



Task 3: Modulator technology

Requirements

Modulator specifications are controlled mainly by klystron specifications and in some degree by the cavity and LLRF system

We need to define technical requirements for XLS Modulator → **input from Task 1**

- Pulse voltage
- Pulse current
- Pulse length
- Repetition rate
- Flattop/stability

Cavity/LLRF system: levels of noise compensation for


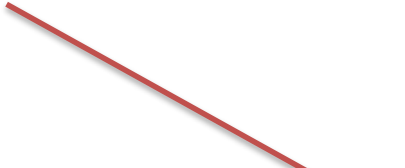
- Amplitude
- Phase
- Droop
- Rise time

Operational Requirements

- Reliability
- Power efficiency
- Flexibility / Stability
- Ease of maintenance
- Maximize klystron lifetime

Setup of the RF unit – CLIC experience

- CLIC X-box 2 (in operation)

- 1 x Modulator (Scandinova K400): 
- 1 x Klystron (CPI VKX-8311A) 
- 1 x SLED pulse compressor

SYSTEM SPECIFICATIONS	UNIT	DATA
Klystron RF Peak Power	MW	30–60
Klystron RF Average Power	kW	40
Modulator Peak Power	MW	160
Modulator Average Power	kW	125
Pulse Voltage	kV	280–450
Pulse Current	A	230–450
Pulse Repetition Frequency Range	Hz	0–500
Pulse Length, Top	μs	0.5–15
Flatness (Voltage)	%	+/-1
Modulator Voltage Stability, RMS	%	0.01
Cooling		Water

- CLIC proposed RF unit for klystron-based linac with common modulator for 2 klystrons

- 1 x Modulator: 366 kV, 265 A
- 2 x Klystron: 68 MW, 1.625 usec
- 2 x SLED pulse compressor: 213 MW, 325 ns
- 10 x CLIC cavities

Typical Operating Parameters		
Item	Value	Units
Beam Voltage	410	kV
Beam Current	310	A
Frequency	11.994	GHz
Peak Power	50	MW
Ave, Power	5	kW
Sat. Gain	48	dB
Efficiency	40	%
Duty	0.009	%

From XLS proposal

- XLS RF unit based on CLIC re-baselining study
 - common modulator feeding 2 klystrons
 - power pulses compressed by 2 pulse compressors
 - Technical Requirements
 - Two klystrons 50 MW (not 68 MW) ?
 - Pulse Voltage ≤ 366 kV ?
 - Pulse Current ≤ 265 A ?
 - Pulse length ≤ 1.625 usec ? (Depending on max average power)
 - Rise-time
 - Flattop / Stability (0.01%)?
 - Repetition rate 50 (100) ? (Depending on max average power)
 - Operational Requirements
 - Reliability
 - Power efficiency
 - Flexibility / Stability
 - Ease of Maintenance
 - Maximize Klystron Life

Objectives

- Well defined parameters will serve as a input for the discussion within the Task and with modulator companies
- Their feedback is crucial for optimization process of the whole RF unit
- Iterative process, elaborating and improving of initial design

Participants

- Uppsala, FREIA Laboratory (Magnus Jobs, Marek Jacewicz) – 4 month FTE
- SINAP
- ...