Beam loss → Radiation → Vacuum problems

→ *These CTF guys have no clue what they are doing !*

Back ground:

After 20 hours of 50 Hz , 3.5 A, 200 ns, 50 % transmission PETS operation a vacuum leak opened up.

The leak turned out to be a flange which could be tightened

5 mSv were measured on contact after 3 days

Bad luck or not astonishing ?

How do we deal with maintenance in the PETS area ?

Burning a hole into the vacuum chamber

3.5 A, 200 ns, 1 mm beam radius, 5 mm wall thickness, 1 Hz

Stainless:	ΔT= 60 K	Tm=1500 ^0C
Aluminum:	ΔT= 34 K	Tm=660 ^0C

Beam Transmission

After a few days of optimization with the 5 A beam,
achieved 80% transmission into the dump,
20% lost in PETS tank,
Transient (70 ns) lost on collimator in girder 4

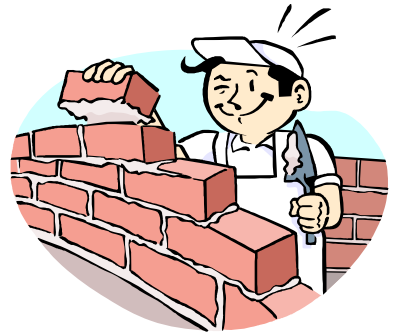
Discussion

- Add some local shielding in critical areas to lower local dose for maintenance (beam line: PETS – dump)
- Replace some of stainless pipes with aluminum ?
- Planning of modifications and maintenance in the PETS area
- Time for beam studies to minimize losses
- Compare simulations and measurements
- Use high repetition rate only if really needed
- Identify high maintenance items and redesign or relocate if possible. (Flange design, Diagnostics)

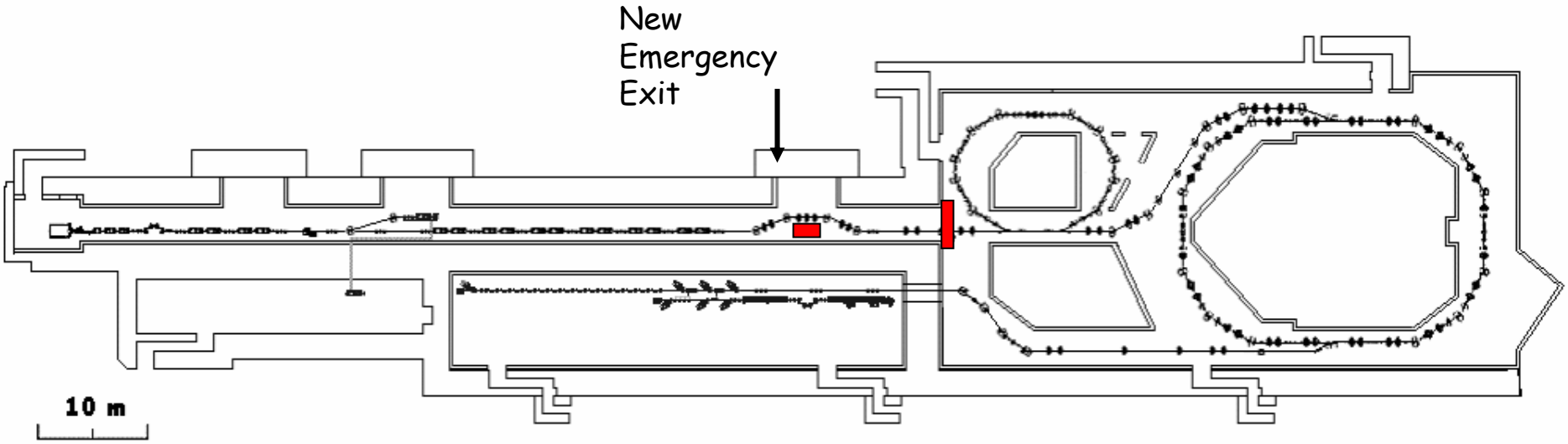
Handling high power beams is one of the critical R&D topics of CLIC to be studied in CTF3 !

But no panic, we need more data !

The Wall



Allows for linac operation for PETS and beam studies during Combiner Ring Installation



<u>Therefore in 2006/2007 two distinct modes of operation:</u>

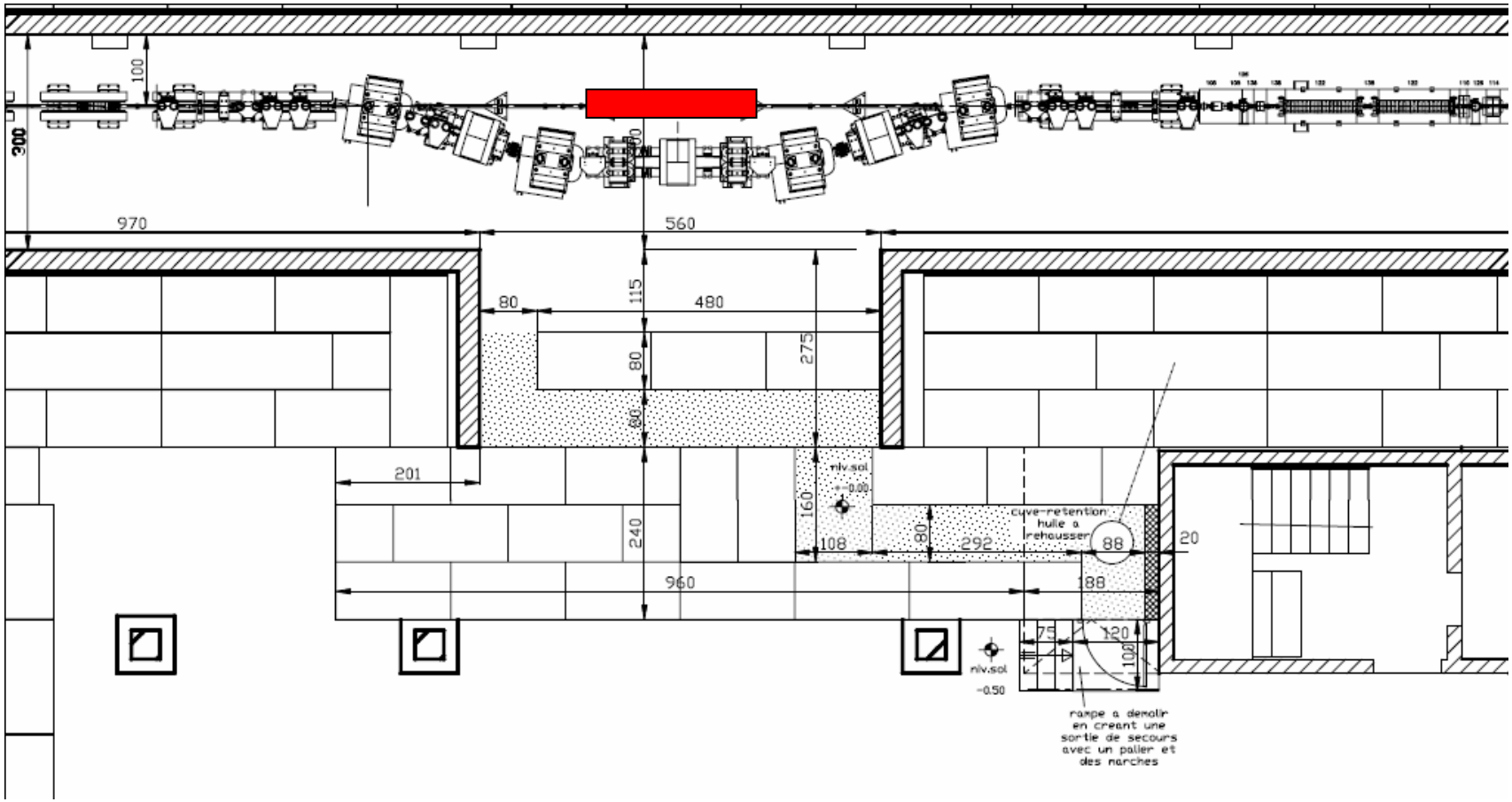
1: Run Linac up to PETS; Linac tunnel + CTFII closed; EPA-building open

2: Delay loop commissioning; Linac +EPA closed; CTFII open

The Wall

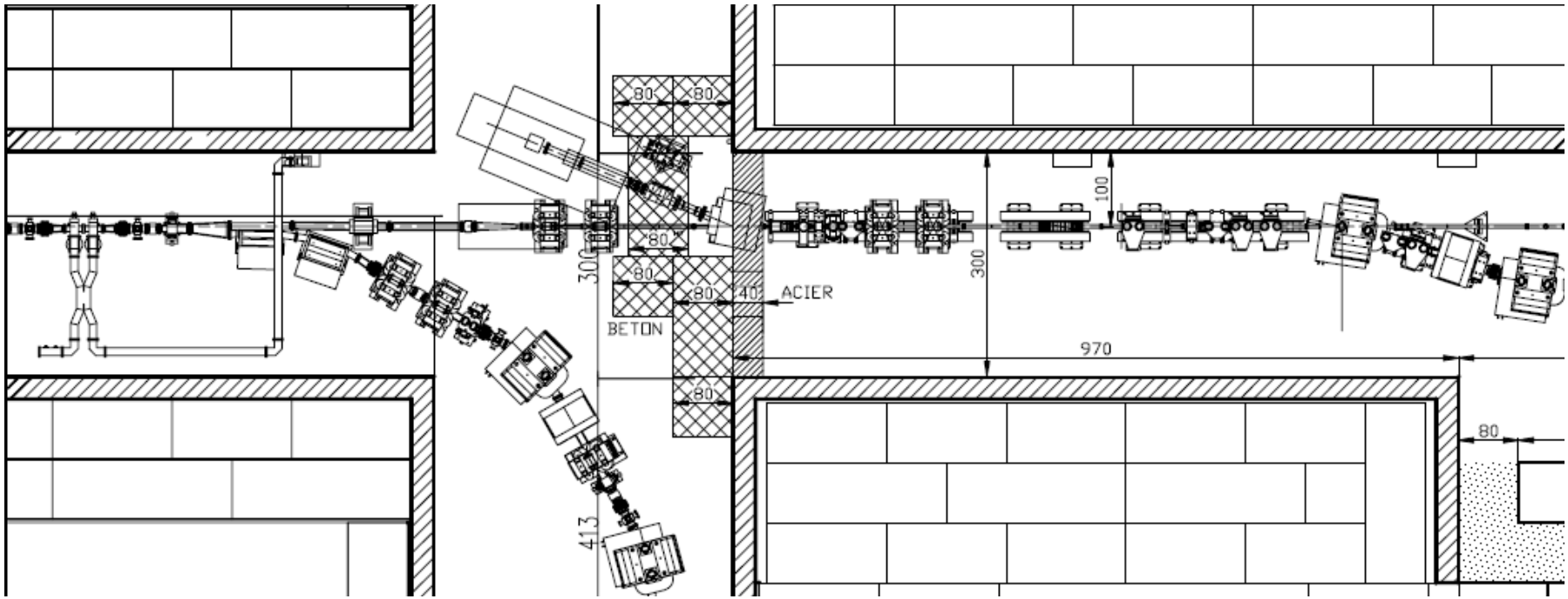
New Emergency exit and beam stopper

We need to use the INFN chicane to send beam into the Delay Loop !



The Wall

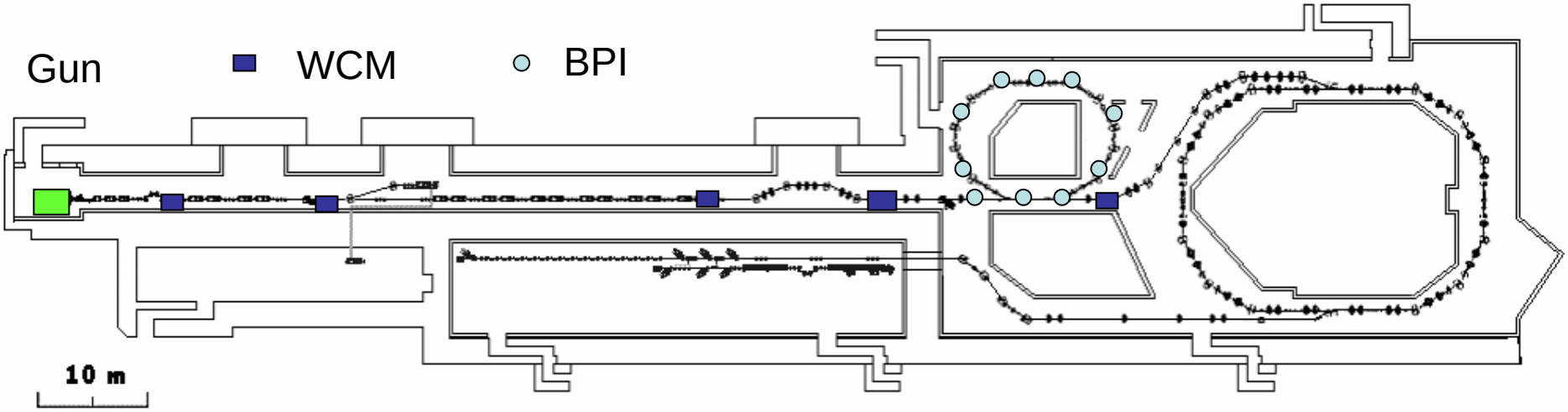
Location of the separation shielding



<u>Consequences:</u>

- Radiation monitor behind the wall
-Spectrometer will be removed
- Cabling into the linac area difficult
- Alignment restrictions

Beam loss monitoring concept for CTF3



- Fast beam inhibit system (1-2 μs) for machine and radiation protection
  analog, independent
  Status: first stage commissioning next run
- Data acquisition system for beam current (seconds)
  software based (Gun timing DSC), beam loss monitoring
  Status: test version under preparation, testing next run
- Radiation Monitors interlocked (ARCON system)
  Status: technical proposal

Beam loss monitoring concept for CTF3

Beam parameters and modes

Nominal beam: 130 MeV, 3.6 A, 5 Hz, 1.5 μs
→ 3.6 kW beam Power

Power production mode: 93 MeV, 4.1 A, 50 Hz, 0.4 μs
→ 7.7 kW beam Power

(Interlocks for mode selection)

Single point beam loss simulated (Th. Otto):

Max tolerable loss: 40 W (~ 1% / 0.5 %) in linac,
20 W (~2%) in delay loop

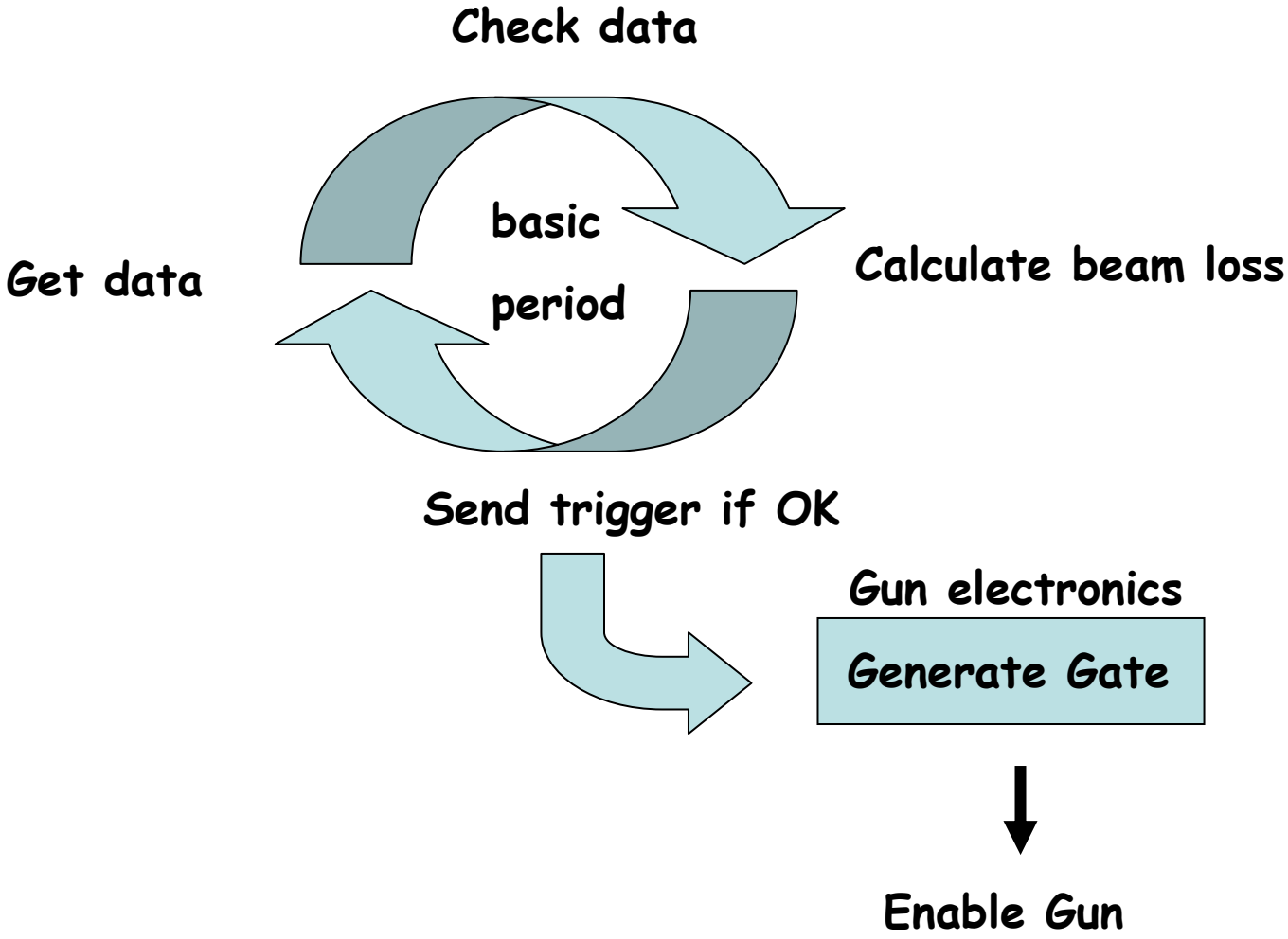
Known beam loss locations (collimators, dogleg entrance) are equipped with additional local shielding

Verify with measurements during beam commissioning !

Description of the beam loss software

- Program will run on the Timing DSC
  (Machine can't run without this DSC working)
- Program generates trigger to actively enable the gun for a few seconds via an hardware gate in the gun electronics, a new trigger has to be send each basic period to enable the gun
- Program checks time stamps and values of arriving beam data to be reasonable
- Thresholds can be changed only by control system experts not by operators
- Program will calculate absolute loss taking into account rep rate and pulse length
- Interlock needs manual reset and restart at lower rep rate or current after trip

Description of the beam loss software



Delay Loop Commissioning this year

We plan a run of max 3 weeks of delay loop commissioning starting Nov 21th

Not all the diagnostic hardware will be ready for the run therefore the proposed beam loss monitoring system to control the losses doesn't make much sense at this point.

20 W single point beam loss is the limit from radiation protection

Proposed beam parameters:

E= 120 MeV, I= 1 A, rate: 0.83 Hz, pulse length: 300 ns

Average Beam Power: 30 W