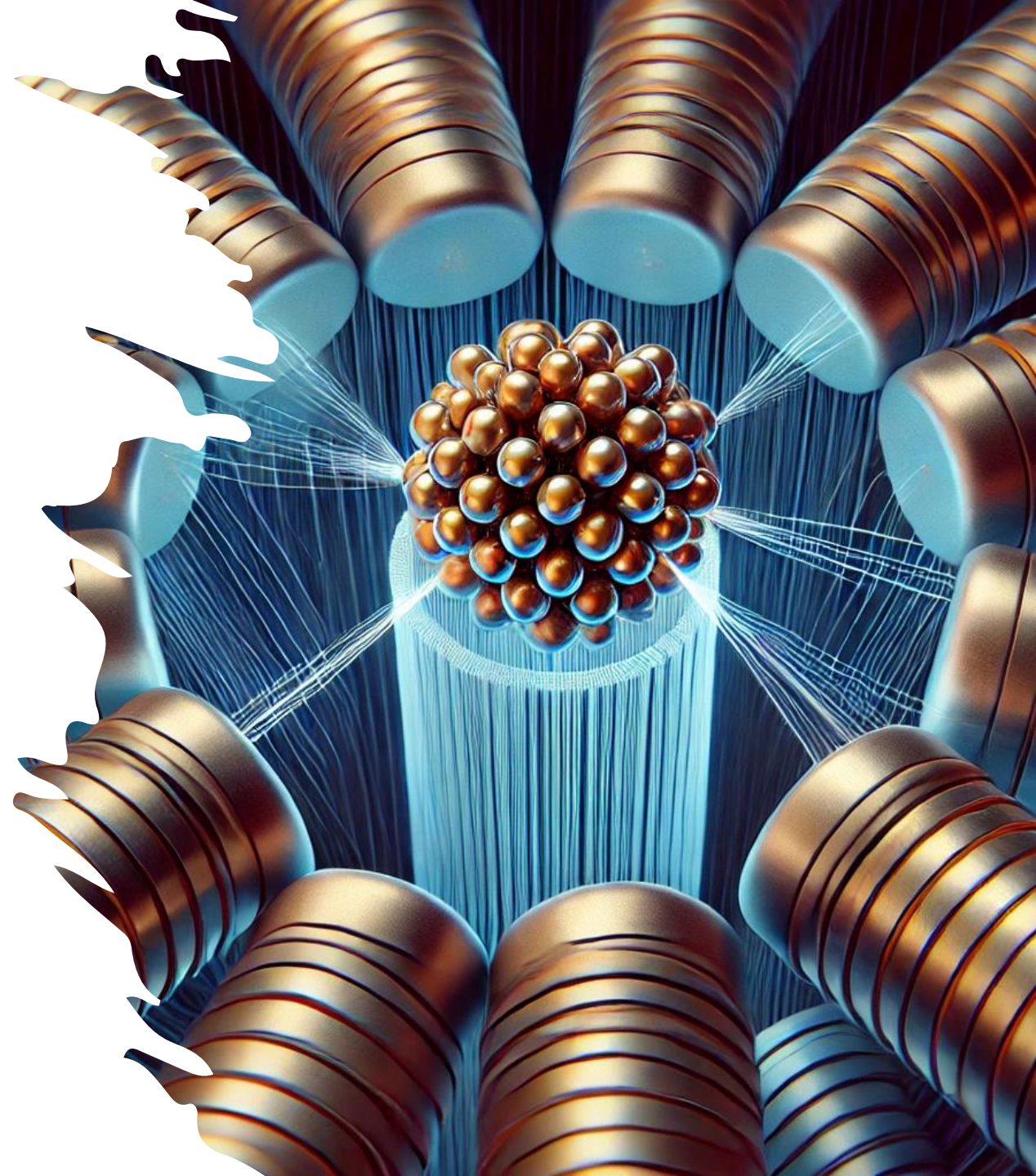


β -IP corrections in the Ion Run

T. Persson

On behalf of the OMC-team



β IP from K-mod

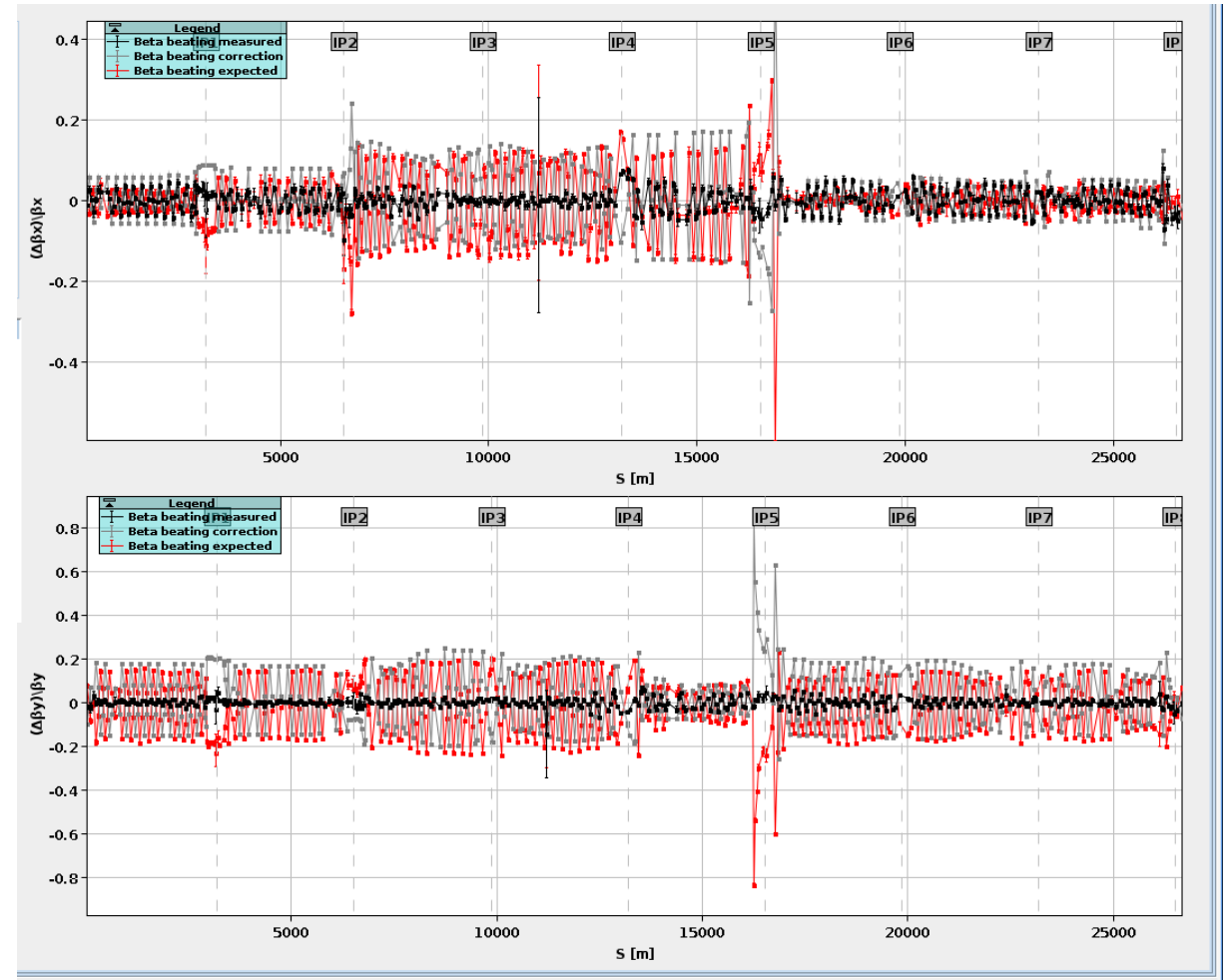
- Global β -beat and dispersion look fine throughout the cycle
- After the global corrections
 - β from K-mod was NOT included due to first issues with acquisition and then with software
- IP1 and IP5 are almost spot on
 - Want minimum change
- Large waist shift in particular in beam 2
 - > ALICE would receive less luminosity

IP2

Plane	β IP
B1H	0.55
B1V	0.57
B2H	0.62
B2V	0.54

Finding a global correction

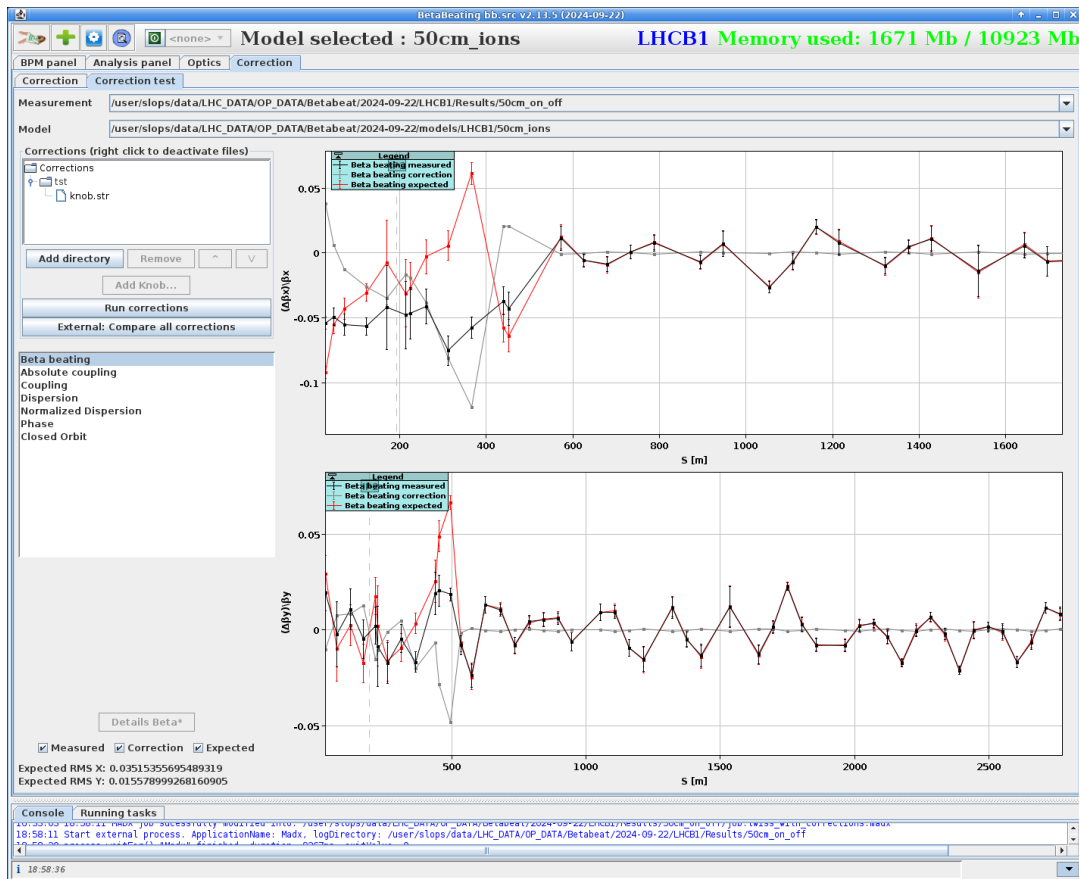
- Could **NOT** find a correction that both :
 - Conserved the β -beat globally
 - Corrected the β^* in IP
- Worked for beam 1 but not beam 2



Global correction using

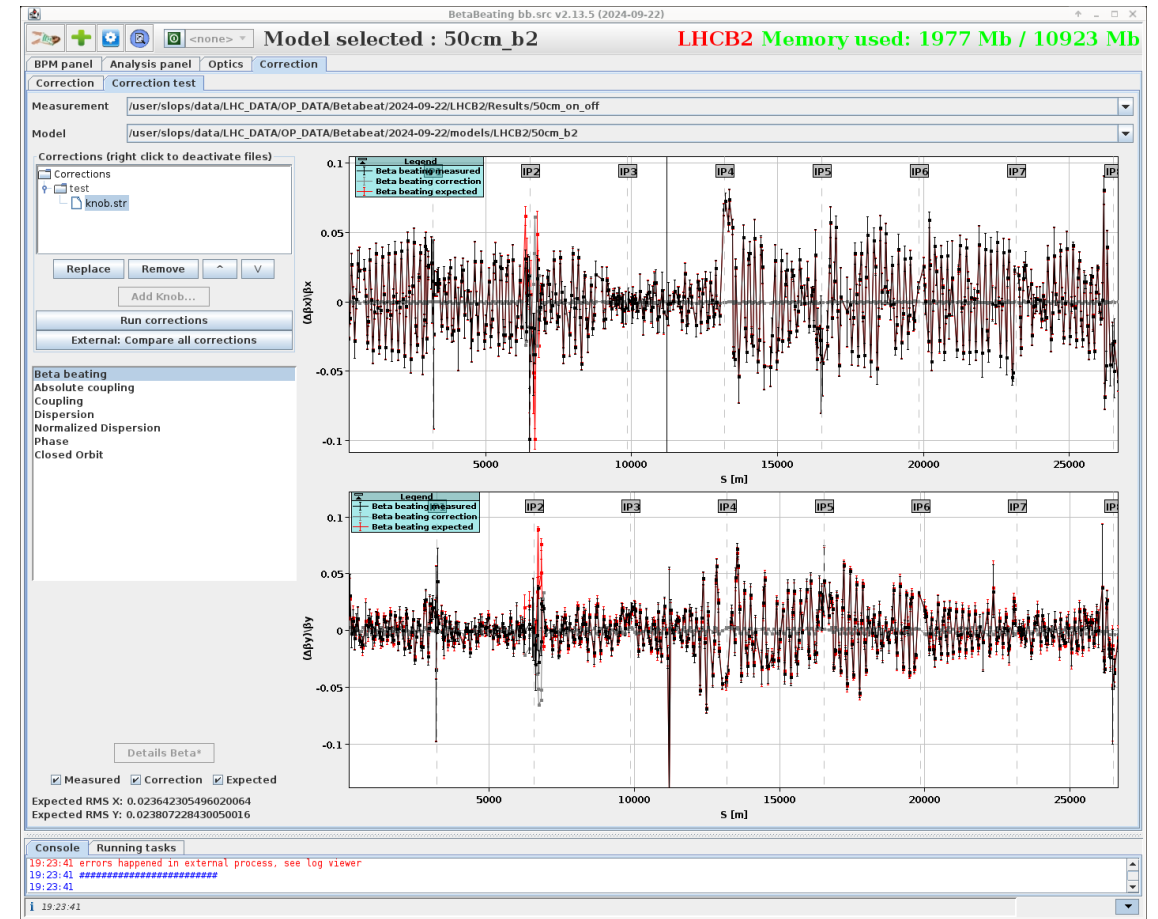
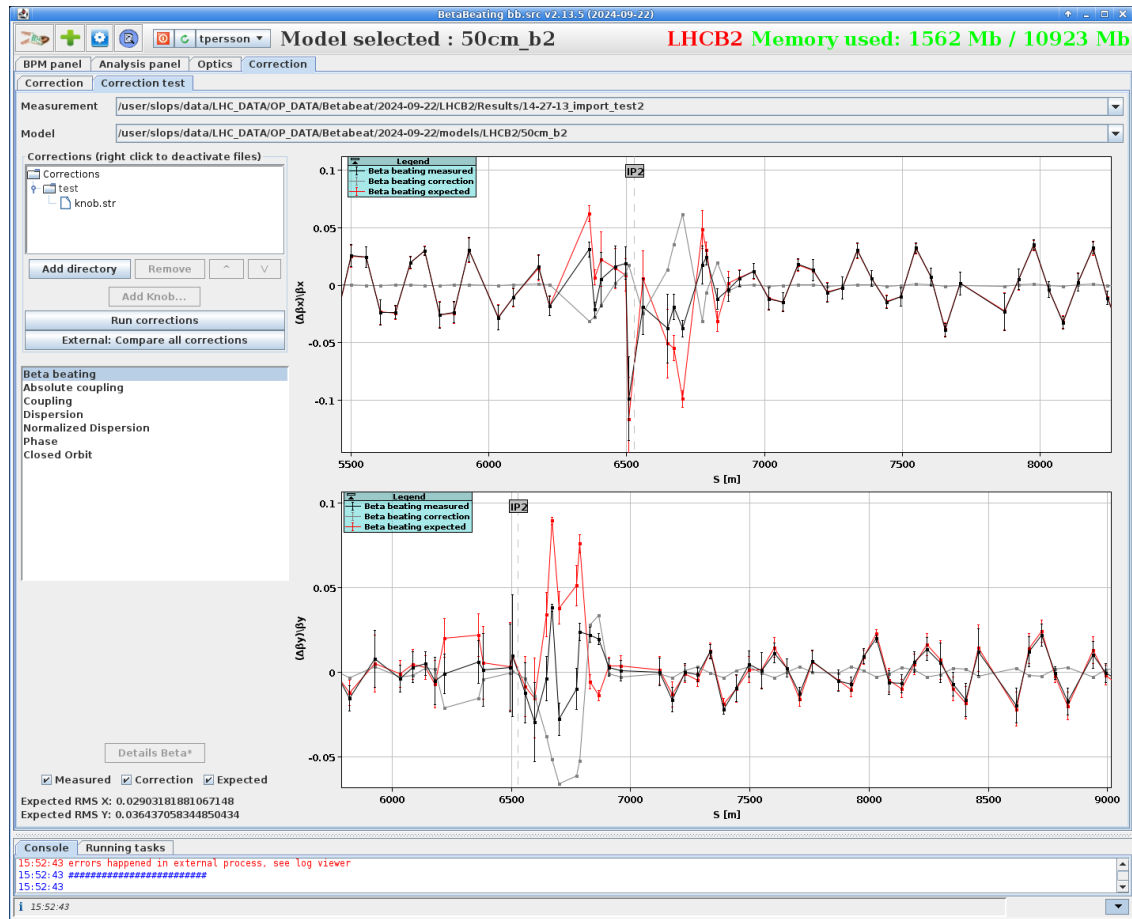
- Made a global matching in MAD-X that matches both beams
- Input:
 - Only data from K-modulation, propagated to the Q1 BPMs
- Uses (only IP2):
 - Triplet magnets
 - All individuals powered to from Q4-Q10 (both beams)
- Constraints:
 - Match the Q1 BPMs (3m tolerance)
 - $\text{Alfx}=\text{dx}=0$ at the IP
 - $\text{Betx_IP1}=\text{Bety_IP5}=0.5$, $\text{alfx}=0$, $\text{alfy}=0$ (here one could have taken a closer point but in the end I tried both and didn't change)

Beam 1



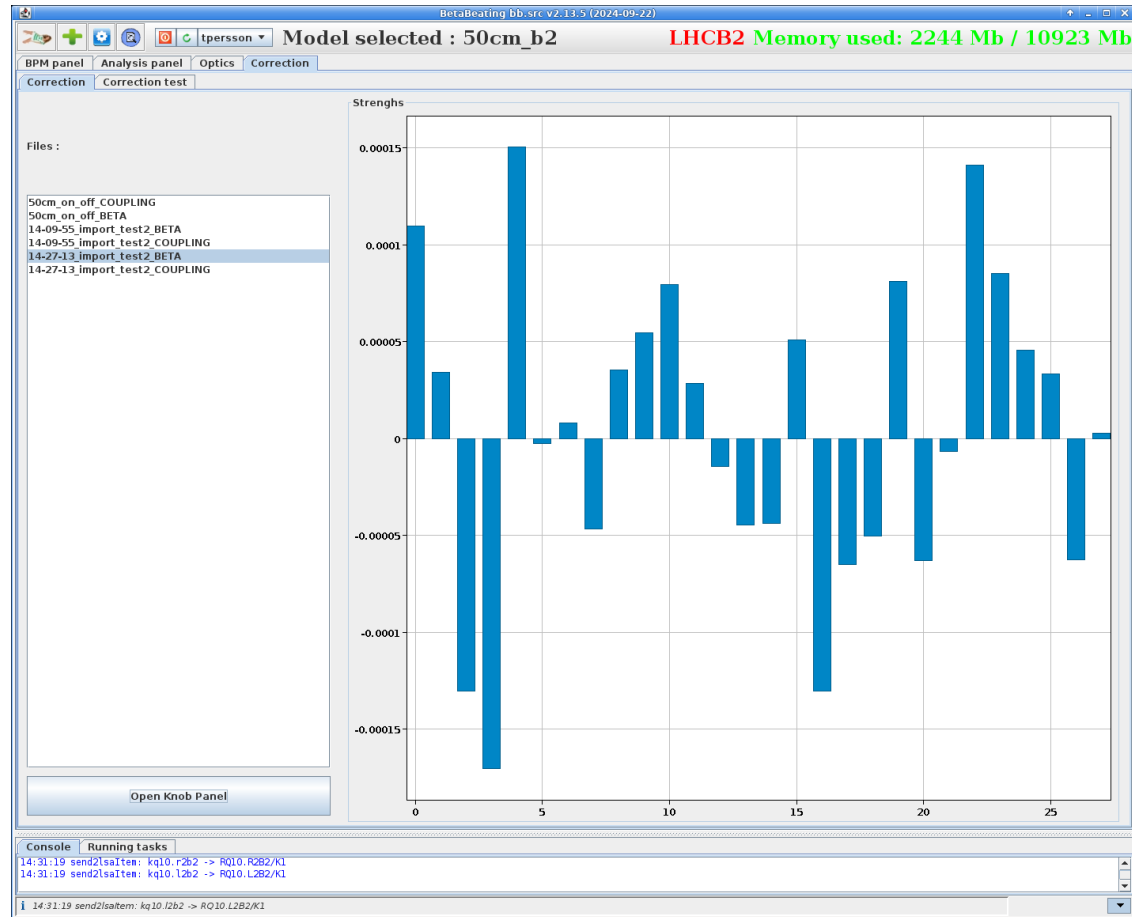
- Some local β -beat is expected to be introduced but in the range of a peak 6-7%

Beam 2



- A bit stronger for beam 2 but still below 10% β -beat
- The β IP2 is predicted to be ~ 50 cm after corrections

Strength of correction



- All corrections less than $2e-5$

The triplet corrections

Magnet	Local	New regional	Local+Regional
Q1.L2	-1.155E-5	1.09E-6	-1.05E-05
Q2.L2	-3.1E-6	1.04E-5	7.30E-06
Q3.L2	-2.0E-5	-1.04E-5	-3.04E-05
Q1.R2	-2.91E-5	-7.05E-6	-3.62E-05
Q2.R2	1.9E-5	1.95E-5	3.85E-05
Q3.R2	1.1E-5	-1.95E-5	-8.50E-06

I was hoping it would reduce the correction strength but in fact it increases them

Combining knobs

The screenshot shows the 'Optics Management Application v18.3.1' interface. The main window is titled 'Parameter selection - LHCRRING'. It features a menu bar with options like 'Edit Knobs', 'Create Knobs from File', 'Combine Knobs', 'Optics Viewer', 'Upload Measured Optics', 'Edit Elements', 'Import Optics', 'Import Elements', 'Import Knobs', and 'Delete Optics'. Below the menu bar, there are several tabs and a search field. The main area is divided into three columns: 'Parameter Groups', 'Type Groups', and 'Parameters'. The 'Parameters' column is currently selected and shows a list of parameters including 'LHCBEAM/2023_04_16_B1_Globallons', 'LHCBEAM/2023_04_16_B2_Globallons', 'LHCBEAM/2023_09_12_B1_Globallons_v2', 'LHCBEAM/ATS_2023-04-14_BX_Local_IP2_ions', 'LHCBEAM/ATS_2023_04_10_BX_LocalCouplingCorr_IP2_ions_trim', 'LHCBEAM/ATS_2024-06-25_globalCorr_ions_B1_50cm', and 'LHCBEAM/ATS_2024-06-25_globalCorr_ions_B2_50cm'. Below the parameter list, there is a 'Search parameter by name:' field and an 'Add Knob(s)' button. A table below the 'Add Knob(s)' button shows the selected knobs and their attributes:

Knob	Scaling
LHCBEAM/ATSR_2024_09_23_betastar_global	1.0
LHCBEAM/ATSR_2024_triplet_for_betastar_corr	1.0

To the right of the table is a 'Knob Attributes' section with dropdown menus for 'Device' (LHCBEAM), 'Group' (BETA-BEATING), and 'Name' (LHCBEAM/ATSR_2024_09_23_BX_betastar_corr_IP2). Below the table and attributes, there are buttons for 'Remove Selected Knob(s)' and 'Save combined Knob in LSA'. At the bottom of the window, there is a 'Console' window showing system logs and a status bar at the very bottom indicating '14:35:45 LHCBEAM/ATSR_2024_09_23_BX_betastar_corr_IP2 uploaded to LSA!'

- Tool by Michi allows to combine several knobs into one
- Used it to combine the triplet with the individual ones
- Maybe we should use this more in the future?
 - Creating temporarily knobs and then move them away and use combined knobs

What is left in terms of optics commissioning in 2024?

- Ions
 - Implement these corrections and re-measure, already 70% of the correction fixes almost all the waist shift
 - Re-check the b3 correction
- Pp-ref
 - Re-measure the ramp after the new corrections included
- Measure more MO circuits if there is an opportunity