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Discussion of suitable diagnostic components for the cSTART project

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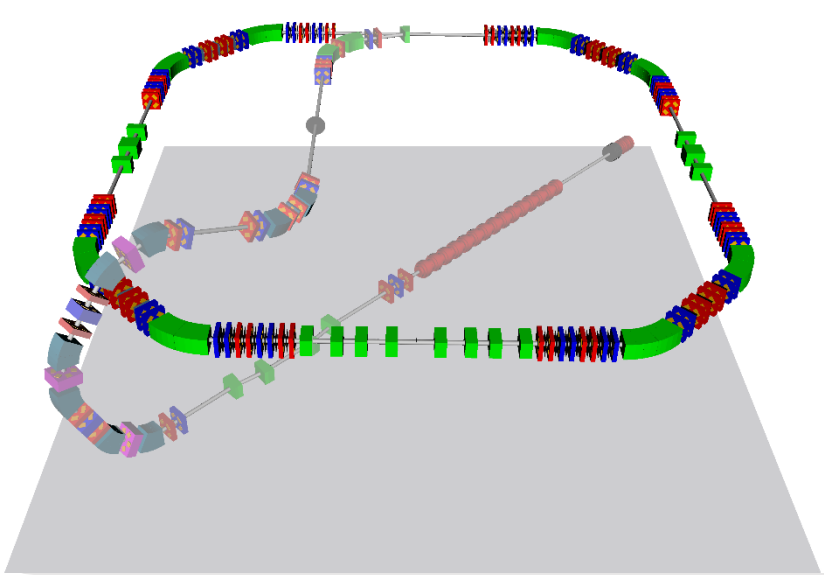
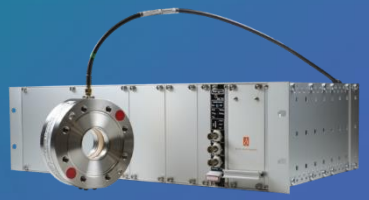
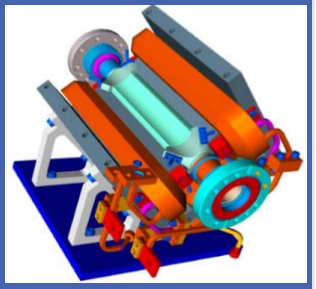




Bergoz Instrumentation

F. Marcellini et al., proceedings of IBIC 2012, TUPA24



D. Noelle et al., proceedings of LINAC 2004, TUP69

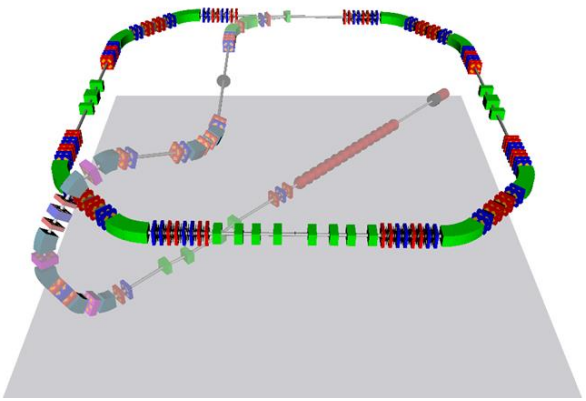
What is cSTART project?

(M. Schuh´s presentation: Status of KIT test facilities and outlook)

- Lattice design of the VLA-cSR (Very Large Acceptance compact Storage Ring) is based on a FODO cell where magnets are very close to each other

- In total four drifts: One for injection, one for physics experiments and two for beam diagnostics

- **Parameters of the VLA-cSR:**



Circumference (m)	44.112
Energy (MeV)	50 (– 500)
Filling pattern	single bunch
Bunch charge	20 – 200 pC up to 1 nC
Bunch length (fs)	down to 20
Revolution frequency (MHz)	6.8

Very senstive, high dynamic range beam diagnostics

Fast readout electronics

Aims and Requirements:

- Commissioning aim: Store the beam for about 1000 turns in the VLA-cSR
- Requirement: A turn-by-turn orbit feedback system with a beam position precision of at least 100 µm
- The beam diagnostic studied so far are beam position monitors (BPM), current monitors (CM), longitudinal profile monitors (LPM) and beam loss monitors (BLM)
- Few of them are being used and tested at IBPT´s facilities (KARA, FLUTE)

ICT: Integrated Current Transformer SRR: Split Ring Resonator
EOSD: Electro Optical Spectral Decoding

Beam diagnostics	BPM	CM	LPM	BLM
Comparison	**Button** ✗ (signal deformation with short bunches) **Cavity** MAYBE (repetition rates?, space limitation) **Stripline** ✓ (insertion inside quadrupoles, and could be used as combined function as a position monitor and a kicker)	**Turbo-ICT** ✗ (limited to rep rates of 2 MHz due to its readout electronics BCM-RF-E) MAYBE (a slight development might be possible to cope with 6.8 MHz) **ICT** ✓ MAYBE (faster than turbo-ICT at 6.8 MHz but maybe noisy especially at low bunch current)	**Streak camera** ✗ (bad resolution 1 ps) MAYBE (as an input to a feedback system to correct for possible coherent bunch oscillations) **SRR** ✗ (destructive method, limited by very small beam sizes though could provide resolutions better than 20 fs) **EOSD** ✓ (promising method, near field and far field approaches, 50 fs resolution)	**Scintillators** ✓ (small sizes, flexible positioning, on the fly beam loss feedback) **Optical fiber.** MAYBE (very precise information on the loss position, installed overall the ring, need to study the secondary particles energies)

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Many thanks for your attention