BESSY VSR - WORKSHOP
"THE VARIABLE PULSE LENGTH SYNCHROTRON RADIATION SOURCE"

Berlin, 14 – 15 October 2013

Summary and recommendations from BESSY VSR-Workshop as defined in the plenary discussion and the closed discussion of the speakers

Prof. Dr. Majed Chergui, EPFL Lausanne; Dr. Linda Young, Argonne National Lab Chicago; Prof. Dr. Nils Huse, CFEL Hamburg; Prof. Dr. Simone Techert DESY, MPIbpC, Uni Göttingen; Prof. Dr. Wilfried Wurth, Uni Hamburg, Vorsitzender KFS; Prof. Dr. Nils Martensson, Uni Uppsala; Prof. Dr. Svante Svensson, Uni Uppsala; Prof. Dr. Claus M. Schneider FZJ; Prof. Dr. Alexander Föhlisch, HZB, Uni Potsdam; Prof. Dr. Andreas Jankowiak, HZB, HU Berlin; Prof. Dr. Hermann Dürr, SLAC Stanford; Prof. Dr. Stefan Eisebitt, TU Berlin; Prof. Dr. James Safranek, SLAC Stanford; Prof. Dr. Martin Weinelt, FU Berlin; Prof. Dr. Johan van Tol, Florida State NHMFL Tallahassee; Prof. Dr. Matias Bargheer, Uni Potsdam

The BESSYVSR users workshop took place as a two day meeting with more than 100 registered participants from 31 institutions from Germany, Switzerland, Sweden, Russia, USA, and other countries.

The panel ENDORSES:

- BESSY ^{VSR} as a science driven instrument that fills with its interlaced ps and sub-picosecond pulses that users can chose at will, with moderate peak brilliance and average brilliance comparable to 3rd Generation Synchrotron Radiation a crucial gap in the temporal dimension for the following research fields and methodological approaches:
  - Chemical dynamics, catalysis and structural dynamics for, e.g., basic energy science.
  - Control and switching of quantum materials, creation of transient and driven states, for, e.g., future information technology.
  - Electronic Structure and structural dynamics determination by imaging and spectroscopy with electrons as well as absorption and coincident probes.

The panel RECOMMENDS to consider in the BESSY ^{VSR} implementation the following aspects:

- To preserve the apparent source size of BESSY VSR (emittance) at the 5 nm mrad level of BESSY II.
- To store 300 mA beam or higher to ensure a high average brilliance
- To operate in a (ideally symmetric) hybrid fill pattern with few single bunches, each within a 100ns gap, interlaced to the multibunch buckets for average brilliance.
  - For three hybrid bunches an ideal situation could be:
    a) One short bunch (few hundred fs with reduced charge)
    b) one ps-bunch with increased charge
    c) one long bunch with highest charge.
  - These hybrid bunches within the gaps should ideally be resonantly kicked onto a distorted orbit for angular separation from the average brilliance bunches.
  - Additional compressed short bunches should be filled between the long bunches of the multibunch train on the multibunch orbit. Additional bunches allow for high repetition rate experiments and FIR/THz generation Some of these (4- max 20 bunches) are compressed and at high charge to boost slicing fluence by more than one order of magnitude towards109 phot/sec.
- To maintain Top-up capabilities for all or most buckets in storage ring operation

The panel ENCOURAGES:

- To finalize the machine design and parameter space accessible by BESSYVSR along the outlined parameter space, and implement BESSYVSR speedily.
- To clarify potential unique scientific opportunities with FIR/THz radiation generated by BESSYVSR over lab sources.