Comments and Thoughts about the Diagnostics

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What diagnostics is installed? What is feasible to add?

Please do not understand this contribution as a presentation, more as a summary of some discussions we had recently in our group.

But what we would like to achieve is to is to trigger a more intense discussion of diagnostics we need.

Areas of diagnostics

- Beam current measurements
- Beam position monitors (BPM)
- Beam profile monitor
- Anything forgotten?

General aspects

- What is installed?
- What is most important to measure?
- Requirements, e.g. resolution
- Improvements at the installed beam instrumentation necessary?
- Feasibility: Budget, manpower, technical

What beam parameters are of interest?

How I understand the experiment from a beam instrumentation point of view:

Most important is the beam behavior during the coasting and a possible slow loss over ~1000(?) turns or more.

→ ca. 0.3ms macro or 55μs RF micro bunch 'time constant'

In discussion with Shinji and Chris the following aspects have to be proofed as most important:

- relative beam current measurement
- beam positioning (centre of the beam)
- determination of increasing tail intensity, in particular vertical

**** Halo might be not the correct way to put it,**
**** tail measurements of both flanks of the beam are more important than a full 1D distribution I(y)**

Beam current measurement

Present situation:

No direct measurement is installed

Beam current is determined through relative loss

Measured due induced charge with the BPM

Future situation:

Is an absolute measurement necessary?

Depending on the space/ vessel design it could be difficult to install e.g. a toroid.

Is it reasonable to improve the present scheme to measure smaller relative changes?

Beam position monitor BPM

Present situation is not fully clear:

We assumed that a BPM is installed to measure the centre of the beam.
When we contacted Yoshi he mentioned a bunch-shape monitor but no BPM --- are we talking of the same thing?

- Anyway, how many (BPM) are installed?
- Do they measure in BOTH vertical and horizontal direction?

Beam profile scanner (1)

Present situation:

No scanner such as a wire is installed.

Vertical AND horizontal beam scraper are available

It would be very interesting to learn more about signal-to-noise ratio and possible errors in beam (tail) size

Issues to clarify/ to discuss:

How many beam scraper (V/ H) are installed?

Do these scarper move only from one side or from both sides into the beam?

Could these scarper be used for fractional current measurements, i.e. integrated deposited charge while scraping?

Beam profile scanner (2)

Is an upgrade possible, either as a wire scanner or non destructive. Most important is the vertical plane I(y)

(Classic) wire scanner

- scattering
- heat deposition
- installation, vessel dimensions
- slow moving compared to rev. freq./ lifetime

Should the wire move through the beam centre or measuring only the tails on both flanks of the beam distribution?

Non—destructive

Beam induced fluorescence monitor

- cross section (p→ N_2 ? aux. gas?)
- residual gas (p~10^{-7}mbar)
- radiation protection <100μS/ h

Other option could be an Ionization monitor

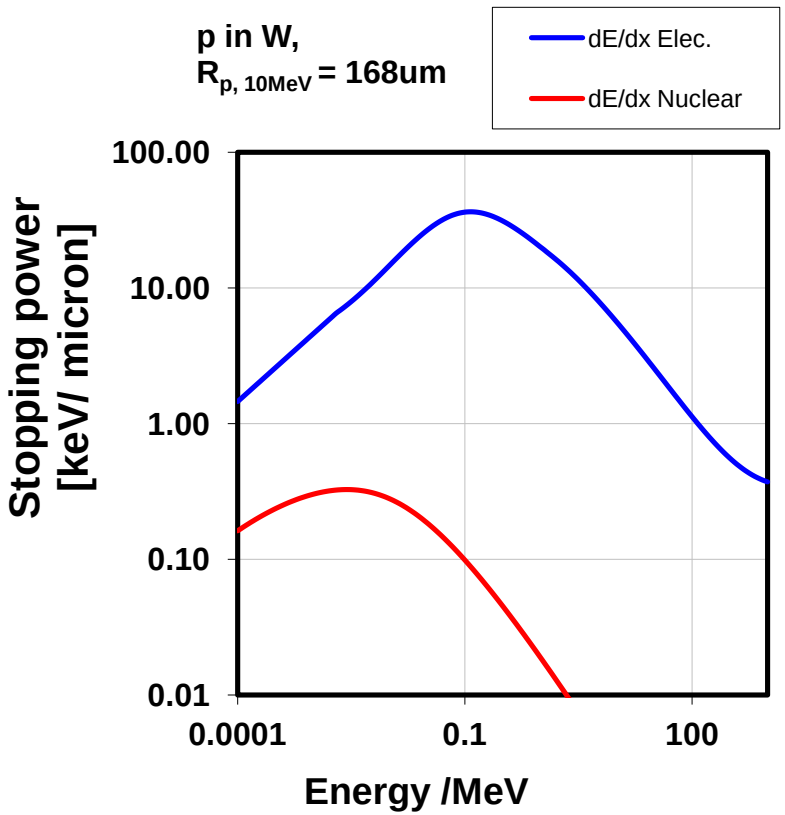
Whatever we decide, technical constraints (vessel, radiation, space) must be considered – most likely pre-experiments are required and time consuming.

Summary

- Detailed overview of the installed beam instrumentation would be helpful.
- We should agree what we want to measure, maybe separated into absolute necessary and what would be nice.
- We would need technical drawings if we consider to build new diagnostics.
- It might be more efficient to expand the existing diagnostics instead of starting from scratch
- Beam parameters are very demanding and we should look for more expertise (mine is more for low energy & emittance measurements)

Is there not an Instrumentation group located at ERIT we should get on board?
ERIT and ADSR-FFAG are similar in terms of diagnostics, and any bigger developments should consider both rings.

Additional Information



Beam induced fluorescence monitor