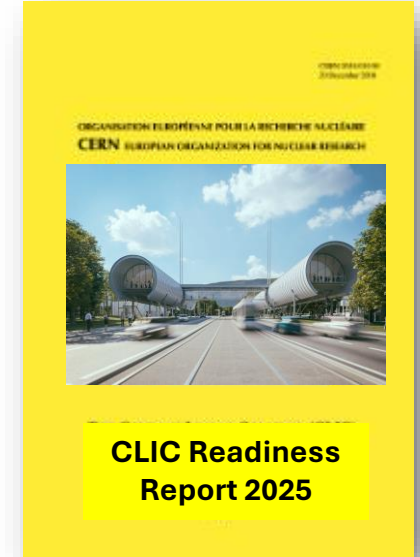
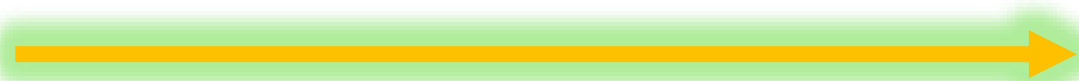
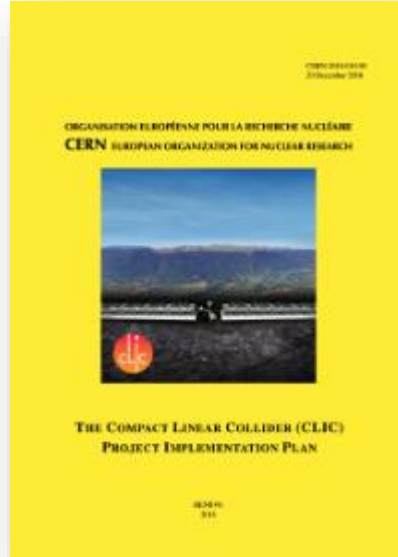


Readiness Report, The systems chapter

- ❑ Overview of the chapter
- ❑ Main changes with respect to the PIP report
- ❑ Conclusion



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Contributions by: Yannis, Andrea, Yongke, Daniel, Vera, Rogelio, Raul, Alexej, Adnan, Igor...

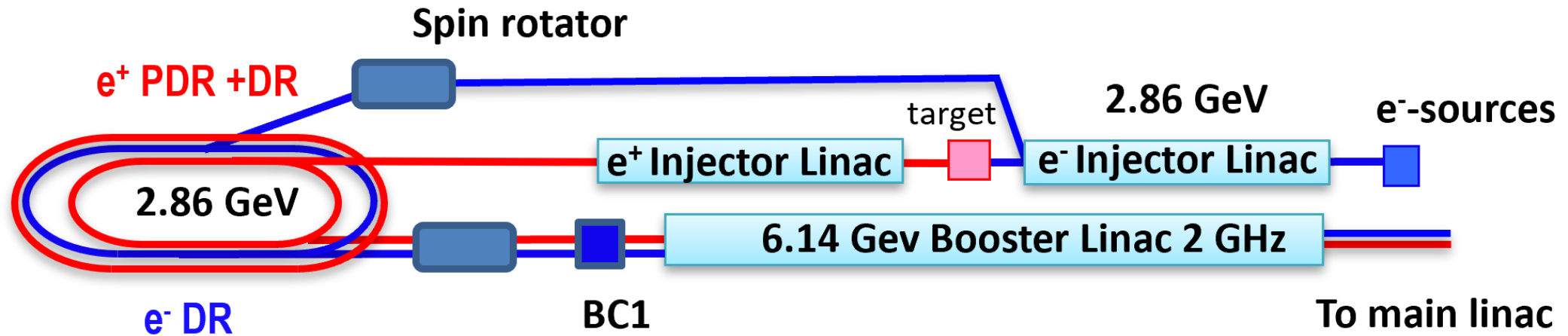
Main intended changes

- **Redesign of the main beam injector complex, aim to save cost and electricity.**
New RF structure design, focus on 380 GeV, higher positron yield, lower drive linac energy, new layout
- **New drive beam klystron, higher efficiency, number of klystrons, RF-structure parameters, some updates in the beam dynamics of the combination complex and decelerators**
- **DR updates, new 2 GHz RF-system integrated, updated performance**
- **RTML optimization, new bunch compressors, performance optimization, new booster accelerating structure**
- **Luminosity performance updates, emittance bumps and machine tuning**
- **Beam delivery: Performance and layout updates (here only 380 GeV)**

- **Not much new in: Main linac, post collision line and machine-detector interface**

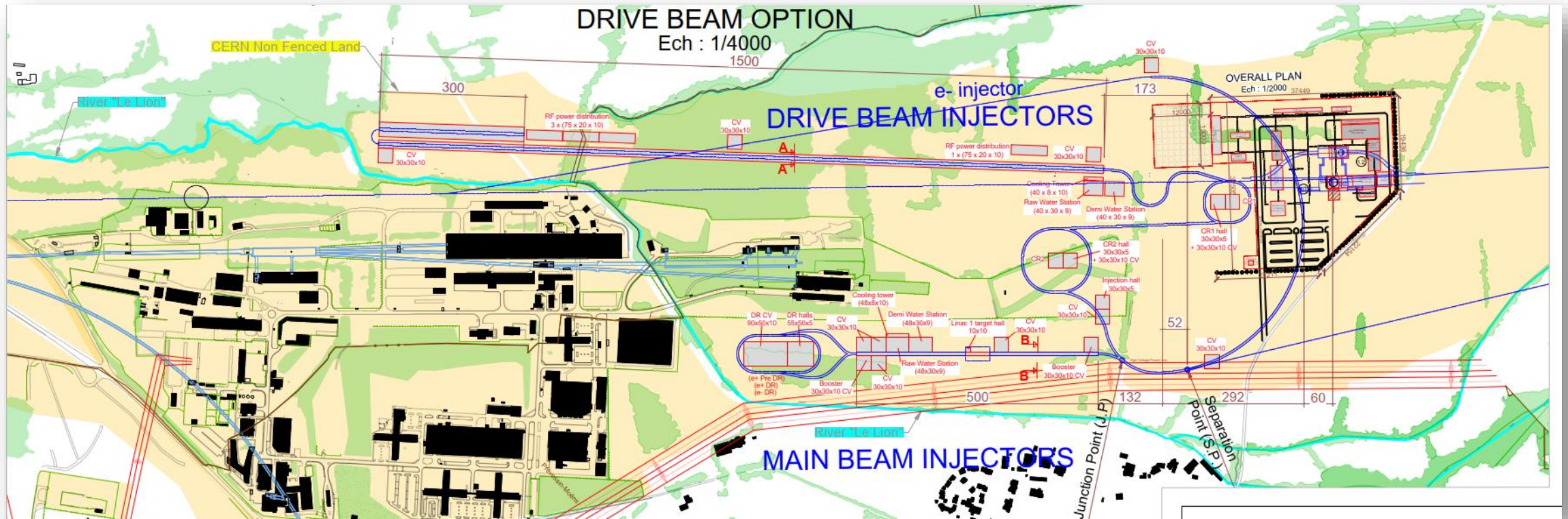
Main Beam Injectors

New design and layout



More details by Adnan and Yongke

Main Beam Injectors New design and layout



Edward Fraser Mactavish et al.

Drive Beam

New klystron, beam dynamics update

New ideas for CLIC 1GHz klystron for DB linac

High Efficiency 24 MW, 1 GHz, CLIC TS MBK performance summary (PIC CTS/3D)

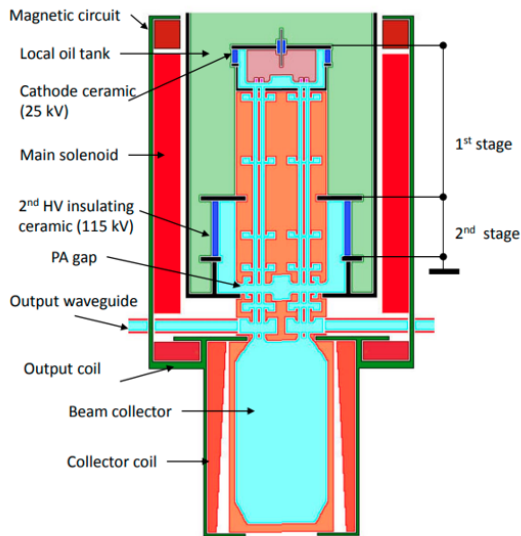
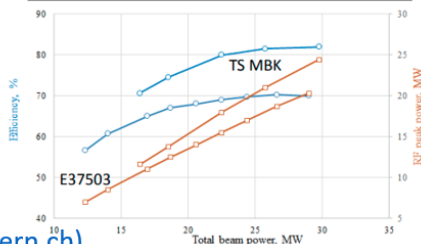


TABLE I. DESIGN AND SIMULATED PARAMETERS (CST/3D) OF THE CLIC TS MBK AND CANON MBK E37503 CATALOGUE DATA

Parameter	TS MBK	E37503	Unit
Operating frequency	1000	1000	MHz
Voltage at the 1 st stage	25	160	kV
Voltage at the 2 nd stage	140		
Total beam current	212	180	A
Number of beamlets	30	6	
Number of cavities	6	6	
Perveance at the 1 st stage	1.77	0.47	$\mu\text{A}/\text{V}^{3/2}$
Perveance at the 2 nd stage	0.133		
Output RF power	24.1	20	MW
Saturated power gain	52	54	dB
Saturated efficiency	82	70	%
Length of RF circuit	900	1500	mm



Novel design Two-Stage (TS) Multi-Beam Klystron (MBK)

2nd stage is not pulsed:
More efficient modulator

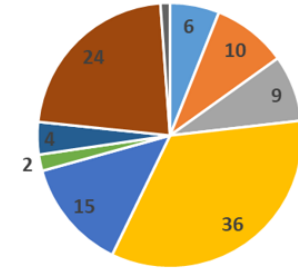
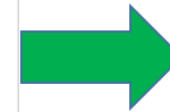
It has more power per klystron compared to PIP baseline: 20 MW -> 24 MW
Significant cost impact

It has higher Efficiency compared to PIP baseline: 70% -> 82%
Significant impact on power consumption

1W MBK vs 24MW TS-MBK

- 11 MW

Drive beam option: 107 MW



- 10 MW

- 1 MW

- DB Frequency Multiplication & Transport
- Two-beam accelerators
- Interaction Region
- Infrastructure and Services
- Controls and Operation

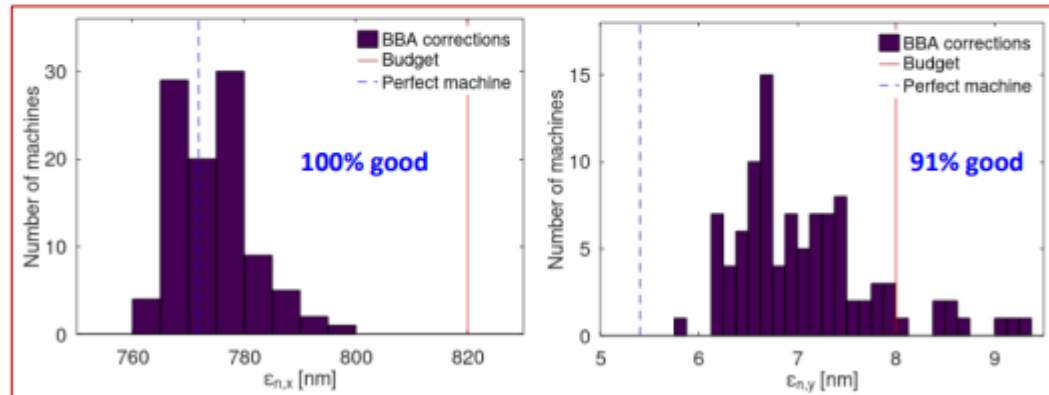
- MB Injectors
- MB Damping Rings
- MB booster & Transport
- DB Injectors
- DB Frequency Multiplication & Transport
- Two-beam accelerators
- Interaction Region
- Infrastructure and Services
- Controls and Operation

CLIC project meeting 15 June 2021 [Igor Syratcev \(cern.ch\)](http://igor.syratchev.cern.ch)

Details: Alexej Grudiev, CLIC Mini Week, Dec. 2023

RTML, New optimized bunch compressors, booster linac, BBA and beam transport

- Results (100 random misaligned machines)
 - 91% good machines (required: 90%)
 - To be optimised, though satisfied
 - * To understand why X emittance is much better than Y

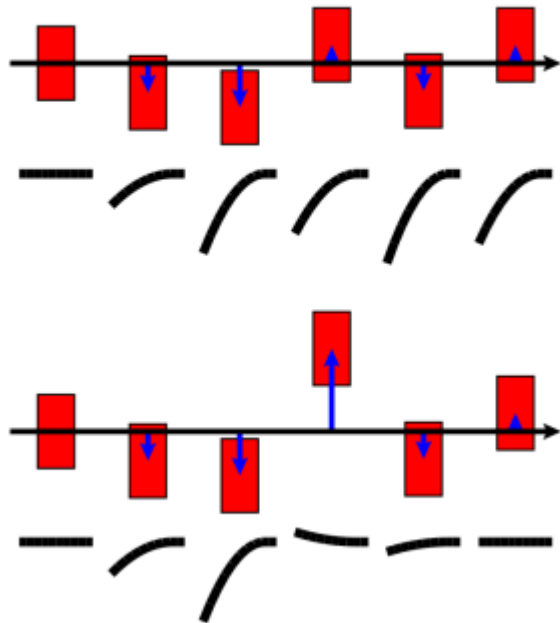


Parameter	Unit	Old		New	
		CDR	PIP	Baseline	Alternative
BC1 RF total voltage	MV	399	477		450.5
BC1 structure length	m		1.5		1.5
BC1 RF gradient	MV/m	13.3	15.9		18.770
BC1 RF peak power	MW	23.8	34.0		47.3
BC1 RF-to-beam efficiency	%	24.8	22.9		20.8
BC1 number of klystrons		10 (6)	10		8
BC1 number of RF structures			20		16
BC2 RF total voltage	MV	1686.4	1763.0		659.3
BC2 structure length	m		0.23	0.275	0.275
BC2 structure aperture	mm	3.63	5.44		3.33
BC2 RF gradient	MV/m	94	98.27	74.916	37.458
BC2 RF peak power	MW	88.4	355.6	39.3	9.8
BC2 RF-to-beam efficiency	%	24.5	7.5	45.1	56.5
BC2 number of klystrons		40	156	8	4
BC2 number of RF structures			78	32	64
BL total voltage	MV		6168.6		6156.3
BL structure length	m		1.5		1.5
BL RF gradient	MV/m		14.9		15.089
BL RF peak power	MW		54.1		55.1
BL RF-to-beam efficiency	%		20.0		19.9
BL number of klystrons			138		136
BL number of RF structures			276		272

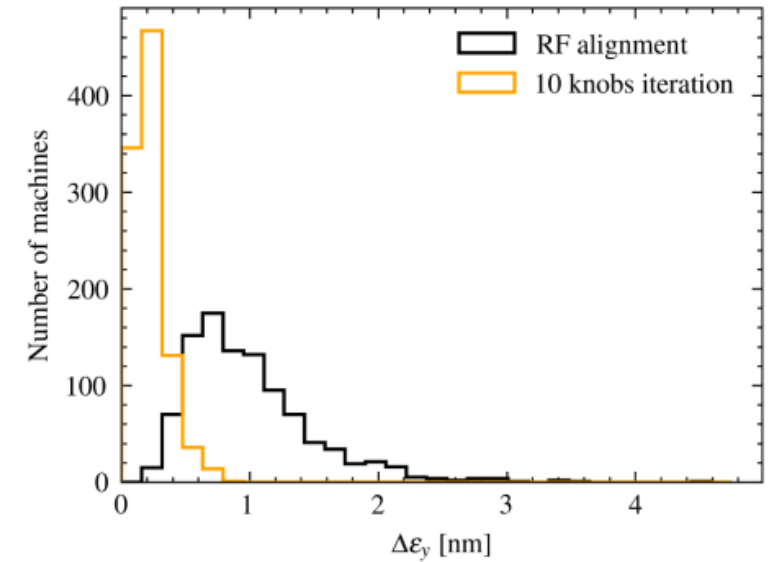
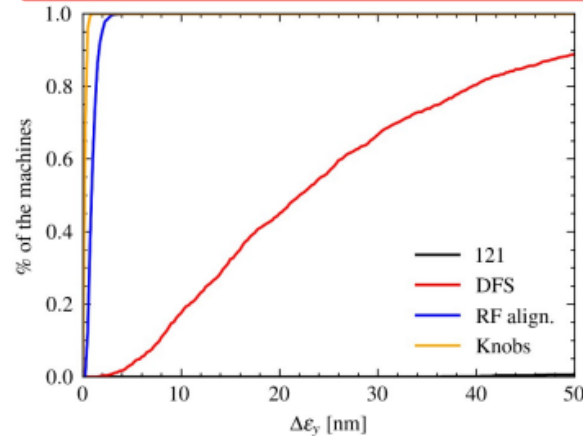
Yongke ZHAO

CLIC RTML optimisation

Main LINAC, Emittance tuning Bumps, BBA performance



- After the knobs tuning:
100% of the machines - < 0.8 nm
95% of the machines - < 0.5 nm
RMS 0.12 nm



Conclusions



The chapter should be ready on time but of course last minute !