

Low Emittance Ring Technologies

Summary

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Helmholtz-Zentrum Berlin / BESSY



LER 2016
SOLEIL
26.-28.10.16

LERT session talks

Review of ALERT2016

Emanuel Karantzoulis (ELETTRA)

Magnet development for ESRF-EBS

Joel Chavanne (ESRF)

SRF system development for BESSY VSR

Adolfo Velez (HZB)

X-ray beam size monitors with a dedicated source wiggler

James Crittenden (Cornell)

Injection/Extraction kickers and harmonic cavities for ALS-U

Stefano DeSantis (ALS)

Design of a fast pulsed kicker for HEPS

Hua Shi (IHEP)

Commissioning of MAX IV 3 GeV ring subsystems

Magnus Sjöström (MAX IV)

Creating round beams by linear coupling

Peter Kuske (HZB / BESSY)

**And some other topics
in talks of other sessions**

Summary

Relation to industry (ALERT2016 workshop)

(R&D collaboration, technology transfer, spin-off, ...)

Injection technology

(kickers, pulser, septa)

Magnets of all kinds

(resistive, PM, modification of existing = e.g. Anti Septum SLS2)

Cavities for different purposes

(crab, multi-cell high gradient, “harmonics”)

Others

(diagnostics, collimators, ...)

Round beam generation

organisational issues and the human factor

(it is all about the people)

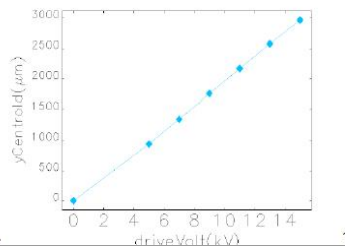
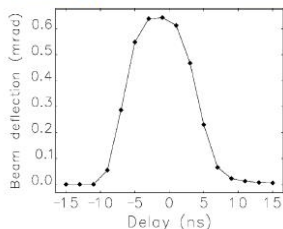
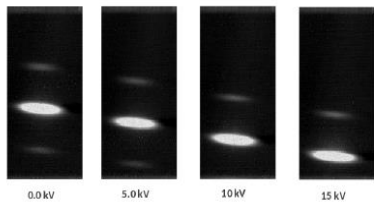
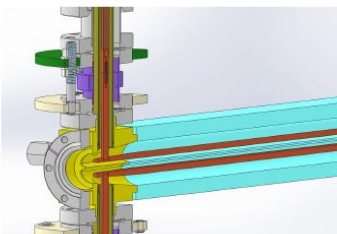
Injection technology

Development of Stripline kicker¹

- 9 mm minimum gap; 1 mrad/m normalized kick angle
- 0.72 mrad @0.72 m
- Prototype installed to APS BTX line: 0.77 mrad at 15 kV; run up to 20 kV.

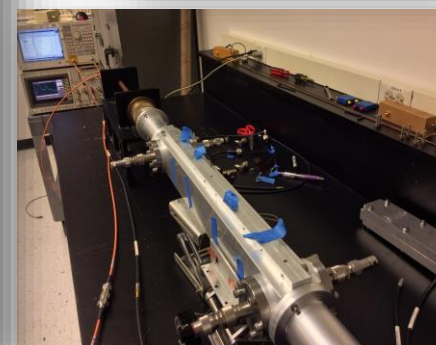
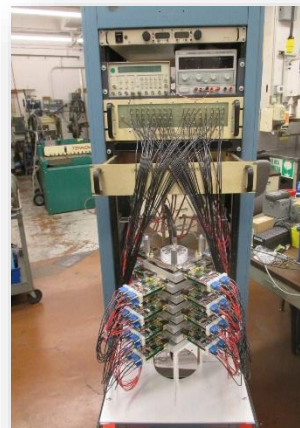
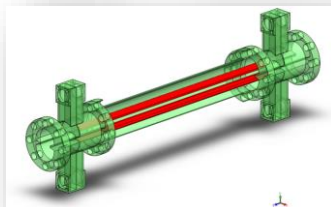
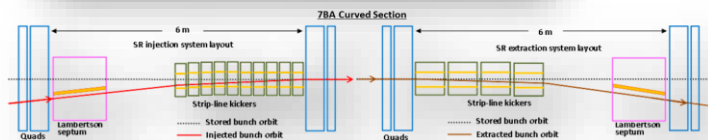
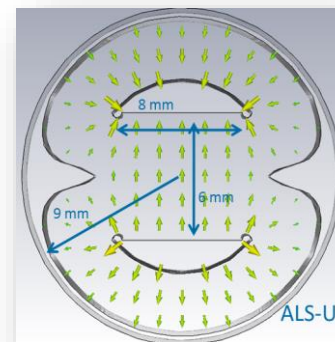
APS-U
1: C. Yao et al., WEPOB24, NAPAC 2016

Courtesy of C. Yao



Fast (ns) strip line kickers and pulser for swap-out injection and ...

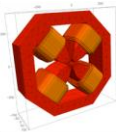
- stability, reliability, ...
- beam tests ongoing



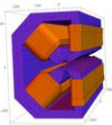
Magnets I



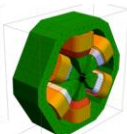
MG quadrupole



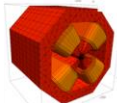
Combined function Dipole/Quadrupole (DQ)



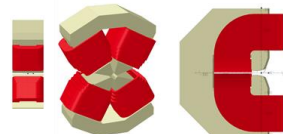
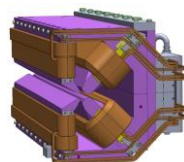
Sextupole



HG quadrupole



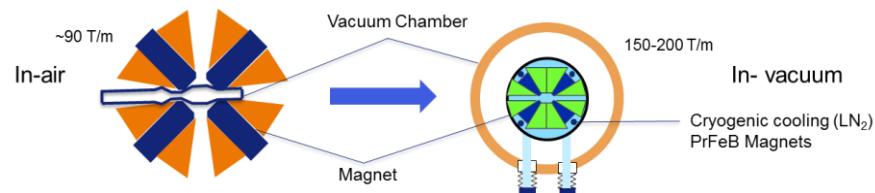
Octupole



resistive magnets of many different kinds

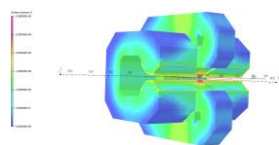
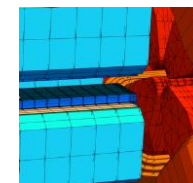
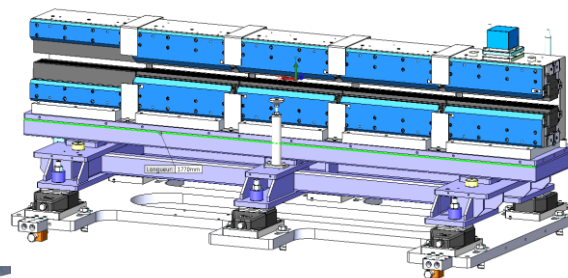
- high gradient, “combined function”, ...
- relying on highest manufacturing precision
- precise magnetic field measurement for development work and quality control

- are we at the limit? What next?



permanent magnets

- large scale installation
- stability, field quality
- longterm rad. hard.

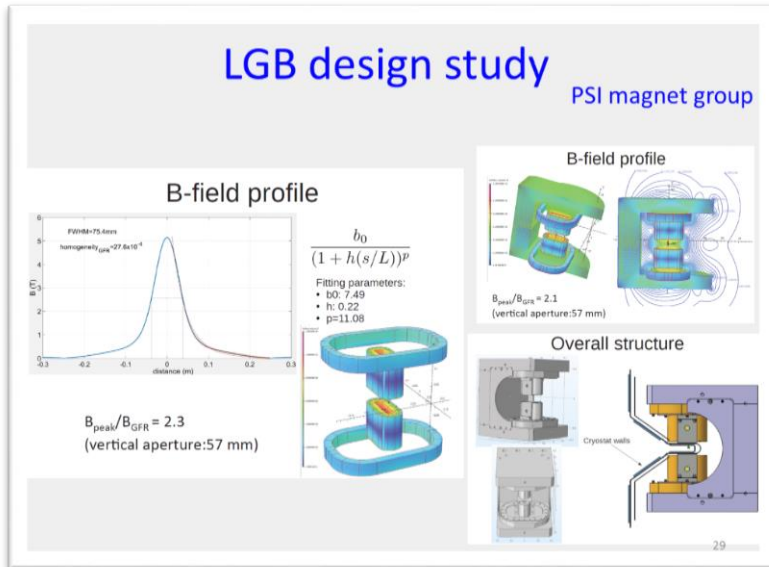


Opera



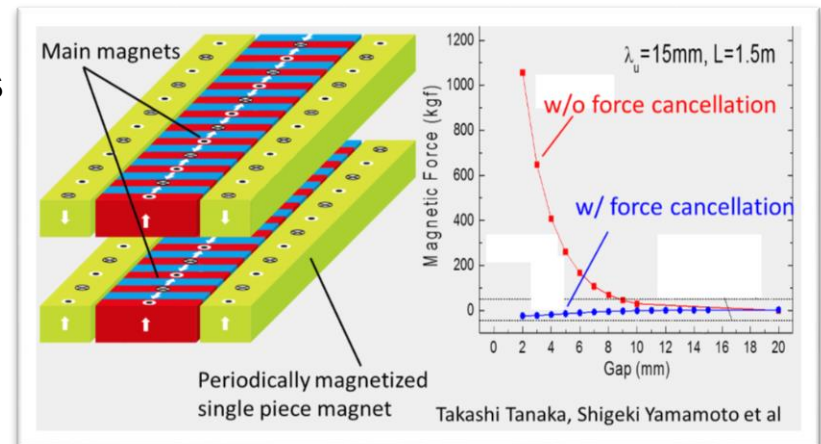
superconducting magnets

- e.g. longitudinal gradient dipole with up to 6T



insertion devices

- force free P.M. IDs
- fixed gap IDs



In general:

- have seen very large variety of different designs (resistive, P.M., sc)
- would be interesting to have an overview on existing designs and achievable parameters ?

Cavities – Harmonic cavities and others

S-band Crab cavities

SLAC

- APS-SPX SRF Crab cavities



Jefferson Lab

Courtesy of Haipeng Wang (JLab)

Mark-I crab cavity by JLab:
0.5 MV per cavity (0.5 m)
Dense spectrum HOMs, big and expensive cryomodule.

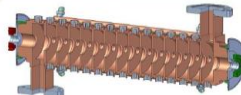


Fermilab

Argonne
NATIONAL
LABORATORY

Lunin, et al., LINAC2014
Conway, et al, IPAC 2014

QMiR crab cavity by Fermilab/ANL:
Up to 2 MV per cavity (0.5 m)
Few HOMs, simpler cryomodule,
Large impedance (smaller V-aperture).



15-cell S-Band traveling wave deflector for LCLS



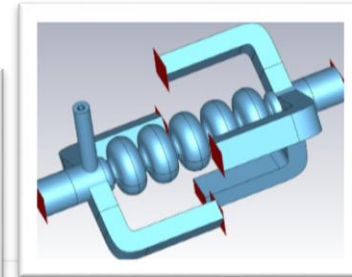
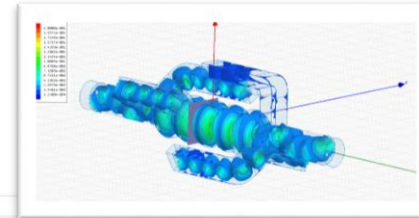
7-cell NC crab cavity for SPEAR3

Zenghai Li, SLAC

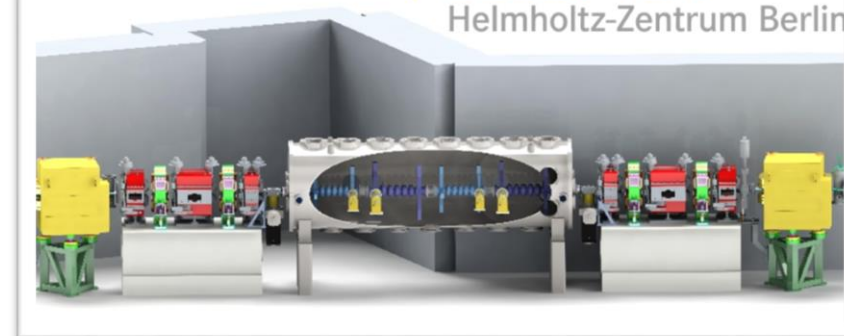
SLAC

sc / nc. crab cavities

- short photon pulses
- bunch separation



 **BESSY VSR**
Helmholtz-Zentrum Berlin



sc cw multi cell, high gradient cavities

- short electron pulses
- beating schemes for variable pulses

somewhat uncharted territory / ongoing large effort necessary /
waiting for integration in storage ring and beam tests

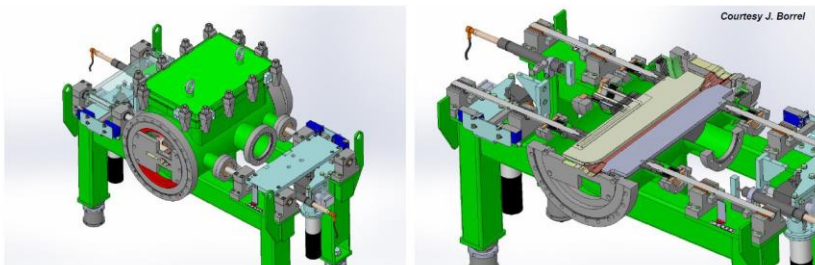
Possible usage in DLSR machines ?

There is a user community asking for high the rep. rate and very stable short pulses (ps) from our storage rings.

III. COLLIMATION SCHEME FOR ESRF-EBS – COLLIMATORS DESIGN

The main challenges for the collimators design concern

- the photon absorber required on the outside jaw (with its cooling system),
- the RF-fingers and tapers at entrance and exit for the chamber transitions,
- the short allocated space (~ 50cm), and the activated environment.



Page 12 ETHLER WORKSHOP - 26-28 October 2016 - R. Versteegen

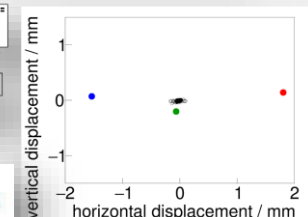
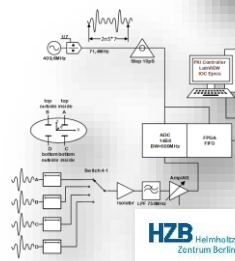
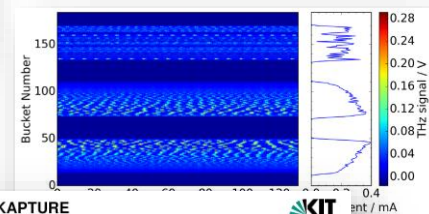
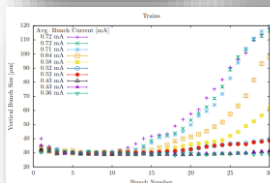
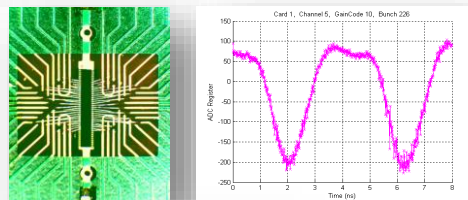
The European Synchrotron ESRF

collimators

- to cope with radiation issues due to beam lifetime in existing enclosures
- reliable, compact design needed
- shielding and activation issues

diagnostics

- Bunch By Bunch (BBB) and Turn By Turn (TBT) data
- position, beam size, length, current, CSR, ...



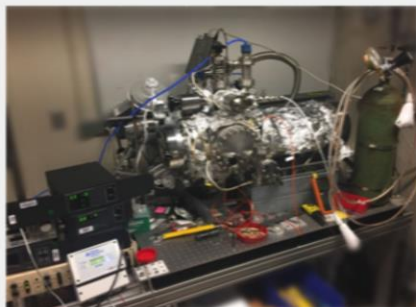
DAQ: KAPTURE

Karlsruhe Pulse Taking and Ultrafast Readout Electronics

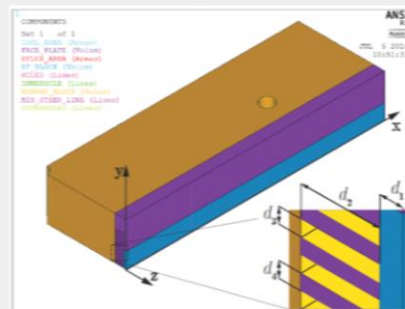
- Simultaneous monitoring of all 184 buckets
- Continuous turn-by-turn read-out of each bucket (500 MHz) → 32 Gb/s
- Four sampling channels with a 12 bit ADC each
- Adjustable delay for each channel in 3 ps steps
- Local sampling rate up to 300 GSa/s
- Alternative: read out multiple detectors simultaneously
- New possibilities in diagnostics

Online monitoring of detector peak height for each bucket at every turn!

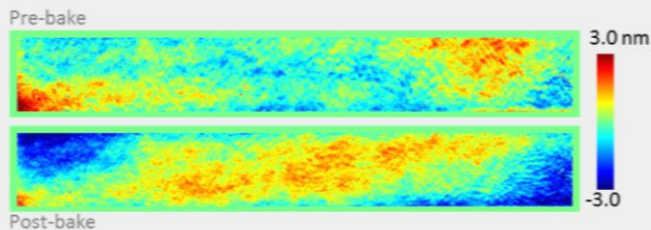
Optics Challenges: ability to preserve coherent wavefront



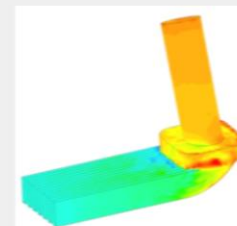
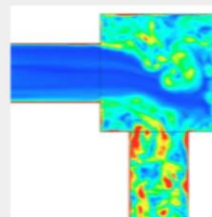
Understanding how to remove/prevent carbon



Understanding the dynamic response of mirrors to changing power density, e.g. ID polarization changing



Si mirror shape changes induced by mirror baking



Water-cooled-mirror fluid dynamics simulations

We must keep an eye on this and push our colleagues to make really the best out of what the new/upgraded machines will deliver!

MAX IV subsystem commissioning

Magnus Sjöström

**From first design, over prototyping, conceptual design, project planning,
implementation phase, commission, operation:**

It is all about the people!

