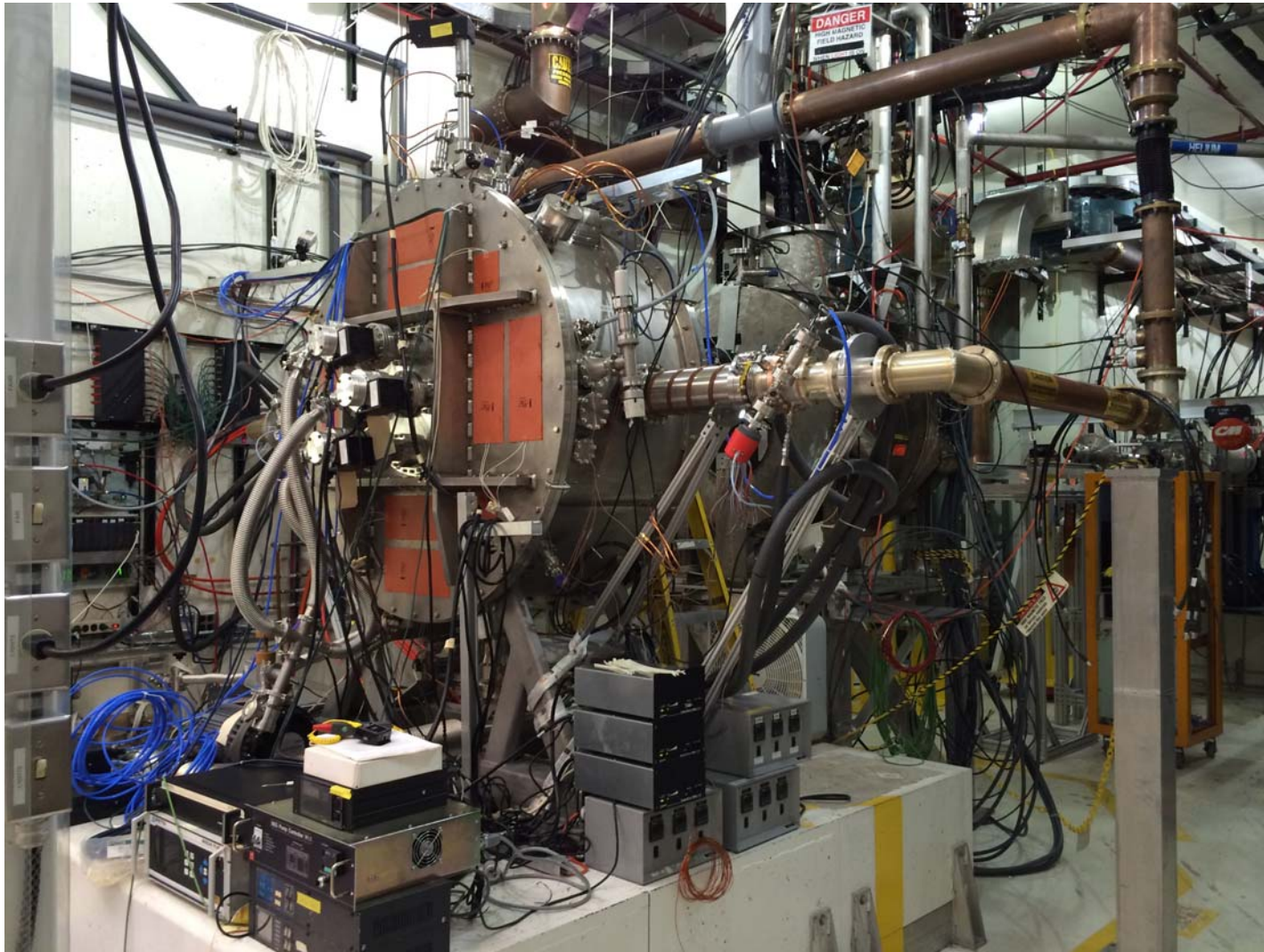




MICE Cavity Commissioning/Operation & Plans



M.A Leonova MAP CM Winter 2014



MICE Cavity Commissioning/Operation & Plans



M.A Leonova

MAP CM

6 December 2014



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MTA Shifts

[Shift manual](#)

For questions about the shift schedule or change requests, contact [Maria Leonova](#).

Guidelines: no more than 2 shifts in a row, 3 in a 24-hr period, 7 per week.

x = cavity off; + = ran unattended; — = no shifter assigned

...

Date		00:00-04:00	04:00-08:00	08:00-12:00	12:00-16:00	16:00-20:00	20:00-24:00	Date	
R F	Mon Nov 17	ML	MB	x	x	BF	PL	Nov 17	Mon
	Tue Nov 18	x	x	BF	ML	MP	DB	Nov 18	Tue
	Wed Nov 19	YT	MB	AM	AK	ML	PL	Nov 19	Wed
	Thu Nov 20	YT	MB	DB	BF	ML	PL	Nov 20	Thu
	Fri Nov 21	+	ML	DB	PL	MP	+	Nov 21	Fri
	Sat Nov 22	+	+	YT	+	+	+	Nov 22	Sat
	Sun Nov 23	+	+	YT	+	+	+	Nov 23	Sun
Date		00:00-04:00	04:00-08:00	08:00-12:00	12:00-16:00	16:00-20:00	20:00-24:00	Date	
R F	Mon Nov 24	+	+	+	x/DP	+	+	Nov 24	Mon
	Tue Nov 25	+	+	+	+	+	+	Nov 25	Tue
	Wed Nov 26	+	+ /YT		END OF RUN			Nov 26	Wed
	Wed Nov 26	+	+ /YT		END OF RUN			Nov 26	Wed
Date		00:00-04:00	04:00-08:00	08:00-12:00	12:00-16:00	16:00-20:00	20:00-24:00	Date	

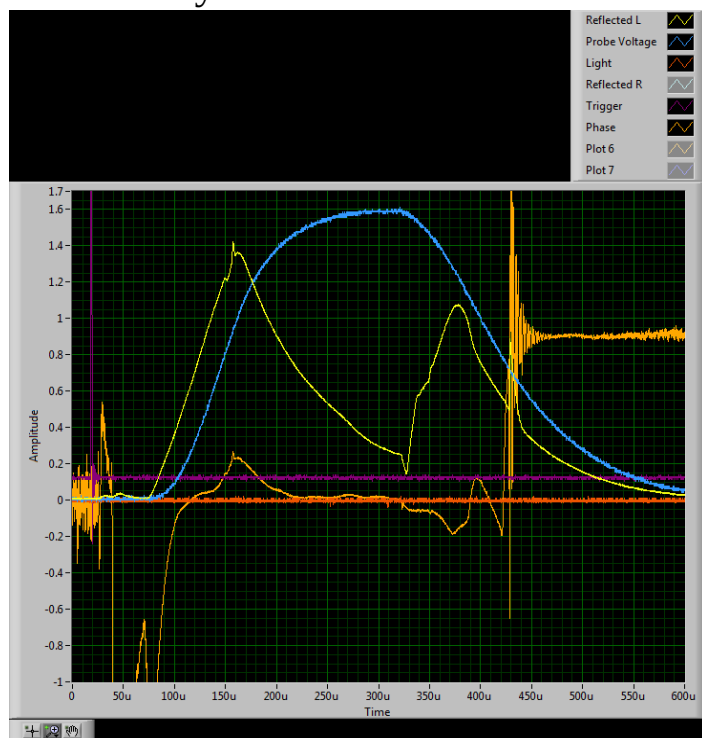
MB = Michael Backfish — DB = Daniel Bowring — BF = Ben Freemire — CH = Chris Hunt — AK = Alexey Kochemirovskiy
 PL = Peter Lane — ML = Maria Leonova — TL = Tianhuan Luo — AM = Al Moretti — DP = Dave Peterson — MP = Milorad Popovic
 DS = David Speirs — TS = Tim Stanley — YT = Yagmur Torun — CW = Colin Whyte — KY = Katsuya Yonehara



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LabView system controls RF



Tuners

Acoustic sensors

ACNET

- Vacuum (vessel and cavity)
- Cavity temperature
- Radiation monitors
- Frequency
- ...

Fast Oscilloscopes

LeCroy:

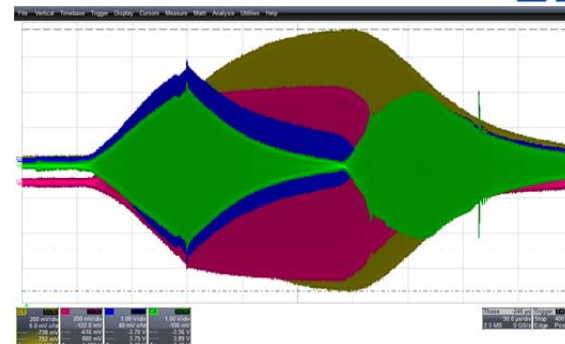
- cavity pickup
- forward power
- reflected power1
- reflected power 2

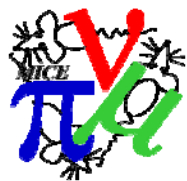
Tecktronics DPO

- NaI crystal
- plastic scintillator
- cavity light
- cavity light

Tecktronics TDS

- field emission probe
- left coupler
- field emission probe
- right coupler
- light from left coupler
- light from right coupler





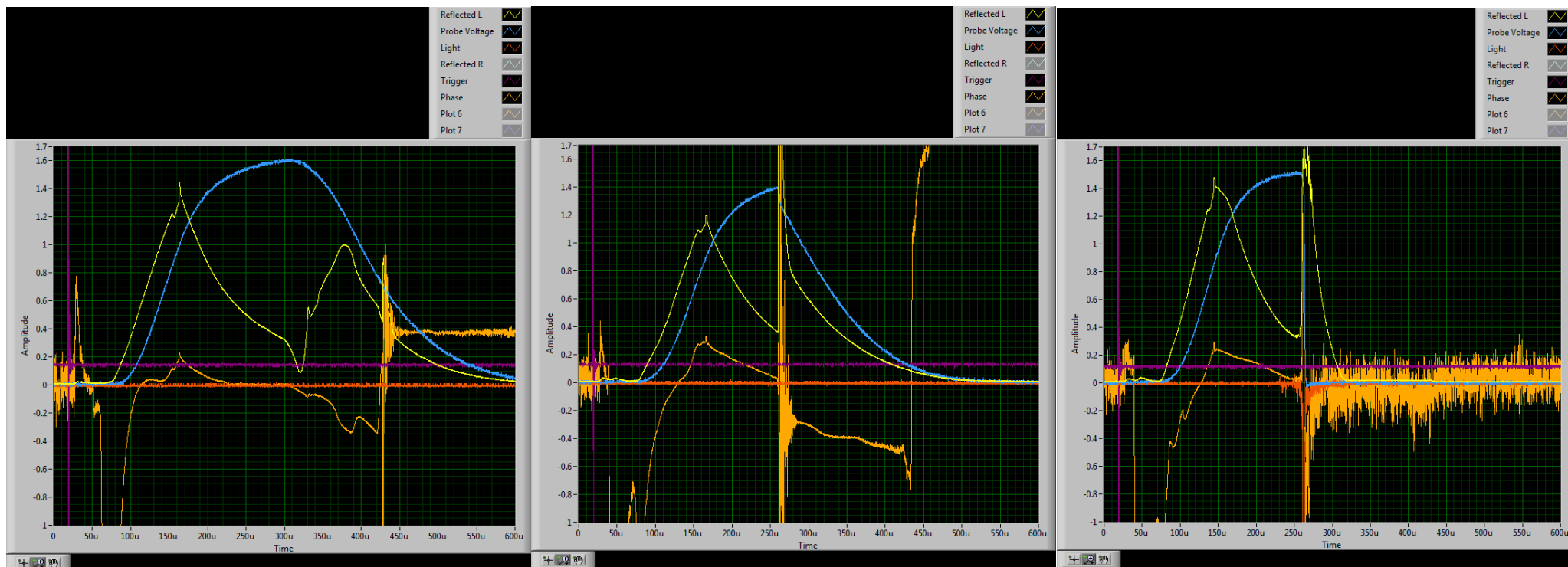
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Normal pulse

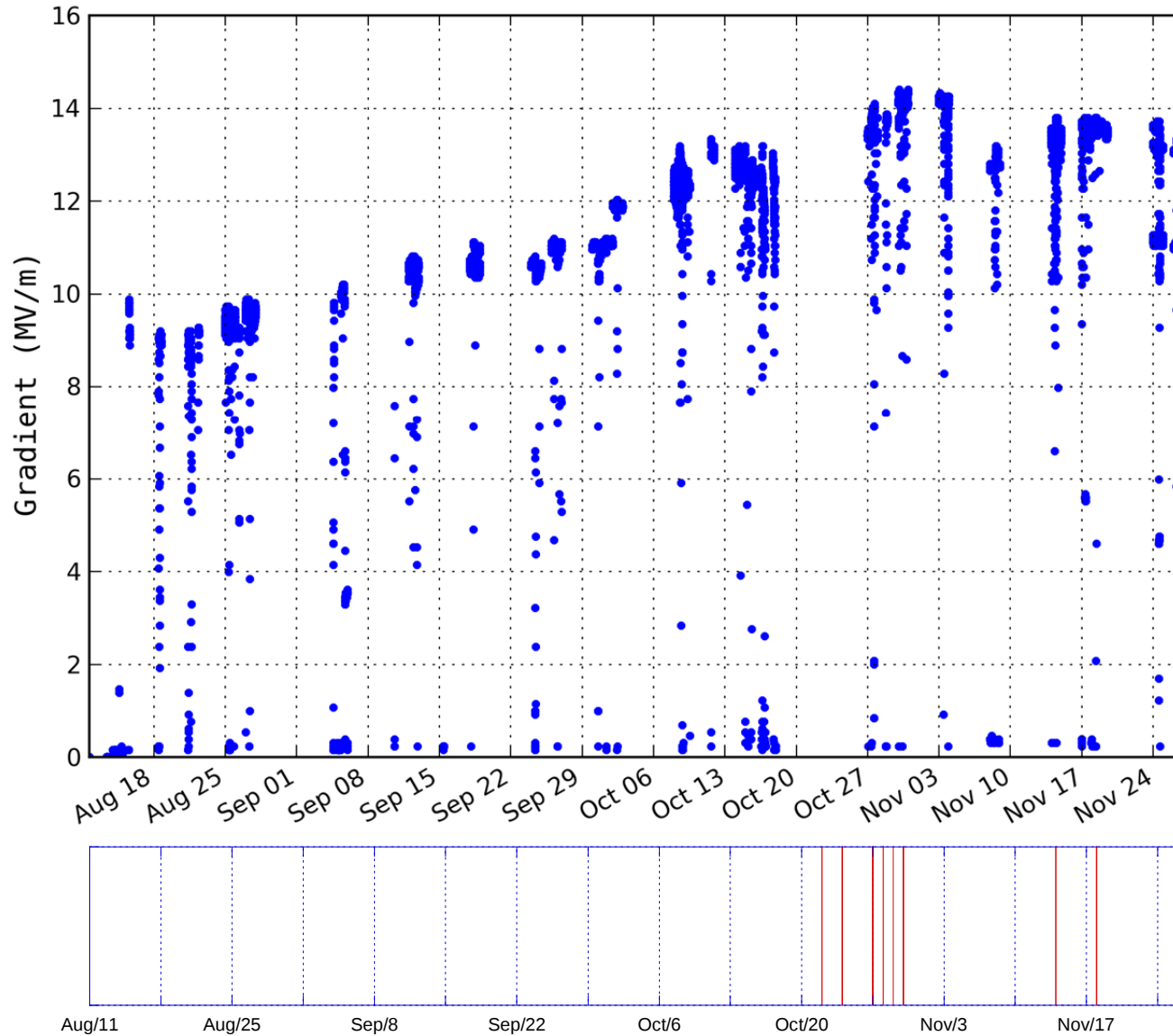
Modulator trip (~400)

Breakdown event (32)





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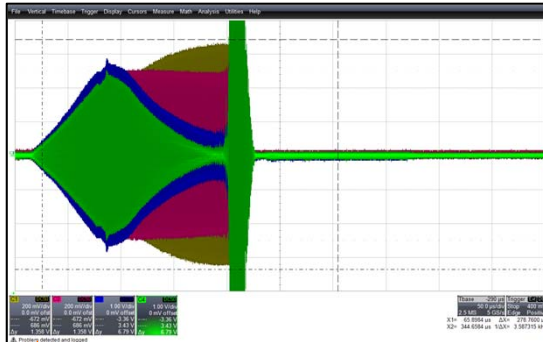
Inspect raw data of MICE RF test (Preliminary analysis)

K. Yonehara & A. Tollestrup

APC, Fermilab

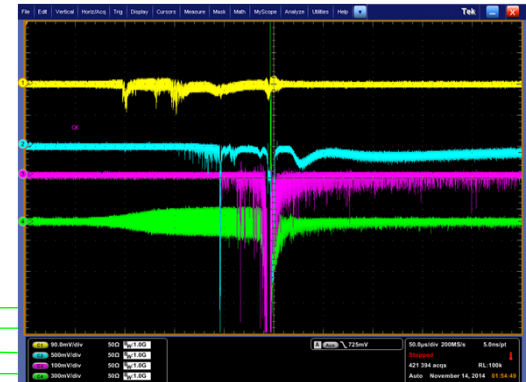
Detector configuration for raw data

Lecroy wave runner 625 Zi

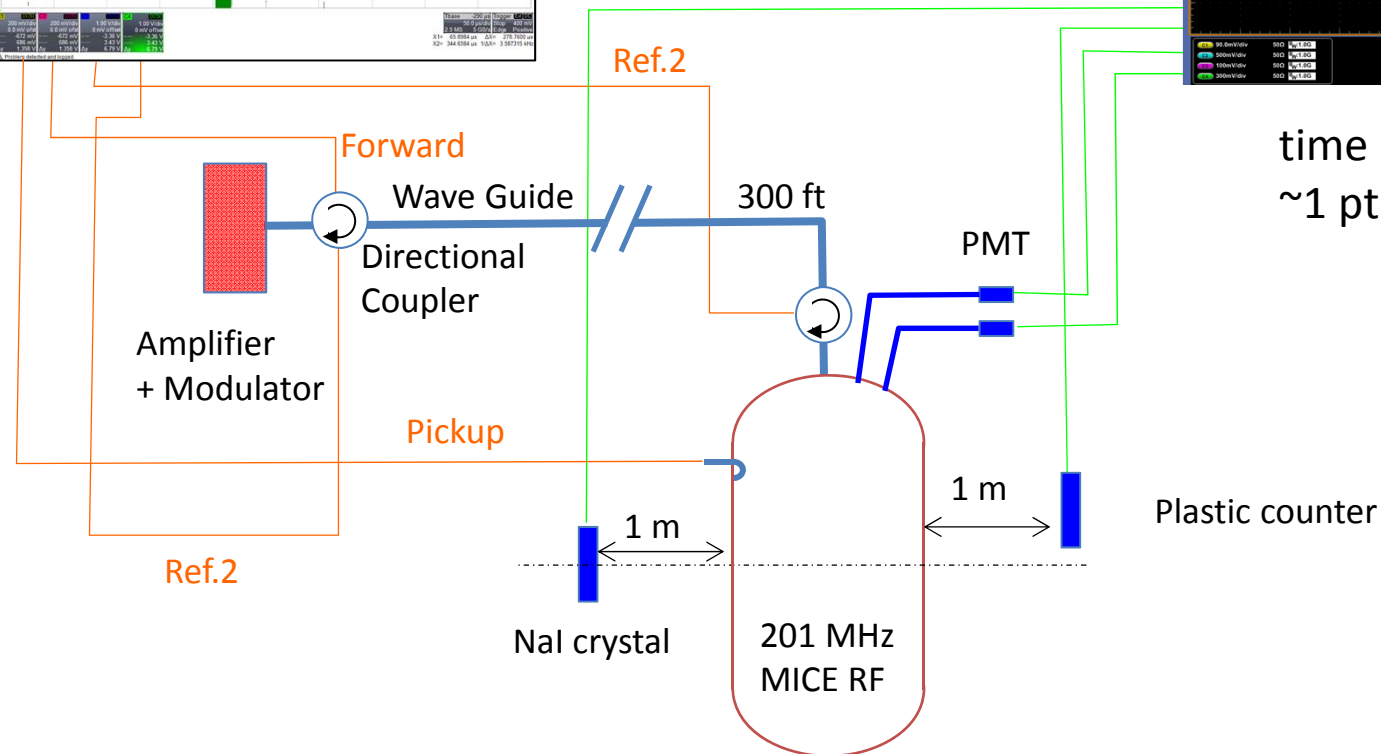


time res. = 0.2 ns
~25 pts per RF cycle

Tektronix DPO7000



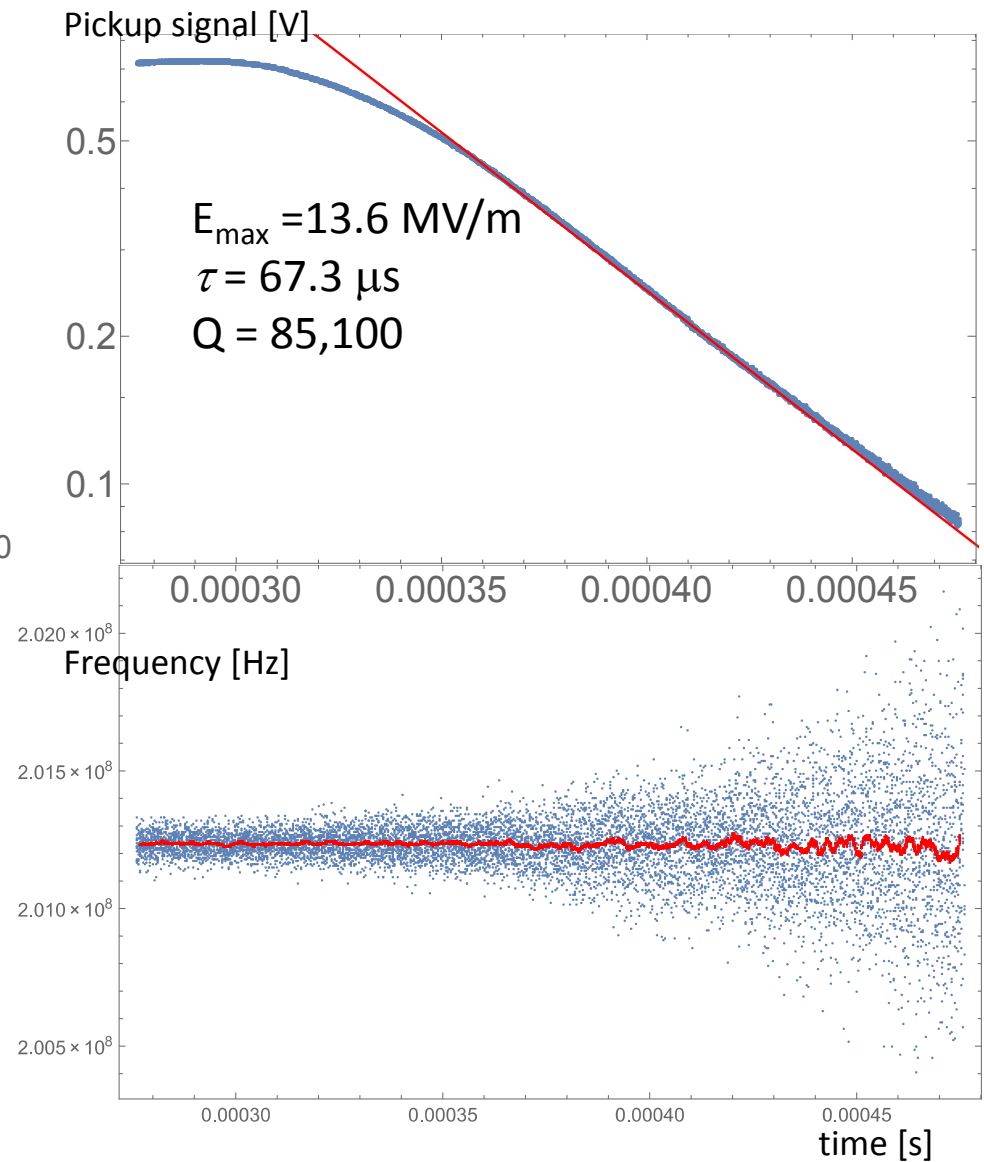
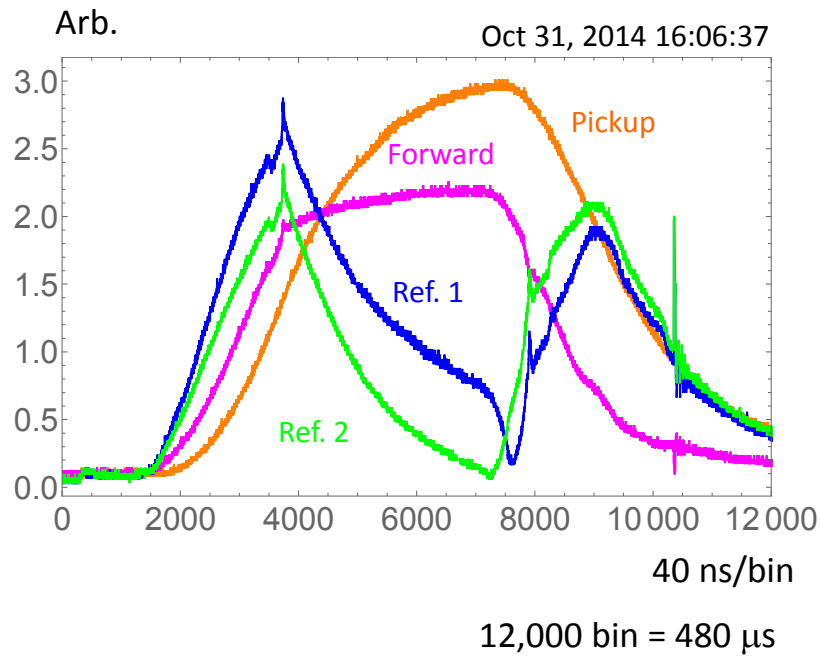
time res. = 5 ns
~1 pt per RF cycle



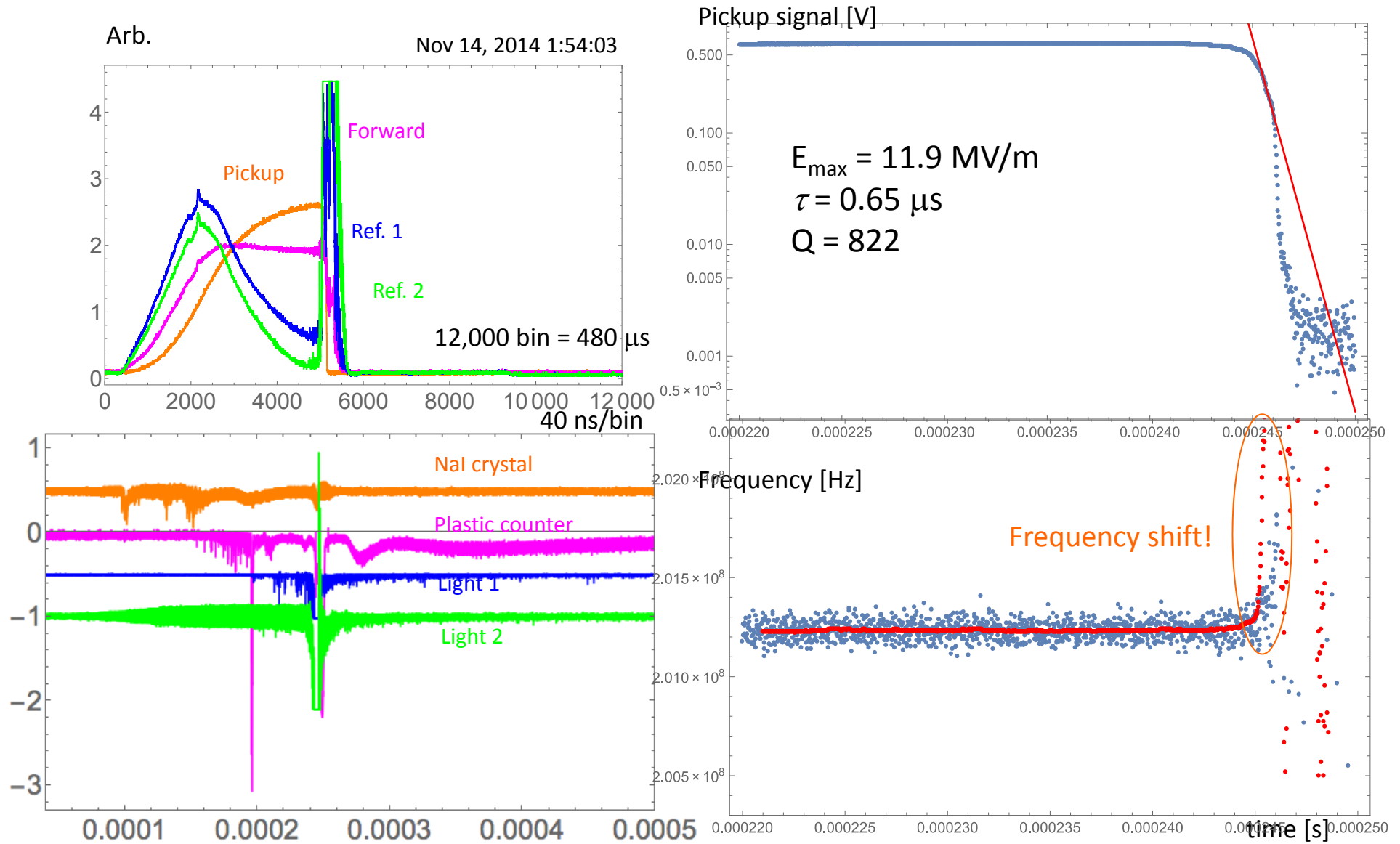
Analyze four different events

- Normal event
- Typical breakdown event
- Unusual breakdown event
- Modular trip

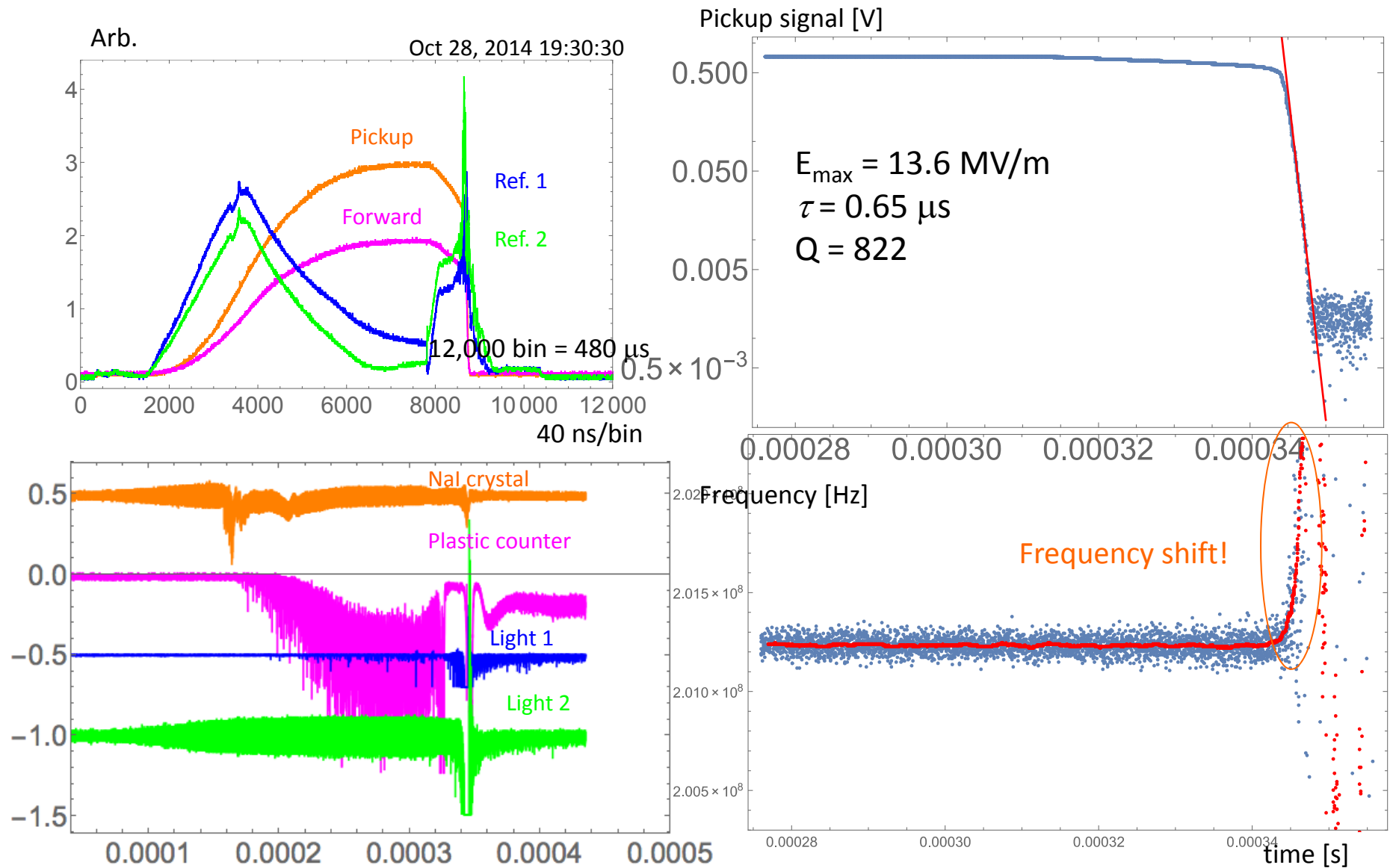
Normal event



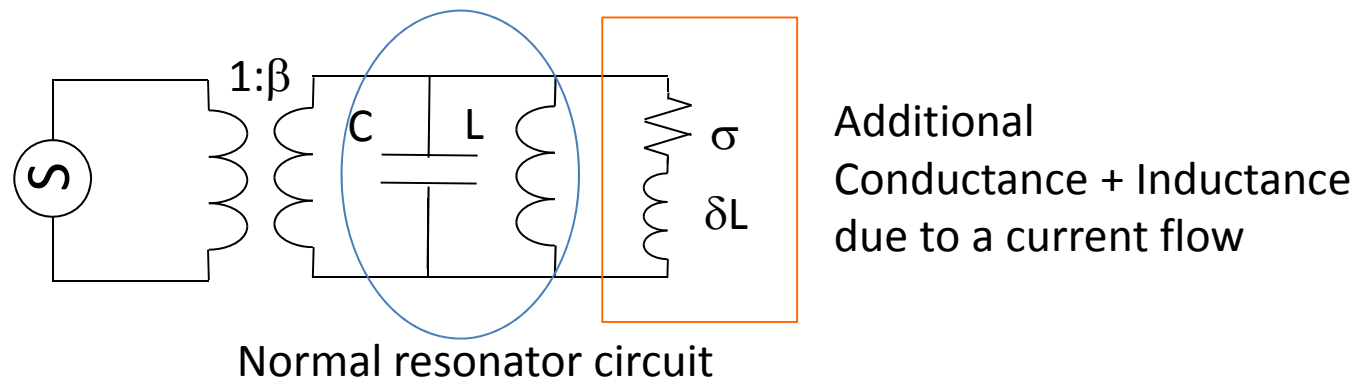
Typical breakdown event



Un-usual breakdown event



Possible mechanism of frequency shift



Additional inductance induces a frequency shift

$$\frac{\delta\omega}{\omega} \approx -\frac{1}{2} \frac{\delta L}{L} \quad \text{where} \quad \delta L = \frac{\mu_0 l}{2\pi} \left[\ln\left(\frac{2l}{a}\right) - \frac{3}{4} \right]$$

l : Cavity gap
 a : Radial size of the current

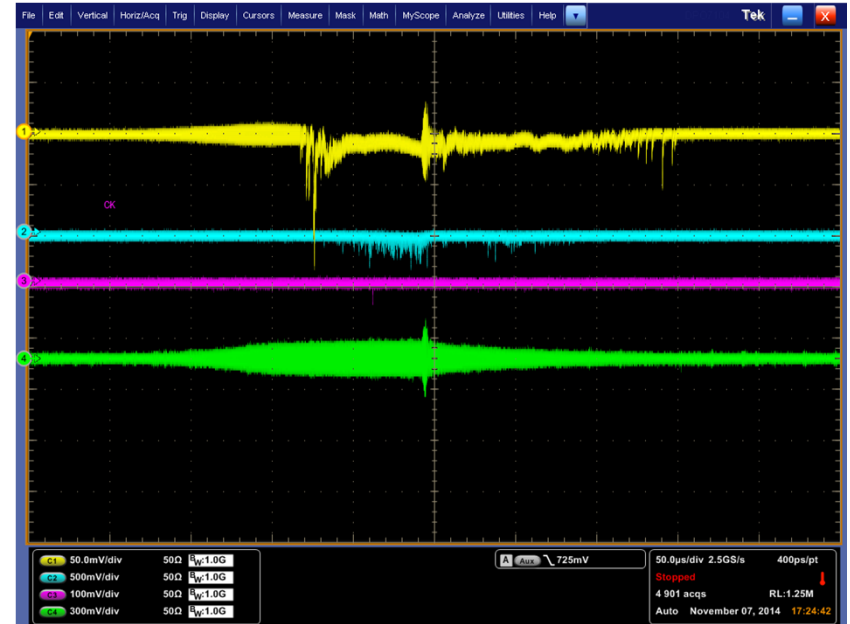
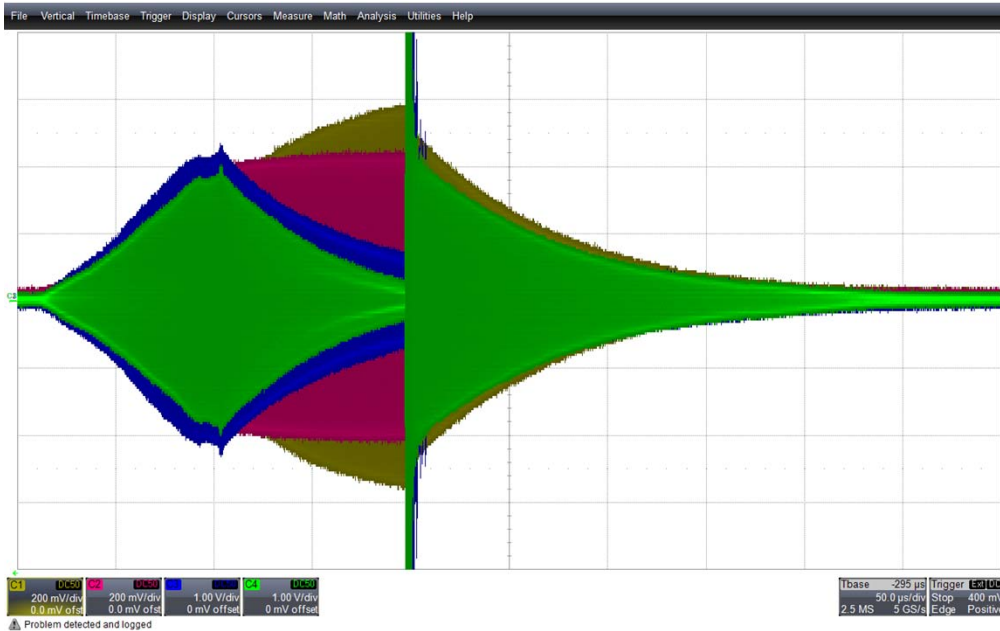
In the electric breakdown (BD)

- Although, we do not know the source of electrons, yet...
- Electrons could be accelerated by the RF field and become a current
- The current reduces the inductance of cavity
- Consequently, it increases the resonant frequency

BD results in the MICE RF indirectly suggest the current model

Possible modular trip event

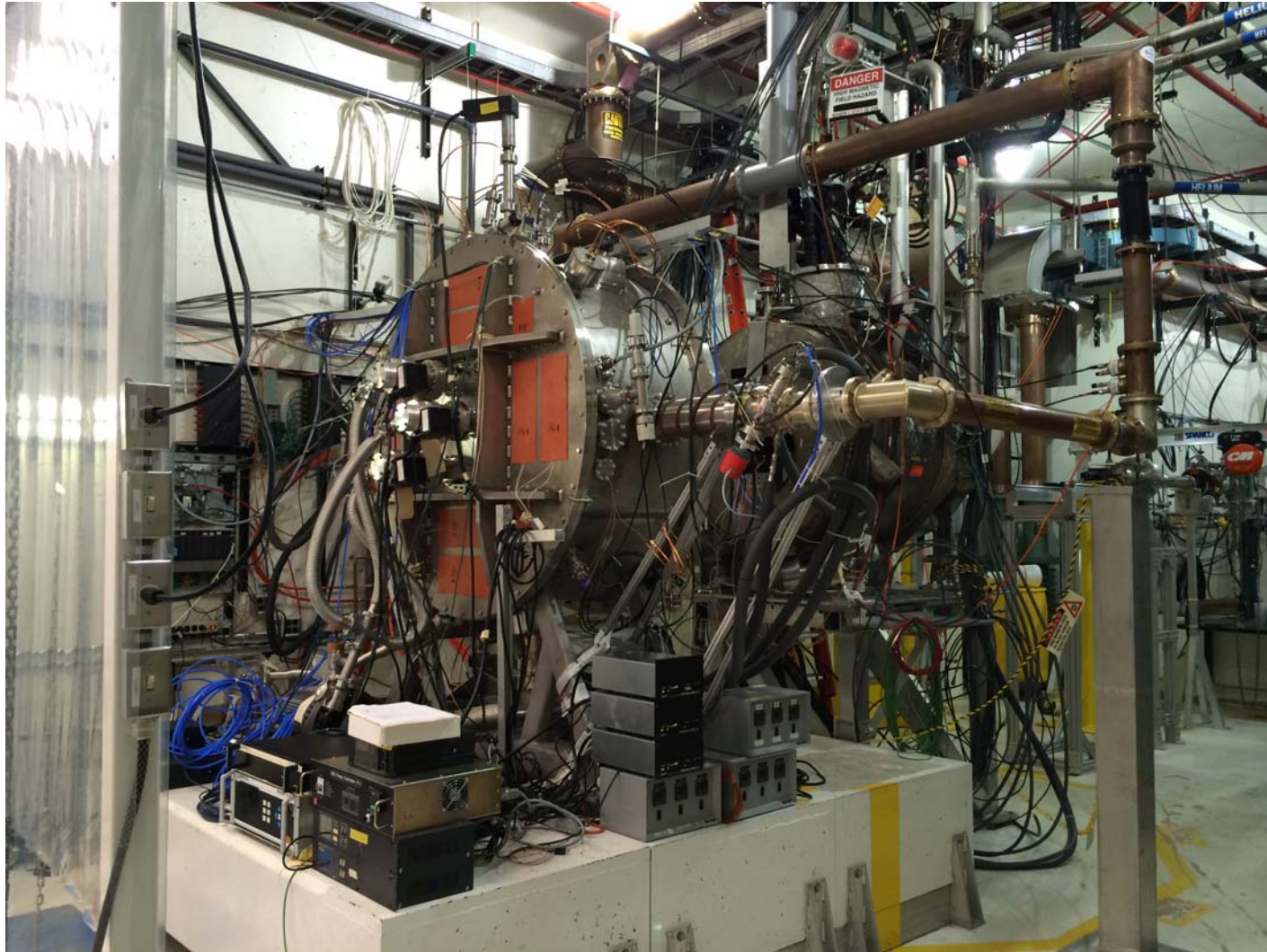
Nov 7, 2014 17:23:51



Although we see a big reflection in RF signal (see a green line in the left plot) there is no light (see in the right plot) & the RF decay time is very long as the same as a normal RF signal
→ This is classified as “Modular trip” or fake breakdown signal



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Plans:

- Cavity surface inspection
- Install Be windows
- Preparation for operation in magnetic field
 - Modifications to the vacuum system
 - Move cavity closer to the magnet
 - Re-train the magnet
- Run
 - W/O magnetic field
 - Tuner test
 - With magnetic field