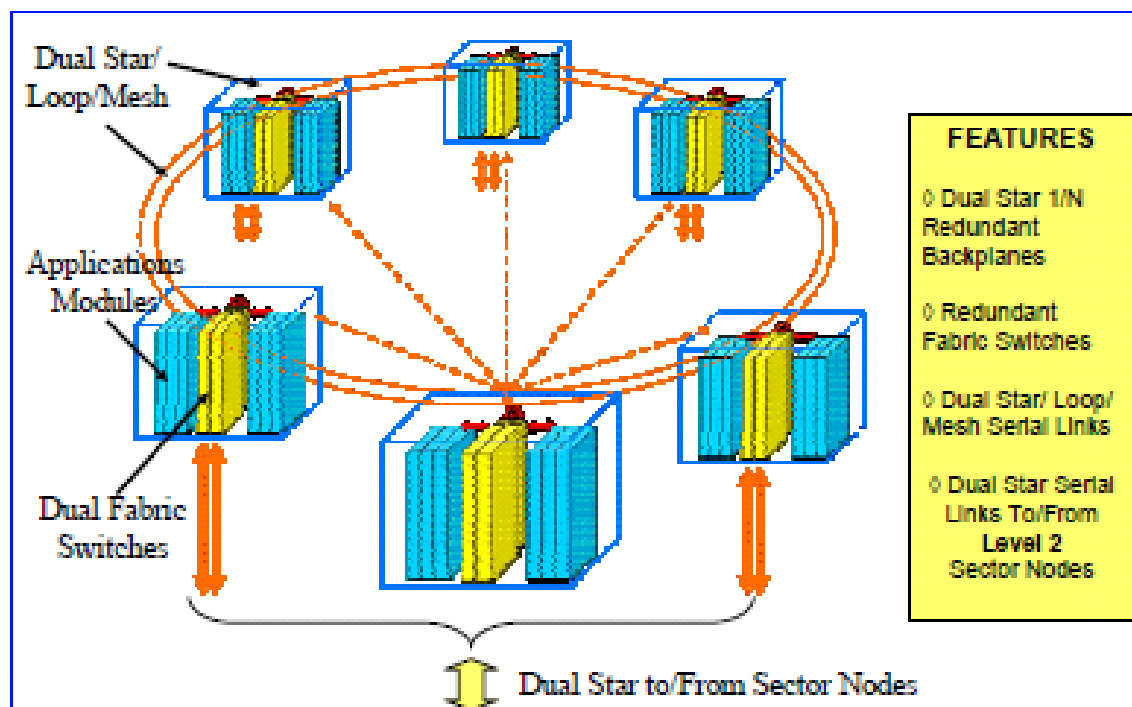


Instrumentation and Controls : Divided 13 subsystems

- 1.Controls Standard Architecture, 2.Timing system, 3.Diagnostic Interlock Layer
- 4.Global Accelerator Network, 5.Machine Protection System, 6.Low Level RF,
- 7.Feedback, 8.Controls – Instrumentation Integration, 9.Machine Detector Interface,
- 10.Beam Position Monitors, 11.Transverse Profile Monitors,
- 12.Longitudinal Diagnostics System, 13.Special Systems

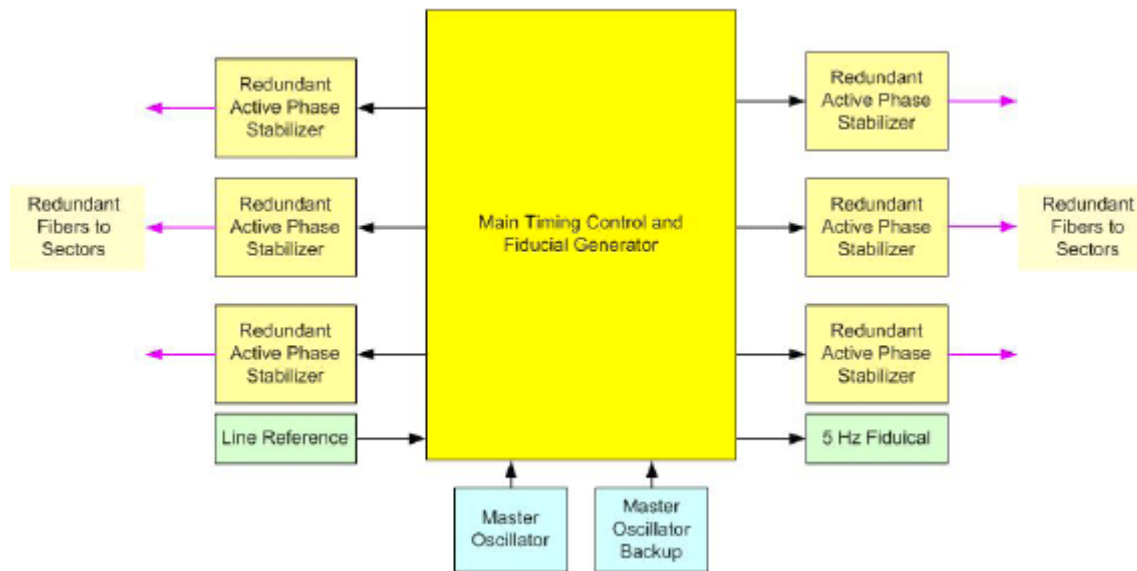
Controls System

Controls Standard Architecture



Control Room Cluster & Dual Serial Networks

Timing System



Block diagram of main timing showing star distribution of master oscillator and 5Hz fiducial

Global Network :

[Instrumentation]

Diagnostic information (for beam tuning, machine protection system and beam-based feedback as an integral part.)

BPM, intensity, profile and loss(BLM)

longitudinal profiles, correlation, beam timing, damped beam parameters, beam halo, feedback, temperatures, field probes, radiation monitors and etc.

According to beam quality, we divided into two pieces : the 'damped beam' section and the injector system

Typical beam sizes and required position monitor resolution for the damped beam are around 1 micron.

Diagnostic Interlock Layer (DIL)

Modulator, DC Power Supplies, etc. (detect failures of machine components)

Beam-based Feedback System

Injection trajectory control into damping ring, Dynamic orbit control in damping ring, Bunch-by-bunch transverse feedback in damping ring, Extraction orbit control from damping ring, Pre-Turnaround emittance correction, Turnaround trajectory feed-forward, Post-Turnaround emittance correction and Beam energy at bunch compressor from Ring to Main Linac, Correction sampling rate for Orbit and Dispersion measurement, correction, beam energy in Main Linac,

Trajectory feedback from pulse to pulse in beam delivery system,

Trajectory feedback from pulse to pulse and Trajectory feedback within bunch-train at Interaction point,

Beam energy at undulator for Positron Source

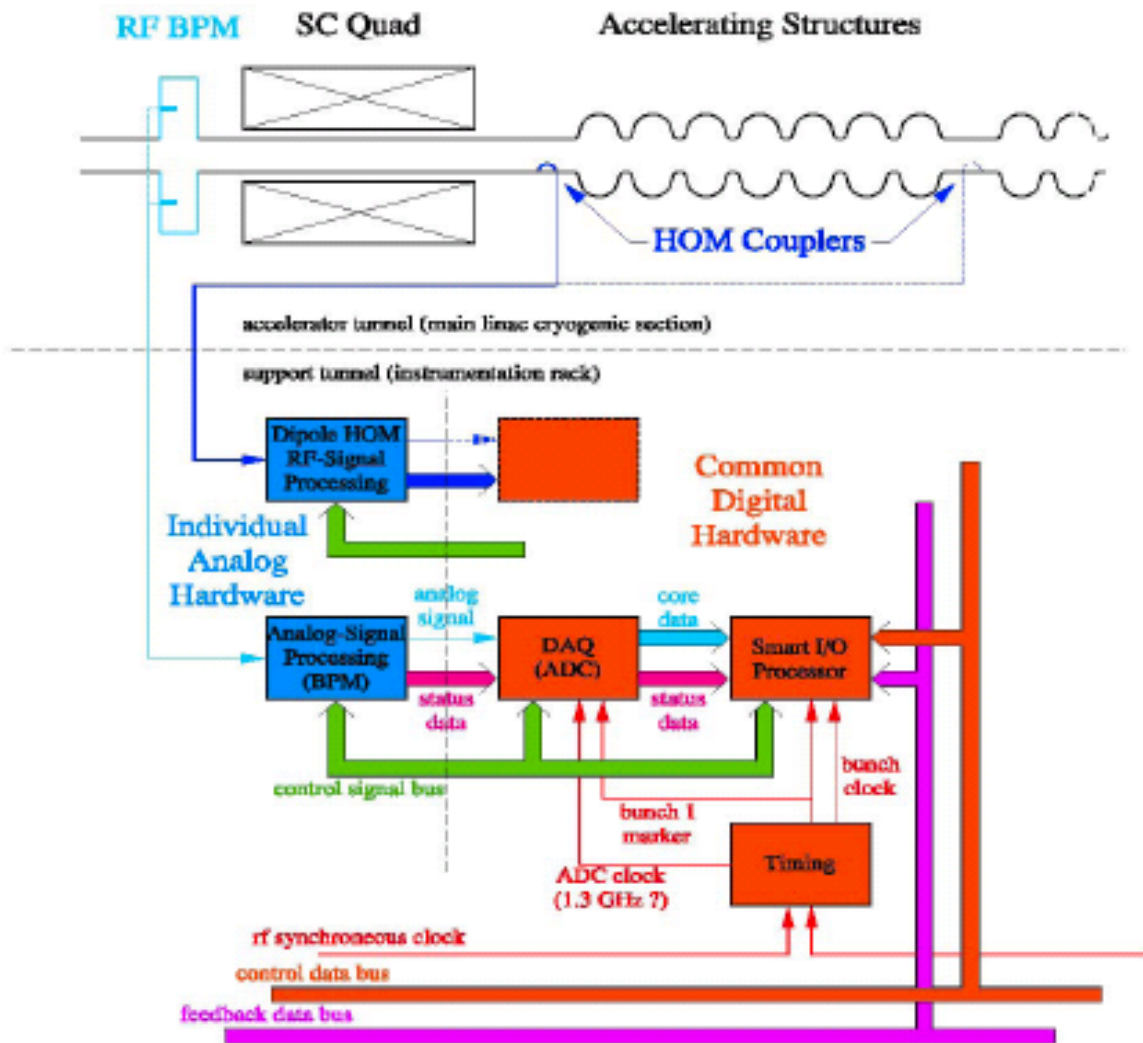
Machine Protection System

	Region name	Begin	End
1	e- injector	Source (gun)	e- Damping ring injection (before)
2	e- damping ring	Ring injection	e- Ring extraction (after)
3	e- RTML	Ring extraction	e- Linac injection (before)
4	e- linac	Linac injection	Undulator (before)
5	Undulator	Undulator	BD; e+ target
6	e- BDS	BD start	e- Main dump
7	e+ target	e+ target	e+ damping ring injection
8	e+ damping ring	Ring injection	e+ ring extraction
9	e+ RTML	ring extraction	e+ linac injection
10	e+ linac	linac injection	e+ BDS
11	e+ BDS	e+ BDS	e+ main dump

Beam shut off points. Each of these segmentation points is capable of handling the full beam power, i.e. both a kicker and dump are required. These systems also serve as fast abort locations for single bunch damage mitigation.

RF Control System : Low Level RF

Controls-Instrumentation Integration



BPM : resolution of 0.5 micron, stability < 10 microns, Aperture 60mm – 70mm, cold environment, quantity : about 800.

Main Linac Beam Position Monitor Requirements

Parameter	Requirement	Comments
Quantity	~800	Every quadrupole
Environment	Cold	In cryomodule
Aperture	60mm – 70 mm	BPMs not to be limiting aperture
Resolution	0.5 micron	
Stability	<10 microns	Over cryomodule thermal cycling
Temporal resolution	bunch-by-bunch	

Beam Delivery System

Beam Position Monitor Requirements

Parameter	Requirement	Comments
Quantity	~400	
Aperture	Various sizes	
Resolution	~ $\sigma/4$ ~250 nm	
Stability	<10 microns	long term
	< 1 micron / hour	Energy Spectrometer only
Temporal resolution	bunch-by-bunch	many places, assume all

Beam Profile Monitor System (Transverse)

Laserwire etc.

Longitudinal Diagnostics System

- 1) coherent radiation
- 2) ultra-fast laser wire
- 3) electro-optical sampling
- 4) RF deflecting structures

Special System