Abstract
The Beam Induced Fluorescence Monitor was developed as a non-intercepting optical measurement device, dedicated for transverse beam profile monitoring at high current operation at the GSI Heavy Ion Linear Accelerator UNILAC. Nowadays, BIF monitors are installed at four different locations and handed over to the operating team as a standard diagnostic tool.

BIF Signal Control
The signal strength and the profile quality obtained by the BIF monitor depend on many factors. Thus, for an optimized signal the profiles have to be evaluated from case to case and settings have to be adopted. Remote controllable parameters are:

- Control of the iris
- Gain of the MCP and the phosphor screen
- Gas pressure

The slow control voltages are applied by a Siemens PLC driven DAC (SM332: 12 bit/4 analogue outputs). Additionally, a relay (SM322: 8 digital outputs) is used for remote power control of all electronics near the beam line.

BIF Usage
For operating of the BIF monitors, the new software ‘ProfileView’ was designed. It automatically controls the camera communication, timing, slow controls and gas pressure and shows profiles, images and calculations in a GUI.

ProfileView ‘User Mode’
- Easy-to-use mode for operation
- Profiles of up to three BIF monitors
- Nitrogen pressure as a free control parameter for adjustment of the signal strength
- All other settings are pre-defined
- Save profiles option

Profile View ‘Expert Mode’
- For experienced users, debugging and research experiments
- Original images can be displayed and saved
- All remote devices and slow controls can be set manually

Experiences and Results
The standard measurement devices at GSI used for transverse beam profile determination are beam intercepting Secondary Electron Emission grids (SEM). BIF was destined to replace these intercepting diagnostics for high current operation, due to these advantages:

- BIF is a non-intercepting beam diagnostic device
- 100 x 80 mm² field of view at a resolution of ~4.5 pixel/mm
- The full beam pulse can be observed as well as a defined time window of min. 100 ns
- Images can be accumulated and smoothing or binning algorithms can be applied
- No charge changing processes were detected yet
- Particle losses due to the beam-gas interaction are negligible
- Original images can be displayed and saved

As a prove of principle before handover to the operation crew, BIF projections were compared to the profiles simultaneously measured by a SEM grid.

As an example, a single shot BIF image and calculated profiles are shown, taken at UNILAC section UA4 at 11.4 MeV/u of an U²⁺ beam with 4·10¹ⁱ particles per pulse (pp) and 5·10⁻⁶ mbar N₂. The profiles of BIF and SEM grid measurement are compared and show a good agreement.

Conclusion & Outlook
The BIF monitors are working as a reliable diagnostic tool to be used by the operating crew. The functionality has been proved under daily conditions and measured profiles were compared to SEM grid measurements. Further monitors will be installed at GSI UNILAC, also in special areas e.g. at charge separation. At the new FAIR facility, several BIF monitors are foreseen in the HEBT lines.

Y = \frac{q^2}{E_{Kin}} \frac{P_{gas}}{P_{ph}}

Image Intensified Camera System
- Proxiltron BV 2592 BX-V 100N
- Bialkali photocathode with a QE of 15-20% at 390-470 nm
- 2-stage MCP in V-stack assembly, magnification of up to 10²
- P46 phosphor screen with decay time of 300 ns and max. emission at 530 nm
- Taper (25:14) or Relay-coupling (Schneider Componon lens 352.8, mag=n.0.6)
- Firewire CCD, ½’ Sony ICX414 chip, VGA resolution and...