



# Americas Region Team WBS x.2 Global Systems

Program Overview for FY08/09

Global Design Effort: Controls & LLRF



## Program Overview for FY08/09

- WBS x.2 Global Systems covers six topic areas:
  - **Commissioning & Operations.**
  - **Global Controls.**
  - **Installation.**
  - **Instrumentation & Feedback.**
  - **Alignment.**
  - **LLRF.**
- The FY08/09 program is designed to strengthen R&D activities, particularly on LLRF in support of RDB S2 goals, beam instrumentation, and high availability.

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## Assumptions about Funding

- The \$42M program is assumed for FY07. It is also assumed that Fermilab will use laboratory core funds to continue construction of ILCTA during FY07.
- The SRF budget line for FY08/09 is understood to be part of the Fermilab core budget.
- This program is intended only to guide priorities for that portion of Fermilab's budget.



## Major scope items for FY08/09

- Global Systems supports the ILC accelerator design process, with specific requirements and expectations coming from the GDE.
- The major milestone is development of an Engineering Design Report by the end of FY10. This will be done in collaboration with colleagues in the European and Asian regions.
- Specific technical objectives will include:
  - **Continuing to refine the ILC reliability & availability model.**
  - **Refine the ILC Installation model.**
  - **Begin defining an ILC Survey & Alignment model**



## R&D

- The Global Systems R&D program is driven by requirements for the EDR and by priorities identified by the GDE Global R&D Board. Given limited available resources, the program will concentrate on a small number of topics, namely:
  - **Perform R&D in support of LLRF requirements for the ILC Main LINAC, including development of LLRF algorithms and RF phase distribution.**
  - **Develop reliable precision beam instrumentation for critical Main LINAC parameters such as beam position and beam profile.**
  - **Perform R&D on high availability hardware & software system implementation for controls, instrumentation, LLRF, and power converters.**
  - **Evaluate new front-end electronics platforms (primarily ATCA).**
  - **Continue to foster collaborations and participate in companion programs in Europe and Asia.**
  - **The NML beam test facility at Fermilab will be used as a means to test and evaluate key specific outcomes of the R&D program.**

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## Facilities

- Several facilities are under construction as part of the ILCTA facility at Fermilab:
  - **Horizontal cavity test stand.**
  - **Vertical cavity test stand.**
  - **NML beam test facility.**
- A key objective of the NML facility is to demonstrate LLRF performance for realistic ILC beam loading conditions.
- Global Systems will participate in the Facilities program in two ways:
  - **Develop, implement, and support ILCTA Controls, Instrumentation, and LLRF technical systems.**
  - **Utilize the NML beam test facility at ILCTA as a means to test and evaluate the results of key R&D activities described above.**



## Facilities

- Technical systems for the ILCTA are largely funded through the SRF budget line. The ILC budget line provides funding to implement R&D prototypes and for a level of support for ILCTA from Argonne and SLAC.
- There is overlap between the goals of three of the technical systems areas, namely Instrumentation, Controls, and LLRF. This program seeks to leverage the overlap by maximizing opportunities for developing common programs with common interest across the three areas. This is most apparent with the R&D program on high availability systems, which is a common theme across all technical systems for the ILC.



## Program Management

- Co-Managers for the WBS x.2:
  - **John Carwardine (Argonne) and Ray Larsen (SLAC).**
  - **Two Laboratories are therefore funded in support of this work package (SLAC and Argonne)**
- “Level-3 Topic Leaders” for each of the six topic areas will support the WBS x.2 Program Managers by coordinating activities for their respective topic areas.





## Interface with other WBS areas

- Work on Facilities is strongly tied with the NML test program and with the cavity program under x.9.
- We need to define the interface with the ILC R&D WBS and EDR.



## Global Perspective

- The following collaborations and activities are relevant to the ART x.2 program and will be part of the ART x.2 program in FY08/09
  - **There is an ongoing active collaboration on LLRF between Fermilab, DESY, KEK, SNS, LBNL, U.Penn, and others.**
  - **DESY is developing a version of their LLRF Simcon board on ATCA, and several other institutions worldwide are beginning to explore ATCA.**
  - **There are ongoing active collaborations on beam instrumentation that involve Fermilab, SLAC, KEK, DESY, U.Oxford, U. London, and others.**



## Laboratory and University participation

- The Global Systems program involves Fermilab, SLAC, Argonne, LBNL, U.Penn and UiUC. The work is highly collaborative, and several work packages overlap between institutions. Each institution's participation in the program is noted briefly below.



# Laboratory and University participation

- SLAC
  - Commissioning & Operations activities for EDR
  - Installation model for EDR
  - High availability power converters (Program Lead)
  - Controls (ATCA, high availability)
  - Instrument Packaging Standards (Program Lead)
  - Instrumentation (bpms, ATF upgrade)
- Fermilab
  - Lead Laboratory for ILCTA facilities support
  - Beam instrumentation (program lead)
  - LLRF (program lead)
  - Controls (ATCA, high availability) (lead for ATCA evaluation)
  - Survey & Alignment (program lead)
- Argonne
  - Global Systems x.2 Program Management
  - Controls (system design, high availability software systems) (program lead)
  - Instrumentation (cavity bpms)
  - Survey & Alignment
  - LLRF (RF phase distribution)
- LBNL
  - LLRF (algorithms and RF phase distribution)
- University of Illinois, Champagne-Urbana
  - Controls (ATCA) (managed through SLAC)
- University of Pennsylvania
  - LLRF (modeling and simulation).



# WBS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
2	FY08 09 Budget Plan - Iteration 2 (4/4/07)									WBS x.2	FY08-09					
4						FY08	FY08	FY08	FY08	FY08	FY09	FY09	FY09	FY09	FY09	
5						Fund	FTE	Direct	Direct	Total	Total	FTE	Direct	Direct	Total	Total
6	WBS	WBS(WP)	Description		Lab(s)	Source		Labor	M&S	Indirect			Labor	M&S	Indirect	
7								K\$	K\$	k\$	k\$		K\$	K\$	k\$	k\$
9	1.y		Management			ILC	0.50	84.75	30		151.3	0.50	84.75	40.00		163.26
15	2.y		Accelerator Design			ILC	6.25	896.75	275.00		1553.59	7.50	1065.00	440.00		1974.82
17		2.2.1	Commissioning / Operations				1.00	140.00	20.00	56.20	216.2	1.00	140.00	40.00	59.20	239.20
20		2.2.2	Global Controls				1.00	182.00	35.00	71.83	288.8	1.25	217.00	70.00	92.28	379.28
25		2.2.3	Installation				2.00	280.00	120.00	124.40	524.4	2.00	280.00	150.00	128.90	558.90
28		2.2.4	Instrumentation and Feedback				1.00	131.00	40.00	56.88	227.9	1.25	166.00	70.00	70.88	306.88
33		2.2.5	Survey & Alignment				0.25	32.75	40.00	19.55	92.3	0.50	65.50	70.00	37.49	172.99
38		2.2.6	LLRF				1.00	131.00	20.00	52.98	204.0	1.50	196.50	40.00	81.07	317.6
43	3.y		R&D			ILC	12.20	1790.25	1210.00		3889.71	13.25	2206.80	1225.00		4487.45
44						SRF	1.00	131.00	45.00		232.98	1.50	196.50	45.00		323.37
46		3.2.1	Commissioning / Operations				2.20	322.8	160.00	147.4	630.2	1.00	437.8	35.00	171.5	644.3
51		3.2.2	Global Controls				3.00	482.50	430.00	249.69	1162.2	3.75	580.75	465.00	294.52	1340.3
60		3.2.3	Installation													
62		3.2.4	Instrumentation and Feedback				3.50	480.0	335.00	236.7	1051.7	4.00	552.3	415.00	279.8	1247.0
72		3.2.5	Alignment				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
76		3.2.6	LLRF				4.50	636.00	330.00	312.64	1278.6	6.00	832.50	355.00	391.76	1579.3
88	5.y		Facilities			ILC	0.75	134.50	100.00		302.13	2.00	309.50	180.00		635.63
89						SRF	15.25	1997.75	1009.00		3927.34	19.80	2593.80	823.00		4534.12
91		5.2.2	Global Controls				7.50	1016.50	350.00	443.29	1809.8	10.00	1348.50	262.00	554.87	2165.4
96		5.2.4	Instrumentation and Feedback				3.50	460.75	355.00	231.39	1047.1	4.30	567.80	330.00	268.06	1165.9
101		5.2.6	LLRF				5.00	655.00	404.00	313.54	1372.54	7.50	987.00	411.00	440.52	1838.52
112			Grand Total ILC				19.70	2906.25	1615.00		5896.73	23.25	3666.05	1885.00		7261.16
113			Grand Total SRF				16.25	2128.75	1054.00		4160.32	21.30	2790.30	868.00		4857.49

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# Additional slides

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WBS x.2 Global Systems covers six topic areas (work packages)

- Commissioning & Operations:
  - **Availability studies.**
  - **Design for operability.**
  - **Machine Protection and Personnel Protection Systems.**
  - **Instrumentation.**
- Global Controls:
  - **Global hardware and software requirements for controls system architecture.**
  - ***Control System high availability***
  - ***Electronic platform development for ILC application***
  - ***Control system architecture***
- Installation.
  - **Installation model for planning and cost estimates for the ILC R&D effort.**

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## WBS x.2 Global Systems covers six topic areas (work packages)

- Instrumentation & Feedback:
  - **Cold L-Band Cavity BPMs.**
  - **High Speed ATCA Digitizers**
  - **Advanced beam monitors**
- Alignment.
  - **Gathering & Tracking Alignment Requirements.**
  - **Fiducialization.**
  - **Prototyping, & Mechanical Supports.**
  - **Geodesy.**
  - **Alignment Techniques.**
  - **Integration.**
  - **Information Systems.**
  - **Ground Motion & Stabilization.**





WBS x.2 Global Systems covers six topic areas (work packages)

- LLRF.
  - Control theory analysis & simulation of the RF system and cavities, expanding to a full simulation of the full linac LLRF system.
  - Develop real-time simulators of the HLRF and cryomodules, beginning with 8 cavities and expanding to 26 cavities.
  - Development of an optimal controller design for the LLRF system.
  - Simulation of beam-based calibration and feedback.
  - Model the behavior and global performance of multi-station RF systems.
  - Firmware and software implementations of defined algorithms.

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