Timing/Phase Reference

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RDR Scope

- Master Oscillator, 5 Hz fiducial Generation
- Long Haul Phase Reference Distribution
- Local Distribution
  - *Phase Reference*
  - *5 Hz Fiducial*
  - *LLRF Local Oscillator*
  - *Event Stream*
- Local Timing trigger modules and event receivers
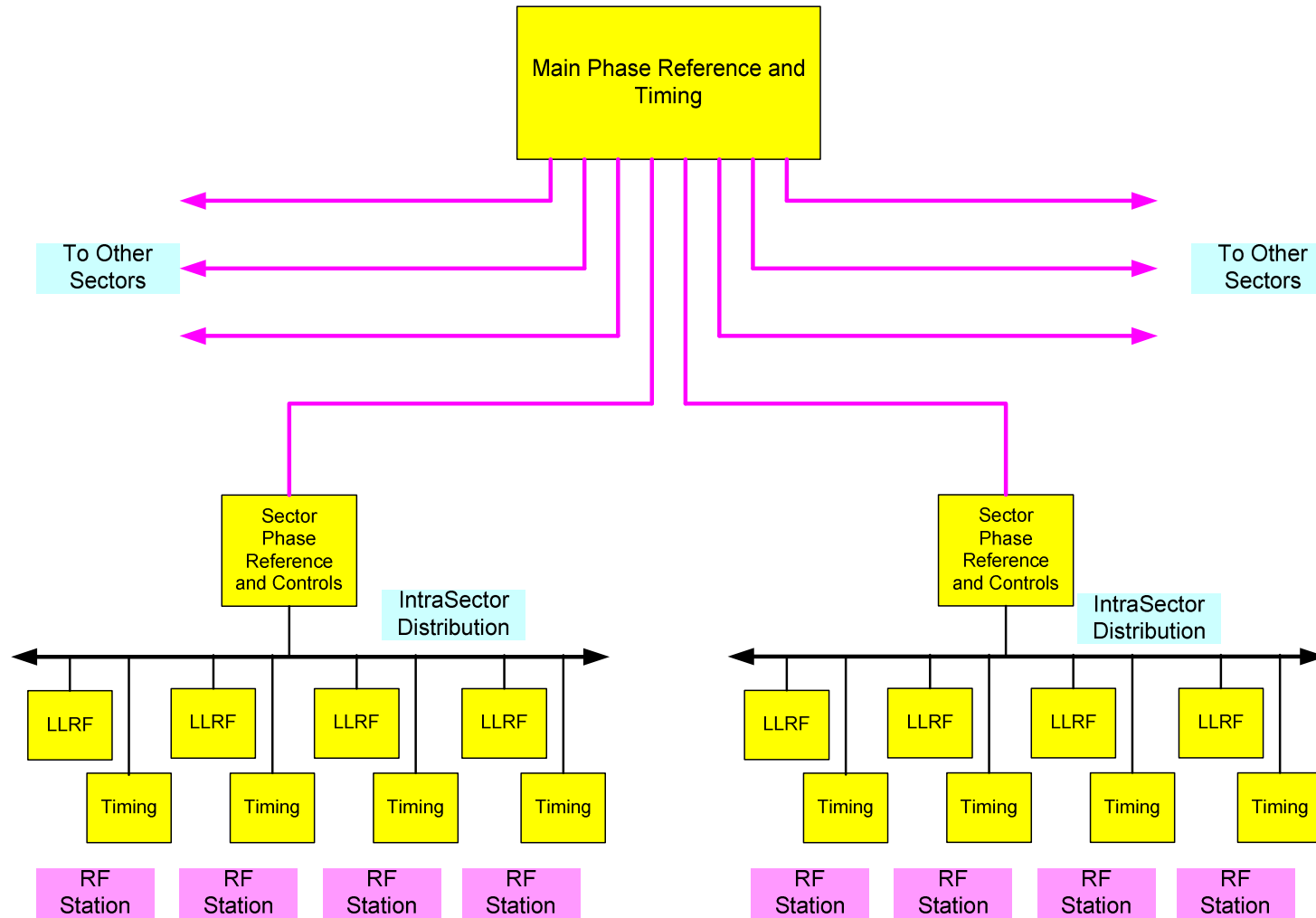- Timing modules for Laser Wires and LOLAs

RDR Scope (Cont)

- Phase Reference Generation for
  - *DR*
  - *Bunch Compressor*
  - *Lasers*
  - *Crab Cavities*
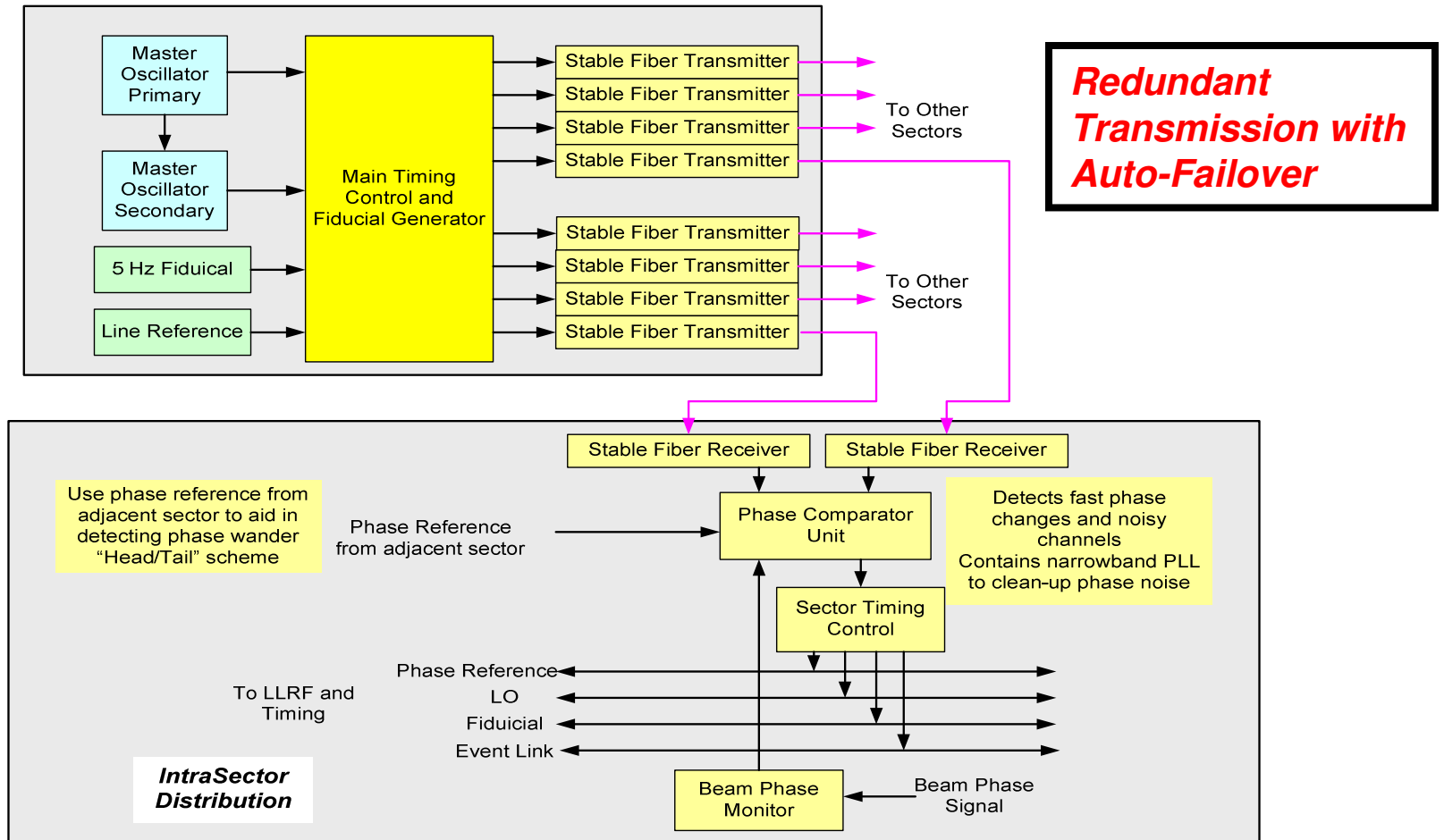- Timing Modules for DR Injection/Extraction

Tolerances

	Correlated	Uncorrelated	RDR Section
Main Linac	0.35 degrees RMS	5.6 degrees RMS	Table 3.9.1
Bunch Compressors	0.24 degrees RMS	0.48 degrees RMS	2.5.4
Crab Cavities		61 femtoseconds	2.7.4.1

Overview

Phase Reference Distribution

Master Oscillator Primary

Master Oscillator Secondary

5 Hz Fiducial

Line Reference

Main Timing Control and Fiducial Generator

Stable Fiber Transmitter

To Other Sectors

Redundant Transmission with Auto-Failover

Stable Fiber Receiver

Use phase reference from adjacent sector to aid in detecting phase wander "Head/Tail" scheme

Phase Reference from adjacent sector

Phase Comparator Unit

Detects fast phase changes and noisy channels
Contains narrowband PLL to clean-up phase noise

Sector Timing Control

To LLRF and Timing

Phase Reference
LO
Fiducial
Event Link

IntraSector Distribution

Beam Phase Monitor
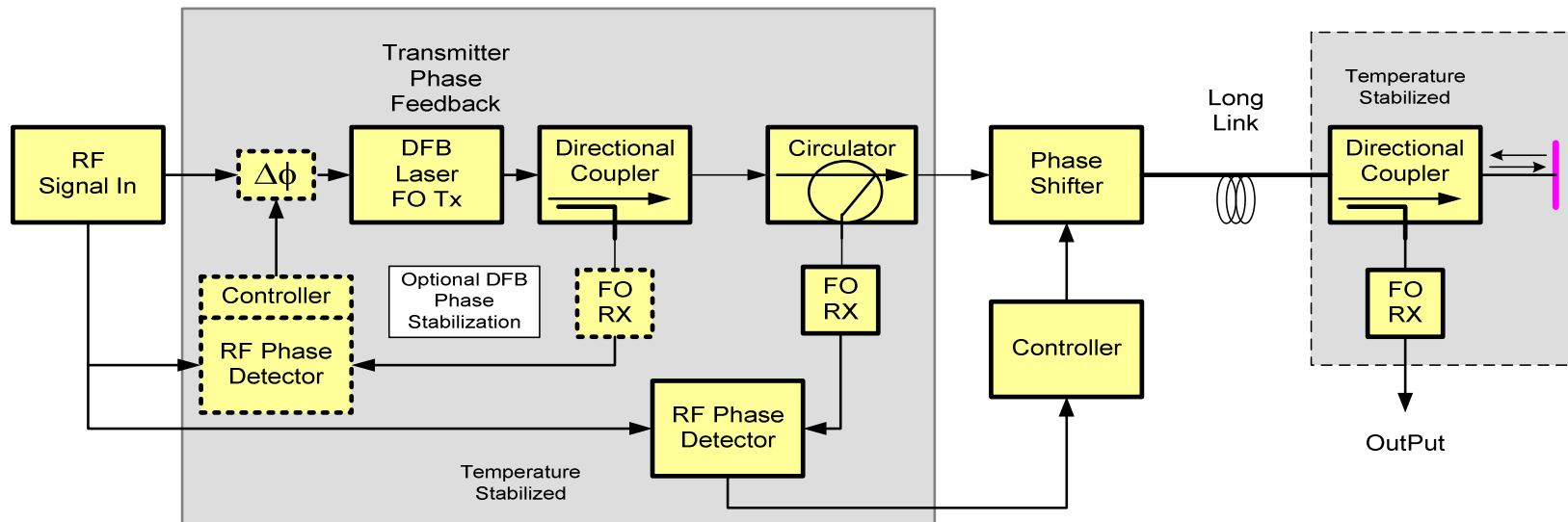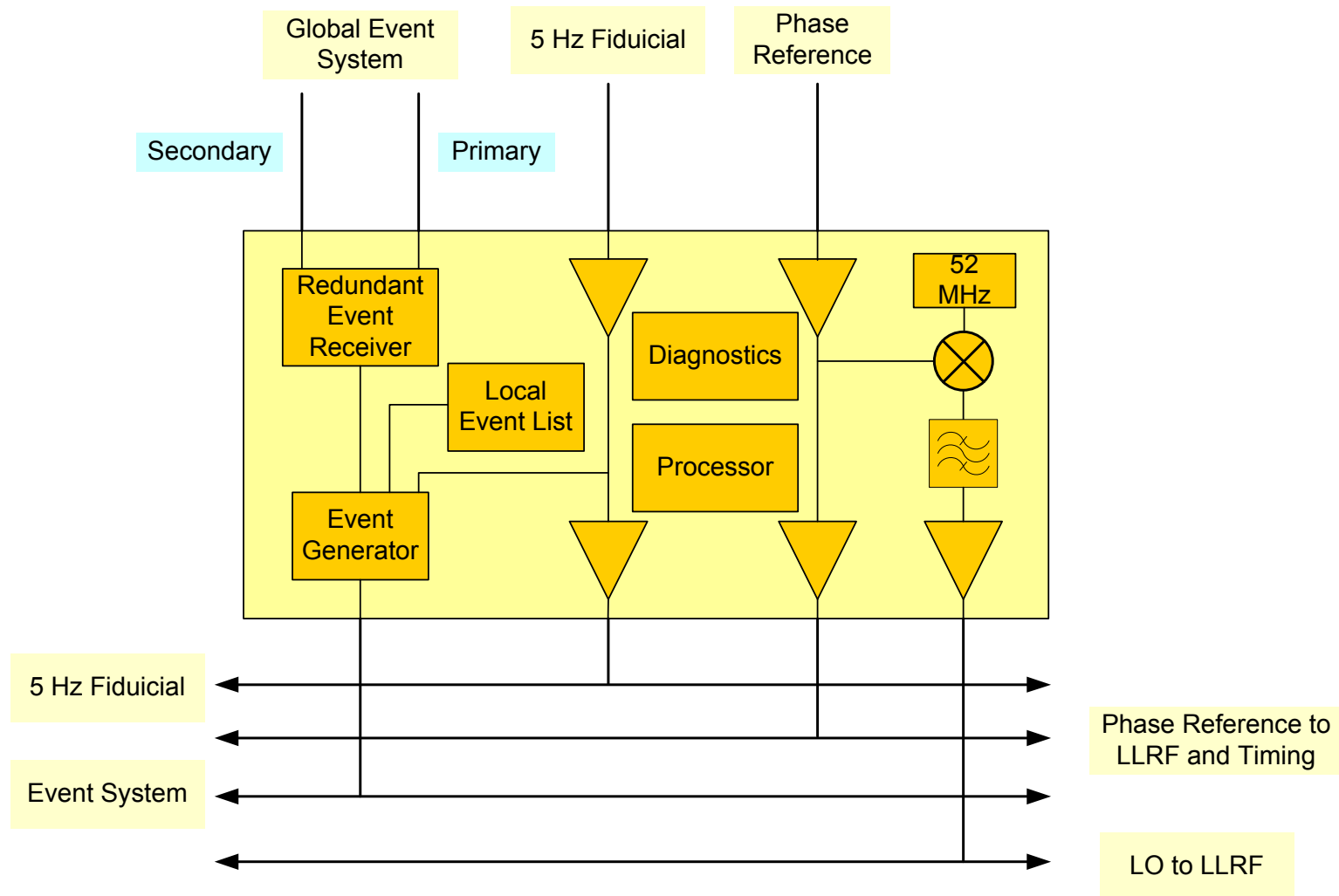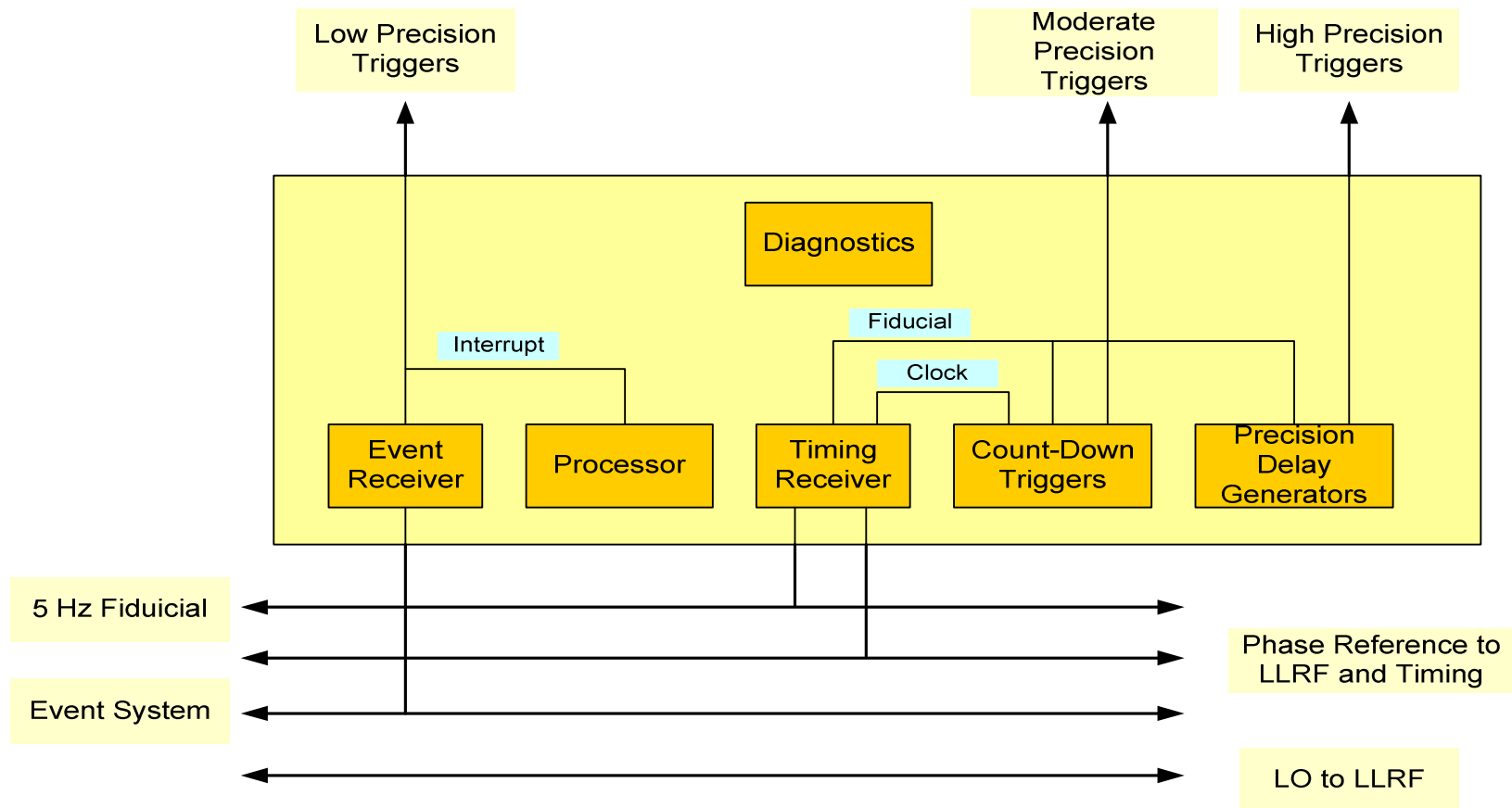
Beam Phase Signal

Active Phase Stabilized Link

Sector Timing Control Unit

Local Timing Module

RDR Costing

- RDR cost estimate for Phase Reference and Timing Distribution
  - *~ $40.5M*
- Basis for Cost Estimate
  - *Phase Reference Distribution*
    - Based on prior work at NLC and TELSA
    - Bottoms up from vendor parts quotes
  - *Intra-sector (Local) phase reference distribution*
    - Based on SNS design with cost reduction for increased volume
  - *Timing Modules*
    - Based on conceptual design and engineering judgment
- Major Cost Driver
  - *LINAC Intra-sector Phase Reference Cable ~ $23M (57%)*

RDR Costing (Cont)

- ## Technical Risks

  - *Long Haul Phase Reference Distribution*

    - New Design: Pushes current state of the art – particularly for bunch compressors and crab cavities

  - *Timing*

    - New Design: Requires some R&D but does not advance current state of the art

Planned R&D

- 3.2.6.1 High Stability RF Phase Distribution System Development
  - *Long Haul redundant distribution*
  - *Local (intra-sector) distribution*

NOT USED SLIDES FOLLOW

Functions

- Master Oscillator Distribution (1.3 GHz)
- 5 Hz timing fiducial distribution
- Programmable triggers for field hardware
- Mechanism to synchronize software processing to timing events
- Time fiducials for synchronized timestamps for software and hardware events
- Mechanism to sequence timing triggers and events
- Phase references for DR, Bunch Compressors, Lasers, Crab Cavities

Redundant Event System