PROCEDURES FOR CHANGES TO BLM SYSTEM SETTINGS DURING LHC RUNNING PERIOD, SOFTWARE SPECIFICATION FOR BLM SYSTEM CONFIGURATION AND DATABASE STRUCTURE DESCRIPTION

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Content

1. Procedures for changes to BLM system settings during LHC running period,
2. Software specification for BLM system configuration
3. Database structure

Procedures

- Document: *Procedures for changes to BLM system settings during LHC running period, software specification For BLM system configuration and database structure description,* Preliminary version available.

- Procedures (plus additional software needed) defined
- Additional software
- Approval process by all involved parties
- Test of the procedures during “dry run”

Use cases

	Use Cases	***Execution Time***
1	Add a monitor	1 day
2a	Disable monitor	1 hour
2b	Remove monitor	1 hour
3a	Change of electronic channel	1 day
3b	Change of monitor location	1 day
4	Change family Master Thresholds (Tf)	1 hour
5	Change family structure (creating, deleting etc)	1 day
6	Change of monitor factor (Cm)	A few minutes
7	Add mobile monitor	1 hour

Procedures

- **BLM representative:**
  - The role of the BLM representative will be filled 24/7 by one person, according to a pre-defined rota (circulation of rota?), reachable by one “BLM telephone line” (forwarded to the mobile of the BLM representative).
- **Agreement of BLM representative:**
  - A written and documented agreement of the BLM representative is needed for:
    1. Any change in the structure of a database (MTF, Layout, LSA, M&L DB)
    2. Any change in RBAC (concerning BLM)
  - The changes shall be requested by an EMDS document using EDMS approval procedure.
- **Execution and documentation of use case procedures :**
  - The procedures will be executed by the BLM representative on request of the MPP representative (role to be defined); or on request of the BLM representative after agreement of MPP representative.
  - The ‘BI issue follow up system’ will be used to document the execution of the use case procedure: http://bdidev1/bdisoft/operational/issuetrack/index.php
  - The procedures should only be executed from the CCC by the BLM representative together with a second person, defined by the MPP (two persons for cross checking).

BLM system parameter changes (including thresholds)

- Can only be performed by experts (2 or 3 persons which hold the RBAC role of BLM_EXPERT).
- with two applications (one for thresholds and one BLECS internal parameters (for system integrity tests)).
- Procedures (automatic and manual) for checking the validity and plausibility of the changes will be enforce by the LSA database and by these applications before the final tables are updated.
- All data manipulations are done in the DB, no local files are used.

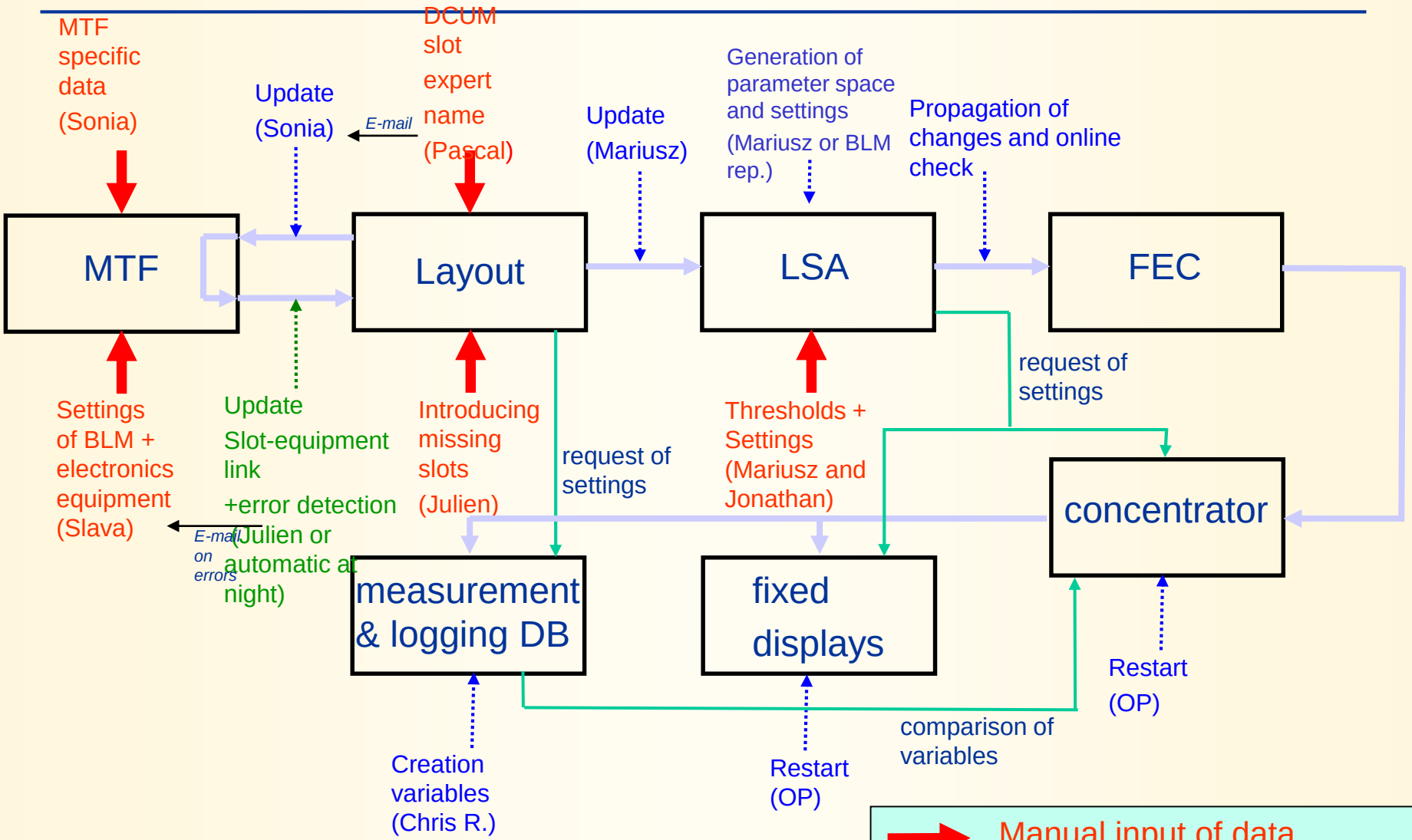
Parameter Checks

- Hardware topology checks are performed in Layout (mainly) and on a low level in LSA.
- Basic checks on the thresholds are performed in LSA (plus advanced checks on other system parameters).
- Advanced threshold checks and verification of the policies to disable monitors will be performed in the GUI BLM expert THRESHOLD application (discussed later in this talk) before attempting to update the final table from stage table, and when updating the LSA from Layout (disable monitor flags).

Monitors not allowed to be disabled or removed

- In the LHC **arc**, six ICs are installed around each quadrupole magnet (they belong to the six standard arc monitor families), three for each beam. A maximum number of one IC per beam and quadrupole magnet will be allowed to be disabled. If one arc IC was disabled in the half cell n, the corresponding monitor of the same family in the half cells n-2, n+2 and n+4 (in beam direction!) shall remain operational.
- In the LHC **dispersion suppressor:** all monitors operational.
- In the LHC **LSS** all monitors shall remain operational on the triplet magnets (Q1, Q2 and Q3). All monitors at collimators and absorbers, and all monitors in IR3 and IR7 shall remain operational. Limits for all other LSS monitors and other special monitors will have to be decided by the MPP representative and the BLM representative on a case-by-case basis.
- All these rules will be enforced by the BLM expert THRESHOLD application used to disable monitors.

Introduce a new monitor in the BLM system



Summary of actions needed to be taken in use cases

scenario	1	2	3	4	5	1	2	3	4	5	6	1	duration
new monitor	X	X	X	X	X	X	X	X	X	X	X	X	1 day
disable monitor			X			X		X				X	1 hour
Remove from DB			X		X	X		X		X	X	X	1 day
change connection			X	X	X	X		X				X	1 day (possible to make faster?
change master					X	X							1 hour
change family					X	X							1 day

1. DCUM slot expert name (Pascal)
2. MTF specific data (Sonia)
3. Settings of BLM & electronics or disable flag (Slava)
4. Introducing missing slots or changing structure (Julien)
5. Thresholds and/or Settings (Mariusz and/or Jonathan)

1. Generation of parameter space and/or settings, propagation to HW and online check using Trim application (Mariusz or BLM rep.)

2. Update MTF (Sonia)
3. Update LSA (Mariusz)
4. Creation of logging variables (Chris)
5. Restart Concentrator (OP)
6. Restart fixed display (OP)

1. MTF->Layout automatic nightly synchronization

Software for BLM system configuration

- **BLM expert THRESHOLD application (under development)**
  - Set/change the beam-abort threshold table and manage BLM ‘families’
  - Disable monitors
  - Trigger LSA update from Layout DB (in case of change of electronic connection)
  - Trigger the update of the electronics from LSA
  - RBAC role holder BLM_EXPERT (2-3 people)
- **BLM expert INTERNAL PARAMETER application (tested by expert)**
  - Change BLECS internal parameters (for system integrity tests)
  - RBAC role holder BLM_EXPERT (2-3 people)
- **BLM TRIM application (deployed)**
  - Change the monitor factors
  - RBAC role holder BLM_USER (a few selected members from people of OP group)

Both Expert Applications Respectively

- Access to LSA tables through a dedicated database account which has been granted the necessary privileges to **read and write** the **threshold tables** or the **internal parameter tables** respectively.
- It is the only database account with such privileges, and the password should only be known by the BLM experts.
- The number of connections to this database account is restricted to one. In this way, only one instance of the application can be run at any time, so that the changes can not be accidentally overwritten by a second application.
- RBAC and LSA timeouts are imposed.
  - The RBAC timeout is set to 1 hour. Expiration of the timeout does not erase the changes which had been done so far, but a re-logging to the application is required.
  - Connections to the LSA database which have been inactive for >=1 day are automatically closed, uncommitted data changes are rolled back.

Both Expert Applications

- Automatic and manual checks on data implemented/foreseen:
  - Adhering to rules
  - Plausibility and consistency of changes

Expert THRESHOLD Application

- Five LSA tables in sequence for the beam abort thresholds:
  - STAGE table (volatile)
  - FINAL table (persistent, propagated from STAGE table)
  - MASTER table (propagated from FINAL table)
  - APPLIED table (created from MASTER table and monitor factors)
  - LSA Settings tables (organised by crates, to be sent to electronics)
- From the LSA Settings tables the parameters are pushed to the electronics.
  - Before each fill it is checked that the APPLIED table, LSA Settings table and the electronics hold the same parameter values (if not, the beam permit is not given by the BLM system).
- **For all 3 applications**: Only the committing of the STAGE tables will be allowed when there is beam in the LHC. All other LSA table changes require the "**LHC Mode**" to be "**no beam**"
  - This safety feature is currently implemented in the LSA database, but not active. It has to be activated as soon as the LHC sequencer is running.

TRIM Application

- Monitor factor by family or single monitor
- 0.1 is default value (30% of quench level)
- Range: 0.001-1.
  - The upper limit ensures protection against damage for the accelerator elements (e.g. for cold magnets it corresponds to three times the quench level). For warm elements safely below damage.
  - The lower limit is set to protect against setting very low threshold which would lead to constant triggering of the beam dump.
  - The limits are imposed on the LSA level.

Databases

- MTF
- Layout
- LSA
  - History of monitor factors is followed by mechanisms built into the trim application (which are common to all parameter settings)
  - Changes to other BLM parameters are captured using a PL/SQL HISTORY package inside the LSA database. All changes are captured. The information includes old values, new values, user account and host from which the change was made, and the time the changed was made.

LSA Database – Category of Data

- The STAGING category of data is intended to allow the BLM Experts to make potentially complex changes to the BLM data configuration in an isolated environment, and only apply them to the FINAL category of data (via database stored procedures) when they are satisfied with the new configuration.

- FINAL category of data: persistent storage of BLM data. All of the rules which govern the data (e.g. threshold boundaries, <=16 cards in a crate, etc.) are applied. This category of data can only be modified via dedicated stored procedures (rather than direct table access).

LSA Database – Category of Data cont.

- MASTER category: operational usage i.e. to drive parameter settings to the electronics. The data is generated via a dedicated stored procedure, using the FINAL tables and additional logic as input (to ensure that each crate has 256 monitor definitions which include real cabled monitors and generated *spare* monitors for unused channels).
  - The MASTER category of data also includes a BLM_APPLIED_THRESHOLDS table which is based on the content of the BLM_MASTER_THRESHOLDS table combined with individual MONITOR_FACTOR parameter values which are stored in the LSA SETTINGS table.
  - The isolation of the MASTER category from the FINAL category of data also means that it is possible to prepare a new data configuration in the FINAL category without actually using it immediately.