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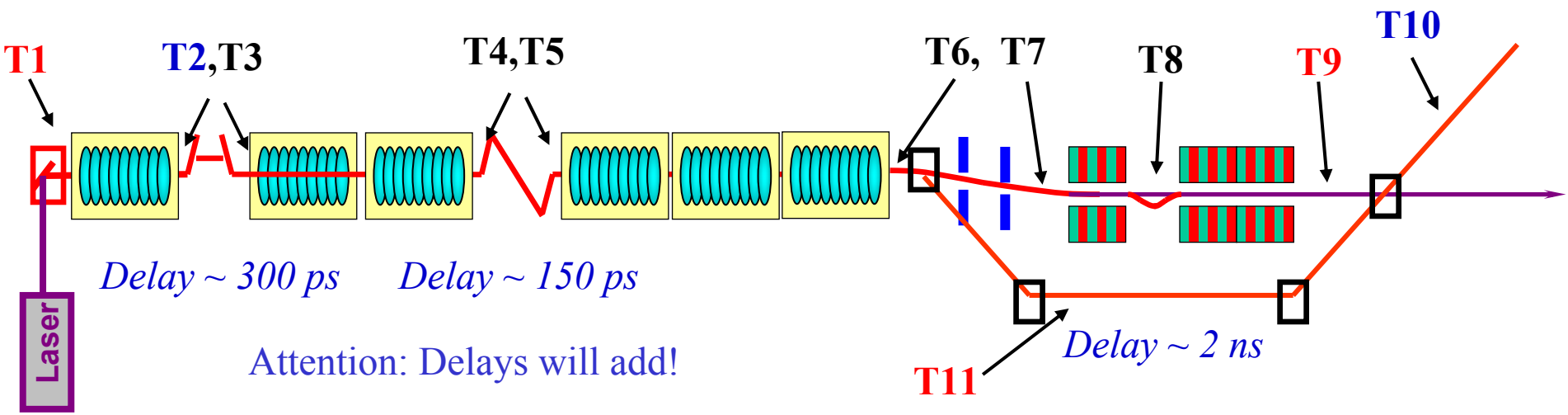
Toroid Protection System

Since last collaboration meeting :

- meeting of M. Luong and A. Hamdi (Saclay) with experts at DESY in Nov. 2003
- Ultimate review before printing of circuits
- Agreement on the concept established in Saclay meeting of April 2003
- Few modifications or precisions

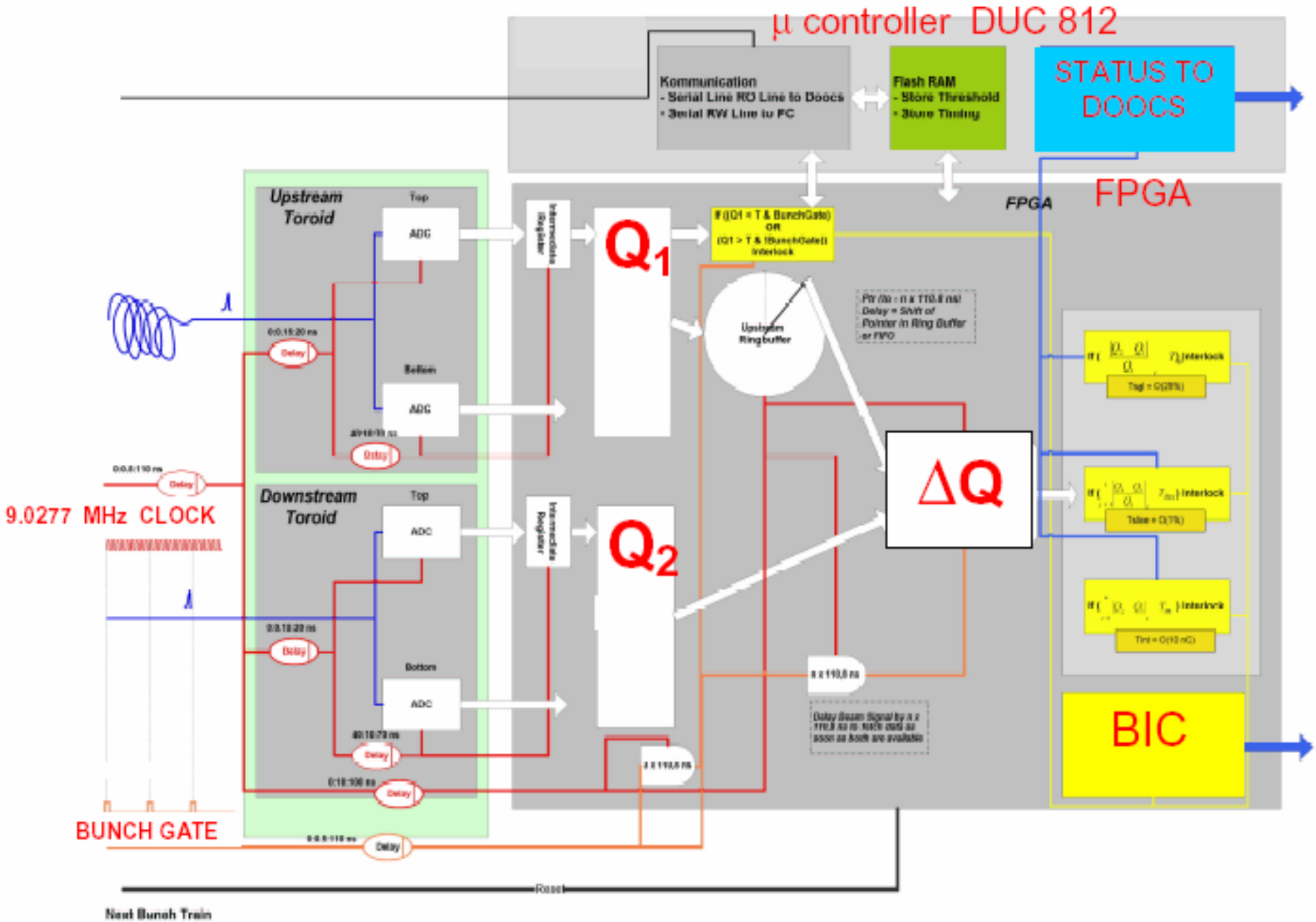
Transmission Based Protection System for TTF II



Tor.	Name	Z-Position	Toroid	Name	Z-Position	Comment
T1	Toroid/3Gun	1,25 m	T9	Toroid/12Exp	244,97m	FEL Beamline, total length
T1	Toroid/3Gun	1,25	T11	Toroid/16Byp	161,254m	Bypass Beampath, total length
T2	Toroid/2UBC2	20,548 m	T10	Toroid/?Dump	Ca. 248,9 m	Make sure beam reaches the dump (FEL Beamline)
T2	Toroid/2UBC2	20.548 m	T10	Toroid/?Dump	Ca. 248,9 m	Make sure beam reaches the dump (Bypass)

Transparency D. Nölle

Electronics for the toroid protection system



Toroid protection system

ADC board

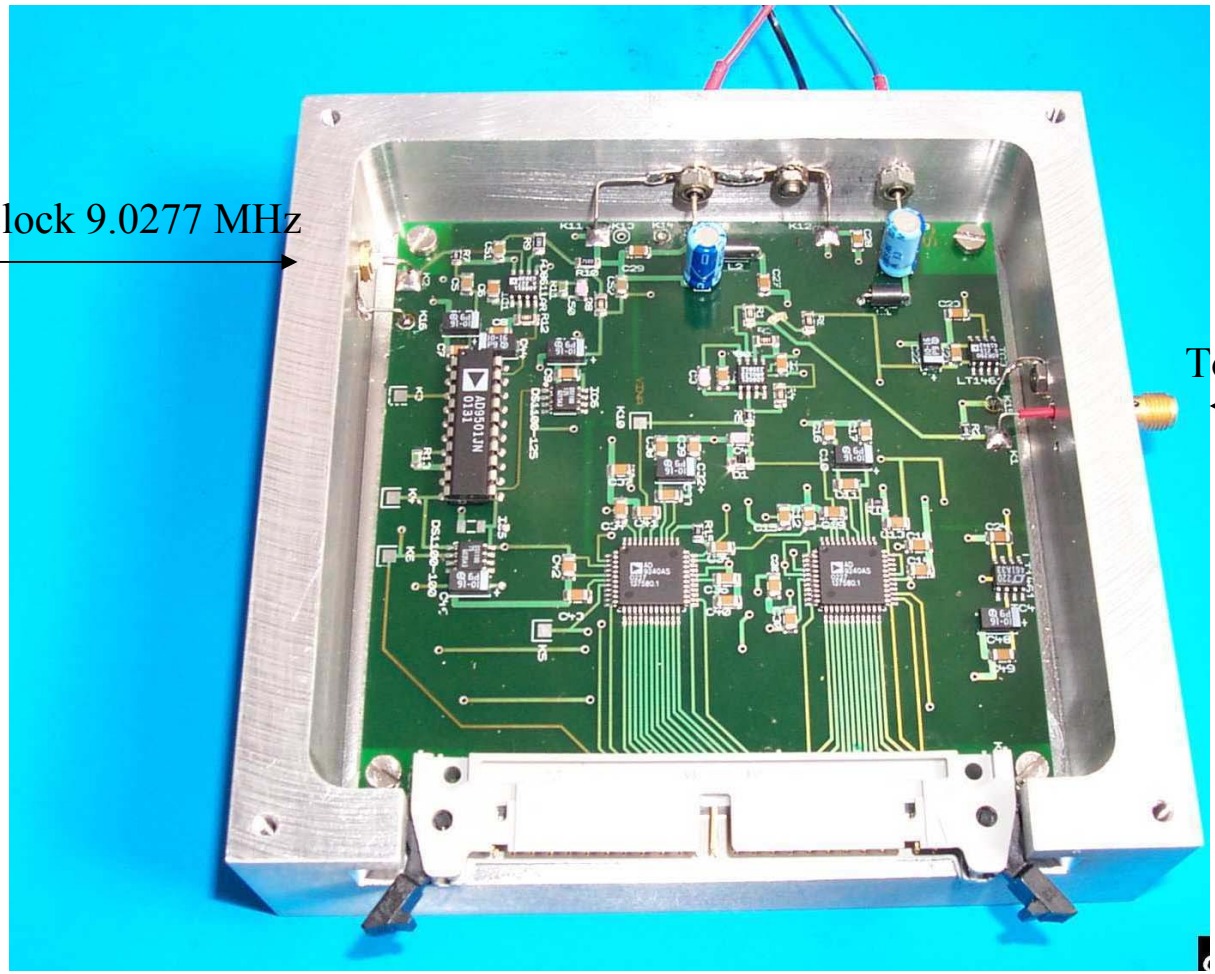
2 units built

Continuous clock

14 bits

10 MS/s

Programmable delay



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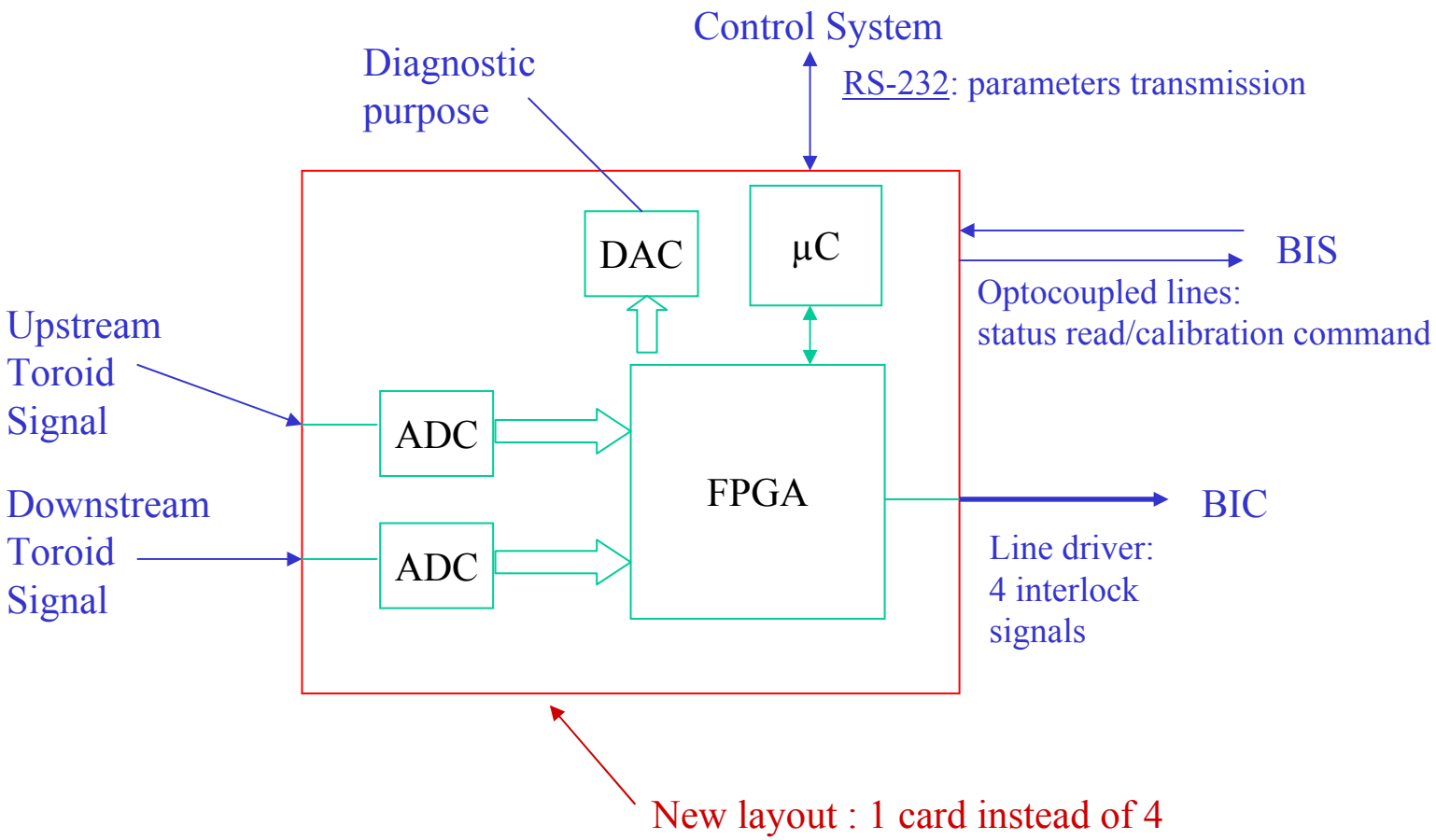
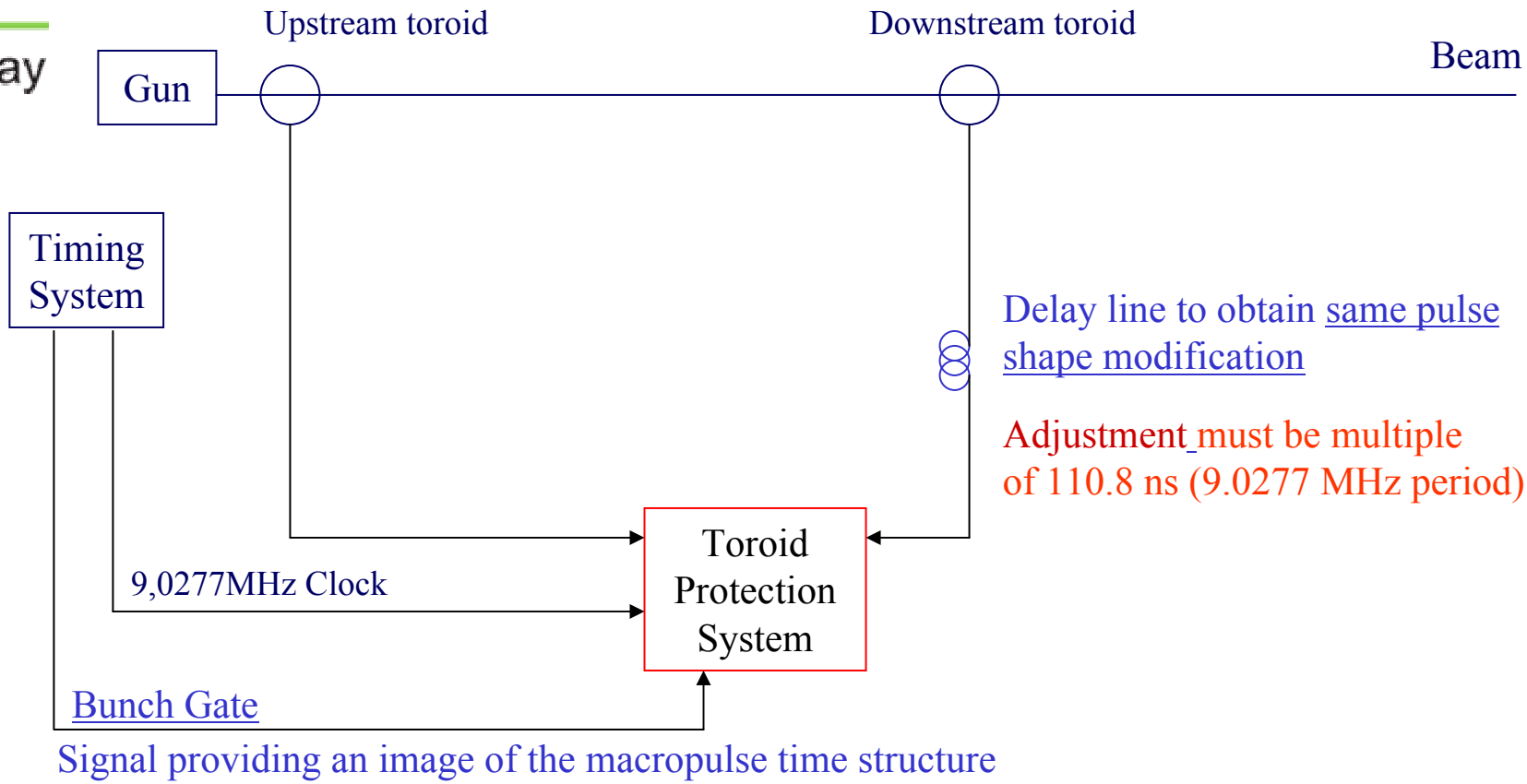
Machine protection with toroids



Machine protection with toroids

Cabling layout



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Algorithms for Loss Detection

- Single Shot Mode
  - $T_{Sgl} \approx O(10\%)$
  - Range: 5 – 10 %

$$\left(\frac{|Q_2 - Q_1|}{Q_1} \right)_i > T_{sgl}$$

- Slice Mode
  - $T_{slice} \approx O(1\%)$ for 10-100 bunches
  - Range: 0.5 – 5 %,
  - if counting n: 5 - 10

$$\sum_{j=i-l}^{i} \left| \frac{Q_2 - Q_1}{Q_1} \right|_j > T_{Slice}$$

Or: If Number ($\Delta Q_i/Q > T_{slice}$) > n

- Integrated Mode
  - $T_{int} \approx O(10$ nC) over the whole train 10^{-3} of Total Pulse Charge)
  - Stop as soon as limit is exceeded.
  - Range: 5 … 50 nC

$$\sum_{i=0}^{n} \left| \frac{Q_2 - Q_1}{Q_1} \right|_i > T_{\text{int}}$$

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Machine protection with toroids

- Currently VHDL(Hardware Design Language) : modelisation and simulation
- Next step : Integration and test…