FNAL Accelerator Physics Deliverables and Budget

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AP issues related to IR design

- Fundamental: dipoles first or quadrupoles first
- Locations, gradients, apertures of magnets
- Constraints on IRs from injection optics
- Linear optics corrections (orbits, coupling) within the IRs
- Nonlinear correctors - strategy and strengths of correctors
- Requirements on magnet multipoles
- Dynamic aperture (single beam and with beam-beam)
- Impact of different bunch configurations e.g. superbunches
- Backgrounds and energy deposition

AP deliverables - FY05

IR Design [4 months]

- Realistic optical design(s) with constraints from magnet designs (e.g. feasibility of non-parallel axes), injection optics, ...
- Requirements on multipoles (first pass)

Wire Compensation [3 months]

- Analysis of compensation with single and multiple wires at LHC upgrade parameters

Energy Deposition [3 months]

- MARS14 $\rightarrow$ MARS15: completing FY04 developments, new hadron-nucleus event generator, complete heavy-ion and parallelized version, new electromagnetic shower module.
- STRUCT-MARS $\rightarrow$ MAD-MARS developments.
- Developments towards response matrices and operational modeling.
- Analysis of operational and accidental beam loss in the LHC (baseline, upgrade) IRs.
- Further modeling of the dipole-first IRs with Cosθ and block coils for pp-collisions and beam loss.

AP deliverables - FY06

IR Design [8 months]

- Refinement of the optics designs (with inputs from wire compensation)
- Requirements on multipoles (DA calculations with beam-beam)
- Nonlinear correction in the IRs
- Sensitivity analysis (alignment, gradient errors)
- Impact of different bunch configurations (e.g. superbunches)

Wire Compensation [6 months]

- Refinement of wire parameters (with sensitivities)
- AP input into an engineering design of a prototype
- If feasible, beam tests with wire compensator at Tevatron/Main Injector/RHIC/....

Energy Deposition [6 months]

- Further developments on response matrices and operational modeling.
- Operational and accidental beam loss in the LHC IR upgrade: modeling and protection.
- Energy deposition in the dipole-first IRs with Cosθ and block coils.

  Conceptual design of a protection system under realistic engineering constraints.
- Calculation studies on near-beam experiments and their interference with the IR systems: TOTEM and Zero-degree calorimeters.

Proposed Budgets for FNAL AP

"Bottoms-Up" Approach

Accelerator Physics FY05

	Labor		M & S	Total
	Months	Cost(k$)	Cost(k$)	Cost(k$)
IR design &...	4	52	-	52
Wire comp.	3	39	-	39
Energy dep.	3	39	-	39
CERN visit	0.5	6.5	4.6	11.1
IR wkshop			3.5	3.5
Total				144.6

Accelerator Physics FY06

	Labor		M & S	Total
	Months	Cost(k$)	Cost(k$)	Cost(k$)
IR design & ...	8	104	-	104
Wire comp.	6	78	-	78
Energy dep.	6	78	-	78
CERN visit	1	13	9.2	22.2
Total				282.2