

# WP4: Task3 - Modulator and Klystron technology

## Participants:

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## RF unit for HARD X-FEL?

1 (2) modulator

2 klystrons: 50MW, 1.5 us -->  $2 \times 45 = 90 \text{ MW @ } 1.5 \text{ us}$

SLED pulse compressors --> **420 MW @ 150ns**

ACS: 0.75m long, operational gradient **65 MV/m @** input power 42 MW

10 structures in one RF unit, active length 7.5 m, **total length 10 m**

Electron acceleration per RF unit 490 MeV

12 units would get us to **~6 GeV beam in 120 meters**

Repetition rate **100 Hz**

Quite feasible with currently available components, few open questions:

- Development of modulator with dual klystron:
  - Funding application submitted in August
- ... ?

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## RF unit for SOFT X-FEL

Can we use the same hardware and run it with 1000 Hz?

Discussion with Scandinova – no first-order problems, they already delivered high-rep systems to other clients:

Rep rate	Power	Frequency	Pulse length
120 Hz	50 MW	11.4 GHz	1.5us
1000 Hz	5 MW	9.4 GHz	0.7us
2000 Hz	4 MW	2.4 GHz	2.0us
2400 Hz	0.3 kW	5.1 GHz	0.5us
50 Hz	-	250 GHz	5.0us

It is essentially the same hardware, some foreseen problems e.g. heating at higher power in the transformers. That can be investigated and fixed

SOFT x-FEL with the same RF unit:

"Only" need  $2 \times 15 = 30 \text{ MW (@ 1000Hz)}$  from both klystrons:  $\sim 22 \text{ MV/m}$  gradient in ACS and 2 GeV beam

From modulator perspective it is feasible.

Scandinova also sees the need of pulsed RF sources to cope with high repetition rate and is interested in such development.

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## Modulator for 36 GHz

Discussion with Scandinova – again, no first order problems, the HV generation parts are always the same. Modifications might be needed to supply the gun, pumps, transformer – that is specific to the klystron