POSSIBLE RF-WIRE IMPLEMENTATION

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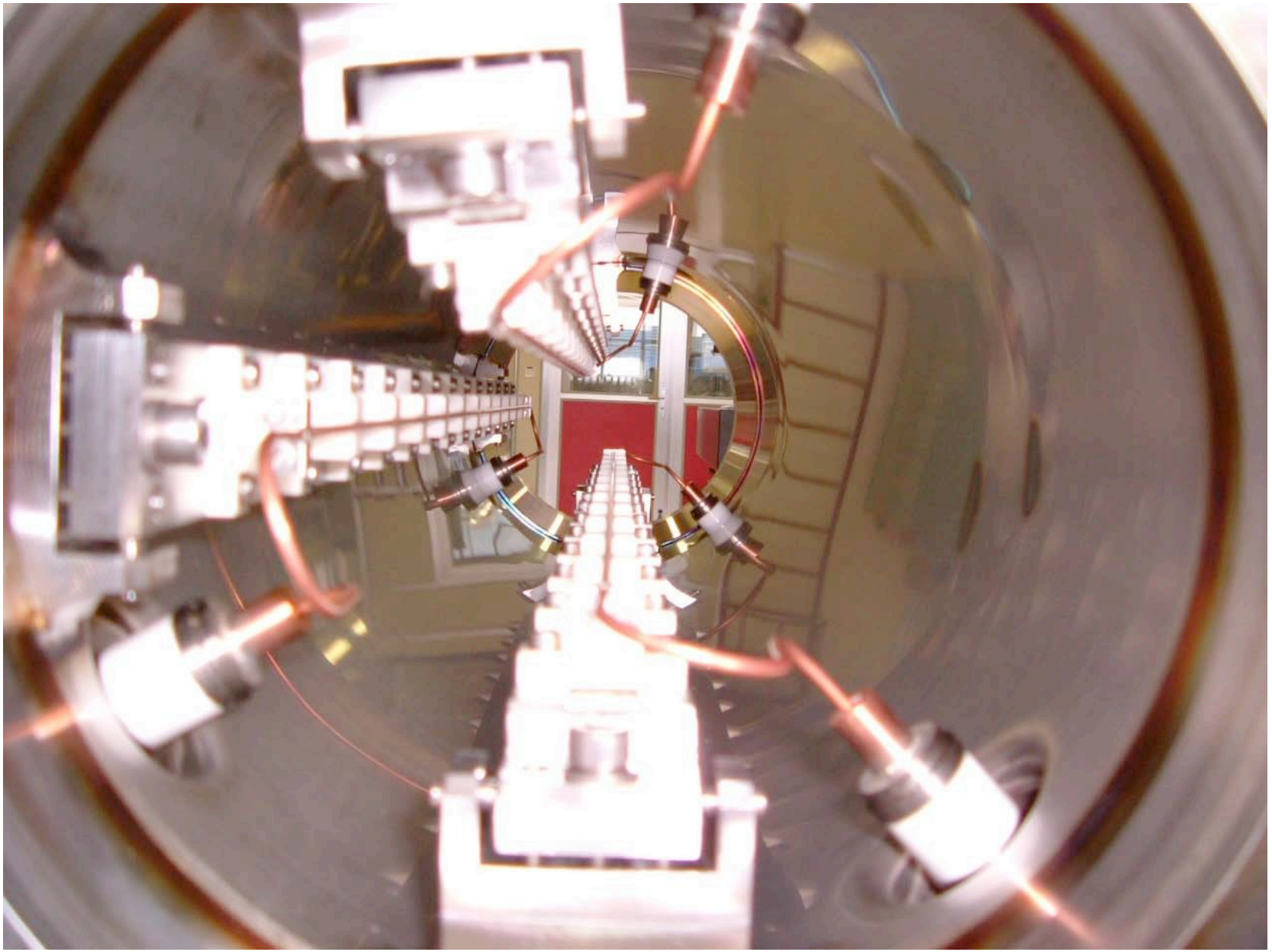
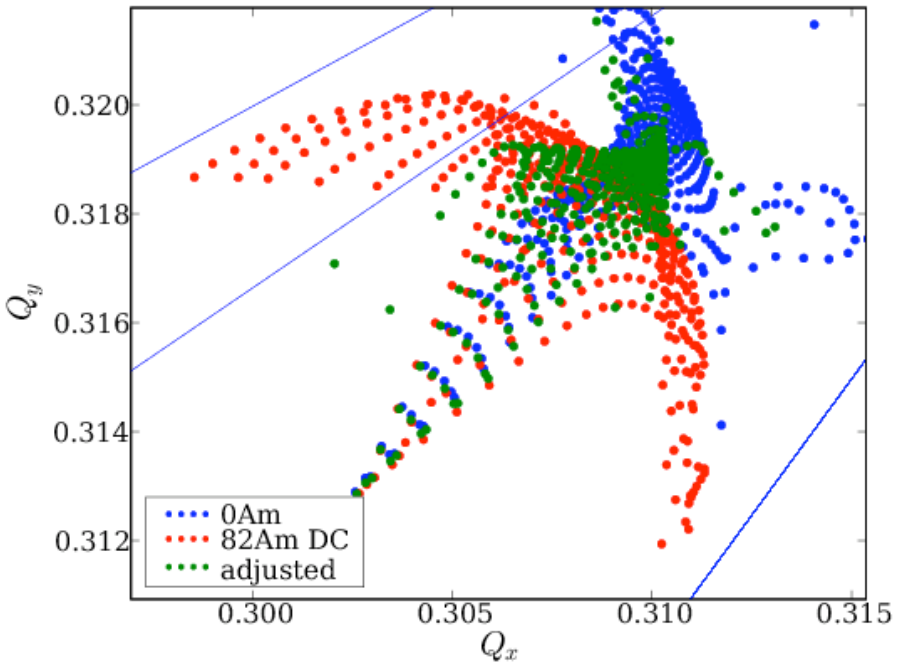
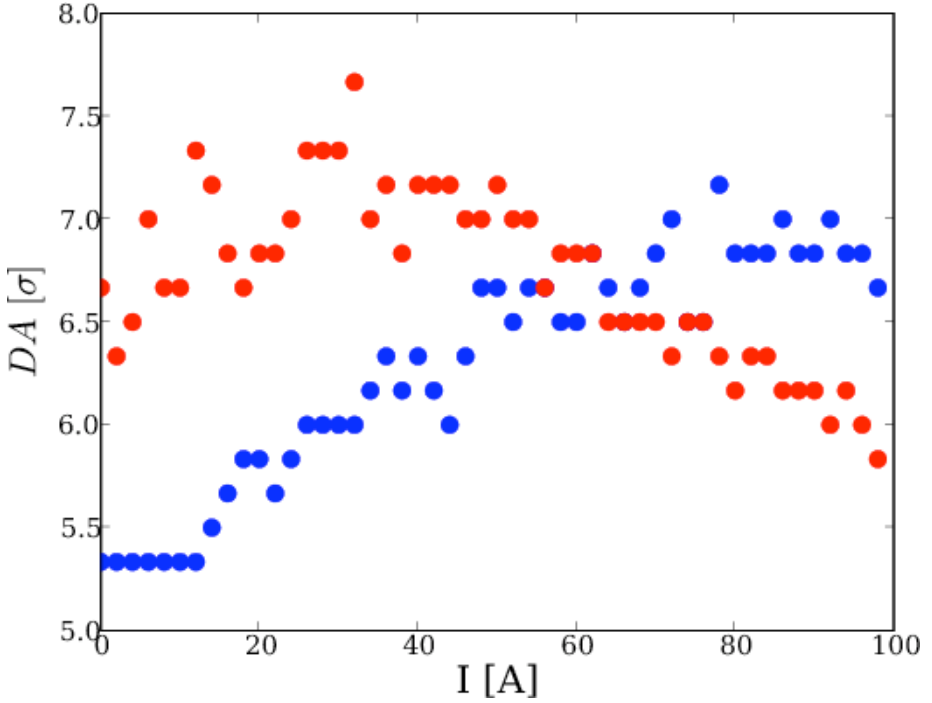
IF THIS IS A BBLR,



ADJUSTED COMPENSATION

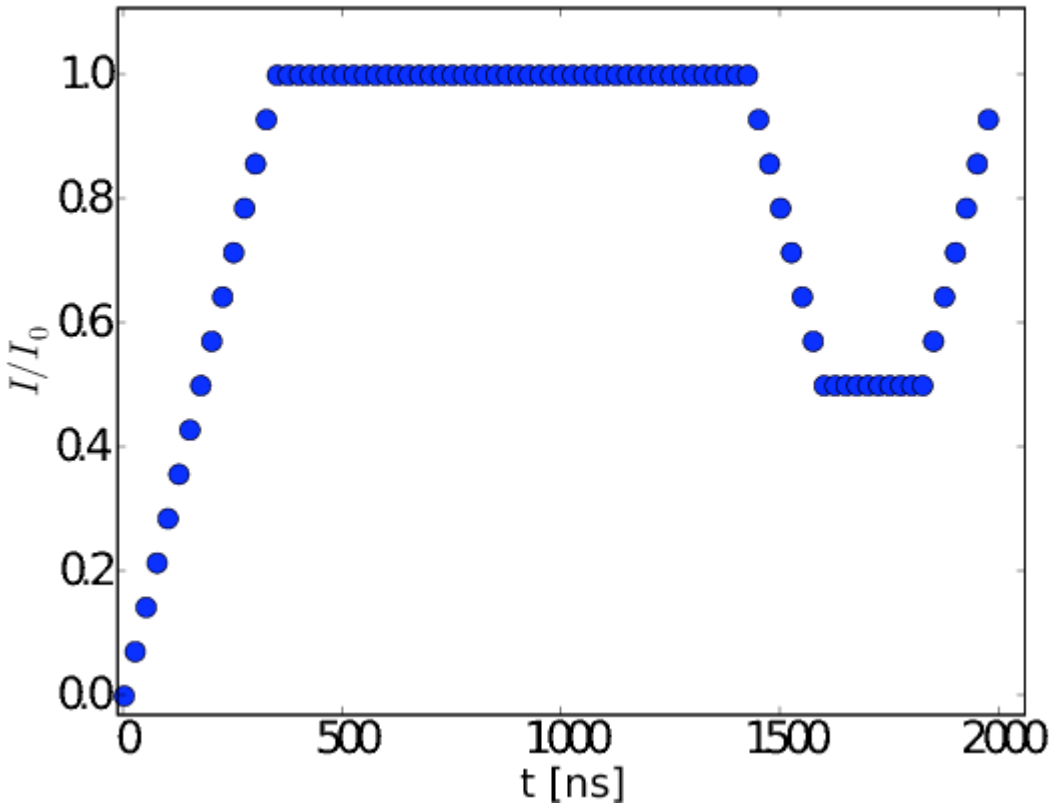
TO PERFECTLY COMPENSATE NOMINAL AND PACMAN BUNCHES ONE NEEDS TO CHANGE THE BBLR CURRENT.



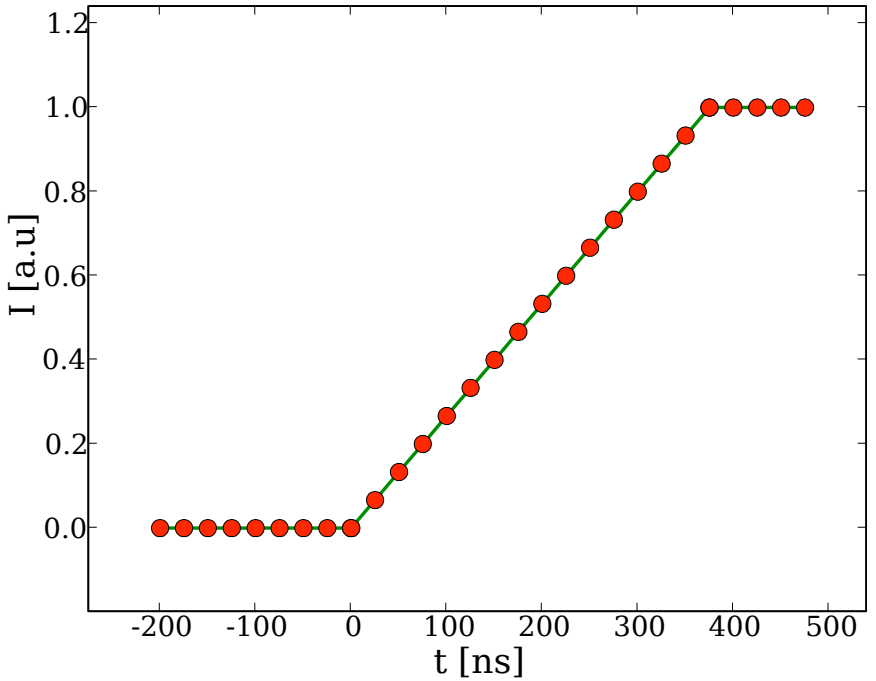


REQUIREMENTS

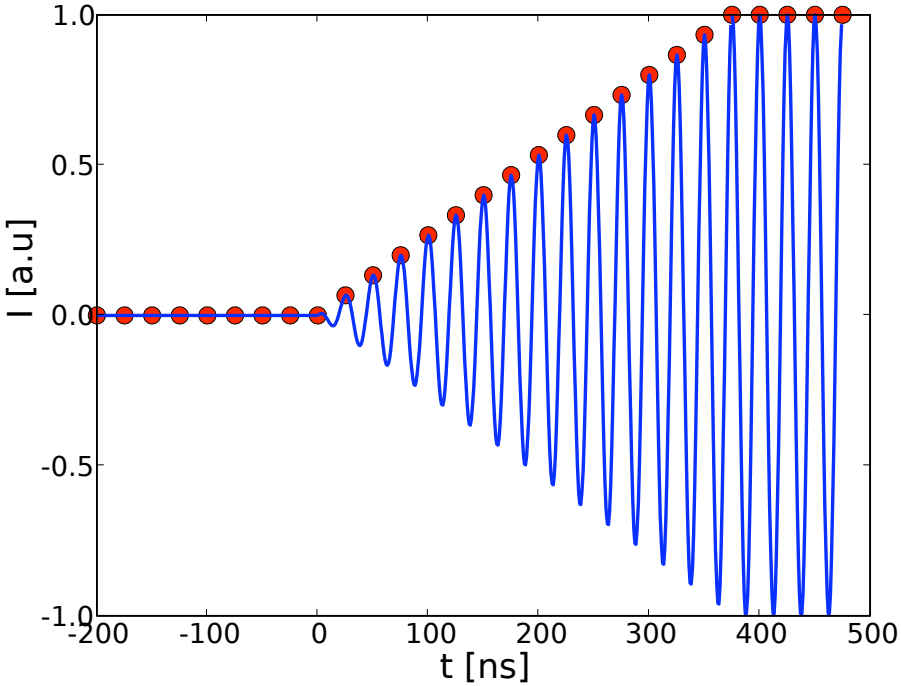
- Create a given field at a given time
- Do this very reproducable
- I ≈ 100A



WHAT IS A RF-BBLR?



Pulsed DC-BBLR

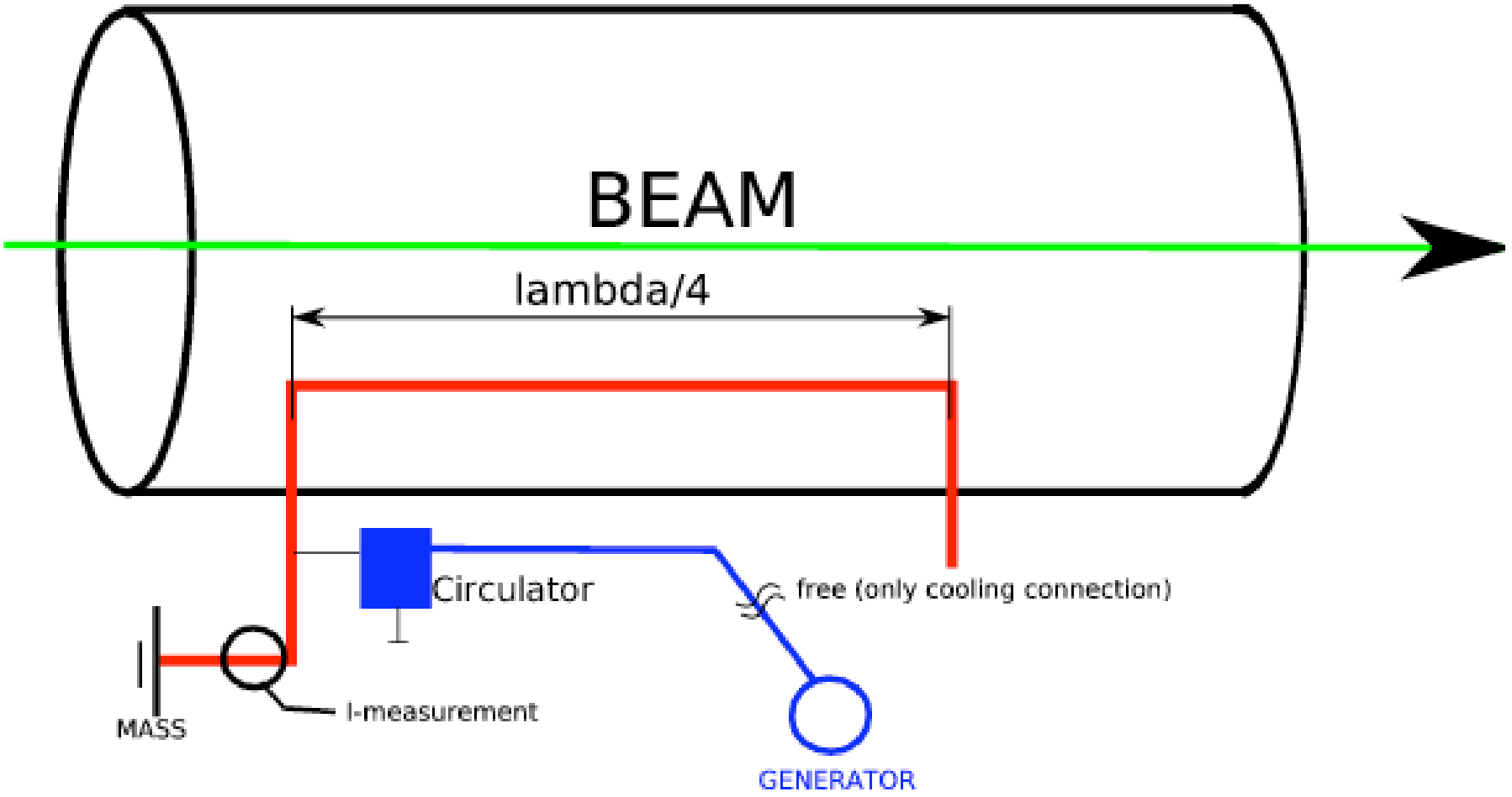


RF-BBLR

Disadvantaged of DC-BBLR

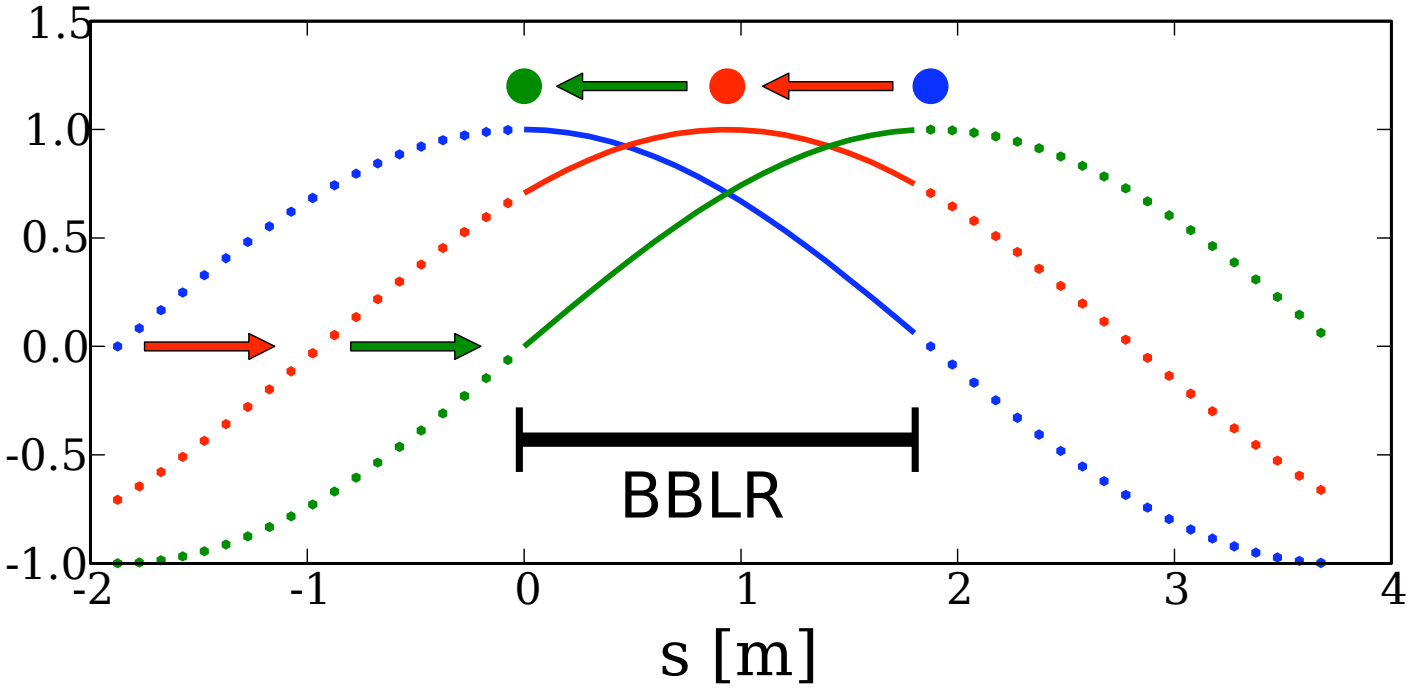
- Extreme timing precision requirements.
- Huge relative bandwidth over several decades
- Long cable to avoid active electronics (power generator) close to the beam
  - Skin effect in the long cable
  - Cable dispersion from DC to several kHz (characteristic impedance is complex and strongly frequency dependent)
- Generator impedance is also complex and very strongly frequency-dependent (possibly time dependent due to switching elements in the generator) → very difficult controllable multiple reflections over a wide frequency range between pulsed DC-BBLR and generator.
- No passive circulators from DC to MHz that can take the high power load.
- Field shielding issue
- Power requirements depend on termination.

RF-BBLR LAYOUT



Counter propagating EM-Wave

- L=λ/4 at 40MHz
- EM-Wave counter propagates bunch → bunch samples λ/2



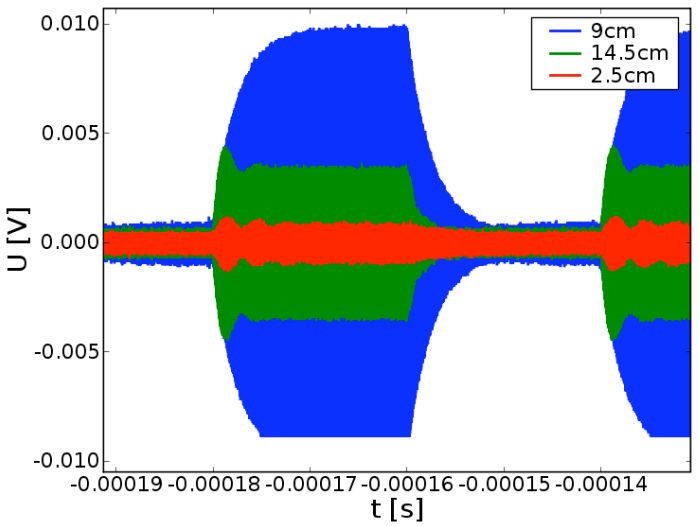
Advantages of the RF-BBLR

- It's a resonator
  - Well known technology
  - Low noise due to timing stability
  - Resonator gain depending on coupling (partially canceled by transit time effect)
- EM field → double effect, field shape exactly like at the LRBB encounters and only negligible deviated from 1/r shape
- Feedback possible (3turns delay)
- Can be mismatched at BBLR and matched at Power generator.
- Circulator is a complex device but seems feasible
- Reduced relative band-width (approx 1 Octave), thus better control of cable dispersion and matching.

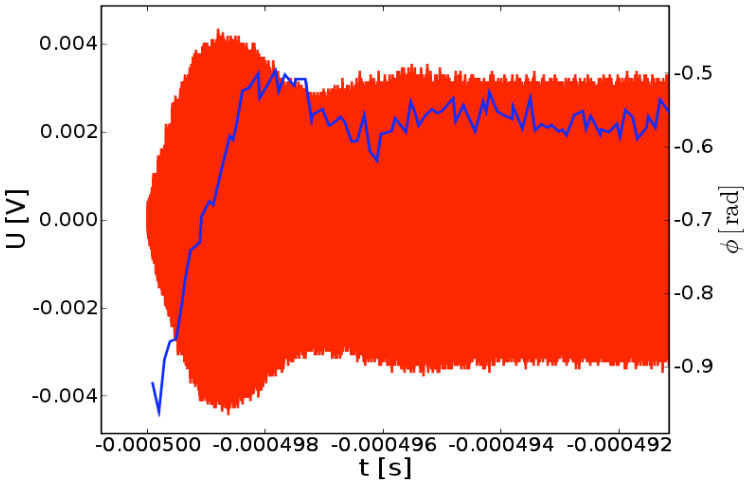
Resonator stuff

Coupling Strength defines the resonator gain.

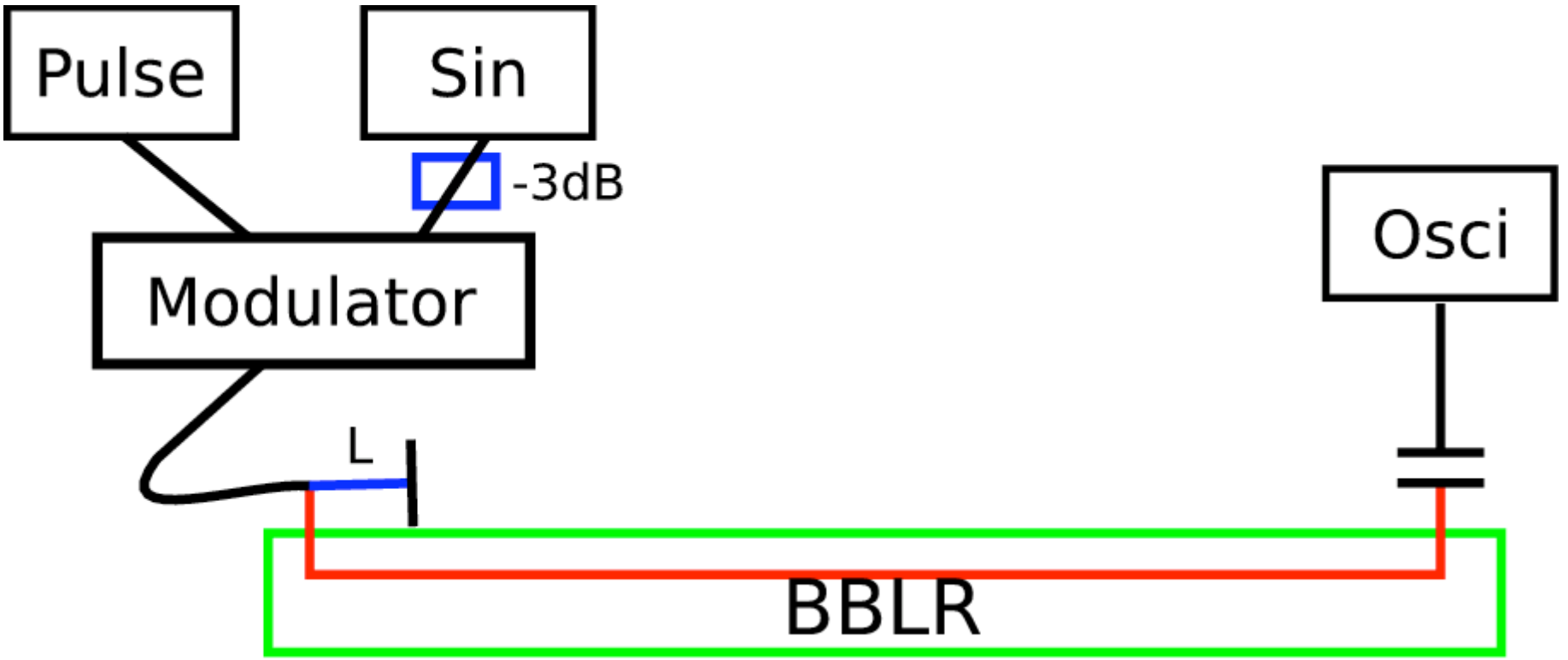
Trade off: power during ramp vs. power at hold



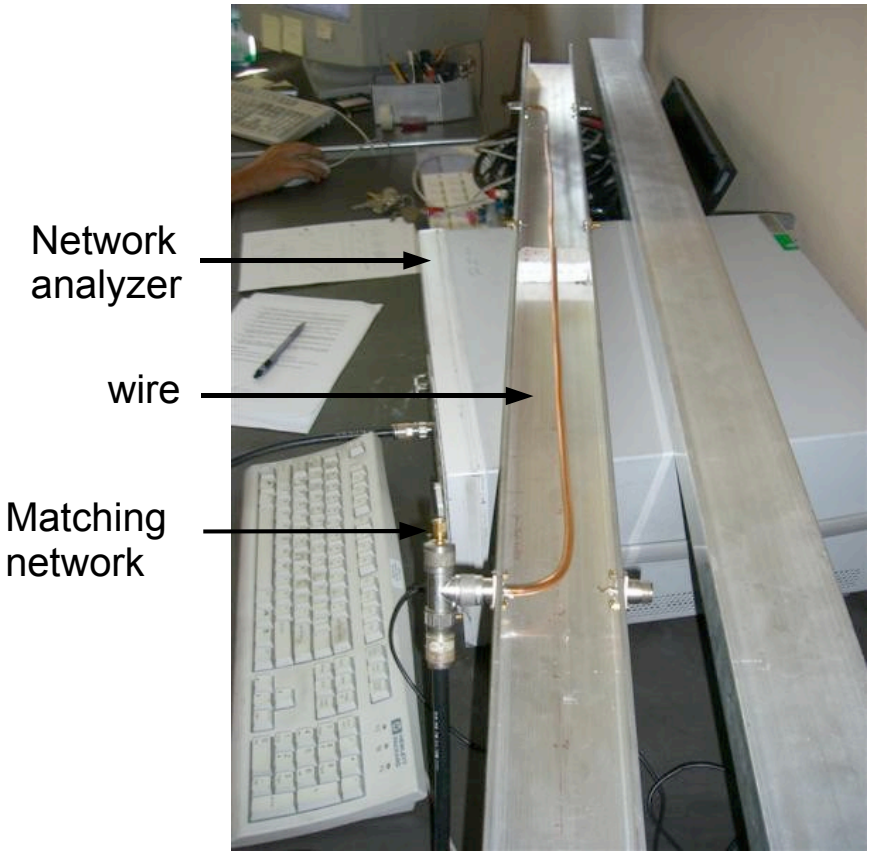
Phase slip during ramp must be compensated for. Like any other accelerating RF-system.



MEASUREMENT SETUP

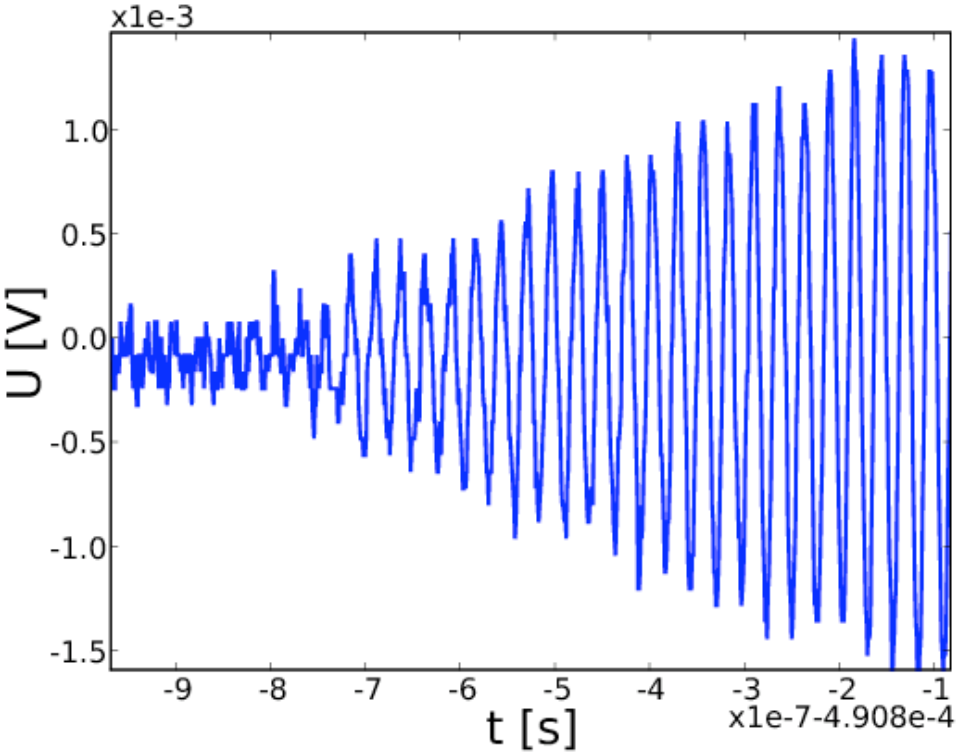


LOW-BUDGET IMPLEMENTATION

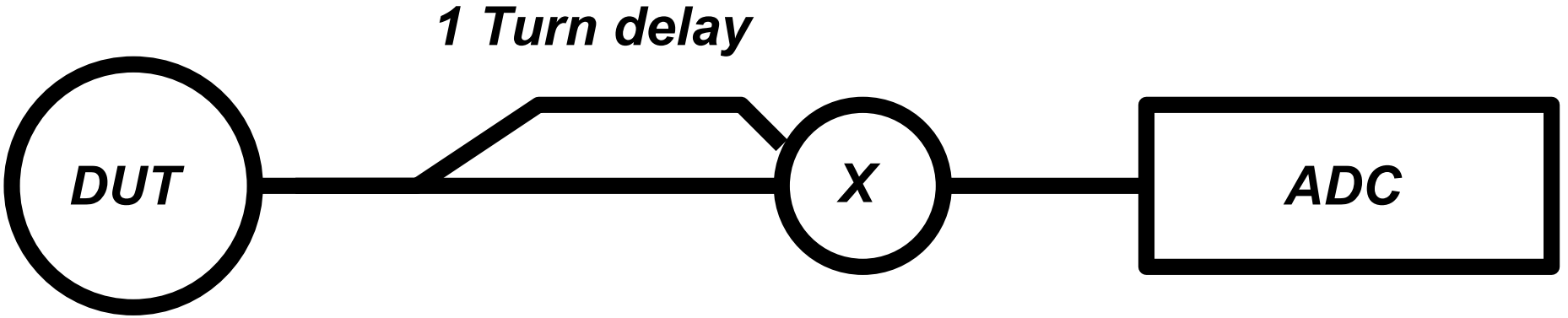


Setup

Measured Ramp



Phase-noise measurement



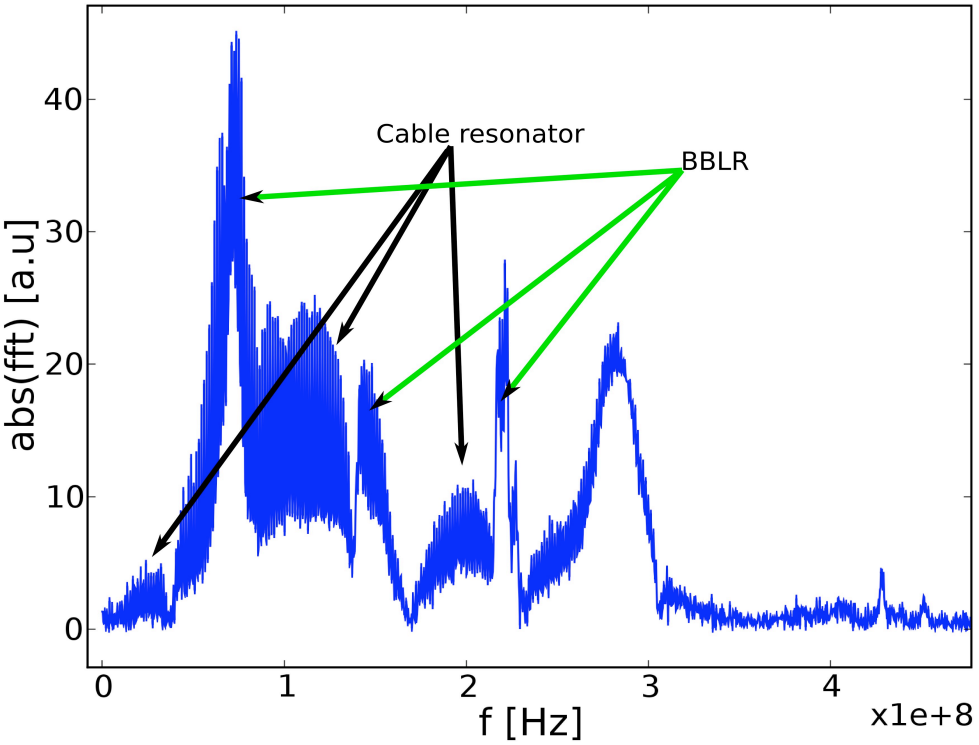
Allows to measure exactly the phase-noise seen by the bunches.

Delay by quartz filters or surface acoustic waves (electro optical converters to noisy, lumped RC to complicated)

Beam induced signal

- Field = generator + induced
- Must be measured and subtracted form applied signal
- Possible to correct for with RF-BBLR

Fourier spectrum of single bunch induced spectrum on SPS BBLR



Other Notes

- Longitudinal Effects might be an issue (as it's a dynamic device, the longitudinal kick at the two ends may differ)
- Alternatively use a RF generator with vacuum tube in the tunnel (radiation hard) → Short cables, No circulator required
- Timing Noise needs more studies (taking transit time into account)