



MATTER AND TECHNOLOGIES  
ACCELERATOR RESEARCH AND DEVELOPMENT

Joint Technology Developments

Superconducting undulators as commercial product

White paper on THz pump facility @ XFEL: "... only accelerator-based sources provide the wide tunability together with high intensity and repetition rates beyond 100 kHz, that will enable a broad application at European XFEL on the most interesting scientific problems in the field ...."

EO laser assembly by ST3 researchers from DESY & KIT

DESY/KIT/PSI common development of Electro-Optical bunch Detection (laser, beamline optics, KALYPSO detector)

A superconducting THz undulator for the European XFEL (DESY, HZDR, KIT)

Single shot measurement of a bunch train at XFEL with 1.12 MHz intra-train rate

E-bunch arrival time at XFEL measured with EOD and BAM

High BW pickup for Bunch Arrival-time Monitors (DESY/HZDR/TU Darmstadt) Test as ELBE, installed at FLASH and XFEL

ST3: ps-fs electron and photon beams

Beam dynamics & Photon Sources

Short bunches in linear accelerators

Coh. radiation & high fields in storage rings

Custom beams: bunch shape manipulation

Advanced photon sources development

ps-fs beam diagnostics

Time domain

Frequency domain

Electron beams

Photon beams

Stability, Controls & Synchronization

Synchronization References

RF Controls

Control System Advances

Coherence control

XUV Seeding

Technology transfer & Networking & Test Facilities

MicroTCA.4 based Laser Synchronization and Optical Link Stabilization (70+ units in operation at DESY/KIT/HZDR)

ELBE optical synchronization system, an adapted copy from FLASH (DESY/HZDR)

Combining turn-by-turn THz detection and EO profile measurements for short bunches in storage rings with ST3 technologies: YBCO detectors, EO detection, KAPTURE and KALYPSO.

Ultra-fast YBCO single and multi-pixel THz detectors (UVSOR, DELTA, DIAMOND, SOLEIL, HZB, KIT)

KAPTURE and KALYPSO high throughput DAQ systems for electro-optical and THz diagnostics with up to 500 MHz repetition rate (KIT/DESY/HZDR)

New fast simulation code "Inovesa" for studies of the longitudinal phase space of ultra-short bunches and the micro-bunching instability in storage rings (HZB/KIT)

The 'snapshot method': a new experimental way for extremely fast mapping of short-bunch instabilities in storage rings based on the KAPTURE DAQ system and ultra-fast THz detectors (HZB/KIT).

Pulse-resolved DAQ at quasi-cw SRF driven photon sources tested at quasi-cw TELBE test facility: already implemented in user operation at TELBE & THz-FLASH demonstrator for XFEL under development (EUCALL)

Unified Control Software Development

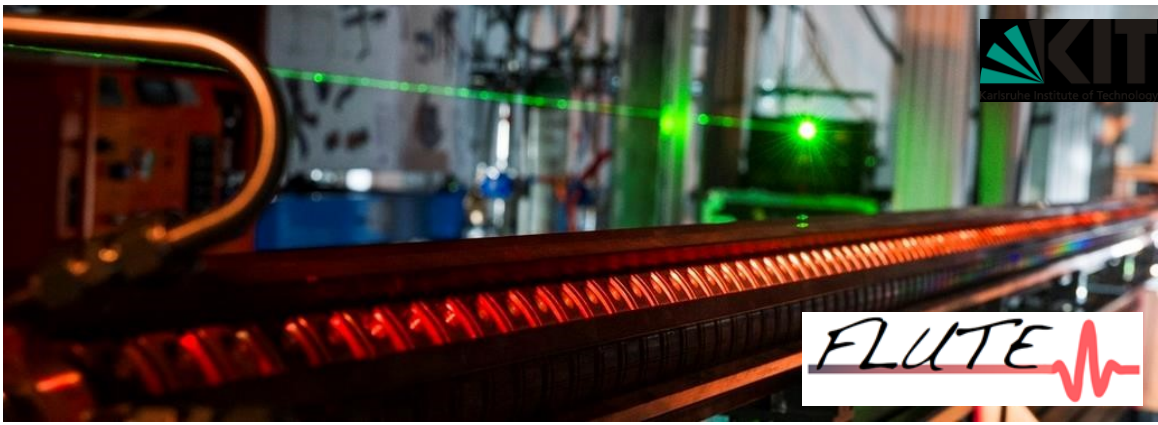
Increasing work needed for software and automation. ChimeraTK allows reusability in different facilities (DESY/KIT/HZDR)

Accelerator Test Facilities

- Advantage: access to test facilities covering a broad range of beam parameters and benchmarking possibilities
- Complementary infrastructures
- Preparing the technology for next-generation accelerators

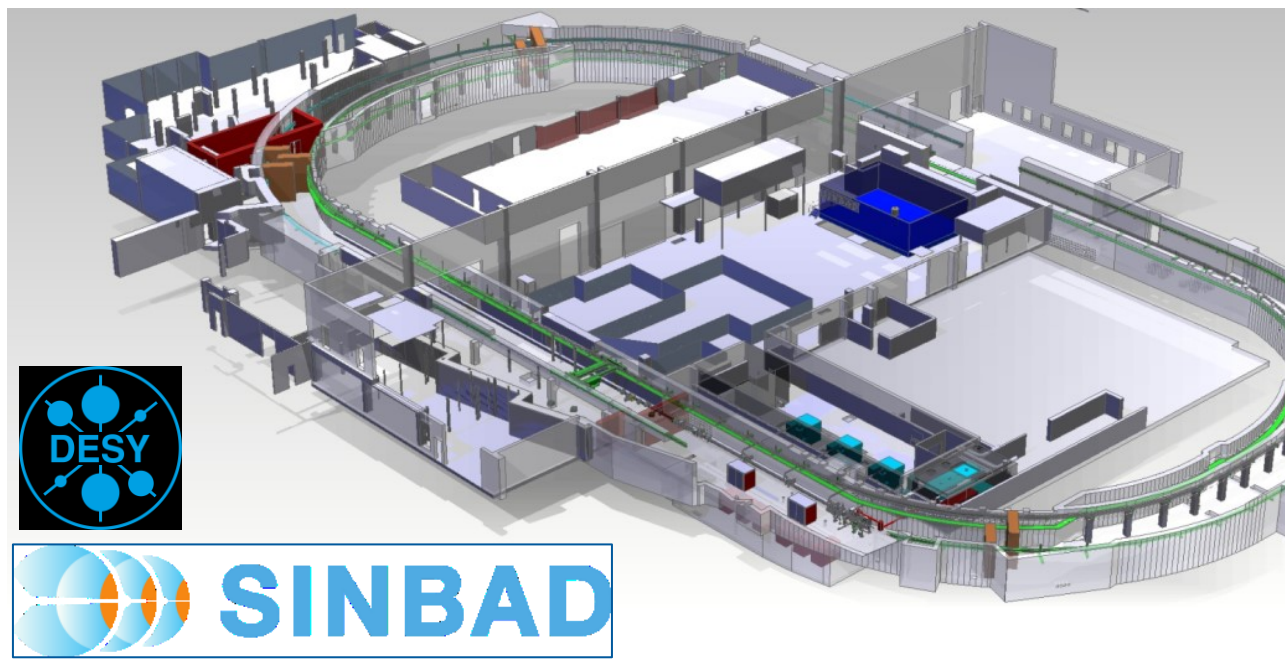


TELBE: quasi-cw instrumentation with high data throughput acts as lighthouse for future quasi-cw upgrades (e.g. XFEL)

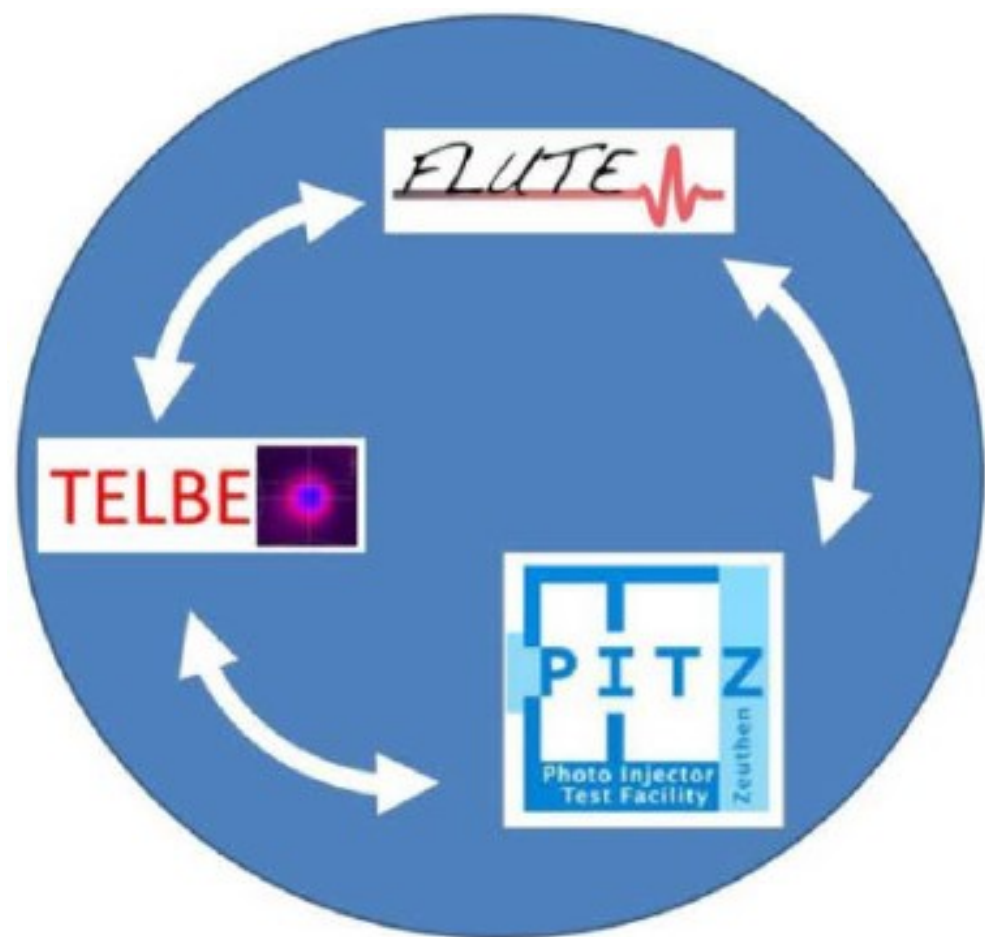


FLUTE: development and testing of ultra-short bunch diagnostics with large dynamic range

SINBAD: Linac for novel acceleration research (LPWA, THz acceleration, Accelerator o a chip) and the development of accelerator technologies.



KARA storage ring: highest repetition rates and radiation source tests



PITZ: understanding and control of longitudinal and transverse phase space

Networking Activities & Know-how Transfer & Education



2012 – 2017	Annual Meetings	Location	# P.
2012, Aug 21-22	1 <sup>st</sup> ARD-ST3 Annual Meeting	DESY/Hamburg	50
2014, Feb 26-27	2 <sup>nd</sup> ARD-ST3 Annual Meeting	HZDR	53
2015, Jul 15-17	3 <sup>rd</sup> ARD-ST3 Annual Meeting	KIT	63
2016, Jul 13-15	4 <sup>th</sup> ARD-ST3 Annual Meeting	HZB	58
2017, Jul 19-21	5 <sup>th</sup> ARD-ST3 Annual Meeting	DESY/Zeuthen	75
2018, Jul	6 <sup>th</sup> ARD-ST3 Annual Meeting	HZDR	

Topical Workshops within the Network:

On Longitudinal Diagnostics for FELs (at PSI, DESY, KIT, STFC)

On ChimeraTK software (at DESY, KIT, HZDR, HZB)

On SRF controls and CW operation (at HZDR)

On MicroTCA.4 (at DESY)

PhD and Master Theses within the Network:

Dr. Nicole Hiller 2013 at KIT with work at DESY and PSI

Tobias Götsch 2013 at KIT with work at HZB

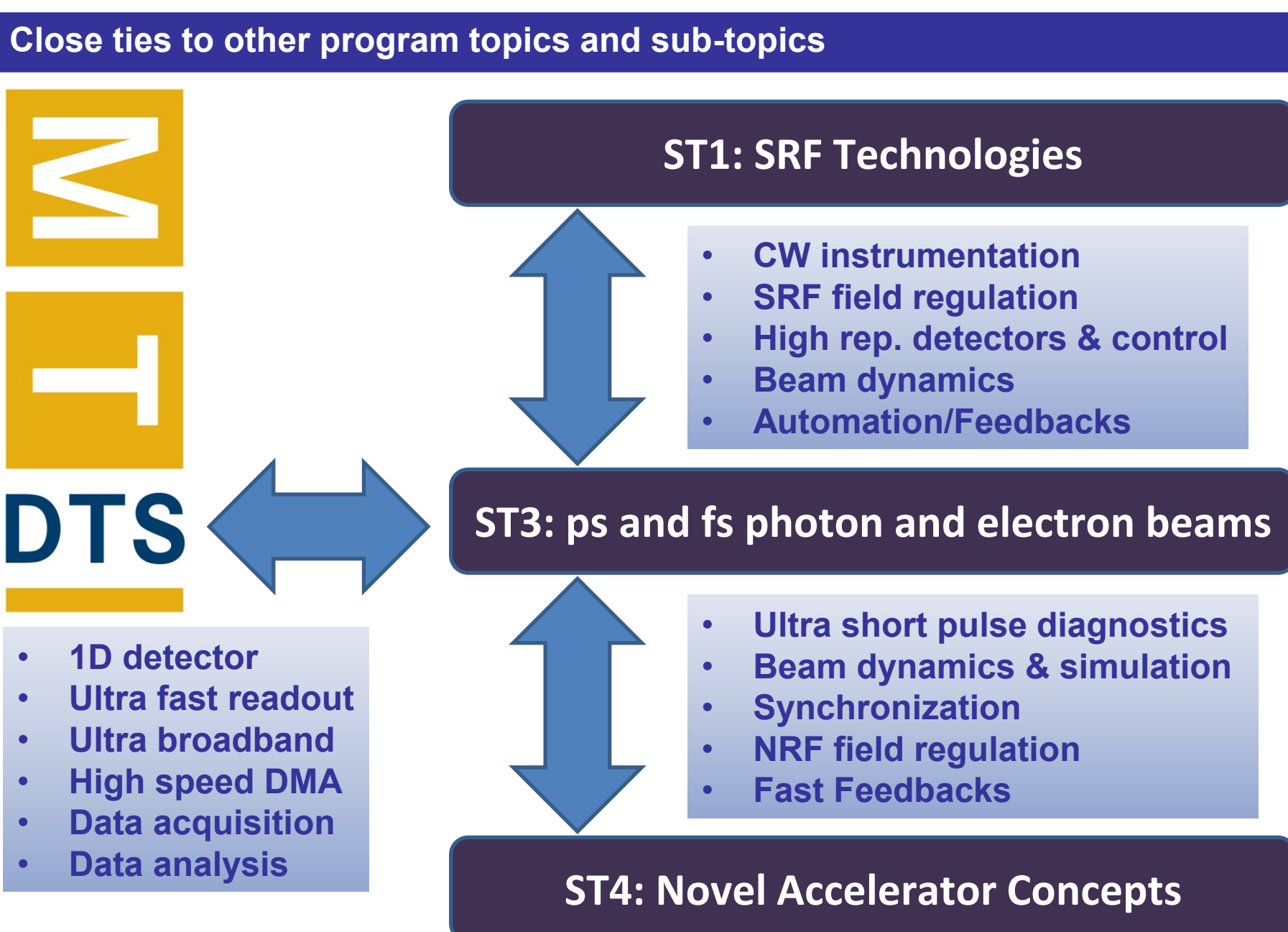
Dr. Michael Kuntzsch 2015 at Uni Dresden with work at HZDR and DESY

Dr. Igor Rutkowski 2015 at Uni Warsaw with work at DESY and HZDR

Maciej Grzegorzka 2015 at Uni Warsaw with work at DESY and HZDR

Dr. Bertram Green 2017 at KIT with work at HZDR

PhD: Adrii Borysenko 2018 at KIT with work at DESY



HELMHOLTZ  
RESEARCH FOR GRAND CHALLENGES