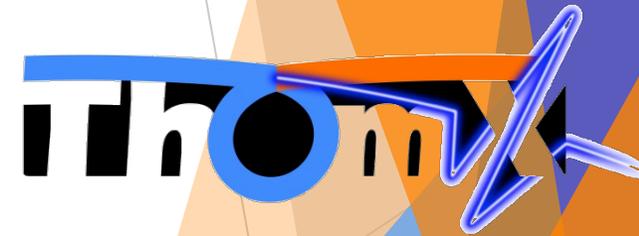


Le système de synchronisation de ThomX

Nicolas Delerue - Vincent Chaumat

LAL



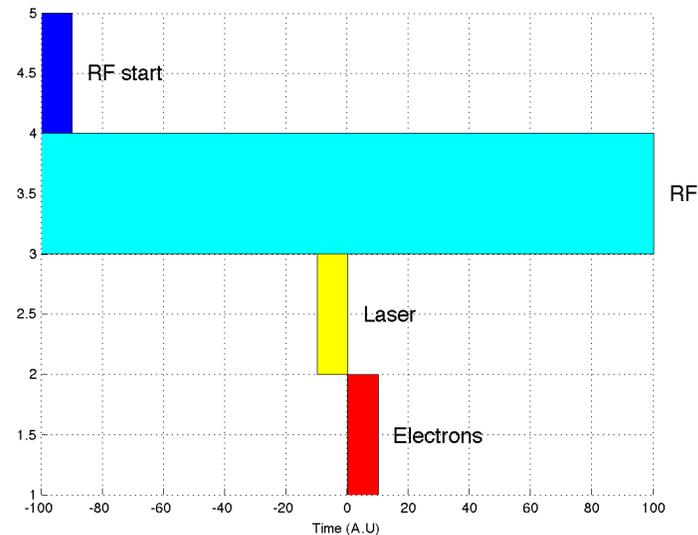
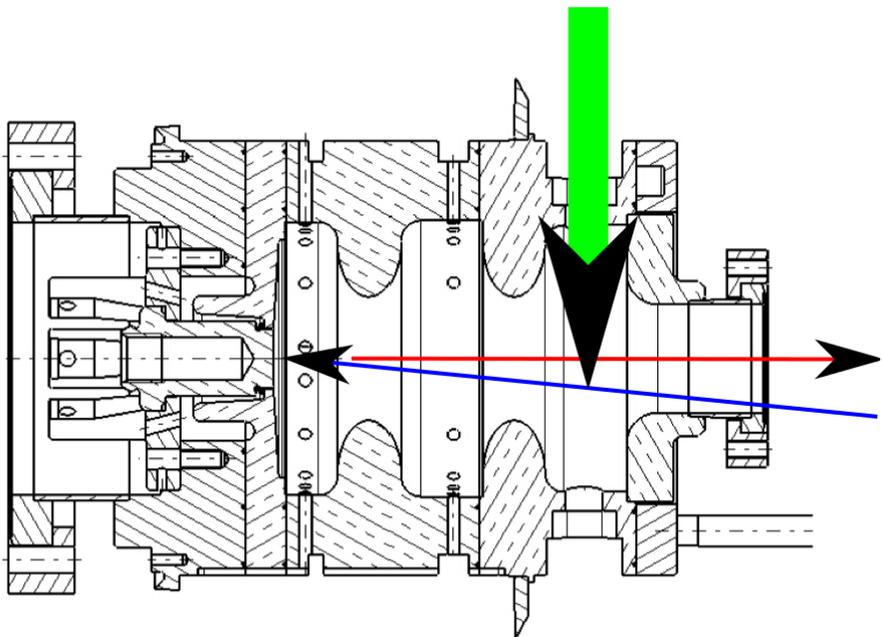
Sommaire

- ▶ Présentation générale du sous-système et de son fonctionnement
- ▶ Etat d'avancement:
 - Transfert des responsabilités LAL => SOLEIL (si applicable)
 - Équipements manquants
 - Équipements pas encore testés
 - Équipements pas encore testé avec le CC (si applicable)
 - Progrès de l'assemblage des composants (si applicable), intervention entreprise extérieure nécessaire (si applicable)
 - Planning d'installation dans l'igloo (identification des étapes pour l'installation, durée, et date d'installation si celle-ci est définie, dépendance avec d'autres sous-systèmes)
 - Liste des tests de validation sur site.
 - Liste des tests de validation sur site avec le CC (si applicable).



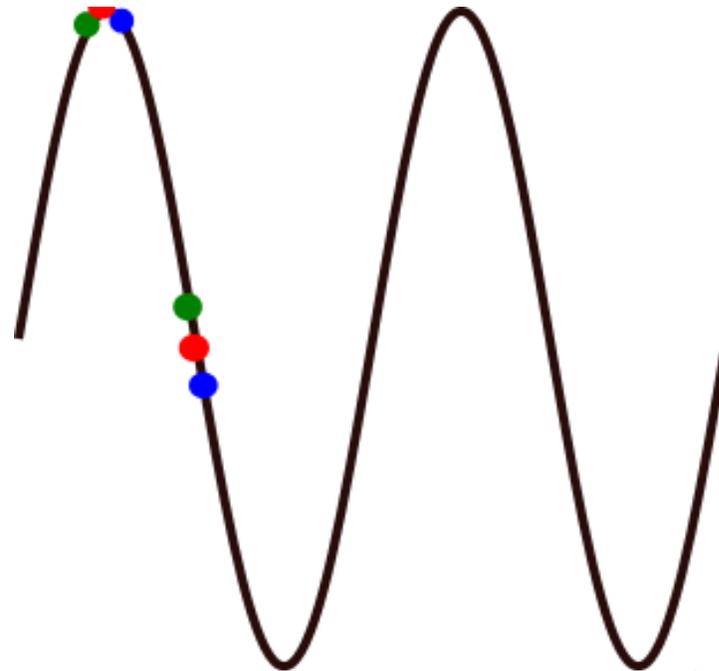
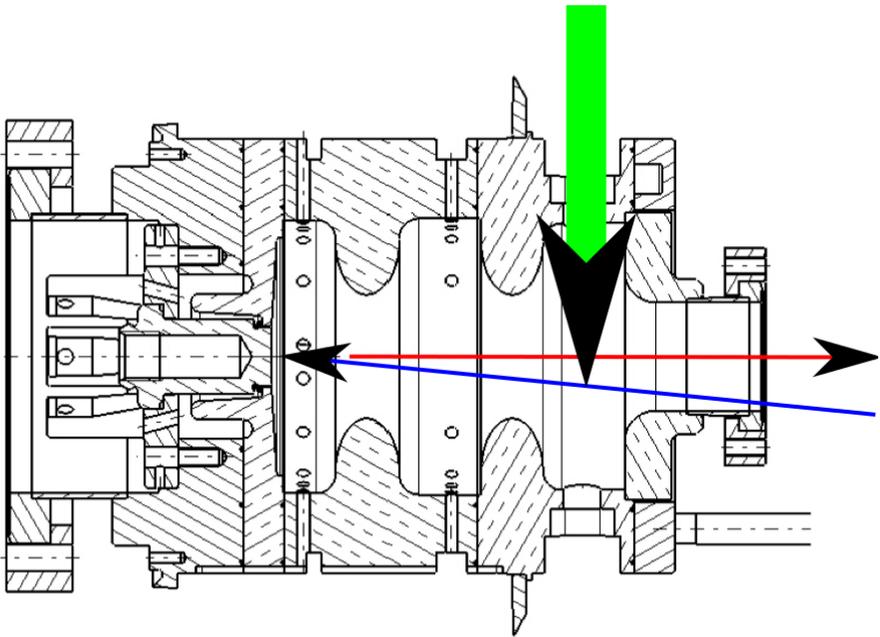
ThomX, from injection to extraction...

- ▶ We will look at what happens in ThomX from injection to extraction.
- ▶ (1) Electrons production
 - This happens when the laser hits the photocathode
 - However the electrons will be accelerated only if the RF is present and has already filled the gun.



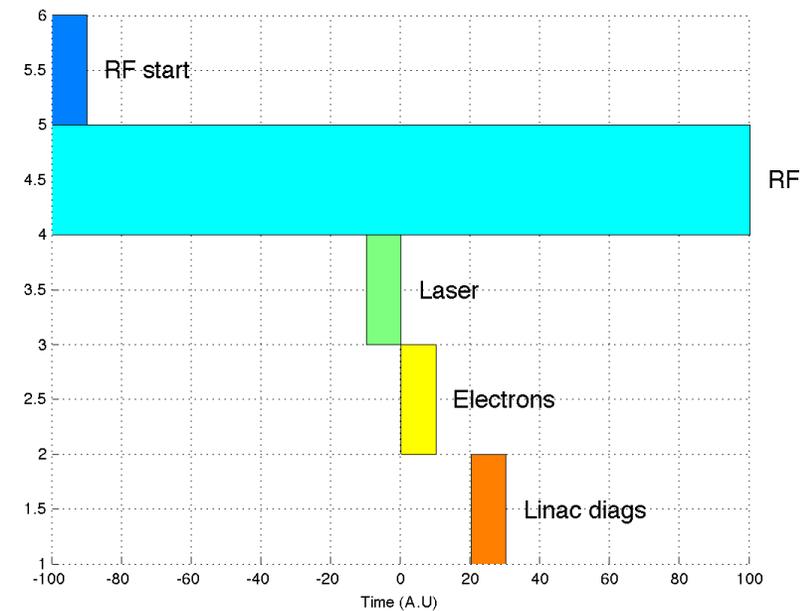
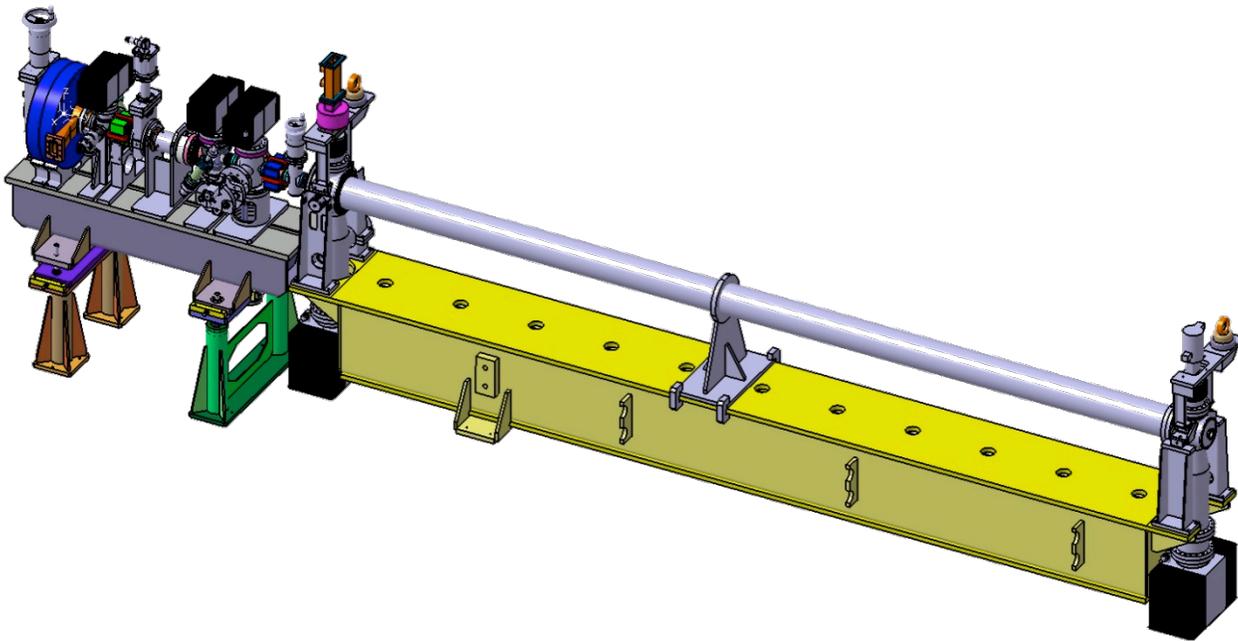
ThomX, from injection to extraction...

- ▶ (2) Electrons acceleration
 - To be accelerated the electrons must be at the correct phase in the RF.
 - Any variation in the RF phase, either in the gun or in the linac will result in energy fluctuations.



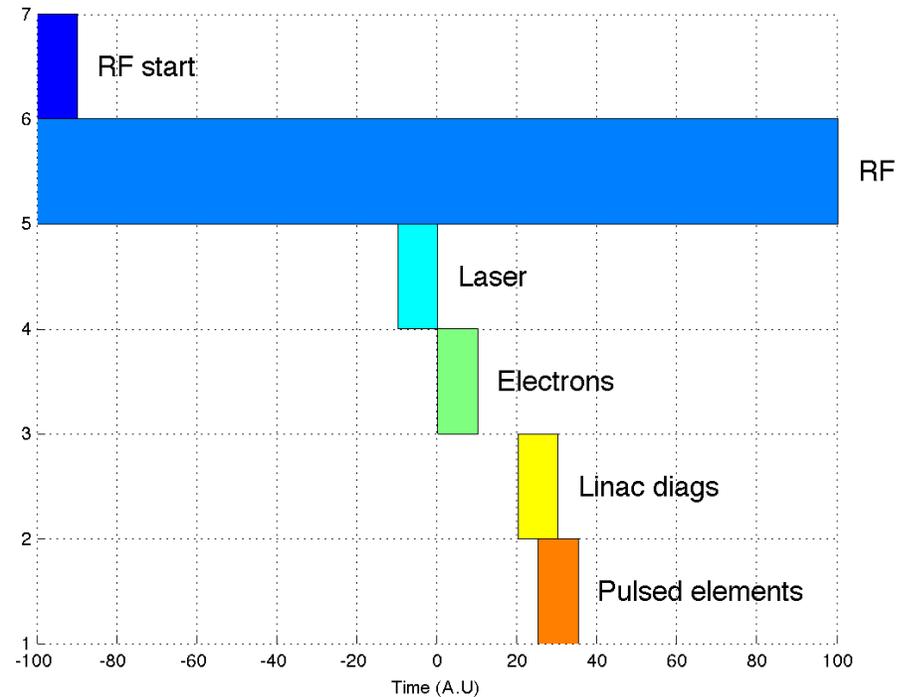
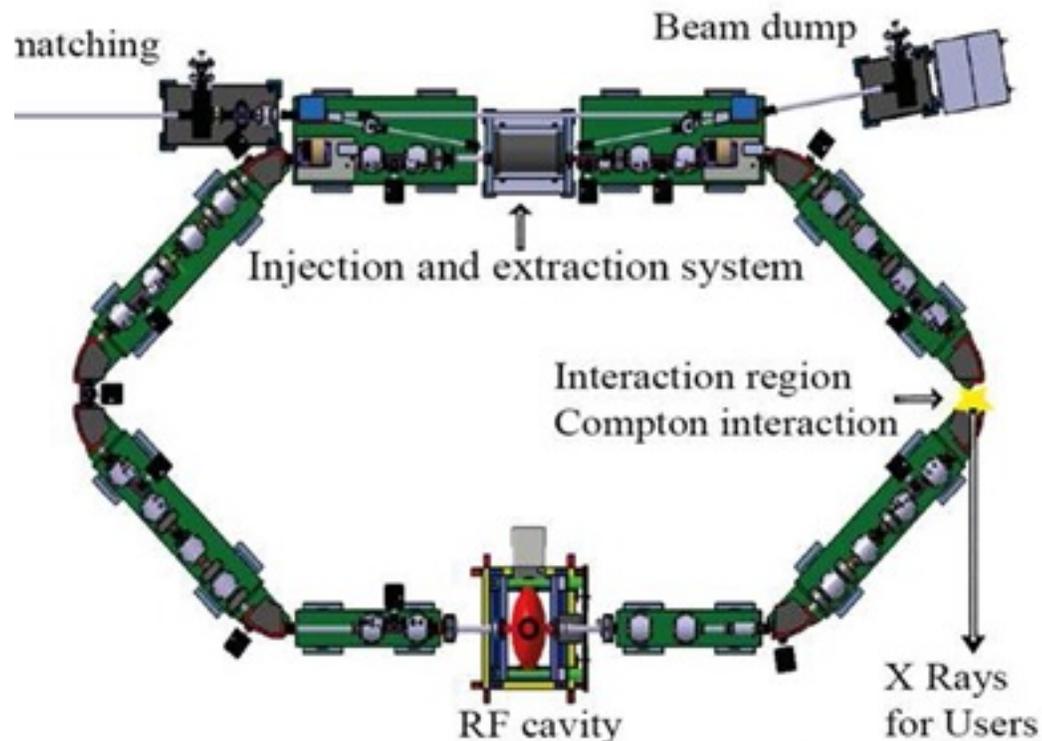
ThomX, from injection to extraction...

- ▶ (3) Linac diagnostics
 - All the linac diagnostics must be ready to take data when the electrons arrive.
- ▶ This also requires the mains' phase to be the same from shot to shot.



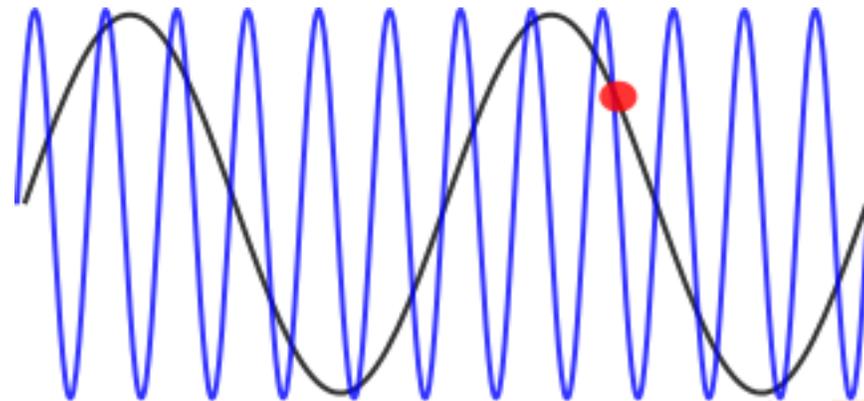
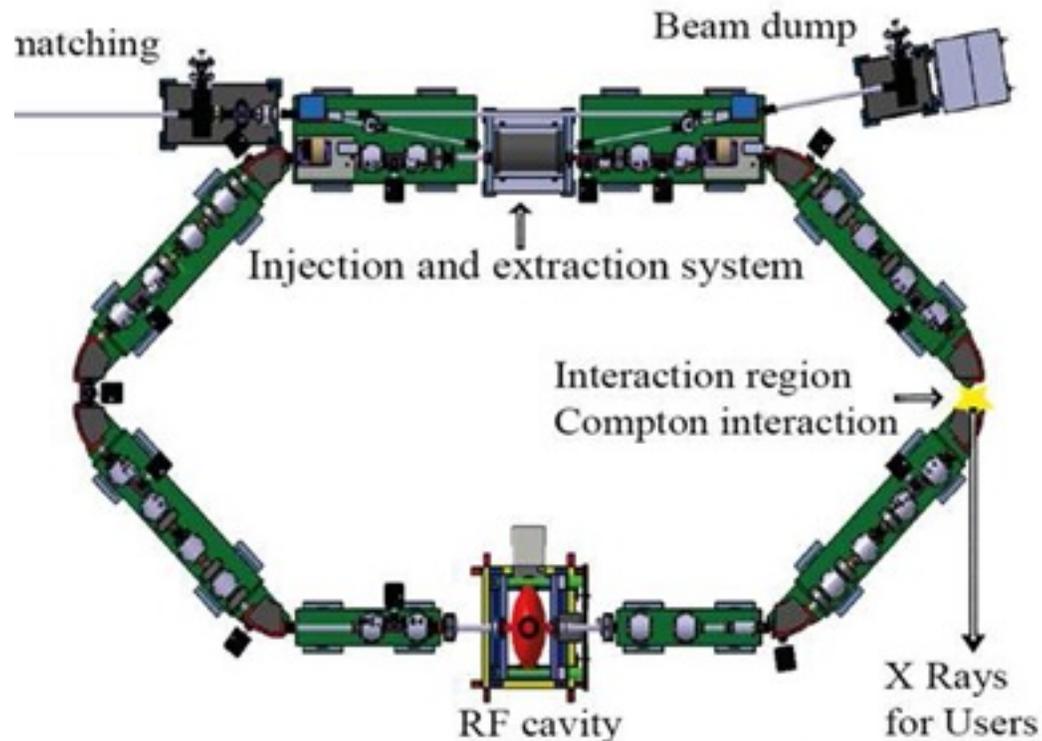
ThomX, from injection to extraction...

- ▶ (4) Ring injection
 - Once the electrons reach the end of the linac they enter the ring.
 - The pulsed elements (septum, kickers,...) must fire at the good time.



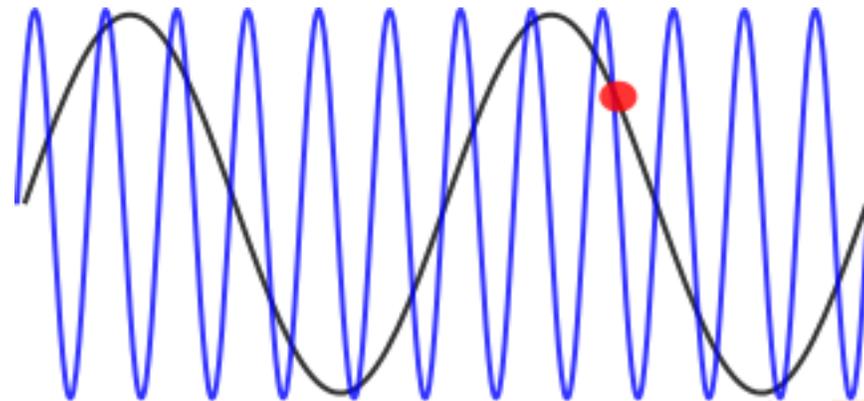
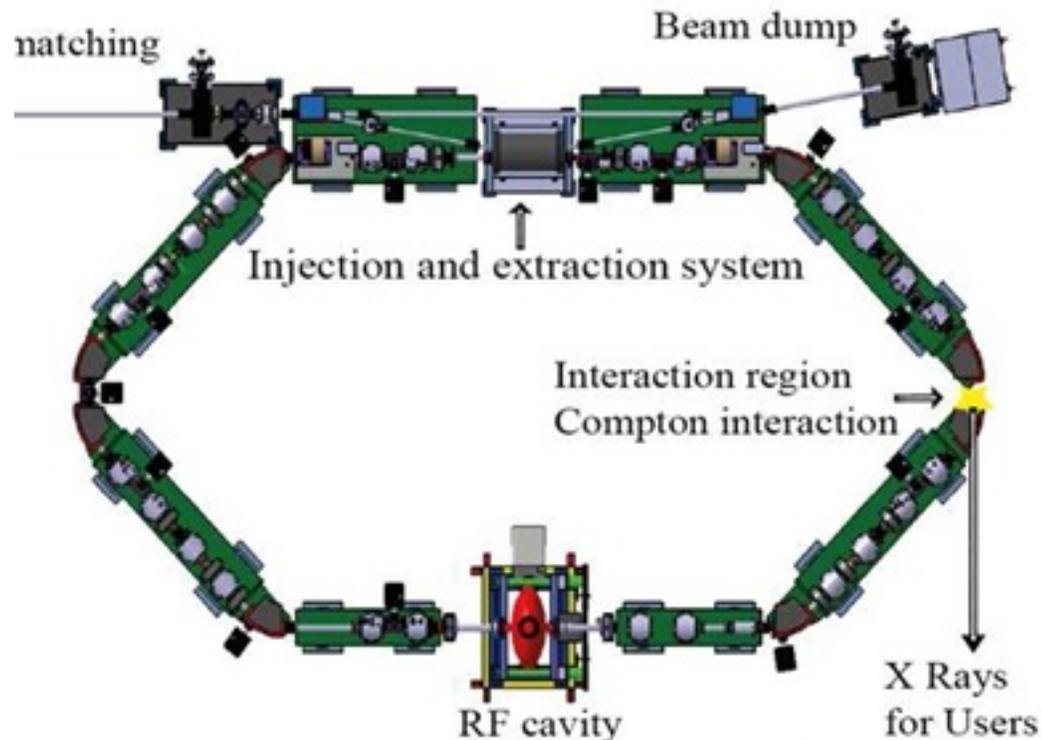
ThomX, from injection to extraction...

- ▶ (4) Ring injection
 - The phase at which the electrons are injected is very important, otherwise they won't be captured correctly in the ring!



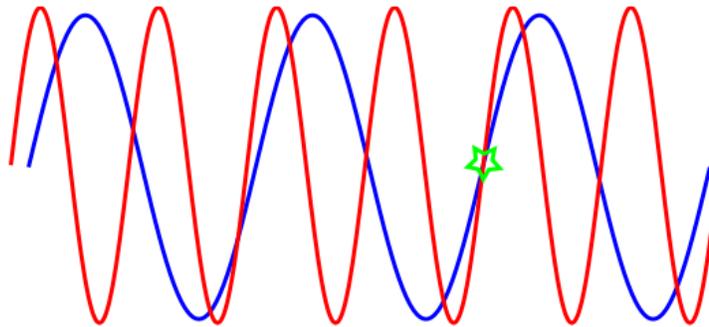
ThomX, from injection to extraction...

- ▶ (4) Ring elements
 - BUT the ring frequency can change!!!
 - The ring must have its own clock!
 - The injection must occur only at a fixed phase of the ring wrt to the linac...
 - This clock is also distributed to all ring diags, the FP cavity and the X-line.



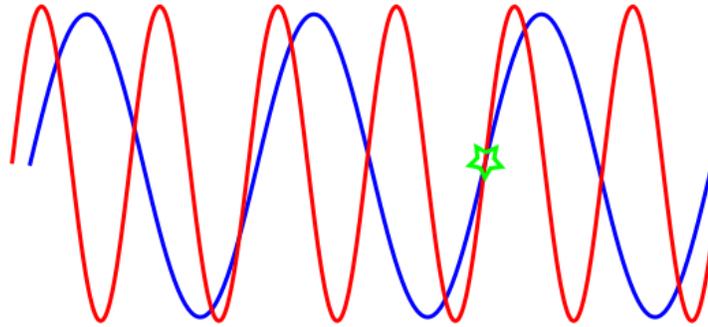
ThomX frequencies

- ▶ The ThomX gun and linac will be based on the the LEP Injector Linac (LIL) technology and use a fixed frequency of 2998.55MHz.
 - ▶ To get the maximum accelerating gradient in the gun its frequency will be fixed by the cooling water.
- ▶ The ThomX ring will operate at the 30th harmonic of 500MHz (16.7MHz).
 - The frequency of the ring will change due to environmental variations.
 - Acceptable ring frequency variations are up to 1% (we expect much less)
- ▶ As a consequence, if we set the ring frequency at a sub-harmonic of the linac frequency at a given time, this will no longer be true a few days/weeks later.
- ▶ We choose different frequencies and heterodyne operations.

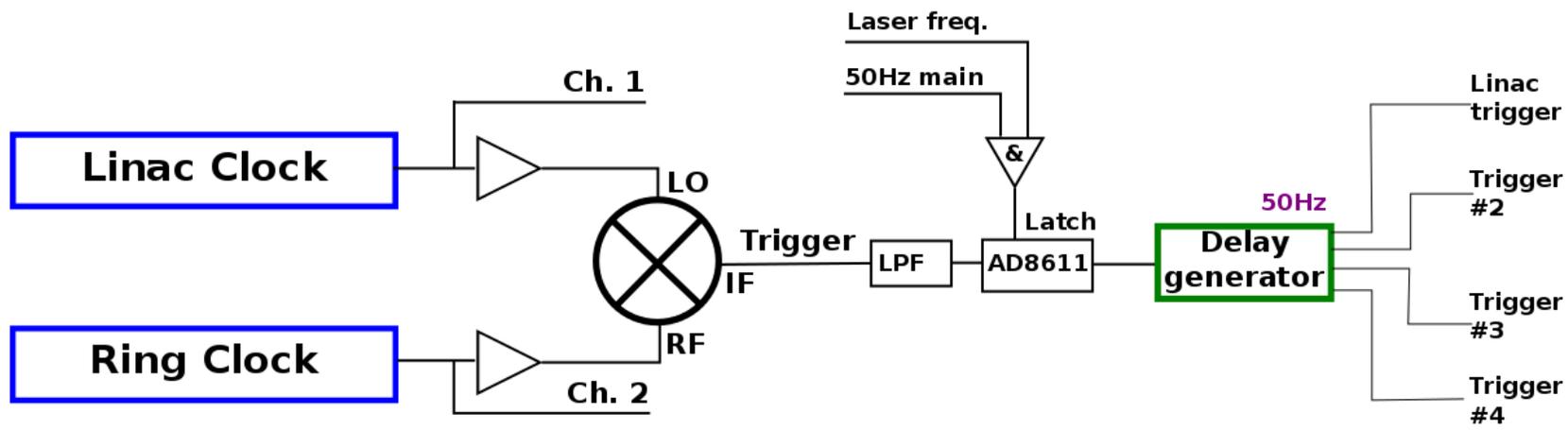


Finding the correct time to trigger injection

- ▶ Even two truly independant clocks are sometimes in phase...



- ▶ We will use a mixer to detect these coincidences



Heterodyne triggering tests

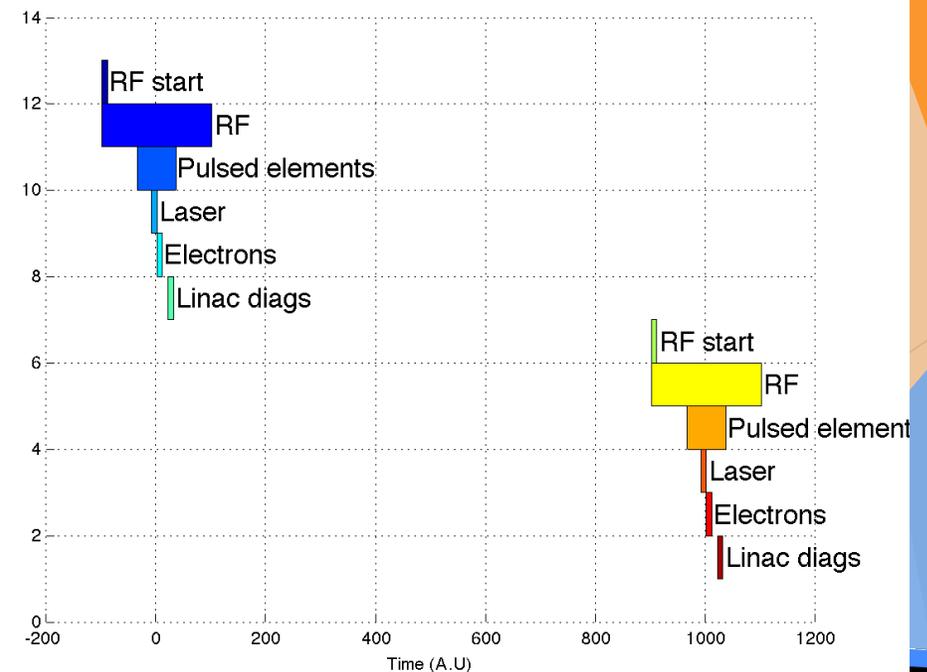
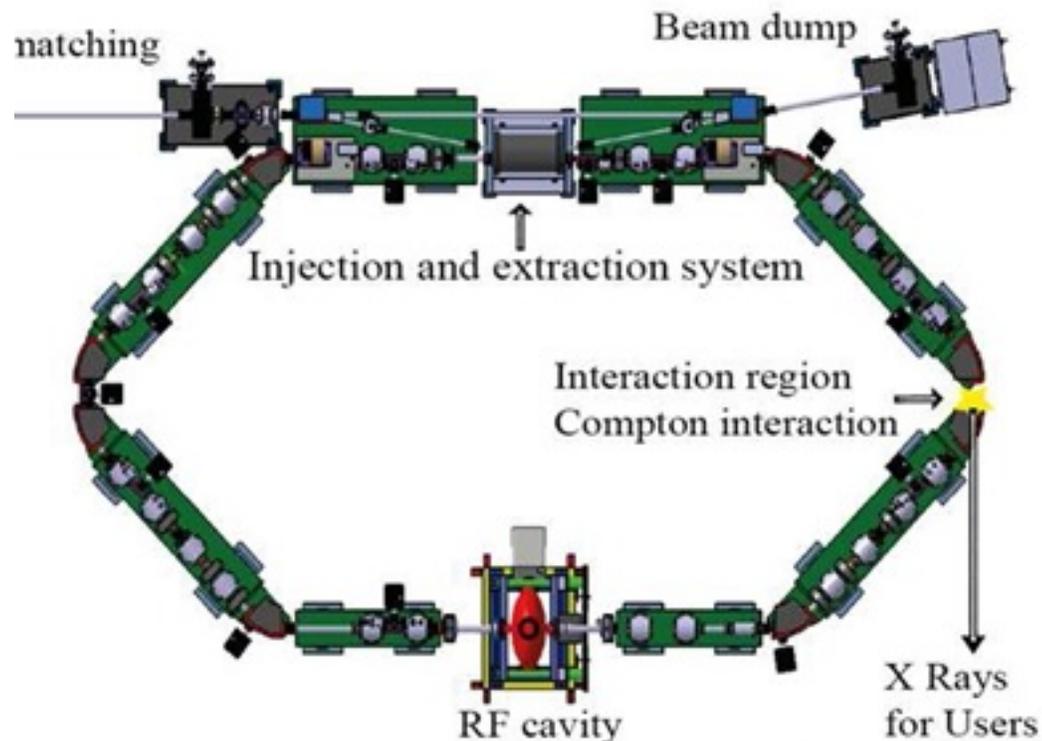
- ▶ We have done several tests (also for another project) on heterodyne triggering and written a paper at IPAC'17 (THPAB093).
- ▶ The noise is obviously better if we operate at lower frequencies.
- ▶ A jitter below 2ps has been measured.
- ▶ For it to work the ring must NOT be at an harmonic of 2998.55MHz.
- ▶ Instead it must be at least 5kHz away from such harmonic...
- ▶ To avoid another problems with the mains all triggering will be done with the 50Hz electrical grid potential will be 0V.
- ▶ With a frequency difference of 5kHz this leads to a trigger within 0.2ms of the mains crossing 0V.

Alternative to heterodyne triggering

- ▶ The MAC has requested us to consider a more conventional triggering scheme.
- ▶ This is possible very easily: we just need to put the two oscillators at harmonic frequencies of each other.
- ▶ However this requires to change the frequency of the linac. This can be done by adjusting the linac and gun cooling/heating temperature.
- ▶ The two schemes will be available and will have to be tested during the first months of operations.

ThomX, from injection to extraction...

- ▶ (4) Ring extraction
 - After 20 ms the pulsed elements must fire again to extract the electrons
 - In fact the pulsed elements do the extraction and injection on the same HV pulse.
 - So the extraction is triggered by the following injection.



Concrètement...

Schéma ThomX synchro RAC .08 ELR-1 ELR-2 Triggerbox

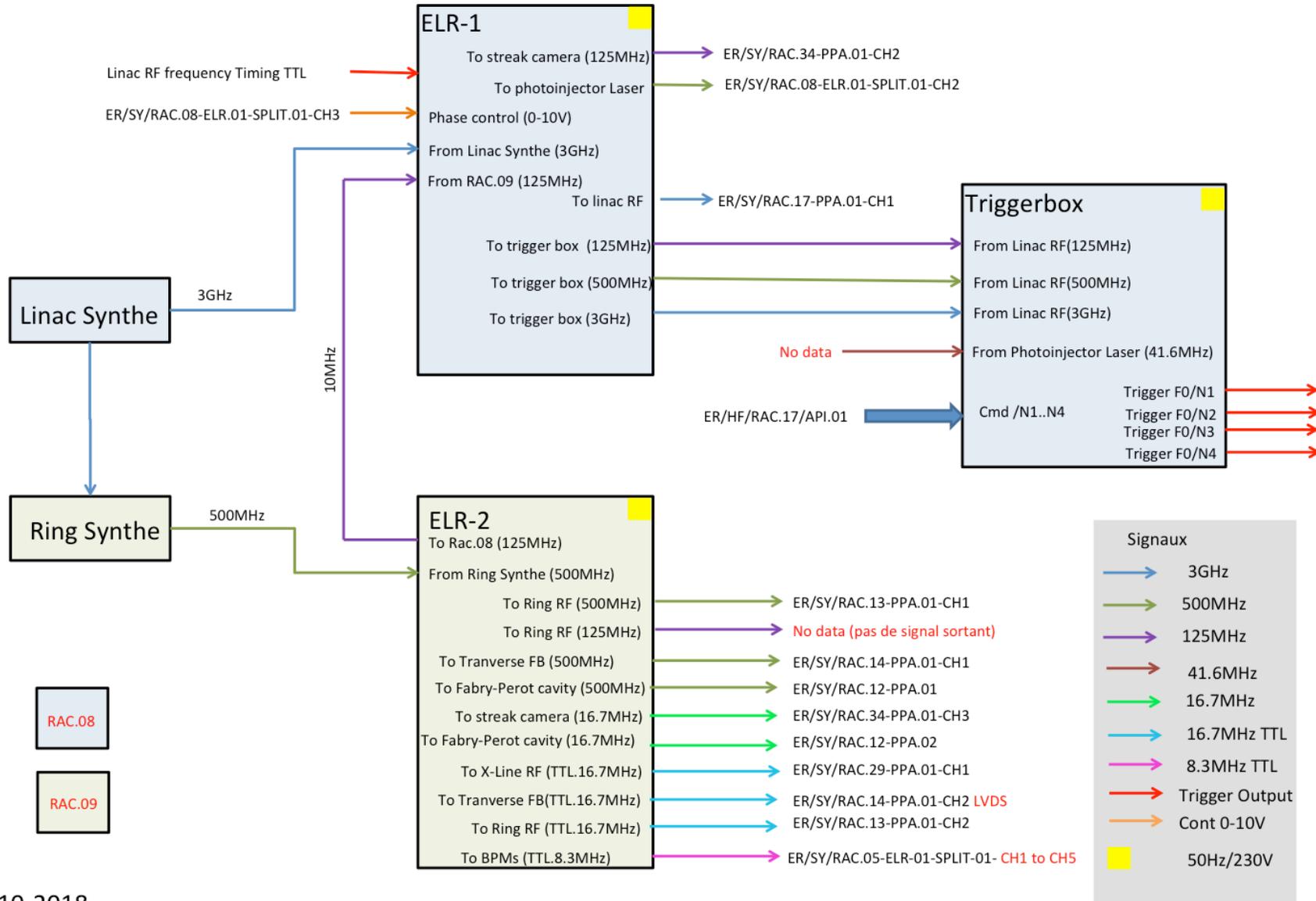
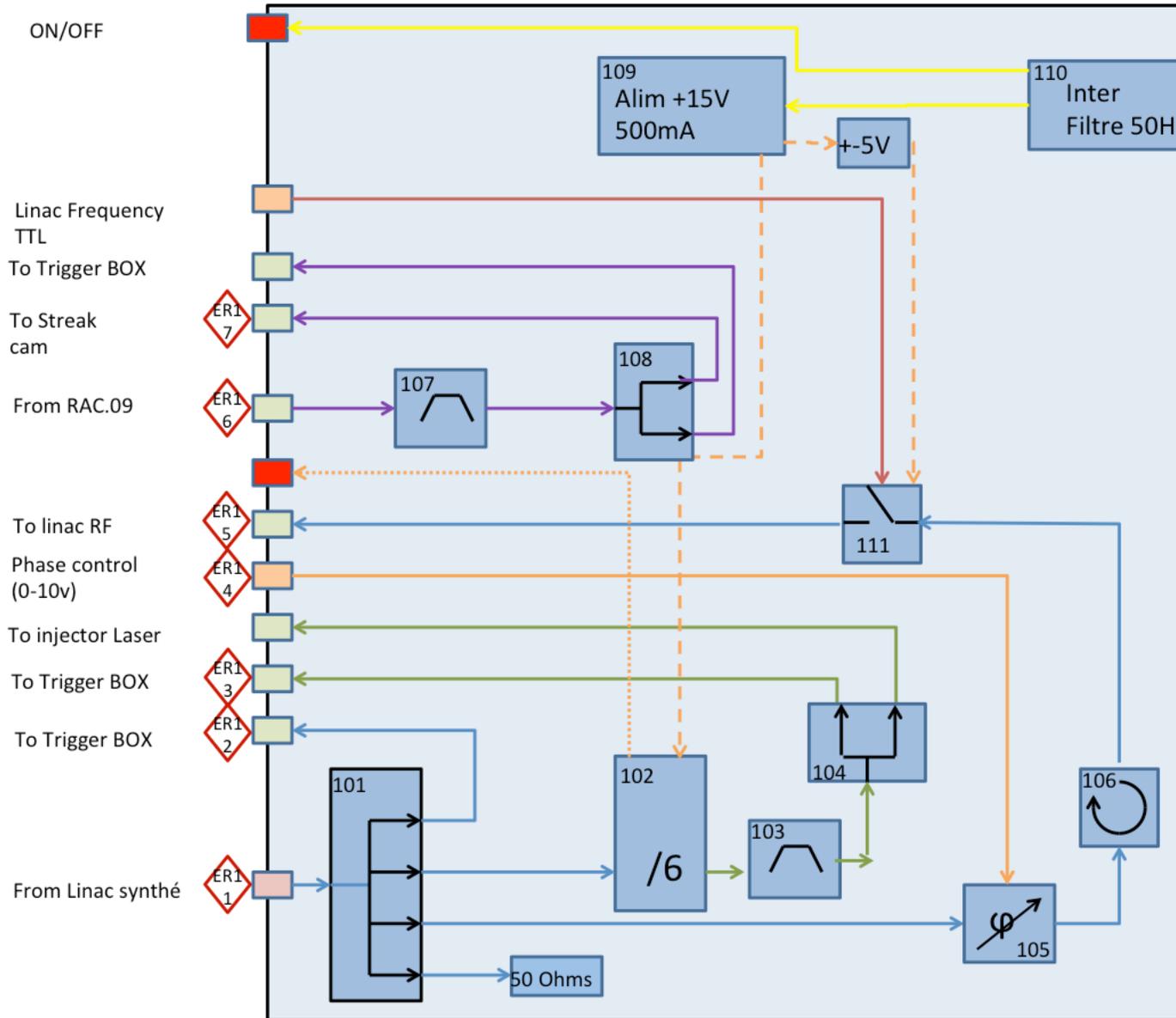


Schéma ThomX synchro ELR-1 (3GHz canon)



Liste des composants

- 101 Mini-circuits-- ZN4PD1-842+
- 102 Atlantic RF labs-- AIN3000-Div
- 103 Microtronics--Passband 500MHz
- 104 clearmicrowave-- D25001
- 105 QUOTANA-- DBVCPS02000400B
- 106 Aerocom--I-E290.310-A1-(F1F1L1a)
- 107 Microtronics--Passband 125MHz
- 108 Mini-circuits-- ZFSC-2-372+
- 109 Radiospare-- 1618211
- 110 SCHAFFNER-- FN284B-6-06
- 111 QUOTANA-- DBSA0102000400A_V0

? Ref measurement

Connecteurs extérieurs

- LED (8mm)
- Sma
- N
- BNC

Signaux internes

- 3GHz
- 500MHz
- 125MHz
- 50Hz
- 0-10V
- Statut diviseur
- +15V/ +5V
- Freq linac TTL



Schéma ThomX synchro ELR-2 (500MHz Ring)

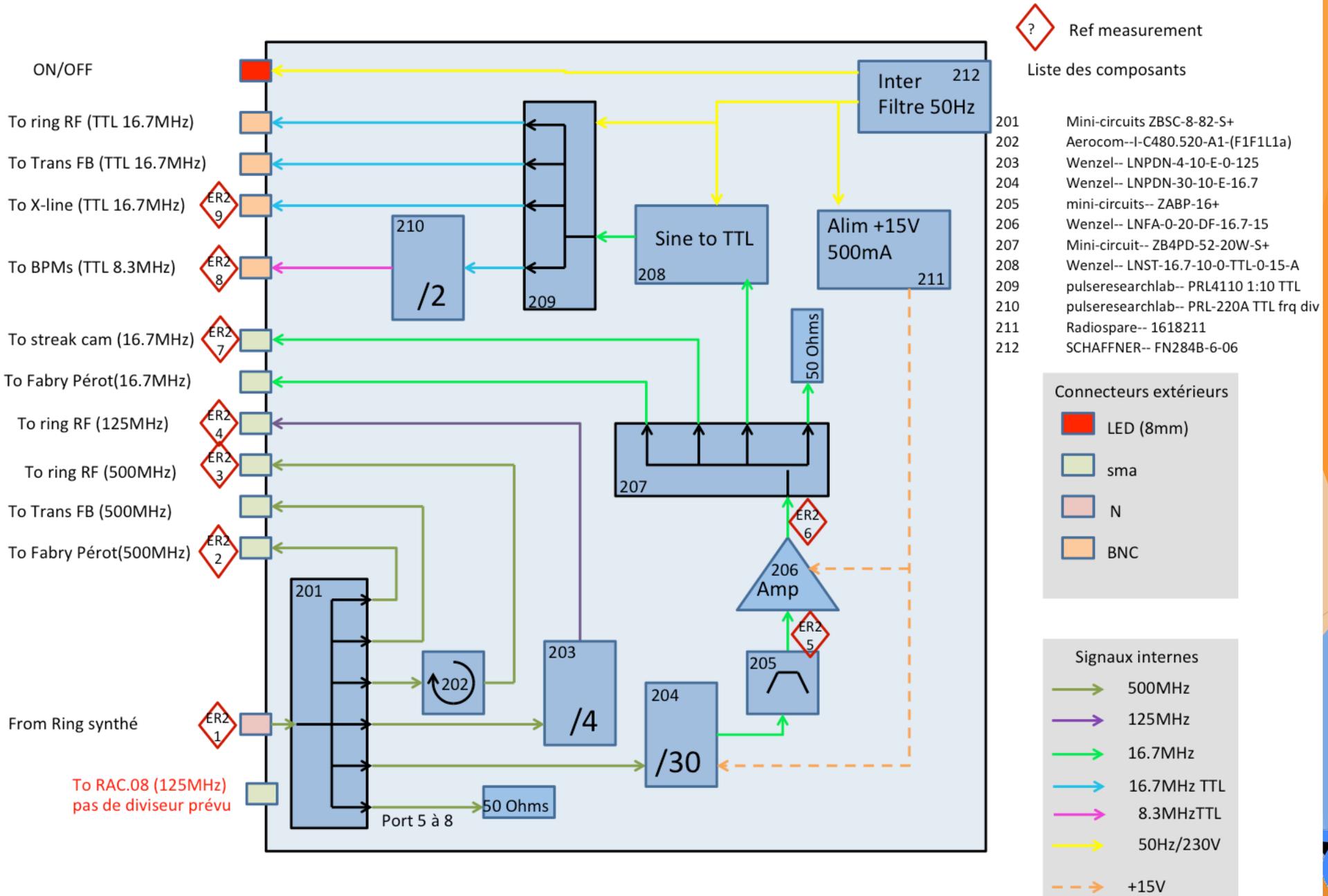
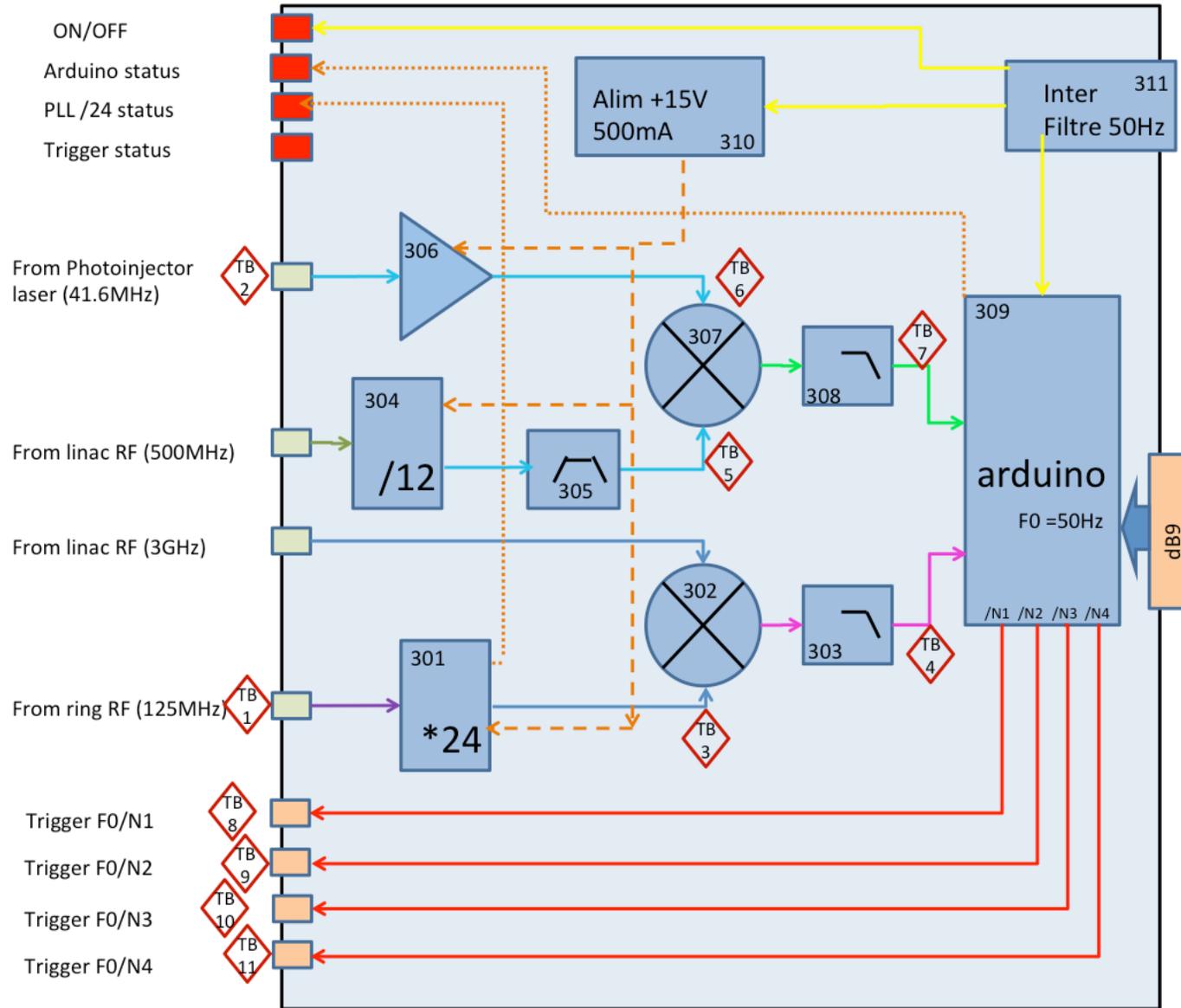


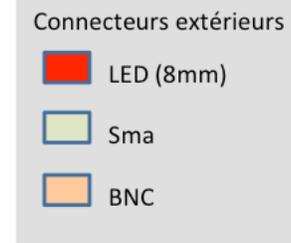
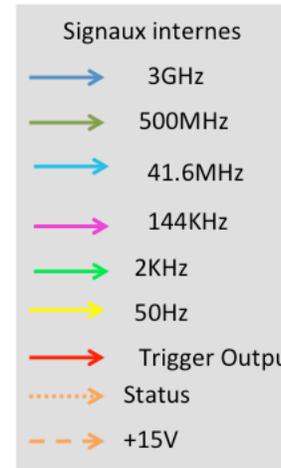
Schéma ThomX synchro Triggerbox



◇ Ref measurement

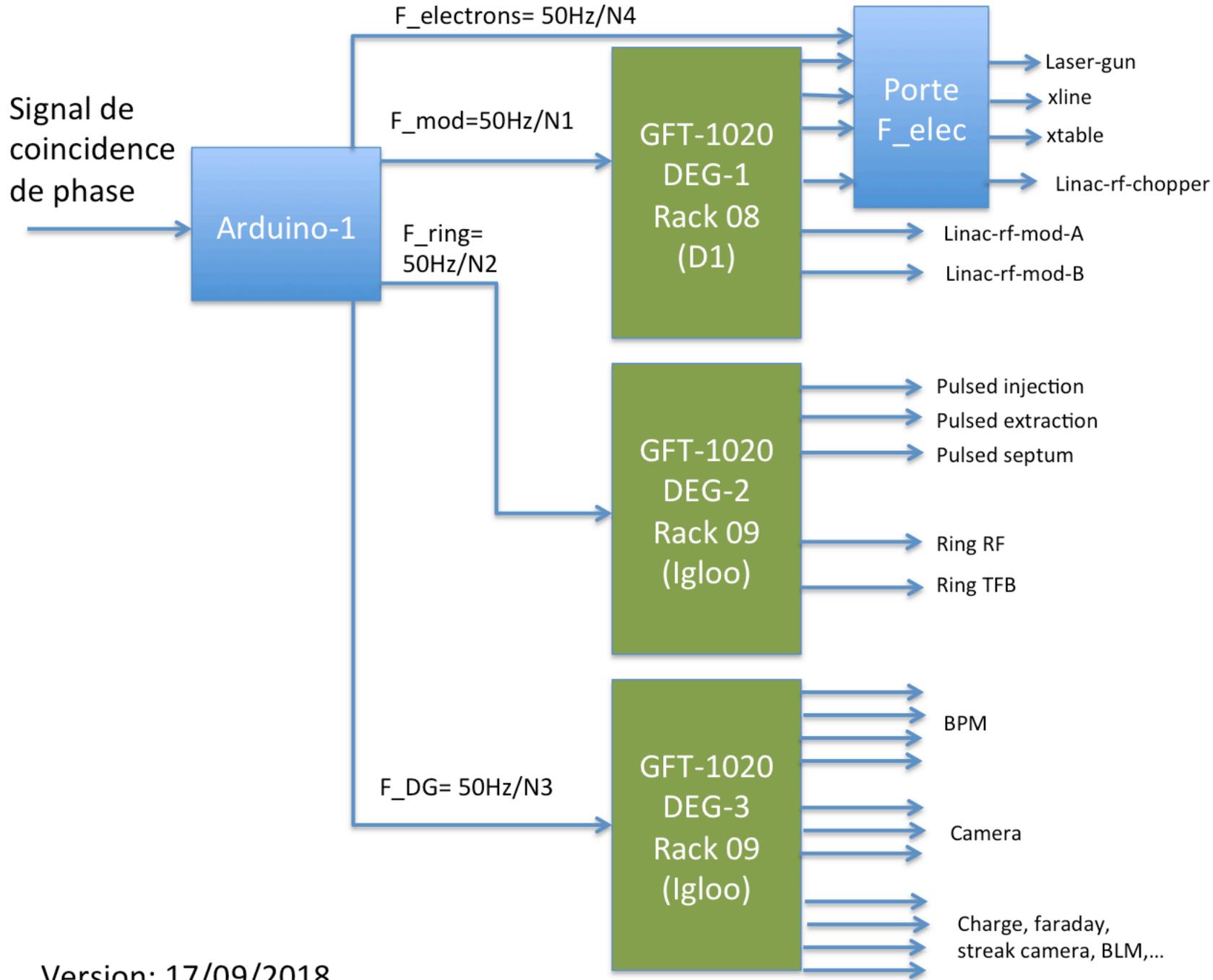
Liste des composants

- 301 Microwave Dynamics PLO-2000-03.00
- 302 Mini-circuits ZX05-C42LH+
- 303 Mini-circuits BLP-1.9+
- 304 Wenzel-- LNPDN-12-10-E-0-41.64
- 305 mini-circuits SIF-40+
- 306 Wenzel-- LNFA-0-20-DU-41.64-15
- 307 Mini-circuits ZRPD-1+
- 308 Mini-circuits BLP-1.9+
- 309 developpement local
- 310 Radiospare-- 1618211
- 311 SCHAFFNER-- FN284B-6-06



Trigger Output





Version: 17/09/2018

Valeurs de N1, N2, N3 et N4 (cf ATRIUM)

Code	Diviseurs				Fréquences (Hz)				
	N1	N2	N3	N4	F_modulateur	F_ring	F_diag	F_electrons	
	N_modulateur	N_ring	N_diag	N_electrons					
0	1	1	0	1000	100	50	0	0,05	0,5
1	1	1	0	500	100	50	0	0,1	0,5
2	1	1	0	200	100	50	0	0,25	0,5
3	1	1	0	100	100	50	0	0,5	0,5
4	1	1	100	1000	100	50	0,5	0,05	0,5
5	1	1	100	500	100	50	0,5	0,1	0,5
25	1	1	0	200	5	50	0	0,25	10
26	1	1	0	50	5	50	0	1	10
27	1	1	5	1000	5	50	10	0,05	10
28	1	1	5	500	5	50	10	0,1	10
29	1	1	5	200	5	50	10	0,25	10
30	1	1	5	100	5	50	10	0,5	10
défaut	31	1	5	10	5	50	10	5	10

Fréquence de base: 50Hz (ErDF).
Valeurs ajustable si nécessaire.

Valeurs de N1, N2, N3 et N4 (cf ATRIUM)

Code	Diviseurs				Fréquences (Hz)				Interval entre déclenchements (s)			
	N1	N2	N3	N4	F_modulateur	F_ring	F_diag	F_electrons	F_modulateur	F_ring	F_diag	F_electrons
	F_modulateur	F_ring	F_diag	F_electrons								
0	1	0	1000	100	50	0	0,05	0,5	0,02	999	20	2
1	1	0	500	100	50	0	0,1	0,5	0,02	999	10	2
2	1	0	200	100	50	0	0,25	0,5	0,02	999	4	2
3	1	0	100	100	50	0	0,5	0,5	0,02	999	2	2
4	1	100	1000	100	50	0,5	0,05	0,5	0,02	2	20	2
5	1	100	500	100	50	0,5	0,1	0,5	0,02	2	10	2
6	1	100	200	100	50	0,5	0,25	0,5	0,02	2	4	2
7	1	100	100	100	50	0,5	0,5	0,5	0,02	2	2	2
8	1	0	1000	50	50	0	0,05	1	0,02	999	20	1
9	1	0	500	50	50	0	0,1	1	0,02	999	10	1
10	1	0	100	50	50	0	0,5	1	0,02	999	2	1
11	1	0	50	50	50	0	1	1	0,02	999	1	1
12	1	50	1000	50	50	1	0,05	1	0,02	1	20	1
13	1	50	500	50	50	1	0,1	1	0,02	1	10	1
14	1	50	100	50	50	1	0,5	1	0,02	1	2	1
15	1	50	50	50	50	1	1	1	0,02	1	1	1
16	1	0	1000	10	50	0	0,05	5	0,02	999	20	0,2
17	1	0	100	10	50	0	0,5	5	0,02	999	2	0,2
18	1	0	50	10	50	0	1	5	0,02	999	1	0,2
19	1	0	10	10	50	0	5	5	0,02	999	0,2	0,2
20	1	10	1000	10	50	5	0,05	5	0,02	0,2	20	0,2
21	1	10	100	10	50	5	0,5	5	0,02	0,2	2	0,2
22	1	10	50	10	50	5	1	5	0,02	0,2	1	0,2
23	1	10	10	10	50	5	5	5	0,02	0,2	0,2	0,2
24	1	0	1000	5	50	0	0,05	10	0,02	999	20	0,1
25	1	0	200	5	50	0	0,25	10	0,02	999	20	0,1
26	1	0	50	5	50	0	1	10	0,02	999	10	0,1
27	1	5	1000	5	50	10	0,05	10	0,02	0,1	4	0,1
28	1	5	500	5	50	10	0,1	10	0,02	0,1	2	0,1
29	1	5	200	5	50	10	0,25	10	0,02	0,1	0,2	0,1
30	1	5	100	5	50	10	0,5	10	0,02	0,1	999	0,1
31	1	5	10	5	50	10	5	10	0,02	0,1	999	0,1(default)



Sur ATRIUM...

En cas de doute sur ce qui a été présenté aujourd'hui (surtout si vous relisez ce document plus tard), la version de référence est sur ATRIUM: Atrium/Projets/ThomX/Groupes/Synchro
<https://atrium.in2p3.fr/bbd00618-cec9-402e-8b4b-7837f5e584cc>

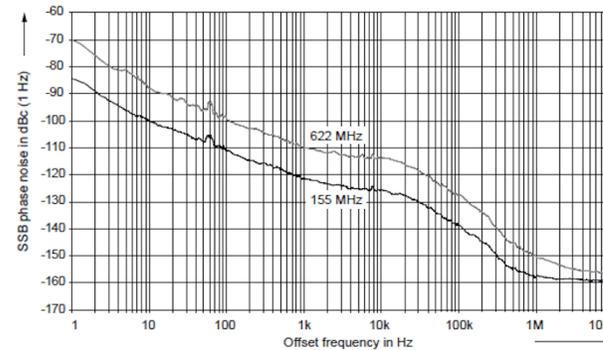
The screenshot displays the ATRIUM web application interface. The top navigation bar includes the ATRIUM logo, a search bar, and various menu items like HOME, ARBORESCENCE, RECHERCHE, ESPACE PERSONNEL, DASHBOARD, TICKET SUPPORT, DÉCONNEXION, and a user profile for delerue@lal.in2p3.fr. The left sidebar shows a hierarchical tree structure with categories like Atrium, Zone de Diffusion, Laboratoires, Projets, ThomX, Communication, Project management, Groupes, Controls, Diagnostics, Electronic, Magnets, Mechanics, RF, Synchro, Documentation, Vacuum, Pulsed magnets, Power supplies, Ligne X, Commissioning, Project_WBS, Documentation, IPAC20, GDR_ALP, and Activités. The main content area is titled 'Synchro' and shows 'LAL - Projet ThomX, group's documents'. Below this, there are tabs for 'Contenu', 'Résumé', 'Modifier', 'Références', 'Historique', and 'Archive'. A table lists documents with columns for Type, Titre, Atrium ID, Créé le, Auteur, Modifié le, Modifié par, Vrs., and Etat. The table contains 10 rows of document information.

Type	Titre	Atrium ID	Créé le	Auteur	Modifié le	Modifié par	Vrs.	Etat
XLS	Codes de synchronisation	ATRIUM-316182	27 sept. 2018	NICOLAS DELERUE	10 oct. 2018	delerue@lal.in2p3.fr	0.2	En projet
XLS	Nomenclature Synchronisation	ATRIUM-98800	11 mars 2016	NICOLAS DELERUE	3 oct. 2018	chaumat@lal.in2p3.fr	0.9	En projet
PDF	Schema de synchronisation	ATRIUM-98799	11 mars 2016	NICOLAS DELERUE	3 oct. 2018	chaumat@lal.in2p3.fr	0.10	En projet
	Documentation		2 oct. 2018	NICOLAS DELERUE	2 oct. 2018	delerue@lal.in2p3.fr		En projet
	Trigger distribution	ATRIUM-315226	18 sept. 2018	NICOLAS DELERUE	18 sept. 2018	delerue@lal.in2p3.fr	0.1	En projet
	Trigger box	ATRIUM-201059	18 mai 2017	NICOLAS DELERUE	4 juil. 2018	delerue@lal.in2p3.fr	0.2	En projet
	ThomX Post-Mortem scheme	ATRIUM-281592	20 janv. 2018	NICOLAS DELERUE	20 janv. 2018	delerue@lal.in2p3.fr	0.1	En projet
	Switching between phase locked and heterodyne triggering	ATRIUM-201060	18 mai 2017	NICOLAS DELERUE	18 mai 2017	delerue@lal.in2p3.fr	0.1	En projet



Clocks Hardware

- ▶ Linac Clock: Rohde & S SMA-100A, up to 6GHz, Low phase noise

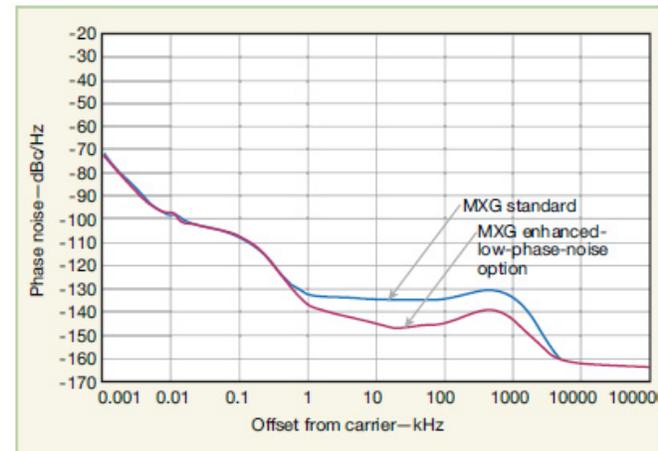


Clock synthesizer (R&S[®]SMA-B29 option): SSB phase noise measured with R&S[®]SMA-B22 option.

- ▶ Ring Clock: Keysight N5181B MXG X-Series, up to 3GHz, Low phase noise, AM FM Phase noise modulation.



4. The MXG signal generators employ a triple-loop synthesis approach and unique frequency plan to achieve outstanding spectral purity to 6 GHz.



Firing everybody at the same time

- ▶ Once we know that the linac and the ring are in phase, we can fire everything at the right time...
- ▶ For that we will use a delay generator.
- ▶ Product selected: 3 x Greenfield GFT1020.

Datasheet du GFT1020



GFT1020 20 Channel Digital Delay Generator

Features

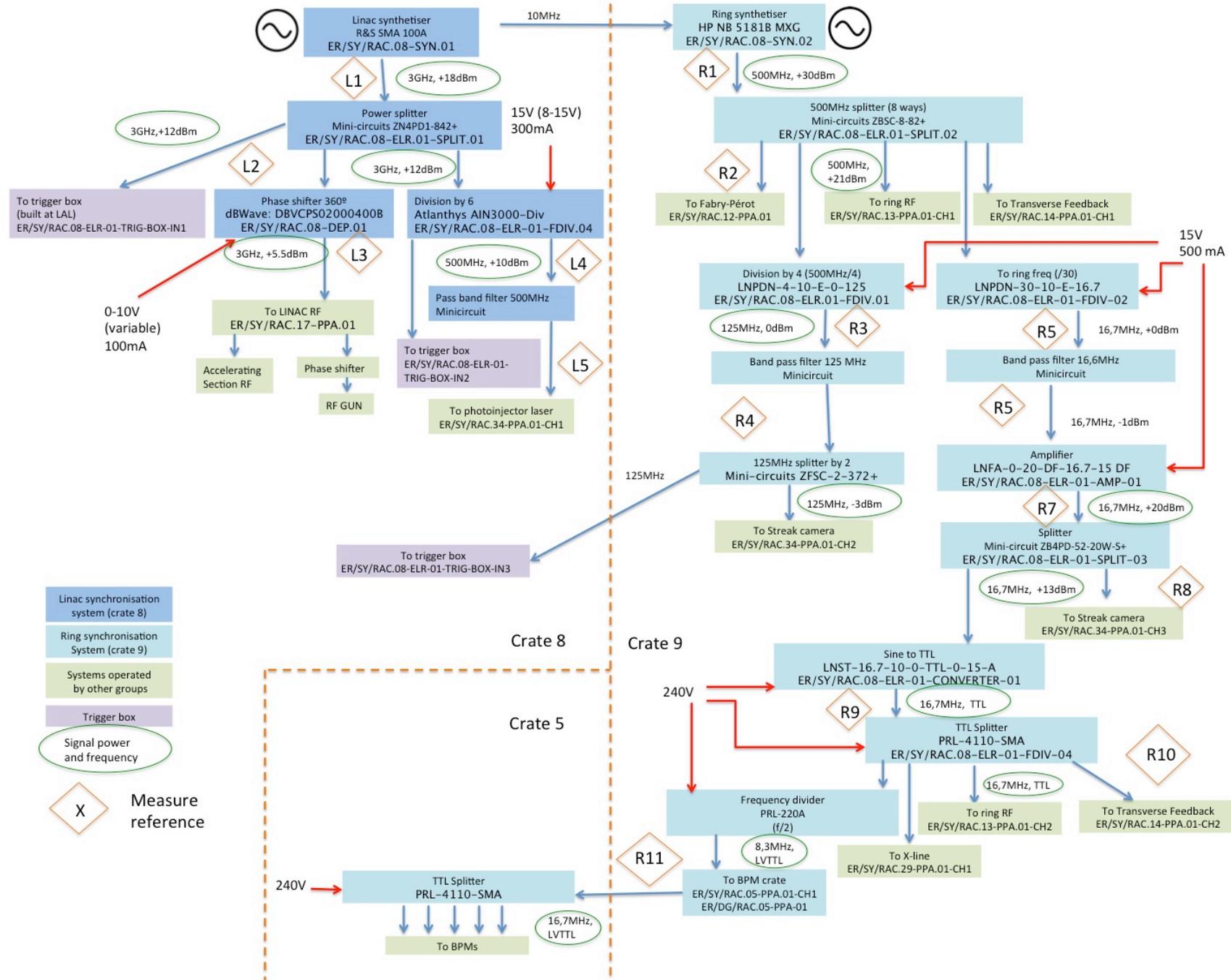
- 20 independent delay Channels
 - 100 ps resolution
 - 25 ps rms jitter
 - 10 second range
- Output pulse up to 6 V/50 Ω
- Independent trigger for every channel
- Four Triggers
 - Three are repetitive from three internal generators
 - One is single-shot from External input, Push button or Software
- External Clocking up to 100 MHz



Campagne de mesure (12/2017)

- ▶ Une première campagne de mesure et de validation du système à eu lieu en décembre 2017.
- ▶ En voici quelques résultats.

Scheme with parts numbers

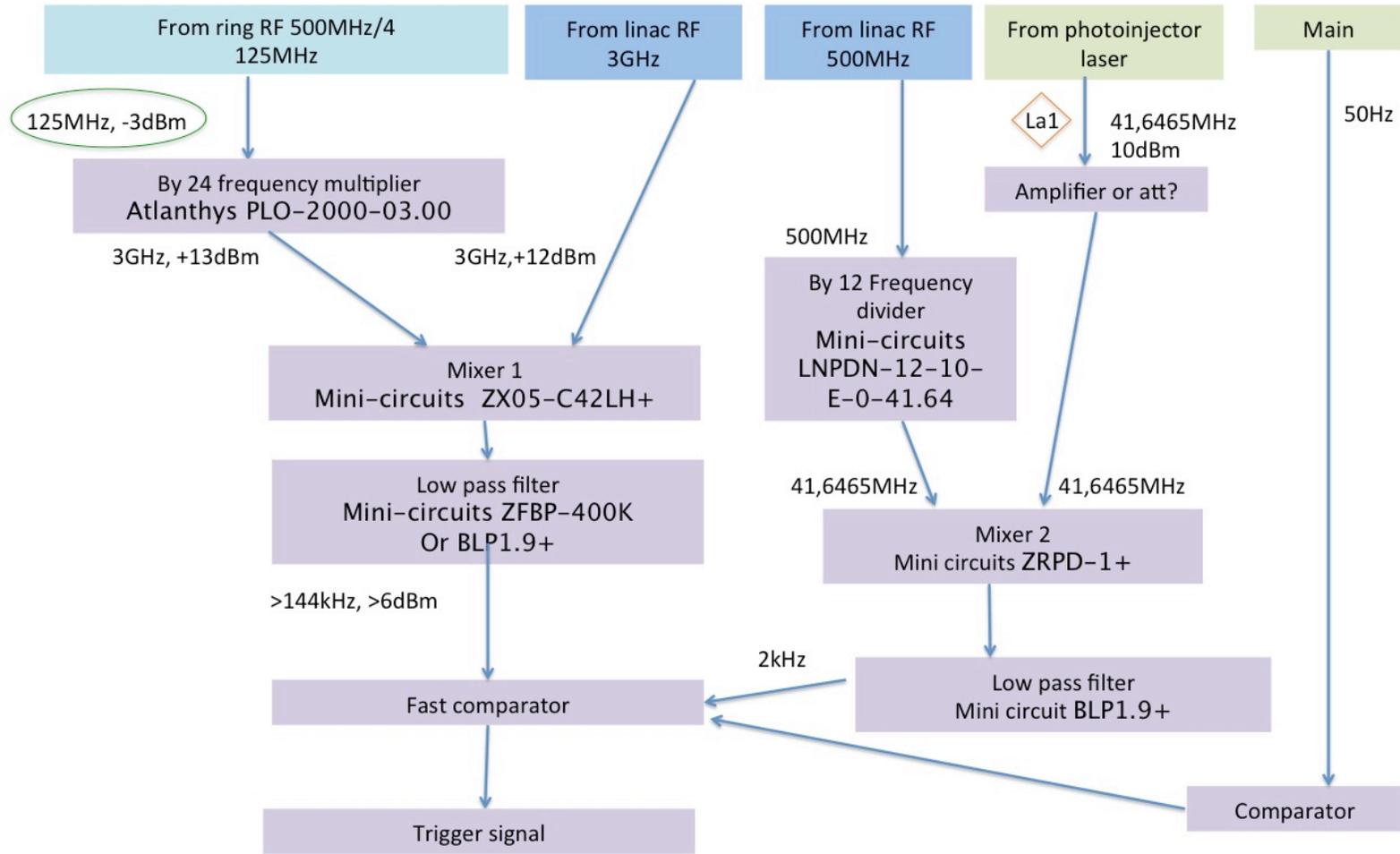


Scheme with parts numbers (triggering)

Version 2017/12/08

Trigger box components

Trigger box (crate 8)
ER/SY/RAC.08-ELR-01-TRIG-BOX

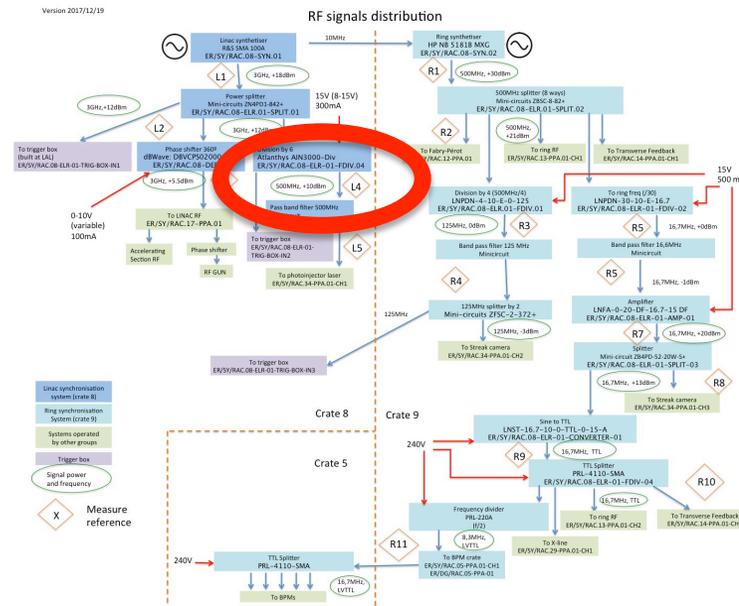


Measurements:

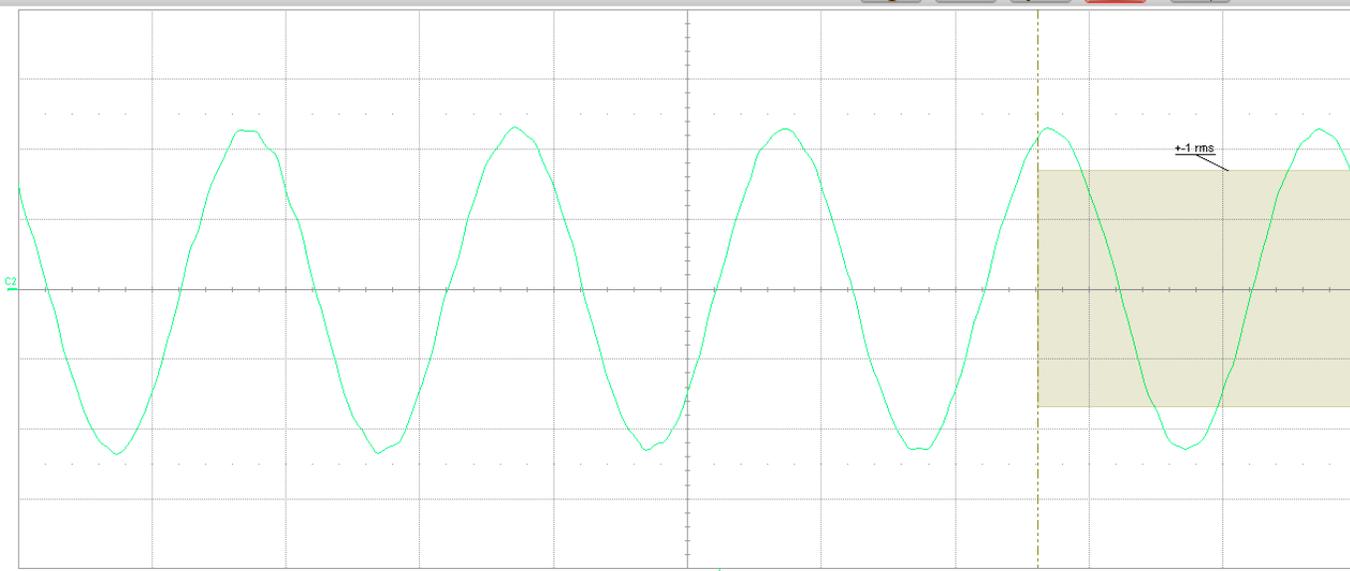
- ▶ Several measurements have been done to check that all components were operational.
- ▶ All components passed the tests.
- ▶ Some signal levels have to be adjusted with respect to the data sheets.
- ▶ Some filters added to increase signal purity.
- ▶ The next slides present some of these measurements.



Measurement at L4 (RF to photoinjector laser before filter)



File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help

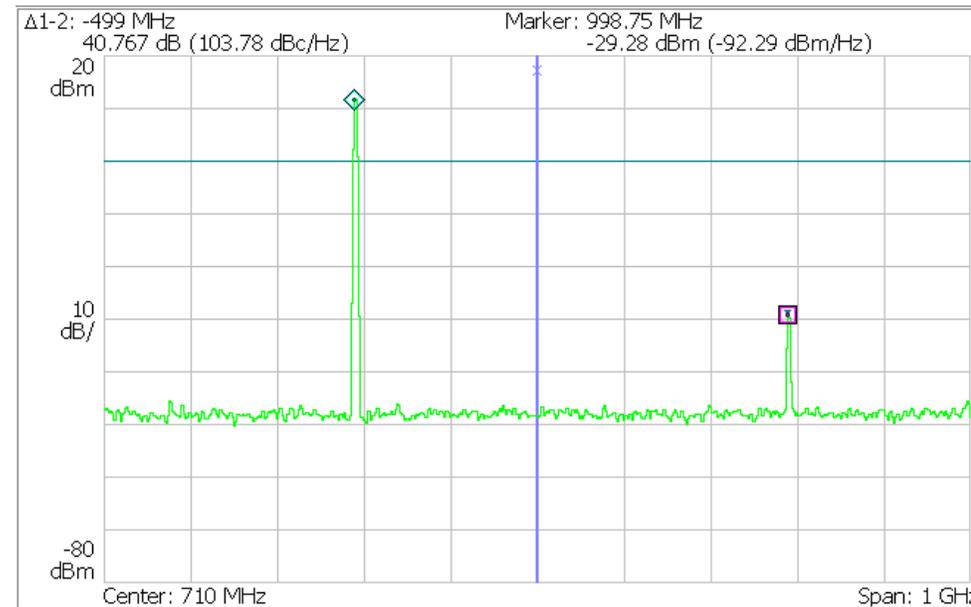


Measure	P1:freq(C2)	P2:ampl(C2)	P3:rms(C2)	P4:dt@lv(C2,...	P5:sdev(F1)	P6:freq(C3)	P7:mean(F1)	P8:hmean(C1)	P9:hamp(C1)	P10:mean(C1)	P11:freq(C1)	P12:freq(C3)
value	500.52 MHz	1.57 V	851 mV									
mean	499.763 MHz	1.56585 V	853.970 mV									
min	493.69 MHz	1.41 V	841 mV									
max	505.73 MHz	1.67 V	865 mV									
sdev	1.546 MHz	38.90 mV	3.320 mV									
num	12.192e+3	3.048e+3	3.048e+3									
status												

TELEDYNE LEICROY
Timebase 240 ps Trigger C2 DC
1.00 ns/div Stop 20 mV
400 S 40 GS/s Edge Positive
08/12/2017 08:37:11

Tektronix RSA 2203A 12/8/2017 3:25:47 PM FREE RUN

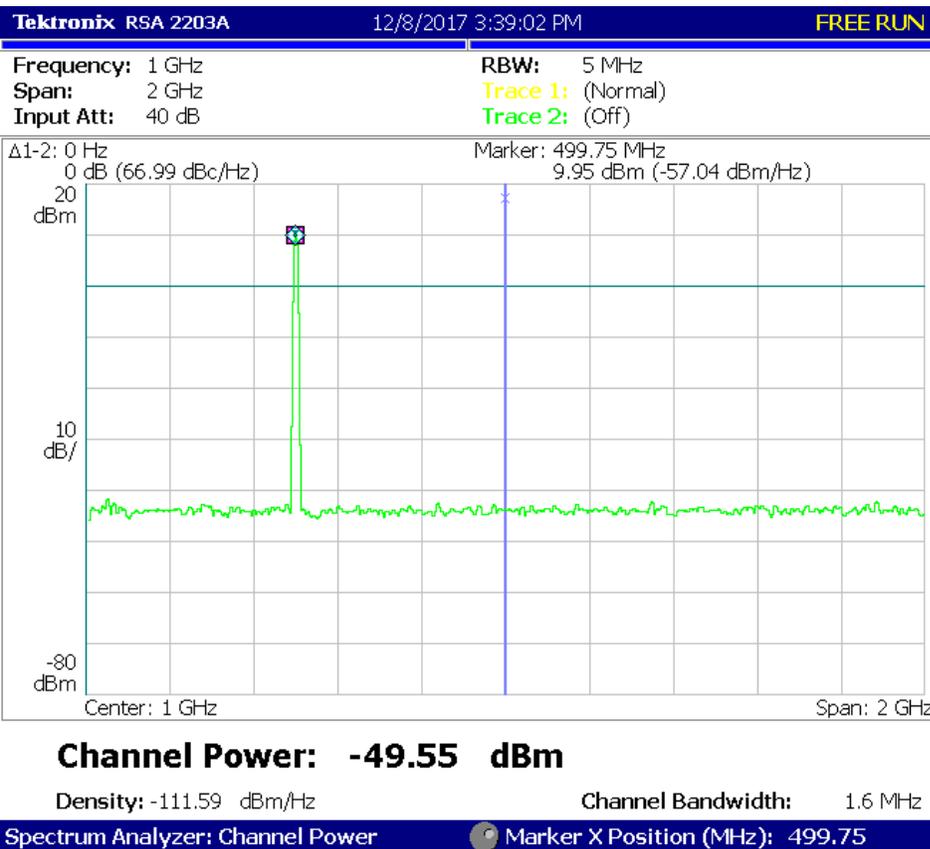
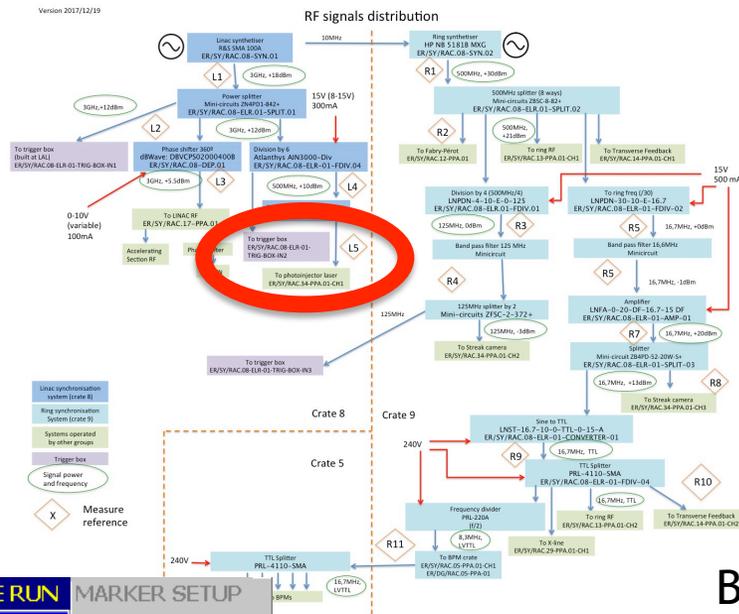
Frequency: 710 MHz Span: 1 GHz Input Att: 40 dB
RBW: 2 MHz Trace 1: (Normal) Trace 2: (Off)



Channel Power: -58.5 dBm Density: -114.52 dBm/Hz Channel Bandwidth: 400 kHz

Spectrum Analyzer: Channel Power
(LAL), 11 octobre 2017

Measurement at L5 (RF to photoinjector laser after BP filter)



MARKER SETUP

Cancel - Back

Select Marker

1 2

Marker X Position (Hz): 499.75M

Markers: Off Single Delta

Reference Cursor to Marker X

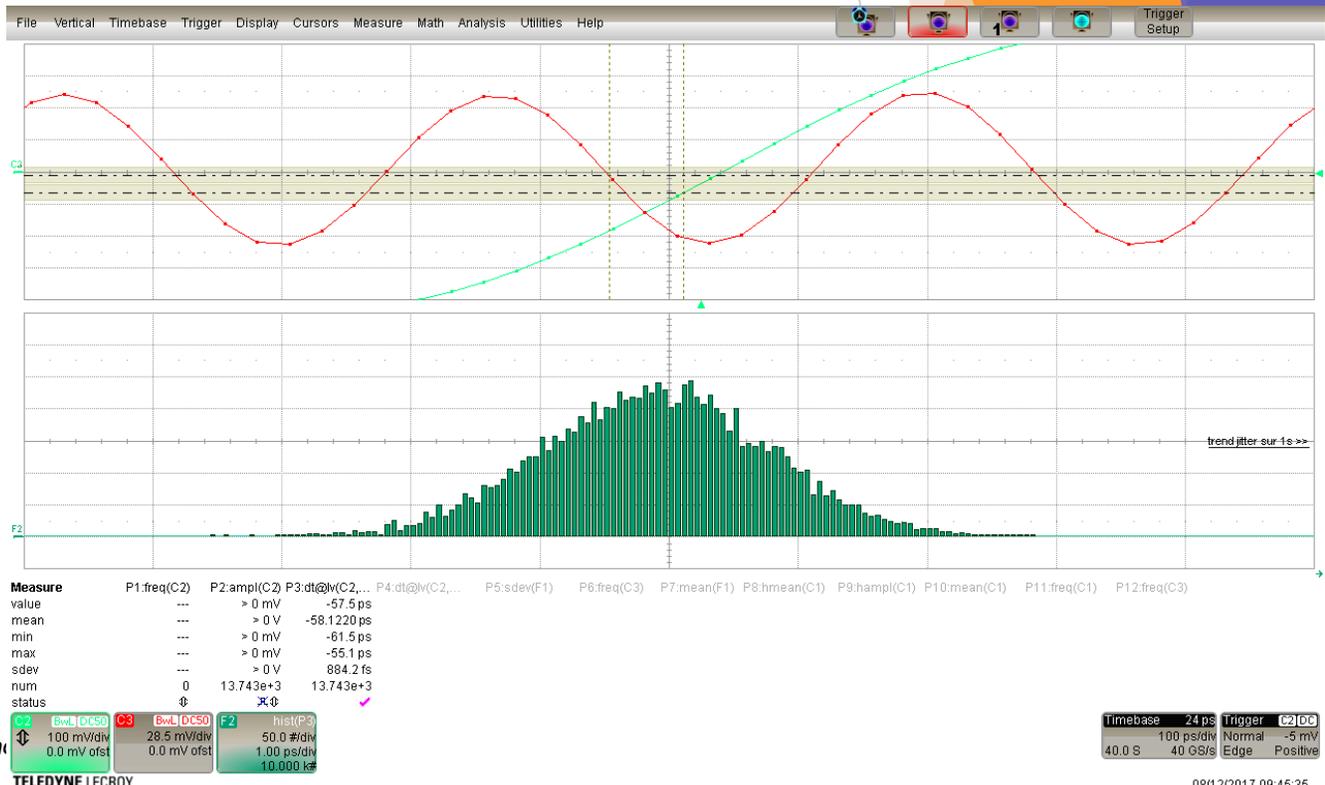
Reference Cursor Off

Selected Marker Off

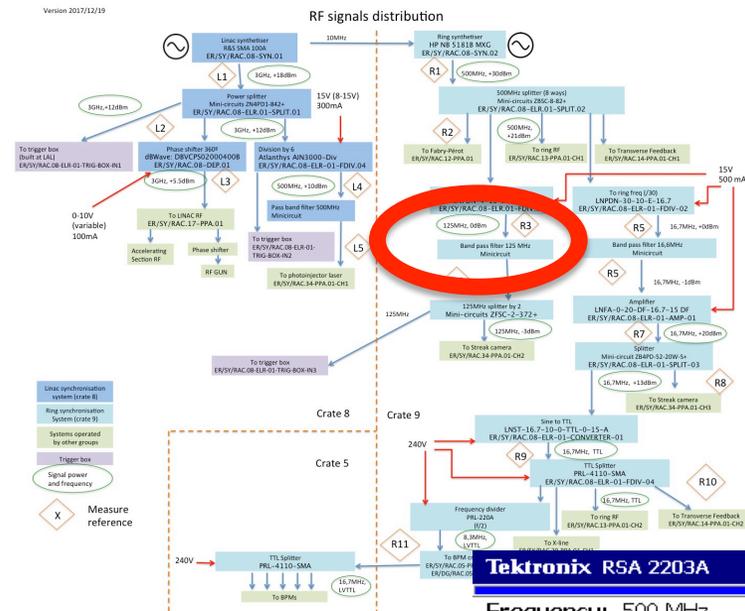
Step Size (Marker X ...): 2M

Go to page 2 (of 2)

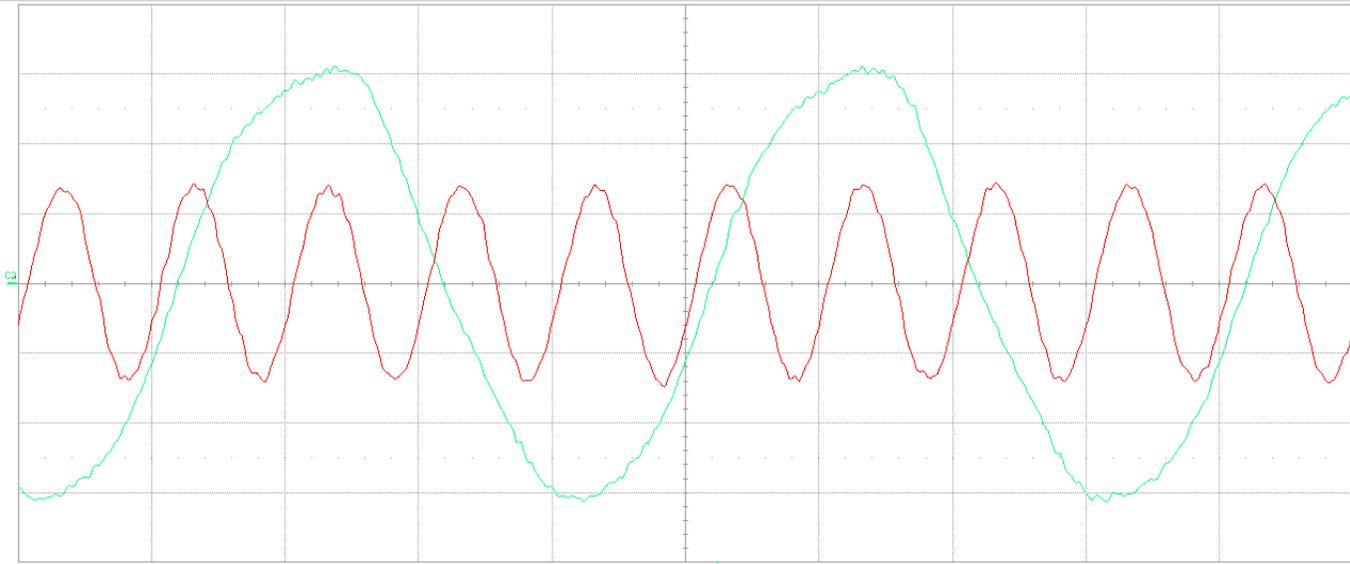
Bruit ~900fs < 1ps



Measurement at R3 (RF to streak camera and trigger box)



File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help

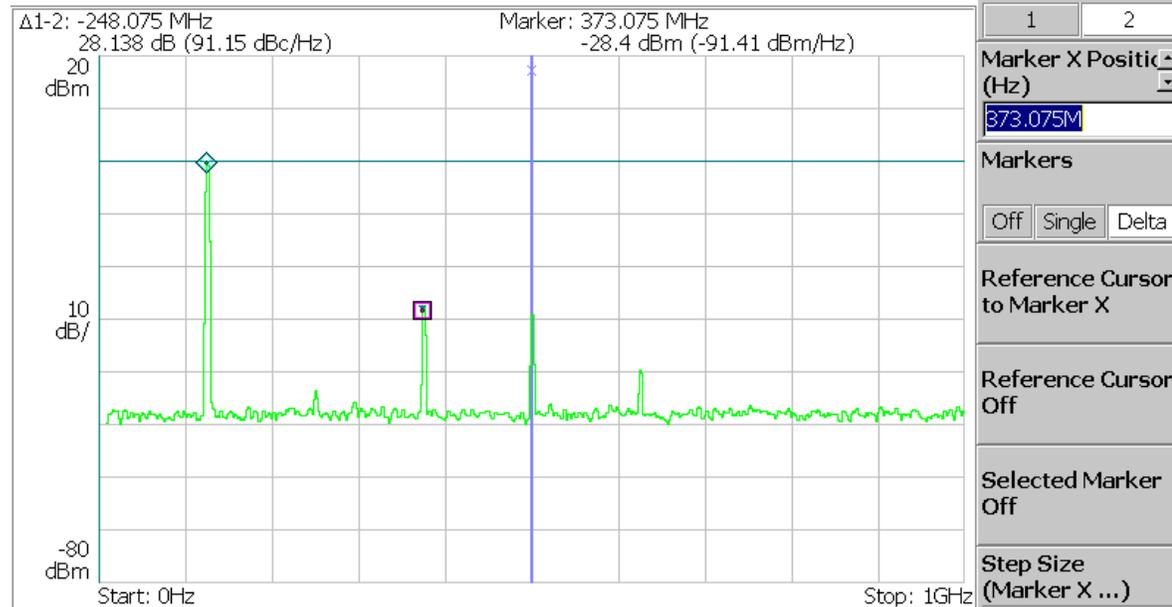


Measure	P1.freq(C2)	P2.ampl(C2)	P3.dt@lv(C2,...)	P4.dt@lv(C2,...)	P5.sdev(F1)	P6.freq(C3)	P7.mean(F1)	P8.hmean(C1)	P9.hamp(C1)	P10.mean(C1)	P11.freq(C1)	P12.freq(C3)
value	124.561 MHz	361.6 mV										
mean	125.0001 MHz	359.98 mV										
min	123.942 MHz	169.9 mV										
max	126.111 MHz	380.2 mV										
sdev	241.7 kHz	10.04 mV										
num	31.902e+3	15.951e+3										
status												

TELEDYNE LEUCROY
C2 100 mV/div 0.0 mV offset
Dc50 1.00 Wdiv 0 mV offset
Timebase 480 ps Trigger C2 DC
2.00 ns/div Stop -5 mV
800 S 40 GS/s Edge Positive
08/12/2017 15:34:27

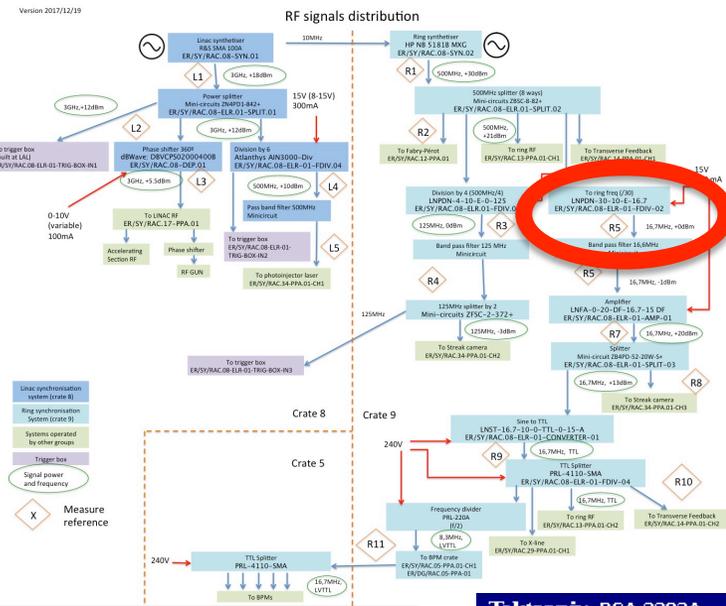
Tektronix RSA 2203A 12/8/2017 10:31:10 PM FREE RUN MARKER SETUP

Frequency: 500 MHz RBW: 2 MHz
Span: 1 GHz Trace 1: (Normal)
Input Att: 40 dB Trace 2: (Off)

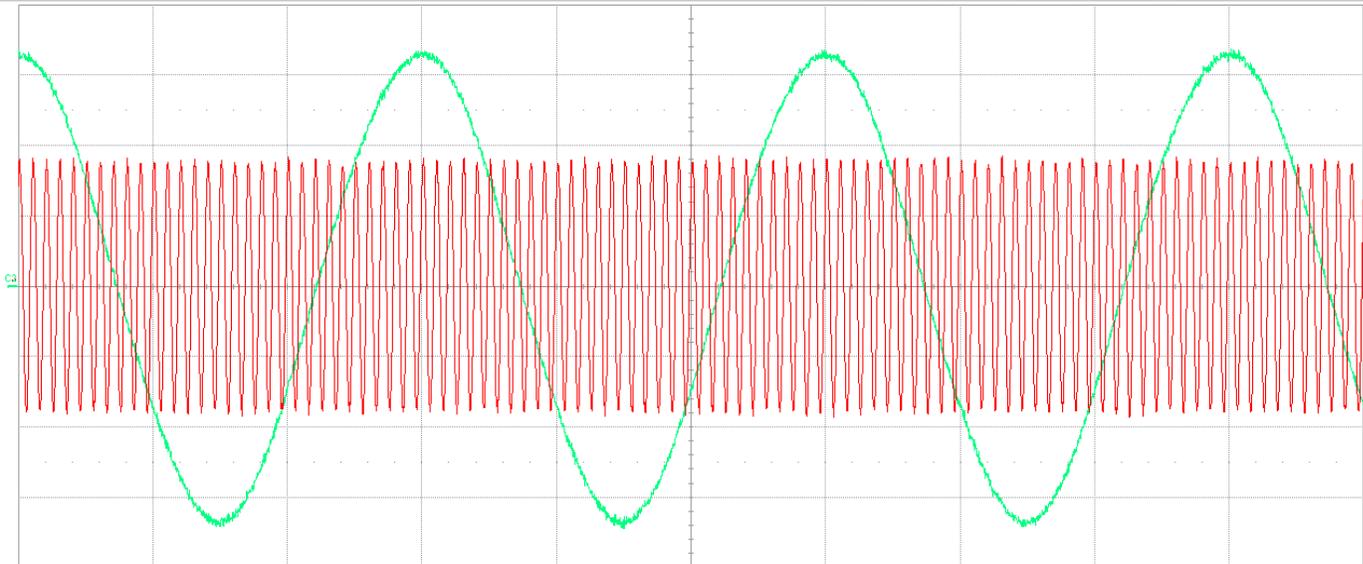


Channel Power: -29.04 dBm
Density: -91.08 dBm/Hz Channel Bandwidth: 1.6 MHz
Spectrum Analyzer: Channel Power Marker X Position (MHz): 373.075

Measurement at R5 (RF to ring frequency)



File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:freq(C2)	P2:amp(C2)	P3:dt@lv(C2,...)	P4:dt@lv(C2,...)	P5:sdev(F1)	P6:freq(C3)	P7:mean(F1)	P8:hmean(C1)	P9:hamp(C1)	P10:mean(C1)	P11:freq(C1)	P12:freq(C3)
value	16.65603 MHz	166.0 mV										
mean	16.66664 MHz	> 162.82 mV										
min	15.89835 MHz	> 23.4 mV										
max	16.79903 MHz	> 400.4 mV										
sdev	31.14 kHz	> 22.56 mV										
num	54.870e+3	27.439e+3										
status												

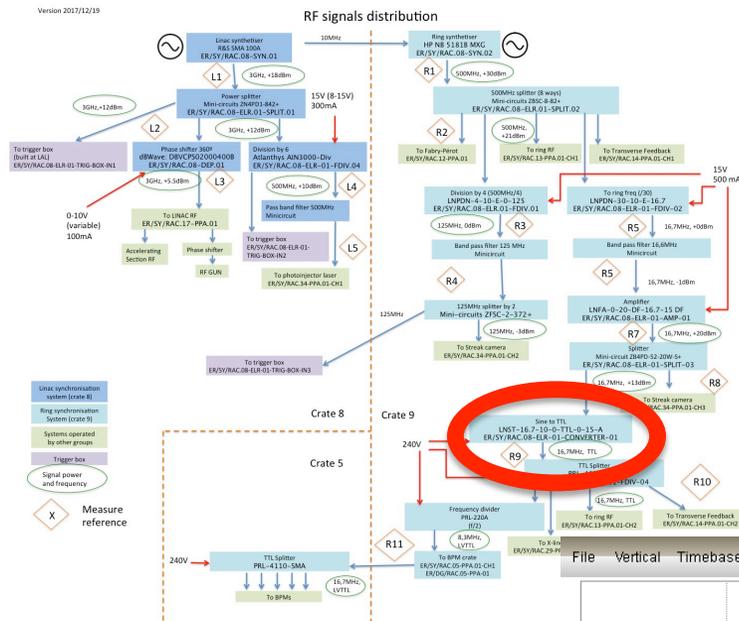
Tektronix RSA 2203A 12/8/2017 10:43:02 PM FREE RUN MARKER SETUP

Frequency: 50 MHz RBW: 300 kHz
 Span: 100 MHz Trace 1: (Normal)
 Input Att: 40 dB Trace 2: (Off)



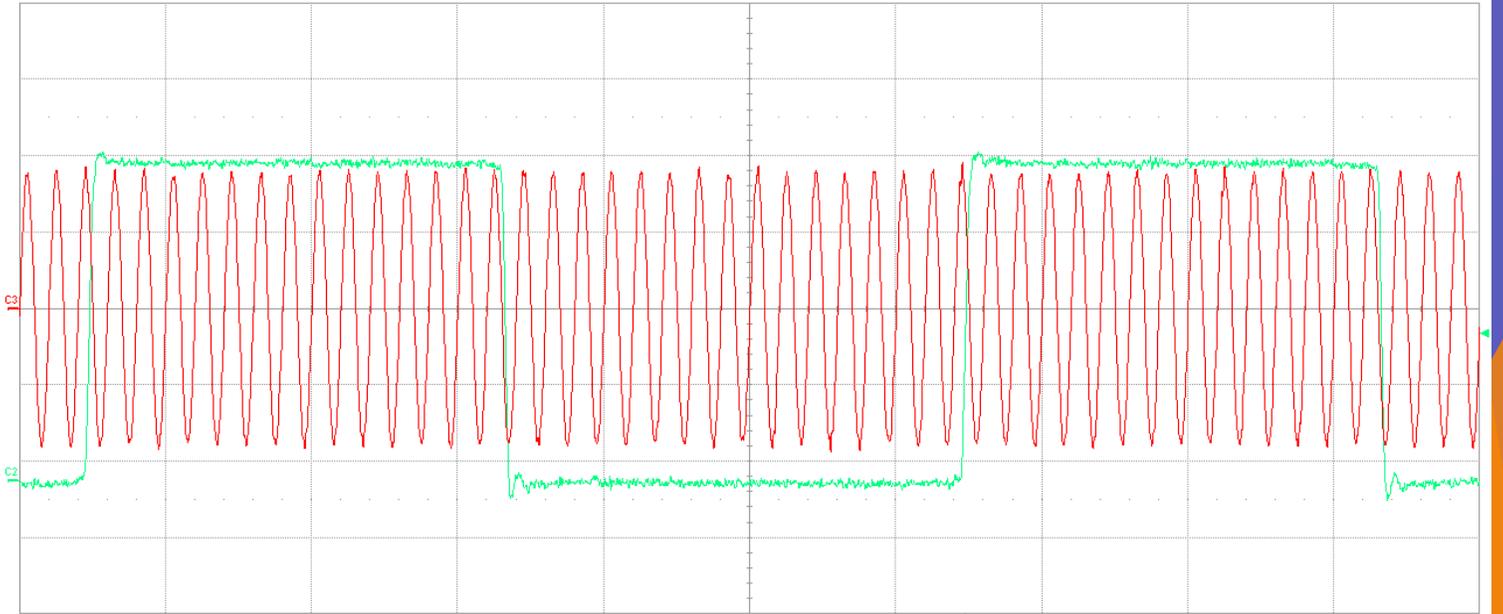
Center: 50 MHz Span: 100 MHz
 Spectrum Analyzer: Measurement Off Marker X Position (MHz): 16.5

Measurement at R9 (RF ring to TTL)



Linac synchronization system (crate 9)
Ring synchronization system (crate 9)
Systems operated by other groups
Trigger box
Signal power and frequency
Measure reference

File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



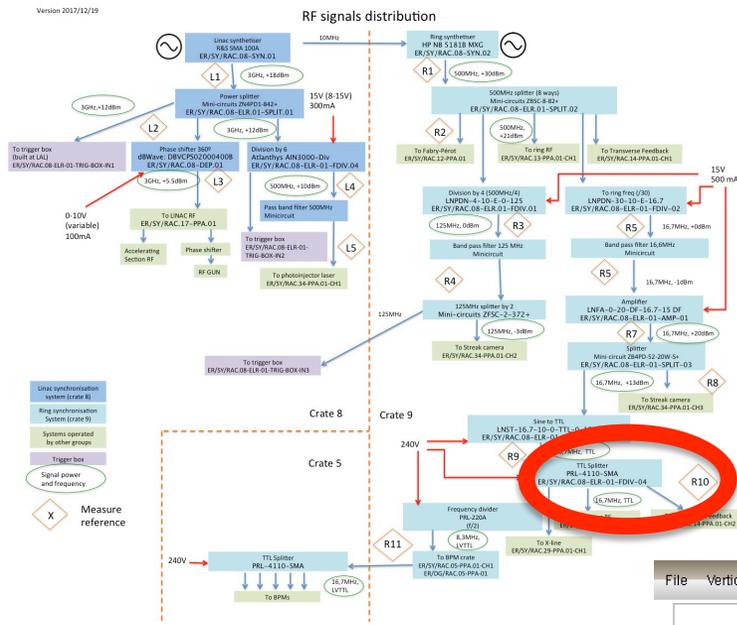
Measure	P1:freq(C2)	P2:ampl(C2)	P3:dt@lv(C2,...	P4:dt@lv(C2,...	P5:sdev(F1)	P6:freq(C3)	P7:mean(F1)	P8:hmean(C1)	P9:hamp(C1)	P10:mean(C1)	P11:freq(C1)	P12:freq(C3)
value	16.66732 MHz	4.10 V										
mean	16.66665 MHz	4.10143 V										
min	16.66091 MHz	3.88 V										
max	16.67322 MHz	4.28 V										
sdev	1.533 kHz	53.26 mV										
num	15.837e+3	15.837e+3										
status												

C2 C3
 1.00 V/div C3 1.00 V/div
 -2.260 V offset 0 mV offset
TELEDYNE LECROY

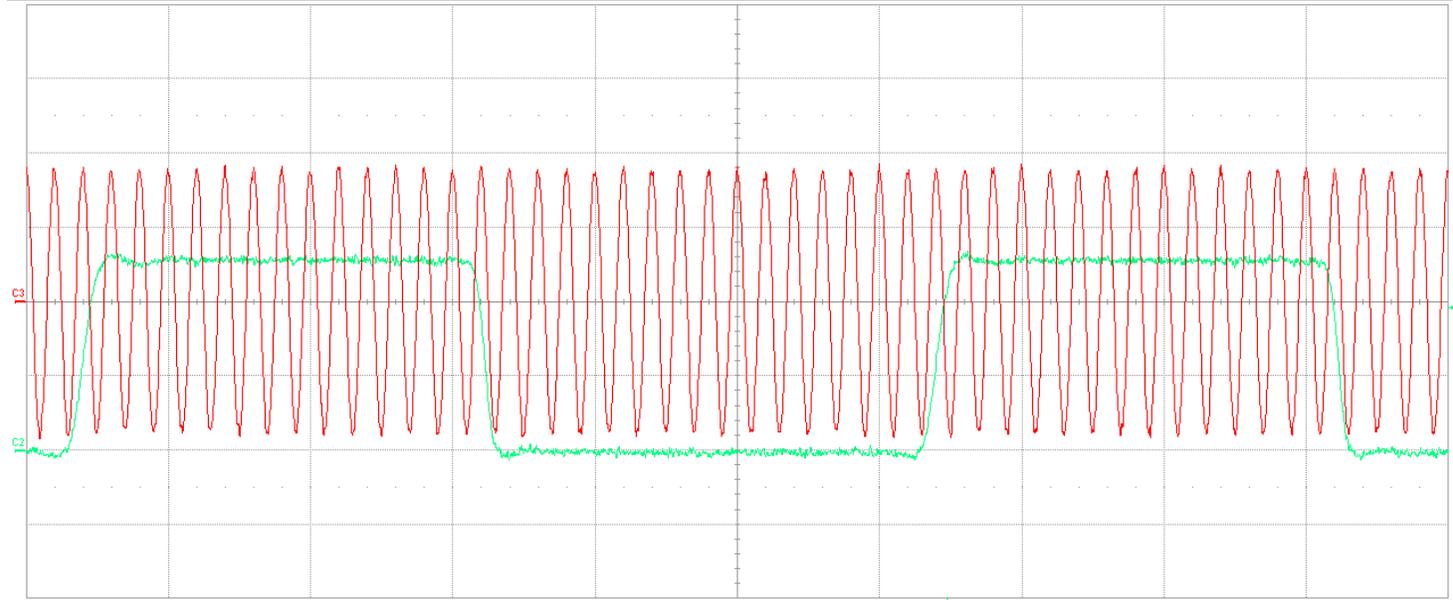
Timebase 14.8 ns Trigger C2 DC
 10.0 ns/div Normal 1.93 V
 4.00 kS 40 GS/s Edge Positive
 08/12/2017 16:42:04

Synchronisation

Measurement at R10 (Ring TTL splitter)



File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help

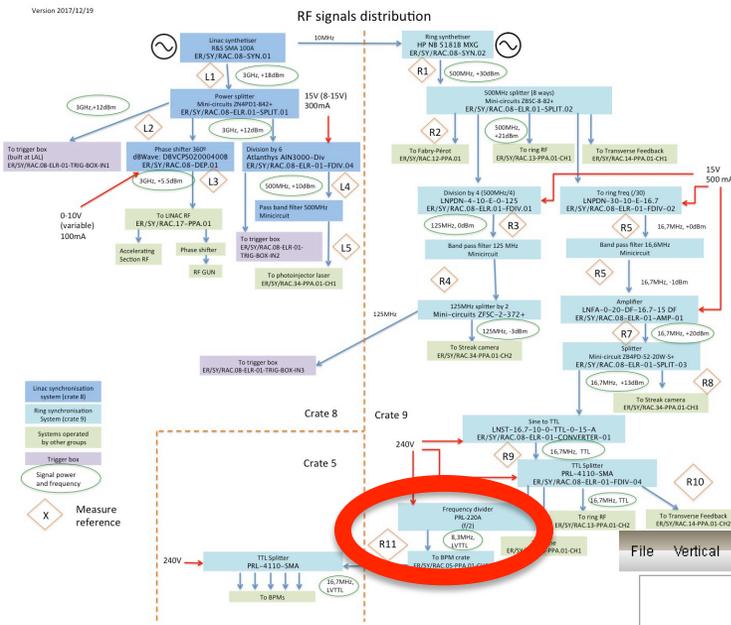


Measure	P1:freq(C2)	P2:amp(C2)	P3:dt@lv(C2,...	P4:dt@lv(C2,...	P5:sdev(F1)	P6:freq(C3)	P7:mean(F1)	P8:hmean(C1)	P9:hamp(C1)	P10:mean(C1)	P11:freq(C1)	P12:freq(C3)
value	16.67599 MHz	2.544 V										
mean	16.66638 MHz	2.59510 V										
min	16.64032 MHz	2.447 V										
max	16.68760 MHz	2.795 V										
sdev	7.140 kHz	72.28 mV										
num	1.078e+3	1.078e+3										
status	✓	✓										

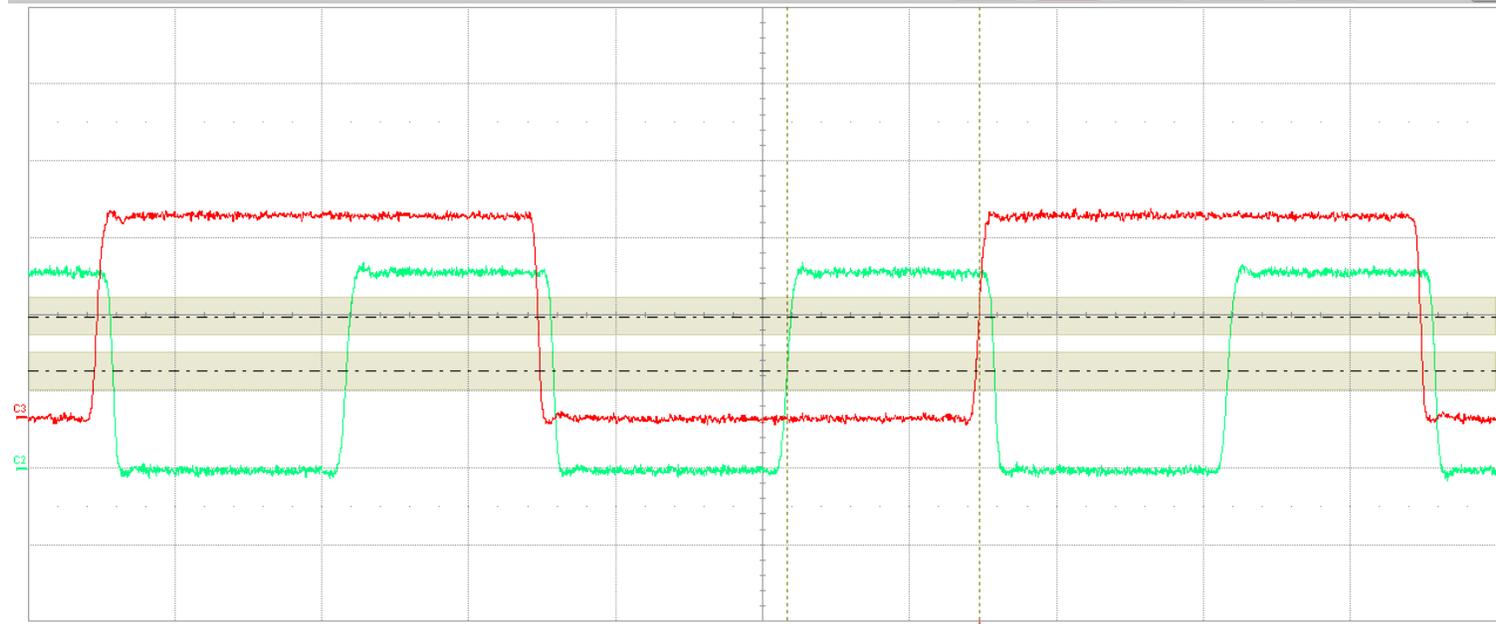
C2 1.00 V/div -2.020 V offset
C3 1.00 V/div 0 mV offset
TELEDYNE LECRYO

Timebase 14.8ns Trigger C2 DC
10.0 ns/div Normal 1.93 V
4.00 kS 40 GS/s Edge Positive
08/12/2017 16:49:37

Measurement at R11 (Ring TTL freq./2)



File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help



Measure	P1:freq(C2)	P2:ampl(C2)	P3:duty(C2,...)	P4:dt@v(C2,...)	P5:sdev(F1)	P6:freq(C3)	P7:mean(F1)	P8:hmean(C1)	P9:hamp(C1)	P10:mean(C1)	P11:freq(C1)	P12:freq(C3)
value	16.66888 MHz	157 mV	26.1105 ns									
mean	16.66666 MHz	167.47 mV	26.09937 ns									
min	16.63883 MHz	121 mV	25.9930 ns									
max	16.69468 MHz	234 mV	26.1982 ns									
sdev	7.392 kHz	15.49 mV	26.05 ps									
num	29.842e+3	8.205e+3	14.126e+3									
status	✓	✗	✓									

Nicol TELEDYNE LECROY

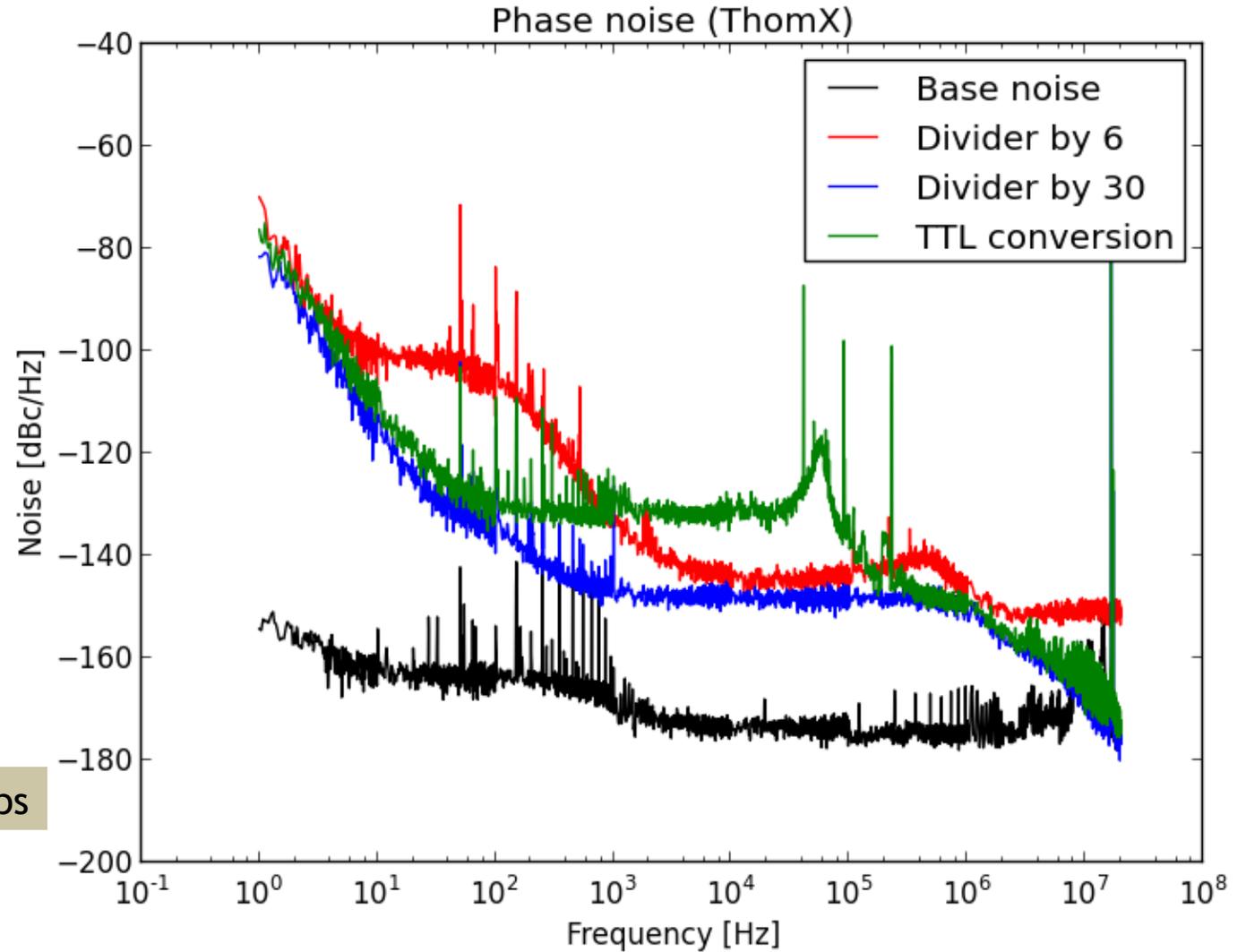
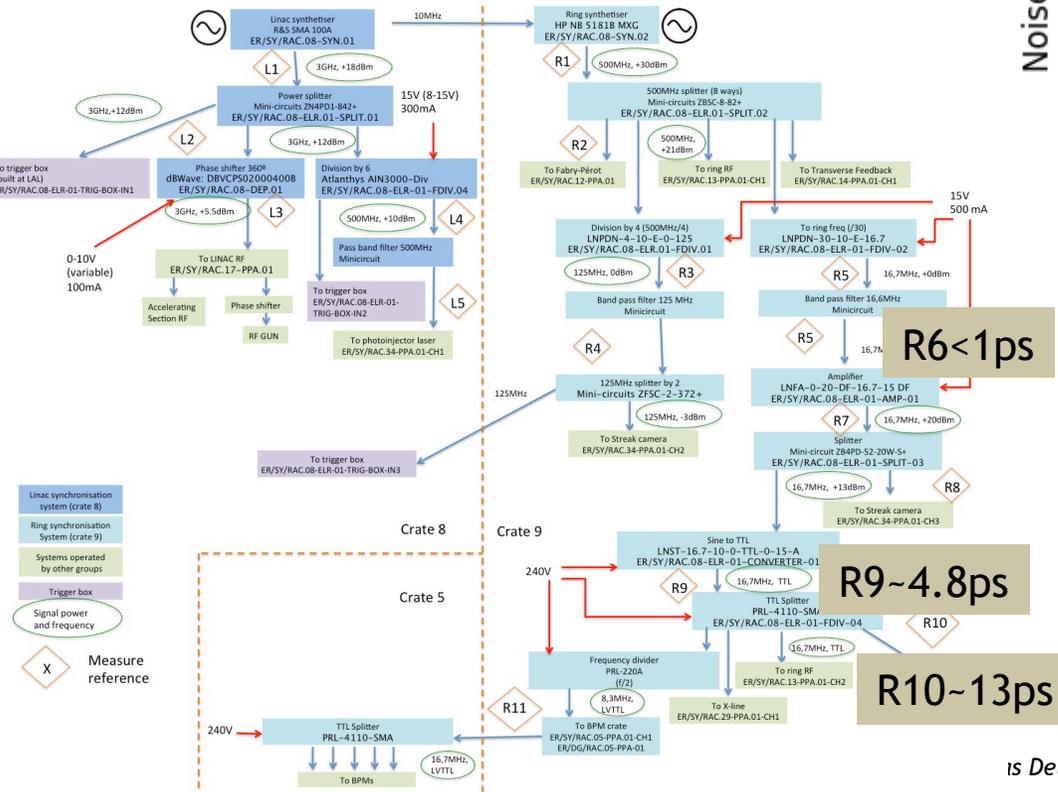
Timebase 29.6 ns Trigger C3 DC
20.0 ns/div Normal 1.30 V
8.00 kS 40 GS/s Edge Positive
08/12/2017 16:56:52

Measurements: noise levels

- ▶ Phase noise measurement did not bring any surprise.
- ▶ Strong increase of the noise after TTL conversion (as expected).

Version 2017/12/19

RF signals distribution



Etat d'avancement: calendrier

- ▶ Disponibilité des signaux de déclenchement: 15 jours après la disponibilité des panneaux de brassage câblés.
- ▶ Disponibilité des signaux d'horloge (hors signal 3 GHz pulsé RF linac et sous réserve de disponibilité des panneaux de brassage câblés 10 jours avant): sur demande à partir du 15 novembre.
- ▶ Campagne de mesure de validation des signaux en Novembre.
- ▶ Tests CC: 4 décembre
- ▶ Système complètement disponible: 10 décembre 2018
- ▶ Interfaces graphiques: début 2019

Etat d'avancement (1/3)

- ▶ Transfert des responsabilités LAL => SOLEIL
 - Non applicable
- ▶ Équipements manquants
 - Quelques petits composants sont encore en cours de livraison (Commutateur 3Ghz pulsé, 2 filtres,...).
- ▶ Équipements pas encore testés
 - Tous les équipements majeurs ont été testés et une première campagne de mesure sur banc a eu lieu.
 - Une seconde campagne de mesure sur site aura lieu en Novembre.
- ▶ Équipements pas encore testé avec le CC (si applicable)
 - Tous les équipements pilotés sont passés par le CC.
- ▶ Progrès de l'assemblage des composants (si applicable), intervention entreprise extérieure nécessaire (si applicable)
 - Fin de l'assemblage prévu pour fin octobre (à l'exception d'un composant en attente d'approvisionnement).
 - Pas d'entreprises extérieures.

Etat d'avancement (2/3)

- ▶ Planning d'installation dans l'igloo (identification des étapes pour l'installation, durée, et date d'installation si celle-ci est définie, dépendance avec d'autres sous-systèmes)
 - Les gros appareils sont déjà dans les baies. Certains sont à repositionner. (1 jour à définir)
 - Installation de l'électronique de distribution début novembre. (1 jour à définir)
 - Dépendances: Câblage et CC.
- ▶ Liste des tests de validation sur site.
 - Une liste de points de mesures a été écrite.
 - Quelques jours en novembre-décembre seront dédiés.

Etat d'avancement (3/3)

- ▶ Liste des tests de validation sur site avec le CC (si applicable).
 - Tests prévus le 4 décembre.
 - Pilotage des synthétiseurs (ER/SY/RAC.08-SYN.01 et ER/SY/RAC.08-SYN.02).
 - Pilotages des générateurs de retard (ER/SY/RAC-08-DEG-1, ER/SY/RAC-08-DEG-2 et ER/SY/RAC-09-DEG-3).
 - Pilotage du déphaseur par un signal analogique piloté (ER/HF/RAC.17/API.01.AO4).
- ▶ Interfaces graphiques:
 - 3 versions déjà réalisées (Matlab, TkInter, Taurus).
 - La 3ème (Taurus) est en cours de tests (problème de rafraîchissement de variable à clarifier).
 - Disponibilité: début 2019.

Perspectives

- ▶ Le système de synchronisation devrait être prêt courant décembre.
- ▶ Vérifiez avec Vincent ou Nicolas que les signaux dont vous avez besoin sont bien prévus.
 - Niveau de signal?
 - Format?
 - Avance/Retard par rapport à l'émission des électrons (pour les déclenchements)?
 - À quel endroit? Dans quelle baie?
 - Si vous avez besoin d'un signal vérifiez qu'il apparaît dans les transparents 10 à 14 de cette présentation.
- ▶ À partir de mi-décembre nous serons disponible pour accompagner chaque sous-système ayant besoin des signaux de synchronisation.
- ▶ Papier de référence publié à IPAC'18 (WEPAL035).