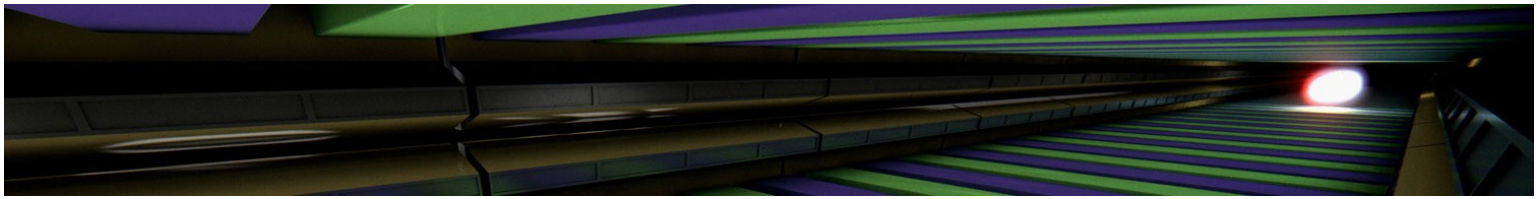
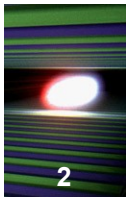


Automation for DOOCS servers for AMTF

W. Cichalewski, J. Branlard, V.Ayvazyan, A. Piotrowski, K. Gnidzinska

Agenda



- AMTF automation
- Acceptance criteria
- Software structure
- Components preparation status
- Open points

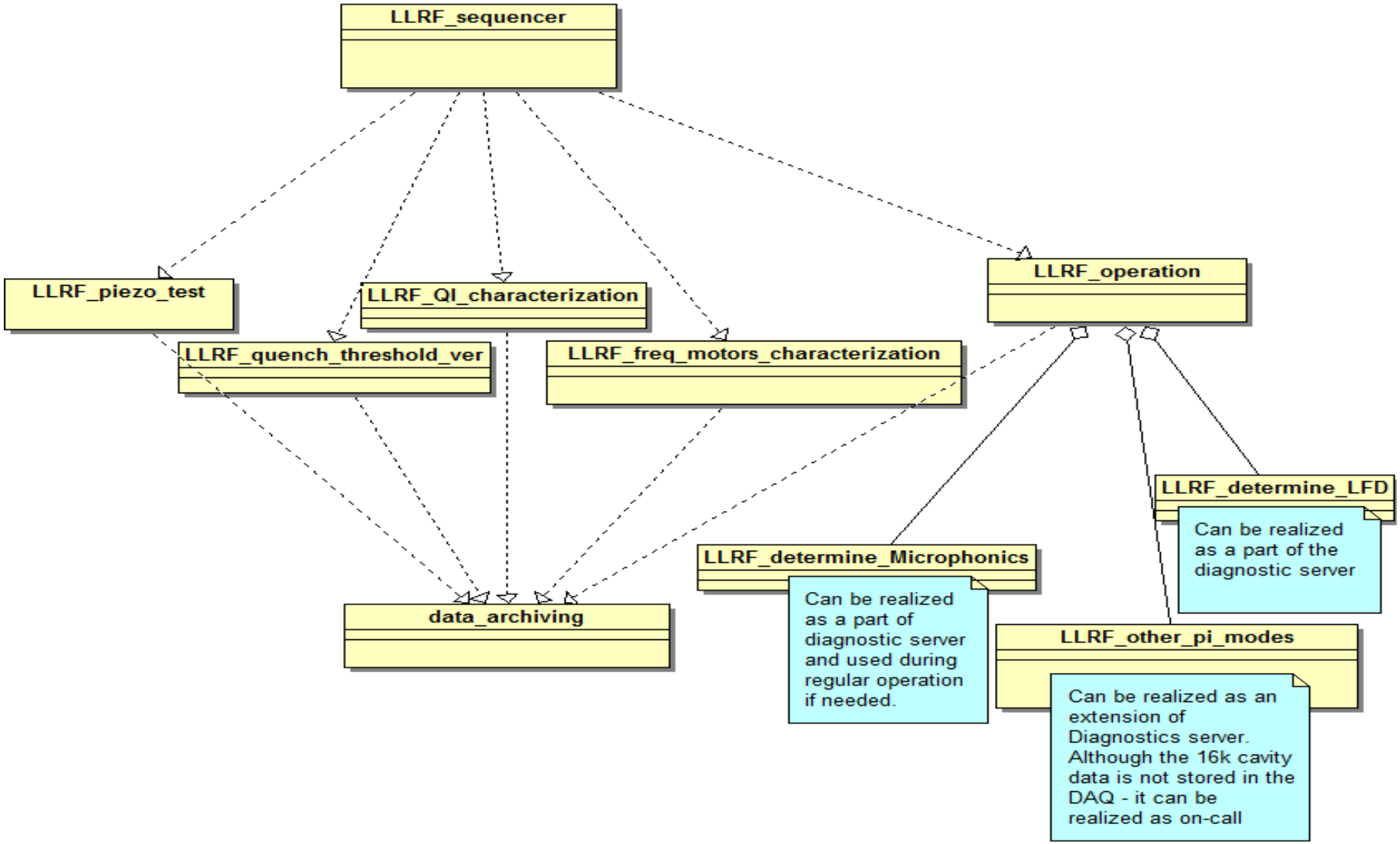
AMTF – acceptance criteria

- Acceptance criteria:
- maximum module field gradient,
- long time operation ability,
- cavity to cavity power distribution spread,
- thermal change of loaded Q for different gradients,
- multipacting effect in coupler showing up as instantaneous loaded Q changes of cavities (to be checked in gradient range 5-25MV/m),
- range of adjustability of loaded Q
- measurement of passbands (8/9 and 7/8pi mode)
- Lorenz Force Detuning constant range,
- microphonics of individual cavities,
- full working piezos (DC/AC operation, Piezo for tuning, piezo for diagnostics),

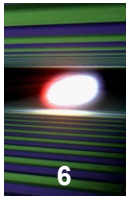
AMTF – acceptance criteria (2/2)

- cavity tuning ability (by piezo) to at least half bandwidth range (acceptable power losses),
- AC piezo tuning range
- mechanical contact verification
- piezo capacity in range
- pre-detuning range
- mechanical cross-talk to neighboring cavities
- frequency shift motor (Hz/steps) transfer behavior (range?, bias, nonlinearity).

LLRF related tests breakdown



Servers breakdown (1/2)



Middle layer servers

Test management layer

- LLRF sequencer
- Data archiver

Test execution layer

- LLRF operation
- Pi modes determination
- LFD determination
- Microphonics determination
- Freq. motors charac.
- QI characterization
- Piezo test
- Quench threshold ident.

Tools layer

- Auto QI set server
- Quench detection server
- Automatic Cavity tuning server
- DAQ server
- Diagnostics server
- Detuning calculation server

Front end servers

- LLRF controller server
- Input coupler FE server
- Frequency motor FE server
- Piezo Controller server

Servers breakdown – status for tests set-up (CMTB, FLASH) (2/2)

Middle layer servers

Test management layer

- LLRF sequencer
- Data archiver

Test execution layer

- LLRF operation
- Pi modes determination
- LFD determination
- Microphonics determination
- Freq. motors charac.
- QI characterization
- Piezo test
- Quench threshold ident.

Tools layer

- Auto QI set server
- Quench detection server
- Automatic Cavity tuning server
- DAQ server
- Diagnostics server
- Detuning calculation server

Front end servers

- LLRF controller server
- Input coupler FE server
- Frequency motor FE server
- Piezo Controller server

Frequency motors characterization

- Goals
  - Evaluate individual cavities tuning availability (range),
  - Determine unwanted motor behaviors – backlash, hysteresis, nonlinearity.

Status

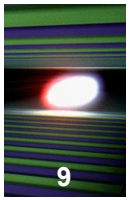
Motors behavior evaluated at FLASH (backlash verified, strange motor behavior observed → acceptance criteria can be redefined),

Characterization realized in Matlab

Automation for optimization of piezo regulation range in preparation, (to be tested on september 2012 by WC)

Server (or application) for step motor characterization and data archiving – not ready (scheduled 09-10.2012, by WC)

Piezo characterization



Goals

- Piezo DC bias scan - log cavity probe and detuning range spanned during scan,
- Piezo AC scan - the full range of piezo AC stimuli (bipolar operation),Log cavity probe and detuning range spanned during scan, both piezos test.
- Measure crucial piezo parameters.

Status

- **Piezo control server prepared and evaluated for VME systems**
- **Software for piezo control for uTCA systems – in preparation? (by ….?)**
- **Server (or application) for DC/AC scans and data archiving – not ready**

Quench thresholds identification

- Goals
  - Verification of individual cavities quench levels (in comparison to levels measured in VTS's),
  - Verification of module gradients acceptance criteria.

Status

- **Server for quench detection developed for VME based systems at FLASH,**
- **The individual cavities quench identification scenario developed (during LLRF studies at FLASH),**
- **QI vs gradient dependency has to be evaluated and included in quench detection server (by JB),**
- **Server (or application) for individual cav. Quench verification and data archiving – not ready (scheduled to 09.2012, by WC)**

QI characterization

Goals

- Characterization of external Q factor modification range for individual cavities,
- Verification of fundamental coupler step motor position adjustment (symmetric in both directions from QI=3e6 - higher and lower) .

Status

- **Server for automatic QI adjustment prepared and tested during 9mA run Feb 2012,**
- **The individual cavities quench identification scenario developed,**
- **Defined system behavior prerequisites for this test – QI vs. gradient dependency,**
- **Server (or application) for QI characterization and data archiving – not ready (scheduled for 09.2012, by KG),**
- **Thermal effects on fundamental couplers behavior not included.**

LLRF operation – open/close loop (1/2)

Goals

- Evaluate open and close loop module operation,
- Long time stability evaluation,
- Module – VS regulation performance evaluation long/short term,
- Controller parameters determination for optimal regulation.

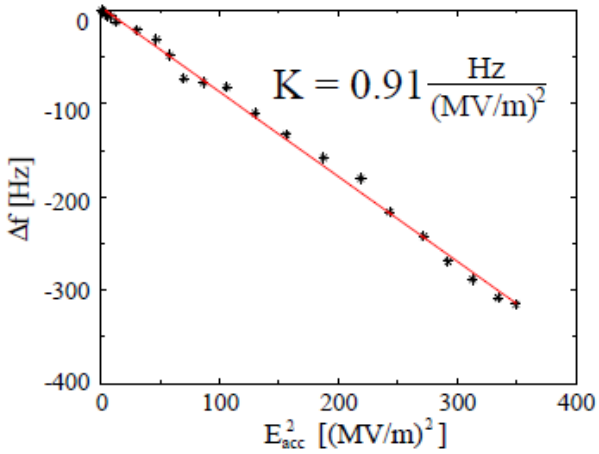
Status

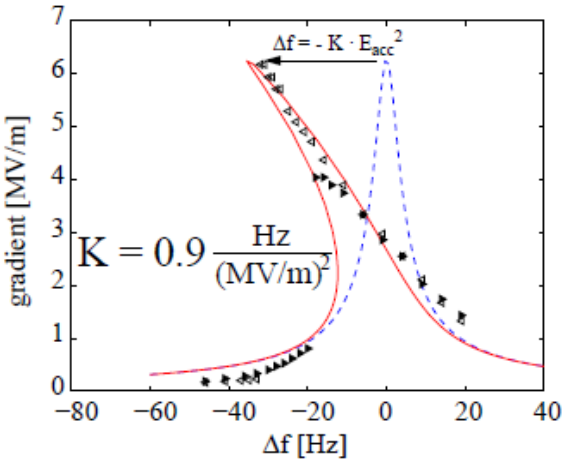
- **uTCA platform based firmware, server prepared for single module LLRF control (ongoing work on MIMO, LFF implementation),**
- **Diagnostic server for regulation performance evaluation has been configured for uTCA platform (but without DAQ support),**
- **Software for gradient scans, feedback gain scan, etc. → exists as a custom made Matlab scripts – not done in DOOCS server form yet,**

LLRF operation – LFD, microphonics, PI-modes, etc. (2/2)

- Goals
  - Determination of LFD characteristics for different gradients,
  - Verification of microphonics spectrum and influence on cavities parameters regulation,
  - Determination of different PI-modes frequencies (7/9pi,8/9pi),
  - ? Other long term phenomenon observation (temperature related performance degradation, cryo heat load level verification, etc)

- Status
  - **Not ready**





Data archiving & tests results reporting

- Goals
  - Acquisition of processed measurement data,
  - Partial reports preparation,
  - Final tests report preparation

- Status
  - **Preparation of „sensitivity list” (TBD till 10.2012, by WC + experts)**
  - **Preparation of implementation proposal (by WC, AP)**
  - **DATRR implementation and tests (by AP, WC, 11.2012).**

Cavity parameters verification

- Cavity gradients compensation capability limit (if any)?
- Minimum range of piezo compensation capability?
- Ql regulation range (is it need to be determined)?
- What parameters should be stored for piezo (apart from DC,AC tuning ranges) maybe capacity, compensation in function of driver current, voltage ?

Module parameters determination

- Parameters of gain performance (gain vs delay vs performance image)?
- Maximum operational gradient ?
- Acceptable cavity to cavity energy spread?