Low Emittance Ring Technologies

Summary

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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)

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**
- 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.

*Courtesy of C. Yao*

**APS-U**

Fast (ns) strip line kickers and pulser for swap-out injection and …
- stability, reliability, …
- beam tests ongoing
Magnets I

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

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?
Magnets II

**LGB design study**

**PSI magnet group**

**B-field profile**

- $B_{\text{peak}}/B_{\text{surf}} = 2.3$
- (vertical aperture: 57 mm)

**Overall structure**

**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?

**superconducting magnets**
- E.g. longitudinal gradient dipole with up to 6T

**insertion devices**
- Force free P.M. IDs
- Fixed gap IDs

**Graph:**

- Magnetic force vs. gap
- $\lambda_u = 15 \text{mm}, L = 1.5 \text{m}$
- W/o force cancellation
- W/ force cancellation
Cavities – Harmonic cavities and others

**S-band Crab cavities**

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

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

**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!