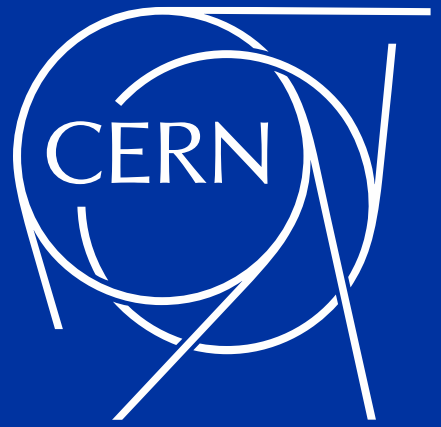


LHC Beam Dumping System

Machine Impact for LBDS Simulators in Remote

C.Durmus; C.Boucly and N.Magnin (SY-ABT-BTC)

17/11/2023

OUTLINE

1. MOTIVATION
2. LBDS IN OPERATION
3. LBDS SIMULATOR IN LOCAL
4. SIMULATOR FUNCTIONS OVERVIEW
5. LBDS SIMULATOR IN REMOTE
6. MODIFICATION AND MACHINE IMPACT
7. TEST & VALIDATION
8. CONCLUSION

MOTIVATION

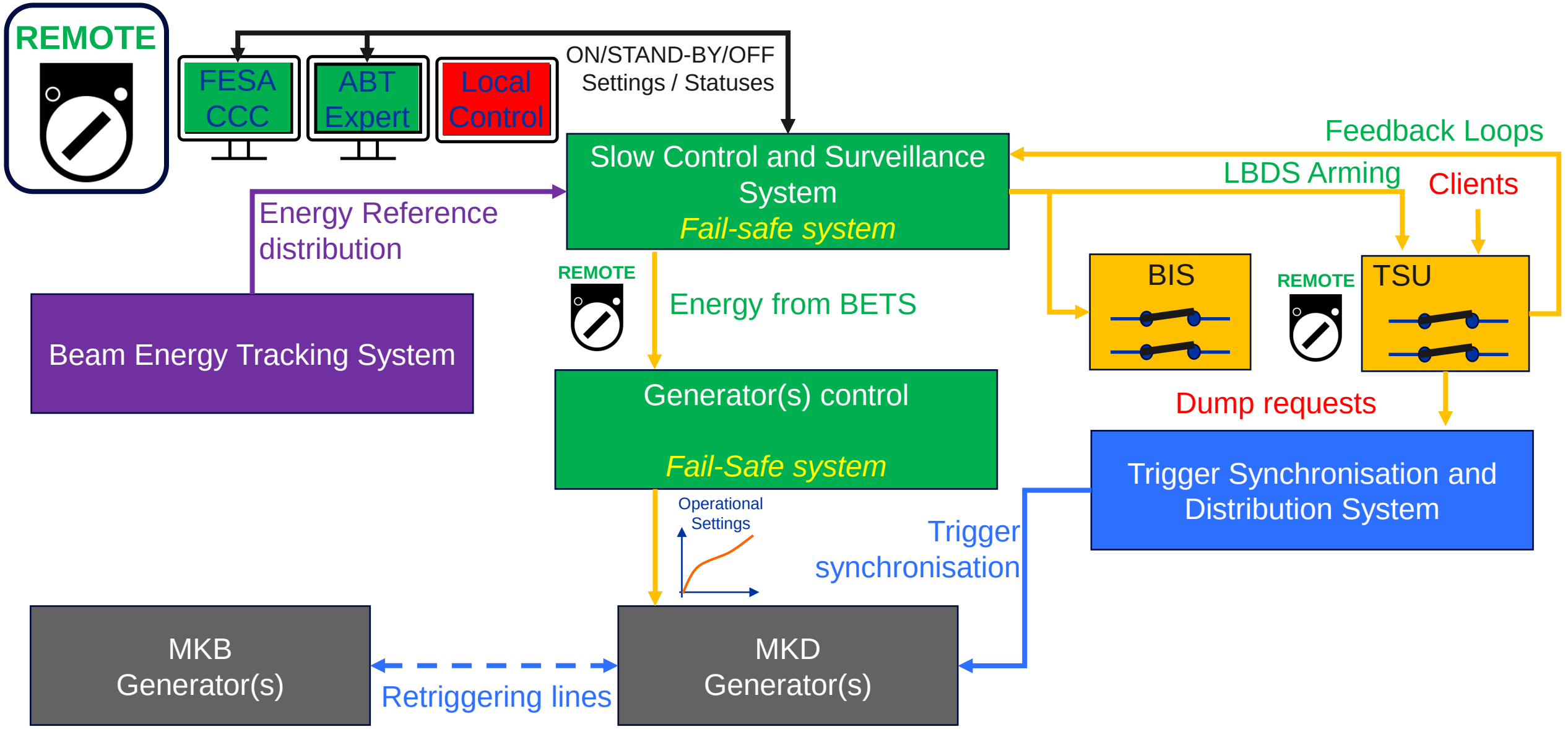
The LHC Beam Dumping System integrates several validation sequences and conditioning functionalities to ensure the system integrity.

<u>These functionalities are only authorised in local mode and an access needed to start the simulator</u>

The principal motivation for the LBDS experts to perform these functionalities remotely are:

- **Significant reduction of access requests for maintenance/intervention in operation;**
  - Magnet (re)conditioning in case of an HV breakdown;
  - Generator (re)conditioning in case of erratic triggering or sparking;
  - Validation of SAM system acquisition status
- **Perform these tests more regularly in operation (started by BE/OP with LHC sequencer)**

GENERATOR CONTROL – REMOTE OPERATION



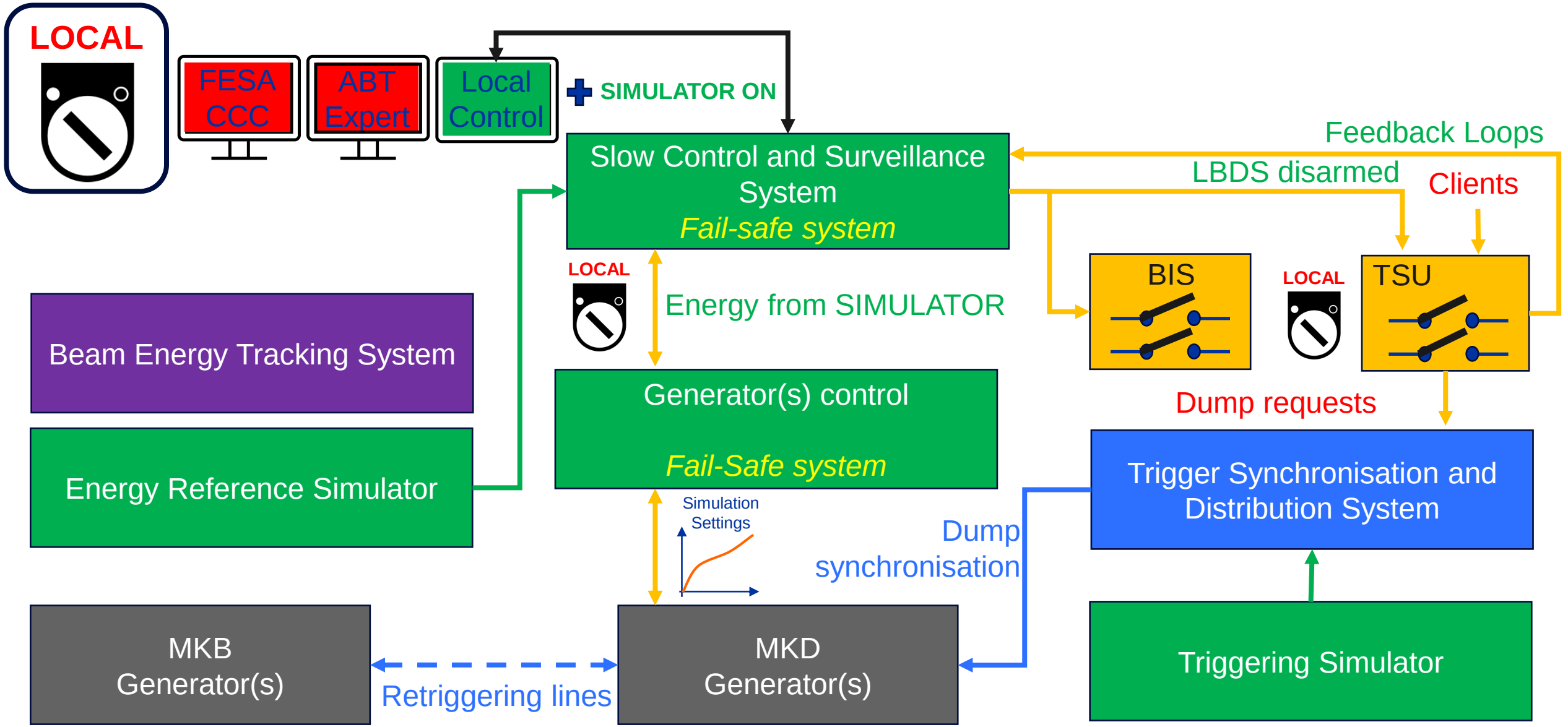
SIMULATORS FUNCTIONS

The SCSS integrate simulator functionalities, allowing the (re)validation of the MKD/MKB generators

The SIMULATOR modes are:

- **Pulse Generator: Stress pulsing condition to validate individual generators;**
- **Energy Scan: Ramping energy function for the generator validation;**
- **Cycle Generation: Operational cycle simulation;**
- **Retriggering Generation: Trigger propagation on the retriggering line to validate the generator synchronisation;**
- **Sparking Activities Monitoring (SAM) : Noise generation onto each HV generator acquisition to validate the acquisition and analysis tools.**

GENERATOR CONTROL – LOCAL SIMULATOR



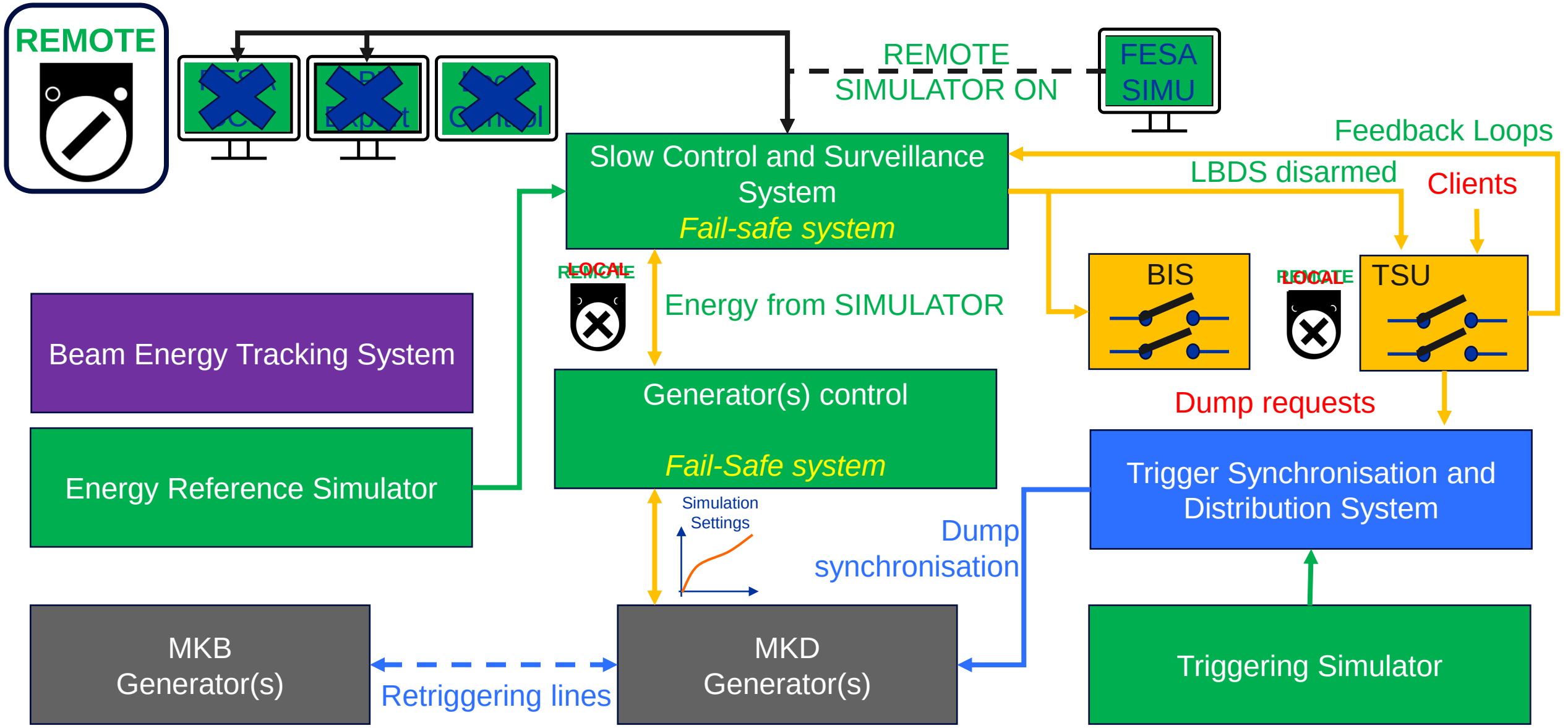
REMOTE SIMULATOR

A FESA class will be used to expose the simulation controls

- **"Remote Simulator Enable" conditions:**
  - The LBDS is not armed
  - The PLC is ready for simulator
- **"Remote Simulator Start" conditions:**
  - The selected simulator mode and the parameters set are valid
  - There isn't a simulator ongoing

- **This is an additional layer for safety to reject invalid requests before reaching to PLC**

GENERATOR CONTROL – REMOTE SIMULATOR



MODIFICATION AND IMPACT ON LBDS

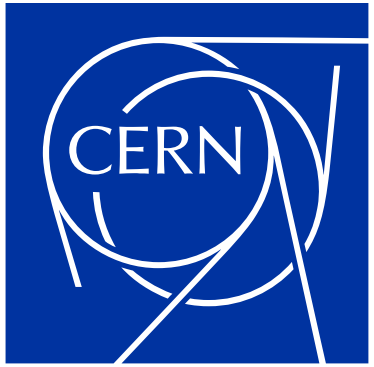
MODIFICATION	FUNCTIONAL ASPECT	SAFETY ASPECT	CONDITIONS TO ENABLE SIMULATOR
FESA	New FESA class for remote simulator control	None	- The LBDS is not armed - The PLC is ready to simulate
SCSS	New settings entries on simulator function (configuration only)	New safety condition to switch in LOCAL mode by software	Safety conditions to grant the REMOTELY SIMULATOR The safety conditions are: - LBDS not armed - SCSS client not ready (TSU) - BIS channels feedback opened
BETS	No modification	No modification	
TSDS	No modification	No modification	

TEST & VALIDATION

- Deployment during the YETS 23-24
- Tests of the changes before the end of the year
- Validation of the system during the local reliability run (4 weeks in Jan 2024)
- Validation of the system during the remote reliability run (4 weeks in Feb 2024)
- In case of any issues identified, rollback to the current PLC version is easy anytime

CONCLUSION

- **Reduce the downtime;**
- **Open the possibility of performing the sanity check during each ramp-down;**
- **No modification of the SCSS functional part;**
- **No modification of the SCSS simulator functionalities;**
- **One point of modification to manage the LOCAL/REMOTE of the SCSS;**
- **Minor modification of the safety functionalities;**
- **BIS, TSU and SCSS safety loops opened during SIMULATION, preventing the operational rearm;**
- **No simulator possible during operation and system armed (FESA & PLC protections)**



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