



THE CLIC K-MODULE EXPERIMENTAL PROGRAM

DISCUSSION FOR A WORKPLAN IN 2021 - 2026

CLIC 21/07/2015 - 20

CLIC Project Meeting– December 2020

Contributions from S. Doebert, M. Aicheler, M. Capstick, H. Mainaud Durand, R. Corsini, W. Farabolini.

OUTLINE

- General guidelines for an experimental program
- Timeline
- Concluding remarks.



GUIDELINES FOR THE CLIC K-MODULE EXPERIMENTAL PROGRAM

ACTIVITIES	AREA
1 General mechanical integration, including vacuum and water cooling - assembly sequences	LAB + CLEAR
2 General alignment, girder and SAS; vibration and environmental studies	LAB + CLEAR
3 Dynamic alignment: mechanical constraints, including vacuum	LAB + CLEAR
4 Thermo-mechanical behaviour of the CLIC K-Module	LAB + Xbox
5 Validation of RF critical components and general RF power handling of the system	Xbox
6 RF conditioning and operational studies of the CLIC K-Unit (RF power source and Module)	Xbox
7 Experimental program with beam in the CLEAR tunnel	CLEAR

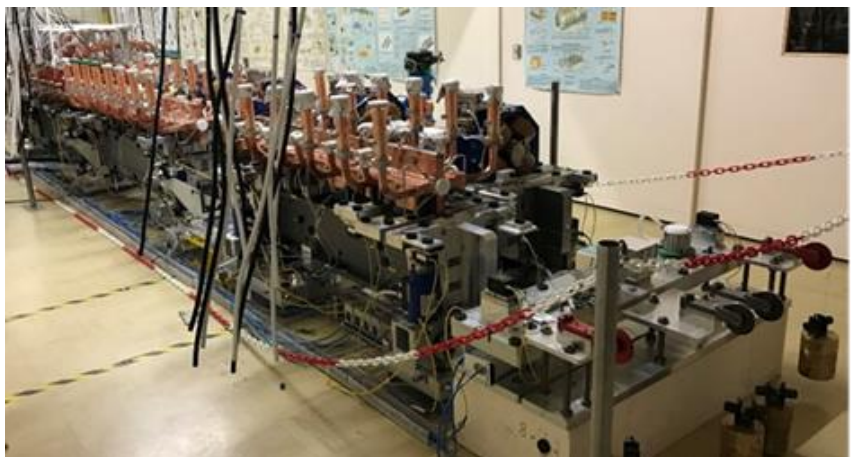


EXPERIMENTAL PROGRAM : MECHANICS AND ALIGNMENT

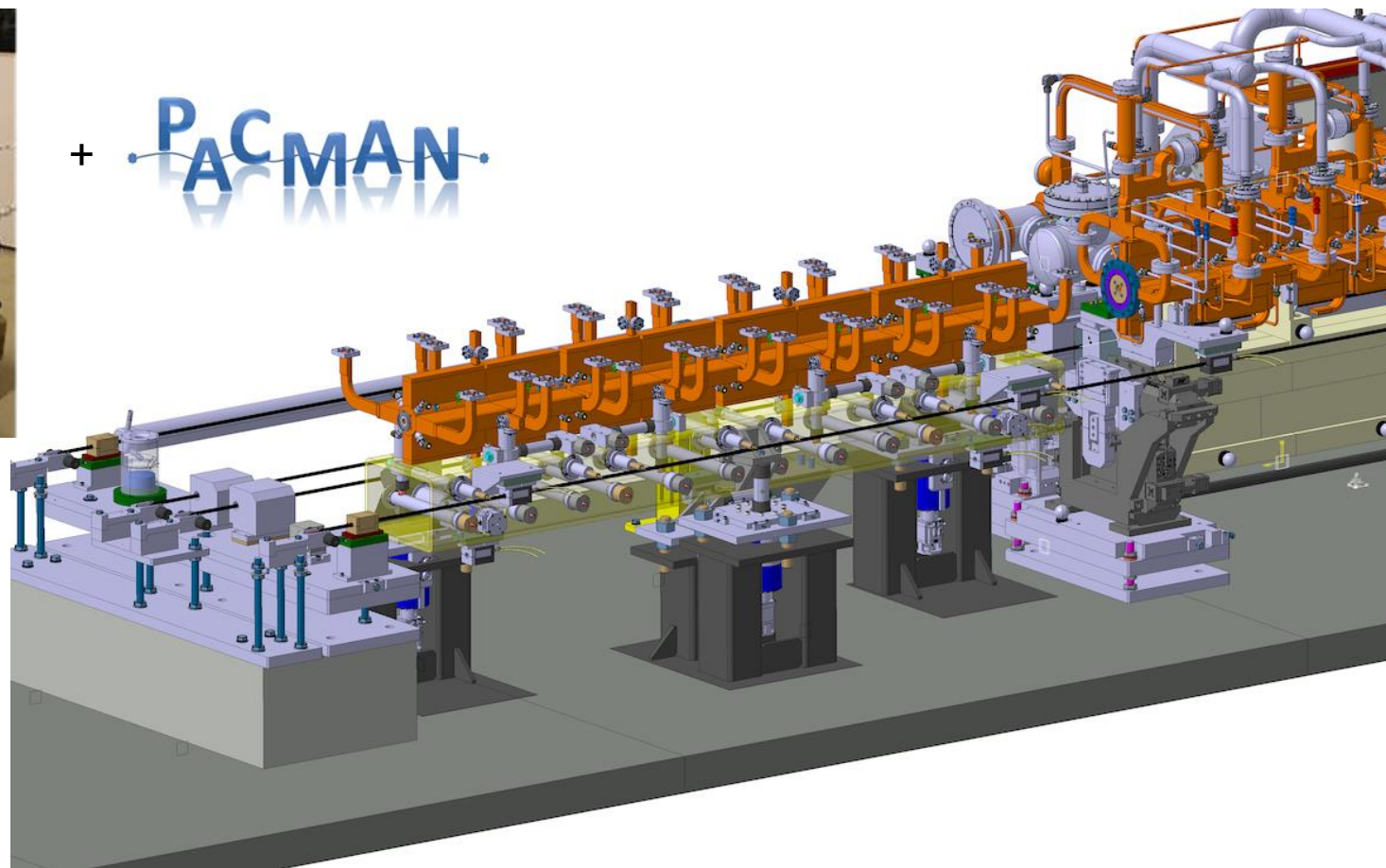
1	General mechanical integration, including vacuum and water cooling - assembly sequences	LAB + CLEAR
	Development of a technical specification for production	LAB
	Fiducialisation "à la PACMAN"	LAB
	Procedures for assembly and installation	LAB
2	General alignment, girder and SAS; vibration and environmental studies	LAB + CLEAR
	Absolute alignment of components, including longitudinal	LAB
	Transport test	LAB
	Test alignment in a real accelerator environment	LAB + CLEAR
	Perform alignment at different ambient temperatures, from 20 °C	LAB
	Vibrational modes characterization (collaboration Oxford ?)	LAB
3	Dynamic alignment: mechanical constraints, including vacuum	LAB + CLEAR
	Experience dynamic alignment with waveguide constraints, vacuum forces and thermal stresses	LAB + CLEAR



EXPERIMENTAL PROGRAM : MECHANICS AND ALIGNMENT



+ PACMAN



Resources for Survey:

- 1 fellow (survey profile): 2021-2023
- 1 fellow (survey profile): 2024-2026
- techs, trainees: 80 kCHF
- 1 doctorate student for Oxford university?
- 4 months of a Labview programmer (BE_CEM-MTA)
- Material 50kCHF/year

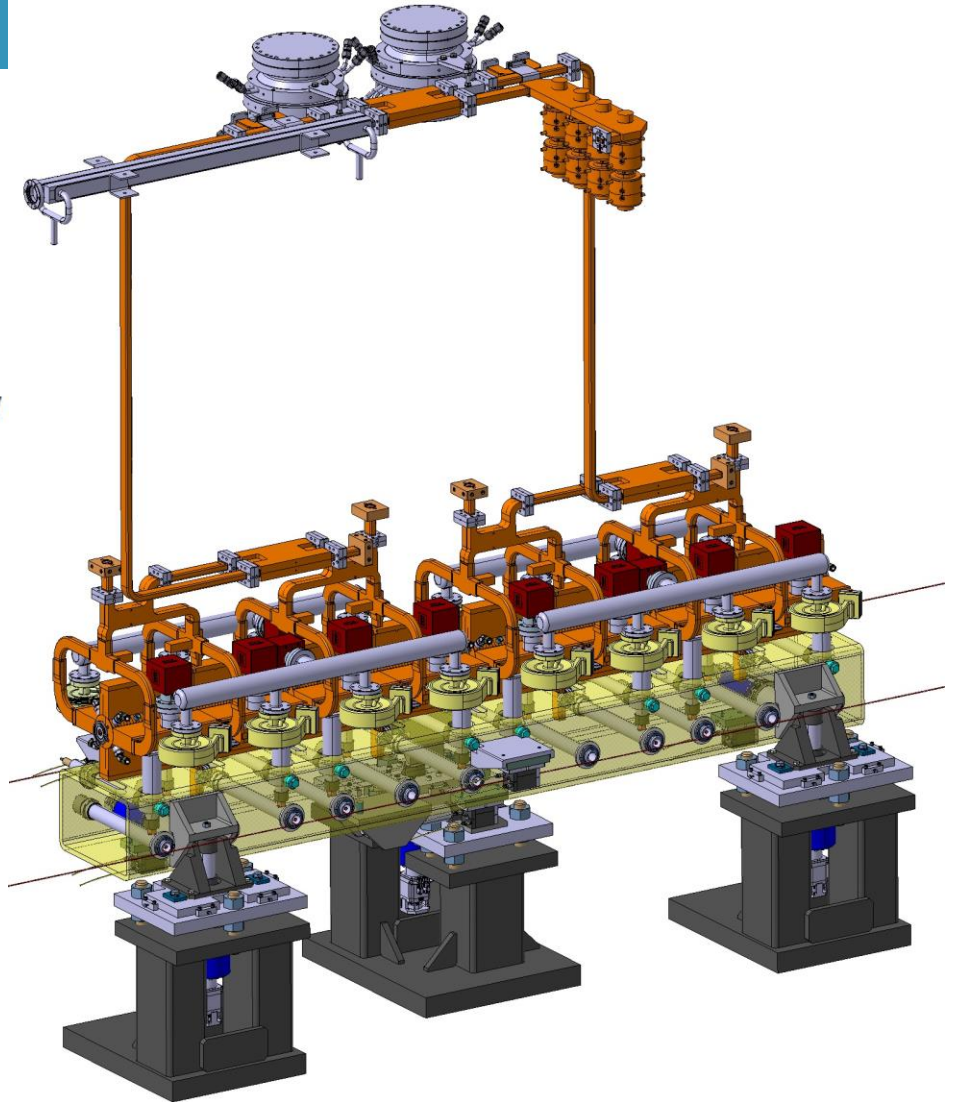
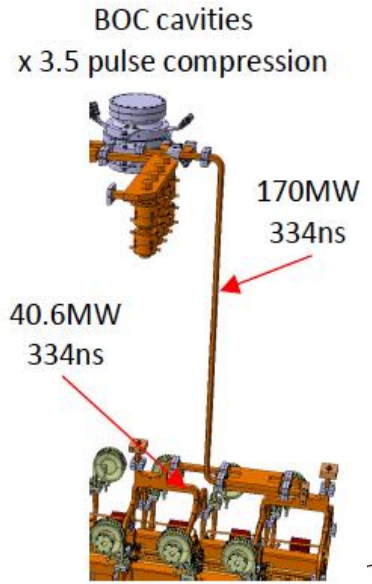
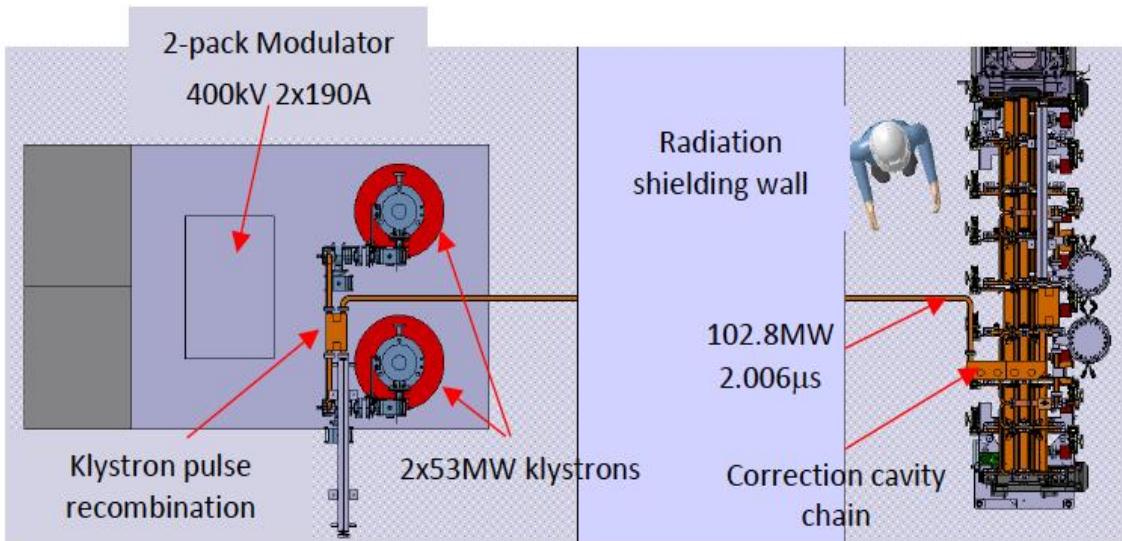


EXPERIMENTAL PROGRAM : THERMO-MECHANICS AND RF CONDITIONING

4 Thermo-mechanical behaviour of the CLIC K-Module	LAB + Xbox
FEA thermal model benchmarking	LAB + Xbox
K-Module cooling circuit optimization	LAB + Xbox
Influence of temperature on sensors, targets, movers (in progress, HL-LHC)	LAB + Xbox
5 Validation of RF critical components and general RF power handling of the system	Xbox
Waveguide circuit stabilization	Xbox
6 RF conditioning and operational studies of the CLIC K-Unit (RF power source and Module)	Xbox
Develop and optimize commissioning strategies for the complete RF K-unit	Xbox
Experience different operational conditions (start-up, breakdown, stable operation)	Xbox



EXPERIMENTAL PROGRAM : THERMO-MECHANICS AND RF CONDITIONING

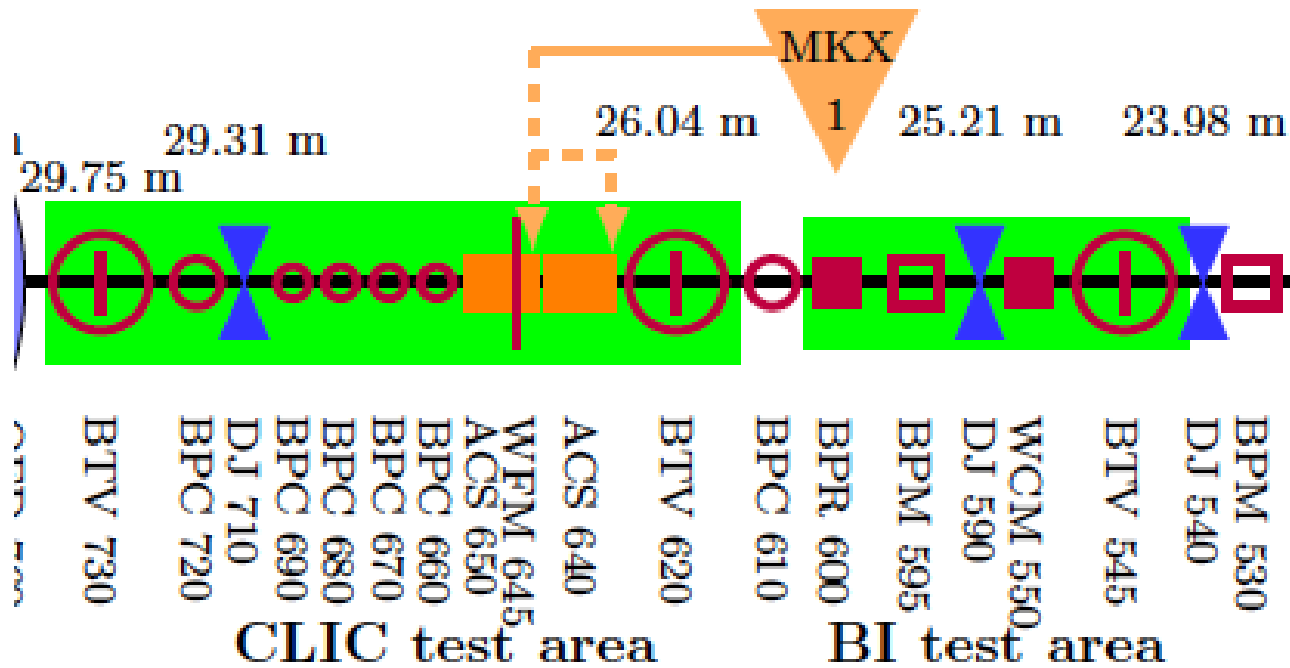


EXPERIMENTAL PROGRAM : OPERATION WITH BEAM

7	Experimental program with beam in the CLEAR tunnel	CLEAR
	Beam-based alignment	CLEAR
	Handle breakdowns	CLEAR
	Check the installation and maintainability easiness with the constraints of a beam line	CLEAR
	Check the accelerating field (detuning has been observed in the first structure)	CLEAR
	Check the correct phasing between various structures while operating	CLEAR
	Check the alignment quality (beam kicks appear when misaligned)	CLEAR
	Check the beam emittance preservation (octupolar fields observed)	CLEAR
	Check the effects of breakdown on the beam (energy loss, beam kicks)	CLEAR
	Check the accuracy of the wakefield monitors	CLEAR
	Check the radiation hardness of all components	CLEAR
	Check the temperature stabilization control	CLEAR
	Show 200 MeV gain on a 2 meter module length compared to 15 m for the old LIL structures, both in CLEX	CLEAR



CLEAR EXPERIMENTAL PROGRAM : AREAS FOR INSTALLATION

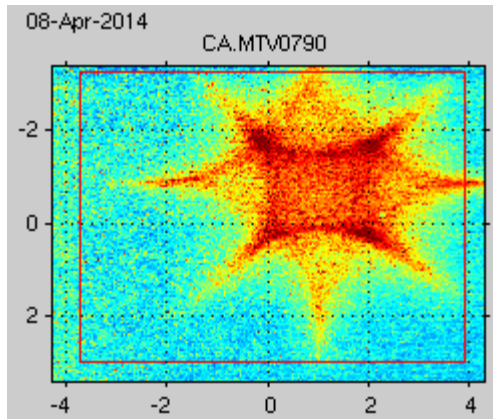


Area for possible installation of the K - RF Unit



CLEAR EXPERIMENTAL PROGRAM : FEW EXAMPLES

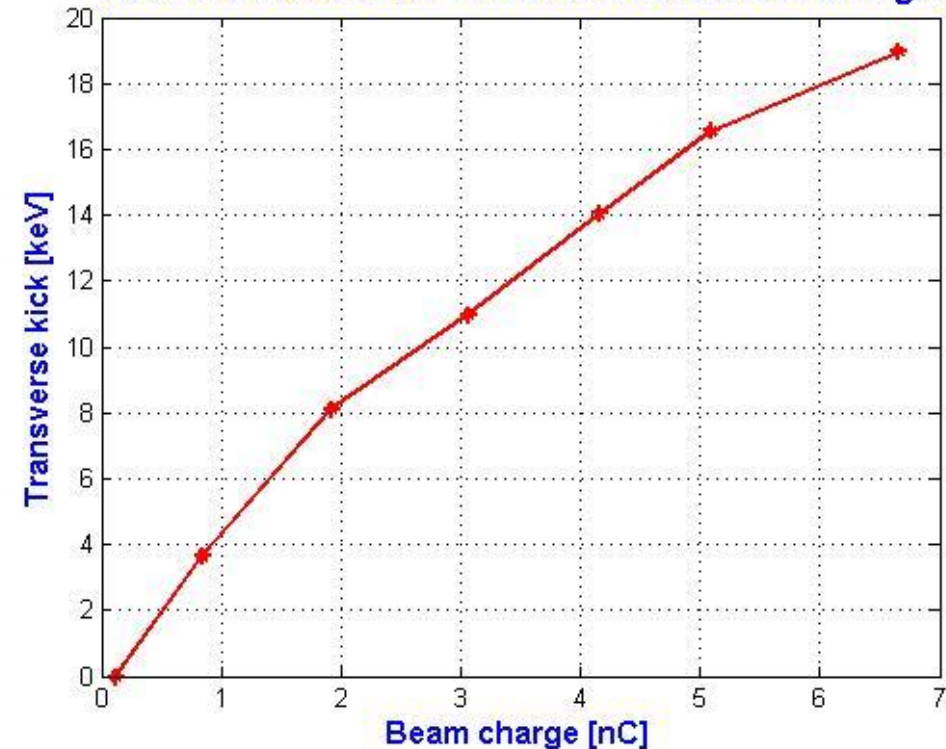
SLIDES BY W. FARABOLINI – CLIC WORKSHOP 2015



A mix depending
on bunch length

Octupole component in CLIC accelerating
structure, **Jim Alexander**, Mon 26/01 14:40

Kick in the ACSs for 1 mm offset vs. beam charge

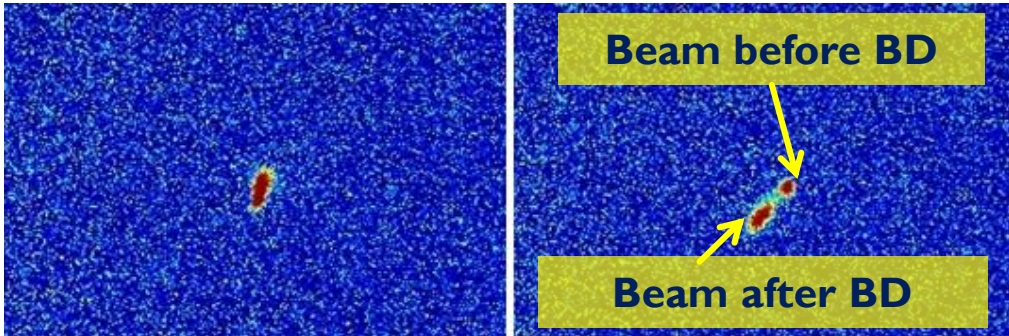


Kick up to 19 kV for 1 mm offset and 0.22 nC per bunch,
30 bunches: **85.5 kV /nC /mm /m**



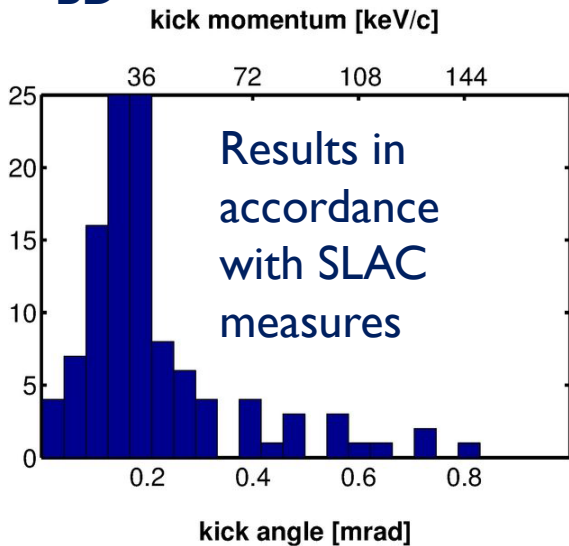
CLEAR EXPERIMENTAL PROGRAM : FEW EXAMPLES

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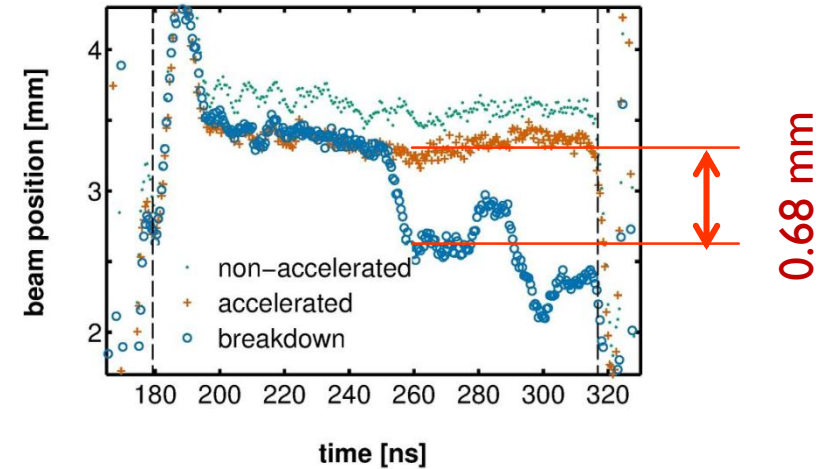
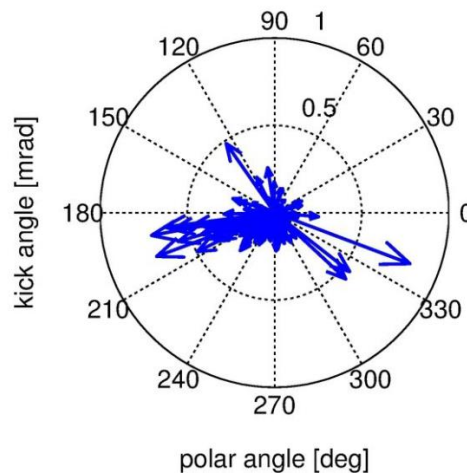
On YAG screen without

BD



With BD

Kicks to the beam measured on screen CA.MTV0790



Time resolved position on cavity BPM

A. Palaia PhD Thesis

EXPERIMENTS WORTH to be CONTINUED with much more statistics

EXPERIMENTAL PROGRAM : TENTATIVE SCHEDULE

ACTIVITIES	AREA	2021		2022		2023		2024		2025		2026		
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	
1 General mechanical integration, including vacuum and water cooling - assembly sequences	LAB + CLEAR	█												
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