



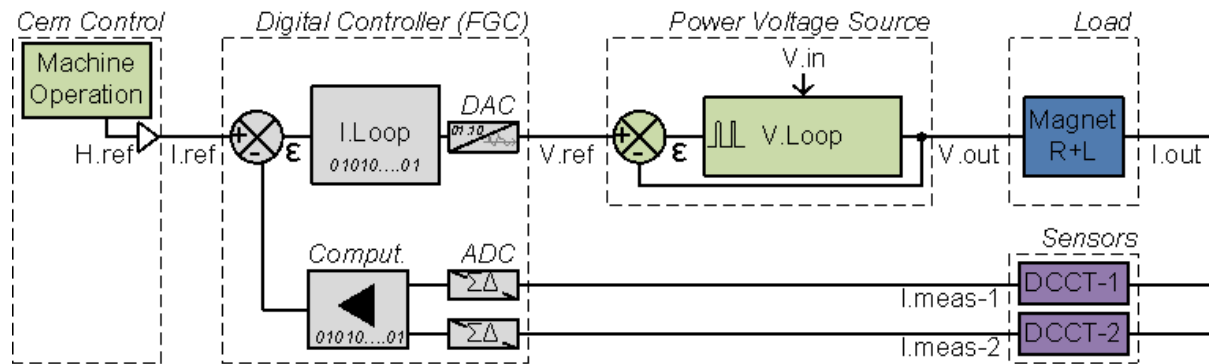
CERN power converters Controlled with FGC3

Jean-Paul Burnet

Magnet power converters

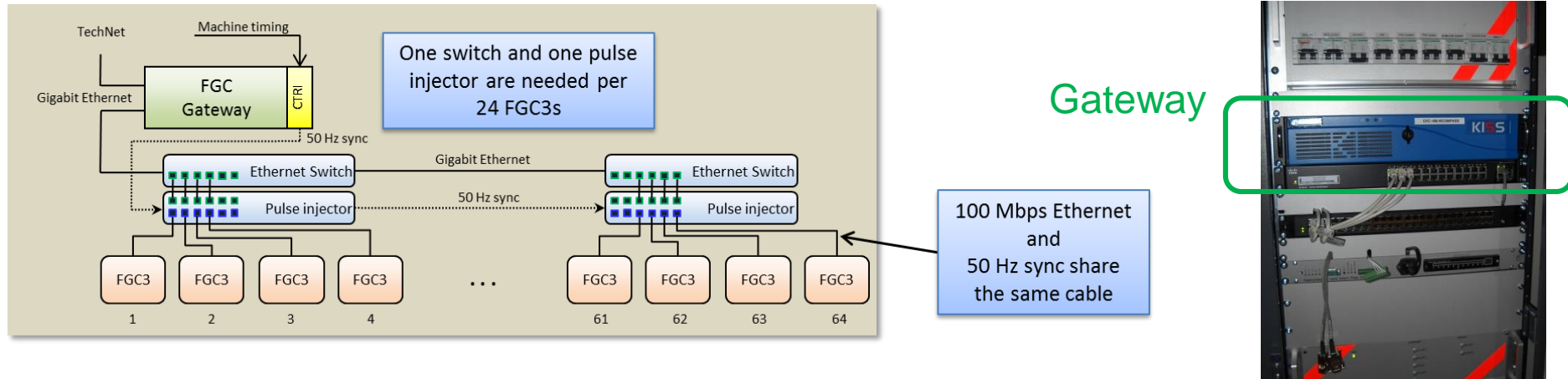
TE-EPC developed many power converters to be operated at CERN.

Each converters is controlled with an FGC (Function Generator and Controller) which receives the current reference and performs the digital current control.



Power converters control

Each converters is controlled by an FGC (Function Generator and Controller) which communicates with a gateway through a dedicated ETHERNET bus.



This gateway makes the interface with the control room through the general control infrastructure.

CERN has a special control infrastructure, very powerful but very complex.

CERN control infrastructure is unique, while Light sources developed common control platforms like EPICS or TANGO.

List of power converters controlled by FGC3

Follow link below:

<u>CANCUN</u>	$\pm 50\text{A}/\pm 30\text{V}$ or $\pm 20\text{A}/\pm 75\text{V}$
<u>RF25KV</u>	8A/25kV
<u>APOLO</u>	$\pm 450\text{A}/\pm 450\text{V}$
<u>COMET</u>	$\pm 250\text{A}/\pm 120\text{V}$
<u>SATURN</u>	$\pm 800\text{A}/\pm 700\text{V}$ or $\pm 1600\text{A}/\pm 350\text{V}$
<u>MIDIDISCAP</u>	$\pm 50\text{A}/\pm 600\text{V}/5\text{ms}$

Commercial Power Supplies Controlled With FGC3: as an example : 700A/14V

Following slides, LINAC4 power converters controlled by FGC3

List of power converters for LINAC4

FGC3 started with LINAC4 (2008)

All power converters of LINAC4 are controlled with FGC3

COMMERCIAL (DELTA)
MAXIDISCAP
MODULATOR



FGC is everywhere at CERN

All type of power converters is controlled with an FGC.
Many ways to integrate it!

Interface case, FGC3 only.
Full integrated control electronics is REGFGC3.

CUTE ($\pm 12,5A / \pm 15V$)



FGC3 only

COMET $\pm 250A / \pm 120V$

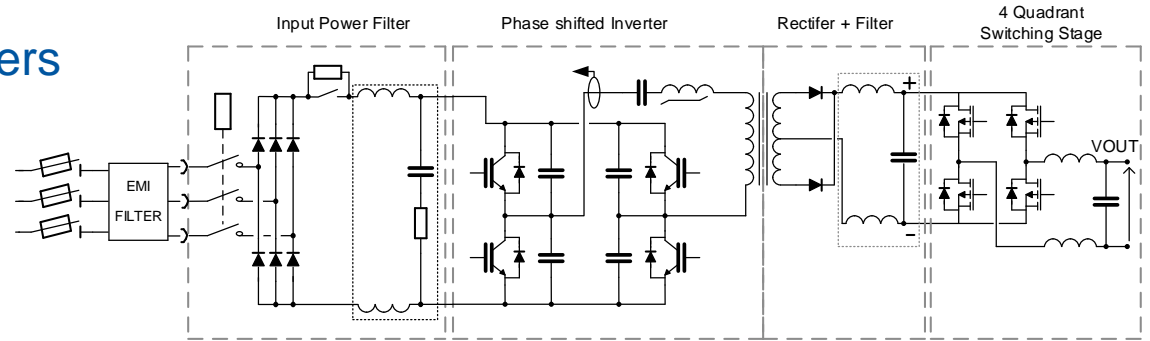


Full REGFGC3

CANCUN

- 4-quadrant power converters
- $\pm 50\text{A} / \pm 30\text{V}$
- $\pm 20\text{A} / \pm 75\text{V}$
- $\pm 5\text{A} / \pm 100\text{V}$

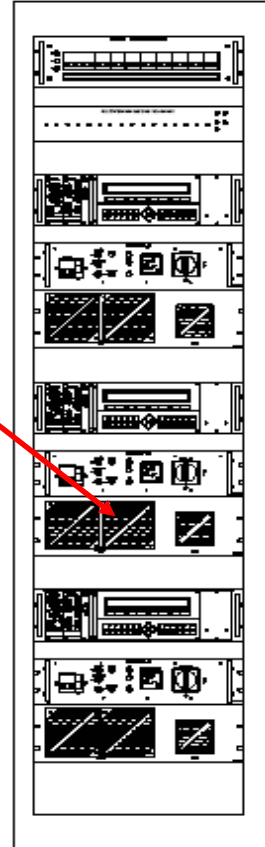
- 300 produced for LIU, ELENA, ...



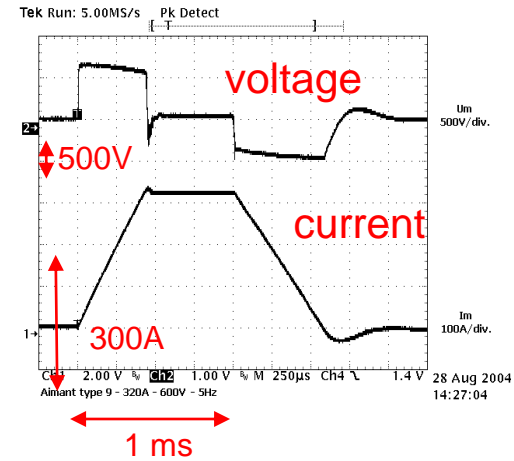
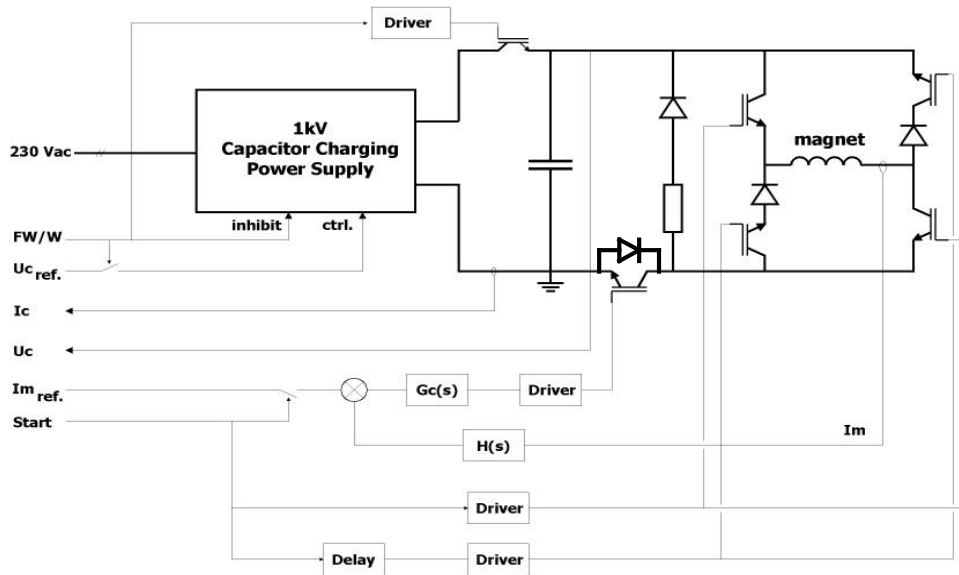
MAXIDISCAP

- 1 kV, 200A;
- pulsed 2 Hz;
- flat-top duration: 1.2ms
- flat-top precision: ~500 ppm

3 units
per rack



Power crate 19", 6U



Technology transfer, first agreement

OCEM got a contract for a 20kA / 70V power converter for TRIUMF.

FCG control was part of their offer (2ppm stability) with EPICS framework.

The specification was challenging in term of current stability, and thanks to FGC control and CERN expertise, TRIUMF was confident to place the contract with OCEM.

The power converter was successfully commissioned in 2018!



Second agreement

ESRF wanted to get a MEGADISCAP for their new injection septum.

CERN proposed to delivered 2 MEGADISCAP (technology transfer agreement).

Standard CERN product, however, CERN isn't a vendor.

The power converter was delivered in October 2019!

Third agreement

SOLEIL wants to get an uniform control system for their power converters.

They identified FGC as a potential controller for their future machine (1700 power converters in 2025).

First step, upgrade of 13 converters in 2020.

Training session done.

Integration of FGC in their control environment for tests, done.

Study of FGC3 and RegFGC3 integration, to be completed.

Summary

FGC controller is part of the CERN KT portfolio.

FGC gateway in TANGO/EPICS version are in good progress.

CERN is looking for industrial partners to ease diffusion.

All lab requests are studied and need appropriated solutions.