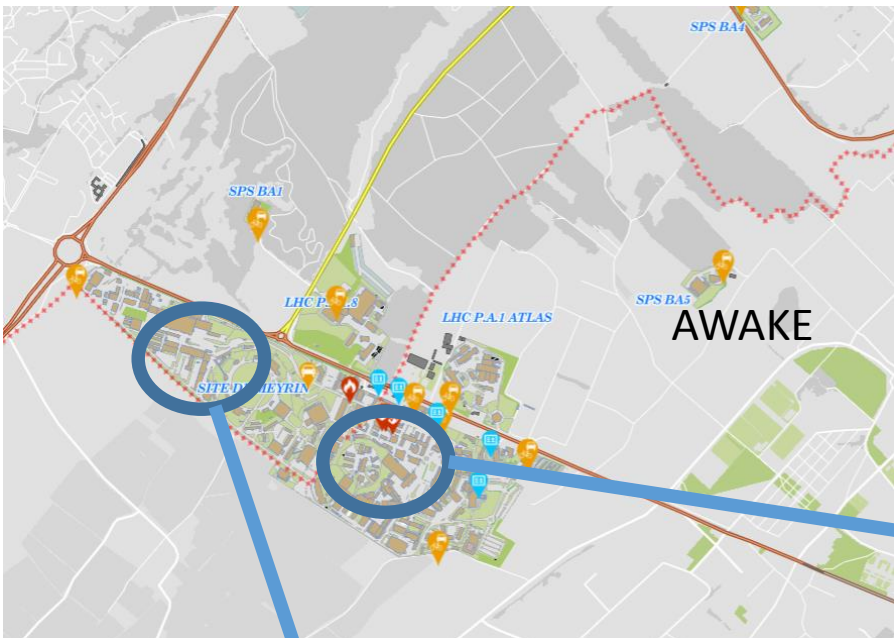


Status of modulators klystrons for CLIC study, CLEAR and AWAKE

Geographic Location of Modulators and Klystrons





Xbox 1 & 2 Status

- 2 operational modulators
 - Xbox1 operational since 2010
 - Xbox2 operational since 2013
- Some spare parts, but needs consolidation, manufacturer 10 year parts redundancy guarantee nearly over
- 4 high power 50 MW tubes
 - XL5, SLAC original, broken, not repairable
 - CPI Serial Number 1
 - Being repaired at CPI, delivery expected start of 2021, needs to be conditioned will be installed in Xbox1 for AWAKE injector tests and CLEAR operations. (Repair paid by AWAKE budget)
 - CPI serial Number 2
 - In Xbox2, running well but already 5 years operation, to be tested with new super Conducting Solenoid end of 2020
 - CPI serial number 3
 - In Xbox1, just repaired by CPI, diode testing almost complete, RF conditioning in next few weeks. To be used to get results for PHD thesis then sent on loan to INFN for new test stand.



Xbox 3 Status

- 4 operational modulators (a, b , c & d)
 - a & b at CERN, operational, some spare parts, new generation models
 - c & d packed and in transit to Melbourne University
- 8 high power 6 MW tubes canon tubes
 - Serial number 1
 - Filament failure, stored at CERN, awaiting repair, budget permitting
 - Serial Number 2
 - At Canon for evaluation for repair (gain jump, perveance change)
 - Serial Number 3
 - Spare (with phase jump problem) going on loan to University of Eindhoven (they have new klystron failure, ion pump)
 - Serial Number 4
 - In shipment to Melbourne
 - Serial Number 5
 - At Canon for window repair
 - Serial Number 6
 - In shipment to Melbourne
 - Serial Number 7
 - Xbox 3a
 - Serial Number 8
 - Xbox3B (operation but worries with filament voltage, Canon informed)

**Klystrons were new development and experience shows short lifetime
Igor, Jinchi and canon have addressed some of these issues in new high efficiency design**



Sbox Status

- 1 new generation operational solid state modulator
- Thales klystron 40 MW
- System being commissioned after removal from CTF3 facility
- To be used for the following tests
 - Retesting KT medical Structure
 - Test of PROBE Structure (Lancaster collaboration)
 - Testing of CLEAR/AWAKE photo injector (delivery from INFN)
 - Priority of testing to be decided



CLEAR and AWAKE Modulator Status

- 3 operational modulators in CLEAR, PFN type, command charging
Consolidation needed,
 - mainly spare charging supplies needed
 - Thyatron reserve ok
 - Klystron reserve ok (see later slide)
- 1 operational modulator in AWAKE, commercial model (PFN) from PPT
 - Consolidation needed,
 - no reserves for
 - charging supplies , klystron and thyatron heater supplies

CLEAR and AWAKE Klystron and Thyatron Status



**Klystron (inventaire)
201910**

Klystron	N°	Cuve	Emplacement	Compteur	Compteur	Date installat°	Total heures
TH2100	210079	7	MKS11	778	2172	Dec-18	25375
TH2100	210073	13	MKS15	754	2231	Aug-18	36457
TH2100	210084	3	MKS31	8064	9386	Jun-17	17552
TH2100	210061	PPT	Awake	24428	24880	Aug-08	24769

**AWAKE klystron, problem with gain , needs to be changed
MKS 15 Klystron nearing end of life**

Spares

Klystron	N°	Cuve	Emplacement	Compteur	Compteur	Date installat°	Total heures
TH2100	94010	9	2001-1-001	ex-MKS11	-	-	1356
TH2100	94011	8	MKS06			Nov-09	37140
TH2100	210040	4	MKS05	51716		Oct-11	30318
TH2100	210077	12	MKS02			Feb-18	25588
TH2100	210078	1	MKS13	ex-MKS15	-	Jun-18	11304
TH2100	210085	6	2010-1-003	ex-MKS07	-	-	11741
TH2100	210087	Scan	MKS21	??	??	Jun-15	??
TH2100	210098	10	MKS14	ex-MKS02-07	-	-	6956
TH2100	210101		169-R-004				neuf
TH2100	201102		169-R-004				neuf


**Thyatron (inventaire)
20191022**


Thyatron	N°	Chassis	Emplacement	Compteur TH	Date installation	Total heures
1836A	3271	09	2010-1-003	-	ex-MKS05	440
1836A	2994	15	MKS03	57708	25-nov.-15	7916
1836A	2997	16	MKS05	90934	ex-MKS06	3105
1836A	2979	07	MKS13	-	-	9887
1836A	2555	05	2010-1-003	-	ex-MKS07	2031
1836A	2689	06	MKS06	-	-	12428
1836A	2615	08	MKS12	73292	9-avr.-15	9501
1836A	2867	01	MKS31	9390	3-nov.-16	9788
1836A	1617	03	MKS15	2236	16-févr.-11	30059
1836A	1939	PPT	Awake	?	-	20082
1836A	2433	12	2010-1-003	-	ex-MKS02	3331
1836A	1627	02	MKL02	40060	30-juin-10	31058
1836A	2488	04	2010-1-003	-	Spare	5073
1836A	3125	14	MKS11	2177	1-sept.-18	8090
1836A	3127	11	MKS14	43542	-	4203
1836A	2977	-	2010-1-003	-	ex-MKS05	4000
1836A	3113	-	169	-	Neuf	0
1836A	3270	-	169	-	Neuf	0
1836A	1609	-	169	-	?	?
1836A	1922	-	169	-	?	?





Other Klystrons

Klystron	N°	Cuve	Emplacement	Compteur	Compteur	Date installat°	Total heures
TH2132	132017R	11	MKS03	27395		Oct-12	23213
TH2132	132022	2	2001-1-001	-	-	-	neuf
TH2170	-	14	MKL02	21049		Feb-07	29697
TH2170	17003	-	169-R-004	-	-	-	neuf
TH2100	94008		169-R-004				HS
TH2100	210074		169-R-004				HS
TH2132	132013		169-R-004				HS
TH2132	132021		169-R-004				HS
TH2100	210090	-	Saclay	-	-	-	

- 

Redundant klystrons from CTF3
Possibility of donating new one to Sinretorone Trieste under agreement KN2633 with Trieste donating 100k€ to high efficiency Xband klystrons purchase for Xbox3. Being processed by procurement and legal
- 

L band (1.5 GHz) 25 MW klystron used for RF deflector in CR of CTF3
No longer needed
- 

Can be repaired if necessary
- 

S band klystron on loan to Saclay Alto, request to purchase, agreed by Freddy, With procurement and legal to finalize payment of 100k€



L Band multi-beam CLIC drive beam test stand

Two klystrons

Thales model,
unstable at factory tests didn't meet performance

Canon model
Installed in modulator at B112 test stand, waiting for TE/EPC to get modulator working



Future purchases

Spare high efficiency klystrons for power upgrade of Xbox 3 (a&b)

Preparing Finance Committee paper for December with expected order in January,
Delivery schedule 13 to 14 months after order placement
Hopefully with financial contribution from Sincretrone Trieste

50 MW tube replacement in medium term plan?

High Efficiency 50 MW klystron ?

2 Klystron Modulator ?

Spare parts for CLEAR and AWAKE modulators