

Progress and Plans of the ALS TOP-OFF UPGRADE

David Robin

September 26, 2005

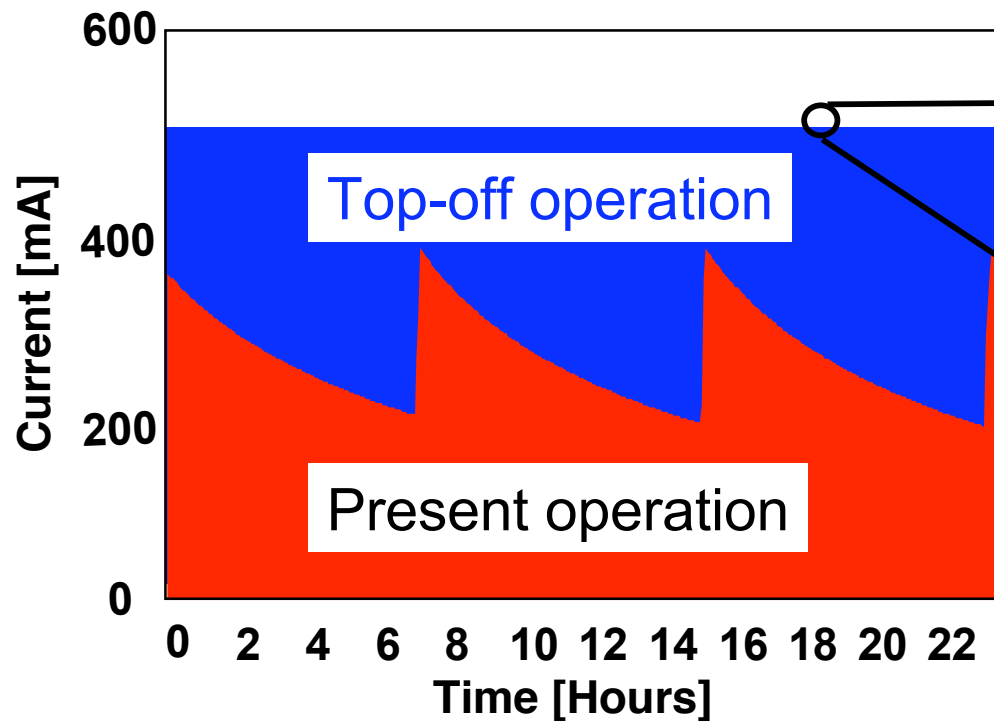
What is the Top-Off Upgrade

Accomplishments in FY05

Future Plans - Schedule for installation shutdown and commissioning

Top-off operation is quasi-continuous injection into the storage ring

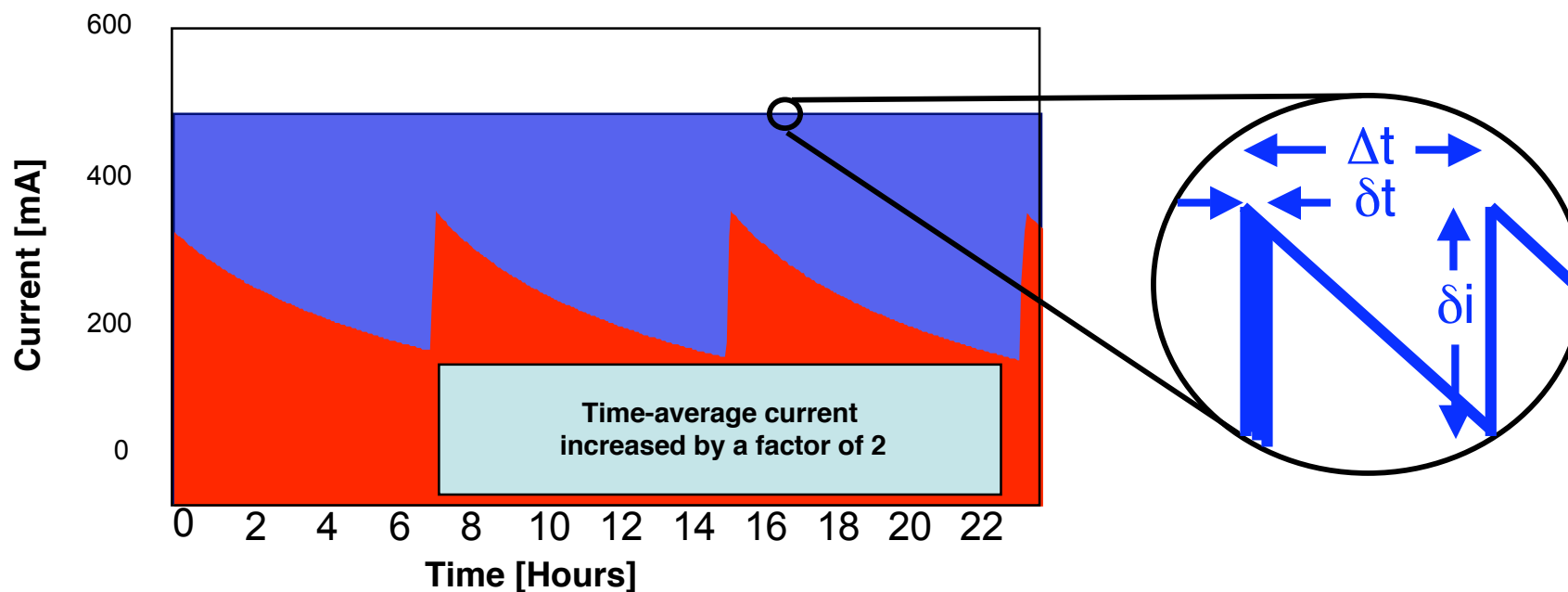
Beam current history for one day



Choice of 500 mA requires minimum upgrades to beamlines and storage ring

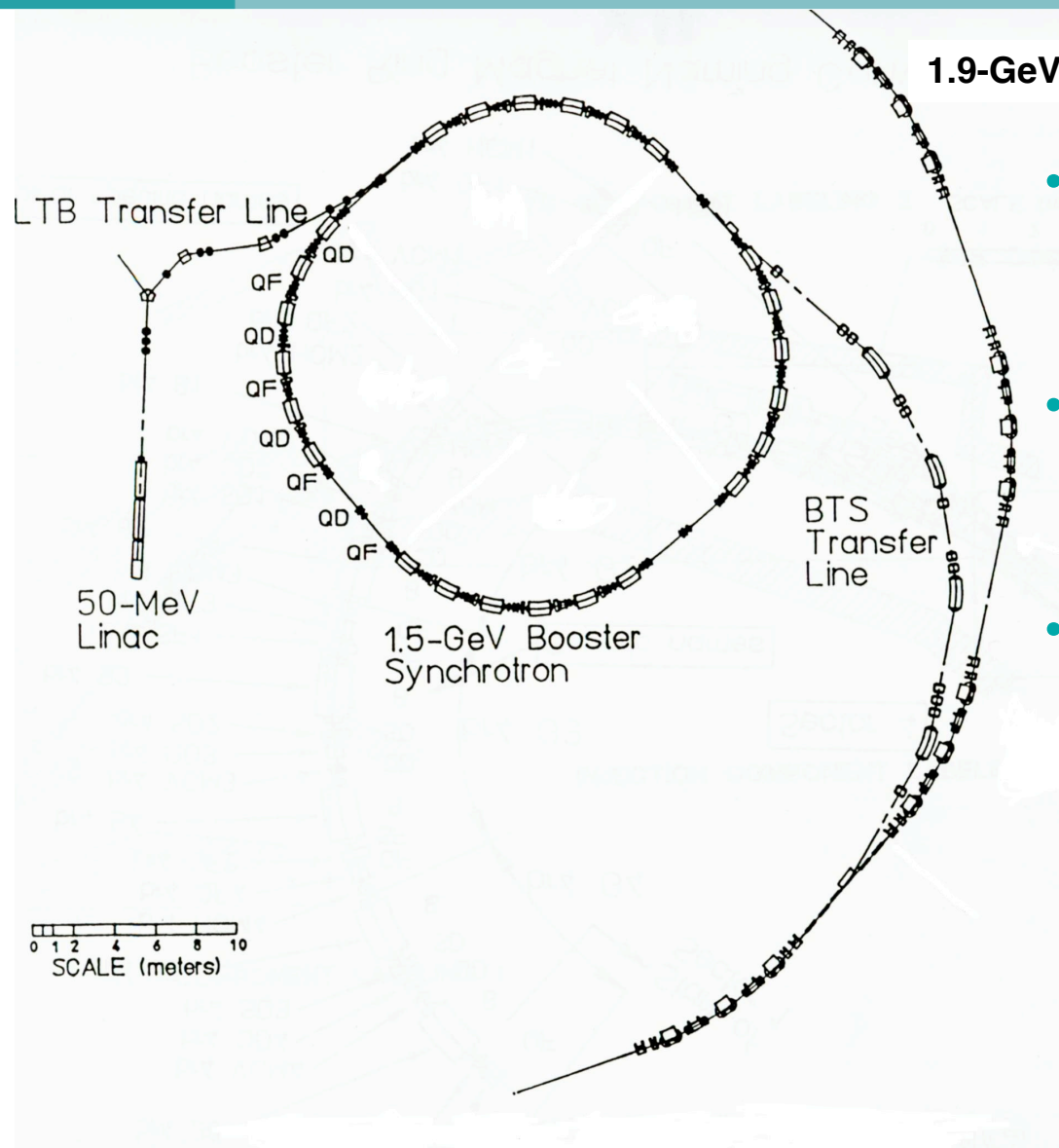
In Top-off mode the plan is to run with

- 2 times higher time averaged current
- 3 times smaller vertical beam size



	δi	Δt	σ_h	σ_v	σ'_h	σ'_v
Before Top-off	200mA	8h	298 μ m	23 μ m	22 μ rad	3 μ rad
After Top-off	1.5mA	32.0s	298 μ m	8 μ m	22 μ rad	6.5 μ rad

- **Upgrade injector to enable full energy injection**
- **Improve diagnostics and other existing systems where necessary for reliability**
- **Upgrade radiation safety system to allow injection with shutters open**
- **Minimize injection transients to reasonable levels and provide a gating signal**
- **Migrate to higher current and smaller vertical beamsizes**
- **Transition to Top-off with minimal negative impact to users**



1.9-GeV Storage Ring

- **New DC Power Supplies and Controls**
- **Upgrade of the RF System**
- **Modifications of the Pulsed Magnets and Supplies**

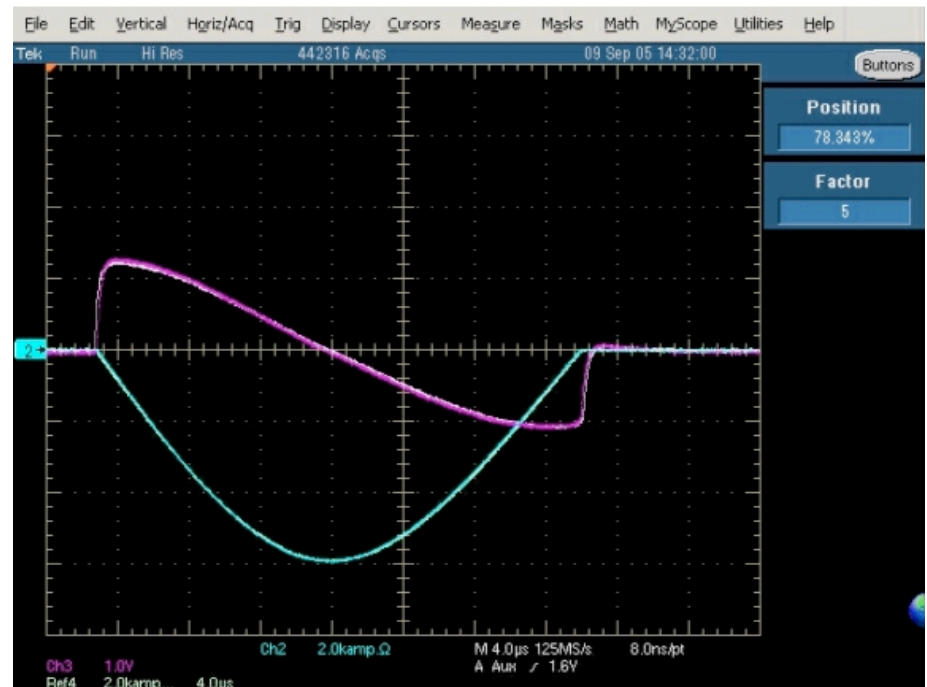
- **Upgrade injector to enable full energy injection**
- **Improve diagnostics and other existing systems where necessary for reliability**
- **Upgrade radiation safety system to allow injection with shutters open**
- **Minimize injection transients to reasonable levels and provide a gating signal**
- **Migrate to higher current and smaller vertical beamsizes**
- **Transition to Top-off with minimal negative impact to users**

- **Conceptual Design Review of the Project in November 2004**
- **Received 3 M\$ in FY05 from BES in March 2005
(on top of 1 M\$ earlier funding)**
- **Performed Extensive Testing of Pulsed Magnet Systems**
- **Finished Design work on major systems**
- **Began Procurement of the Major Long Lead Items**
- **Conducted Many Tests and Simulations Concerning Radiation Safety and Began Upgrading the Radiation Protection System**

- **Project Management:**
 - D. Robin (Project Leader), S. Rossi (Project Controls), C. Steier (Project Manager)
 - **Electrical:**
 - B. Bailey, K. Baptiste (RF Lead), Walter Barry (Electrical Lead), M. Chin, M. Fahmie (Power Supply Lead), J. Julian, S. Kwiatkowski, F. Sannibale (Diagnostics Lead), G. Stover (Pulsed Magnets Lead)
 - **Mechanical:**
 - R. Duarte (Mechanical Lead), B. Gath, J.Y. Jung, J. O'Neill, S. Prestemon, R. Schlueter, D. Shuman
 - **Controls:**
 - A. Biocca, C. Timossi (Controls Lead), E. Williams
 - **Accelerator Physics:**
 - W. Byrne, H. Nishimura, F. Sannibale, T. Scarvie, C. Steier (Acc. Phys Lead)
 - **Radiation Safety and Interlocks:**
 - R. Donahue, R. Mueller (Interlock Lead)
- with help from T. Henderson, A. Ritchie, D. Rogers (EH&S), ALS survey group, J. Tanabe, W. Thur

- **Conceptual Design Review of the Project in November 2004**
- **Received 3 M\$ in FY05 from BES in March 2005
(on top of 1 M\$ earlier funding)**
- **Performed Extensive Testing of Pulsed Magnet Systems**
- **Finished Design work on major systems**
- **Began Procurement of the Major Long Lead Items**
- **Conducted Many Tests and Simulations Concerning Radiation Safety and Began Upgrading the Radiation Protection System**

- Successfully tested each of the Pulsed Magnets at full energy
- Currently finishing (short) lifetime tests

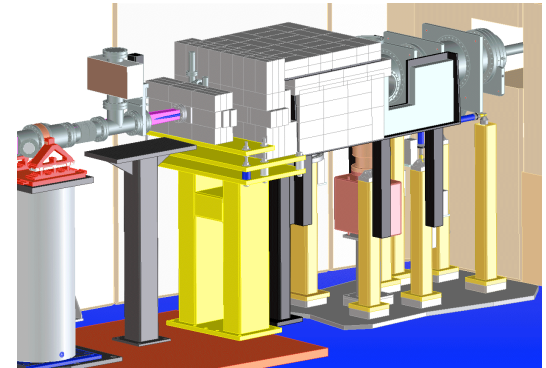


Thin Septum Test Setup

- **Conceptual Design Review of the Project in November 2004**
- **Received 3 M\$ in FY05 from BES in March 2005
(on top of 1 M\$ earlier funding)**
- **Performed Extensive Testing of Pulsed Magnet Systems**
- **Finished Design work on major systems**
- **Began Procurement of the Major Long Lead Items**
- **Conducted Many Tests and Simulations Concerning Radiation Safety and Began Upgrading the Radiation Protection System**

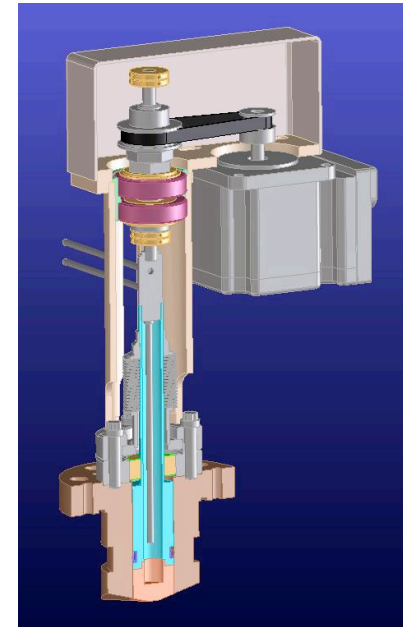
Changes in operation after Top-Off

- Injection with the personnel safety shutters opened
- Higher stored beam losses



The radiation protection systems (interlocks, collimation, local shielding) will be upgraded to ensure safe operation with Top-off

- Extensive testing on beamline 4.0
(already tested 1.5 GeV top-off with beamline 4.0 open)
- Working closely with DOE
- (External) Review in Spring 06
- ALS Safety Analysis Document (SAD) will be modified



- The present baseline scope of the Top-off upgrade **does not** include provisions for injecting “clean” bunches into the storage ring anymore
 - Using top-off injection during two-bunch operation, there would be some current in “untargeted bunches” that may not be acceptable for some 2-bunch users
- Techniques exist (SPRING-8, ESRF) for “cleaning” the bunches in the injector ⇒ expensive, part of delayed scope
- It may be possible to clean bunches in storage ring during top-off, but:
 - Beam will be unstable during cleaning
 - Will require (all) users to use a gating signal (of at least 100 ms)

- **Extended shutdown will be in Fall 2006**
 - Exact date and duration to be determined (6 to 8 weeks including initial commissioning)
- **Plan to operate with full-energy injection immediately following the shutdown**
- **Will slowly migrate to full top-off operation during the following six months**