

# LHC Beam Abort Signals

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## Outline:

**Beam Abort & Warning**

**High Risk Operation & Warning**

**Injection & Warning**

**The pdf file of this talk is available at:**

**[http://cmsdoc.cern.ch/cms/TRIDAS/tr/0503/smith\\_LEADE\\_mar05.pdf](http://cmsdoc.cern.ch/cms/TRIDAS/tr/0503/smith_LEADE_mar05.pdf)**



# Signals: Machine → Experiment

## INJECTION

- The machine is injecting or attempting to inject or about to inject beam into the LHC.

## LUMINOSITY

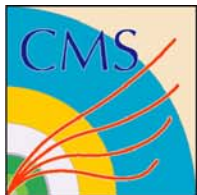
- Beam conditions are stable and changes in beam operation are unlikely to occur.

## HIGH RISK PROCEDURE

- Indicates during running that a high-risk beam procedure is about to be initiated (i.e. major retuning, beta-squeeze, etc.). The experiments could then choose to move back some detectors or reduce high voltage during this time.

## BEAM DUMP

- Fast signal to alert experiments that the beam is about to be dumped. It might not be possible to provide this in all cases, but when a controlled dump is planned, this should be raised in advance.



# Exp → Mch: Beam Abort

Each experiment will have a single signal made up from hardwired logic that will transmit a beam-abort signal to the machine.

The information from this logic will be used by the machine group and the experiment to diagnose the cause of a beam-abort signal after the fact but will not be used to “second guess” the beam abort decision when it happens.

In general, the beam-abort signal would indicate that backgrounds are over the acceptable level.

The beam abort will be done in a fail-safe system where the absence of a beam-permit signal from the experiment will cause an abort.

The experiment will be responsible for the logic, recording its state regularly and recording its state upon any logic transition.

The hardware logic for the beam abort signal should be independent of that for the other signals.



# Exp → Mch: Beam Abort Warning

Each experiment will have a single signal made up from hardwired logic that will transmit a beam-abort warning signal to the machine.

This logic is the same logic used for the beam-abort signal except that the thresholds will be set at some fraction of those required for the beam-abort. Provision can also be made to set this signal if the rate of increase of the values tested by the beam-abort is rapid enough to predict exceeding these thresholds in a short amount of time.

The inputs to this signal would be monitored online by the experiments and also provided to the machine group.

The purpose would be to provide a warning to the machine-group that conditions exist that could lead to a beam-abort signal. The machine group could then take actions to avoid this.

Receipt of this warning could be used to examine the input signals to the beam-abort signal to understand the source of an impending beam-abort in order to take more informed actions.



# **Exp → Mch: Ready for Injection**

**Each experiment will provide a “ready for injection”, which would be required to be true for injection to take place.**

**This would differ from the abort signal in that its absence would indicate that movable detectors were not in position for injection or the experiment voltages were not set for injection.**

**The ready for injection system need not be provided by hardwired logic, but is provided by the experiment Detector Safety System and its state is logged regularly.**

**It is provided in a fail-safe manner where the absence of a “ready for injection” signal would prevent injection.**



## **Exp → Mch: Ready for High Risk Procedure**

**Each experiment will provide a “ready for high-risk procedure”, which would be required to be true for the machine-group to start high-risk procedures that are “voluntary”, i.e. improve beam conditions or operation, but not required to maintain beam.**

**This signal is an “acknowledge” in response to the “High-Risk Procedure” signal from the machine. It indicates that whatever steps should be taken by the experiment to minimize damage during machine high-risk procedures have been taken and the experiment is ready for these conditions.**

**Since such steps as ramping down voltages or remotely moving detector components take time, receipt of this signal would prevent initiation until these steps are complete.**

**The “ready for high-risk procedure”, need not be provided by hardwired logic, but is provided by the experiment Detector Safety System and its state is logged regularly.**



# Exp → Mch: Ready for Beam Abort

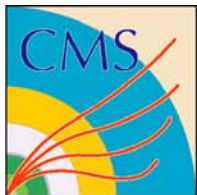
Each experiment will provide a “ready for beam abort”, which would be required to be true for the machine-group to abort the beam after alerting the experiments that the beam would be aborted.

These beam aborts would be those that are needed on a time scale too quick for voice communication between the machine group and the experiment, but yet not of an emergency nature requiring an immediate response from the machine.

This signal is an “acknowledge” in response to the “beam-abort” signal from the machine. It indicates that whatever steps should be taken by the experiment to minimize damage during machine abort have been taken and the experiment is ready for the beam abort.

Since such steps as ramping down voltages or remotely moving detector components take time, receipt of this signal would prevent initiation until these steps are complete.

The “ready for beam abort”, need not be provided by hardwired logic, but is provided by the experiment Detector Safety System and its state is logged regularly.



# Conclusions: Questions

**Are these the correct signals?**

**Are they named correctly?**

**Is anything missing?**

**Are any of these signals unnecessary?**

**What else should we specify?**

**Thanks for comments: D. Macina, N. Ellis**

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