# LDX Implementation

- ☀ Proposed Strategy
  - ✹ **Nominate** contact
    - ✹ Experiment
    - ✹ LHC machine
  - ✹ **Prioritize** parameter list in order to have at least the compulsory systems ready at LHC start up
  - ✹ **Identify** equipment required + equipment supplier
  - ✹ **Define** WPs for implementation
    - ✹ Experiment
   - ✹ LHC machine
  - ✹ **Assign** required resources
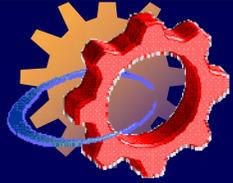
Contact persons

- LHC: Rudiger.Schmidt@cern.ch

- ALICE: Detlef.Swoboda@cern.ch

- ATLAS: ??.??@cern.ch

- CMS: Andrea.Gaddi@cern.ch

- LHCb: Vincent.Bobillier@cern.ch

- Totem: (Daniela.Macina@cern.ch)

  - Paolo.Palazzi@cern.ch
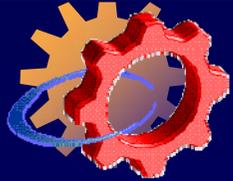
Systems involved

- Beam Interlock System (BIS)
  - H/W link from USER to Beam Dump System; i.e beam dump request, injection inhibit
  - Injection inhibit → NO beam dump
  - S/W interlocks NOT for beam dump
- Timing, Trigger, Control (TTC)
  - 1 Ref. Clock @ 40.08 MHz
  - 2 RF control clocks
  - NO guaranteed clock during shutdown
- Beam Position Monitors (BPM)
- Beam Collision Rate Monitors (Luminometers)
- Beam Loss Monitors (BLM)
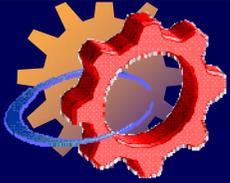
Data Interchange Concept

Entities considered for Data Interchange

Dataxchange.vsd C.H.S Aug 99
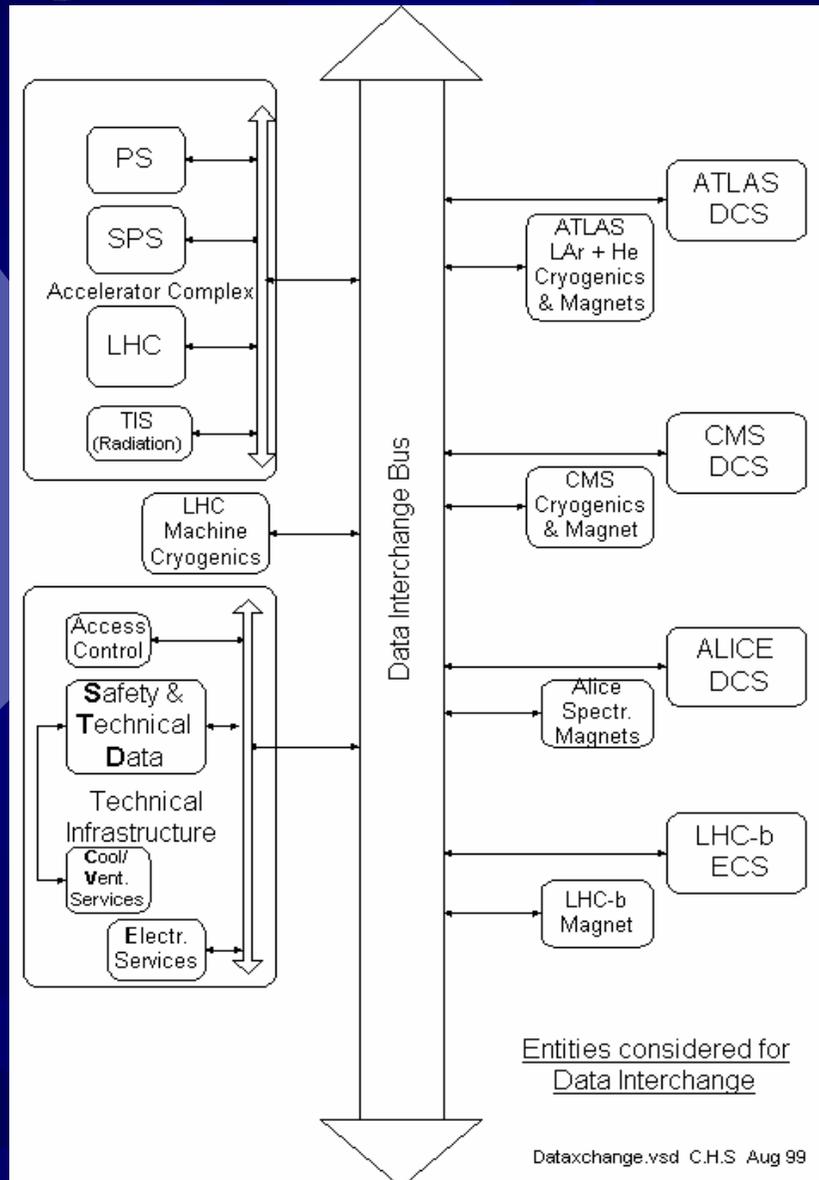
Concept:

- ☀ DIP (data interchange protocol)
- ☀ Publish/Subscriber paradigm
- ☀ All data with UTC time stamp

Questions:

- ☀ Contact from Experiments?
- ☀ Contacts from LHC?
- ☀ Definition of DATA SET
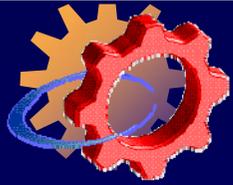
Experiments → LHC
minimum data set

Measurement	Units	Production Volume (Bytes)	Production Interval (sec)	Data Rate (Bytes/sec)
Total luminosity	cm-²s-¹	4	1	4
Average rates	Hz	12	1	12
Luminosity per bunch	cm-²s-¹	14256	60	238
Rates for individual bunches	Hz	42768	60	713
Position and size of luminous region (average over all bunches)	cm	24	600	0.04
Total per experiment				**966**
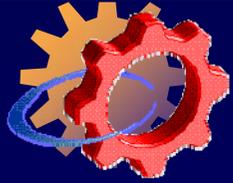
Interlock Signals Experiments

| Signal	Client	Type
Spectrometer Magnet Interlock	LHC Beam Interlock System (BIS)	Hardware
Beam Abort	LHC Beam Interlock System (BIS)	Hardware
Injection Inhibit	Experiment Injection Interlock System	Software (Hardware remains as upgrade option)
READY-FOR-ADJUST	CERN Control Centre (CCC)	Software
READY-FOR-BEAM-DUMP	CERN Control Centre (CCC)	Software
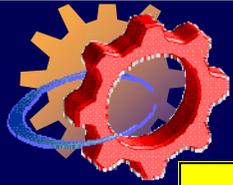
LHC → Experiments

Producer	Measurement	Data type	Production Volume (Bytes)	Production Speed	Production Rate (kB/s)	Expected Accuracy	Remarks
AB-BDI	Total beam intensity	Charges	8	1 sec	0.008	1%	
AB-BDI	Individual bunch intensities	Charges	28 512	1 min	0.475	5%	
AB-BDI	Average 2D beam size	mm	16	1 sec	0.016	15%	For transport to IP will require knowledge of beta function
AB-RF	Average bunch length	ps	8	1 min	$1.3\ 10^{-4}$	10%	
AB-BDI	Luminosity		28 512	10 sec	2.851	1% relative	Relative measurement between bunches
AB-BDI	Average Beam Loss		16	10 sec	0.002		Average from 50 selectable BLMs
AB-BDI	HOR & VER Positions	µm	128	1 sec	0.128	5µm Resolution	From all Q1 BPMS
AB-BDI	HOR & VER Positions	µm	64	1 sec	0.064	5µm Resolution	From 8 TOTEM BPMWT
AB-BDI	HOR & VER Positions	µm	16	1 sec	0.016	5µm Resolution	From 2 ATLAS Roman Pot BPMSA
AB-BDI	Total longitudinal distribution		285.120	1 min	4.752		Will be able to detect ghost proton bunches at the 0.1% level of nominal. Instrumentation will not be available in time for LHC Phase I.
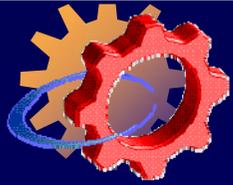
Timing signal LHC

Signal	Client System	Type
RF Timing	Timing, Trigger, Control (TTC)	Hardware
Beam Synchronous Timing	Experiment Detector Control System / DAQ	Hardware
General Machine Timing	Experiment Detector Control System / DAQ	Hardware
BPTX Timing	Experiment Detector Control System / DAQ	Hardware
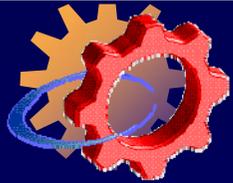
Beam Interlock system

item	parameter	no	description	cost
BIC	Input ch HW non-mask	7	3 x Beam 1/2	
			4 x Beam (1&2)	
	Input ch HW mask	7	3 x Beam 1/2	
			4 x Beam (1&2)	
	Input ch SW	1	SW_IL sys	
	Input GMT	1	safe beam param (SBP)	
	transmission	14	Cu-cable ≤ 1200 m	
			freq 10 MHz sqr-wave	
BIS	BIC	2 x 8	2/IR	26 kCHF/unit
	transmission	2 x 2	FO ch from point 6	
CIBU	Input ch HW	A + B	user IF unit 2U/19"	2 kCHF/unit
	transmission	2	CU-cable ≤ 300 m	2.6 kCHF
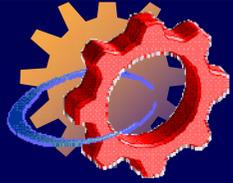
BIC cabling campaign

| FONCTION DU CABLE	ORIGINE							
	OUVRAG	EQUIPEMENT	ELEMENT	OSV POSH	CONNECT	CONVN	OUVRAG	EQUIPEMENT
BIC.R1#Atlas_Experiment_Detector	US152	CYCIB02	CIBC.R1		19BPMB	"bic"	USA151	4Y.02-03.A1
BIC.R1#Atlas_Experimental_Magnet	US152	CYCIB02	CIBC.R1		19BPMB	"bic"	USA151	4Y.02-03.A1
BIC.R1#Atlas_Movable_Device-Beam1	US152	CYCIB02	CIBC.R1		12BPMB	"bic"	USA151	4Y.02-03.A1
BIC.R1#Atlas_Movable_Device-Beam2	US152	CYCIB02	CIBC.R1		12BPMF	"bic"	USA151	4Y.02-03.A1
BIC.L2#Alice_Experiment_Detector	UA27	CYCIB01	CIBC.L2		19BPMB	"bic"	RB26	C28 - C29
BIC.L2#Alice_Experimental_Magnet	UA27	CYCIB01	CIBC.L2		19BPMB	"bic"	RB26	C28 - C29
BIC.INJ1#Alice_ZDC-Beam12	SR2	YYACS01	CIBC.INJ1		19BPMB	"bic"	RB26	C28 - C29
BIC.R5#CMS_Experiment_Detector	UJ561	CYCIB01	CIBC.R5		19BPMB	"bic"	USC55	S1E08
BIC.R5#CMS_TOTEM_Experiment_Detecto	UJ561	CYCIB01	CIBC.R5		19BPMB	"bic"	USC55	S1E08
BIC.R5#CMS_Experimental_Magnet	UJ561	CYCIB01	CIBC.R5		19BPMB	"bic"	USC55	S1E08
BIC.R5#CMS_TOTEM-Beam1	UJ561	CYCIB01	CIBC.R5		12BPMB	"bic"	USC55	S1E08
BIC.R5#CMS_TOTEM-Beam2	UJ561	CYCIB01	CIBC.R5		12BPMF	"bic"	USC55	S1E08
BIC.L8#LHCb_Experiment_Detector	UA87	CYCIB01	CIBC.R8		19BPMB	"bic"	UX85	D3B09
BIC.L8#LHCb_Experimental_Magnet	UA87	CYCIB01	CIBC.R8		19BPMB	"bic"	UX85	D3B09
BIC.L8#LHCb_VeloPosition-Beam12	UA87	CYCIB01	CIBC.R8		19BPMB	"bic"	UX85	D3B09
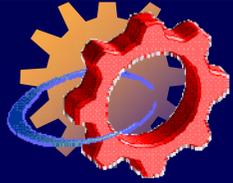
Status

- Racks are identified at each LHC point
- Cabling LHC → Racks <= end 2006
- Experiments to identify racks for CIBUs
- Cabling CIBU → rack ~ 2007
- TTC progressing (S. Baron)
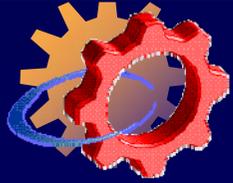
System Providers

Id	Supplier	Item	Date
1	AB-BDI	CRD	

Id	Supplier	Item	Date
1	M. Beharrell	DIP	
2	R. Billen	TIMBER	
3	B. Puccio	BIC	
4	J. Serrano/ R. Lauckner	GMT	
5	Sophie Baron	TTC https://edms.cern.ch/file/628545/3/TTCsystemUpgradeFinal.pdf	
6	Rhodri Jones	BST	
7	PH/ESS	request fibres and patch panels required to deliver BST from the CCC to each experiment	ok
8	experiment	integration of own specific BST receiver modules (Bobr)	
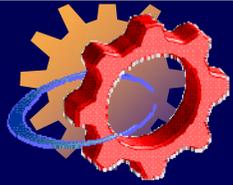
ToDo List

Todo			
Id	Eqmt	Task	Procure
1	BST	Check signal LHC side	Diagnostics, Rcv card
2	BIC	Fct. Spec → design	Cable requirements
3	CRD	Investigate common dsgn for all	I-chbrs (1, 5), CdTe (2, 8)
4	TTC	Define location in XP areas	Finance by XP (Dig. Version ~ 0.3 kCHF)

Todo			
Id	Eqmt	Task	Procure
1	TTC	Specify O-fibre requirements and planning	Spec ok, procurement ongoing, TS-EL

Todo			
Id	Eqmt	Task	Procure
1	DIP	Common GUI	API, GUI
2	TIMBER		
3	Rpots	Safe positionning	System to pull Roman Pots out in emergency
4	GMT	LHC modes	Include in data (*XPs 2 contact Serrano*)