

LANSCE's TIMING SYSTEM STATUS AND FUTURE PLANS*

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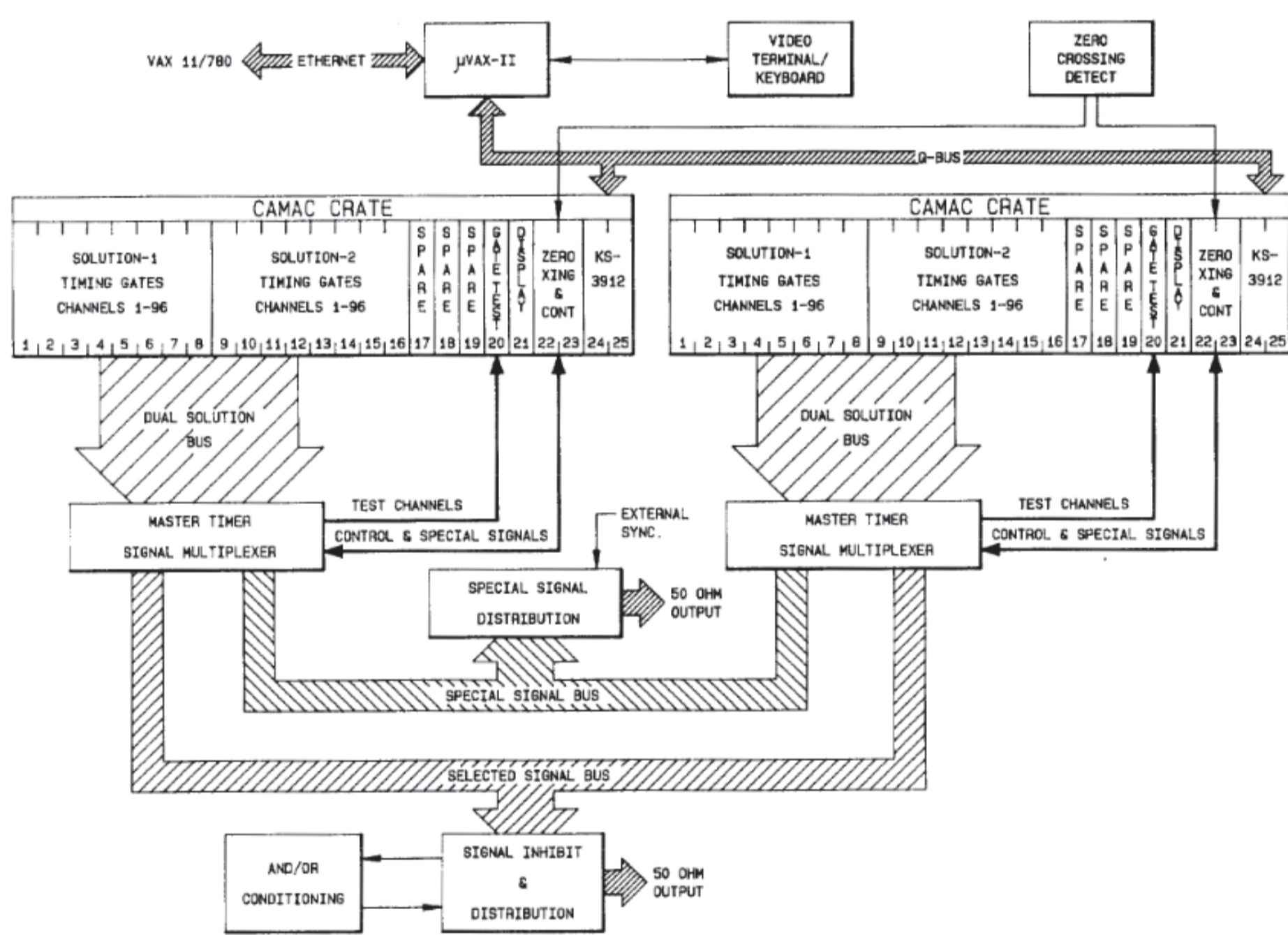
Abstract

The Los Alamos Neutron Science Center (LANSCE) operates at a maximum repetition rate of 120 Hz. Timing gates are required for synchronization of the accelerator to provide beam acceleration along the LINAC and beam distribution to the five experimental areas. They are also provided to other devices with sensitive operating points relative to the machine cycle. Over the last 50 years of operations many new time sensitive pieces of equipment have been added. This has changed the demand on, and complexity of, the timing system. Further driven by equipment obsolescence issues, the timing system underwent many upgrades and revitalization efforts, with the most significant deployment starting in 2016. Due to these upgrade efforts, the timing system architecture design changed from a purely centralized system, to a distributed event-based one. The purpose of this paper is to detail the current state of the timing system, as a hybrid system with the gate events being generated from a new timing master system, while still utilizing legacy distribution and fanout systems. Upgrades to the distribution system are planned, but due to the required beam delivery schedule, they can only be deployed in sections during four-month annual maintenance cycles. The paper will also cover the off-the-shelf solutions that have been found for standardization, and the efforts towards a life cycle management process.

Upgrades

Legacy System

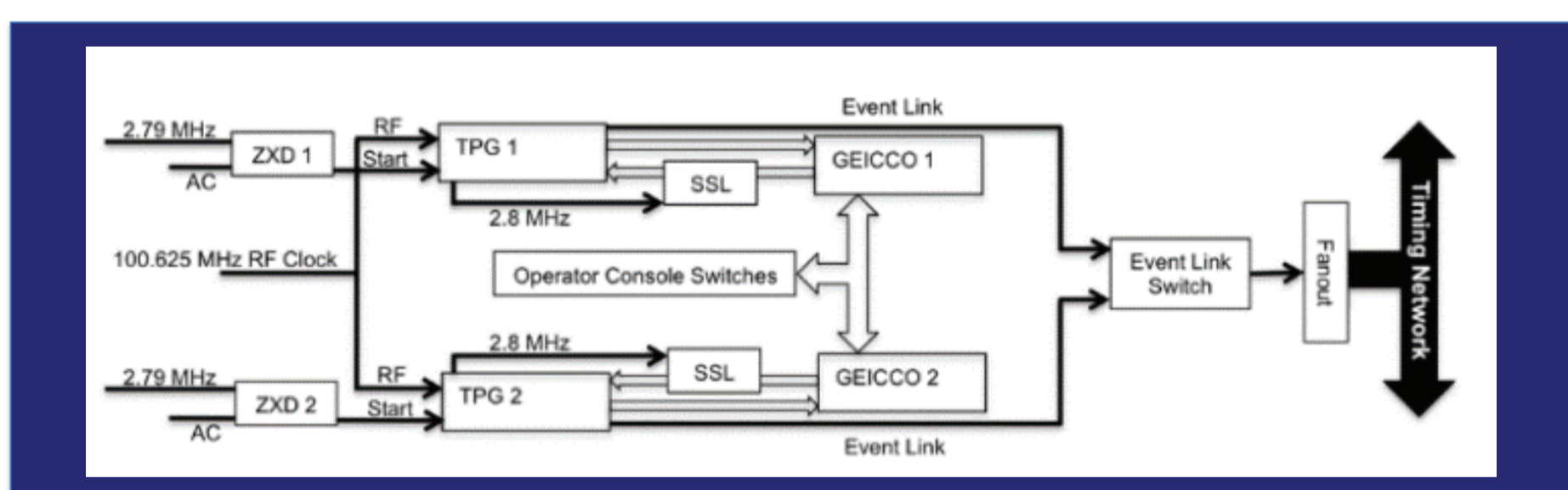
The legacy system was composed from a series of antiquated CAMAC cards and an obsolete MicroVAX computer. This system was a completely centralized system with the gates being generated in the Central Control Room and then being sent throughout the facility.



Legacy Timing Master

Current System

The current system uses a collection of VME crates and cRIOs to replace the old timing system. It contains event generators to create an optical signal based on the events it receives. This signal is sent to the field on the same fiber that is used for the rest of the control system network.

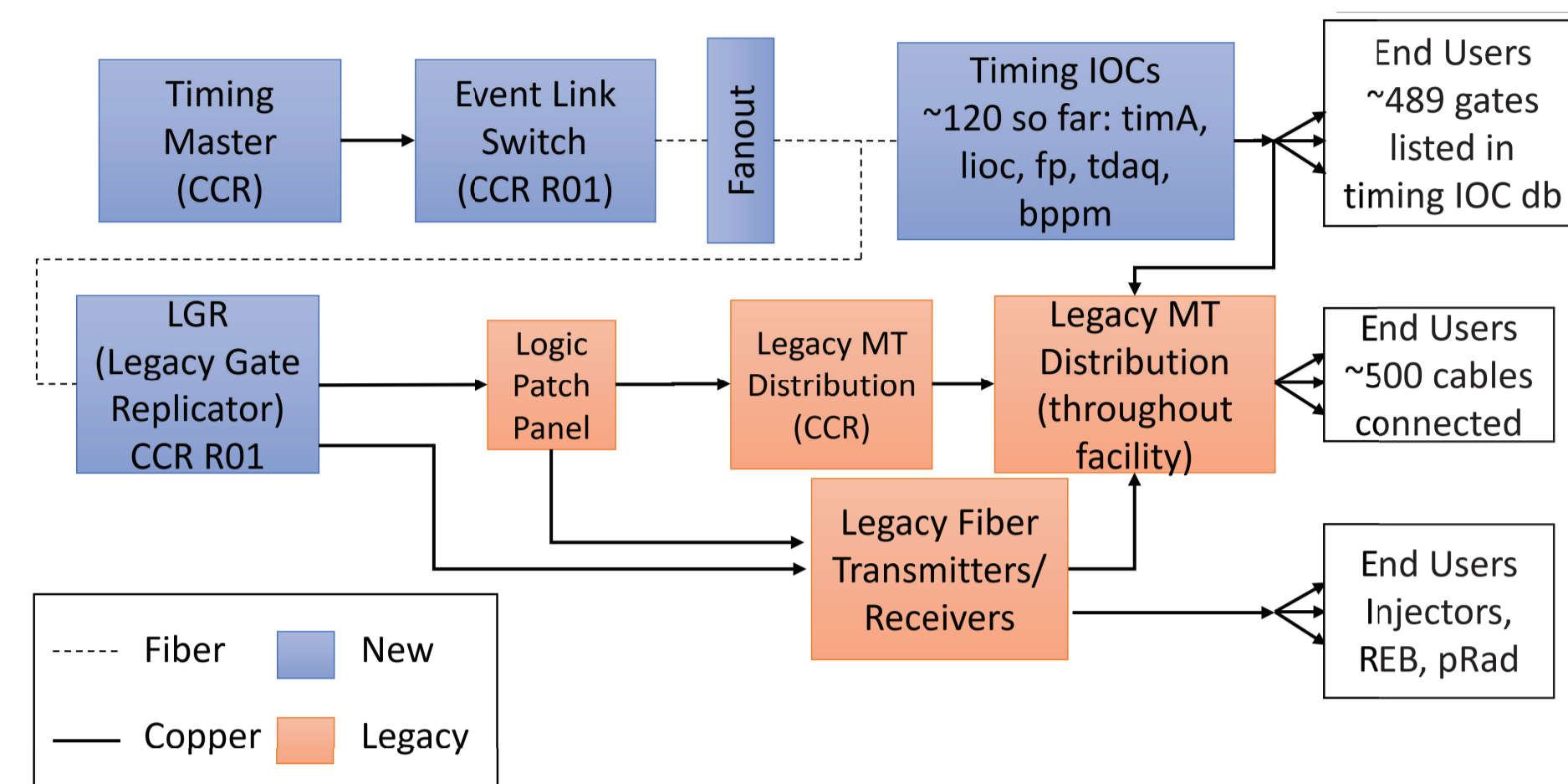


Current Timing Master

Hybrid System

The timing system is currently in a hybrid state, with some of the system having been upgraded and some dependent on the legacy system. The current timing system still relies on the following legacy components:

- Distribution/Amplification Chassis
- Patch Panel
- Copper cables for distributing the signal
- Legacy Fiber transmitters



Block Diagram of hybrid state of the timing system

As seen here the blue boxes show the upgraded components while the orange are those that still need to be updated.

Future Plans

Legacy Distribution System

Many systems are still being prototyped to determine if they are suitable replacements for the legacy parts of the timing system.

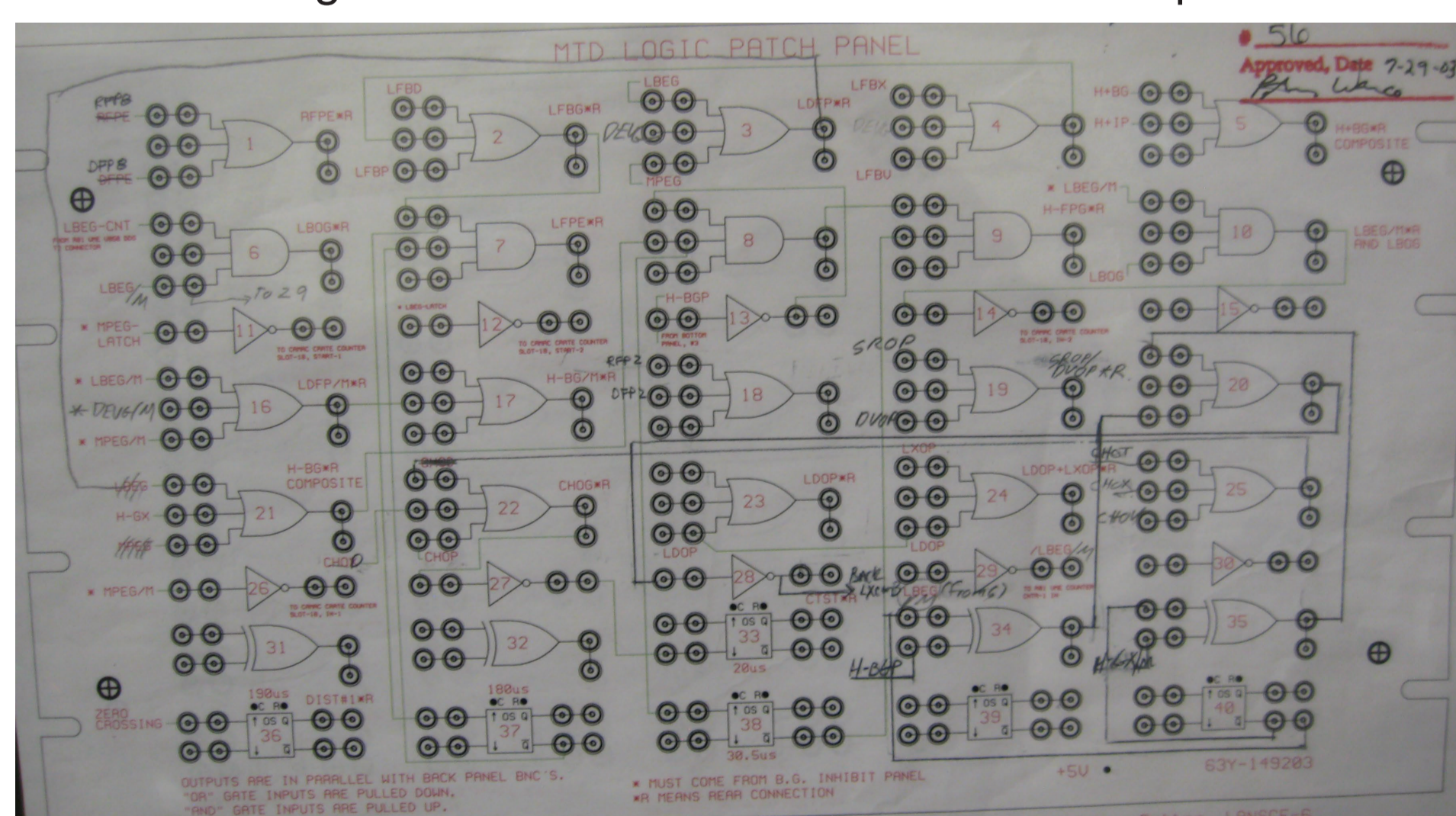


Legacy Timing Distribution Unit



Meinberg SDU

If suitable, this will be a replacement for the distribution aspect of the legacy distribution unit. The unit will be deployed next to the EVRs for the gates that connect to more than one endpoint.



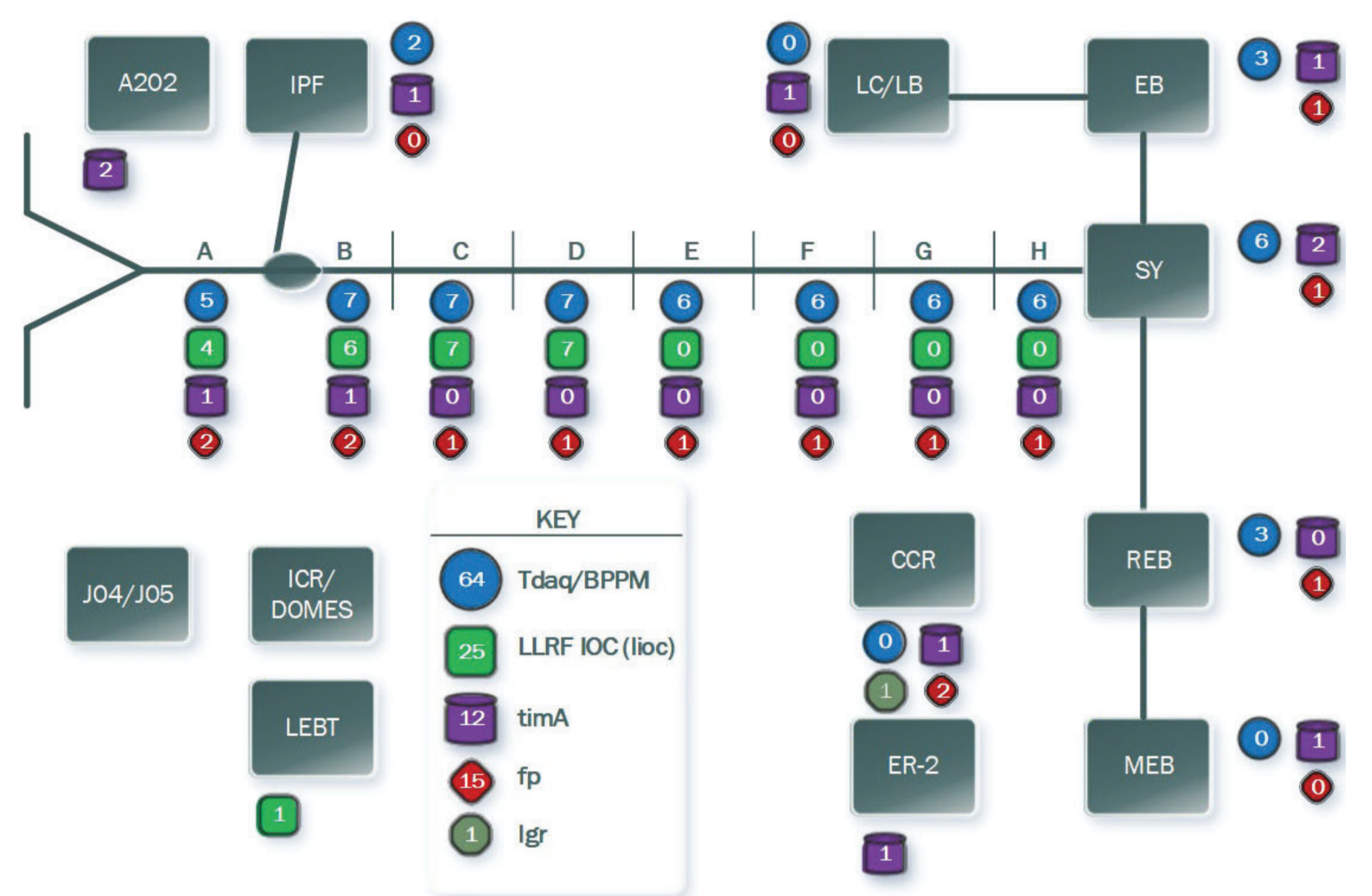
Logic Patch Panel



Caen DT5495

If suitable, this will be a replacement for the logic patch panel. These units will be distributed throughout the facility next to the EVRs that have gates that need additional logic applied.

The goal of the timing upgrade to distribute the timing signals and deploy hardware that is easy to maintain to increase the longevity of the system.



Distributed Timing System at LANSCE

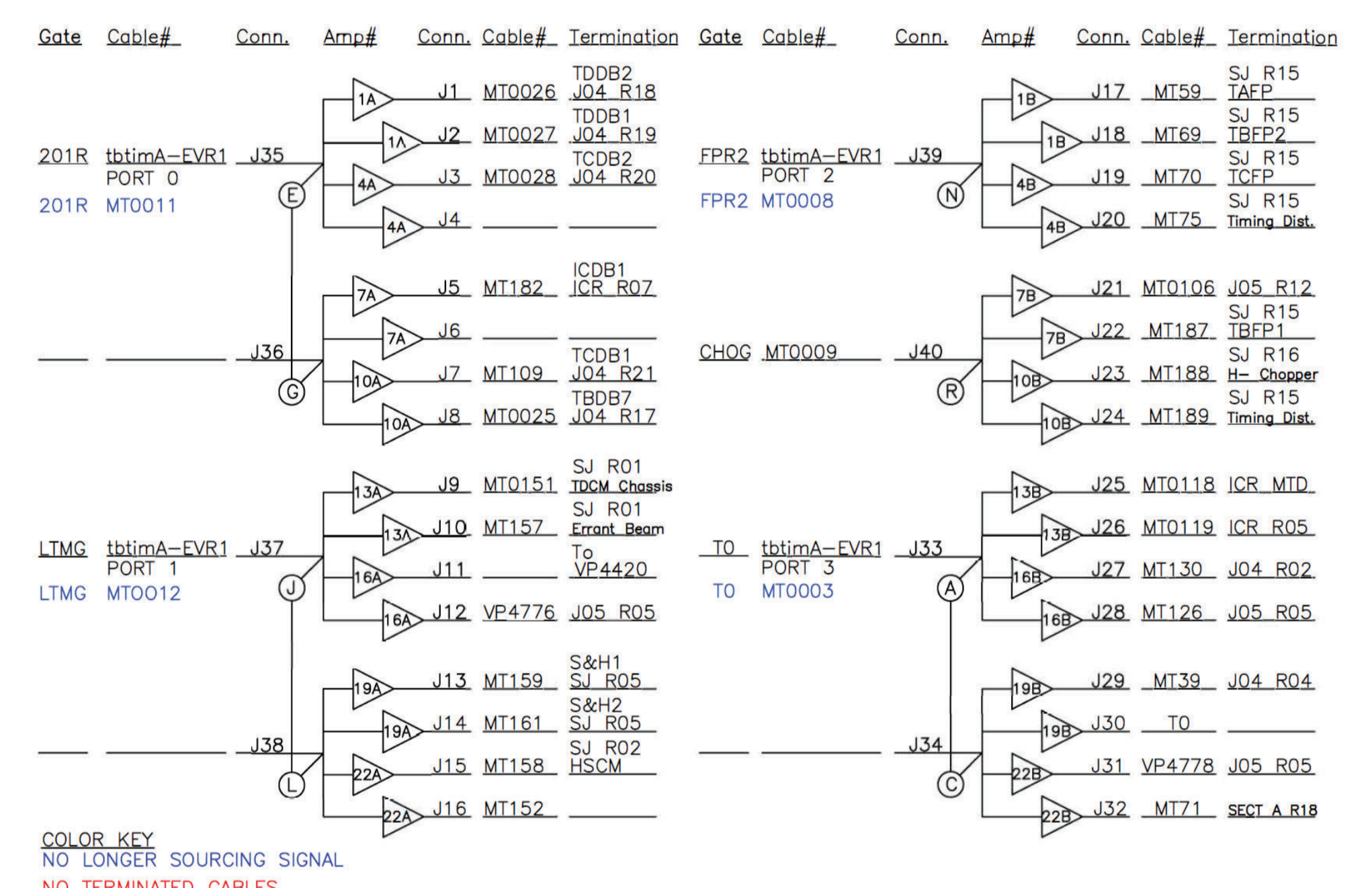
Documentation

Legacy Distribution Chassis

The Legacy Distribution Chassis documentation available to its users has numerous challenges. Many of the items have not been updated to record the completed changes. Additionally, the ending termination is commonly listed as a rack location instead of including the equipment that it is connected to. This has led to many discrepancies in the documentation that need to be addressed to obtain a complete understanding of the current status of the timing system.

MASTER TIMER DISTRIBUTION
J05 R04 Unit 1

3/27/23



COLOR KEY
NO LONGER SOURCING SIGNAL
NO TERMINATED CABLES

Legacy Timing Distribution Documentation

All connections to the legacy distribution units have been checked to verify there is a wire present. The next step is to verify the connection at the other end of the cable to see which cables are still needed.

EVR-1	Gate	Rack	Equipment
Univ-0	cycle start	01R11	01tdaq cycle start
Univ-1	T0	01J00	A1 9205 Trigger
Univ-2	Spare	-	-
Univ-3	Spare	-	-
Univ-4	Spare	-	-
Univ-5	Spare	-	-
Univ-6	Spare	-	-
Univ-7	Spare	-	-
Univ-8	Spare	-	-
Univ-9	cycle start	01R11	01tdaq2 cycle start
Univ-10	Spare	-	-
Univ-11	Spare	-	-

Event Receiver Documentation

A program was created to display the programmed gates automatically as they are coded for specific outputs of the EVR.

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