LHC revolution frequency
  - Use standard TTC channel “A” transmission system to the experiments and other LHC users. Already tested with beam.
- 3) BST for beam instrumentation
  - Use TTC channel “B” as a carrier for the BST information, being developed by SL/BI

How to provide it? (2)

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

- See following slide



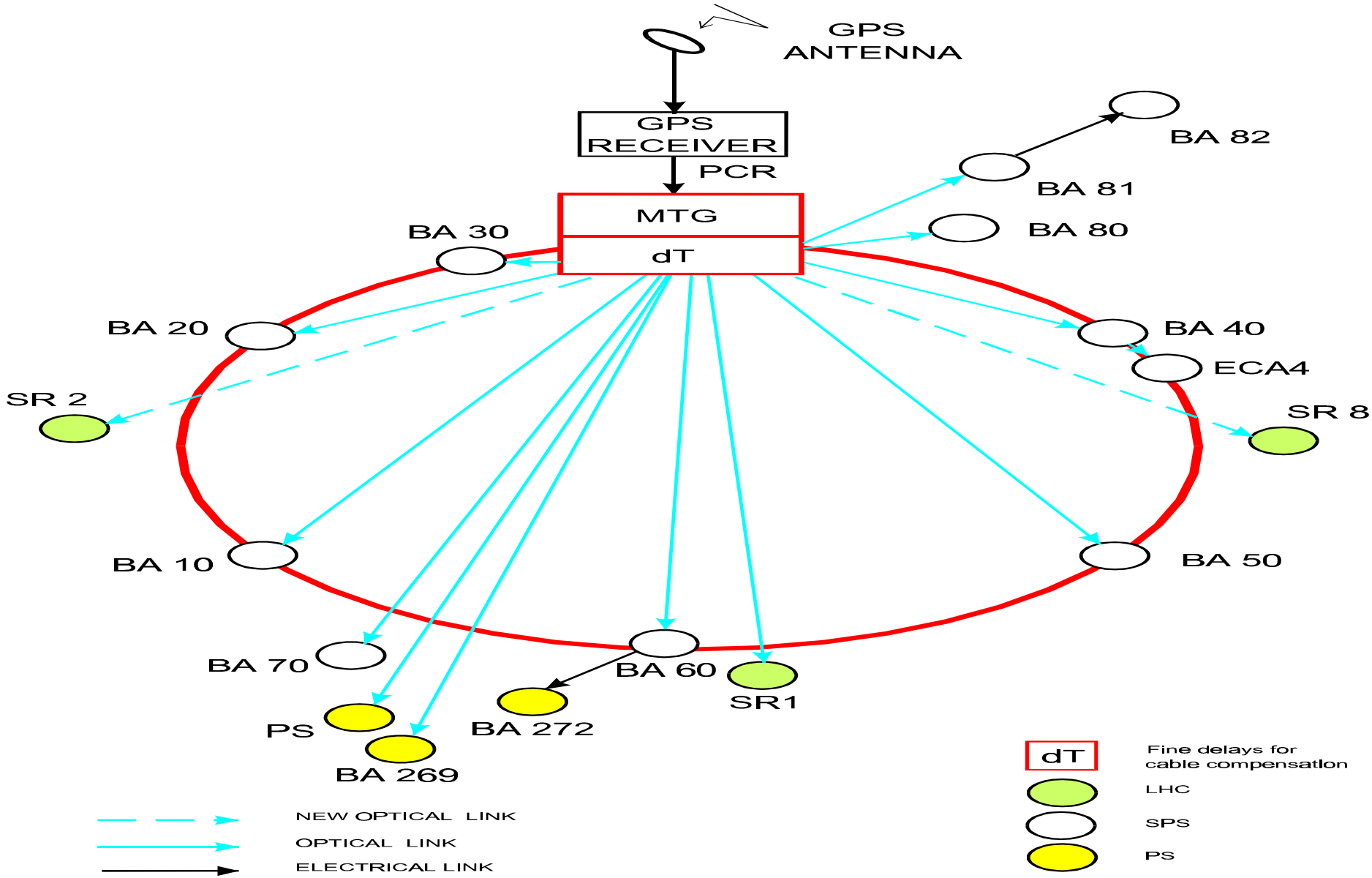
SPS PREPULSE NETWORK

prepulse1 JB. RIBES 25/10/2000

How to provide it? (3)

- 5) SPS Slow timing
  - Required for MUGEF systems which will be installed in SR2 and SR8
  - Extend standard SPS optical transmission system from PCR

- See next slide



SPS OPTICAL TIMING NETWORK FOR GMT

gpso3 JB. RIBES 24/11/2000

How to provide it? (4)

- 6) IRIG-B, Inter-Range Instrumentation Group, world standard for transmitting time of day information.
  - Over 200 LHC connections foreseen.
  - Transmit over copper so as to avoid radiation problems in the tunnel and also to use standard industrial equipment, Siemens, Schneider, etc.
  - Already tested in LEP

How to provide it? (5)

- 7) Synchronising hardware pulses.
  - For synchronising WorldFIP and industrial systems to UTC, period 10ms, 100ms, ...
  - Already generated by standard IRIG-B modules.
  - Could be produced by a new generation timing card.

How to provide it? (6)

- 8) Time of day (UTC)
  - Mainly for postmortem, logging, alarm systems but could also be used for timing applications
  - IRIG-B, +- 1us jitter
  - LHC slow timing system, +- 1us
  - NTP (>20ms for systems administration)

How to provide it? (7)

- 9) LHC slow timing
  - Use control network, Ethernet gateways etc.
  - Use BST/TTC system, “piggy-back” on the system being developed by BI.
  - Use conventional timing system (PS, SPS, LEP) with a granularity of 1ms.

Control network

- Totally different concept, “handshake” rather than “broadcast”
- More complex for MTG, every front-end gateway user has to be registered and managed by the LHC MTG
- Transportation from MTG to gateways free
- Will have to develop local transmitters synchronised by IRIG-B
- A very interesting challenge

BST/TTC System

- Increased complexity results in more transmission bandwidth, 160MHz.
- Avoids a separate dedicated optical timing transmission system wherever the BST information is required.
- But, will it be installed in alcoves and pits?
- Requires totally new interfacing equipment, however, we may profit from BI work.

Conventional Timing system

- We know it works deterministically, in operation at PS, SPS and LEP.
- Increase the transmission rate from 3 to 7 events per ms, limited by timing receiver.
- All optical transmission equipment available (unused LEP Foxcom, 49,704FS).
- Additional optical fibre costs 19,600 FS
- But no great technological leap.

Planning

- LHC sector tests start beginning 2004
- Overall design must be frozen by 2002
- User interface specification finalised during 2001
  - I.e. one year to study progress of TTC/BST and real-time control systems before deciding on long distance transmission system.

Conclusions

- The existing classic deterministic timing system will work for LHC and will be compatible with PS and SPS. I.e. we have a solution now.
- Must freeze the user interface, i.e. output pulses and data formats, by 2001.
- Final decision on long distance transport mechanism early 2002.