

Non-Invasive Beam Profile: Methods in Evaluation

1. Residual Gas Luminescence
 - Estimated photon count in ESS cryogenic section (without additional gas): $\sim 1/s$
2. Residual Gas Ionization
 - Estimated ion rate $\sim 2000/(s \cdot cm)$
 - Using MCPs limits operational lifetime
 - **Other detectors (wire, silicon strip)**
3. Crossed Particle Beam Interaction
 - **Ageing of electron gun may not be a problem**

Techniques for Main Injector

- Various techniques for measuring deflection
 - Fast scan through peak of bunch (see W. Blokland's SNS talk)
 - Requires fast deflector (< 1 ns sweep time)
 - Slow scan, akin to flying wires (most likely solution in short time frame of Nova)
 - Position the beam and record the maximum deflection as the beam passes by
 - Leave the electron beam stationary
 - Sweep the beam along the proton direction
 - » Obtain longitudinal distribution

Electron-beam scanner experience at ORNL

Electron Scanner progress:

Verified with wirescanner and position measurements

Improvements made:

Scan range, cathode current, cameras, analysis, magnetic shielding

Future plans:

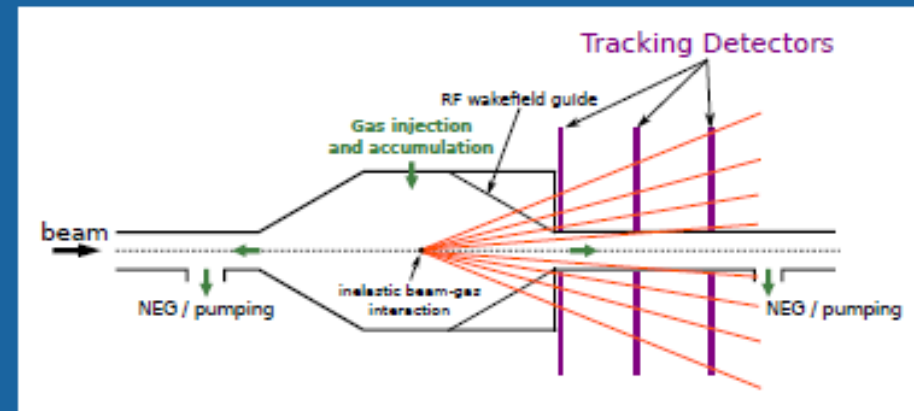
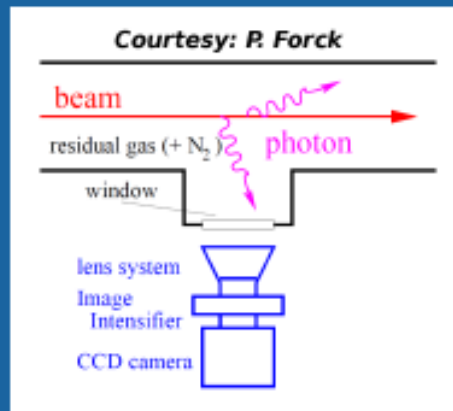
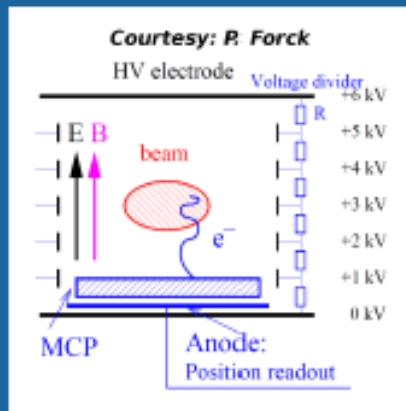
Better cameras, deflector electronics, HV transformer, move markers, scrapers, simulation for ebeam transport

Important to verify e-beam density for faster scans, i.e. can the camera see something



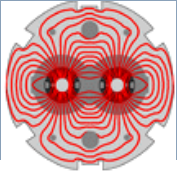
Profile measurements with gas

Process	Products	Measure with
Ionisation	Electrons/ions	MCP / Anode / Phosphor screen + photon detector
Fluorescence	Photons	Photon detector (CCD camera, PM)
Inelastic collision (QCD)	Charged particles	Tracking detector





To do list for DR@LHC



- DR light intensity is not a limitation even for large impact parameters (turn-by-turn, bunch-by-bunch measurement ?)
- Compared to Sync. Light monitor, no limitation from diffraction nor from having an extended source
- Imaging the slit might be enough to monitor the evolution of beam size through the cycle – Imaging in far infrared ?
- Sensitivity to beam size using slit interference to be checked carefully – Choice of wavelength – might be very different at injection and top energy
- **Need a precise positioning of the target with respect to the beam (high precision BPM close to the Target)**
- **Impedance is an issue in LHC – Lessons from the LHC sync. light telescope – Adequate design of the slit holder and choice of slit material – Temperature effects might be a killer for interference scheme**
- Do we need a SR mask in LHC ?
- Will OTR from halo particles degrade the measurements (How much of beam halo to be expected at distances of 10σ or higher) – Measuring OTR at shorter wavelength and compensating for that