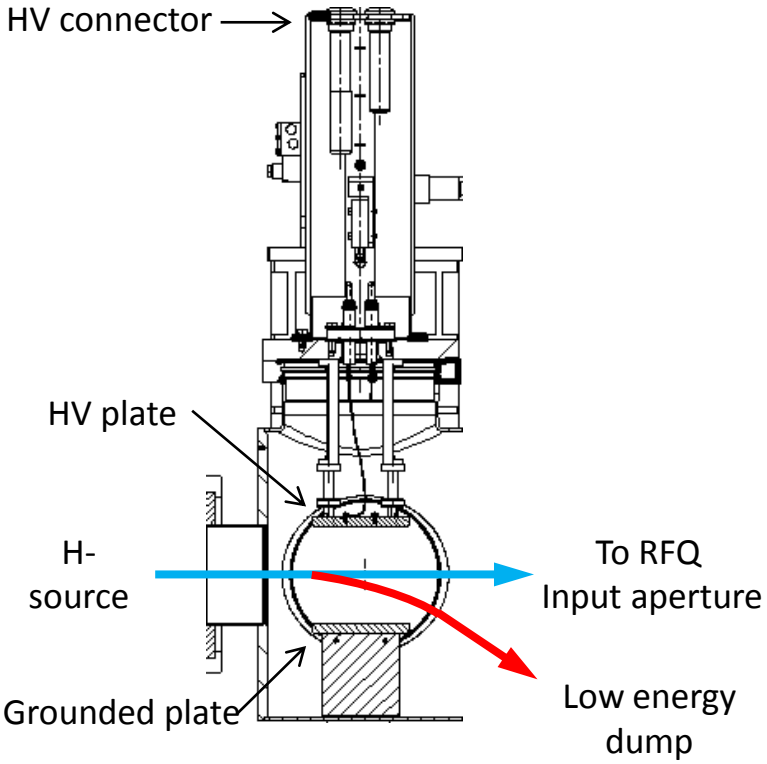
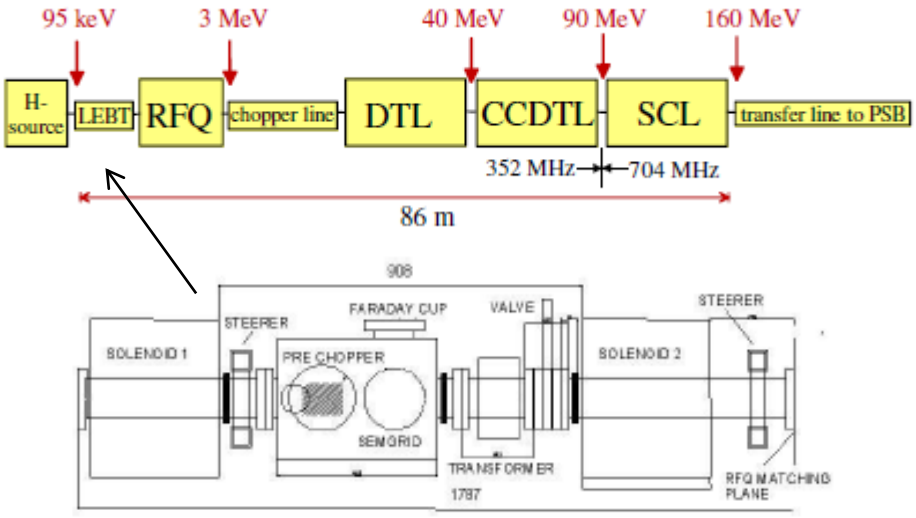
LINAC4 Pre-Chopper

Status
& interlock logic

System architecture overview

Pre-Chopper is a pulsed electric field device located in the LINAC4 LEBT. It deflects the 95keV beam away from the RFQ input aperture when it is not required. This is done by applying -20kV to a plate in vacuum, which is switched to 0V when the beam should pass.





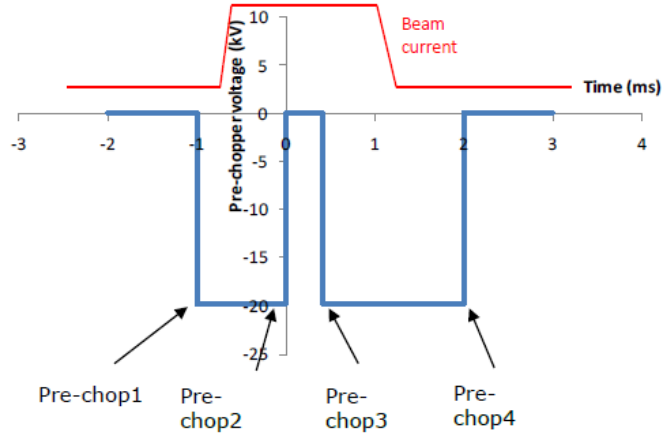
The Pre-Chopper is used to :

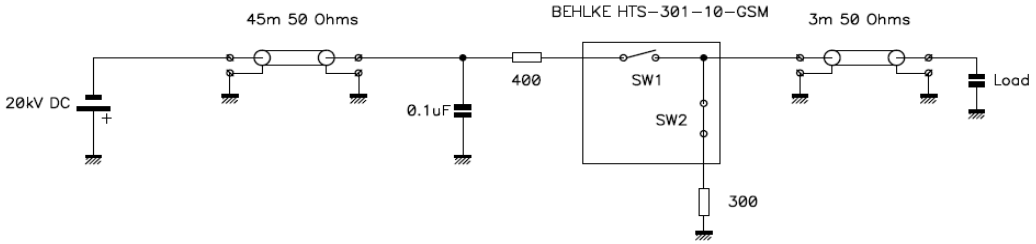
- Reduce the rise time of the beam
- Cut the tail of the beam
- Dump the beam if an interlock is present

Pulsed power supply

Specifications		
Nominal electrode voltage	-20	kV
Max. rise time (0 to 99%)	2	µs
Max. fall time (to -10V)	2	µs
Flat top stability	2	%
Flat bottom stability	-10	V
Delay (input trigger to start of voltage change)	<1	µs
Jitter	<0.5	µs
Max. repetition rate	2	Hz

Scheme of the applied voltage, and required timings.





Timings signals :

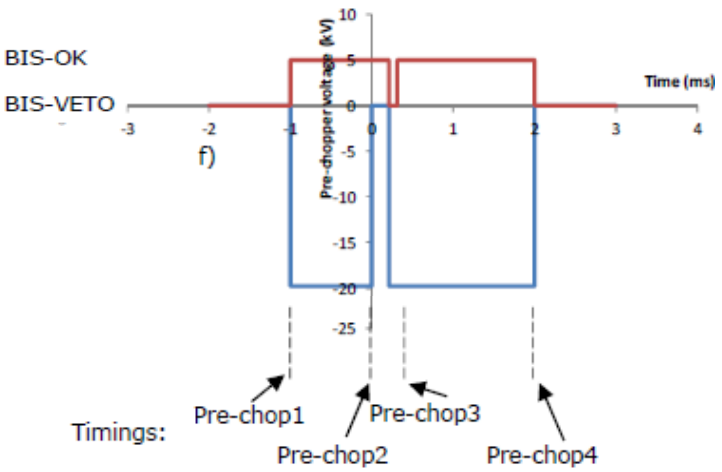
- L4X.STARTCHOPPER 'Prechop1'
- L4X.HEADCLIPPER 'Prechop2'
- L4X.TAILCLIPPER 'Prechop3'
- L4X.STOPCHOPPER 'Prechop4'

Beam Permit interface

Prechopper is the target system (client) of two Beam_Permit signals from BIS :

- Source RF BIC
- Chopper BIC

In case of BIS veto the chopper has to prevent the beam to pass to RFQ by deflecting it :



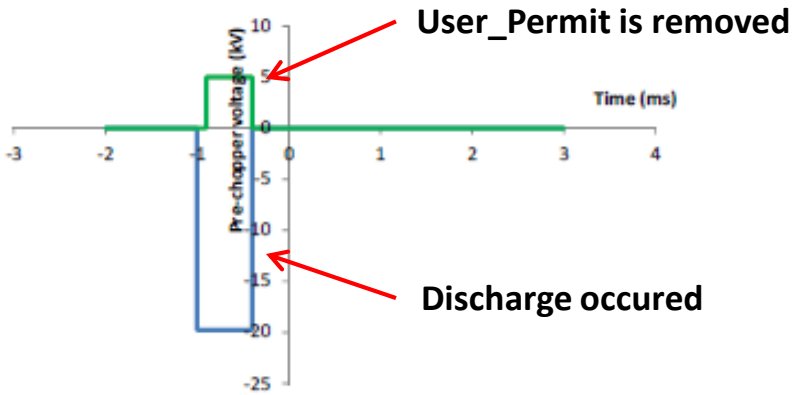
Source RF BIC uses as one of its input the User_Permit from the Pre-Chopper
-> Source RF BIC signal is received after the User_Permit has been delivered.

User_Permit interface

Pre-Chopper driver provides a User_Permit signal to the BIS.

Fault conditions detected by the driver :

- External interlock (Vacuum , HV connectors micro-switches, Belhke fault, PXI fault)
- Belhke overvoltage protection
- Capacitive buffer voltage out of predefined limits
- Timing fault (wrong timing sequence or signals received out of limits)
- Analog fault on the applied voltage between plates during pulse (Flat-top, Flat-bottom, rise time, fall time)



Interlocking system status

Pre-Chopper interlocking system status :

- All the interlock functionalities implemented and validated at the time of the commissioning of the Pre-Chopper in L4 (11/2013)

- BIS interface tested and controlled during the BIS commissioning at 50MeV (10/2015)

- No need for change or add-on specified for the half sector test and final configuration.

(Functional Specification: https://edms.cern.ch/document/1166012/0.2)