

CURRENT MEASUREMENTS OF LOW-INTENSITY BEAMS AT CRYRING

A. Paal, A. Simonsson, A. Källberg, Manne Siegbahn Laboratory of Physics, Stockholm, Sweden

J. Dietrich, I. Mohos, Institut für Kernphysik, Jülich, Germany

Abstract

The demand for new ions species leads to an increasing number of cases in which the ions can only be produced in small quantities. thus weak ion currents below 1 nA quite often have to be handled and measured in low energy ion storage rings, like CRYRING.

-We have built a new amplifier with 86 dB gain and $0.6 \text{ nV}/(\text{Hz})^{1/2}$ RMS input noise.

-It was moved close to the ICT.

In the Bunch Signal Processor the gain by 20 dB has been decreased to get lower slow offset.

-A low pass filter has been added (10 Hz, 100 Hz).

INTRODUCTION

Various detector systems have been developed to measure such low intensity bunched and coasting beams by using the overlapping ranges of those systems (Fig.1).

Bunched beam measurements

Bunched beam parameters:

Frequency range: 40 kHz-1.5 MHz

Duty cycle: 10%-50%

Pulse width: 60 ns-13 μ s

A Bergoz Beam Charge Monitor with Continuous Averaging (BCM-CA) and an Integrating Current Transformer (ICT) was installed 1997 to measure the bunched beam intensity with 200 A full scale range and 20 nA RMS resolution.

Modifications:

Result: The 200 μ A full scale range have been extended down to 5 μ A with 1 nA RMS resolution.

A bunched beam current measurement is shown in Fig.2.

The amplified sum signal of the capacitive pick up closest to the ICT can be used to set up the measuring windows for the BCM and for the second Gated Integrator. The RMS resolution is about 100 pA. The PU Amplifier [1] has $1.2 \text{ nV}/(\text{Hz})^{1/2}$ RMS noise.

Coasting beam measurements

To measure the coasting beam intensity, neutral particle detectors have been built [2, 3]. At high particle energies the RGBPMs are used [4]. Their fast Micro channel plate detectors can handle 1 Mcps count rate.

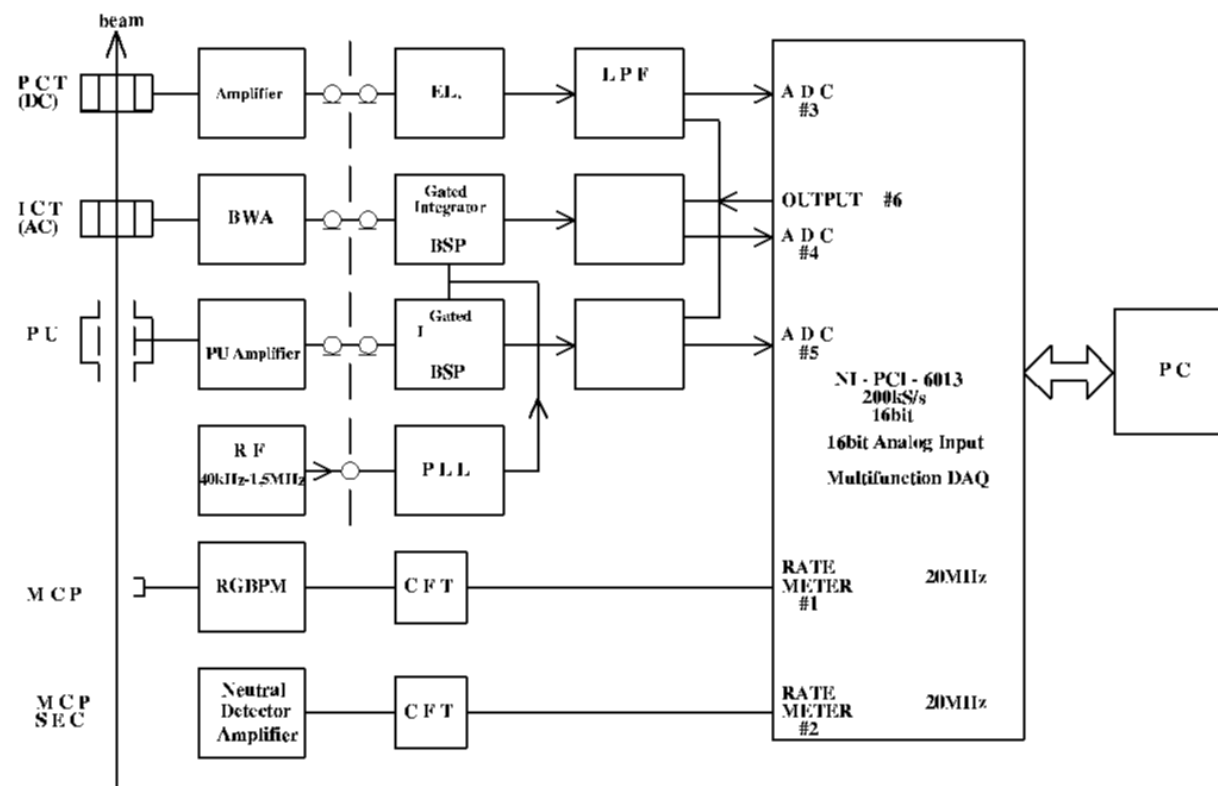


Figure 1: Beam Current Monitoring system of CRYRING

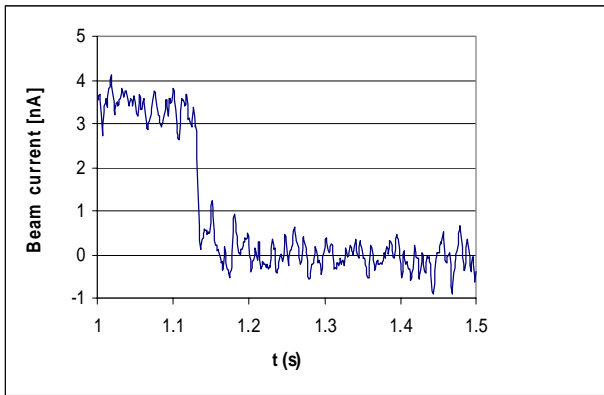


Figure 2: DN_2O^+ beam. After 1.12 s the RF is turned off.

Presently a 50 Mcps Secondary Electron Multiplier is under construction. The ETP Pty. Ltd Active Film Multiplier, type 14850H TOF with a conversion dynode, is planned to use. Its max dark count rate is 0.05 cps.

On the magnetic flat-top, 100 ms is available to calibrate the count rate of the neutral particle detectors, the residual -gas ionization beam profile monitor, and the segmented capacitive pick up signal.

References

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- [2] A. Källberg, et al., DIPAC 97 proceedings, p. 150
- [3] D. Hanstorp, Meas. Sci. Technol. **3** (1992) 523
- [4] A. Kerek et al., EPAC 98 proceedings, p. 1577