Platform for Research and Applications with Electrons

PRÆ

P2iO
Physique des 2 Infinis et des Origines

Projet Emblématique

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Programme SESAME

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LAL
LABORATOIRE
DE L'ACCÉLÉRATEUR
LINÉAIRE

Dechirper structure

Sandry Wallon

2018.10.08

NGLS Longitudinal Phase Space after Linac
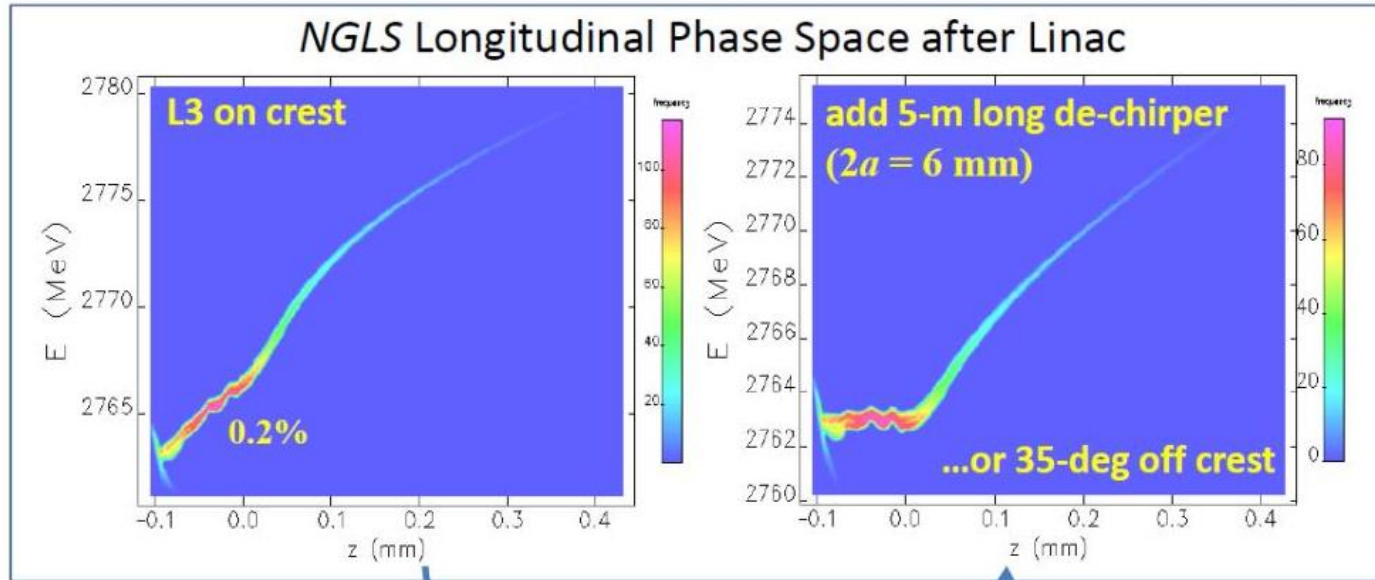
add 5-m long 'dechirper' after linac

Dechirper and its applications – 23 May 2014
Heung-Sik Kang
Pohang Accelerator maboratory

- Dechirper for PRAE used to correct the beam longitudinal phase space portrait.

  → Longitudinal wake field to be generated.

  → Avoid (minimized) transverse wake field (dipole and quadrupole effects).

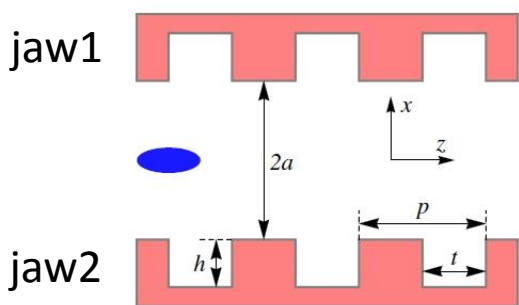## Corrugated structure used to generate wake fields

jaw1

jaw2

FIG. 1. Geometry of a (horizontal) dechirper module showing three corrugations. The blue ellipse represents an electron beam propagating along the z axis.
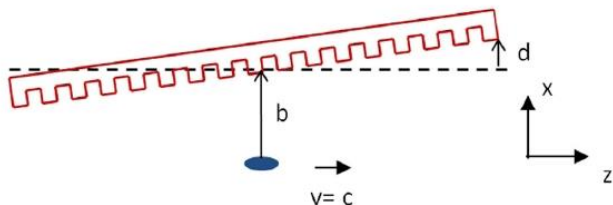
FIG. 2. Sketch of orientation of beam and jaw during measurement (for a horizontal jaw). The beam (blue ellipse) moves in the z direction below the dechirper jaw (red), at average offset b; the jaw tilt (with respect to z) is defined by the change in offsets at the jaw ends, $\pm d$. Note that the corrugation size and tilt angle as sketched are much larger than they are in reality.
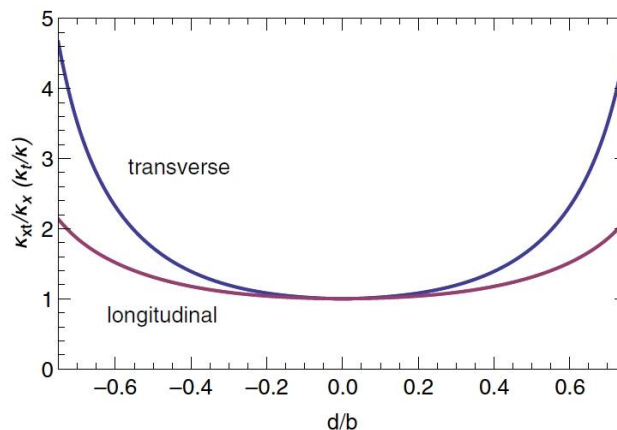
FIG. 3. The kick factor for the tilted-plate configuration normalized to the non-tilted case, $\varkappa_{xt}(b,d)/\varkappa_x(b)$, as function of d/b (blue). Here we have used as corrugation parameters those of the RadiaBeam/SLAC dechirper, full bunch length $\ell = 18\,\mu m$, and average offset of plate from beam, $b = 1$ mm. For the longitudinal case, the change in relative loss factor, $\varkappa_t(b,d)/\varkappa(b)$, derived in Appendix A, is given in red.

Wake measurements of a dechirper jaw with nonzero tilt angle - 29 May 2018
Karl Bane, Marc Guetg, Alberto Lutman
SLAC

→ To minimize transverse wake field, jaws need no tilt w.r. to the beam

Side talk : "Obviously", the beam must see two corrugated surfaces symmetrical together (one wake field component then equals to zero).

- Existing dechirpers / sources of inspiration :

  – LCLS project at SLAC : 1 hori. + 1 vert. dechirpers
    (hori. model showed a 25 μm backlash issue ; vert. model intended to have no tilt issue thanks an unusual design [See May 2018 paper quoted previous page]).

  – LAL collimator project t at ATF2 (not a dechirper, but some affinities ; showed linear disp. statistical error within +/- 3 μm)

- Jaws' specifications :

  – Not known yet (required wake depends on beam dynamics)

  – First mechanical design done w/ 1 m long jaws
    (LCLS used 2 m long jaws… and 2 "crossed" dechirpers. Does these configuration [crossed] useful / suitable for PRAE?)

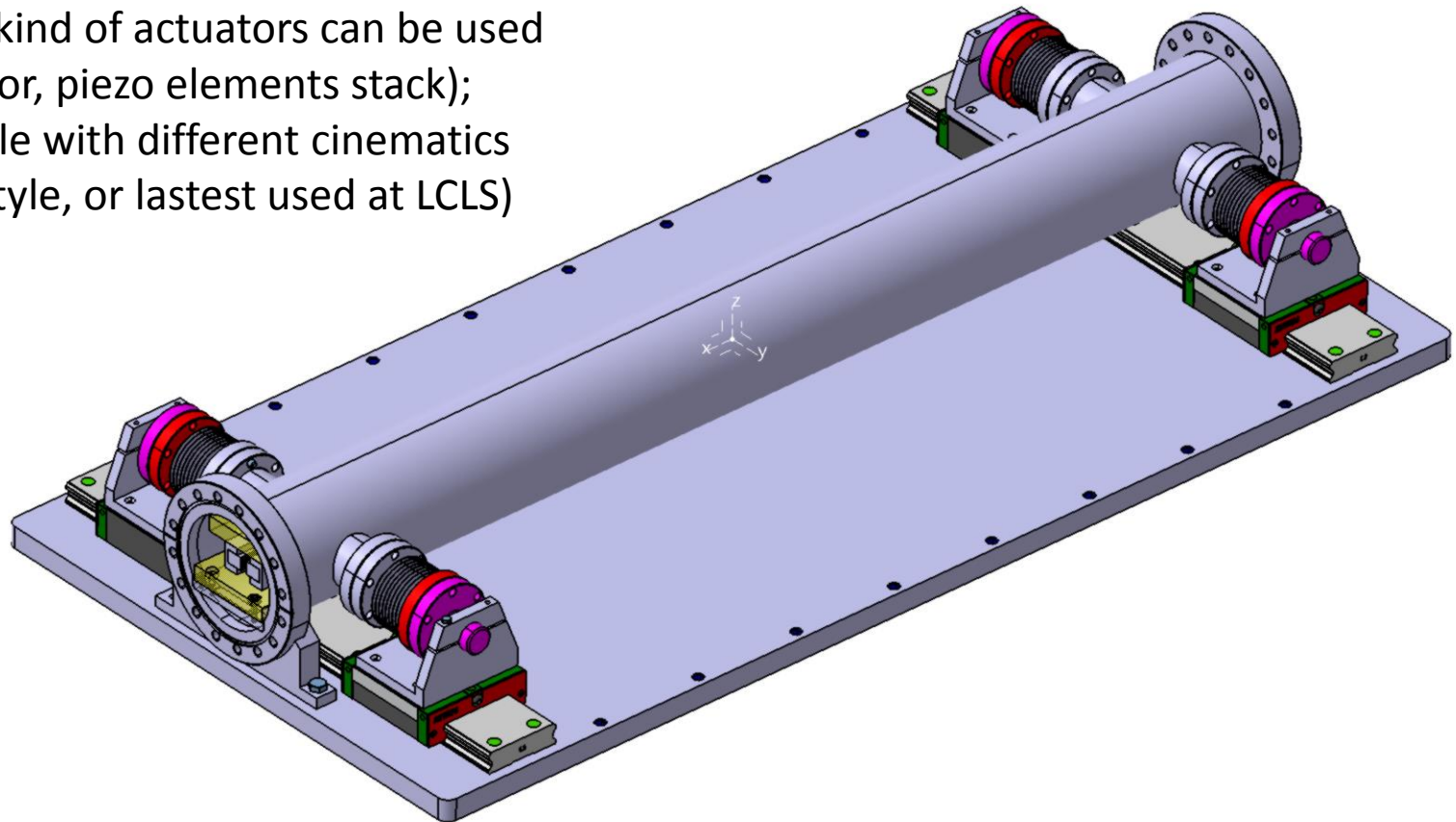Dechirper main subsystem.

Features :

- Follows the KISS principle (i.e. make it simple);
- Different kind of actuators can be used (step motor, piezo elements stack);
- Compatible with different cinematics (regular style, or lastest used at LCLS)

Dechirper main subsystem can be mounted on an optical table, giving high flexibility to installed equipment (actuators, manual positioning stages, linear position encoders)

Mechanical interfaces : DN100CF flanges non-rotatable (used also as references for alignment)
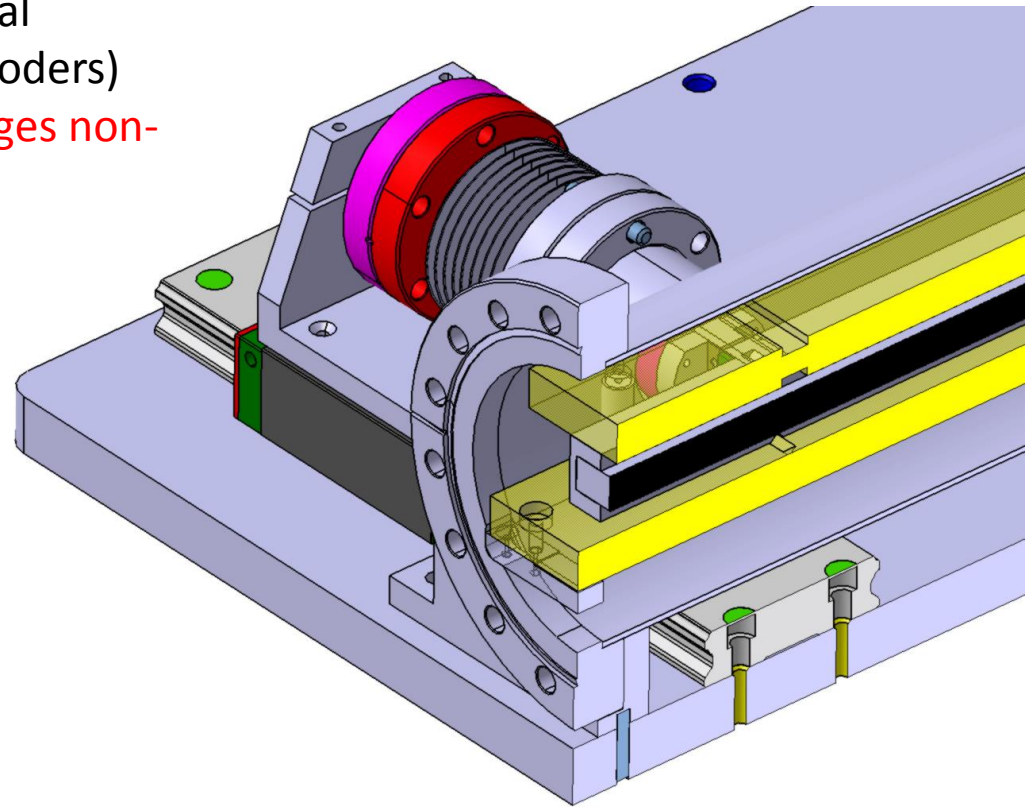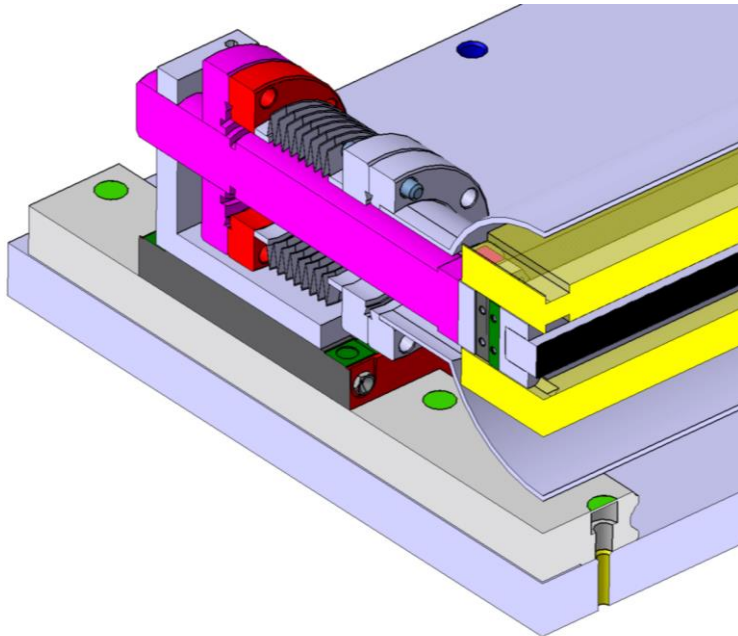
- Budget done (next page)

- WBS done (but not a planning) (nest page)

- Main subsystem designed ; drawings done, but will be updated...

- ... Jaws need to be specified

Dechirper budget & (non fine tuned) WBS

Sandry Wallon, 2018.10.07

Pos.	WP	Field	Item / work	Material only (if fab.at LAL)	Min price	Max price	Qty	Tot. Price (min) €	Tot. Price (max) €	Brand / supplier / Human R.	LAL's HR - estimated work time required (wk)	Rem.
1	WP1.1	Mec. design	Derchirper main subsystem				1					Raphael Vilar(Trainee) - work finsihed
2	WP1.2	Mec. drawing	Derchirper main subsystem				1					Raphael Vilar(Trainee) - work finsihed
	WP2.1	Mec. design	Derchirper - linear actuators integration				1					Sandry Wallon, trainee
	WP2.2	Mec. drawing	Derchirper - linear actuators integration				1					Trainee
	WP3.1	Mec. design	Derchirper - support				1			LAL		Need to known LAL's mec. Dpt's position
	WP3.2	Mec. drawing	Derchirper - support				1					
	WP4	Mec. drawing	General layout drawing				1					
3	WP5	Manufacture (machining, welding)	Chamber	Y	100	600	1	100	600			
4			Stems w/ flange to be welded	Y	10	20	4	40	80			
5			Misc. Parts	Y	300	400	1	300	400			
6			Jaw (1 m long)		1500	4000	1	1500	4000	KG industrie or		**Specs unknown on Sept. 2018**
7		General supplies	Metal bellow w/ 2 DN40CF flanges		350	350	4	1400	1400	Mewasa		
8			Optical table w/ legs (bench)		2500	6000		0	0	Thorlabs		If dechirper support not manufactured at LAL, for instance following LAL's machanical Dpt's specs/habits.
9			Solid aluminum breadboard probably to be machined from Al board (at LAL) or honeycomb style breadboard	Y or N	200	1300		0	0	LAL or Thorlabs		
10			Linear slide with 2 blocks		500	700	2	1000	1400	Hiwin or other		
11			DN40CF non-rotatable flange		28	28	8	224	224	NEYCO		

#	WP	Category	Description						Supplier		Notes
12	WP6		DN100CF non-rotatable flange	154	154	2	308	308	NEYCO		
13			Special screws and washers (vented, molycoated)	200	200	1	200	200	MDC		
14			Regular screws and washer	50	50	1	50	50	LAL's warehouse		
15		Sensitive supplies	Linear actuator w/ electonics (e.g. linear stage based on step motor w/ brake, EGSK-26-100-2P like)	1800	1800	4	7200	7200	FESTO or other	not estimated	Check thrust needed ; Tx and Rz coupled -> 4 same actuators ; if Tx and Rz uncoupled -> 2 types of actuators
16			Linear position encoder (LVDT - linear variable disp. tranducer)	200	500	4	800	2000	Misc.		1 um requested "accuracy" ; Warning : "While most *LVDTs* are magnetically shielded, it is recommended that ferrous metals should not be located closer than 1/4 inch from the open end of the *LVDT* body."
	WP7	Checks	Linear actuators and linear encoder to be checked and assess the performance								proposal : Frédértic Bogard ; devices could be checked w/ LAL's interferometer -> Statistical and systematic errors to assess
17	WP8	Checks	Parts dimensions and specs to be checked w/ CMM								Bruno Leluan
18	WP9	Cleaning	Cleaning for vaccum app			1					LAL's vacuum group
19	WP10	Mechanical assembly	Assembly			1					proposal : Filip Rudnyckyj
27	WP11	Checks	He leak test			1					LAL's vacuum group
20		Electrical supply	Box for 2 controllers and 1 power supply	106	150	2	212	300			See Patrick Cornebise
21			Misc. Parts for controller box	101.5	150	2	203	300			
22			(set) Basic cables (PC to controler : RJ45 ; 24/48VDC power supply to controler)	0	100	4	0	400	LAL		
23	WP12		(set) Encoder and motor cables (if longer than 8 m)	0	100	4	0	400			
		Design & drawing	Controler box - wiring diagramm and boxe machining drawing			1					proposal : Patrick Cornebise
24		Electrical assembly	Controler box w/ power supply and controler			2					proposal : Patrick Cornebise
25	WP13	Checks	Test of assembly with its "power supply" (test with power on) - Adjust jaws position w/ respect of external references - final test under vacuum condition and w/ power on			1					Bruno Leluan + proposal : Frédértic Bogard
26	WP15	Installation	Installation			1					Sandry Wallon proposal : Filip Rudnyckyj
			Total (€)				13537	19262			