

Introduction to SPESO

SP-ANR meeting, 15th of March 2013

Introduction to SPESO

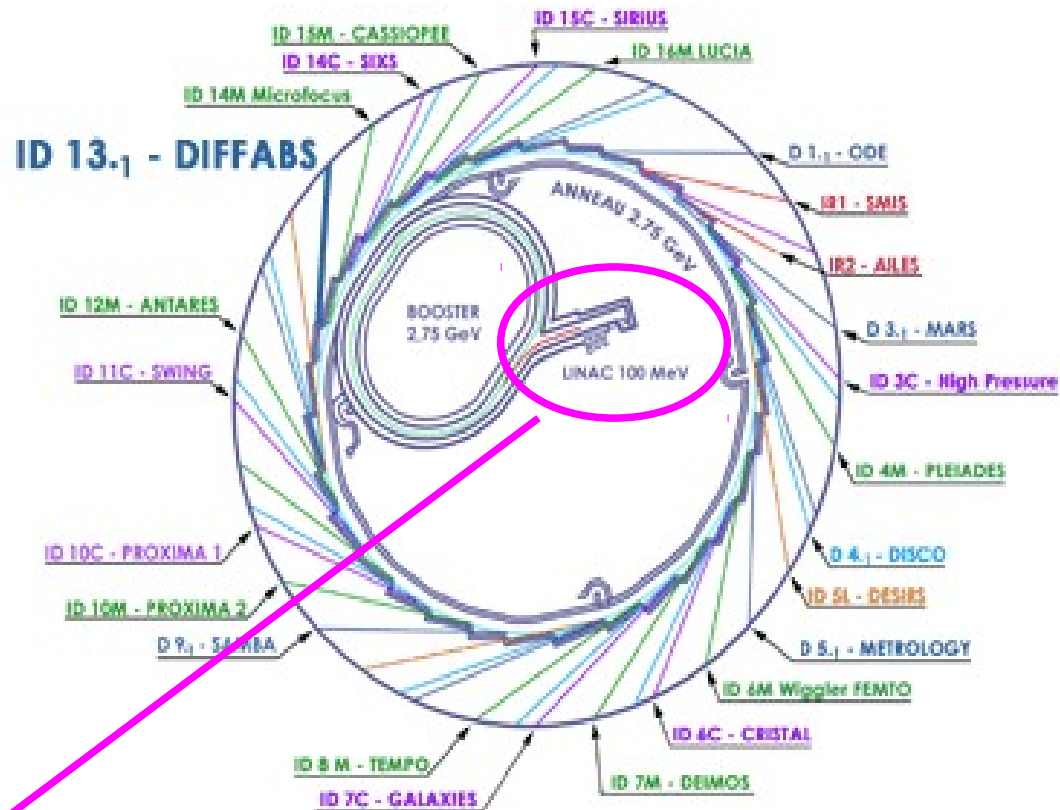
SPESO

=

Smith-Purcell Emission @ SOleil

- Build an SP monitor prototype for SOLEIL
- Make systematic measurements testing various setups
- Compare theories/codes/measurements
- R&D towards single shot device

SOLEIL accelerators



LINAC:

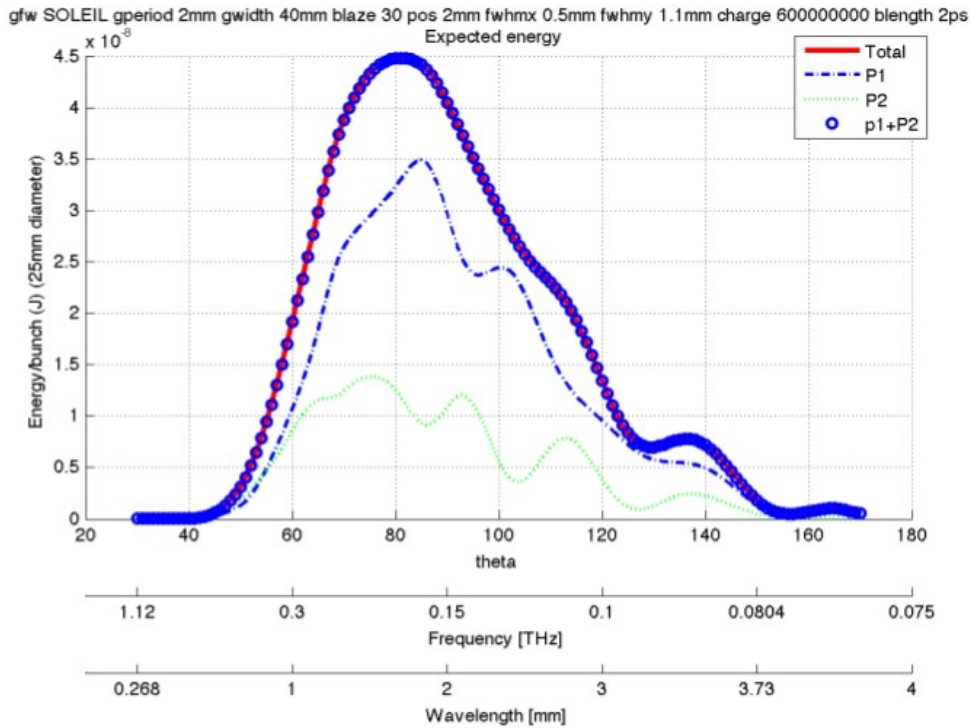
Available access to e- beam
(not in storage ring)
Fresh bunches ~ every 3 min

LINAC e- beam properties

- Energy: 100 meV
- Bunch duration: 1-2 ps-rms
- Transverse size: 1 mm-rms
- Repetition rate: bunch trains every 2-3 min
- Time structure:

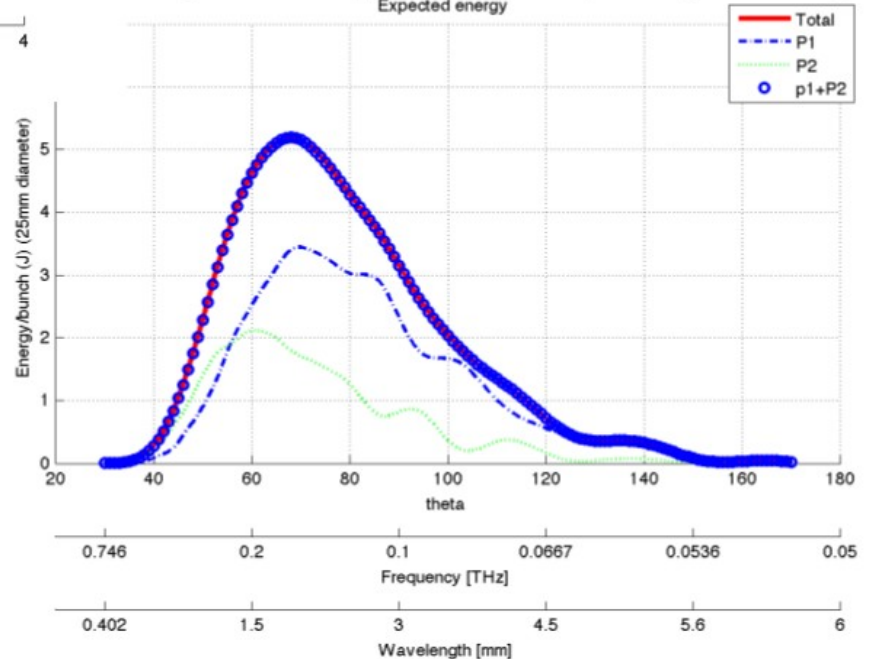
Filling pattern in ring	Time structure in Linac	Nominal charge	Max. charge
Multi bunch 4/4	104 bunches at 352 MHz in 300 ns	4 nC/train	10 nC/train
Hybrid mode	104 bunches in 300 ns + 1 single bunch	4 nC/train 0.5 nC/bunch	10 nC/train 0.5 nC/bunch
8 bunches mode	2 bunches separated by 150 ns	0.5 nC/bunch	0.5 nC/bunch

TABLE 1 – SOLEIL Linac filling patterns



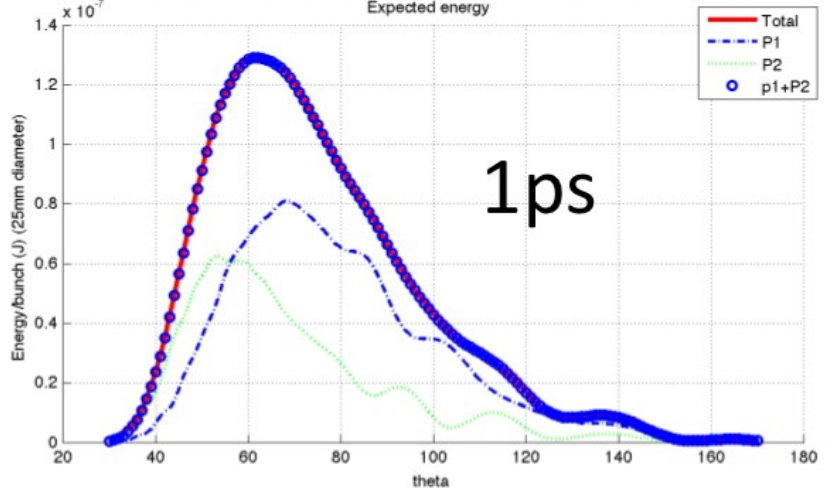
Predicted yield

rd 3mm gwidth 40mm blaze 30 pos 2mm fwhmx 0.5mm fwhmy 1.1mm charge 600000000 length 2ps
Expected energy

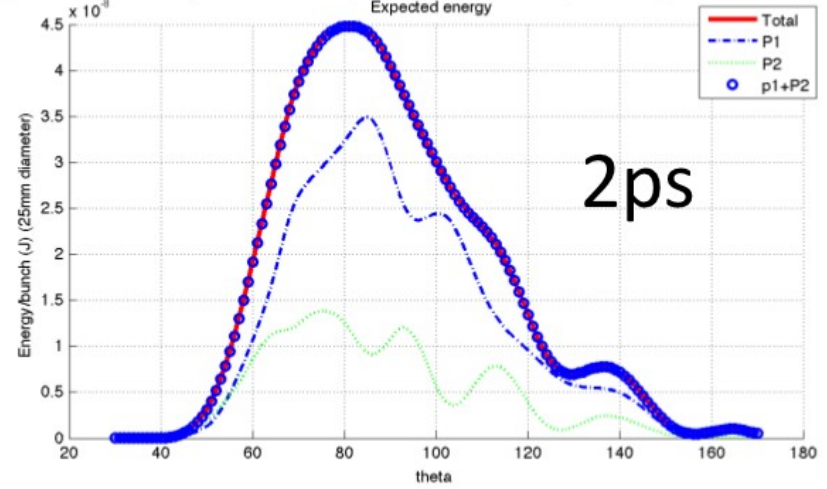


- Predicted yield is low
- Simulations:
grating=2-3mm, bunch
length 2ps FWHM,
37.5pC => ~45nJ/bunch
=> 4,5uJ/train

gwf SOLEIL gperiod 2mm gwidth 40mm blaze 30 pos 2mm fwhmx 0.5mm fwhmy 1.1mm charge 600000000 blength 1ps

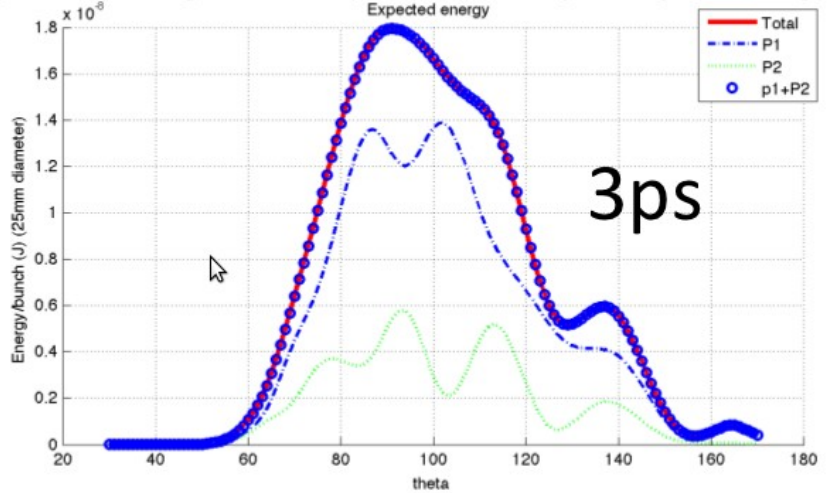


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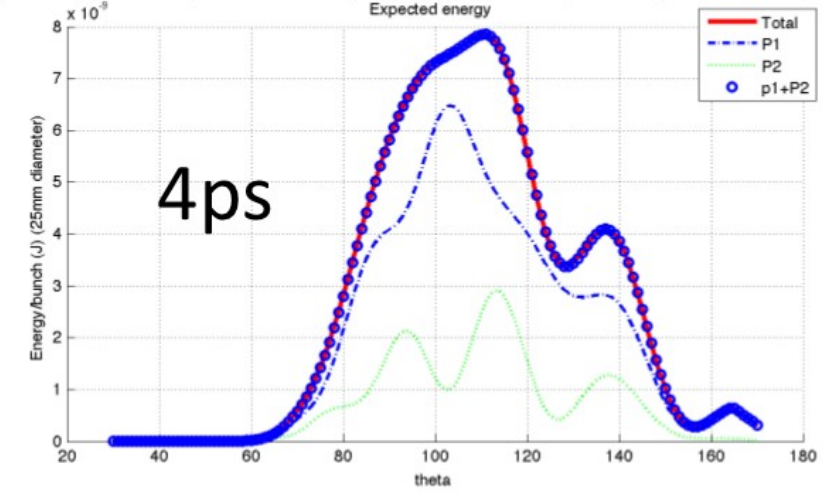


Effect of bunch length

gwf SOLEIL gperiod 2mm gwidth 40mm blaze 30 pos 2mm fwhmx 0.5mm fwhmy 1.1mm charge 600000000 blength 3ps



gwf SOLEIL gperiod 2mm gwidth 40mm blaze 30 pos 2mm fwhmx 0.5mm fwhmy 1.1mm charge 600000000 blength 4ps



1.12 0.3 0.15 0.1 0.0804 0.075

Frequency [THz]

0.268 1 2 3 4

Wavelength [mm]

1.12 0.3 0.15 0.1 0.0804 0.075

Frequency [THz]

0.268 1 2 3 3.73 4

Wavelength [mm]

1.12 0.3 0.15 0.1 0.0804 0.075

Frequency [THz]

0.268 1 2 3 3.73 4

Wavelength [mm]

1.12 0.3 0.15 0.1 0.0804 0.075

Frequency [THz]

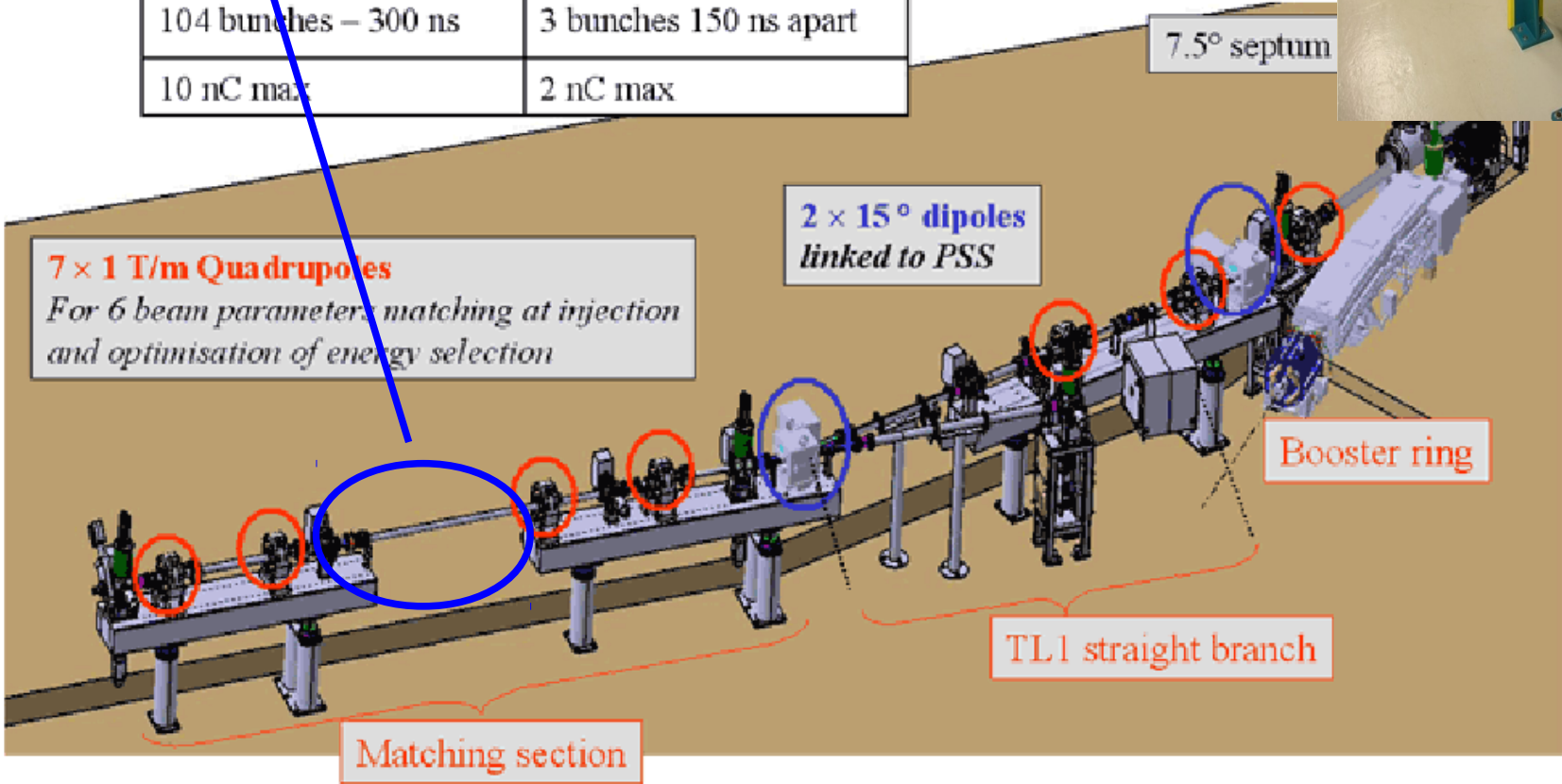
0.268 1 2 3 3.73 4

Wavelength [mm]

LINAC tunnel

Free space !
 → SPESO

<i>Top up multibunch mode</i>	<i>Top up F S Bunch mode</i>
104 bunches – 300 ns	3 bunches 150 ns apart
10 nC max	2 nC max



Outside wall

...before...

J2

J1

LINAC/VIS.2

e-

LT1/VIS.1

LT1/V/PI.1

LT1/V/PI.2

LT1/V/PI.3

LT1/V/PI.4

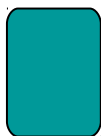
Inside wall



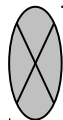
Station écran



Charge monitor



Pompe ionique



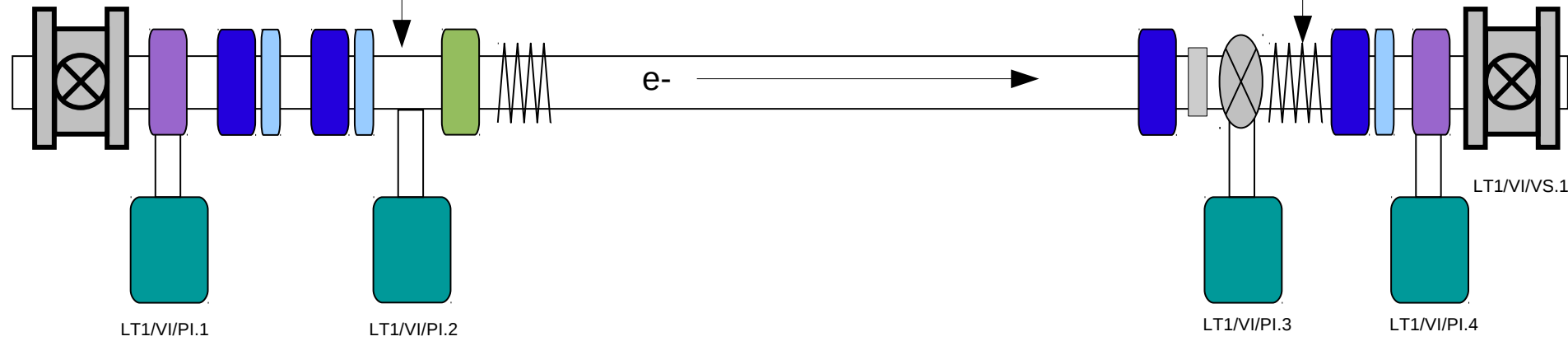
Vanne d'équerre

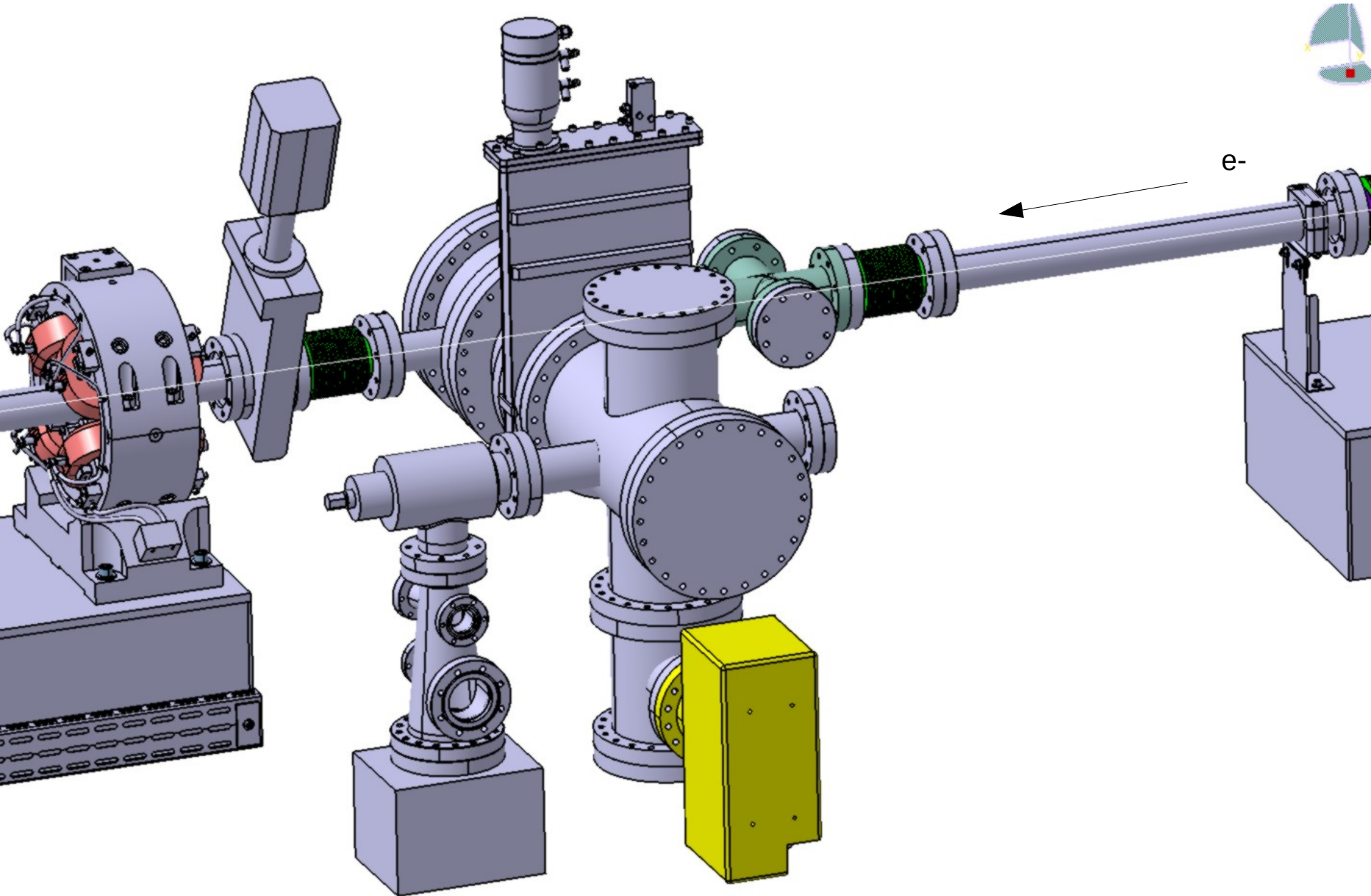


Q-pole



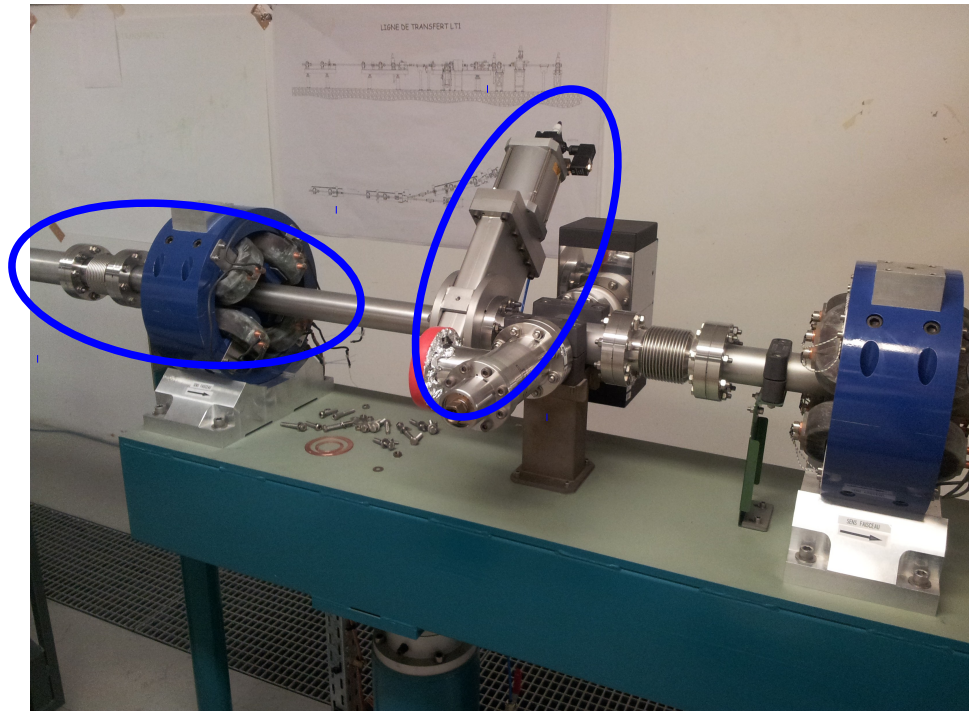
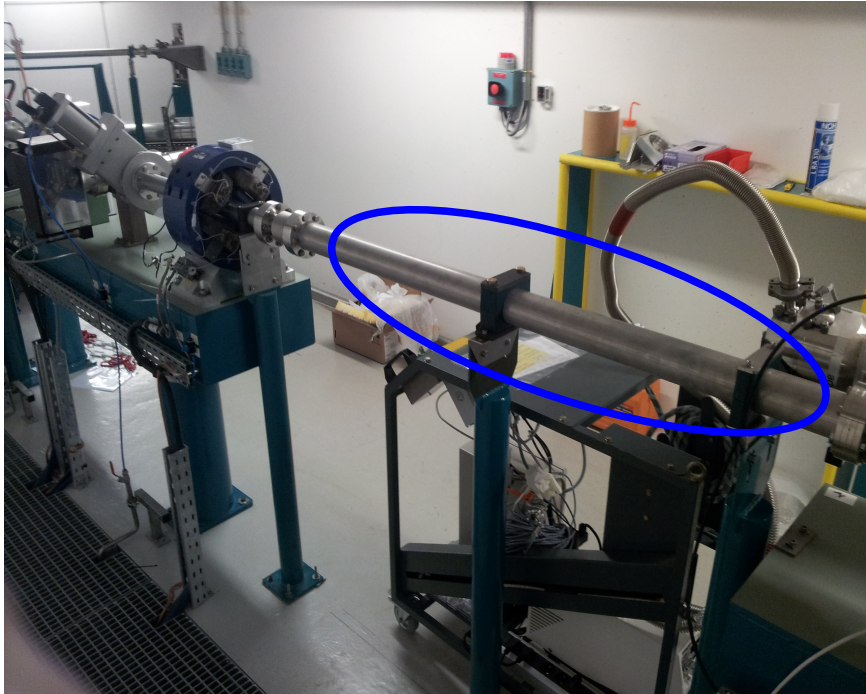
Steerer





e-

First installations in January 2013



New tubes + valve → vacuum break → isolated cell for SPESO

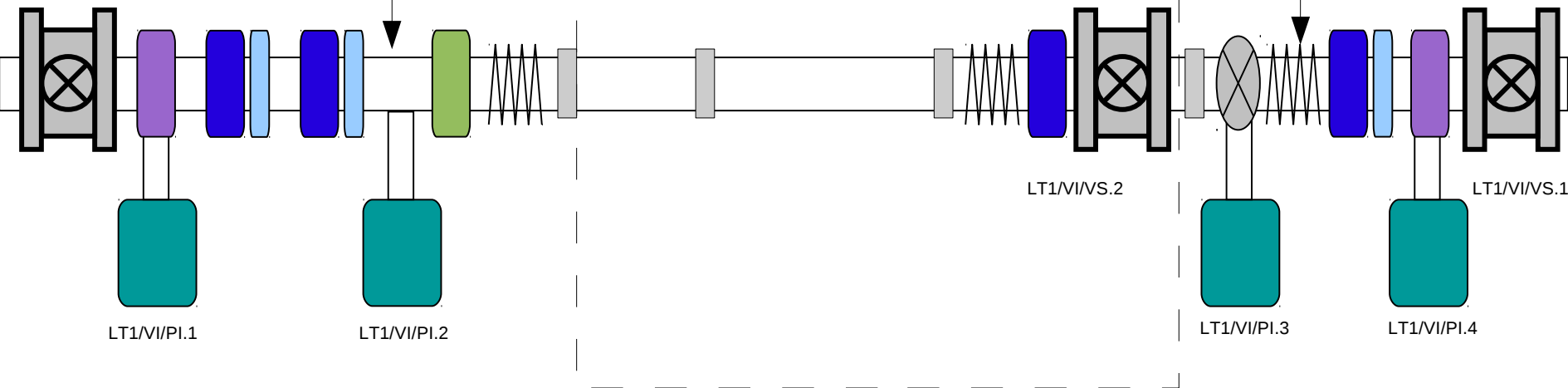
Outside wall

...now...

J2

J1

LINAC/V/VS.2



LT1/V/VS.2

LT1/V/VS.1

LT1/V/PI.1

LT1/V/PI.2

LT1/V/PI.3

LT1/V/PI.4

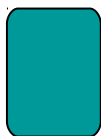
Inside wall



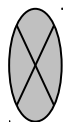
Station écran



Charge monitor



Pompe ionique



Vanne d'équerre



Q-pole



Steerer

Next installations planned for April 2013

(shutdown period)

- CaV1: main vacuum chamber
- CaV2: secondary chamber for grating storage/exchange
- VS3: valve for grating exchange
 - Security system to protect LINAC vacuum
- Pumps for CaV1 and CaV2 (vacuum < 10e-8 mbar)
- Motorized arm: for grating insertion
 - Security system to protect LINAC beam
- Girders for mechanical support

Next installations planned

(during users's operation period and/or august shutdown)

- THz Detectors
- Data acquisition system
- Motion stage for the detectors
- Remote grating change system
- Large quartz viewport
- ...

