Redundancy switch and controller design status

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Redundancy role and structure

➢ Redundancy aim to increase Master Oscillator reliability

➢ In case of a failure event:
  ▪ Power drops less than 3 dB for less than 1 us
  ▪ Phase returns to original value with worst-case error about 1 ps in less than 2 us
High-Q Filter

- High quality-factor dielectric resonator filter
- Used for energy storage
- Ready to use
- The newest version withstood +50 dBm RF power for weeks
Generation Channel synchronisation

- Vector modulator used as an unlimited phase shifter
- Custom assembly variant of the uVM (DRTM-VM2)
  - Used as standalone unit
  - Already ordered
  - Digital M-LVDS link to the Redundancy Controller
  - Digital SFP link to TMCB for monitoring

- To do
  - Custom firmware
  - Small Zone3 adapter board (Marcin Sosnowski)
  - Fixing assembly (Łukasz Zembala and Maciej Woźniaczko)
RF Switch module (1)

- SP3T RF switch capable of handling high power (+40 dBm)
- Integrated phase and power detectors
- Fast switching (latency < 100 ns)
- Custom -40 V drivers (additional piggyback modules)
- Complex topology
  - Symmetrical layout
  - 6 SPDT switch ICs
RF Switch module (2)

- Main board: six layer PCB, low drift material on RF layers
- Prototype currently in production - should be ready in early July
- Standalone tests and measurements until mid-August
- Driver modules: double sided PCB, production in following weeks
Redundancy Controller

> General concept is ready

> Task force:
  - Bartosz Gąsowski – general concept, specification
  - Tomasz Owczarek – detailed AFE concept, digital solution selection
  - Marcin Sosnowski – schematic and PCB design

> Device is planned to be:
  - Designed in August
  - Manufactured in September

> Open points
  - When exactly assert MPS alarm? (not urgent: configurable in firmware)
Redundancy Box

> Other modules/components

- TMCB for monitoring and communication
- FRED (open point: allow supply switching or not?)
- -45 V power supply for RF Switch (TODO)
- High power RF loads

> Mechanical design will be done after all modules
Redundancy subsystem tests (1)

> General test ideas are ready
> Detailed plan should be prepared
> Basic tests and calibration will be done in the lab
  - As soon as possible
  - For each module separately
  - For whole subsystem (as much as possible with available hardware)
Redundancy subsystem tests (2)

Tests in XFEL

- Currently planned for October
- Some quick tests might break output reference signal
- Longer tests are generally passive and “safer”

Requirements

- All redundancy modules ready
- Usable version of firmware available
- All three Generation Channels operational

Optional final calibration

- Will be done during tests (if needed)
Documentation status

- Conceptual and functional documentation, specifications
  - Available on the N: drive
  - For the Controller specification working draft is available in Redmine

- Final documentation (user and maintenance)
  - Still to be done
  - Will be done in parallel with tests

- All MO related files are available on the N: drive:
  - `N:\4all\public\MSK_Projekte\RFSyn\XFEL_MasterOscillator`

- RF Switch design is available in SVN repo: `XFEL_MO_RF_Switch`
Thank you for your attention