# Low Emittance Ring Technologies

## Summary

Andreas Jankowiak
Helmholtz-Zentrum Berlin / BESSY

LER 2016
SOLEIL
26.-28.10.16

# Menu

## 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

# Main topics

**Relation to industry (ALERT2016 workshop)**
(R&D collaboration, technology transfer, spin-off, …)

**Injection technology**
(kickers, pulser, septa)

**Magnets of all kinds**
(resisitive, 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

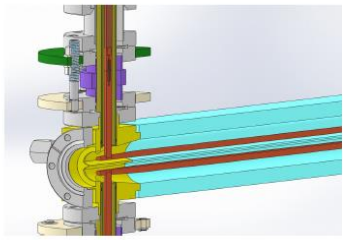
## Development of Stripline kicker[1]

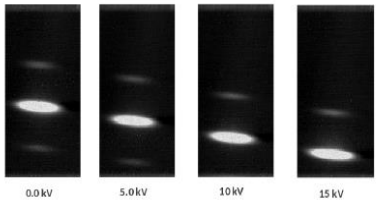
**APS-U**

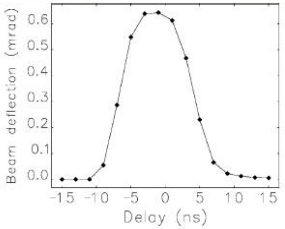
- 9 mm minimum gap; 1 mrad/m normalized kick angle
- 0.72 mrad @0.72 m
- Prototype installed to APS BTX line: 0.77 mrad at 15 kV; run up to 20 kV.

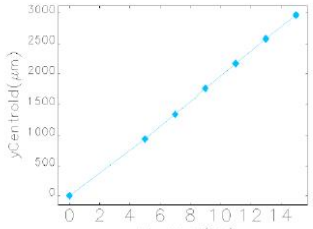
1: C. Yao et al., WEPOB24, NAPAC 2016

Courtesy of C. Yao





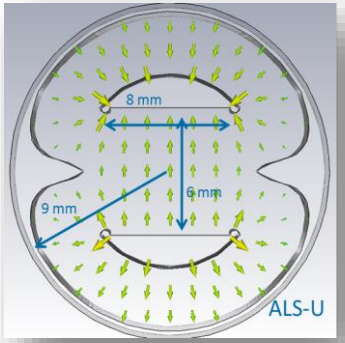

14

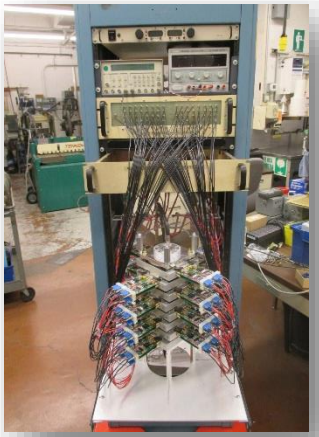
**Fast (ns) strip line kickers and pulser for swap-out injection and …**

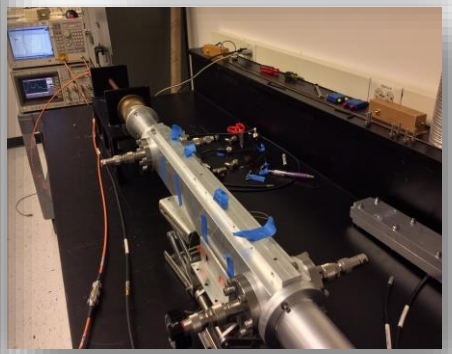
**- stability, reliability, …**

**- beam tests ongoing**

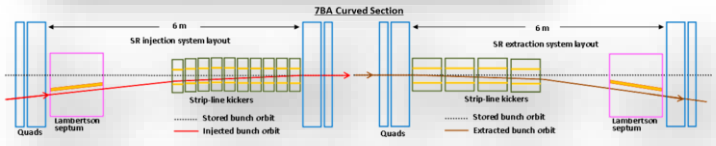
ALS-U

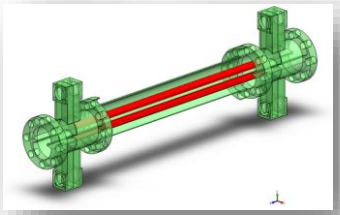


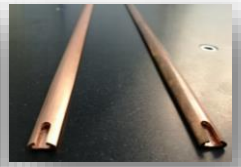





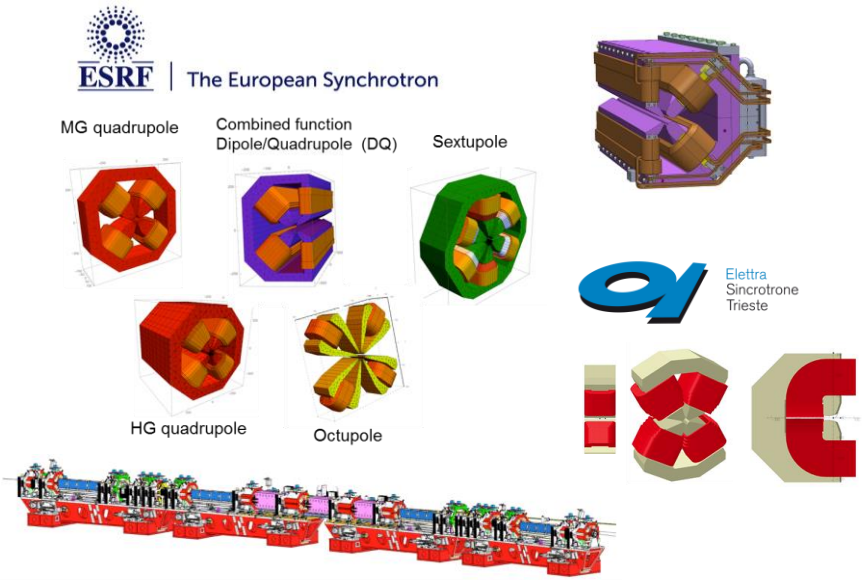
中国科学院高能物理研究所
Institute of High Energy Physics
Chinese Academy of Sciences





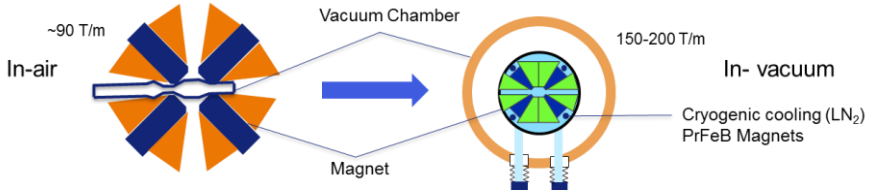
# Magnets I




## resitive magnets of many different kinds

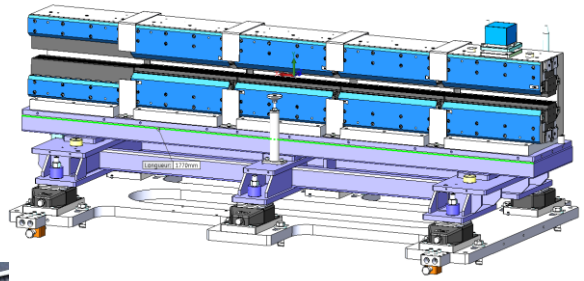
- high gradient, “combined function”, …
- relying on highest manufacturing precision
- precise magnetic field measurement for development work and quality control

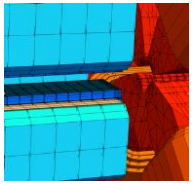
- are we at the limit? What next?

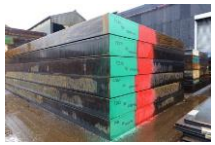


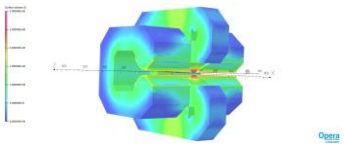

## permanent magnets

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

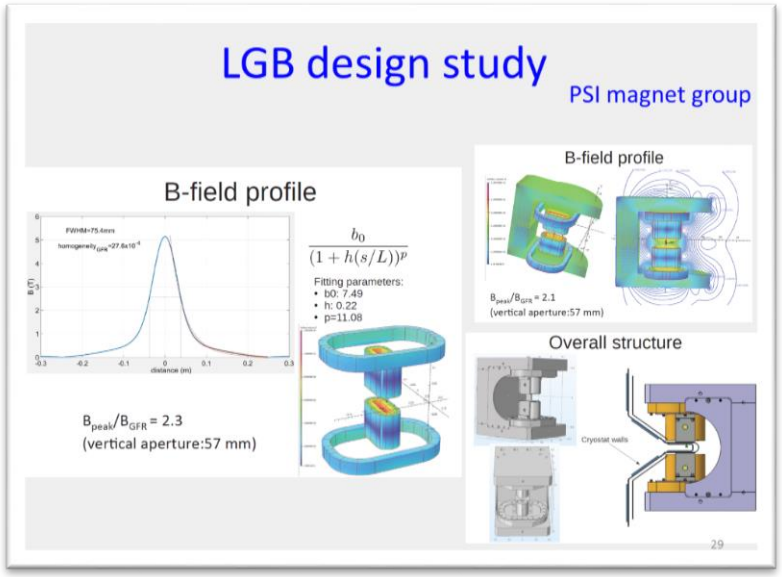








# Magnets II



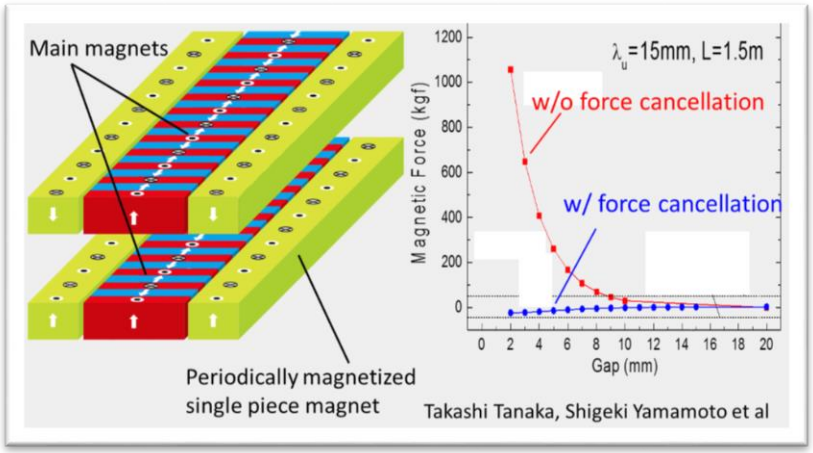

**superconducting magnets**

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

**insertion devices**

**- force free P.M. IDs**

**- fixed gap IDs**



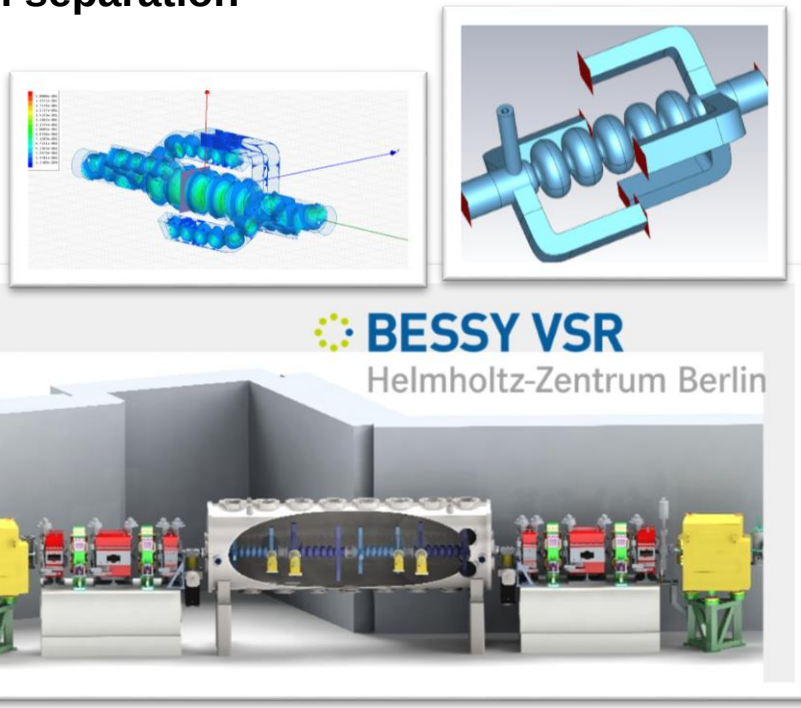

**In general:**

**- 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


**sc / nc. crab cavities**
**- short photon pulses**
**- bunch separation**

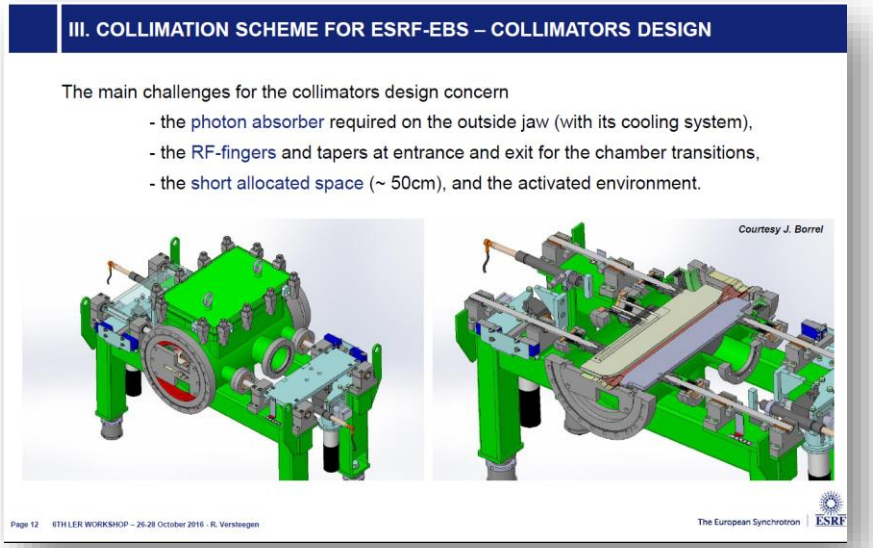



**sc cw multi cell, high gradient cavities**
**- short electron pulses**
**- beating schemes for variable pulses**

**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.**

# Diagnostics / Collimators / …

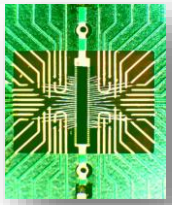


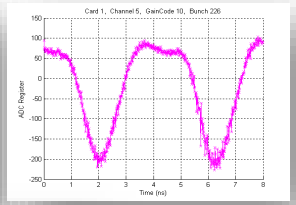

## collimators

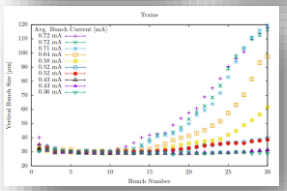
**- to cope with radiation issues due to beam lifetime in existing enclosures**
**- reliable, compact design needed**
**- shielding and activation issues**

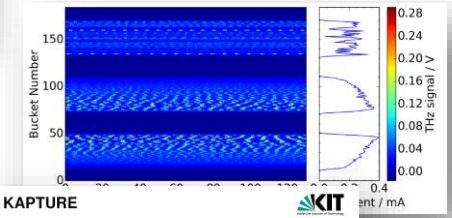
## diagnostics

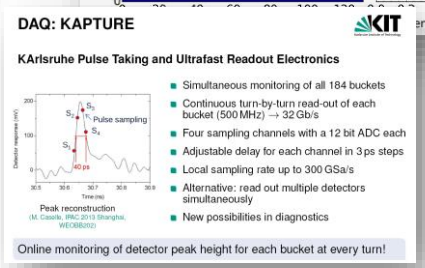
**- Bunch By Bunch (BBB) and Turn By Turn (TBT) data**
**position, beam size, length, current, CSR, …**

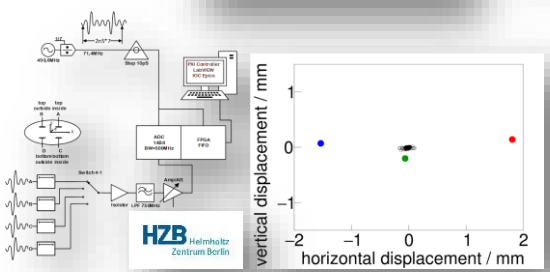






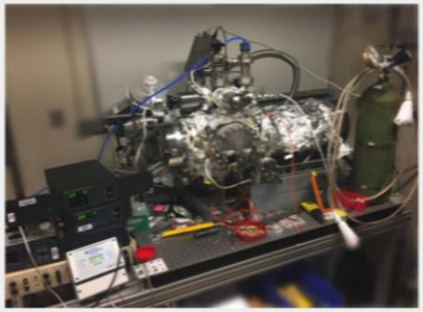


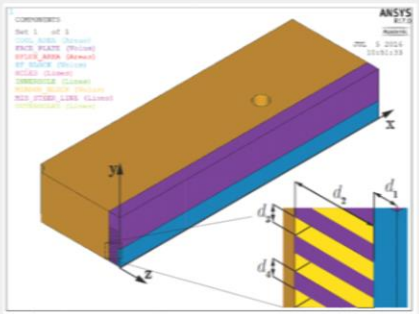



# Not only WE need to develop further

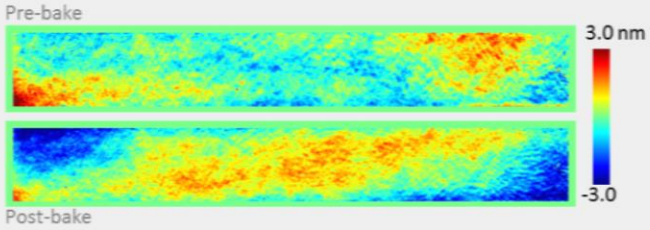
## Optics Challenges: ability to preserve coherent wavefront



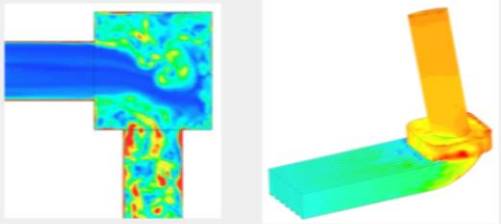
Understanding how to remove/prevent carbon



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!**