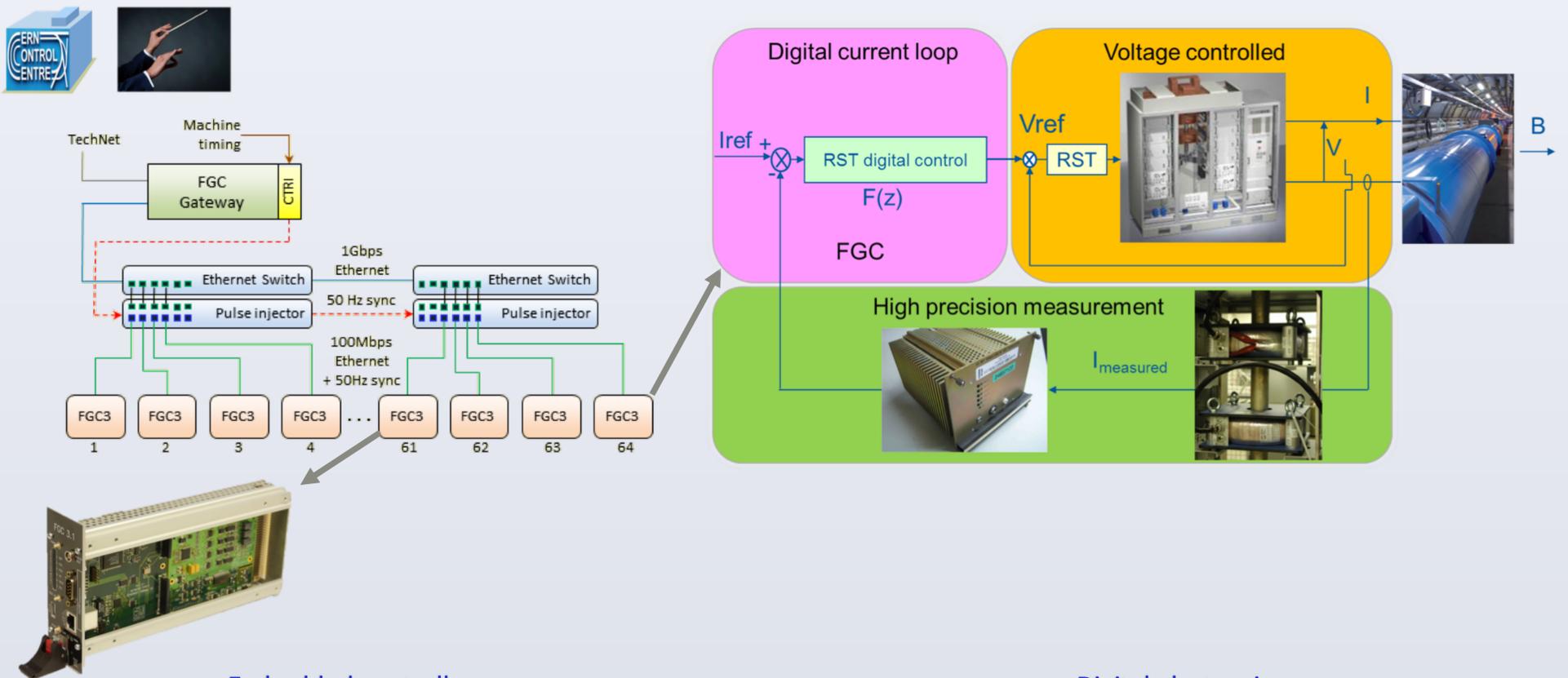




Electrical Power Converters

High precision power supplies

Particle accelerators require high accuracy power converter for the magnets. The magnets drive the beam and require a very stable DC current. The input of the power converter is usually AC (from the electrical network) and the output is a DC voltage applied to the magnet. As in most of the cases, the magnetic field of the magnet can't be measured in real-time, the output current of the power converter is used to control the beam. The current is measured with a highly accurate current transducer. This transducer employs zero-flux compensation techniques and it is called a DCCT (Direct Current Current transformer).

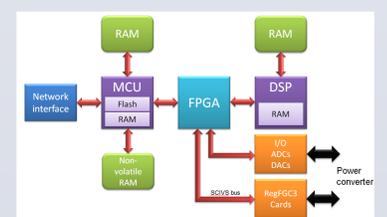


Embedded controller

Digital electronics

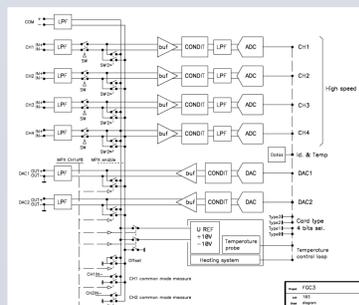
The Function Generator Controller (FGC3) is a power converter control module developed by CERN. The FGC3 module is physically installed within a power converter. The FGC3 will receive information over Ethernet from a front-end computer acting as a gateway between the FGCs and the CERN technical network.

The internal architecture of the FGC3 combines a microcontroller with a DSP and FPGA. Both have private memory and a shared memory area through which they can communicate.



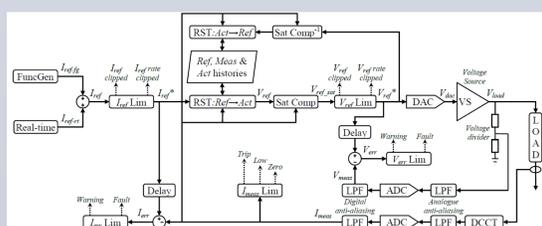
High precision analog to digital conversion

A high precision analog to digital board (ANA103) provides 4 channels, based on the 20-Bit, 1Msps, SAR ADC, LTC2378 from Linear Technologies. An external ADC with higher stability can be connected through optics fibre for the most demanding applications.



Digital control algorithms

The FGC3 DSP can regulate current or magnetic field using an algorithm based on the RST polynomial equation.



High precision transducer

Power converters for particle accelerators are required to deliver extremely accurate currents to the accelerator magnets. The best current measurement device is the DCCT (Direct Current Current Transducer), which was originally developed by CERN and which is now a commercial product.



High-precision control

The performance of the power supplies is critical to control the beams. The uncertainty needs to be defined with accelerator physicists.

