RF acceleration with local k-index correction

2014. 02. 12　(3min)

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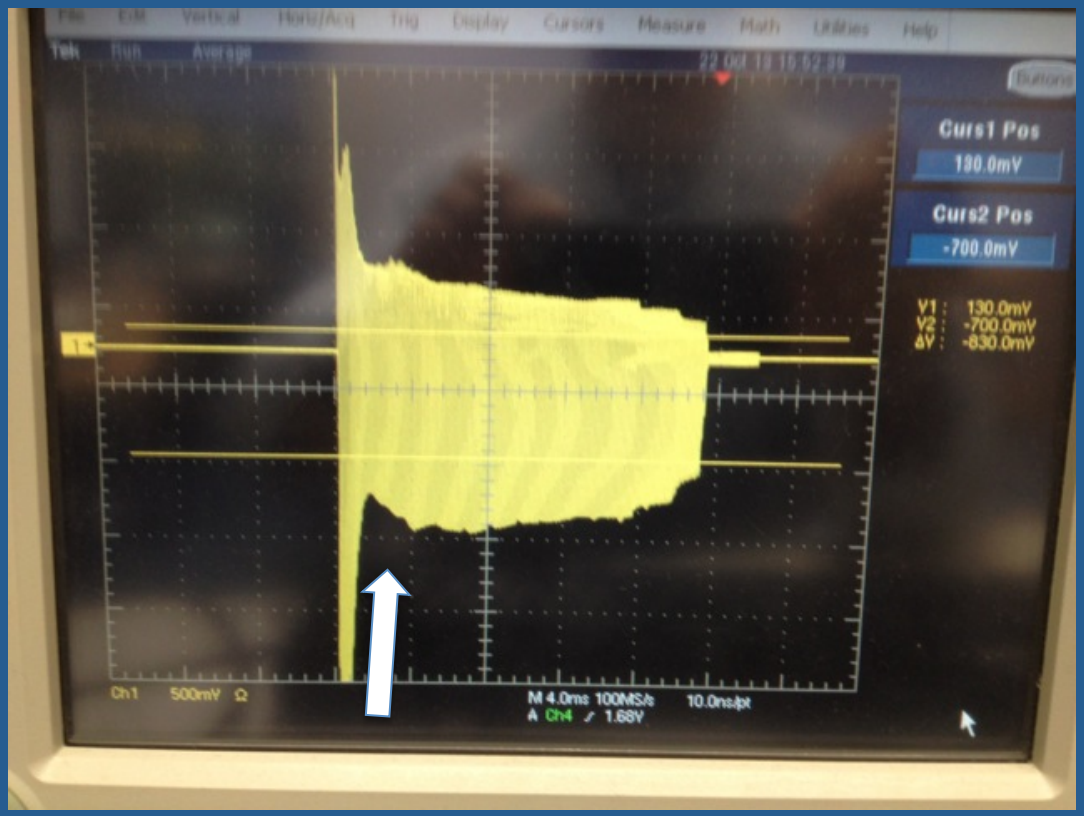
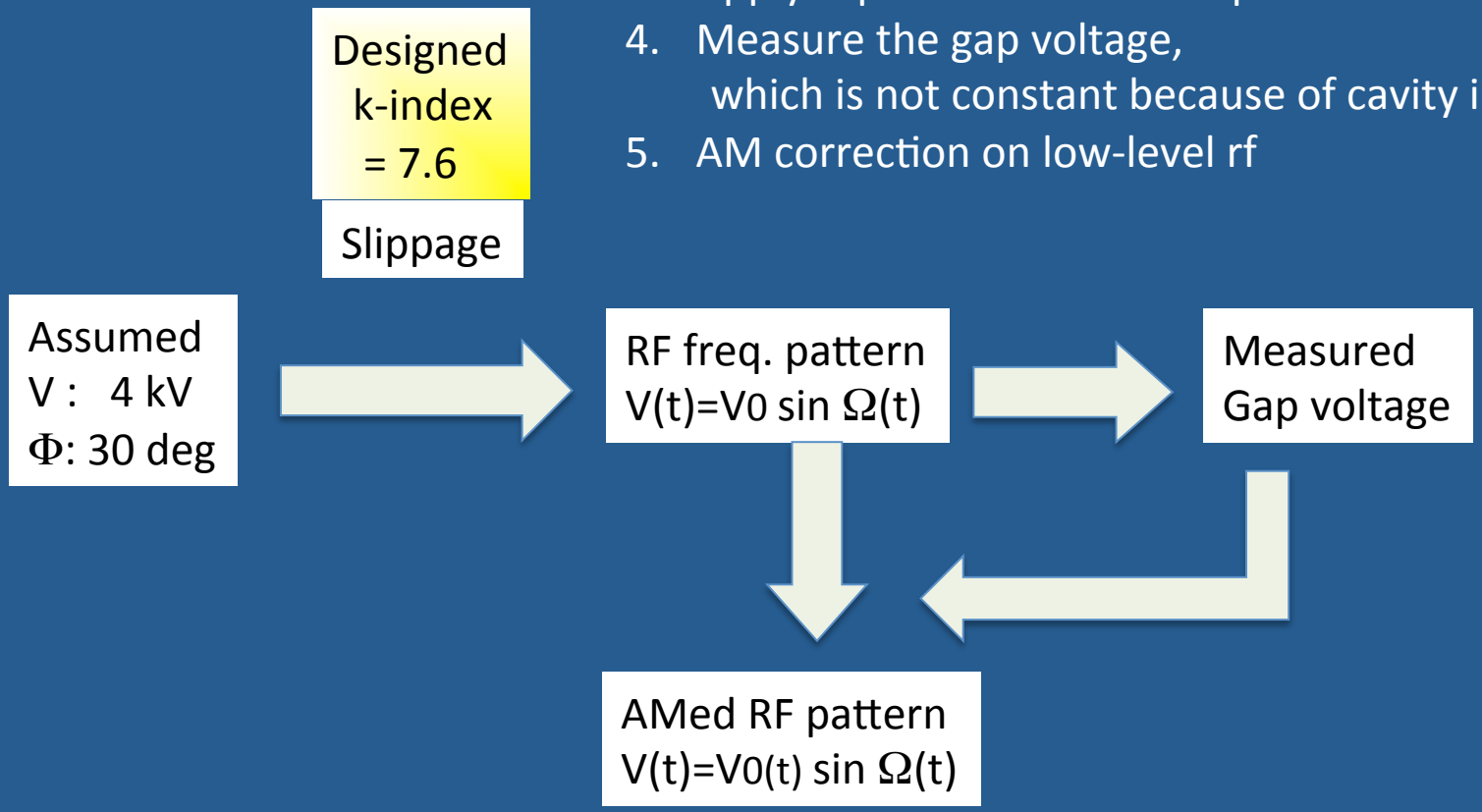
Fast loss at injection energy



Longitudinal loss ?

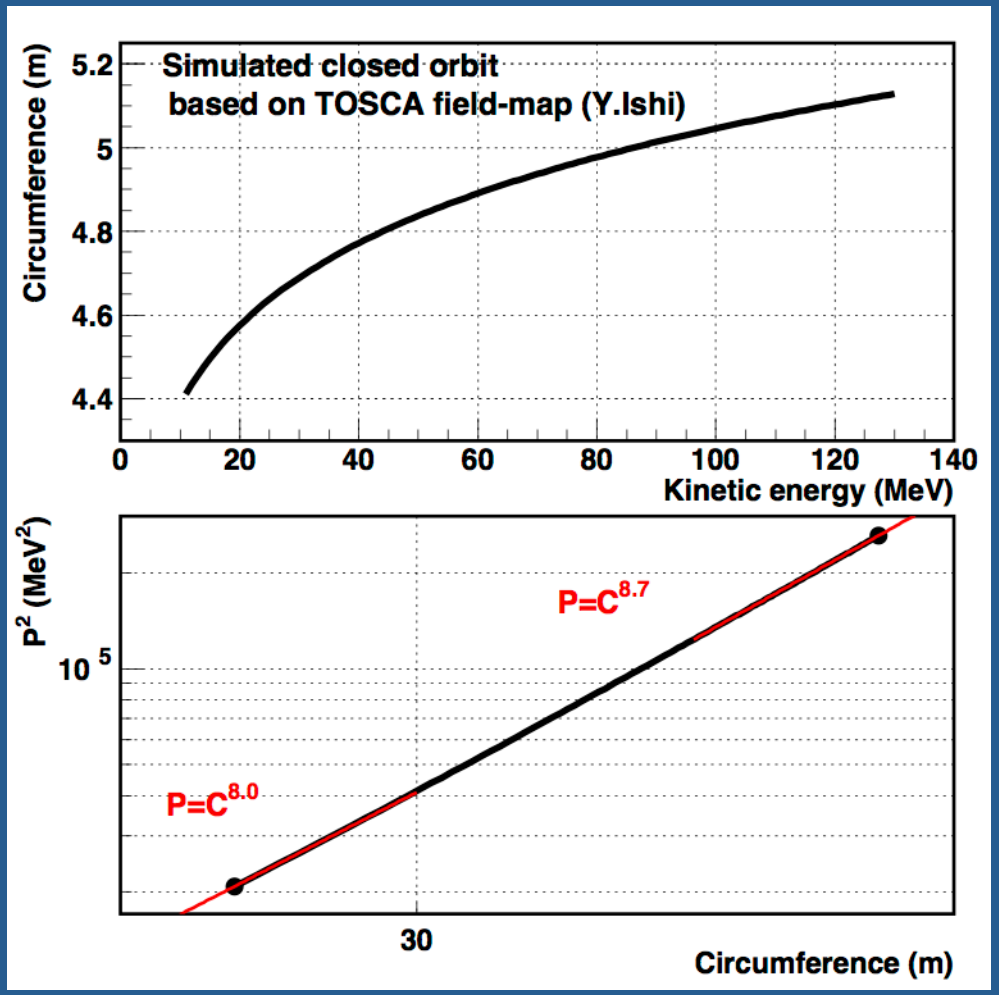
Normal rf pattern

1. Assume Constant amplitude and accelerating phase
2. Derive rf frequency pattern f(t) = …..
   (k-index = 7.6)
3. Apply rf pattern into the amplifier
4. Measure the gap voltage,
   which is not constant because of cavity impedance
5. AM correction on low-level rf



k-index is not constant (imperfect scaling) in reality !

Local k-index in our FFAG MR

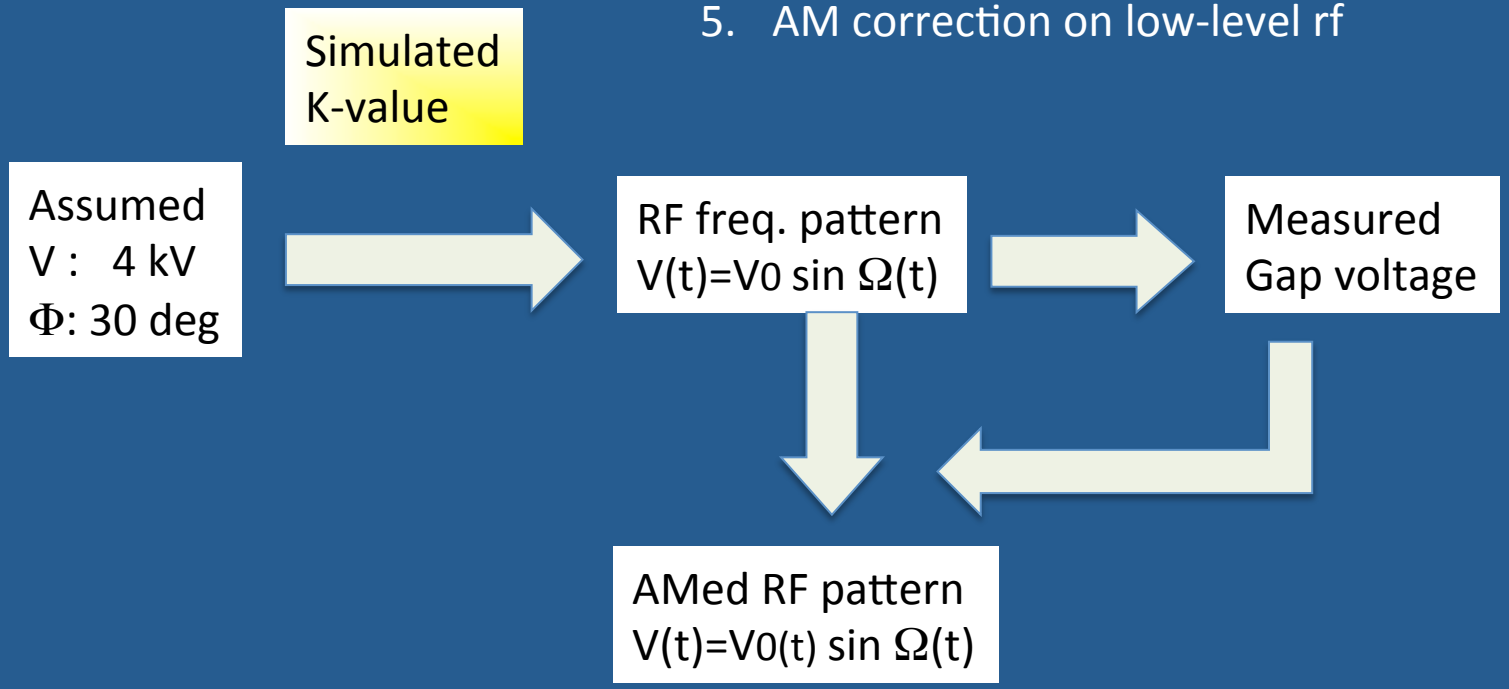


k-index is not constant of particle energy

(lower at lower energy region)

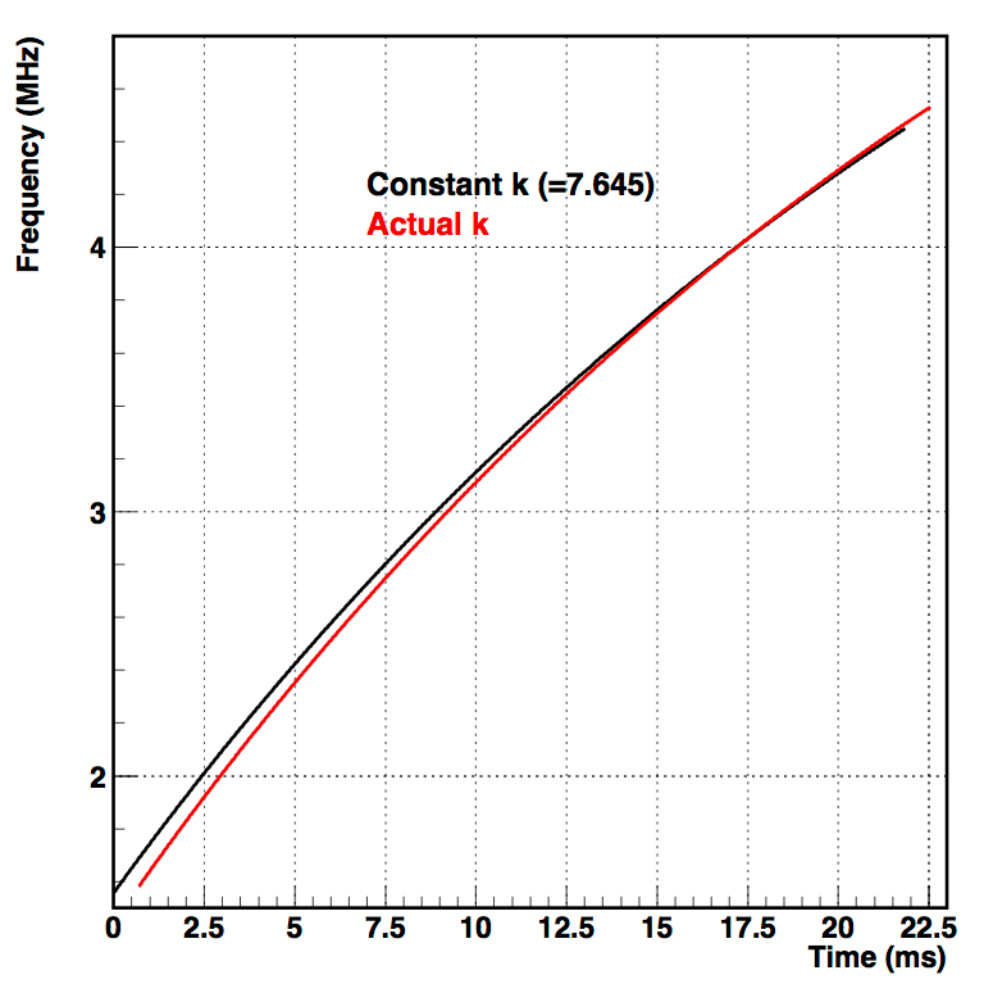
Improved pattern

1. Assume Constant amplitude and accelerating phase
2. Derive rf frequency pattern f(t) = …..
   by simulation
3. Apply rf pattern into the amplifier
4. Measure the gap voltage amplitude,
   which is not constant because of cavity impedance
5. AM correction on low-level rf

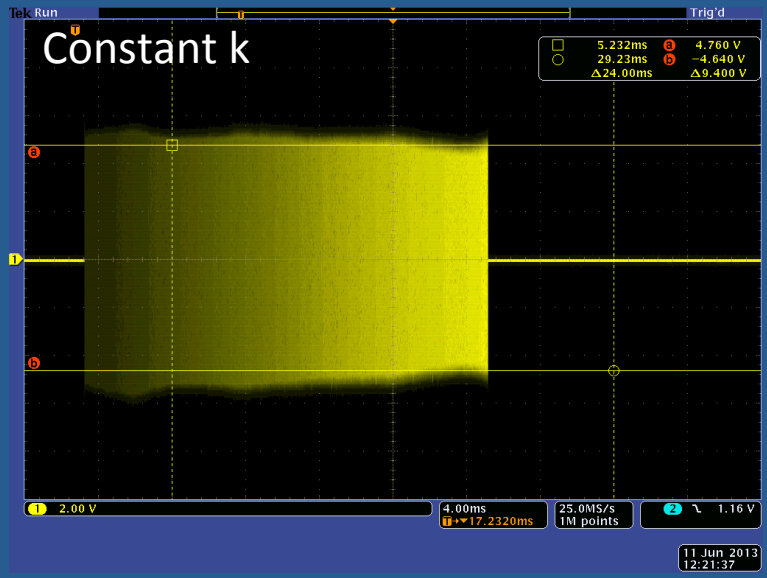


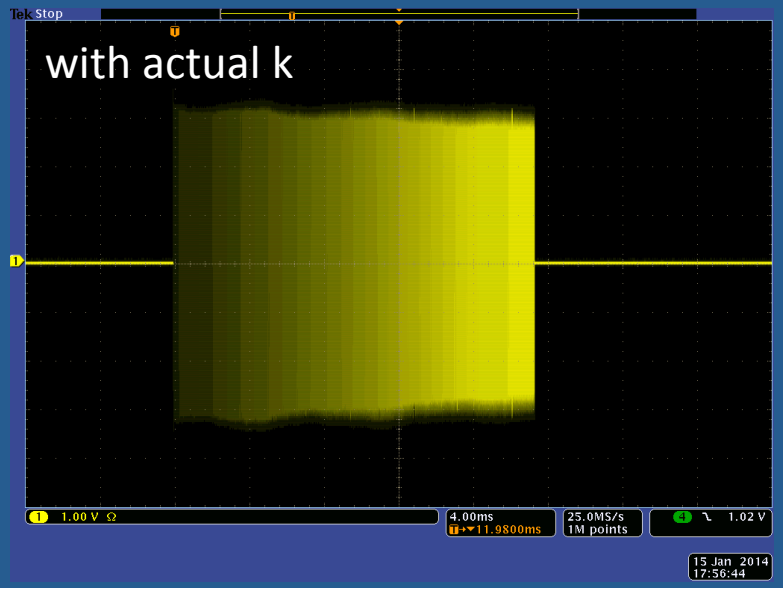
Frequency difference

Frequency pattern



Gap voltage (after AM)



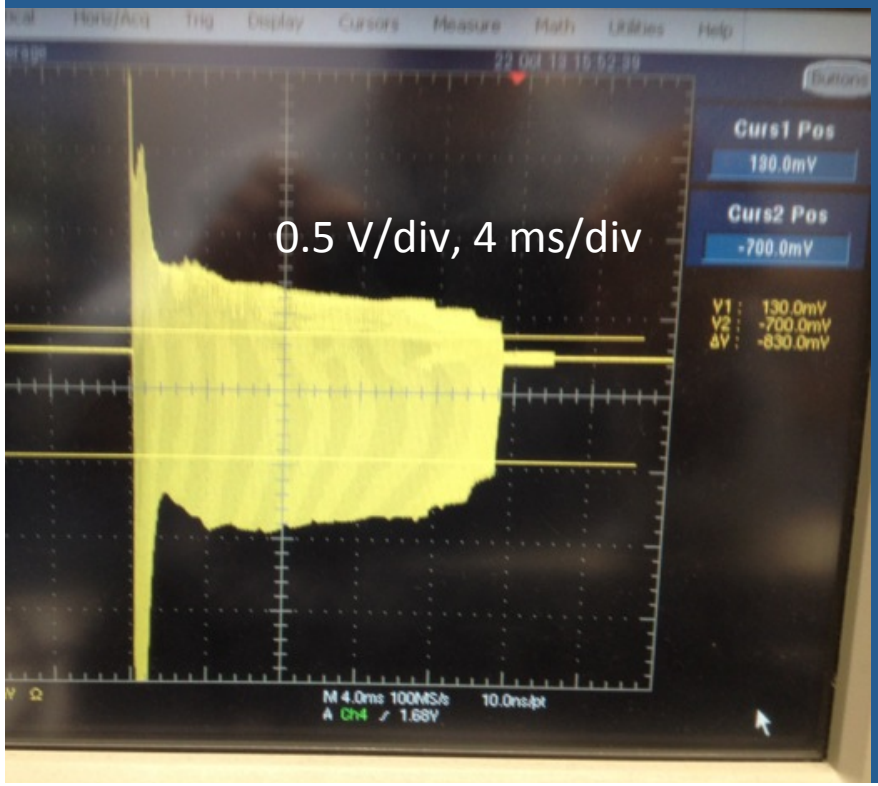


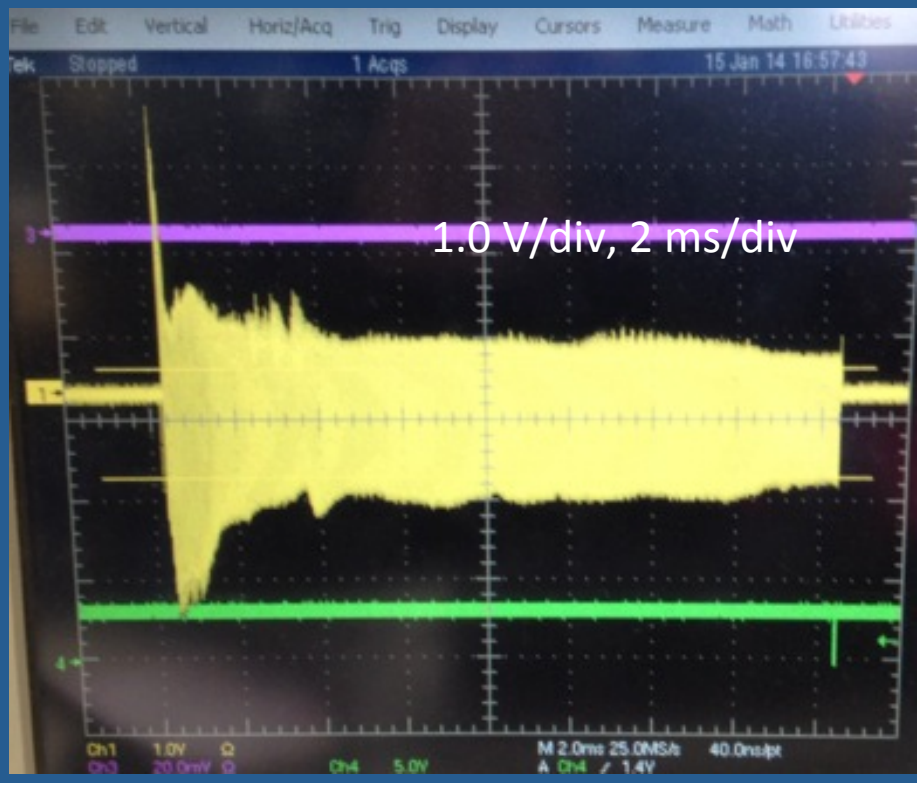
Results

The initial beam loss has been improved .

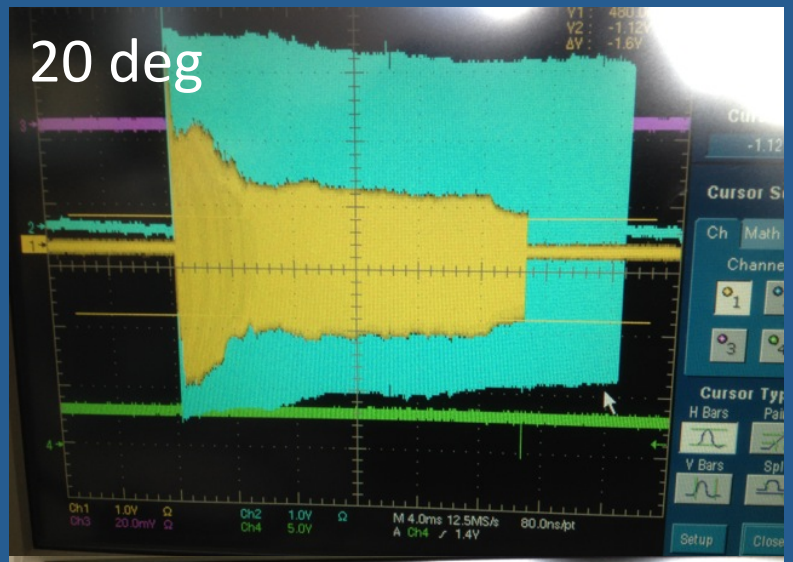
CONSTANT K

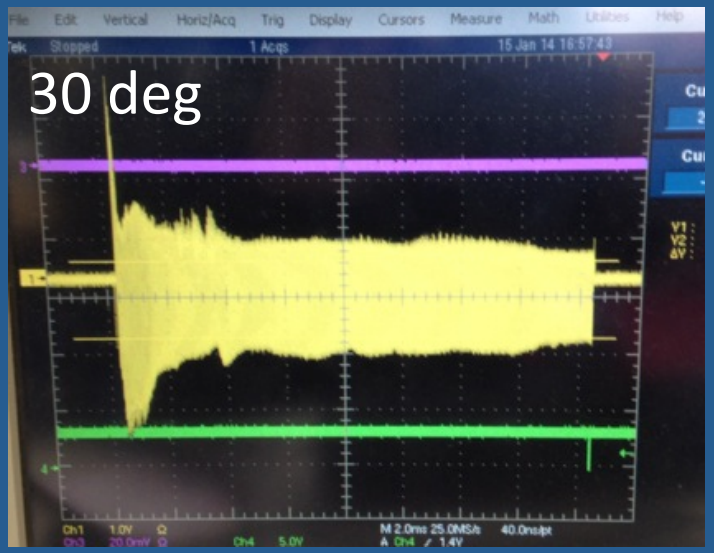
VARIABLE K

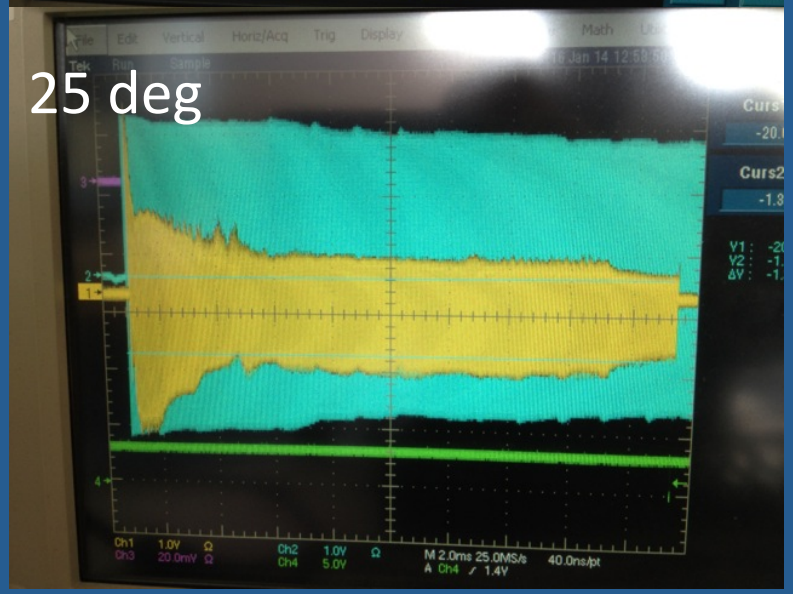


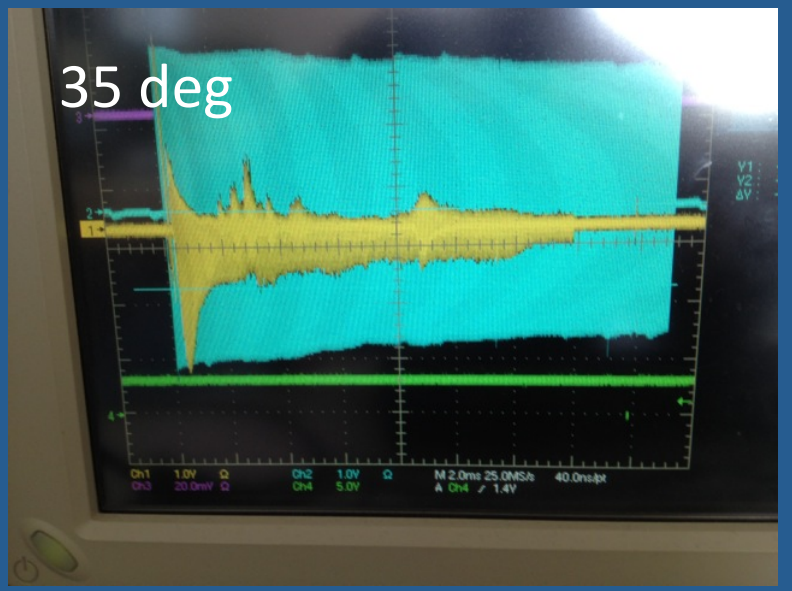


Best Phi_s ; 20deg?



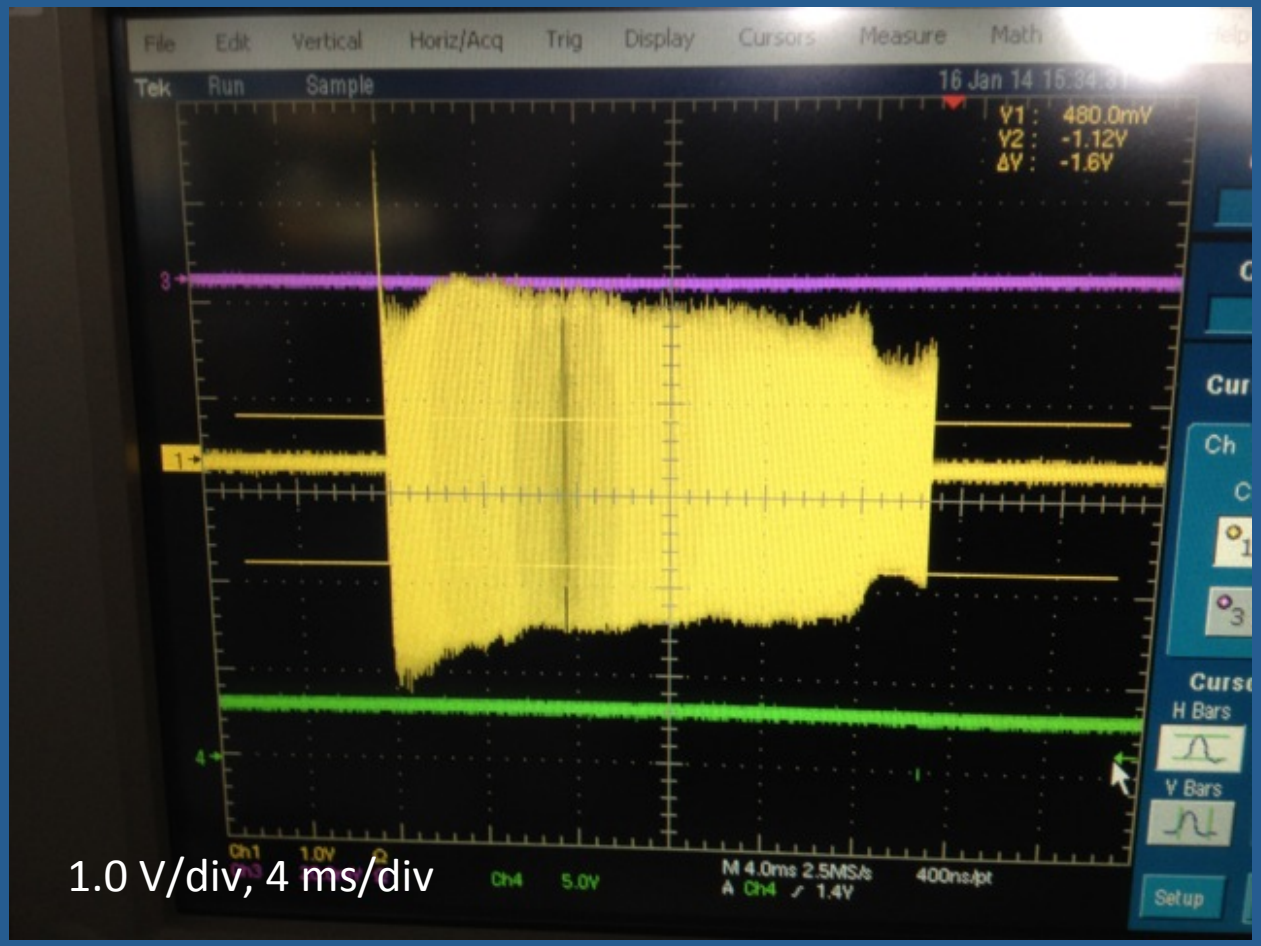






BEST

Φs =20 deg, Beam-transport line was optimized,



1.0 V/div, 4 ms/div

SUMMARY

- Fast beam loss at injection energy was improved by correcting rf frequency pattern using simulated k(E).
- More precise correction should be done by measuring k(E).