



This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under GA No 101004730.

WP 11.2

“High-Efficiency Klystron Industrial Prototype”

I.FAST Open Steering Committee

15-16 November -2021

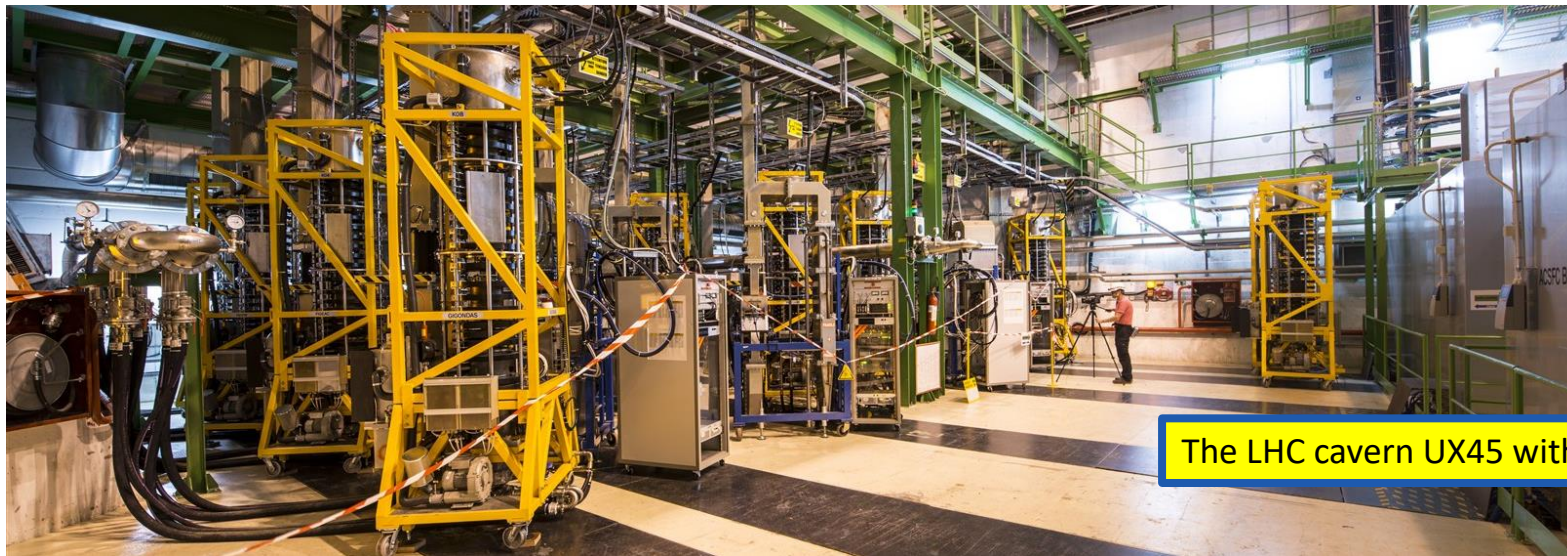
N. Catalan-Lasheras & O. Brunner /CERN

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Scope

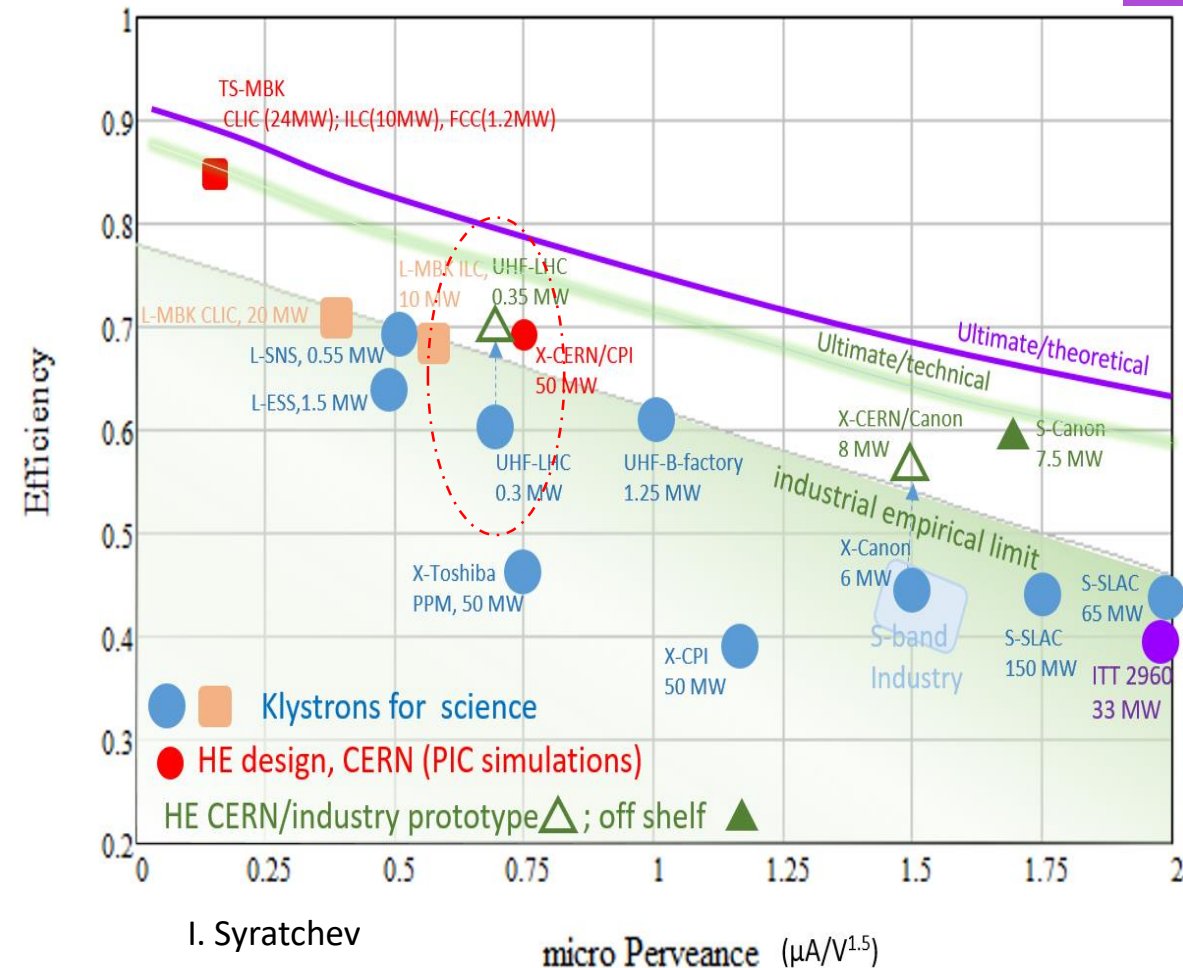
- Fabrication and tests of industrial prototypes of High Efficiency Klystron for LHC.
- Refurbishment of the existing LHC klystron “*TH2167*”; this allows to re-use the existing infrastructure and subassemblies of the existing tubes.
- Expected gain in DC to RF conversion efficiency: + 10 - 15 %



The LHC cavern UX45 with the klystron gallery.

Higher energy efficiency is a must

- Also to all future accelerator projects.
- Impressive progress in High efficiency klystron technologies in recent years.
- The HE-LHC klystron will be the flagship demonstrator -> I.FAST 11.2.
 - demonstrate the performance in operation in LHC
 - reduce the electricity bill and the environmental impact
 - increase the operational margin when operating with higher intensities (“HL-LHC”).



The teams



- CERN (N. Catalan, I. Syratchev, O. Brunner)
 - Igor is the driving force for HE Klystron.
 - Nuria is leading the HE klystron effort @ CERN.



Nuria Catalan



Igor Syratchev



Olivier Brunner



- Thales AVS France SAS (A. Beunas, O. Mielle, G. Batto...)
 - Thales is the only European supplier for high-power klystrons



Armel Beunas



- University Lancaster (G. Burt, J. Cai)
 - University of Lancaster, part of the Cockcroft Institute, is a productive and reliable partner - Graeme (Associate Director and Professor),
 - Jinchi (formerly CERN fellow) has developed an advanced klystron simulation code (KLyC) and is key player in the HE klystron development.



GRAEME BURT
Lancaster University
BBC BREAKFAST

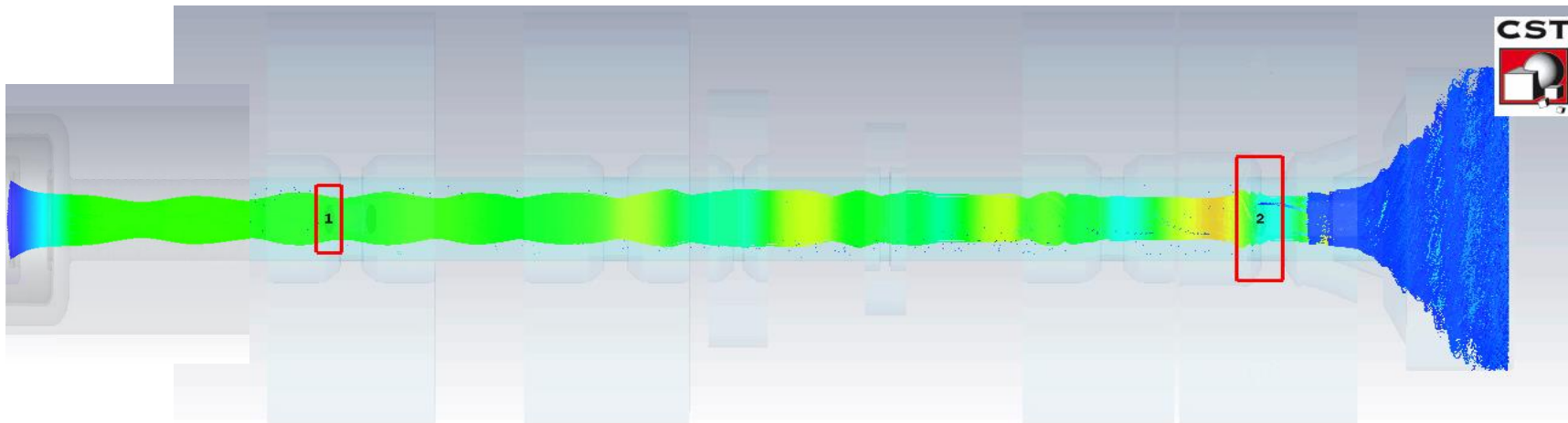


Jinchi Cai



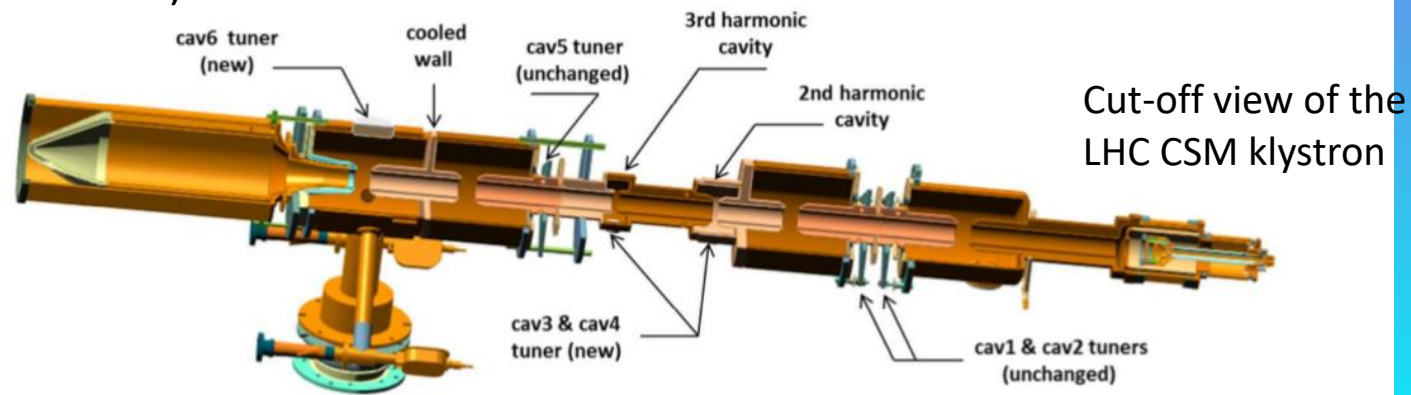
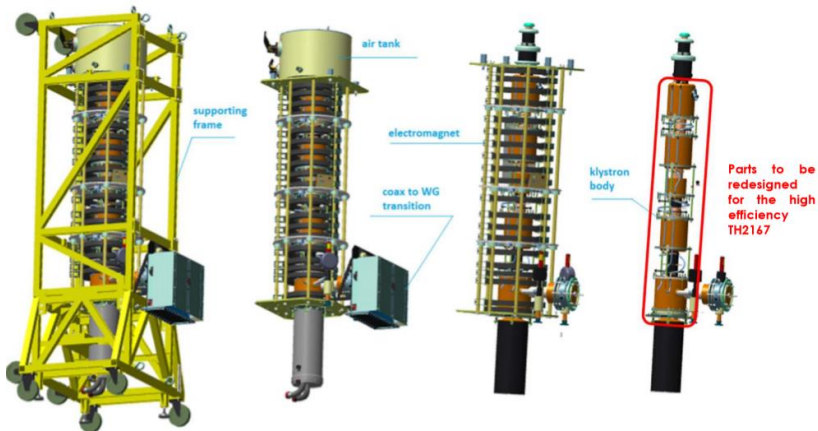
Retro-fit of the LHC klystron -> $\eta+10\%$

- Replacement of the interaction region (3D PIC full tube (cathode +solenoid + RF circuit + collector) simulations)



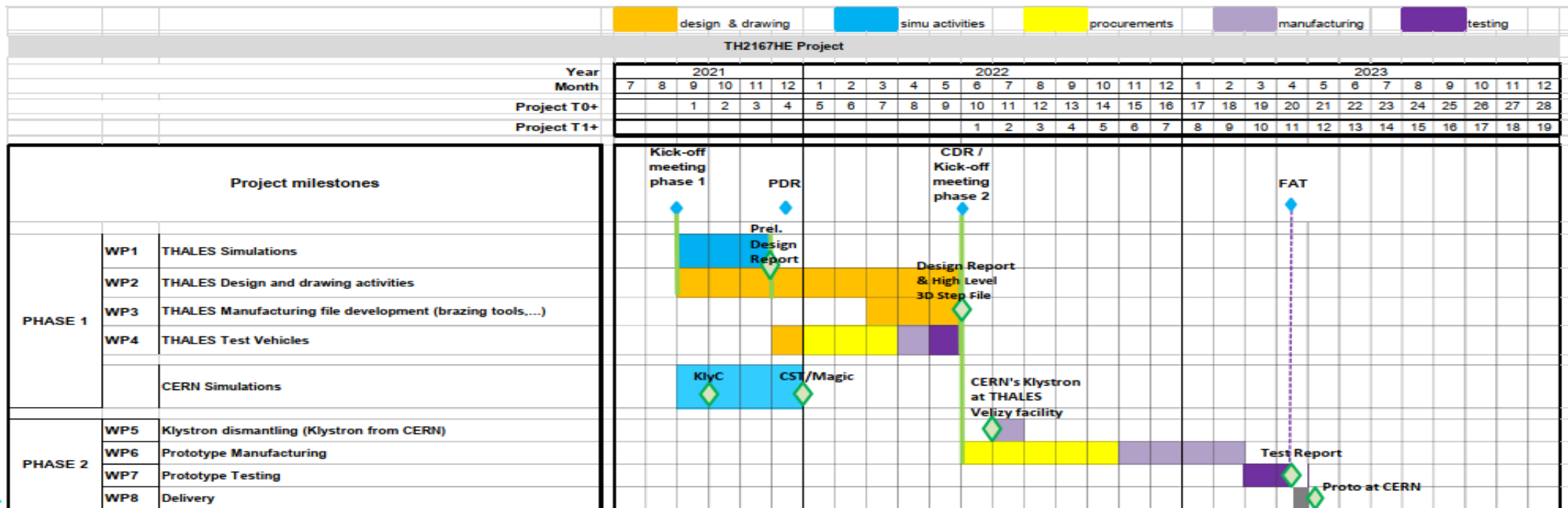
	LHC/CSM	LHC/Thales
Frequency, GHz	0.4	0.4
Beam power, MW	0.5	0.5
Perveance,	0.72	0.72
RF power, MW	0.35	0.30
Efficiency, %	70	60

- Re-used housing, electron gun and solenoid (also efficient!)



Where do we stand?

- A collaboration agreement*) CERN/Thales was elaborated and signed – goes beyond the scope of I.FAST
- The HE LHC Klystron Kick Off Meeting took place on the 2nd of September 2021



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I hope this was efficient !

Thanks!



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