TUPD24

INSTALLATION OF A BEAM LOSS MONITORING SYSTEM AT THE S-DALINAC*

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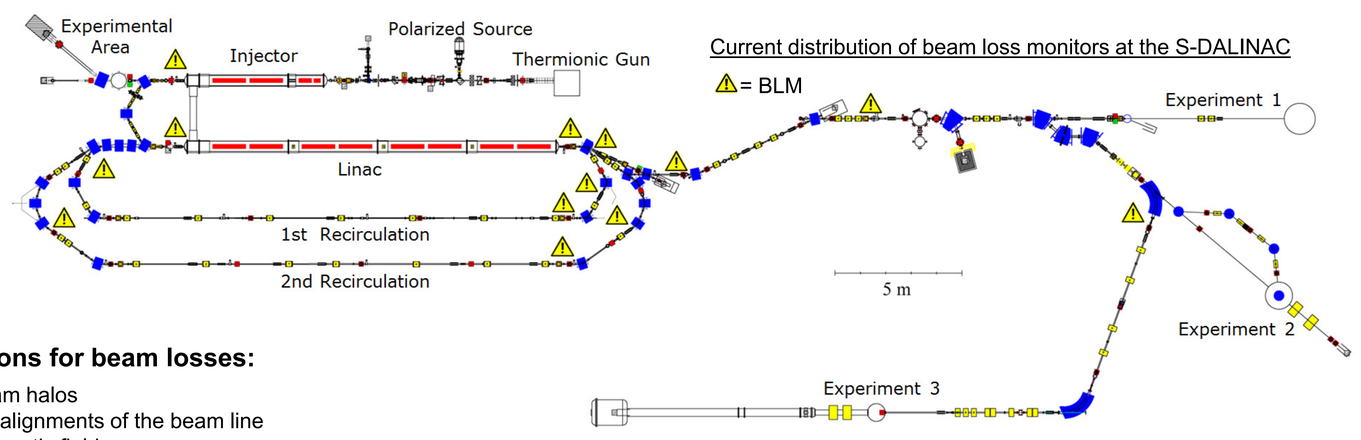
S-DALINAC

Temperature:	2 K	Design energy:	130 MeV
Frequency:	2.997 GHz	Design energy (injector):	10 MeV
Duty cycle:	cw	Max. beam current:	60 µA

Beam loss monitoring system at the S-DALINAC



Reasons for beam losses:

- beam halos
- misalignments of the beam line
- magnetic field errors
- jitters from RF-system

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- part of the beam can be lost in the walls of the vacuum chamber
- secondary radiation is produced

Special requirements for beam loss monitors:

- sensitive for (secondary) electrons
- high radiation hardness
- easy mounting
- compact design

In addition:

- providing short-time readout for direct feedback
- integration into the EPICS-based accelerator control system

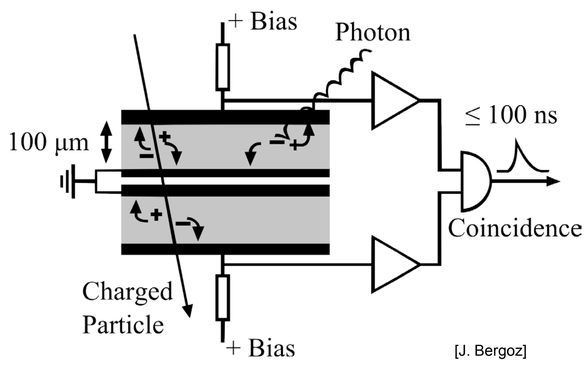
Beam Loss Monitor

Beam Loss Monitor by bergoz

- originally designed and implemented by K. Wittenburg at HERA
- further developed and actually manufactured and distributed by bergoz

Operating Principle:

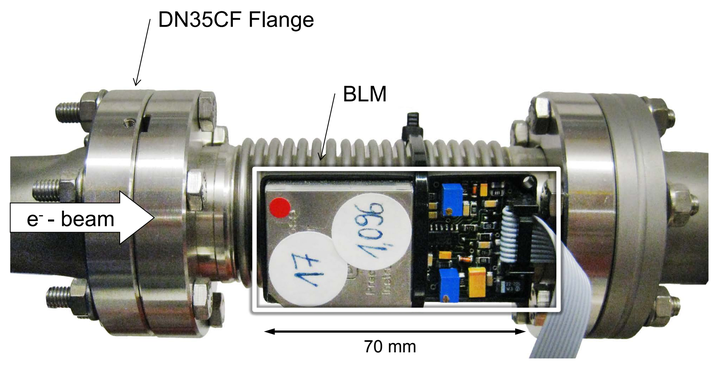
- based on a coincidence setup of two PIN-photodiodes
- both reverse biased at + 24 V
- ionizing particles interacting with both diodes within the coincidence interval will create an event
- the concidence setup suppresses events caused by dark current in the diodes
- also events caused by single photons e.g. synchrotron radiation are suppressed



[J. Bergoz]

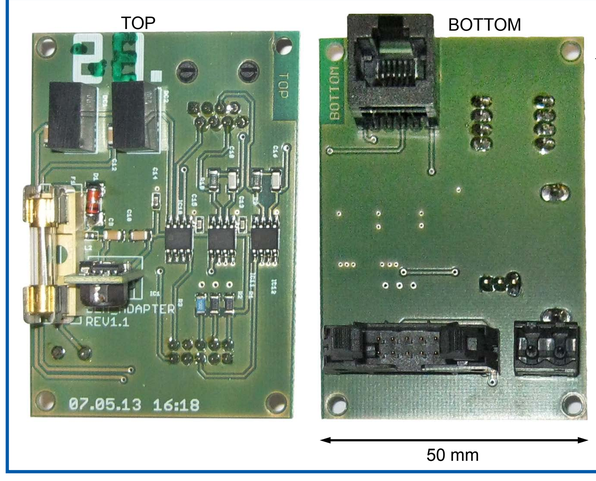
Properties [1]:

- sensitivity: ~ 50 nC / rad / cm²
- efficiency: > 30 %
- radiation hardness: up to 10^8 rad
- maximum count rate: 10 MHz
- output: positive TTL pulse
- required voltage supply: + 5 V, - 5 V, +24 V
- size: 69 x 34 x 18 mm
- PIN-diodes: BPW34



[1] Beam Loss Monitor User's Manual, Bergoz Instrumentation, February 2001

In-house developed electronics

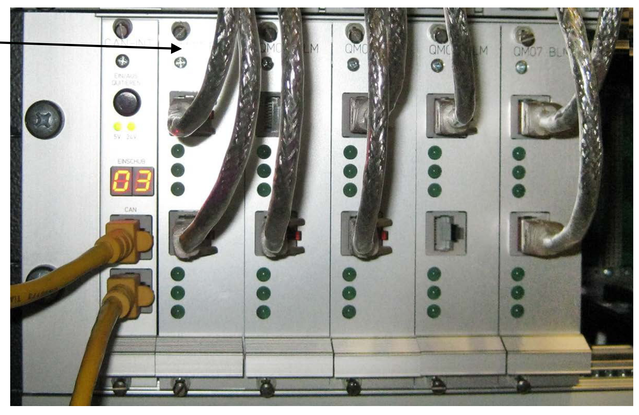


Power supply including differential line-drivers:

- voltage supply: 12 V to 36 V → + 5 V, - 5 V, + 24 V
- one unit per BLM
- max. distance from BLM 5 m
- connection to BLM: 10-pin, ribbon cable
- maximum driven rate: 20 MHz
- signal transport towards counting card: Cat5 twisted-pair

Fast counting cards:

- compatible to existing in-house developed QM07 multipurpose-measurement system
- EPICS IOC compatible
- each card provides two input channels
- flashing LEDs on front panel indicate actual counting rate
- longest readout interval: 1/7 s

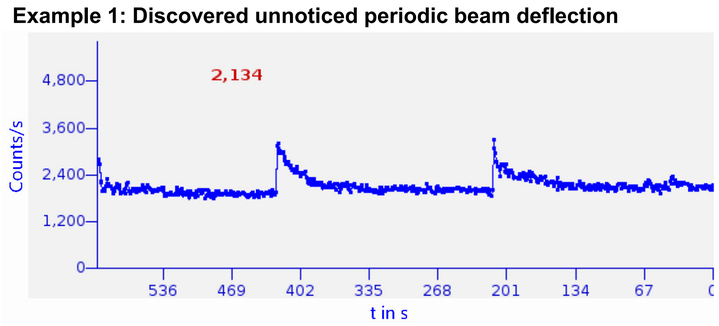


Commissioning and future plans

The Beam Loss Monitoring System:

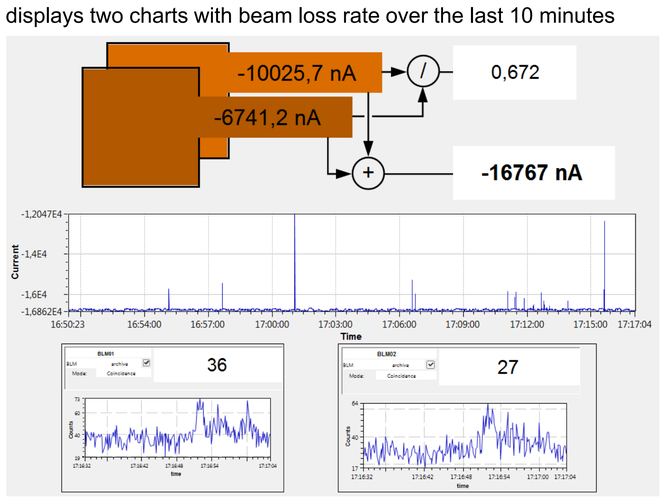
- high reliability, no failure within two years
- high flexibility:
  - changing monitored positions within few minutes
- manifold benefits:
  - short-time response
  - integration into EPICS-based control system
  - easy machine protection
  - improved beam tuning

Example 1: Discovered unnoticed periodic beam deflection



Example 2: Customized operator interface including beam current and beam loss rate

- customized window for Nuclear Resonance Fluorescence experiments (injector only)
  - contains two values for the beam current (two radiation production target sheets)
  - displays a chart for the total beam current over the last 30 minutes
  - includes beam loss rate behind the injector cryostat
  - displays two charts with beam loss rate over the last 10 minutes



Future plans:

- expanding the system, including beam loss monitors along the injector beamline
- optimizing the monitored positions

Beam break up investigations:

- beam break up also observed at the S-DALINAC
- allready occurs at low threshold currents of some µA

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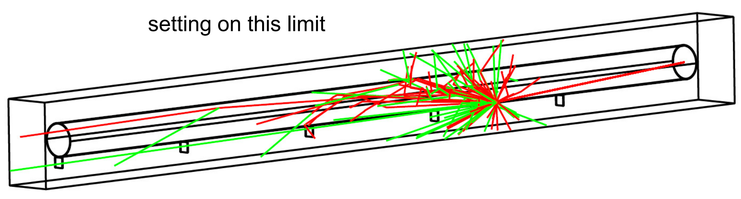
- several methods to counteract the BBU will be investigated to gain information for future high current ERLs
- beam loss monitoring system will indicate the BBU limit and therefore it helps to show the effect of each setting on this limit



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