RF Power Plant: Status and Evolution

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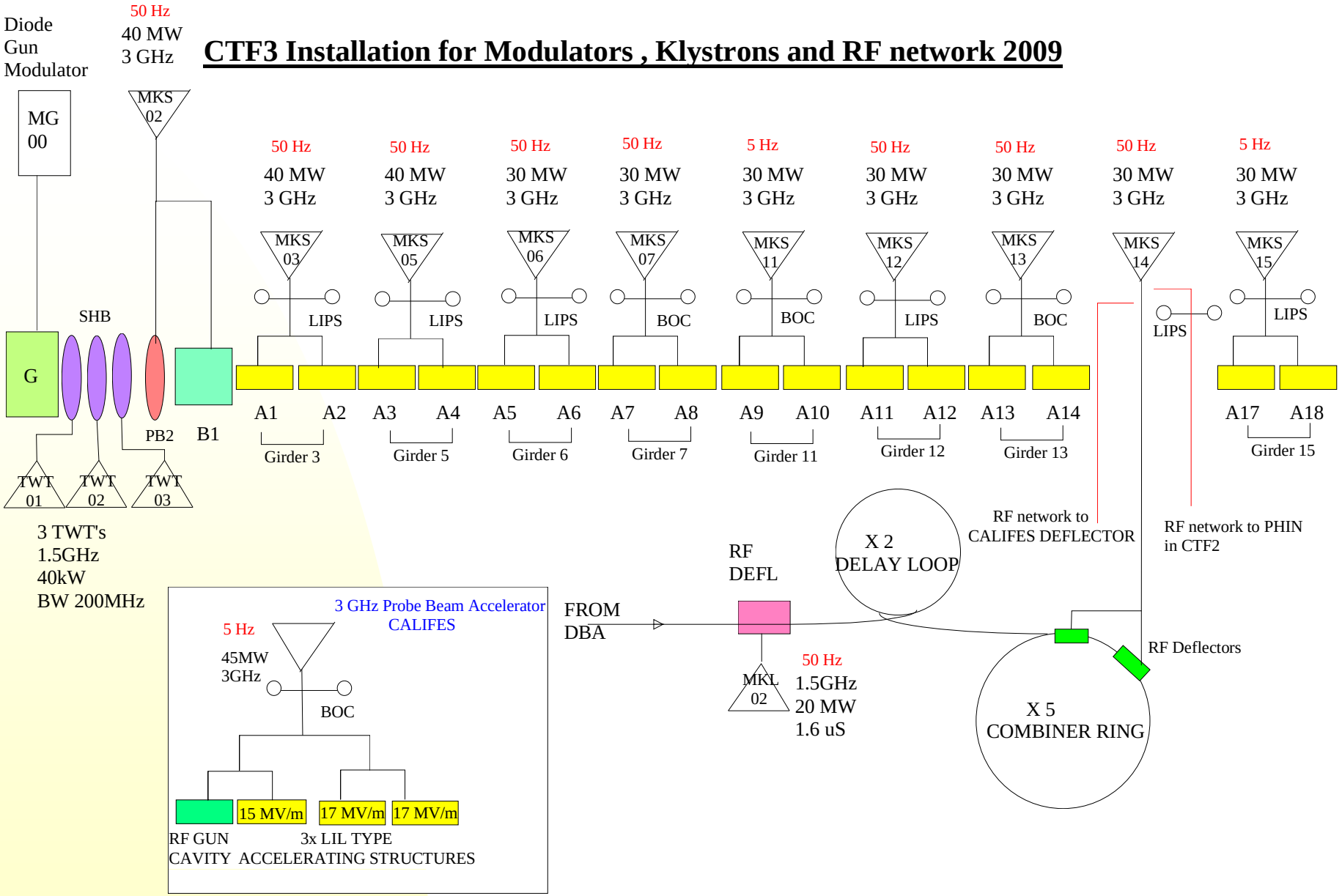
Introduction

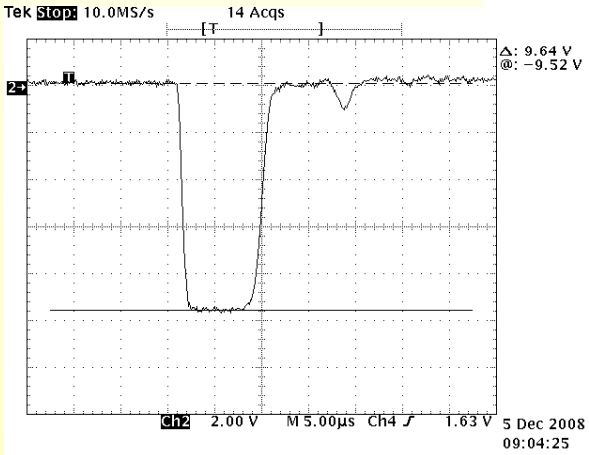
- Overview of existing installation
- Progress on probe beam RF installation
  - Probe Beam Modulator
  - RF network
- RF network for PHIN testing
- Observations on 2008 operations
  - Modulators
  - Klystron situation
- Improvements foreseen in 2009
- 12 GHz stand alone power source project

CTF3 Installation for Modulators , Klystrons and RF network 2009

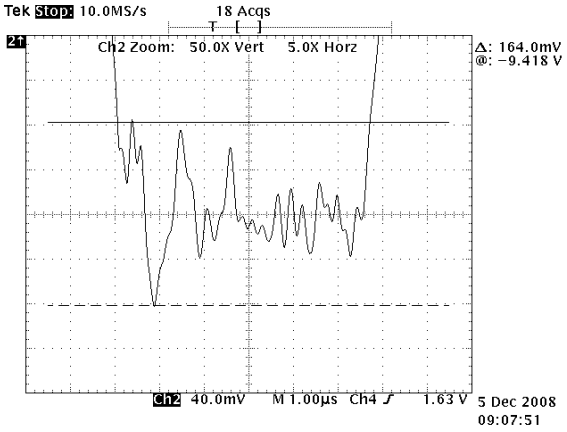


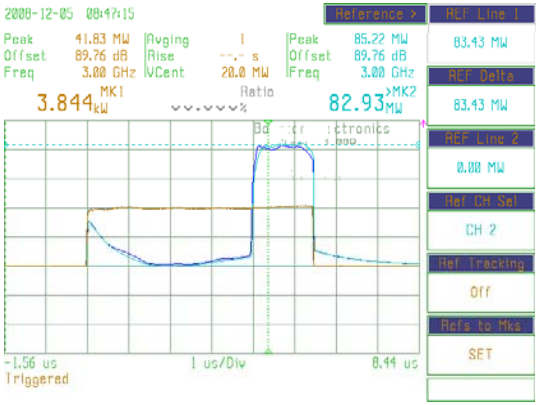
RF network for Probe Beam (CALIFES)

- Apart from two components all the RF network has been installed and conditioned to near nominal RF power
- The modulator is operational but along with our colleagues from CEA Saclay we are still working with the supplier to sort out some control and voltage stability problems.



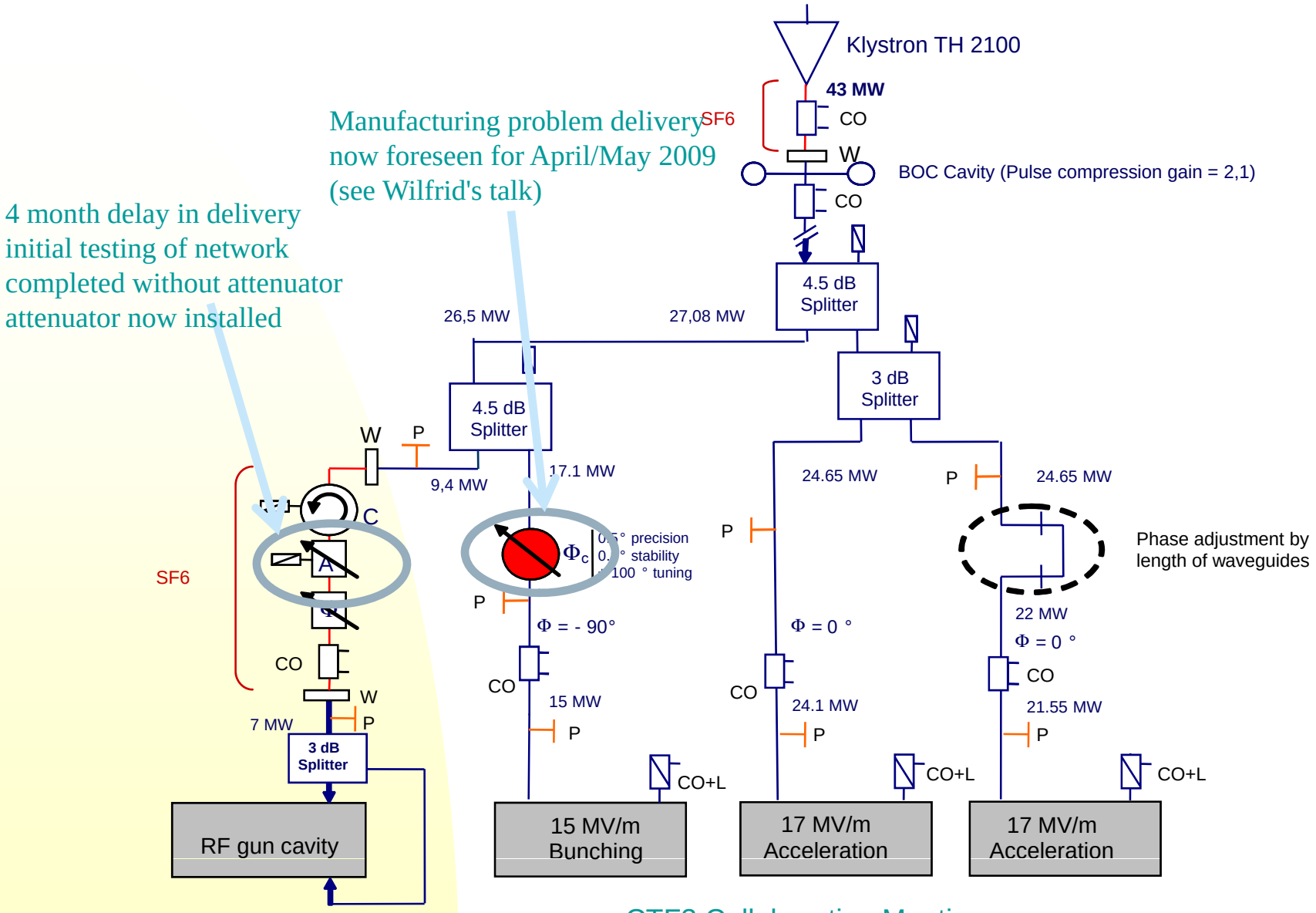
V klystron



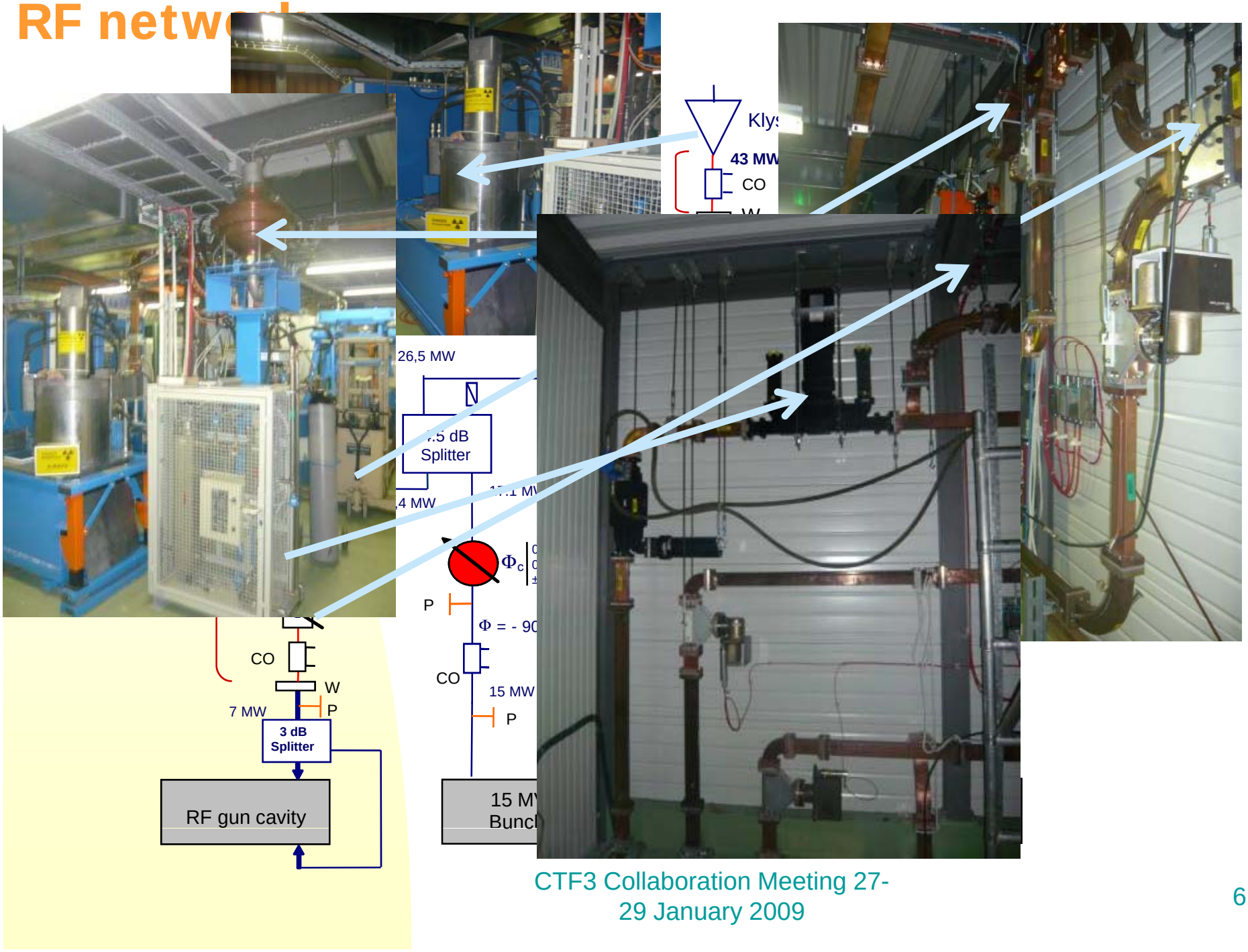


R f out and compressed pulse

RF network


Manufacturing problem delivery now foreseen for April/May 2009 (see Wilfrid's talk)
4 month delay in delivery initial testing of network completed without attenuator attenuator now installed
Klystron TH 2100
43 MW
SF6
CO
W
BOC Cavity (Pulse compression gain = 2,1)
CO
4.5 dB Splitter
26,5 MW
27,08 MW
3 dB Splitter
4.5 dB Splitter
W
P
9,4 MW
17.1 MW
24.65 MW
P
24.65 MW
C
A
SF6
Φc
° precision
° stability
100 ° tuning
P
Φ = - 90°
Φ = 0 °
22 MW
Φ = 0 °
CO
CO
CO
W
7 MW
P
15 MW
24.1 MW
21.55 MW
P
P
P
3 dB Splitter
CO+L
CO+L
CO+L
RF gun cavity
15 MV/m Bunching
17 MV/m Acceleration
17 MV/m Acceleration
Phase adjustment by length of waveguides

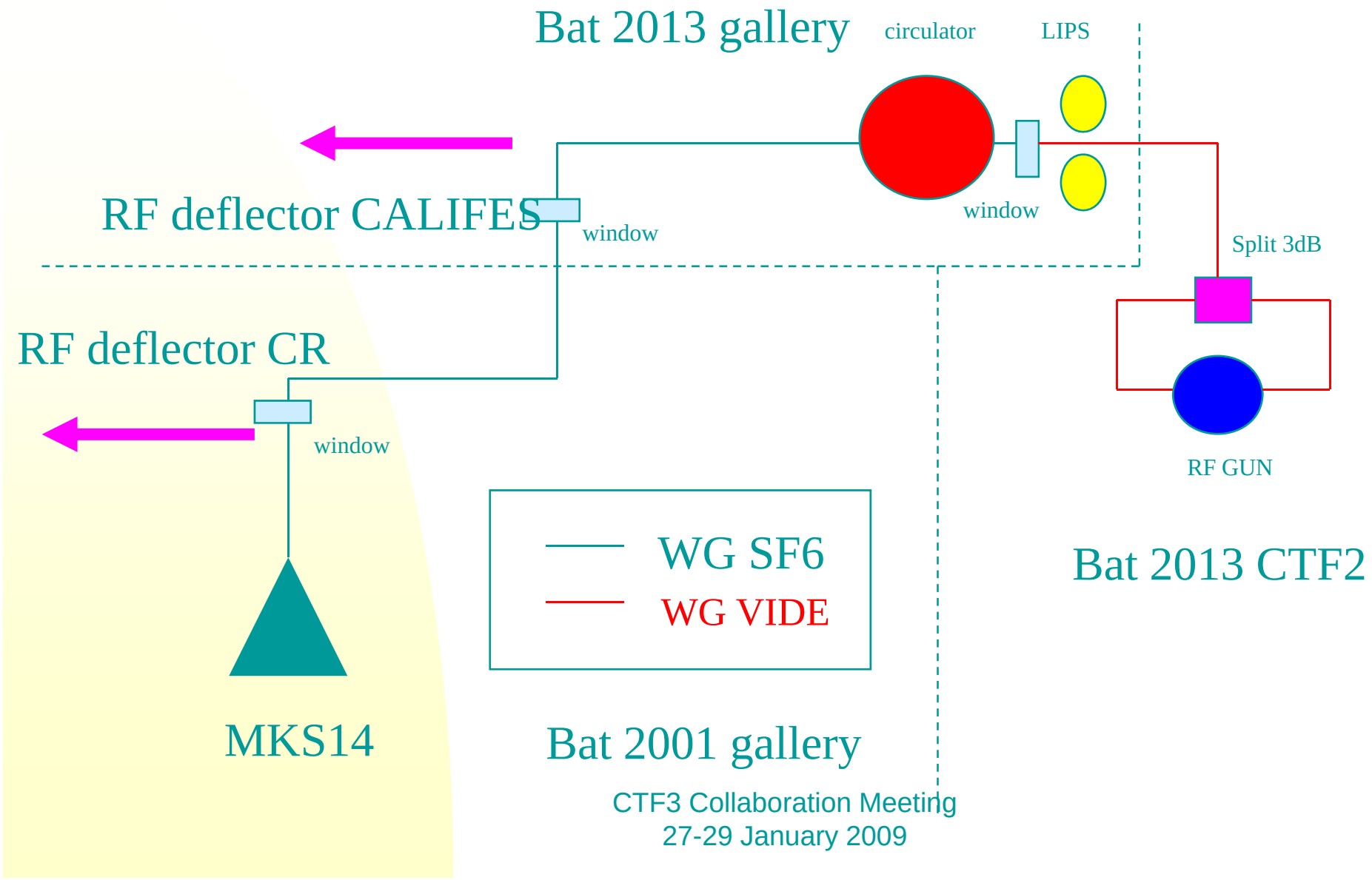
RF netwo


Klys
43 MW
CO
26,5 MW
Splitter
4 MW
Φc
P
Φ = - 90
CO
15 MW
P
CO
W
7 MW
P
3 dB
Splitter
RF gun cavity
15 M
Bunch

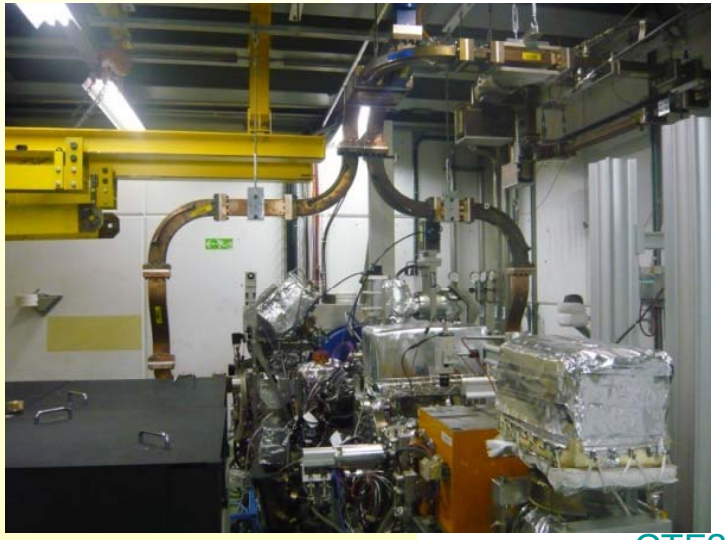
RF network

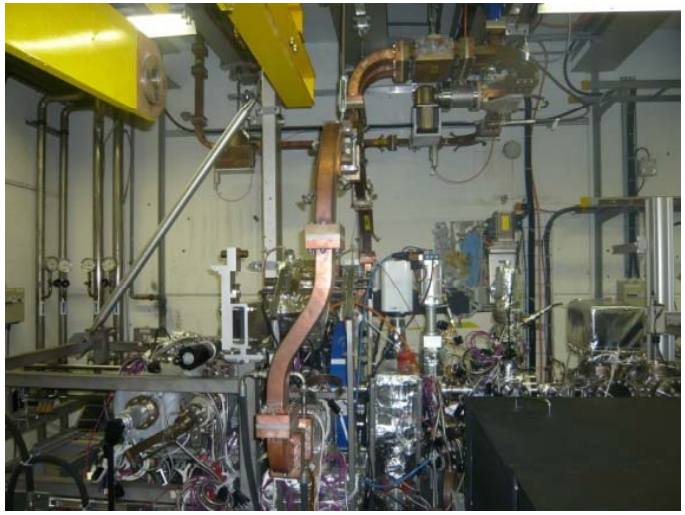
Distance between accelerating structures normally n x wavelength unfortunately not the case here made calculations for the adjustment of waveguide lengths' more tricky to achieve the correct phase

RF network for PHIN



RF network for PHIN





B.2013 gallery

B.2013 CTF2

circulator

LIPS

window

RF deflector CALIFES

window

Split 3dB

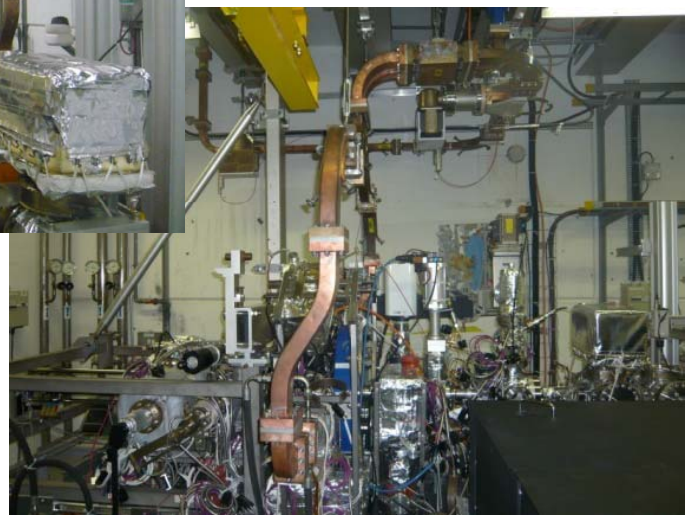
RF deflector CR

window

RF GUN

WG SF6

WG vacuum



MKS14

Bat 2001 gallery

Observations on 2008 operations

- Modulators 02,03,05,06 and 07 ran for approximately 3500 hours (heater) This was for 30 GHz production and full Linac operation
- Modulators 11,12,13,15 ran for approximately 2000 hours (heater) this was for full Linac operation
- Modulator 14 ran for approximately 1600 hours for RF deflectors or PHIN
- Modulator MKL 02 ran for approximately 700 hours (heater)
- Modulators and klystrons running at approximately 95-100% of their peak capability
- Successful integration of the new charging supplies in MKS11 and MKS 15.
- Successful testing new diode stack. Replacement stacks are now in house to be used when old ones fail

Observations on 2008 operations (Downtime of Modulators)

- Thyratron or Klystron failures (0.5 to 4 hrs maximum to replace)
  - BUT due to no test modulator
  - another 0.5 to 2 days for conditioning to achieve nominal operation as there are no hot spares
- Timing problems
  - Intermittent, missing or additional timing pulses from timing distribution causes instabilities in the RF output hence in the beam
  - Control group have been informed and intervened many times last year and hopefully they have understood the problem and it will be resolved for this years start up
- General power cuts
  - Difficulty in restarting and obtaining stable conditions
- Water
  - Pump upgraded and additional circuits added (CLEX)
  - Water filters contaminated by unclean pipes and faulty filters

Observations on 2008 operations

- zero Klystron failures
- 6 Thyratron failures
- CTF3 now has 11 S band and 1 L band klystron modulators running at 95-100% of nominal and 3 TWT's
  - We still have no facility to test spares, conditioning needs to be done online i.e. longer downtime
  - Spare situation improving
  - Resources' down again we are now only 3 FTE in the MDK team

Klystron Position and Hours January 2009

MODULATOR	TANK		KLYSTRON	Peak Power	No. Of Hours		
	Number	TX ratio					
MKS02	13	14.8	TH2100 S.No.40	42 MW	10350		
MKS03	11	14.8	TH2132 S.No.21	45 MW	20370		
MKS05	2	14.8	TH2132 S.No.13	45 MW	25300		
MKS06	4	13	YK1600 S.No.12	35 MW	28130		
MKS07	1	13	YK1600 S.No.5R	35 MW	28100		HOT SPARES
MKS11	6	13	TH2094 S.No.2R	35 MW	26310	Klystron	Peak Power
MKS12	5	13	YK1600 S.No.6R	35 MW	8300	TH2132 S.No.22	45 MW
MKS13	10	13	TH2100 S.No.7	37 MW	6200	TH2100 S. No.10	37 MW
MKS14	3	13	YK1600 S.No.11	35 MW	32300	TH2100 S.No.24	42 MW
MKS15	9	13	TH2100 S.No.8	37 MW	5360		
MKL02		13	TH2170 S. No.1	25 MW	4820		
MKS30	PPT	15	TH2100 S.No. 60	45 MW	200	SPARES	
						YK1600 S.No8	35MW
Spares							
KLYSTRON	Peak P	No. Of Hours					
TH2100 S.No.23	45 MW	0					
TH2100 S.No.11	35 MW	0					
TH2132 S.No.17	45 MW	0	in factory for reception test				

2009 RUN OBJECTIVES

- Consolidate existing modulator performance
- Finish commissioning of probe beam
- Integrate “PSI” modulator as test set up and use it as model for eventually changing the G64 and CAMAC controllers in the other modulators
- Prepare for 12 GHz testing

12 GHz Stand alone power source

- Last years projections were unfortunately held up by administrative problems. Now that they are resolved we have every confidence in the technical side
- Preparing CERN infrastructure to receive modulator at end of year and klystron beginning of 2010

Conclusions

- With the diminished manpower in the modulator team, 2008 was a difficult year to keep all required components online
- Successful integration of new components to increase modulator reliability
- Very successful ongoing collaboration with CEA Saclay for the CALIFES project
  - Once again thanks to all participants
- New collaborations with PSI and Trieste on common 12 GHz requirements
- Challenging program in 2009
  - Consolidate and keep existing systems running,
  - Finish commissioning CALIFES modulator and RF networks
  - Continue testing of PHIN in CTF2
  - Completion of PSI modulator
  - Still -1 FTE in team
- 12 GHz test stand
  - Challenging and exiting program over the next 12 months
  - Still need the technician post from the white paper allocation
- The missing 2 FTE's could have enormous consequences on the availability of the high power RF for CTF3 over the next few years should there be any absences due to illness or even retirement