

# Diagnosics Overview SwissFEL Injector

# Diagnostics Overview SwissFEL Injector

- > Diagnostics by Purpose
  - > Commissioning
  - > Operation / Feedbacks
  - > Beam Parameter Changes (on User Request)
  - > Troubleshooting
  
- > Diagnostics by Type
  - > Transverse Position
  - > Transverse Profile
  - > Longitudinal Position
  - > Longitudinal Profile
  
- > Measurement Infrastructure

# Diagnostics for Commissioning

- > Must be operational as early as possible
  - > Externally calibrated monitors (WCM, ICT, SCR) available on Day 1
  - > Some monitors require beam for calibration (BPMs)
- > Enable first beam through machine
- > Find errors in beamline
- > Optics matching
- > Demonstrate beam parameters (charge, emittance, bunch length) required for SASE

# Diagnostics for Operation

- > Monitor accelerator operation
- > Source for feedbacks
- > Reliable, hands-off operation

# Diagnostics for Beam Parameter Changes

- > On user request: change
  - > Bunch charge
  - > Bunch length
  - > Beam energy
- > After every parameter change, tune:
  - > Emittance
  - > Bunch length

# Diagnostics for Troubleshooting

- > Primarily during initial commissioning
- > Also helpful later during operation

# Diagnostics by Type

- > Charge
  - > Wall Current Monitor
  - > Differential Integrating Current Transformer
  - > Cavity Beam Position Monitor
- > Transverse Position
  - > Cavity Beam Position Monitor
- > Transverse Profile
  - > Screen Monitor (OTR / Scintillator)
  - > Optical Synchrotron Radiation Monitor
  - > Wire Scanner
- > Longitudinal Position (Arrival Time)
  - > Bunch Arrival Monitor
  - > Wall Current Monitor
- > Longitudinal Profile
  - > Transverse Deflecting RF Structure
  - > Multi-Color Bunching Monitor (CSR / CDR)

# Differences to Injector Test Facility

- > Replace scopes and PCs for data acquisition by FPGA systems as much as possible:
  - > Most monitors will operate at 100 Hz \*
  - > Most monitors will support beam synchronous data acquisition \*
  - > Most monitors will be able to provide data to the feedback system \*
- > Some monitors will be able to distinguish the two bunches
- > Additional monitors
  - > Loss monitors
  - > Laser heater overlap monitors (longitudinal / transverse)
- > Suppressed monitors
  - > Electro-optical monitors
  - > All wall current monitors except the first
  - > OTR in bunch compressor
  - > Series of screens in FODO section
  - > All wire scanners except two

\* with the exception of a few transverse profile monitors that will be equipped with inexpensive cameras for “just looking”



# Task Distribution

- > Project
  - > Define requirements
  - > Agree with GFA management on task distribution
  - > Provide resources as agreed with GFA management
- > Diagnostics Section
  - > Propose technical solution
  - > Present technical solution in a review
  - > Oversee fabrication, installation and component commissioning
  - > Provide expert applications
- > Controls
  - > Provide controls infrastructure
  - > Provide Epics servers
- > Beam Dynamics / Commissioning / Operation Group
  - > Oversee system acceptance test for every component
  - > Commissioning with beam
  - > Provide beam dynamics applications

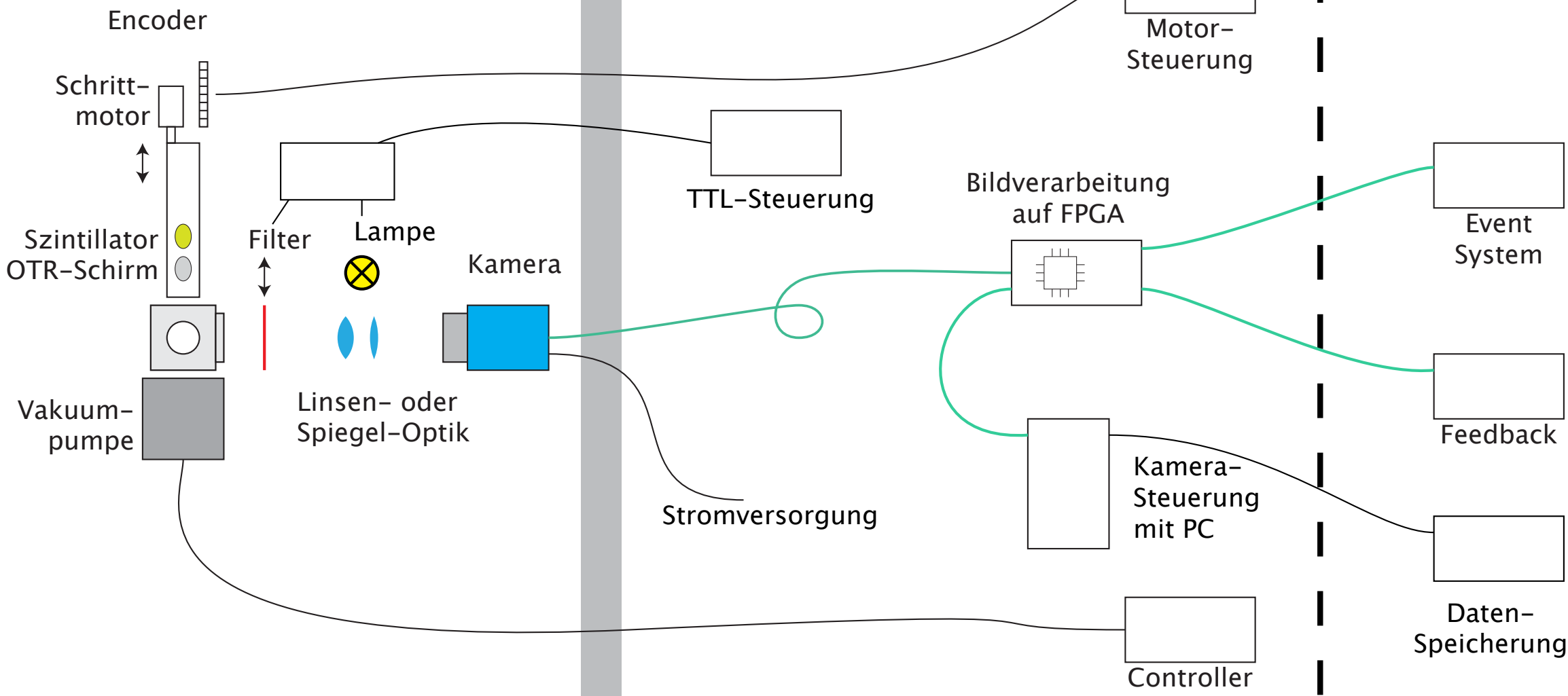
# Infrastruktur

DSCR Schirmmonitor

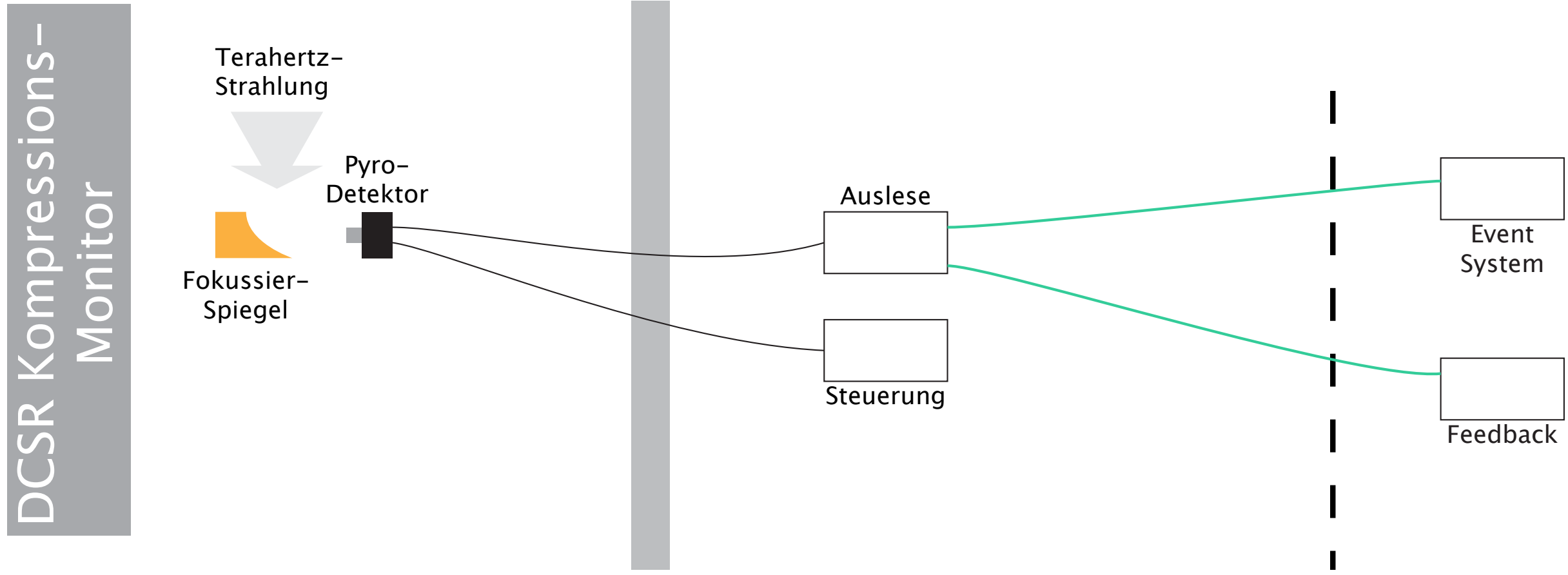
## Strahlengang

## Technische Galerie

## Zentrale Infrastruktur

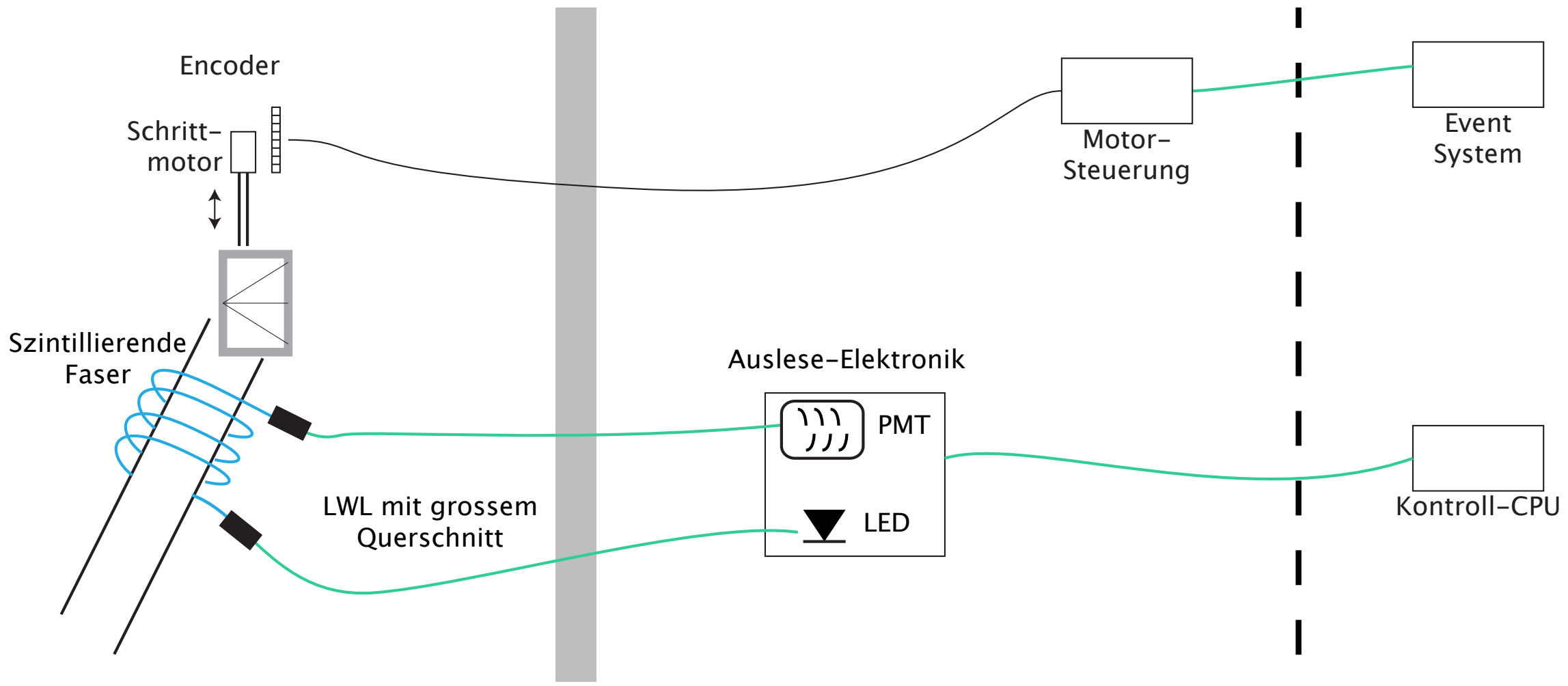


# Infrastructure



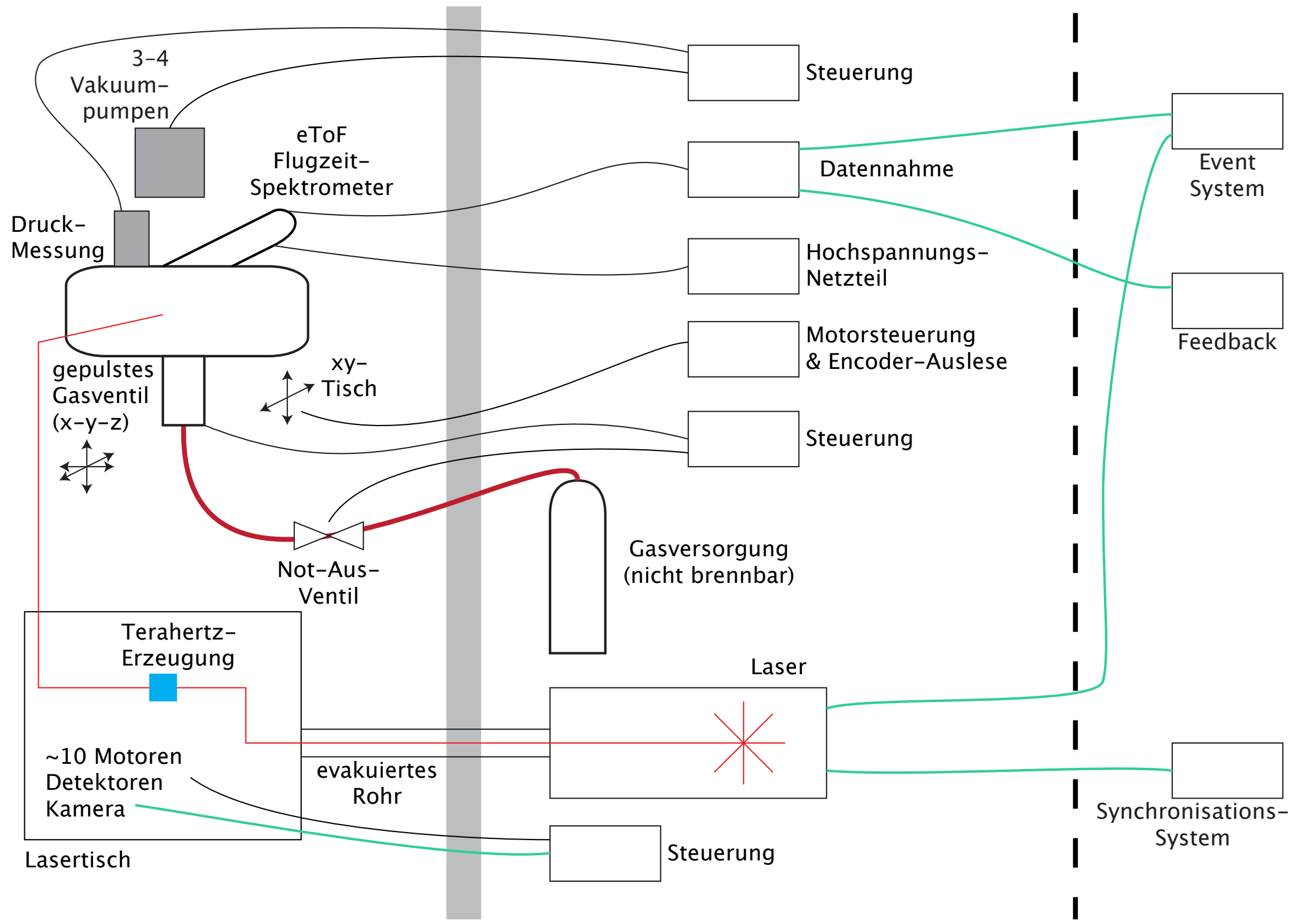
# Infrastructure

DWSC Draht-Scanner

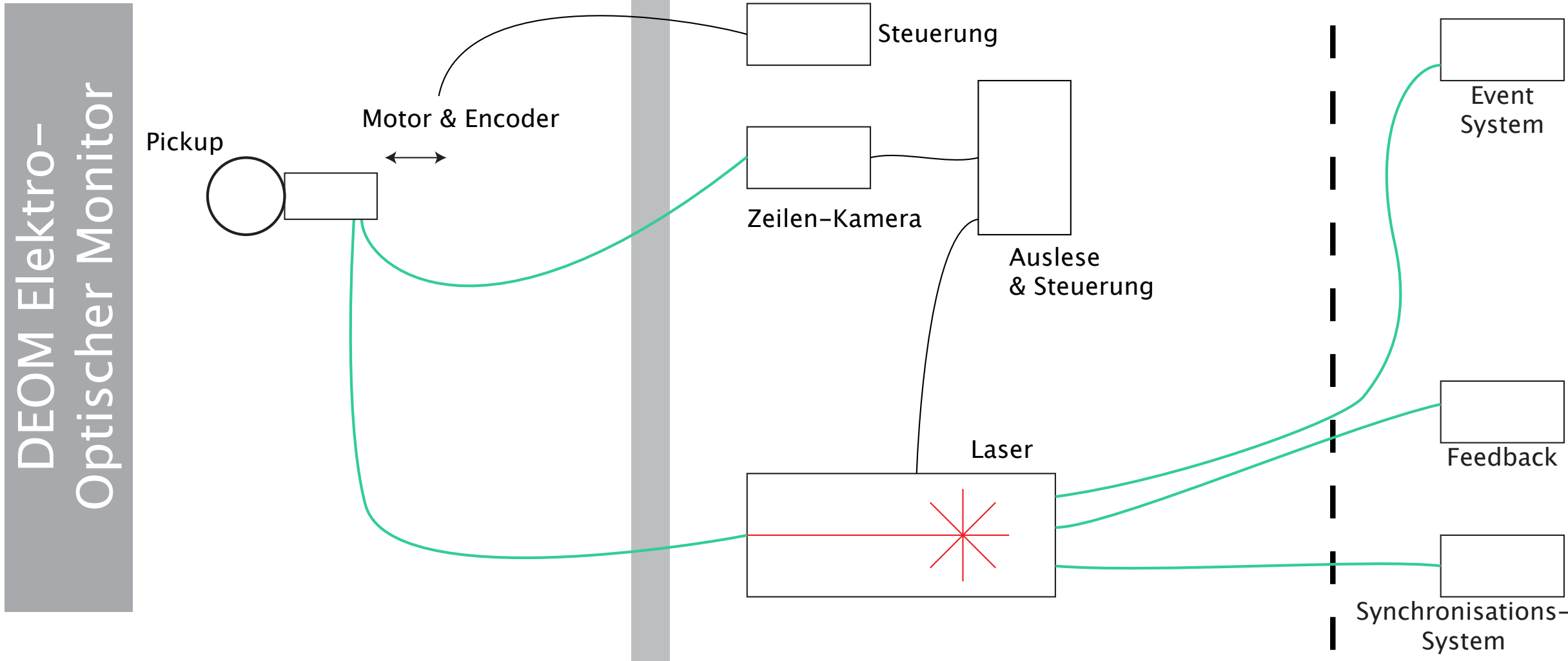


# Infrastructure

## DTSC Terahertz Streak Camera

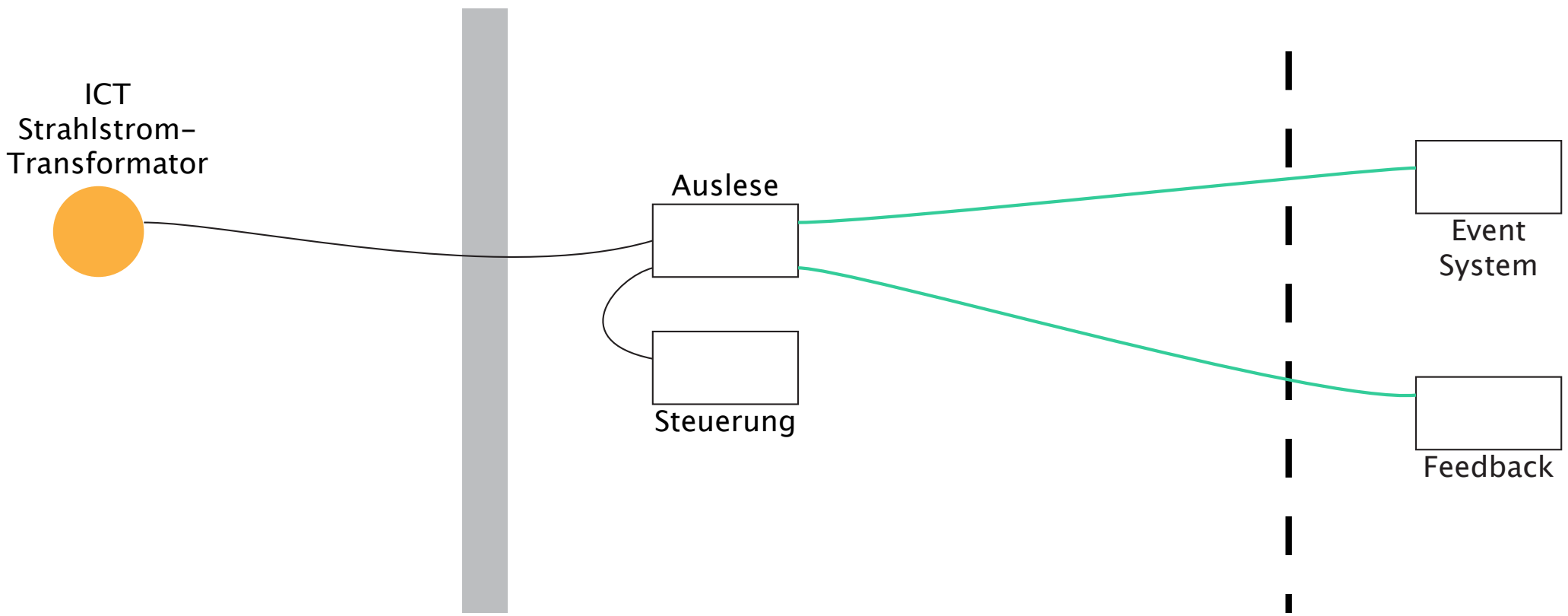


# Infrastructure



# Infrastructure

DICT Strommonitor



# Comments

- > Slit is before screen in SIND100
- > BPM in low-energy spectrometer
- > 2 BPMs in LH
- > Screen after first S-band cavity in booster
- > BPM between X-band cavities
- > Wire scanner directly after spectrometer dipole
- > Faraday cup?
- > Wall current monitor after bunch compressor