

FY17 Landau System Update

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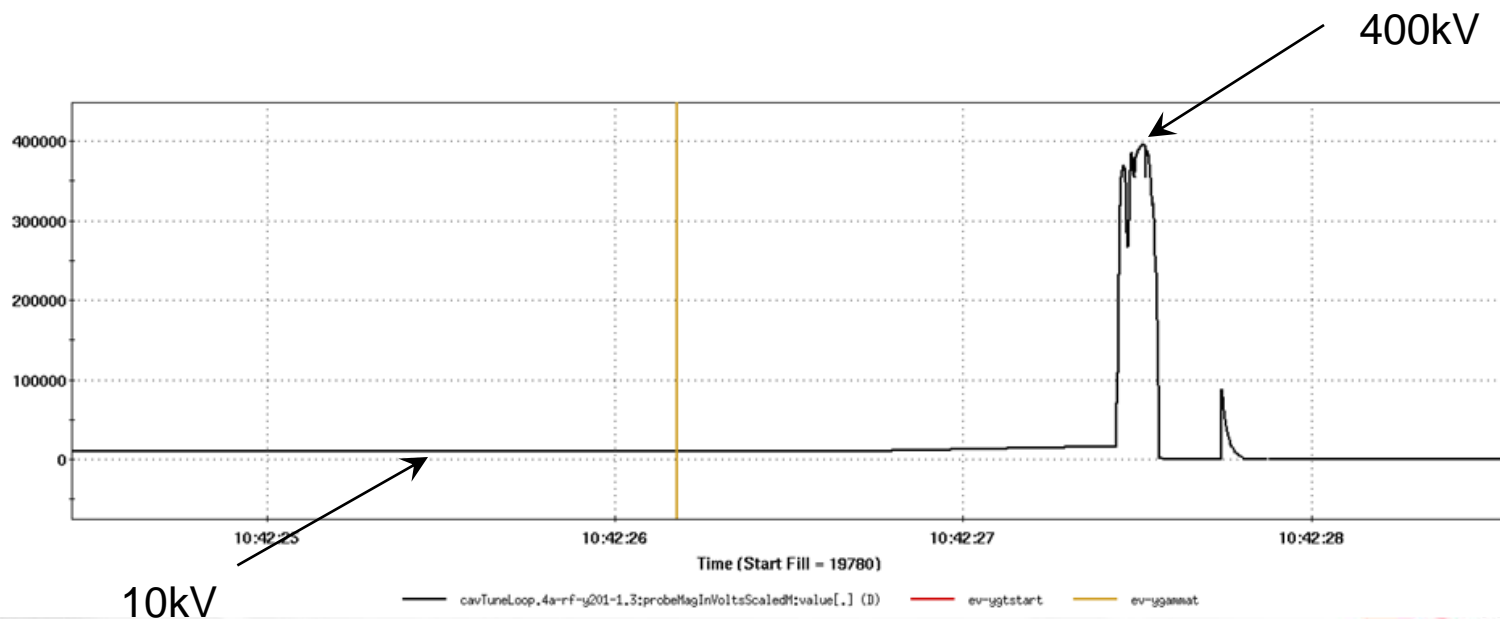
70 YEARS OF
DISCOVERY

A CENTURY OF SERVICE



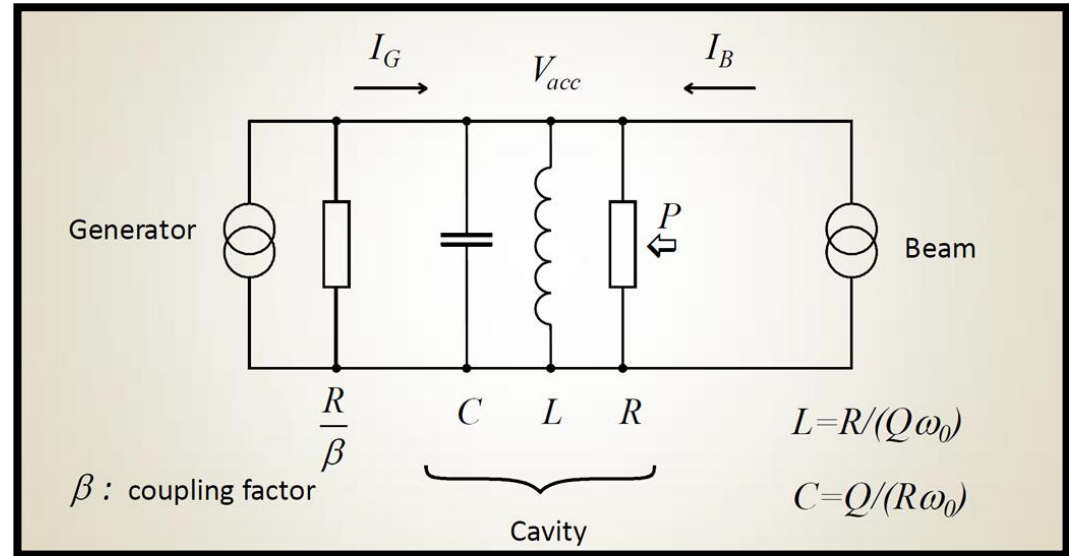
Landau Cavity issues with higher beam intensities

- Beam Loading
 - Beam current “overpowers” the cavity
 - Over 400kV induced on the gap by the beam
 - 10kV command from the LLRF



Possible solution using existing hardware

- Existing configuration is critically coupled ($\beta = 1$)
- Rotating the drive loop will increase the coupling factor to a potential $\beta=6$



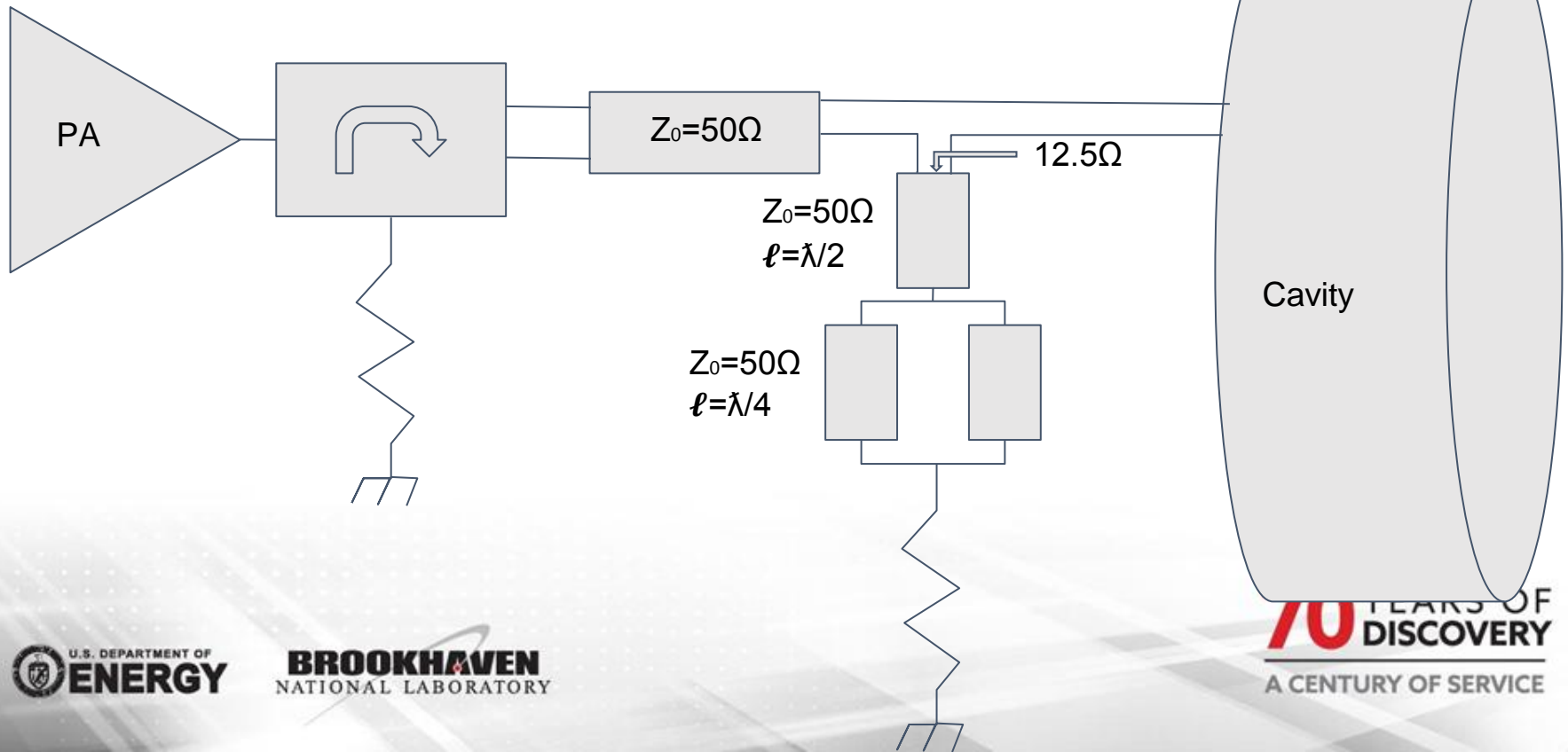
β of 6 coupling factor will potentially reduce the effect of the beam on the cavity by a factor of ~ 4 allowing us to run higher intensities

Chosen Solution: External Loading Network

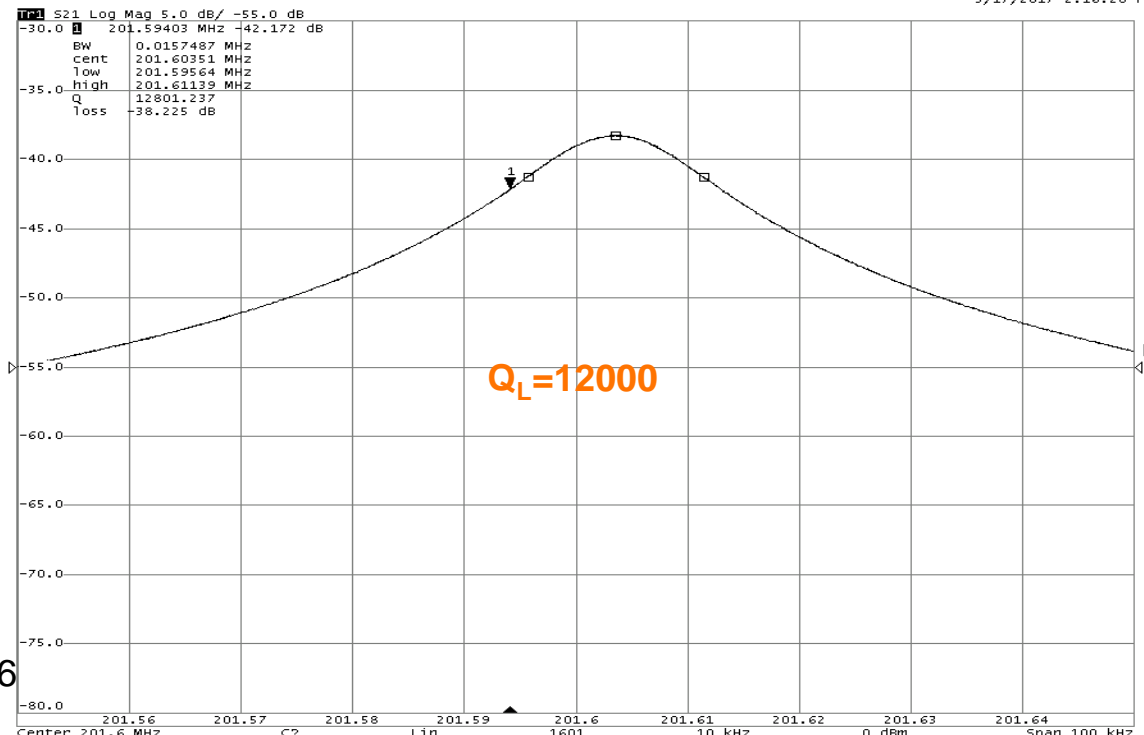
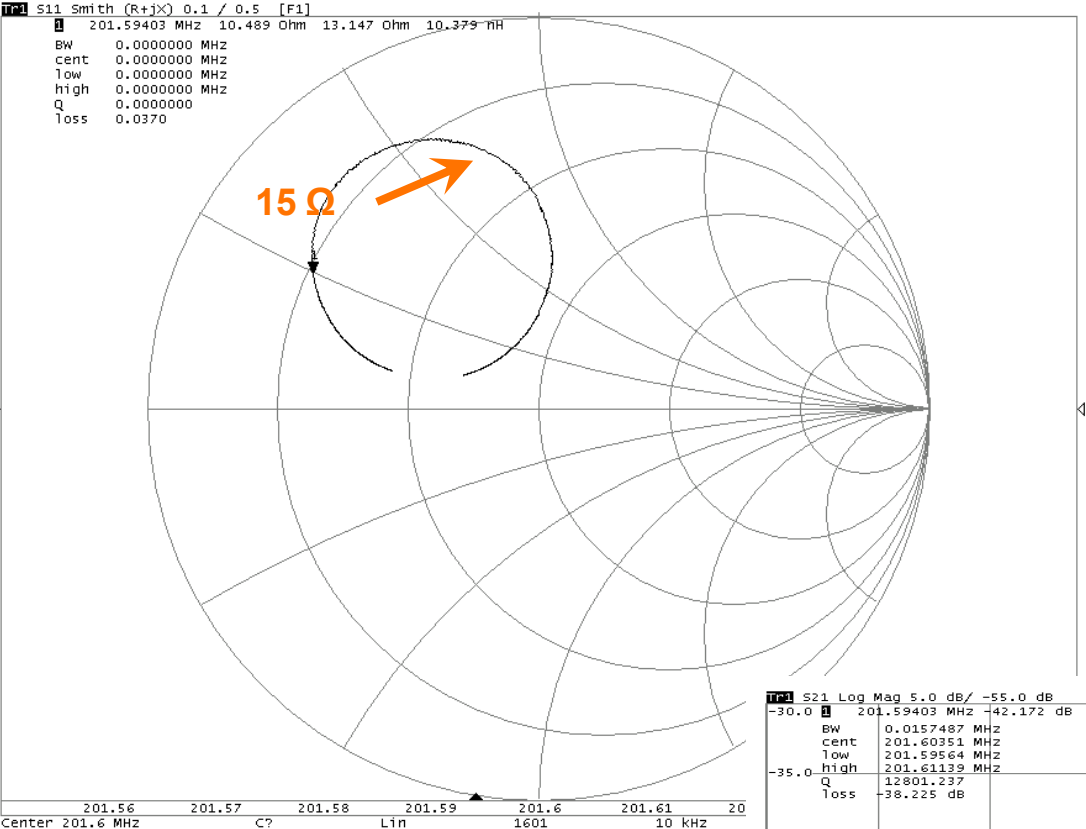
- No vacuum work required
- Can modify impedance on the fly
- Reduces stress on existing circulator
- Made from off-the shelf components

External Loading Network

Parameter	Critically Coupled	Ideal Externally Loaded
β	1	5
Q_L	22,000	8,000
R_{SL} (M Ω)	3.63	1.21
Z_{in} (Ω)	50	10
FFB Gain (dB)	40	33



Measured Parameters

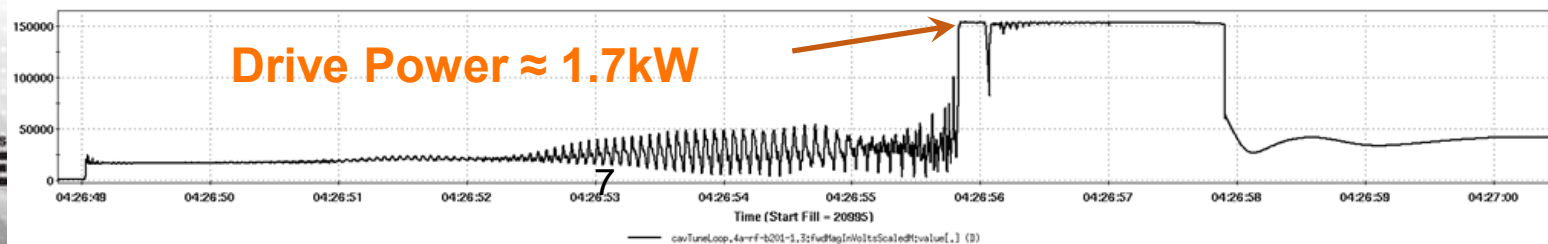
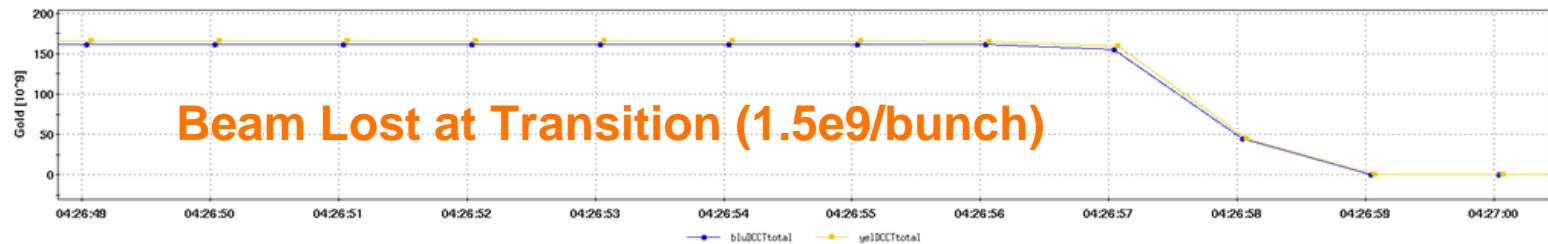


- Network not yet fully optimized
- β only 2.6

Blue Landau System FY17 Au Run

• Early Au Run Performance

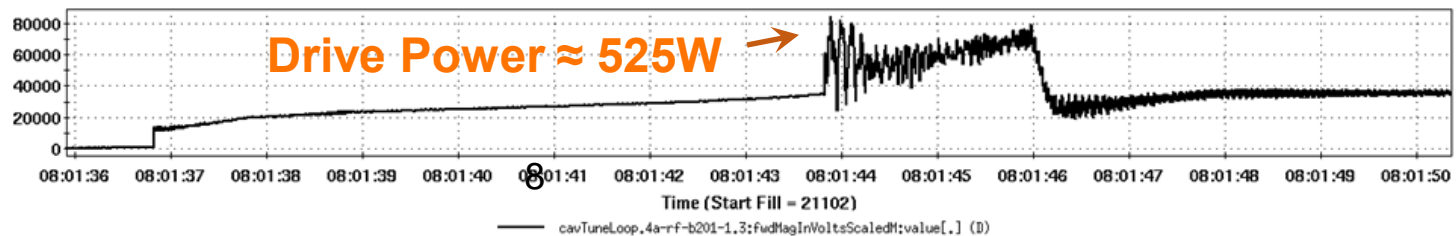
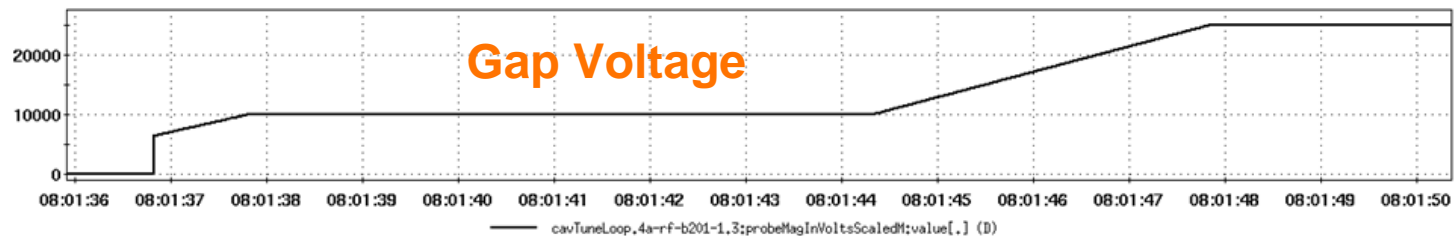
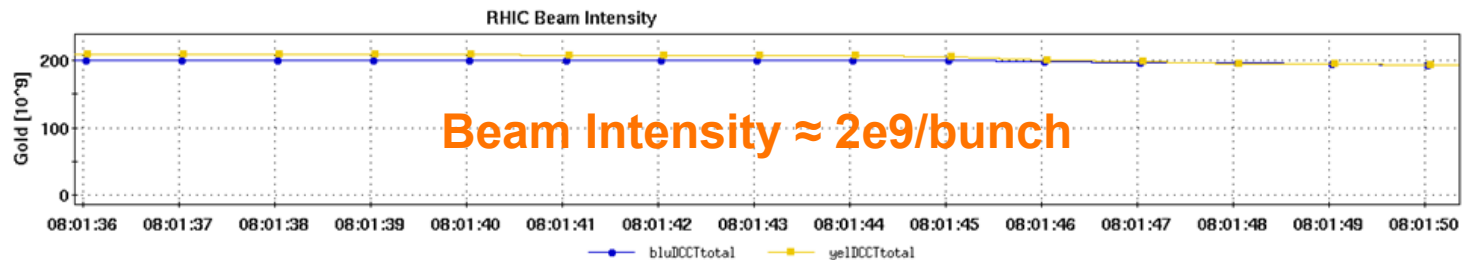
- At the higher intensities the landau cavities were tripping at transition causing beam aborts.
- After both cavities were optimized the Blue Landau continued to struggle with the blue rings transient beam loading at transition.



Blue Landau Optimization

- Machine Development (6/8/17)

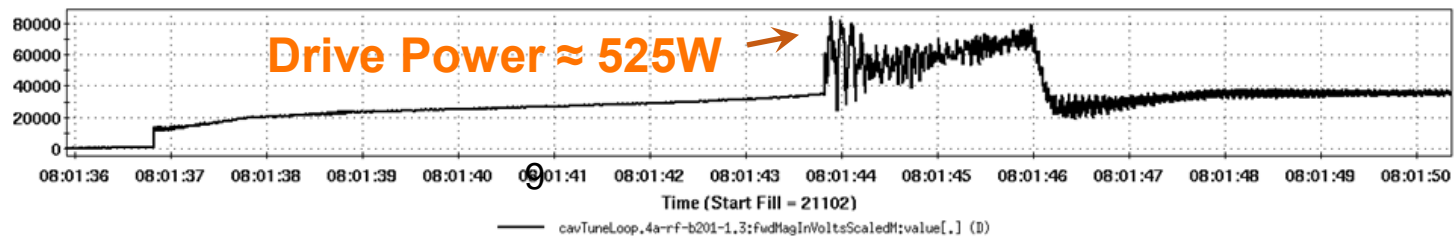
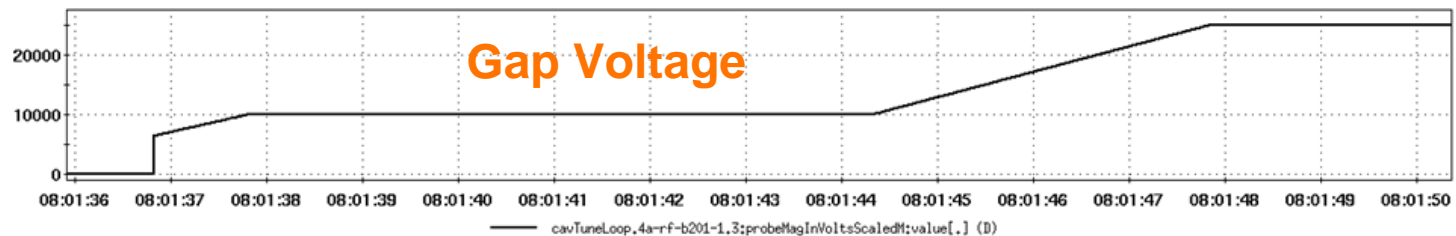
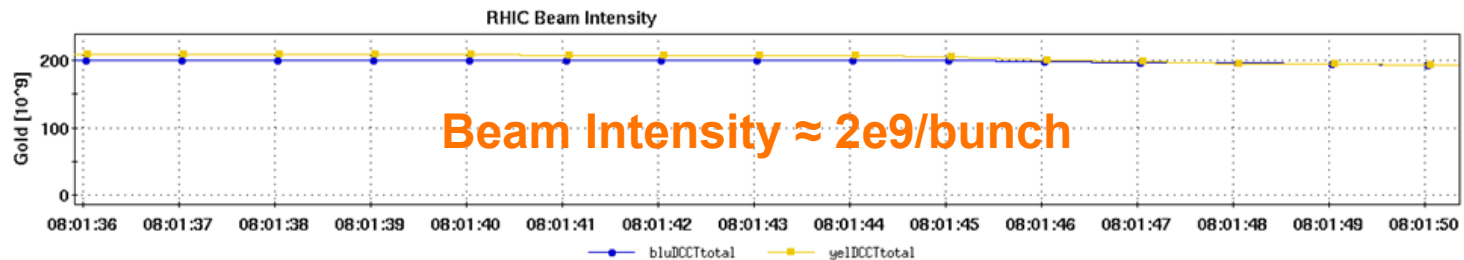
- After much system performance characterization, it was concluded that the source of gap voltage non-compliance was due to early saturation of the systems fast feedback loop and subsequently the IQ loop.



Blue Landau Optimization

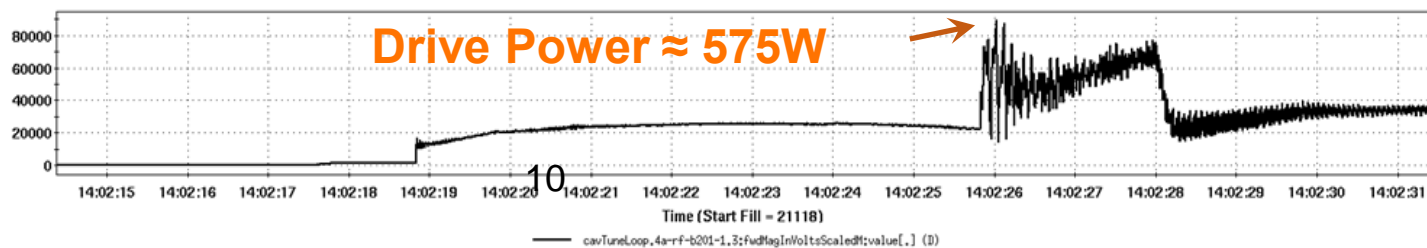
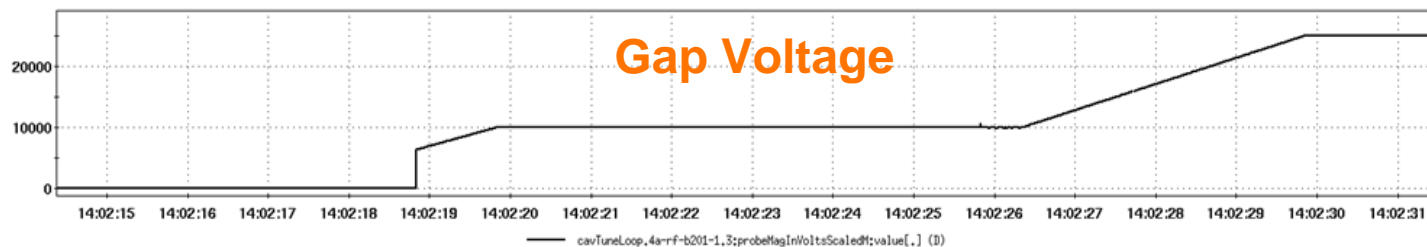
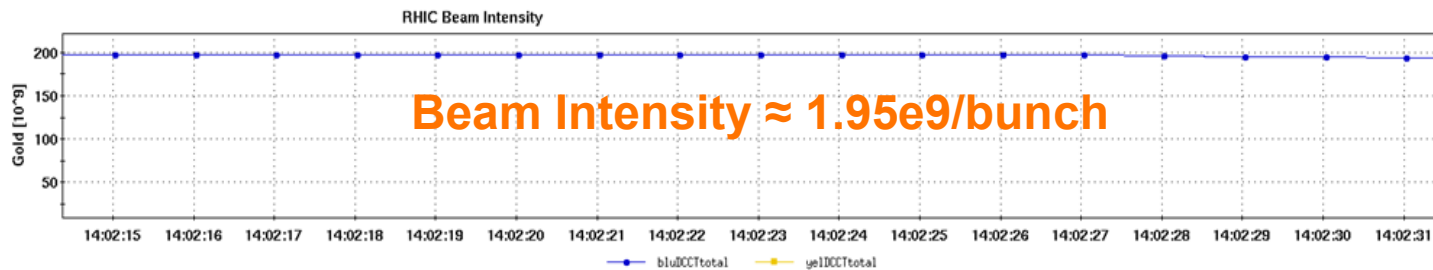
• Resulting actions:

- Replace faulty PA in the driver amplifier
- Fast Feedback Θ Reset
- Tuning Loop Optimization



Testing Blue Landau's Limits

- Efforts were made to test higher beam intensities
- The machine could not provide high intensity so bunch patterns were modified to simulate higher beam intensity at landau harmonic
- Drop every 16th Bunch, Drive Power up 10%



Blue Landau Conclusions

- Extrapolating from FY17 Au data, the forward power requirement for 3.0×10^9 is approximately 1200w
- Landau power amplifier capable of 2000w linear
- Even with a β of only 2.6 proof of principle a success!