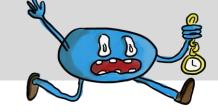


EVR : Event Receiver
MEBT : Medium Energy Beam Transport
SCL : Super Conducting Linac
LLRF : Low Level RF
RF : Radio Frequency
RFQ : Radio Frequency
MRF : Micro Research Finland

MRF TIMING SYSTEM DESIGN AT SARAF

A. Gaget[†], R. Duperrier, CEA Saclay IRFU, Gif sur Yvette, France E. Reinfeld, I. Shmuelly, Y. Solomon, SNRC, Yavne ISrael





Hardware platform

Topology EVM Master main element of the topology action Synchronized by the GPS and the master oscillator. Acquisition In charge of the distribution of: ShutBeam Reference frequency Manual PostMorten Event trigger Timestamp Magnetron Upstream events propagation Chopper Injector As close as possible of the Overview of events distributed on the main EVM to avoid MRF optical fiber network propagation time and get shut beam as soon as possible. MEBT / SCL Possibility to operate them independently EVM : Event Maste



Operation Mode

| Committee | Comm

▶ RF conditioning Mode :

- RFQ, rebunchers and cryomodule cavities have to be conditioned.
- Each subEVM is able to produce events necessary for its own cavities.

E CW (123152) (23152) (23152) (23152) (23152) (23152) (23152) (23152) (23152)

▶ Pilot Beam, mode to operate beam in the accelerator

- Operator configures the following sequence and MRF sequence is executed in a loop
- subEVM just used as fan-out/concentrator

Trigger event	20 (chopper)	22 (RF)	70 (beam presence)
Timestamp	0	480	500
Mask	1	0	1

Chopper RF Gate Beam presence Beam Stop Beam

► Stop Beam / Start Beam

- During changing the beam destination, RFQ has to be left ON so sequencer is still ON.
- Mask (StopBeam) or Unmask (StartBeam) some events in the sequencer
 - Inputs of EVG (through EVRU) can Mask some event in the sequencer (Development to add this functionality in the mrfioc2 EPICS Driver)

EVR Backplane

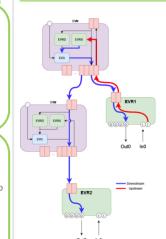
Through backplane EVRs and LLRF can manage here up to 4 cavities

EVR will manage up to 3 BPMs

Auteur

Machine Protection System

Part of the MPS is delegated to MRF cards.



Critical defect example :

- EVR 1 detects rising edge (critical defect) on InO, then propagates upstream events 13 on the network.
- Internal EVRU of the EVM detects event 13, send signal on the internal EVG of the EVM
- EVG detects rising edge on inputs then propagate downstream event 13
- Depending on the EVR, event 13 will shut some signals or trig some Postmortem analysis



Topology of the timing system

EVM Master main element of the topology

- Synchronized by the GPS and the master oscillator.
- In charge of the distribution of:
 - Reference frequency
 - Event trigger
 - Timestamp
 - Upstream events propagation

Injector

As close as possible of the main EVM to avoid propagation time and get shut beam as soon as possible.

MEBT / SCL

Possibility to operate them independently

Glossary

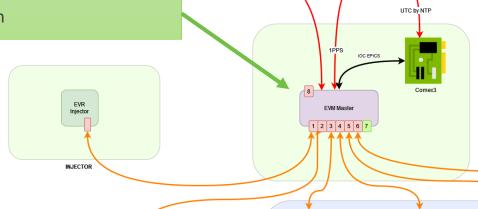
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MEBT: Medium Energy Beam Transport

SCL : Super Conducting Linac

LLRF : Low Level RF RF : Radio Frequency

RFQ : Radio Frequency Quadrupole MRF : Micro Research Finland



EVR BDM

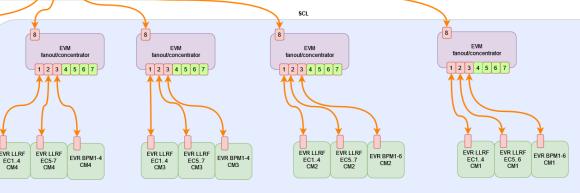
1234567

(PCIe

Master Oscillato

Event	action
1	Acquisition
13	ShutBeam
14	Manual PostMortem
18	Magnetron
20	Chopper
22	RF
70	Beam Presence

Overview of events distributed on the MRF optical fiber network



Hardware platform

Industrial PC

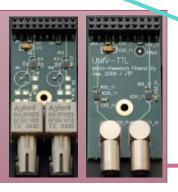
- IFB300SAM
- IPC Kontron
- PCIe-EVR300DCS

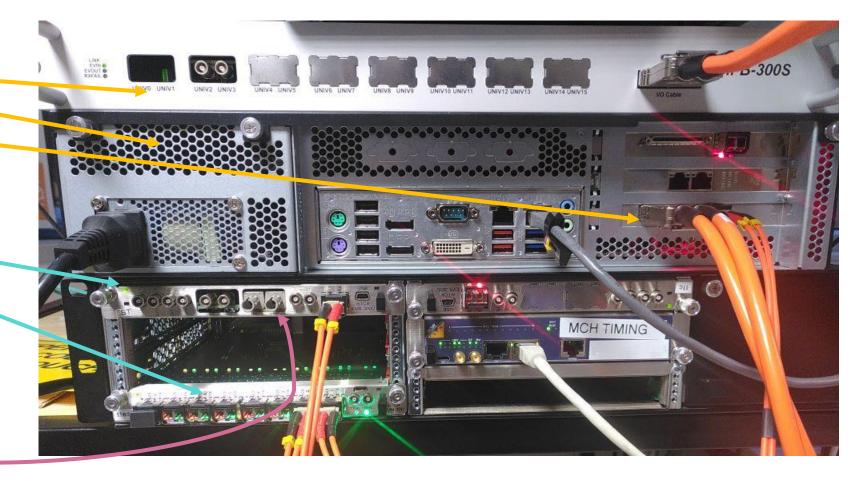
MTCA.4

- NAT R2 crate + MCH PHYS80
- + MCH-COMEXe3
- MTCA-EVR-300U
- MTCA-EVM-300

Universal Modules

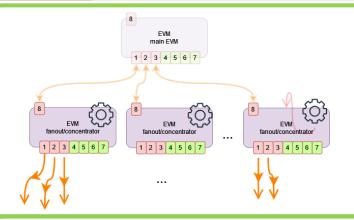
- TTL 5V output
- TTL input
- Optical fiber





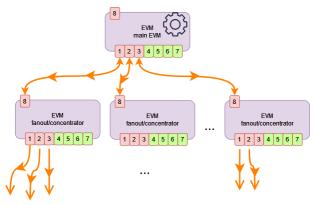


Operation Mode



► RF conditioning Mode :

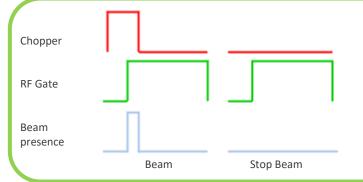
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► Stop Beam / Start Beam

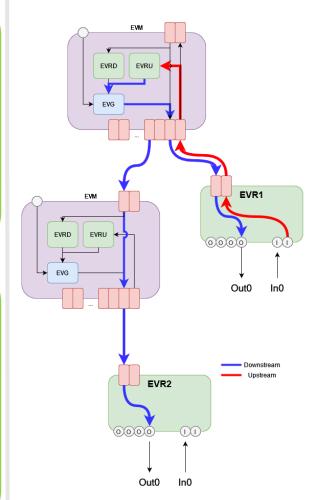
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EVR backplane configuration / Machine Protection System

MTCA.4 backplane bus trigger examples TS6: GPM TS4: RF Gate TS3_2b: Stop RF Cav4 TS3_2a: Stop RF Cav3 TS3_1b: Stop RF Cav2 TS3_1a: Stop RF Cav1 TS2: Beam Presence TS1: TUB 0 1 2 3 4 5 6 7 Through backplane EVRs and LLRF can RF security 4 cavities LLRF x2 LLRF x2 manage here up to 4 Input cavities rS5_1a ShutBeam TS3_3 ShutBeam TS3_2 ShutBeam TS3_1 ShutBeam TS2 Acquisition 0 1 2 3 4 5 6 7 EVR will manage up to 3 BPMs 3 2 1 0

Part of the MPS is delegated to MRF cards.



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