FLASH 9mA beam studies: HLRF/LLRF Integration

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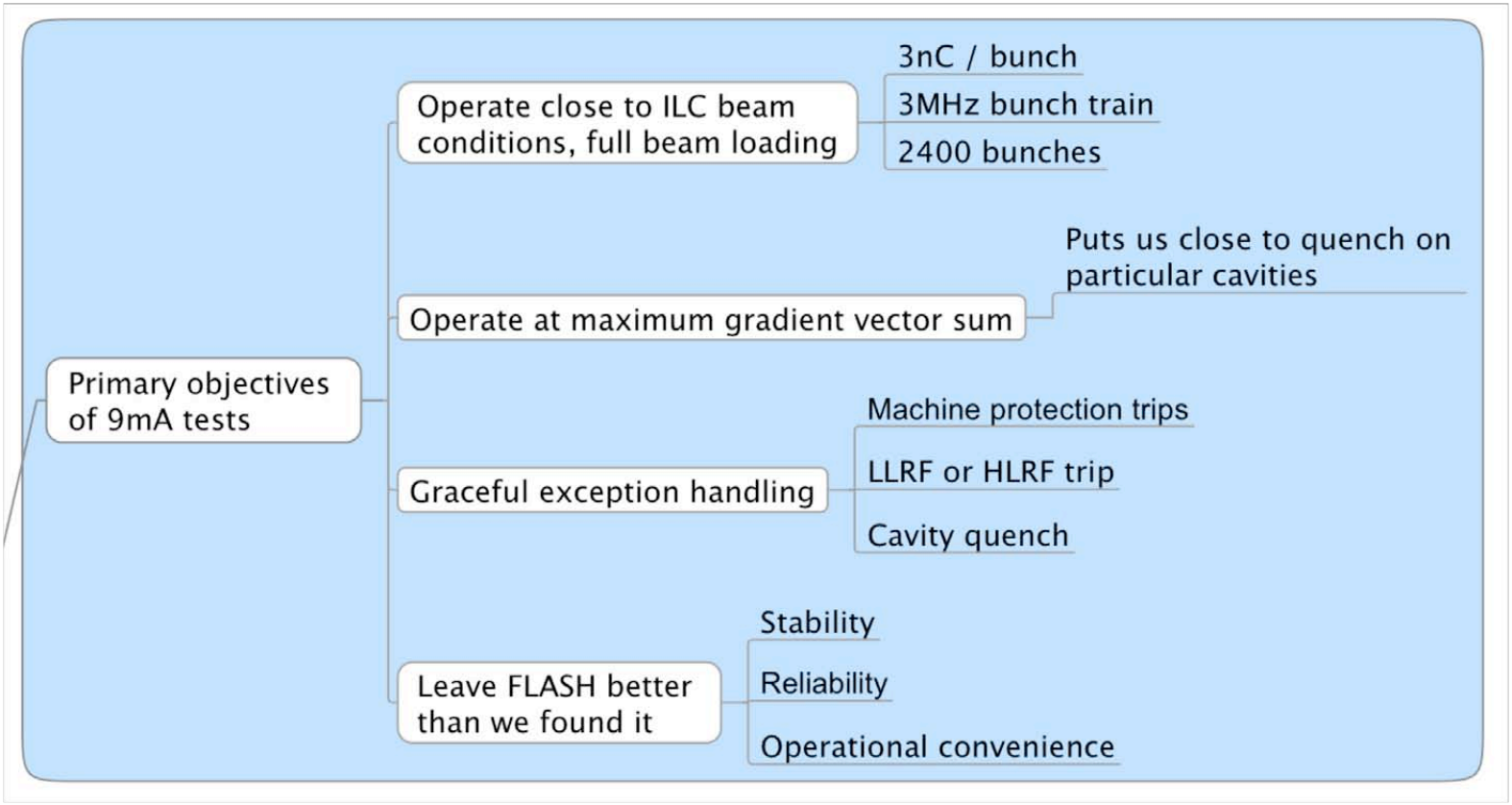
11 June, 2008

Outline

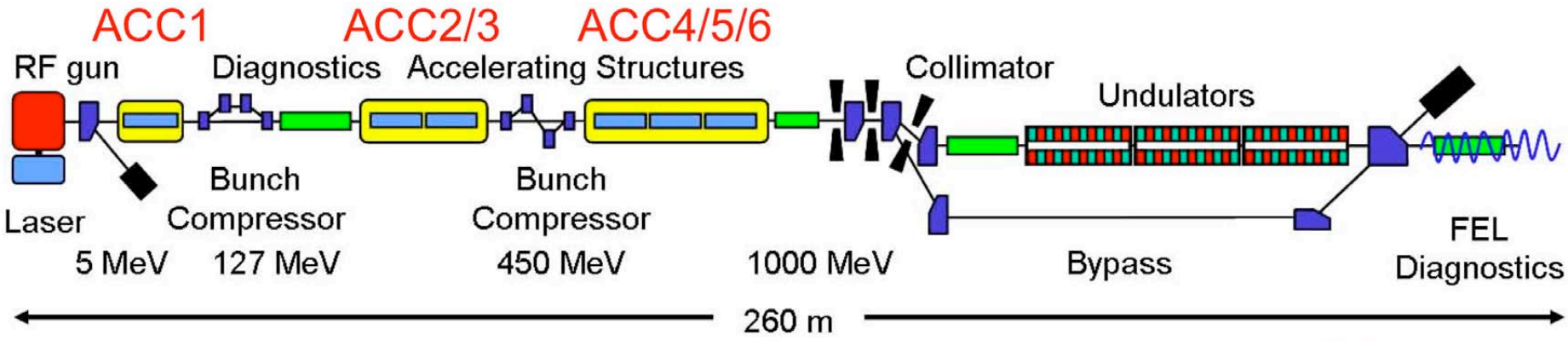
- Goals of the FLASH beam studies program
- HLRF / LLRF integration topics
- Beginning a task list

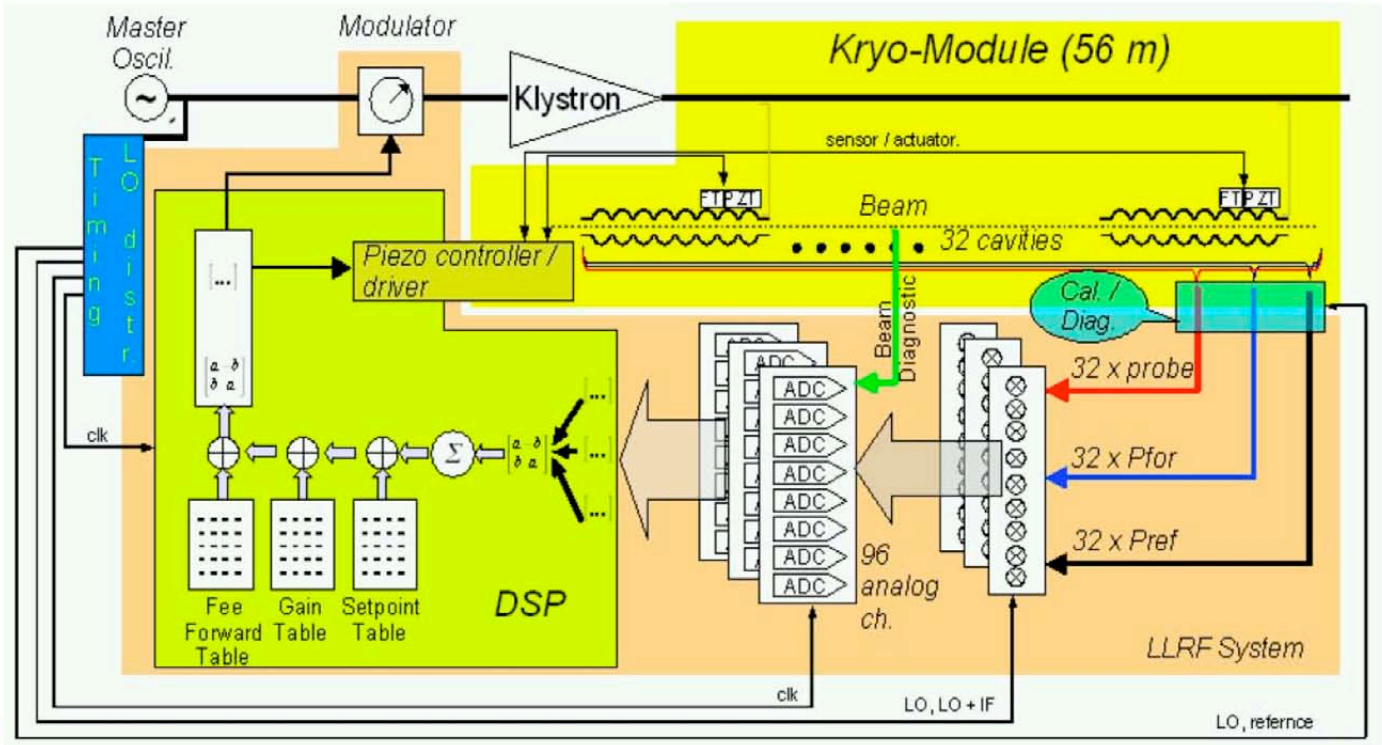
Primary objectives of 9mA beam studies



- Three remaining studies periods before major FLASH shutdown:
  - **Sept 08; Jan 09; Mar 09**

FLASH layout + LLRF block diagram





S. Simrock

Power Overhead issues

RDR

TABLE 2.6-2
RF unit parameters.

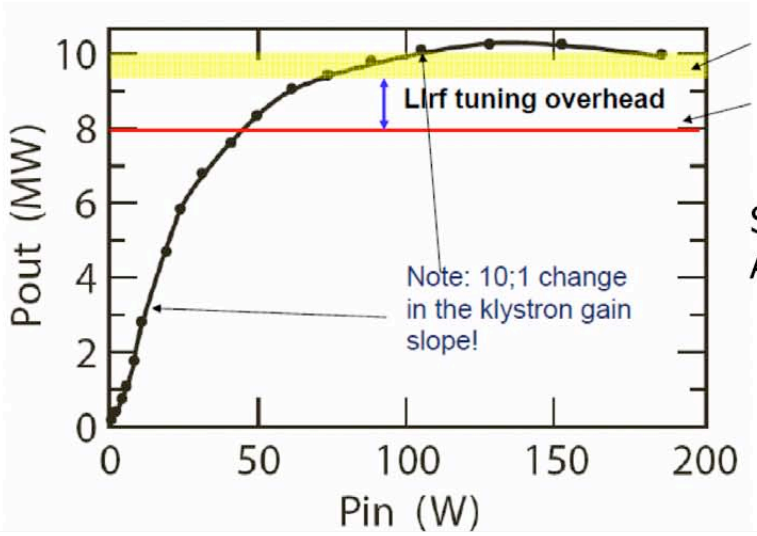
Parameter	Value	Units
Modulator overall efficiency	82.8	%
Maximum klyston output power	10	MW
Klystron efficiency	65	%
RF distribution system power loss	7	%
Number of cavities	26	
Effective cavity length	1.038	m
Nominal gradient with 22% tuning overhead	31.5	MV/m
Power limited gradient with 16% tuning overhead	33.0	MV/m
RF pulse power per cavity	293.7	kW
RF pulse length	1.565	ms
Average RF power to 26 cavities	59.8	kW
Average power transferred to beam	36.9	kW

LLRF claimed the small overhead for enough feedback margin.
There are some items which make the overhead smaller such as tuning error, over coupling and so on.
→ **LLRF has a presentation.**

Does the RDR overhead match to the reality?
Should HLRF consider the Potential increase of overhead? (higher efficiency? More power?)

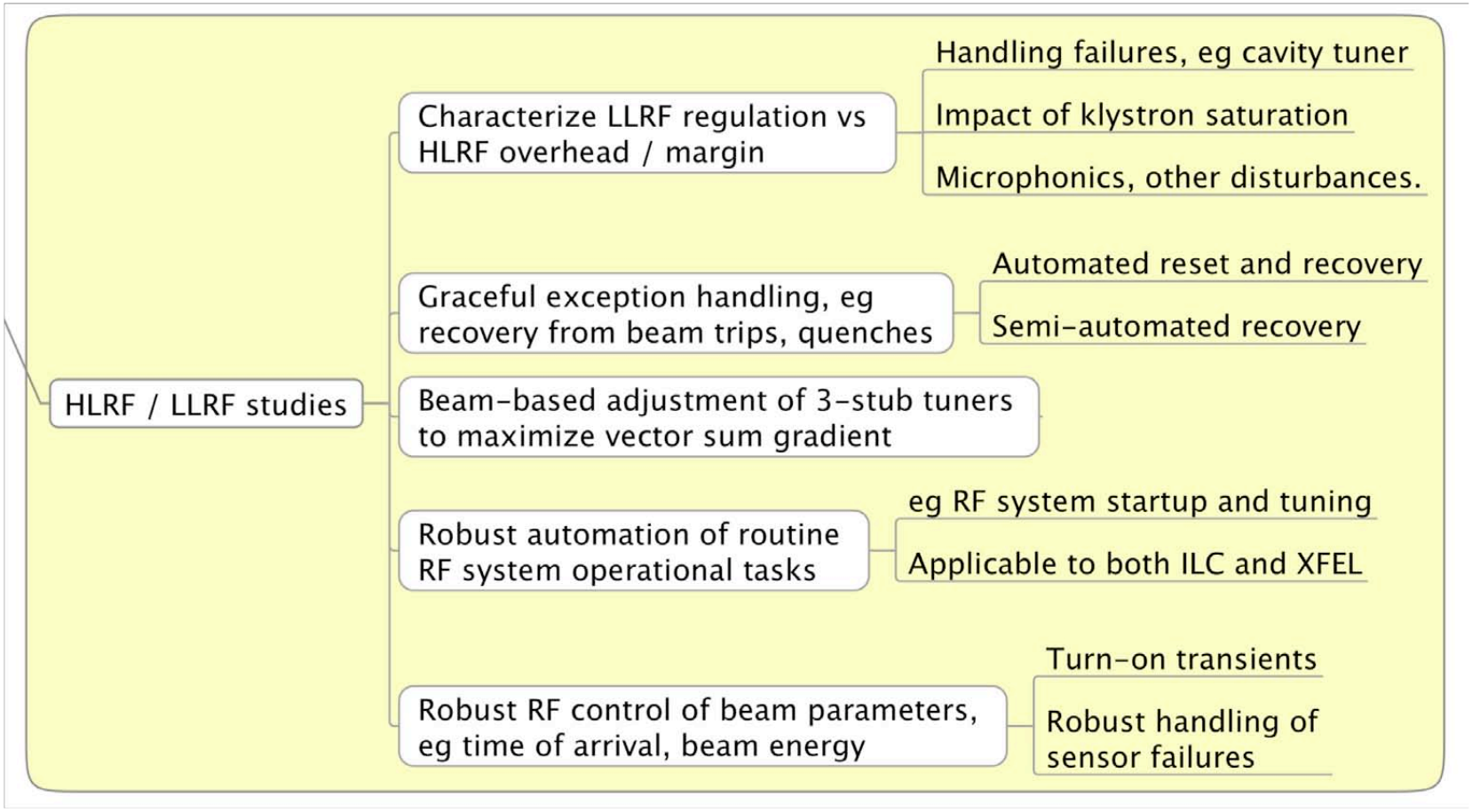
Discussion

• As in RDR, llrf tuning overhead is only 16% in power. corresponding to 8% in driving amplitude. (too narrow!)



Shin Michizono
At HLRF KO(2007)

HLRF/ LLRF integration studies



- Other studies to add…?

How to involve the international community?

Task List: preparation

- Develop studies plans for each topic area

- Develop a list of key exception-handling items, detection methods, desired response
- Develop list of automation topics to be implemented and strawman responses

- Understand what is installed at FLASH now
  - **Regulator algorithms, performance**
  - **Exception handling: detection, mitigation**
  - **Limitations: LLRF, HLRF, machine operations**

Task list (cont)

- FLASH preparations
  - **Verify operation of cavity piezo tuners**
  - **Verify operations of 3-stub tuners remote adjustments**
  - **Calibration of key signals**
  - **Ensure signals are available in DAQ (eg no modulator output voltage & current for ACC2/3 + ACC4/5/6)**
- Develop scripts for collecting & analyzing DAQ data
- Develop a feedback algorithm for beam-based adjustment of the 3-stub tuners
- Develop automation algorithms

Comments

- There's more on the list than we can do in 3 studies period
  - **HLRF power overhead has priority**
  - **Other topics are important for ILC and XFEL, will need longer term studies program**

- Availability of local resources at DESY
- How to mesh ongoing LLRF studies program, eg XFEL prototyping

- How could other labs (KEK, SLAC, Fermilab?,..) best contribute?
- Contact points:
  - **Stefan Simrock: LLRF at DESY**
  - **Fukuda-san: HLRF**
  - **Nick Walker: overall 9mA studies coordination**
  - **John Carwardine: RF coordination**

- Begin regular meetings