Lumi Test at the FNAL Radiation Damage Facility

LARP Collaboration Meeting

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Motivation

- Use FNAL booster Radiation Damage Facility (RDF), a beam dump area to study detector performance.
  - Accelerated life test of detector performance under reproduced high radiation environment at the LHC High Luminosity Interaction Points.
  - use attenuated 53 MHz bunched *p*-beam to demonstrate bunch-by-bunch luminosity measurement capability

RDF Test Challenges

We requested the maximum allowable booster intensity (1.4e12/sec) over a two week period

- Booster safety considerations (RDF is near booster egress)
- Concerns over thermal performance of detector using existing vessel with maximum allowed booster intensity. Issues resolved with new vessel design.
- Attenuation of dump marginal to optimise detector for 53 MHz performance.
- Operating time strongly limited by Tevatron shutdown schedule.

- RDF test indefinitely postponed

Tests underway at ALS:

- Detector characterization using 1.5 GeV e-beam at 1 Hz
- Possible test of 40 MHz performance in main ring
- Suggestions for alternate source?
- Develop plans for radiation hardness

The high luminosity LHC IPs

- From N.Mokhov simulations: detectors at the TAN absorbers each side of the High Luminosity IPs to stand **severe radiation environmental situation**:

- **Integrated dose**: 170 MGy/op.yr
- **Neutron flux**: 4.6×10^{16} n/cm^2/op.yr
- **Charged hadron flux**: 4.7×10^{15} ch.h./cm^2/op.yr

Assumed: 1 op.yr=10^7 s

Flux of Charged secondaries at 22cm inside TAN

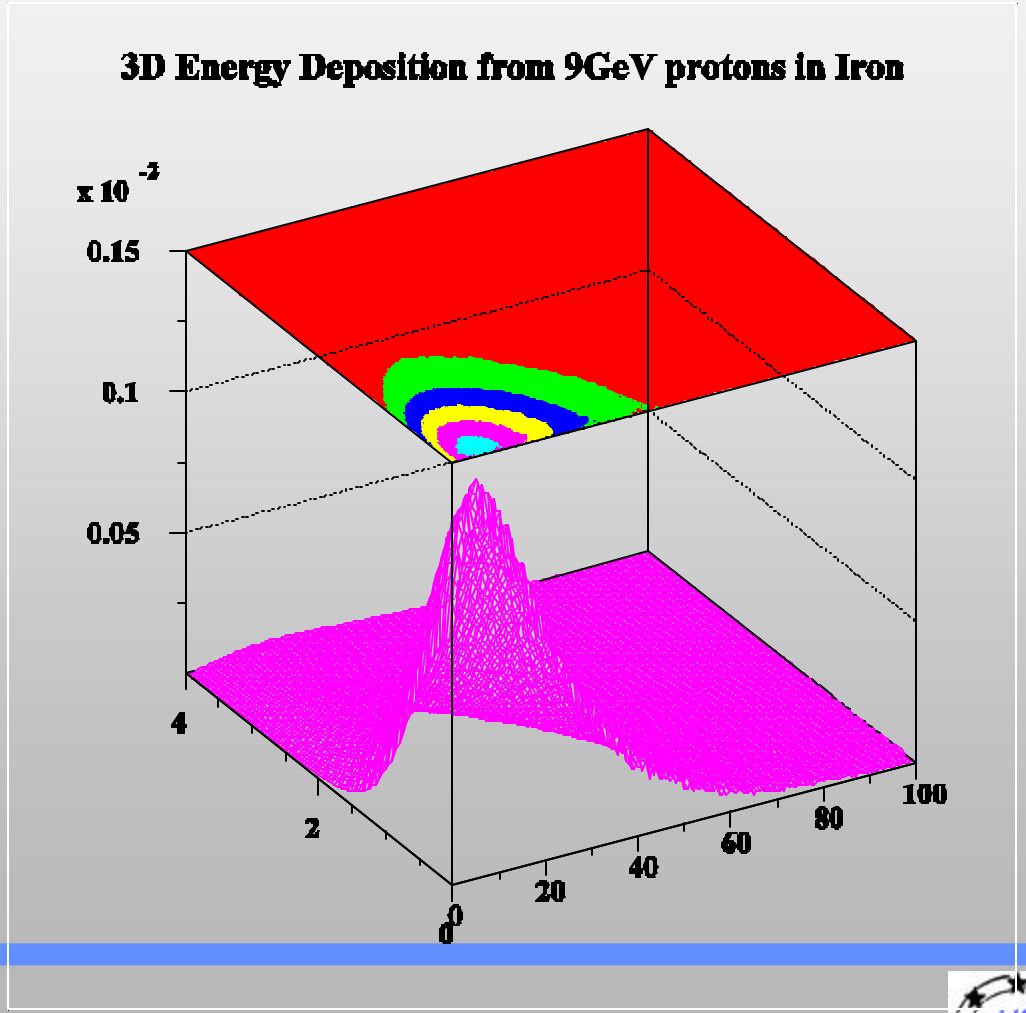
- Neutrons from IP: 0.48 n per pp interaction (N.M.)
- Charged multiplicity at 22cm: ~1200 mips/n
- Charged flux @ detector ~350 mips/pp int.
  (Det. Acceptance ~60%)
- $L=10^{34}$ > 25 ppi/bunch Xing > ~10^4 mips/Xing
  (10 mips/Xing at $L=10^{31}$)

The RDF *p*-beam

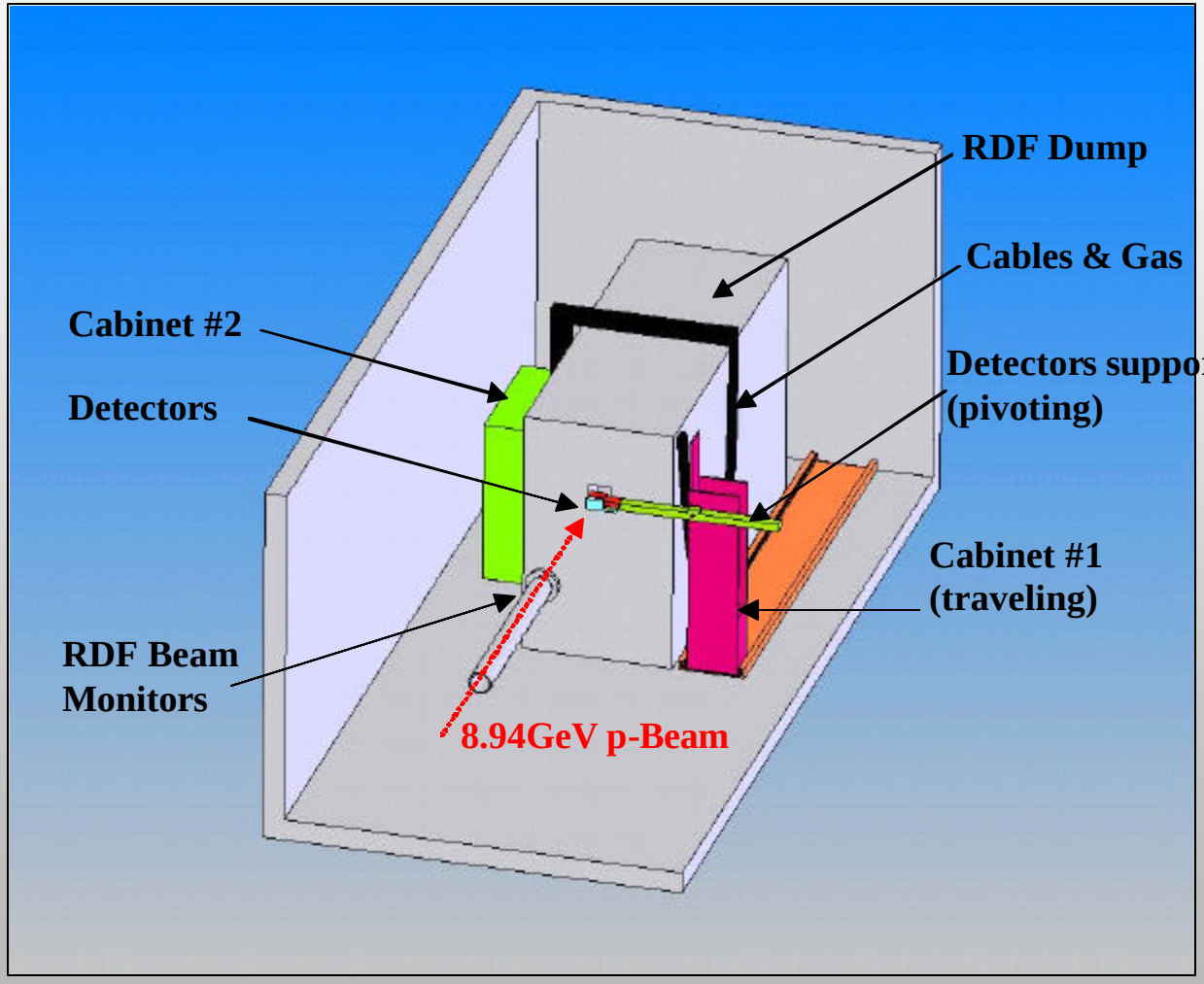
- Total Energy: **8.94 GeV (8 GeV kinetic)**
- Structure: **80 bunches / pulse**
- Intensity: **$(0.6\text{-}6)\cdot 10^{10}$ p/bunch, $(0.5\text{-}5)\cdot 10^{12}$ p/pulse**
- Extraction rate: **1-15 pulses/s**
- Bunch separation/rep. rate: **18.9 ns / 52.9 MHz**

LHC Beam time (op. yrs)	RDF beam time ($N_p = 1.4\cdot 10^{12}\ p/s,\ s_b = 6\text{mm}$)		
	Integrated peak Dose (hrs/days)	Neutron peak Flux (hrs/days)	Hadron peak Flux (hrs/days)
1	**156 / 6.5**	6.6 / 0.3	1.2 / 0.05
5	(780 / 32.5)	33 / 1.4	6.1 / 0.3
10	-	66 / 2.8	12.1 / 0.5
20	-	**133 / 5.5**	**24.3 / 1**

MARS SIMULATIONS



RDF layout


RDF Dump
Cables & Gas
Cabinet #2
Detectors support
(pivoting)
Detectors
Cabinet #1
(traveling)
RDF Beam
Monitors
8.94GeV p-Beam

Summary

RDF test indefinitely postponed due to

- Booster safety considerations
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- Attenuation of dump marginal to optimise detector for 53 MHz performance.

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