ILC feedback count and RDR input

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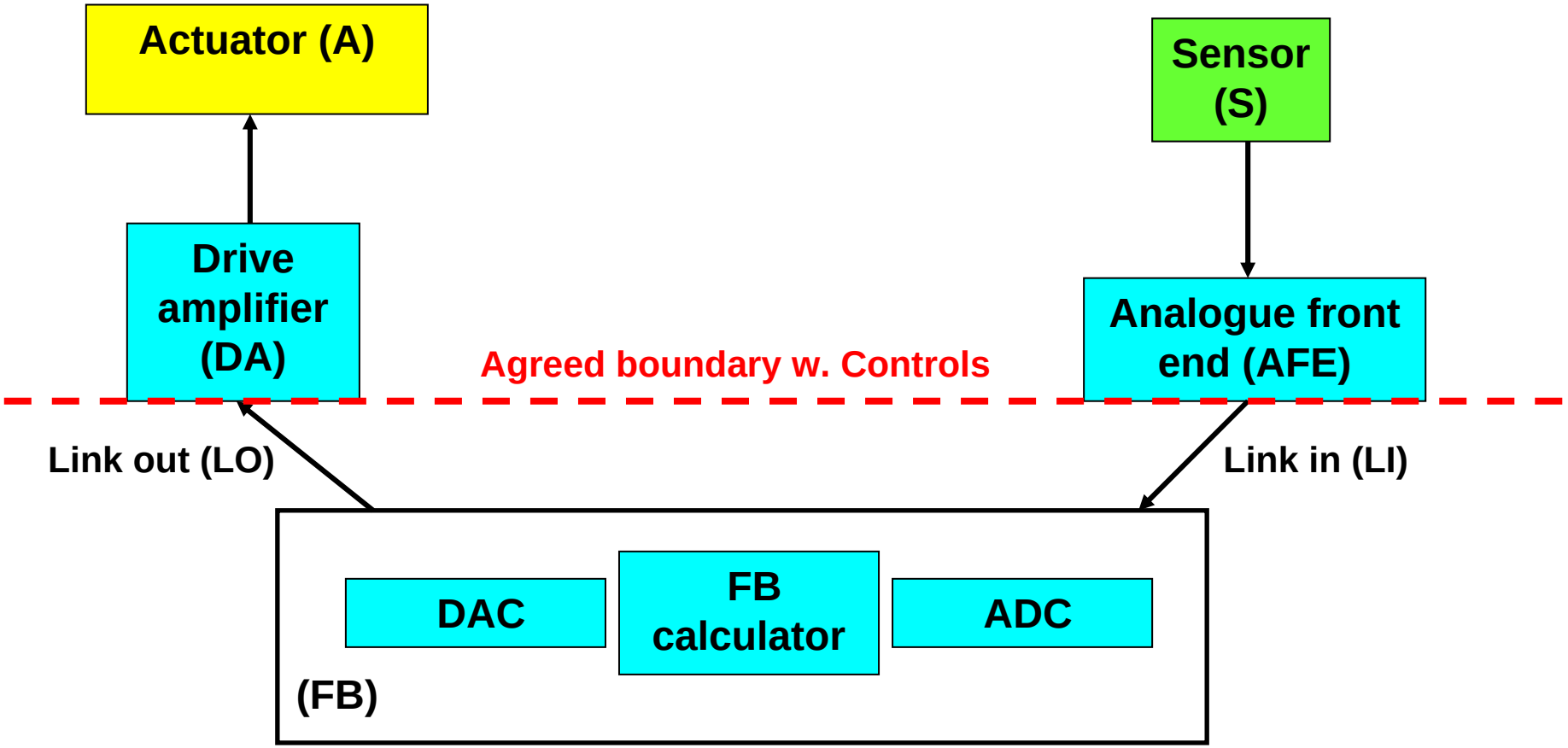
Generic feedback block diagram



Feedback dictionary

Sensor (S): typically BPM

some special cases (synch stripe, laserwire, LOLA, ref cavity…)

Analogue front end (AFE): typically comes with BPM

some special cases where low latency needed (3MHz)

Link in (LI): typically part of Controls system

dedicated fast link where low latency needed (3MHz)

Feedback (FB): typically algorithm in Controls system

dedicated board in some special cases (3MHz)

Link out (LO): typically part of Controls system

dedicated fast link where low latency needed (3MHz)

Drive amplifier (DA): typically corrector power supply

dedicated amp in some special cases (3MHz)

Actuator (A): typically corrector or RF

dedicated kicker in special cases (3MHz), vert. crab cavity …

List of feedbacks – please give feedback!

Area	Feedback Loop Name	Intra-train (3MHz)	Train-Train (5Hz)	DR Rev. (50KHz)	Other (Rate)	Sensor Type	Actuator Type	# systems	Description/comment
E- Source									
	Pre-DR trajectory control	X				BPM	Kicker	4	after warm section: x, x', y, y'
	Pre-DR energy	X				BPM	RF	1	after warm section
	Pre-DR energy spread		X			Synchr. Stripe	RF	1	after warm section
E+ Source									
	Pre-DR trajectory control	X				BPM	Kicker	4	after warm section: x, x', y, y'
	Pre-DR energy	X				BPM	RF	1	after warm section
	Pre-DR energy spread		X			Synchr. Stripe	RF	1	after warm section
	Undulator energy	X				BPM	RF	1	In electron linac
	Undulator trajectory	X				BPM	Kicker	4	In electron linac: x, x', y, y'
Damping Rings									
	Injection trajectory		X			BPM	Corrector	12	x, x', y, y' per ring
	Orbit Correction			X		BPMs	Correctors	6	x+x', y+y' per ring
	Transverse bunch-bunch feedback				X	BPM	Kicker	6	x, y per ring; per bunch turn by turn
	Longitudinal bunch-bunch feedback				X	BPM	long. Kicker	3	1 per ring
	Extraction trajectory		X			BPM	Corrector	12	x, x', y, y' per ring
RTML									
	Pre-turnaround emittance		X			laserwire	Corrector	8	x, x', y, y' per RTML
	Turnaround trajectory feedforward	X				BPM	Kicker	8	x, x', y, y' per RTML
	Post-turnaround emittance		X			laserwire	Corrector	8	x, x', y, y' per RTML
	Energy at bunch compressors	X				BPM	RF	2	1 per RTML
Main Linacs									
	Start of linac trajectory feedback	X				BPM	Kicker	8	x, x', y, y' per linac
	Trajectory feedback through linac		X			BPMs	Correctors	2	1 system/linac comprising N loops
	Dispersion control				< 5Hz	BPMs	Correctors	2	1 system/linac
	End of linac beam energy	X				BPMs	RF	2	1 per linac
	Energy spread		X			Synch. stripe	RF	2	1 per linac
	End of linac trajectory feedback	X				BPM	Kicker	8	x, x', y, y' per linac
BDS									
	Trajectory slow control		X			BPM	Corrector	16	x, x', y, y' per BDS side
	Trajectory fast control	X				BPM	Kicker	16	x, x', y, y' per BDS side
	y-z bunch shape		X			LOLA	vert crab cav	4	y-z per BDS side using 1 bunch per train
	Inter-linac timing	X				ref. cavity at IP	RF	1	actuator in bunch compressor
	Spectrometer beam energy		X			Spectrometer	RF	2	1 per linac
Other?	Waist FBs etc…								

Special FB cases (typically intra-train)

Sources: pre-DR intra-train trajectory + energy spread,
e+ undulator intra-train trajectory

Damping rings: orbit correction,
bunch-bunch transverse + long. (covered by DR)

RTML: pre+post-turnaround emittance, turnaround feed forward

Linacs: start and end intra-train trajectory,
intra-train beam energy, energy spread

BDS: intra-train trajectory, y-z bunch shape
inter-linac timing
beam energy

Assumptions for costings

Sensor (S): BPMs typically covered in Instrumentation parts list

Analogue front end (AFE): typically covered under BPMs

Link in (LI): typically covered by Controls

Feedback (FB):

need to cost design effort (software or hardware)

Link out (LO): typically covered by Controls

Drive amplifier (DA): typically covered under Magnets

Actuator (A): typically covered in Magnets parts list

Cost assumptions for specials – very prelim.

Sensor (S): BDS intra-train stripline BPMs: $5k (+5k – 3k) /channel (Steve Smith)
inter-linac timing ref. cavity $??

Analogue front end (AFE): BDS intra-train: 1 year design + $1k/channel (Oxford)
inter-linac timing: $??

Link in (LI) + link out (LO) : most intra-trains, DR orbit, RTML FF,
inter-linac timing, BDS y-z: $??

Feedback (FB): 1 year design + $5k/channel (Oxford)
$20k/channel (Lyrtech)
+ algorithm design: n years

Drive amplifier (DA): 1 year design + $10k (+90k -8k) /channel av. (Oxford)

Actuator (A): intra-train kickers: $10k/channel (+10k -6k) (Steve Smith)
y-z vert. cavity: $??