The ALBA Linac

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The ALBA Linac is a 100 MeV electron linac supplied by THALES Communications as a turn-key system. It is used as a pre-injector for the ALBA Synchrotron Light Source.
The ALBA Linac was commissioned in 2008 and it works in routine operation since 2010.
The Linac produces an electron beam up to 4nC in either Single or Multi Bunch modes.
The normalized beam emittance is below 30πmm mrad.

Parameter at Linac Exit	SINGLE BUNCH MODE	MULTI BUNCH MODE
Number of Bunches	1 to 16	[18 … 512]
Pulse Length	< 1ns (FWHM)	[36 … 1024] ns
Bunch spacing	6 … 256 ns	2ns
Charge	Q ≥ 1.5 nC	3 ≤ Q ≤ 4 nC
Energy	≥ 100 MeV	≥ 100 MeV
Relative energy spread	≤ 0.5 % (rms)	≤ 0.5 % (rms)
Norm. Emittance (1σ)	≤ 30 π mm mrad	
Energy Variation Pulse-to-pulse	0.25% (rms)	
Beam position stability pulse-to-pulse	<10% of beam size	
Jitter pulse-to-pulse	≤ 100 ps (rms)	
Repetition rate	1 to 5 Hz	

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2 Accelerating Sections
96 cell – 2/3 π Travelling Wave.
Constant gradient: 10-15 MV/m
Beam at crest
Energy gain: 55 MeV

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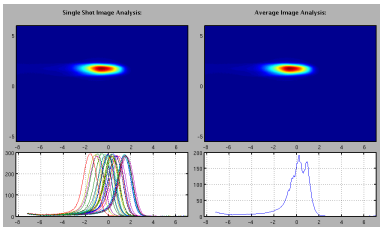

Beam at Linac exit: E = 110 MeV
ΔE = 0.35 %

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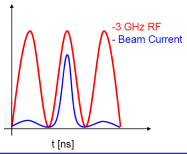
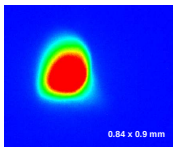
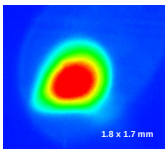
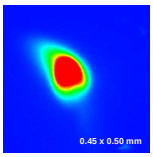
Buncher
22 cell - standing wave π/2
Bunch compression
Energy Gain: 16 MeV









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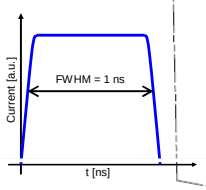
Thermoionic cathode
90 keV electrons
DC-beam

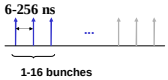


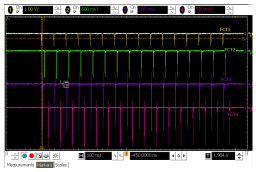
RF power to cavities
2 Klystrons TH2100
Pulsed at 3 GHz
37 MW peak

Diagnostic element	Amount in Linac
Fast Current Transformer	6
Fluorescence Screen, YAG	3
Beam Position Monitor	1
Beam Charge Monitor	1

LINAC INJECTION MODES

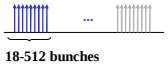
Single Bunch Mode (SBM)
Number of bunches per injection: 1-16
Time interval between bunches: 6-256 ns

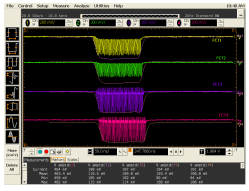




Fast Current Transformer signals

Multi-Bunch Mode (MBM)
Number of bunches per injection: 18 - 512
Time interval between bunches: fixed, 2 ns





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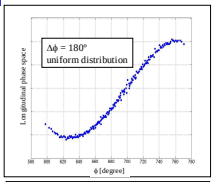
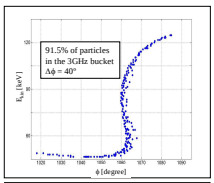
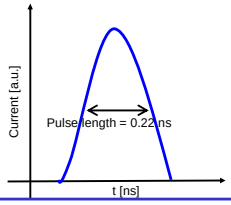


E_{kin} = 90 keV
Pulse length = 1ns FWHM



E_{kin} = 90 ± 30 keV
Pulse length = 0.22 ns FWHM



2 Pre-bunchers:
500 MHz and 3 GHz
Bunch compression and energy spread reduction