

Thanks to:

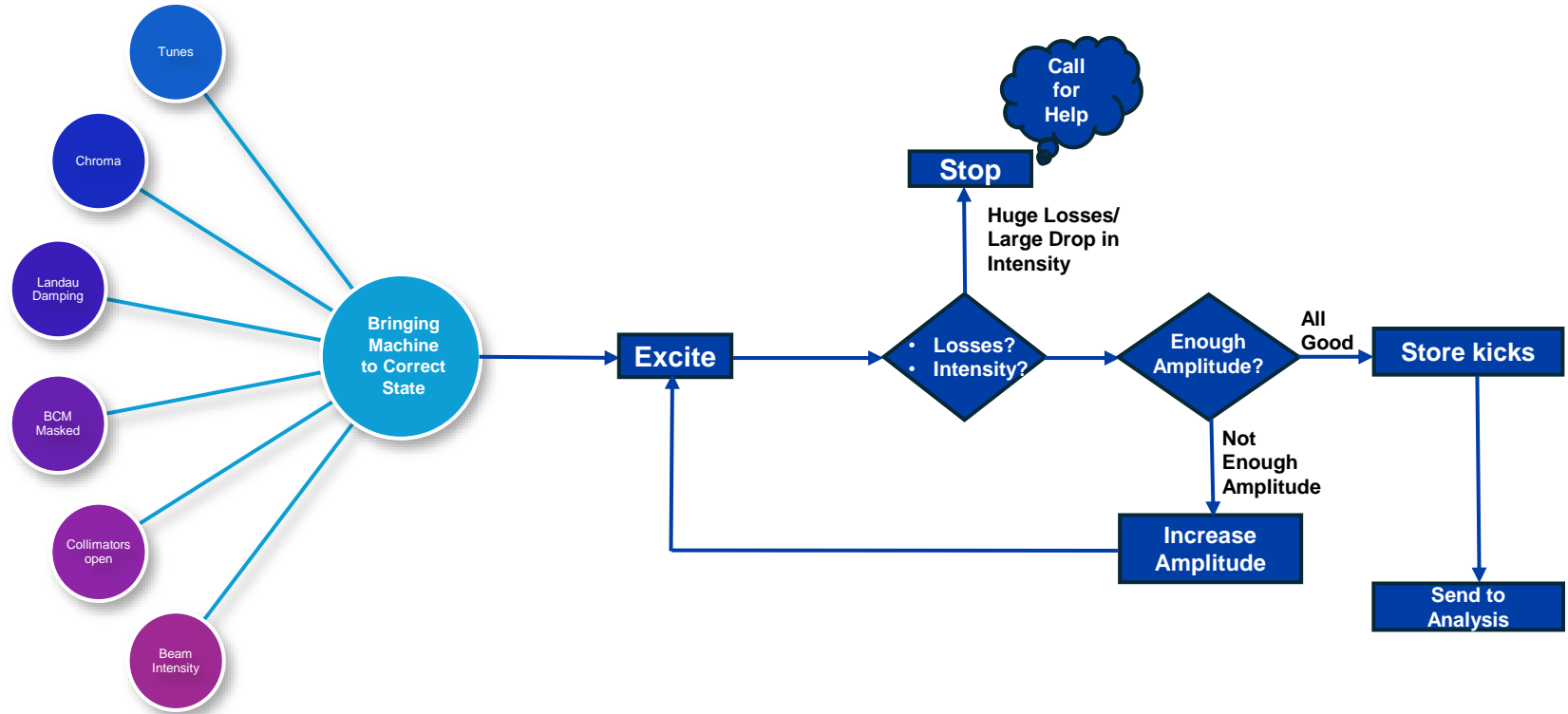
Tobias H. B. Persson, Michi Hostettler, Andrea Calia,
Delphine Jacquet, Joshua W. Dilly, Ewen H. Maclean,...

Updates and Plans:

Linear Optics Measurements Automation

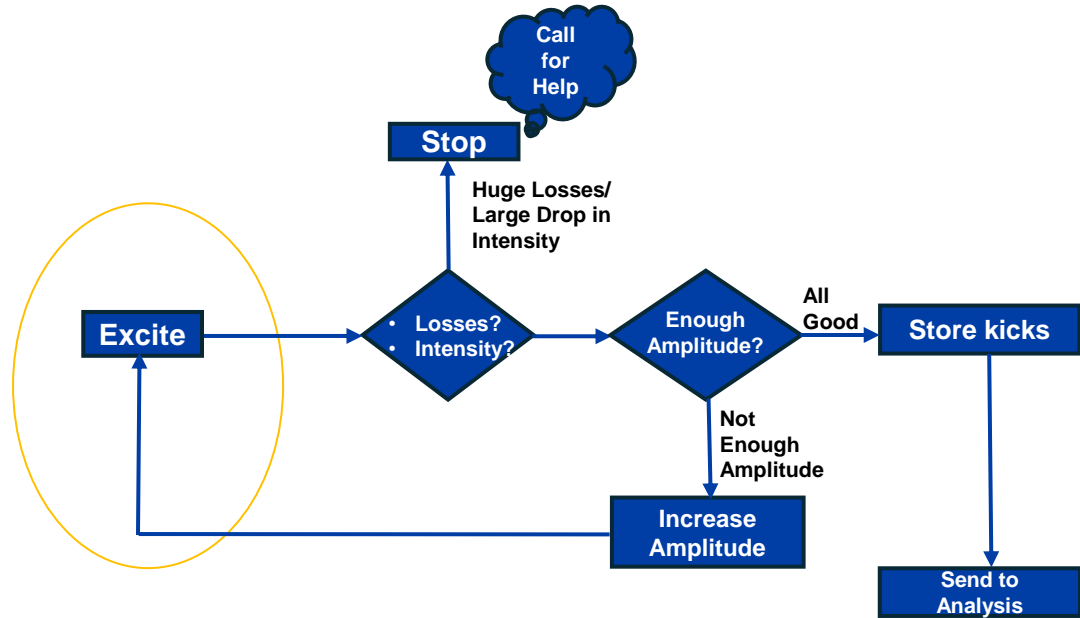
Ujani Kar
University of Applied Sciences

Planning for Automation



Current Focus: Kick Amplitude based Excitation - GUI

1. Analysis of Error in Beta Beat for Every Kick
1. Conditional Kicking Based on Peak-to-Peak Amplitude
1. GUI related to Automated Kicks



The Multiturn

The screenshot displays the LHC Multiturn control interface. The window title is "LHC Multiturn <no version>". The interface is divided into several sections:

- File Help**: Standard menu options.
- BP: PHYSICS-6.8TeV-1.2m-2024_V1@135_[END]** and **Optic: R2024aRP_A41cmC41cmA10mL200cm**: Beam parameters and optics settings.
- Acquisition BEAM1** and **Acquisition BEAM2**: Acquisition mode selection.
- BEAM1**:
 - Flag status**: Includes "Beam Presence" and "Setup Beam" buttons.
 - Kick Group**: "No Group Acti..." and "Select Active group" button.
 - Measurement Environment**:
 - Feedback state**: "Orbit OFF" and "Radial sep OFF" (red bars).
 - Tune feedback state**: "H1 H", "H1 V", "H2 H", "H2 V" (red bars).
 - Chroma state**: "H1 H", "H1 V", "H2 H", "H2 V" (red bars).
 - Landau Damping**: "H1" (red bar).
 - Tunes set-up**: "H1 H" (0.0) and "Acquire QH"; "H1 V" (0.0) and "Acquire QV".
 - Auto-run analysis**: "Internal analysis" and "Harpy" checkboxes.
 - Concentrator settings**: "Bunches" (Select ...) and "Turns" (10).
- Exciters**:
 - ADT AC Dipole Status**: "H: IDLE" and "V: IDLE".
 - HORIZONTAL SETTINGS**:
 - Excitation Amplitude (%)**: 1.0.
 - Tune Delta**: "Tune Delta Start" (-0.01).
 - Start Excitation Tune**: -0.01.
 - Turns**: "Measured Number of Turns" (5600), "Rise Turns" (1000.0), "Fall Turns" (1000.0), "Flat Top Turns" (8000.0).
 - VERTICAL SETTINGS**:
 - Excitation Amplitude (%)**: 1.0.
 - Tune Delta**: "Tune Delta Start" (0.012).
 - Start Excitation Tune**: 0.012.
 - Turns**: "Measured Number of Turns" (5600), "Rise Turns" (1000.0), "Fall Turns" (1000.0), "Flat Top Turns" (8000.0).

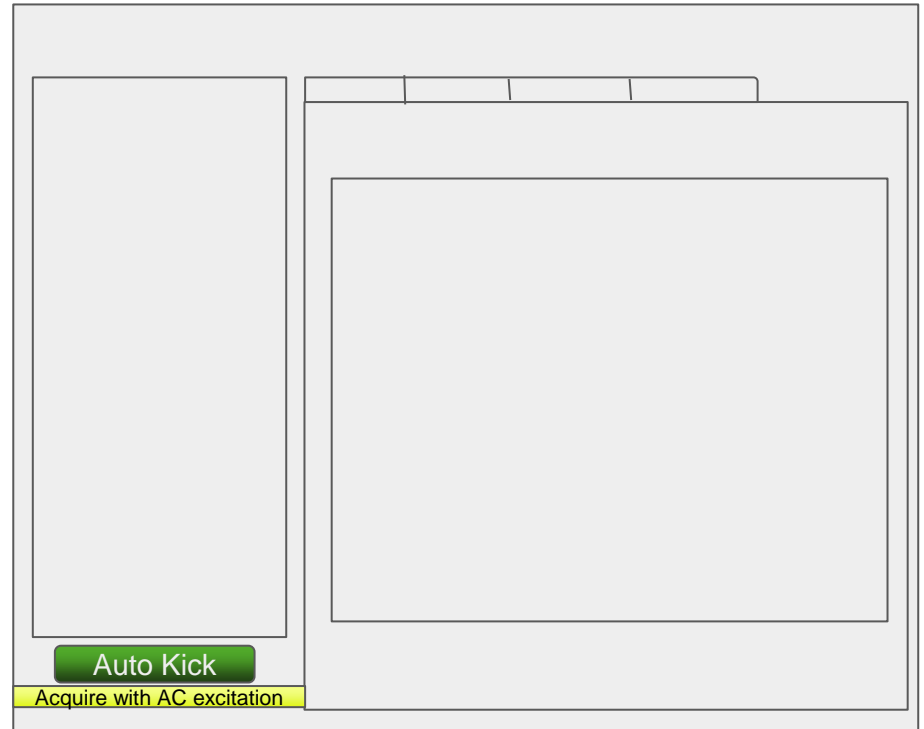
A status bar at the bottom shows an error: "15:25:42 Multik: Unhandled UnhandledException in thread AWT-EventQueue-0: Unhandled exception: SubscriptionProblemException : Failed to connect to ser..."

Plan - Button for Automated Kick

Plan - Button for Automated Kick

- Adding a button to start auto kicking.

It will only be available for AC Dipole kicks for now.



Plan - Button for Automated Kick

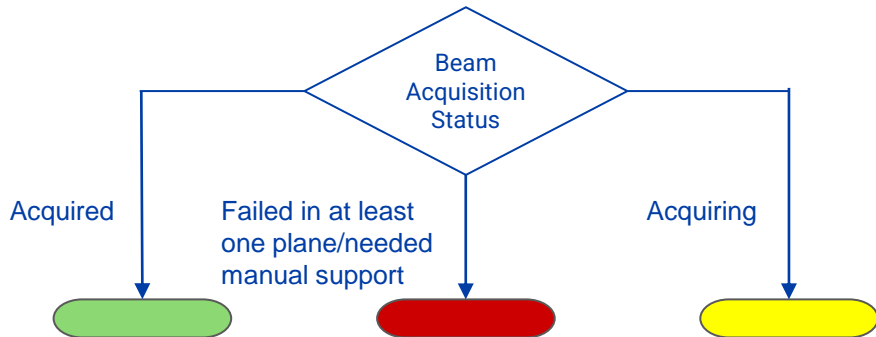
- Adding a button to start auto kicking.
- On button click - Starts a new window with the kick plan.

Kick Plan

Kick Number	Horizontal Amplitude	Vertical Amplitude
	<input type="text" value="Editable Fields"/>	<input type="text" value="Editable Fields"/>
	<input type="text" value="Editable Fields"/>	<input type="text" value="Editable Fields"/>
	<input type="text" value="Editable Fields"/>	<input type="text" value="Editable Fields"/>
	<input type="text" value="Editable Fields"/>	<input type="text" value="Editable Fields"/>
	<input type="text" value="Editable Fields"/>	<input type="text" value="Editable Fields"/>
	<input type="text" value="Editable Fields"/>	<input type="text" value="Editable Fields"/>
	<input type="text" value="Editable Fields"/>	<input type="text" value="Editable Fields"/>

Plan - Button for Automated Kick

- Adding a button to start auto kicking.
- Starts a new window with kick plan.
- On clicking Kick in the kick plan window, beam acquisition is started off of the pre-loaded kick plan. Colour coded for visual cues.



Kick Plan

Kick Number	Horizontal Amplitude	Vertical Amplitude
Acquired		
<error occurred in atleast one plane> (Show appropriate error message)		
Acquired		
Acquisition Ongoing		
5	<Value of amplitude>	<Value of amplitude>
6	<Value of amplitude>	<Value of amplitude>
7	<Value of amplitude>	<Value of amplitude>

Kick Change

Kick Plan

- At whichever kick number, the peak-to-peak becomes $\approx 2\text{mm}$, the program stops, takes 3 kicks at that amplitudes, and exits the auto kicking.
- Already putting in the delta tunes.

Kick Number	Horizontal Amplitude	Vertical Amplitude
1	5	5
2	10	10
3	15	15
4	20	20
5	25	25
6	30	30
7	35	35
8	38	38
9	40	40
10	42	42
11	45	45

Plan - Button for Automated Kick

- Adding a button to start auto kicking.
- Starts a new window with kick plan.
- Starts beam acquisition from a pre-loaded kick plan.
- All table fields are editable. But, any changes in the fields are only brought into effect when clicked on “Change” button. This also stops the acquisition and restarts it all over again from the first value.

Kick Plan

Kick Number	Horizontal Amplitude	Vertical Amplitude

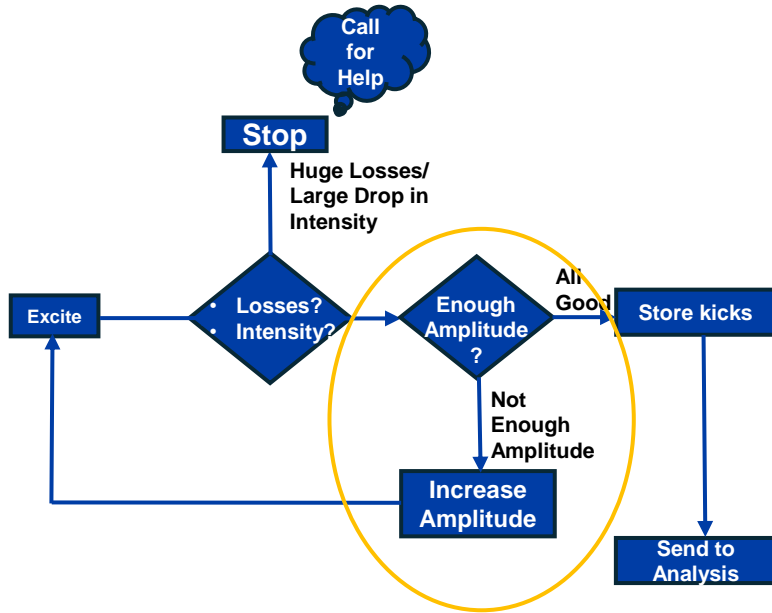
Summary

- Adding a button to start auto kicking.
- Starts a new window with kick plan.
- Starts beam acquisition from a pre-loaded kick plan.
- All table fields are editable.
- Change in kick plan and restart occur when clicked on “Change” button.

Thank You!

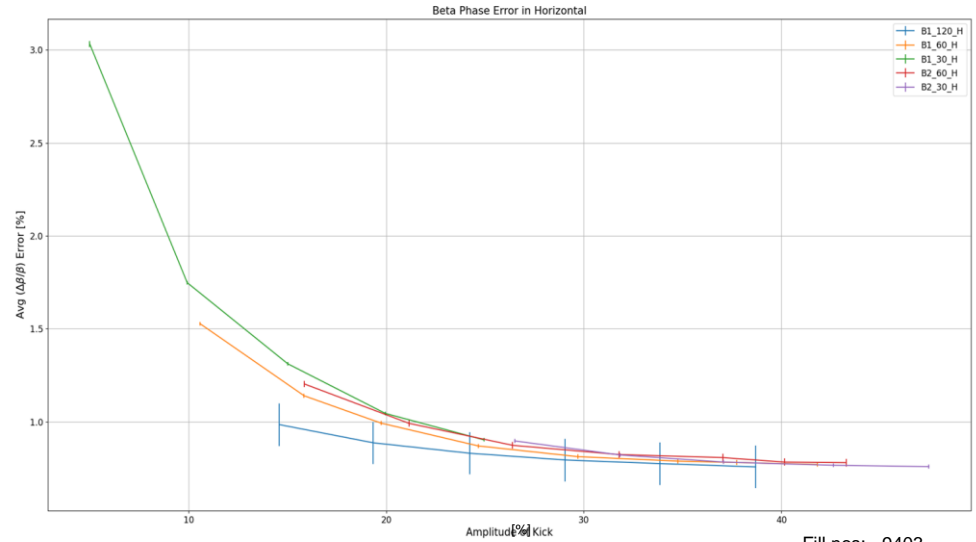
Extras

Excite based on Amplitude



[Only works if there are no major changes in the optics/beam set up, such as in 60 degrees]

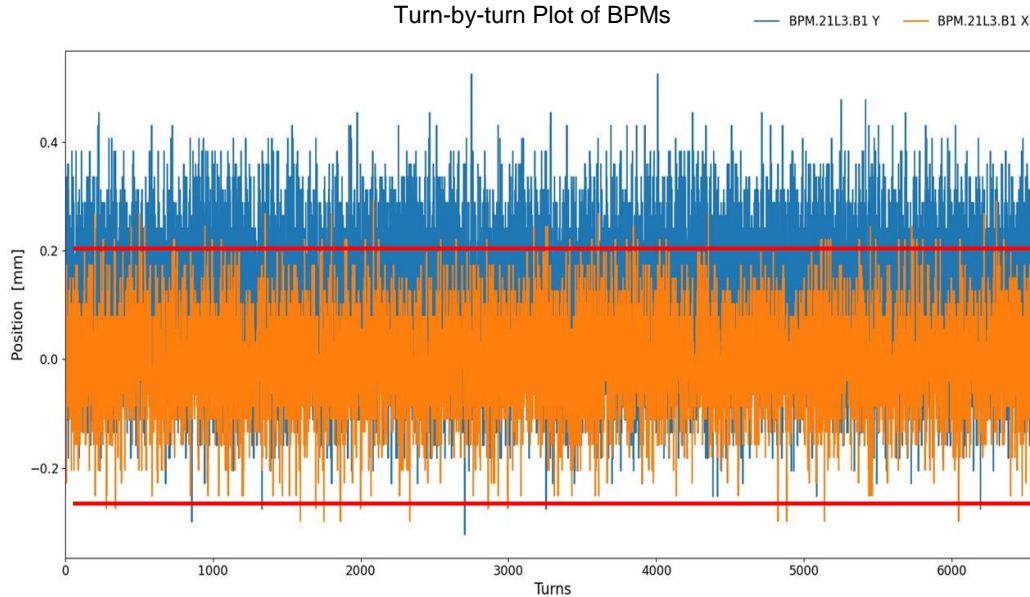
1. Analysis of Error in Beta Beat for Every Kick



Fill nos: 9403,
8521

- Betabeat analysed for different kick to find an acceptable level of errorbars in beta amplitude to get a good kick.
- Higher amplitude kicks -> Signal-to-noise ratio gets better

2. Conditional Kicking Based on Peak-to-Peak Amplitude



Peak-to-peak amplitude is computed for individual BPM in Non-ATS arc and checked.

[Non-ATS arcs as they stay constant]

- If the BPMs peak-to-peak is above $\sim 2\text{mm}$ --> acceptable for the errorbars of betabeat --> Programmed exit.