

Development of Digital Low Level Radio Frequency Controller at SSRF

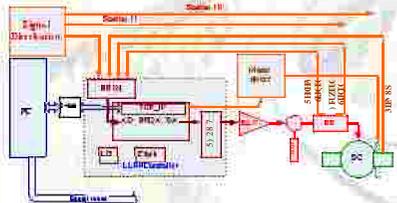
Yubin Zhao, Zhigang Zhang, Xiang Zheng, Kai Xu, Shenjie Zhao, Zheng Li, JianFei Liu.
Shanghai Institute of Applied Physics, CAS (SINAP) Email: zhaoyb@sinap.ac.cn

SSRF LLRF Specification

- ☑ SRF cavity amplitude is stabilized better than +/- 1%
- ☑ SRF cavity phase is stabilized better than +/- 1°

Introduction

- ☑ Amplitude loop
- ☑ Phase loop
- ☑ Frequency loop
- ☑ Labview GUI





Digital LLRF Architecture for SSRF storage ring

• Control Box

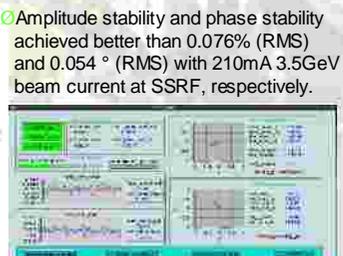
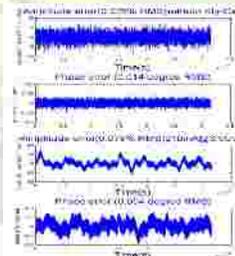
Digital LLRF Control Interface

- ☑ Successful and stable operation since Dec. 2007.
- ☑ It helps SSRF machine operated in top-up mode with 220mA beam current .
- ☑ Performance better than the specification:
 - ☐ Amplitude stability better than 0.15% (RMS) Phase γ better than 0.06° (RMS)

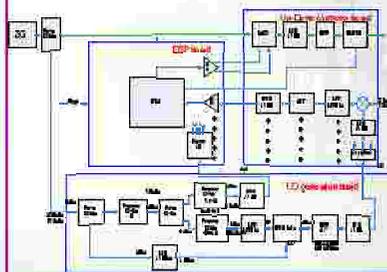
Performance Improved Digital LLRF Control Board



- ☑ Six channels ADC 125MSPS
- ☑ Two channels DAC 275MSPS
- ☑ Altera ep2s60 FPGA
- ☑ Ethernet and USB communication port
- ☑ EPICS interface
- ☑ Amplitude stability and phase stability achieved better than 0.025% (RMS) and 0.014° (RMS) without klystron or cavity, respectively.



XFEL LLRF Architecture and Some development Boards



- ☑ RF frequency of XFEL will adopt two frequency: 2856MHz and 5712MHz, some IC's will use wide band chips which cover those two frequency.
- ☑ XFEL will plan to adopt micro-TCA or VME racks and boards.
- ☑ The down converter board (up-right picture) has been fabricated and tested, the dynamic range is from -70dBm to 0dBm, and the channel crosstalk can achieve 80dBc.
- ☑ Future works: package the boards, test the performance of LO signal, choose a suitable modulator, etc.

