

Phase Changes to A RF and B RF at Transition

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I. Introduction

Both the RPOS phase shifter driven by PSDRV and the Paraphase Phase shifter triggered by the transition Jump Gate (B:TTRX(nn) and B:TTRXOF) change the phase of the A RF and B RF at transition w.r.t. the RF out of the Frequency Reference DDS module (VCO). Additionally, there is a single offset value applied to the paraphase voltage near transition that offset the A RF and B RF w.r.t one another.

Figure I.1 illustrates the manner that the phases changes. When triggered at transition, a scale factor of the Radial Position Controller PSDRV voltage is ramped from +1 through 0 to -1 in an adjustable time interval of 10 to 40 microseconds. Simultaneously the phase of the group 'A' and 'B' RF is phase shifted 180 degrees over the same 10 to 40 microsecond interval. The 180 degree phase shift is executed with the phase offset decrementing, that is rotating clockwise.

A phase detector was setup to measure the phase changes. Figure I.2 illustrates the measurement setup and where in the Booster LLRF electronics the signals were measured. The length of cable between the Booster RF distribution box and the phase detector was chosen to make the change of phase at transition symmetric around zero. The cable delays can distort the phase measurement as the frequency sweeps fro 37 MHz to 52 MHz.

The measurements were triggered on \$13 Booster cycles when there was beam and when there was not. Measurements were made comparing the A RF and B RF to the Booster RF (VCO, DDS) at the distribution box before the phase shifters.

The scope screen captures that follow show a full Booster cycle, a view zoomed in at transition and a view at transition zoomed out enough to see when the paraphase steps.

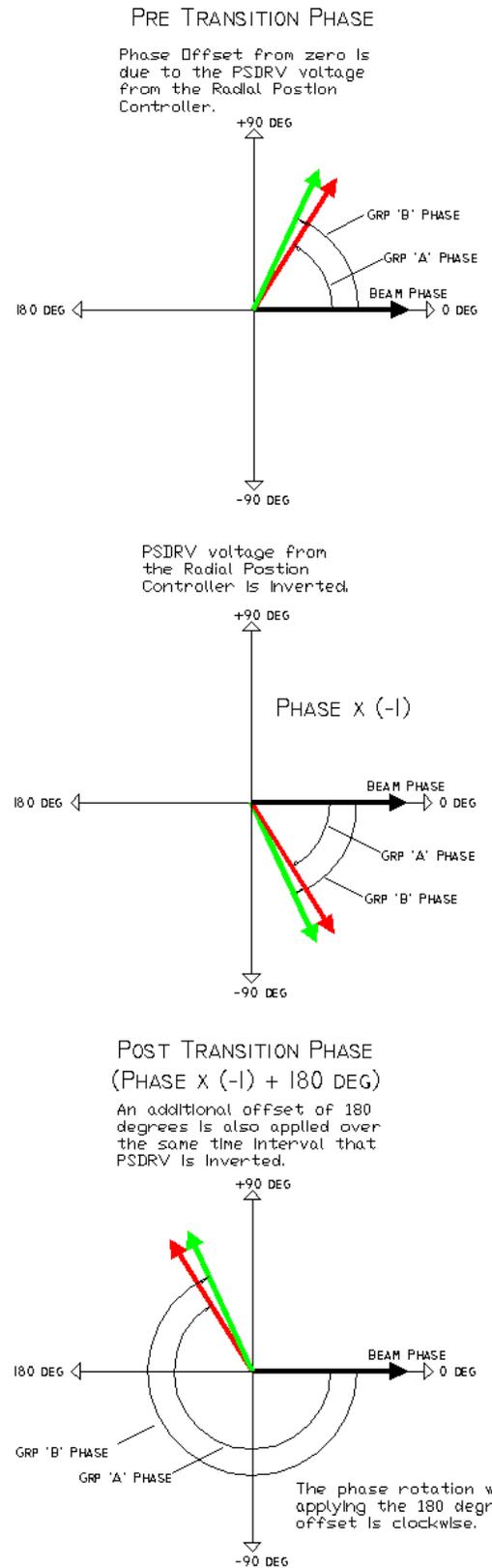


Figure I.1 Phase change at transition

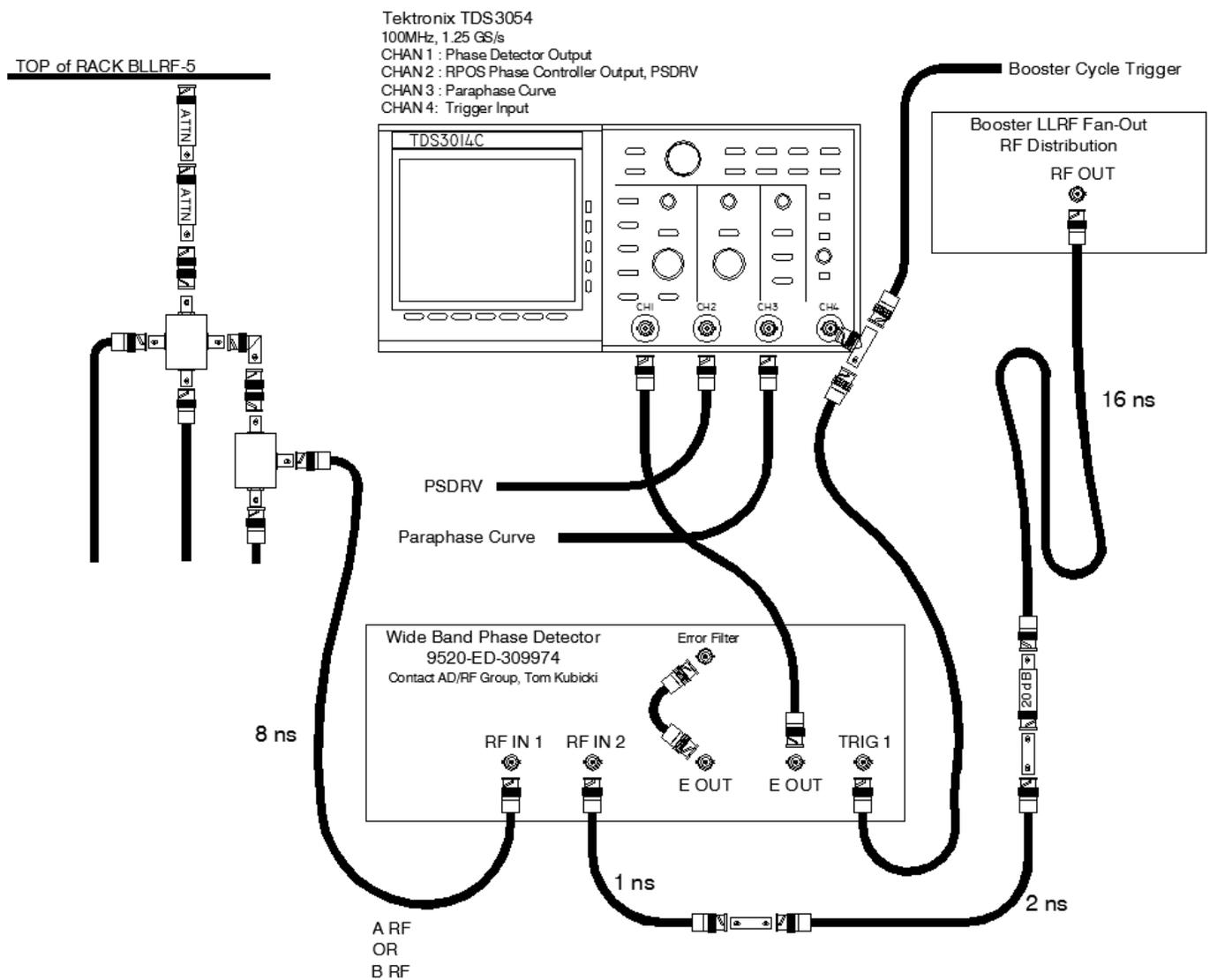


Figure I.3 Phase measurement setup.

II. Scope Screen Captures

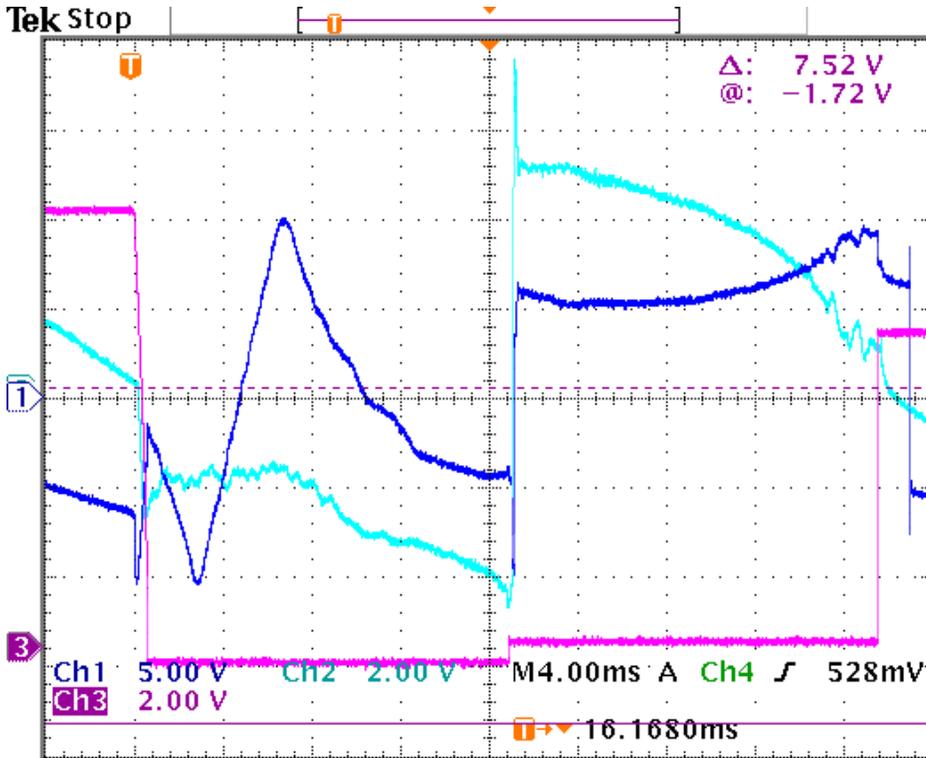


Figure II.1 B RF vs. Booster RF, with beam.

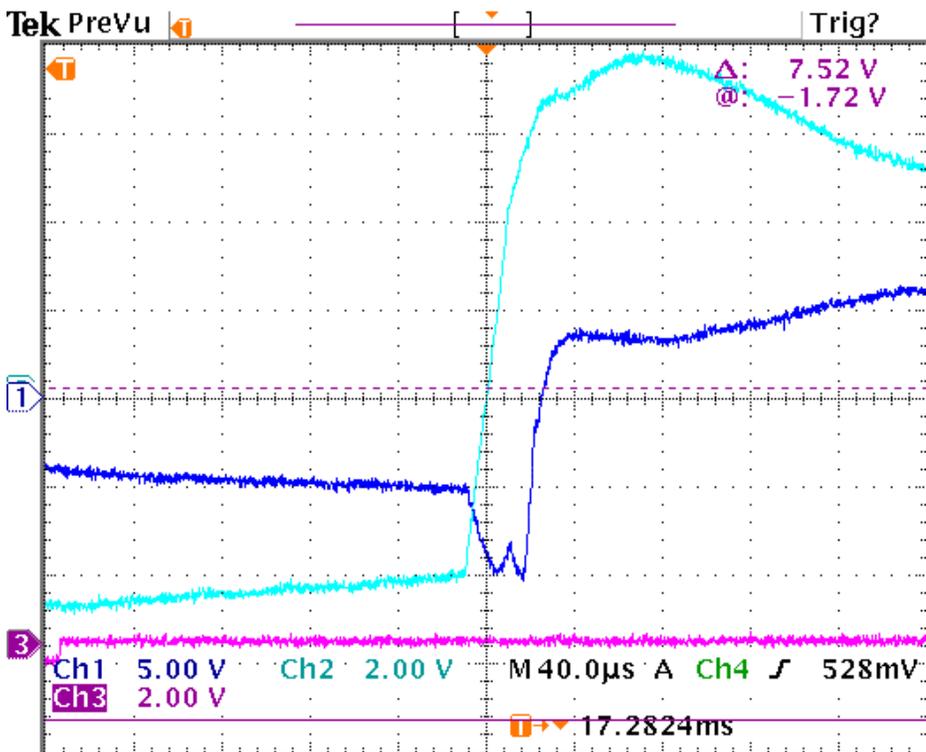


Figure II.2 B RF vs. Booster RF, with beam, zoomed in at transition.

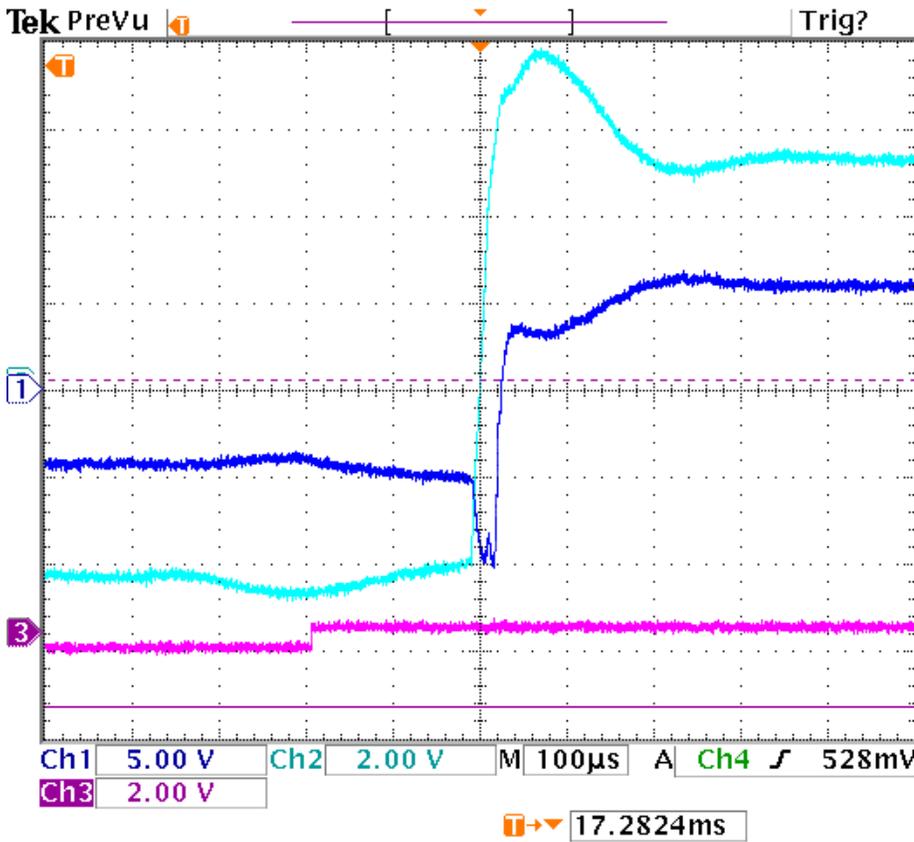


Figure II.3 B RF vs. Booster RF, with beam, zoomed in at transition showing paraphase step.

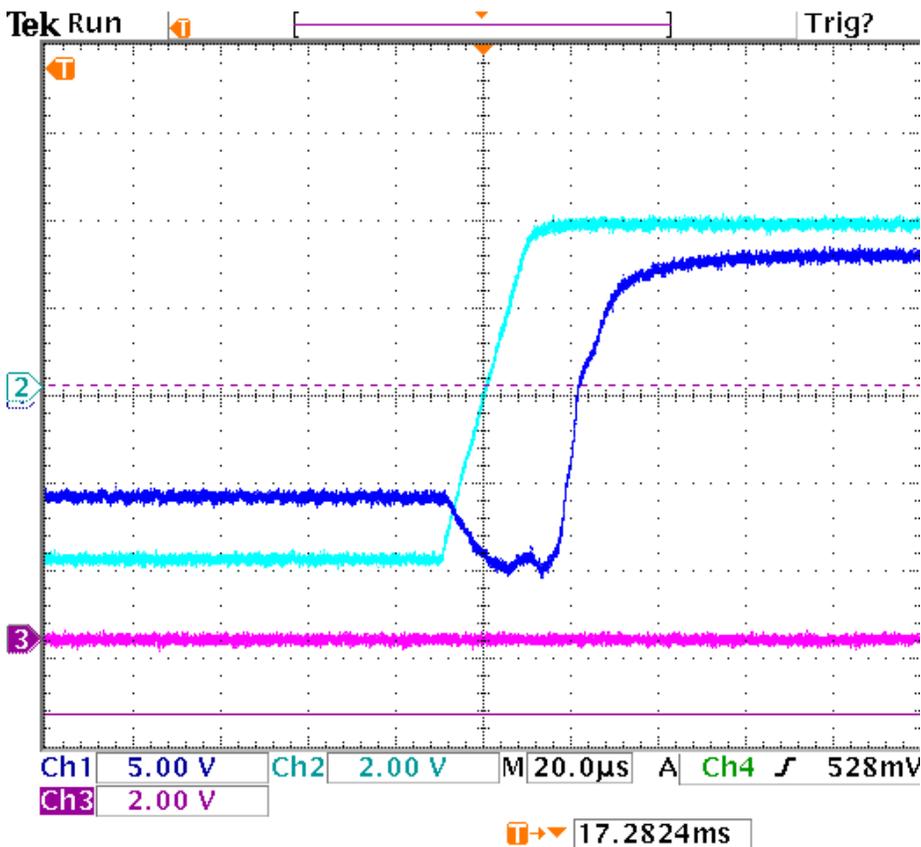


Figure II.4 B RF vs. Booster RF, **no beam**, zoomed in at transition **more**.

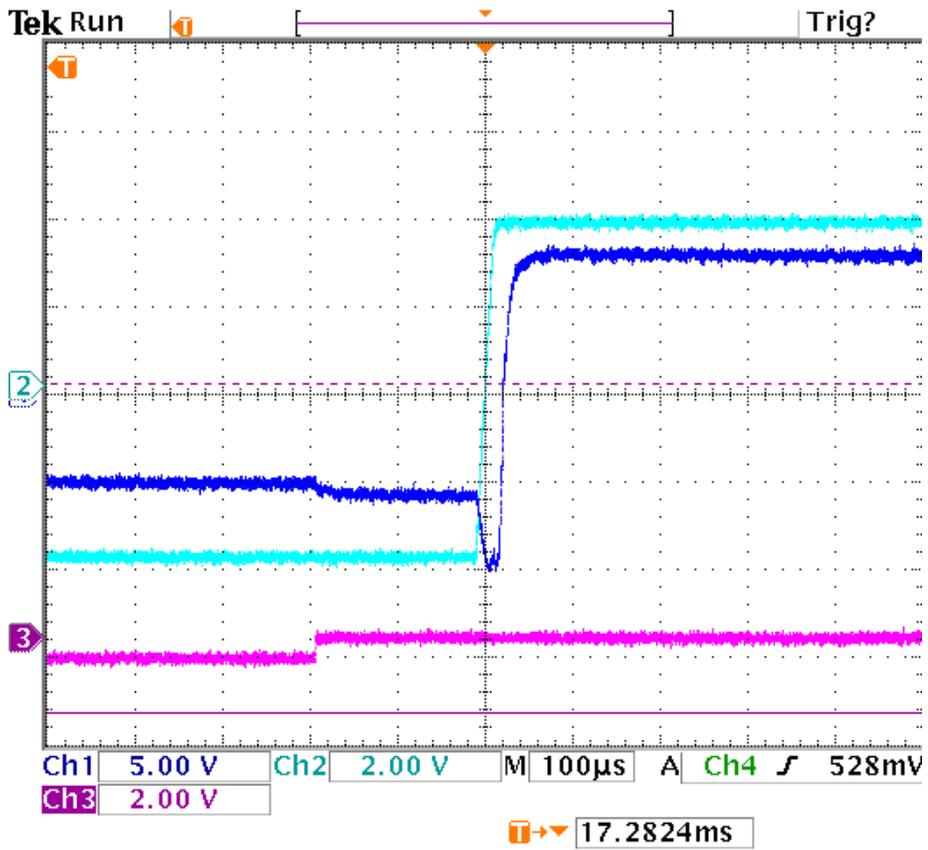


Figure II.5 B RF vs. Booster RF, **no beam**, zoomed in at transition showing paraphase step.

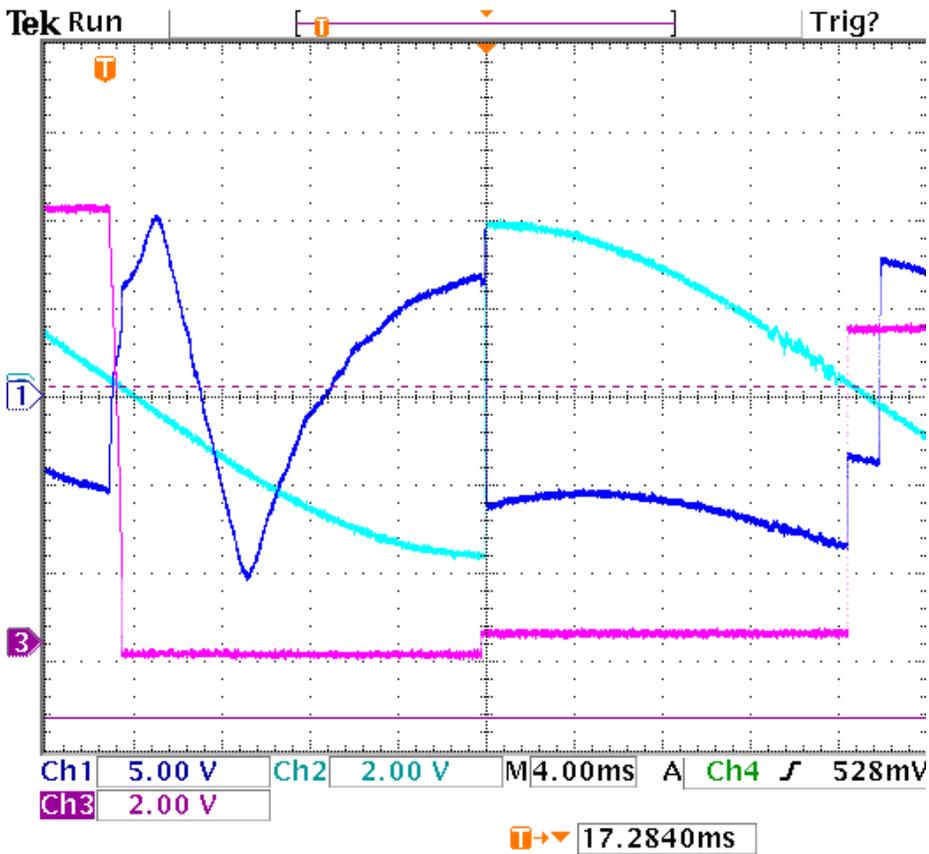


Figure II.6 A RF vs. Booster RF, no beam, full cycle.

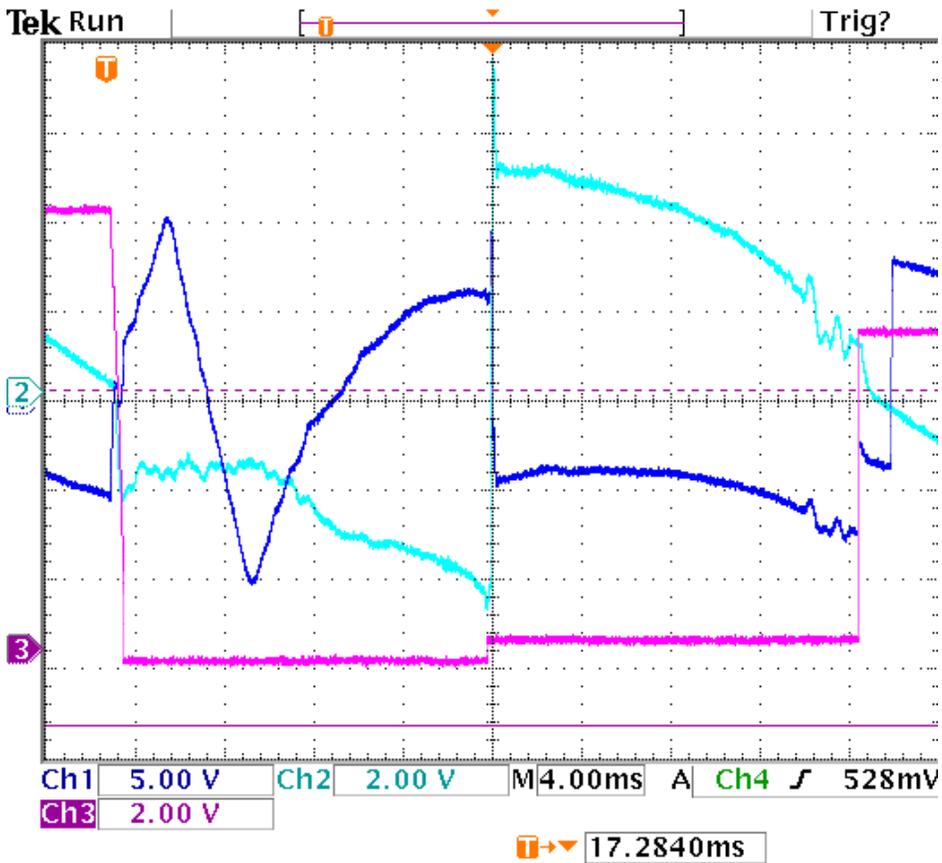


Figure II.7 A RF vs. Booster RF, with beam, full cycle.

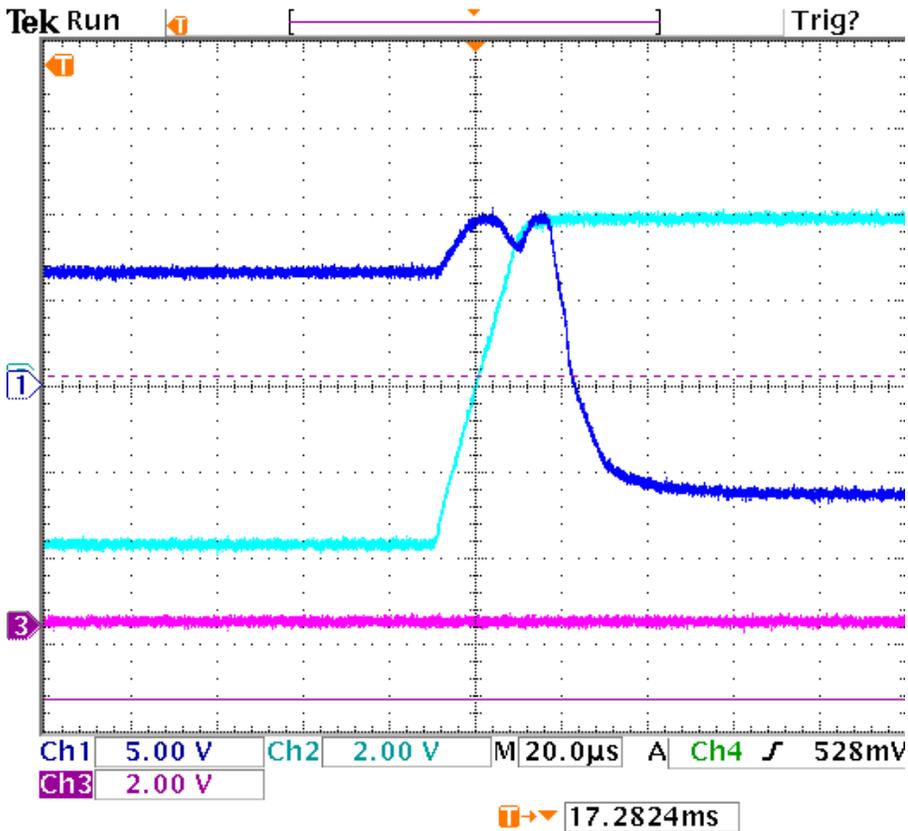


Figure II.8 A RF vs. Booster RF, no beam, zoomed in at transition.

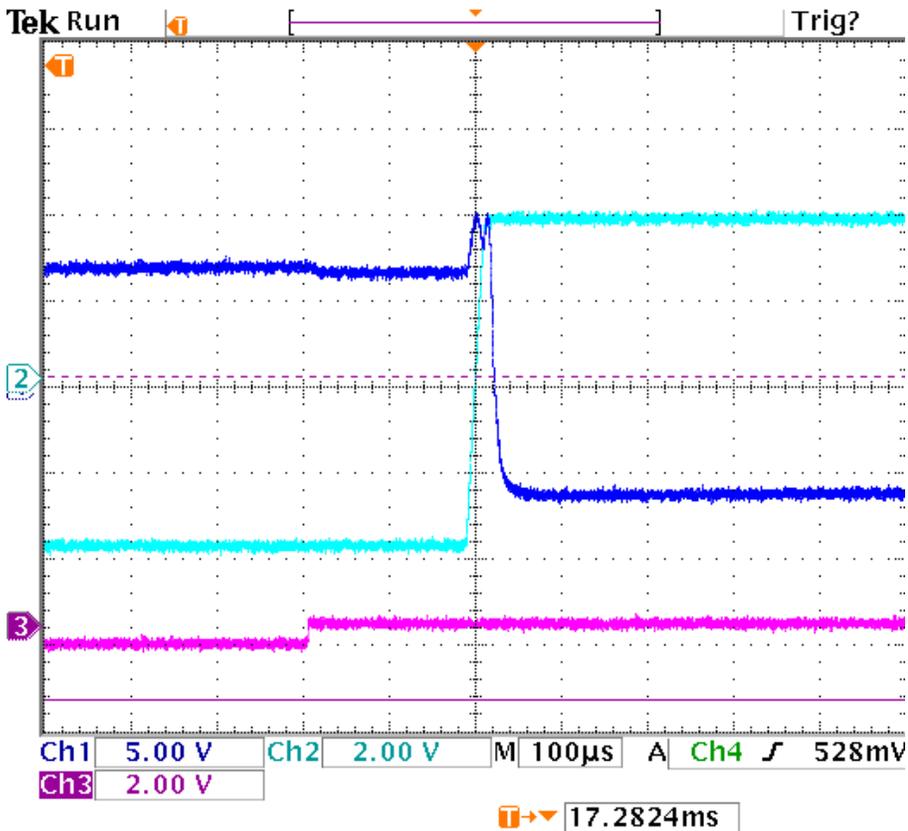


Figure II.9 A RF vs. Booster RF, no beam, zoomed in at transition showing paraphase step.

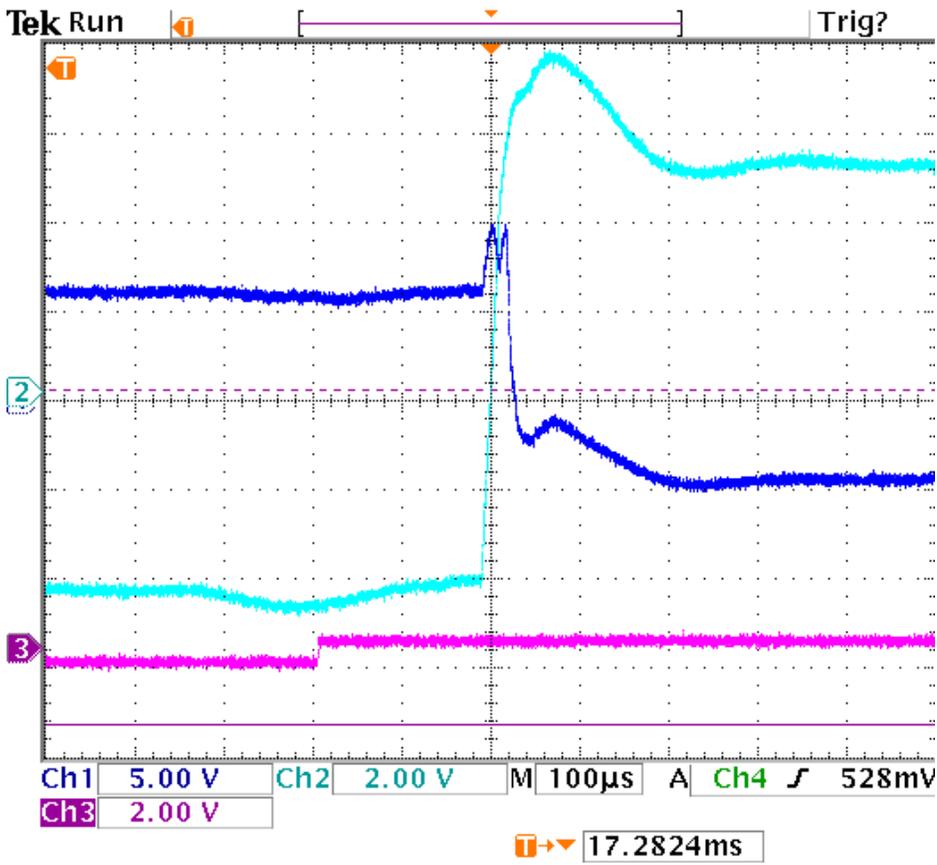


Figure II.10 A RF vs. Booster RF, with beam, zoomed in at transition.

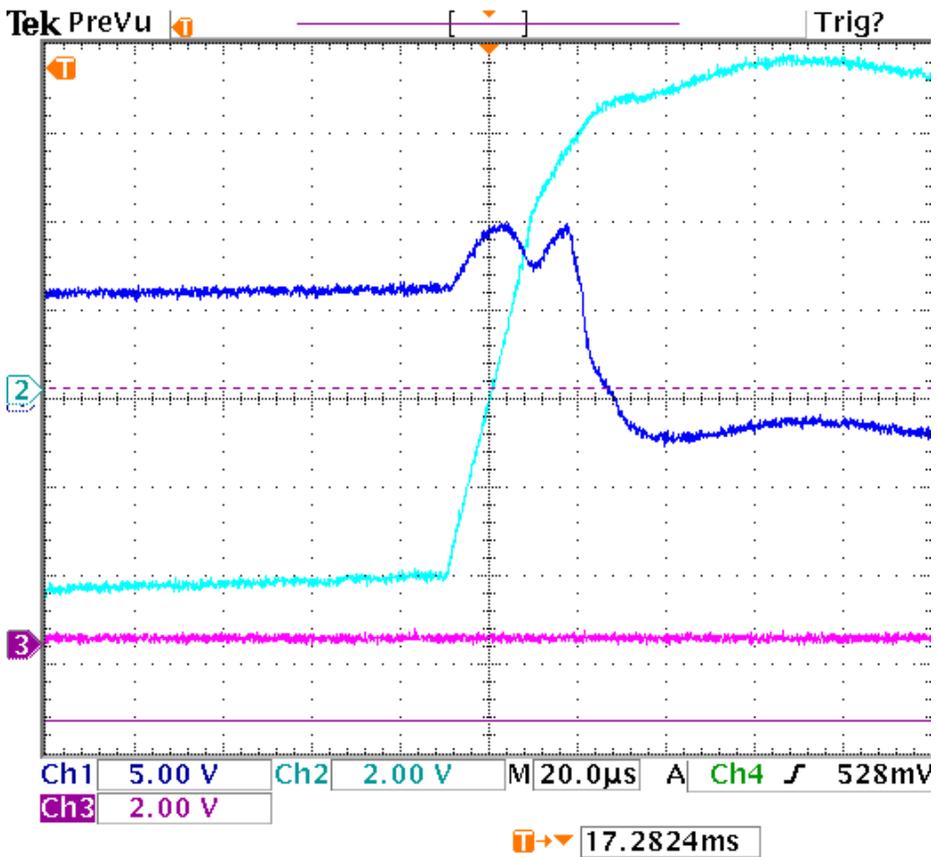


Figure II.11 A RF vs. Booster RF, with beam, zoomed in at transition more.

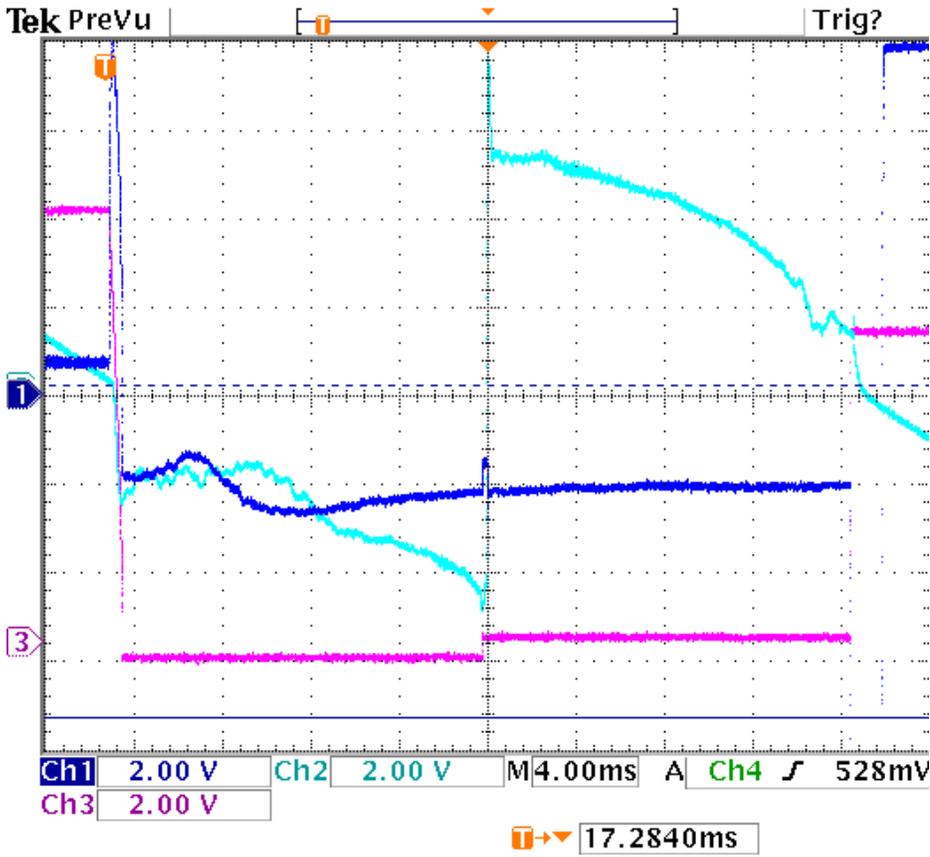


Figure II.12 A RF vs. B RF (CH 1), with beam, full cycle.

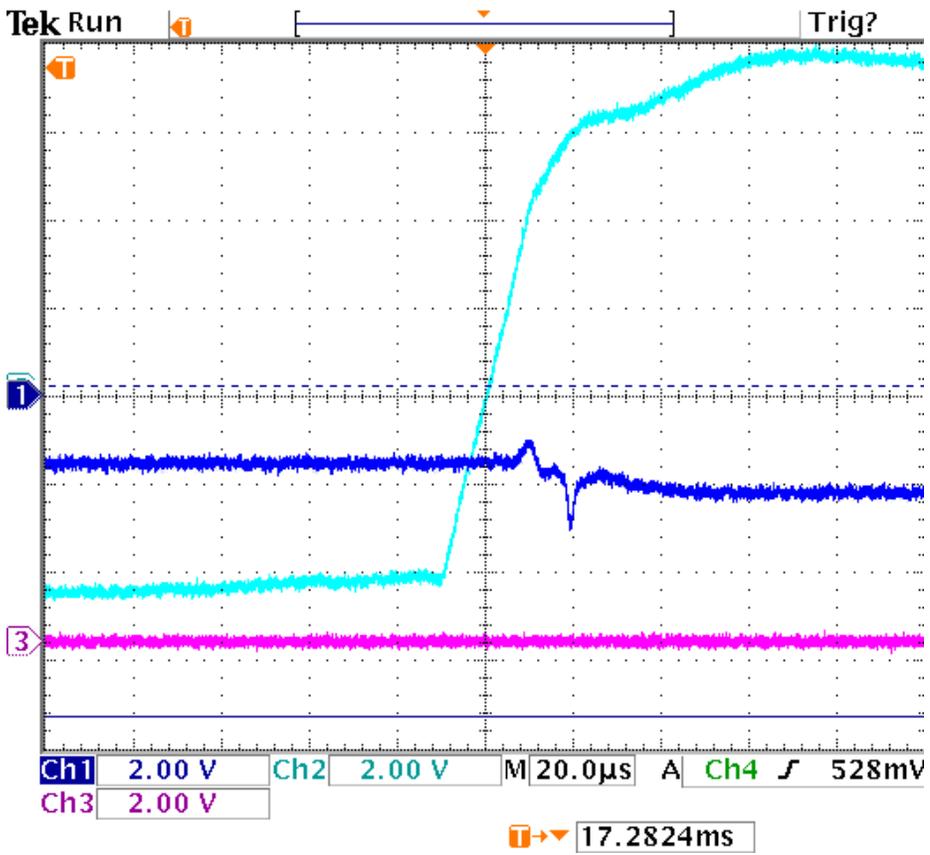


Figure II.13 A RF vs. B RF (CH 1), with beam, zoomed in at transition.

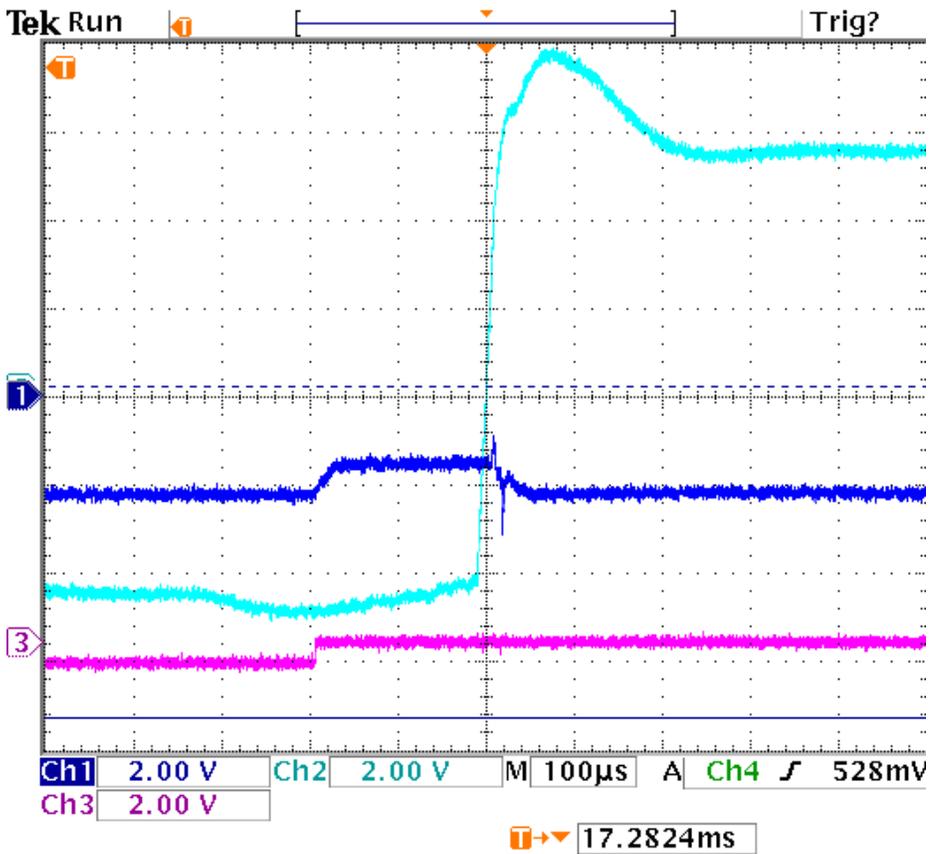


Figure II.14 A RF vs. B RF (CH 1), with beam, zoomed in at transition showing paraphase step.

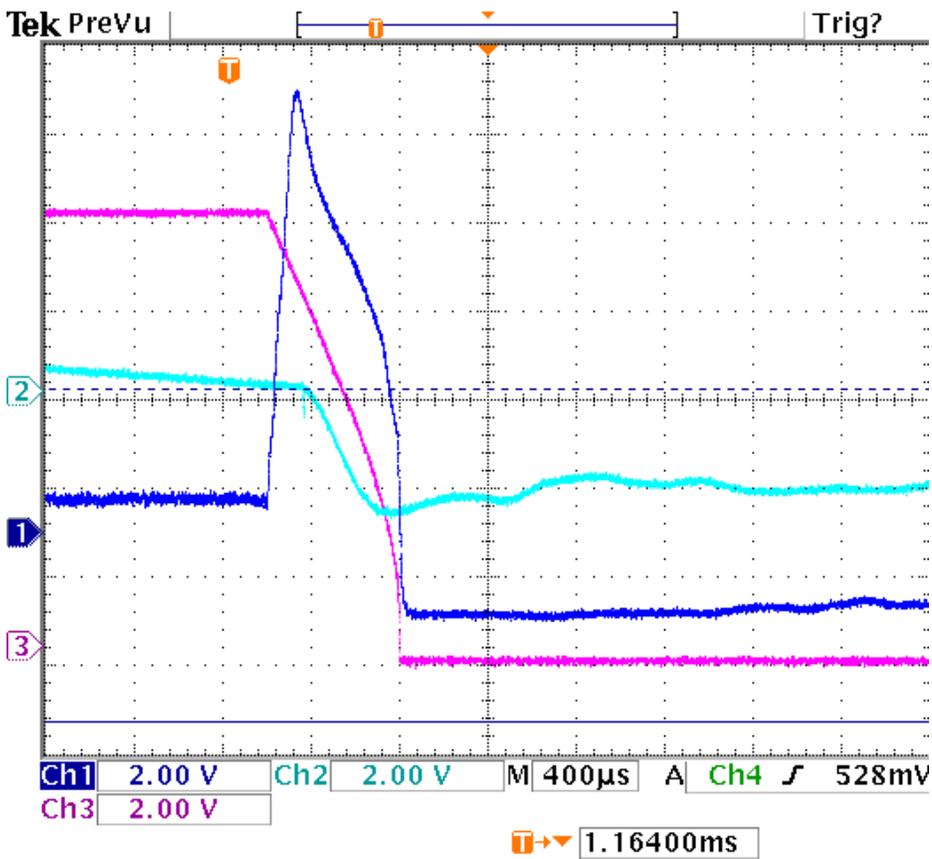


Figure II.15 A RF vs. B RF (CH 1), with beam, zoomed in at injection.