UVa Target Lab Update

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G_E^n Cell Inventory

Cell	Geometry	Type
Panache*	GEN-LARGE	K/Rb
Mama Mia*	STANDARD	K/Rb
Sosa	GEN-LARGE	pure Rb
Chloe*	GEN-LARGE	K/Rb
Anna	GEN-LARGE	K/Rb
Barbara	GEN-LARGE	K/Rb
Al the Target Cell	GEN-small	K/Rb
Bubba?	GEN-small	K/Rb

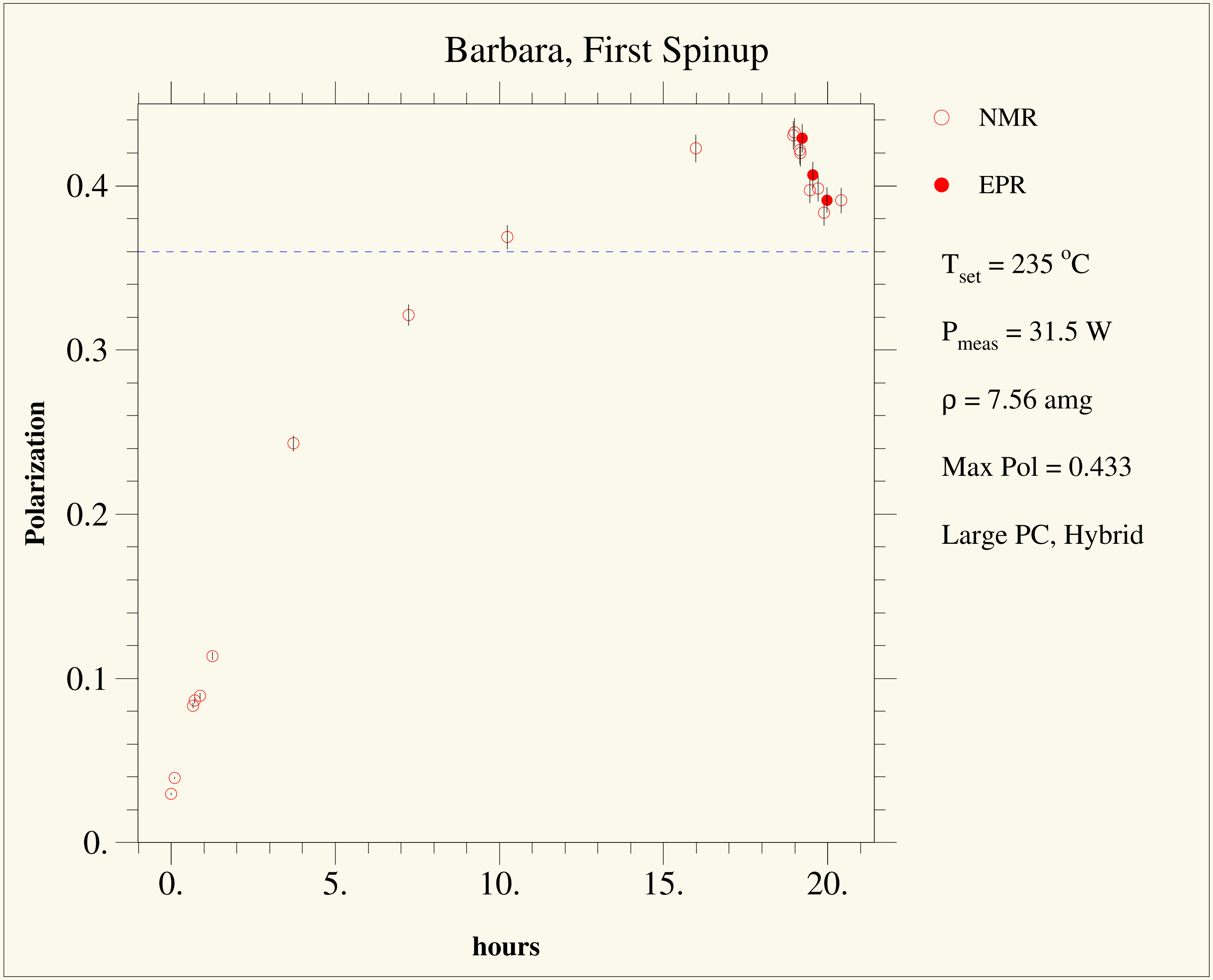
*currently not usable for G_E^n
?status unknown to me

All hybrids are estimated to have a nominal 20:1 (K:Rb) vapor density ratio at operating temperatures.

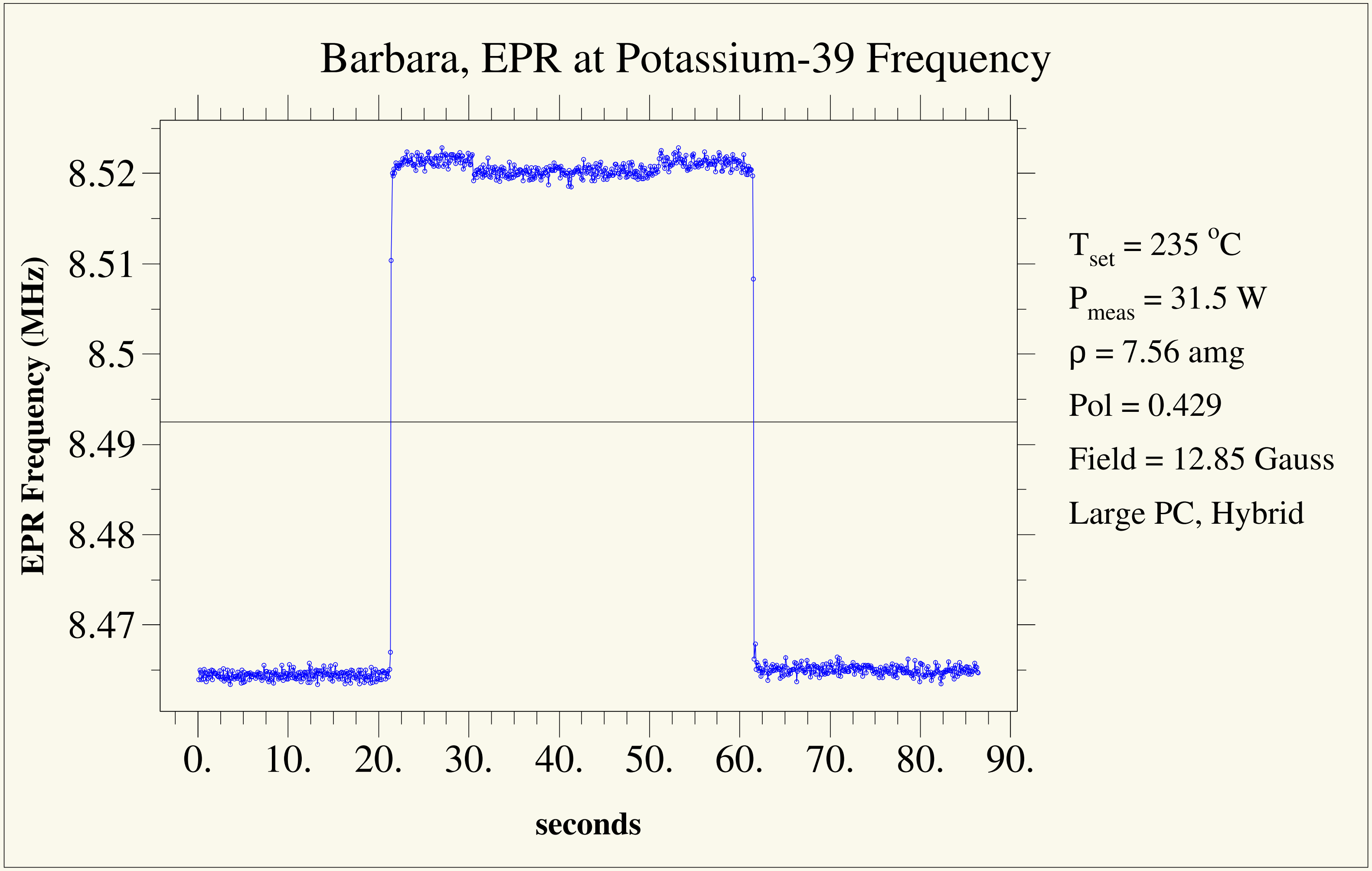
Cell Performance

Cell	Max Pol	Lifetime
Anna	38%	not measured
Barbara	43%	not measured
Al the Target Cell	45%	(25 ± 5) hrs

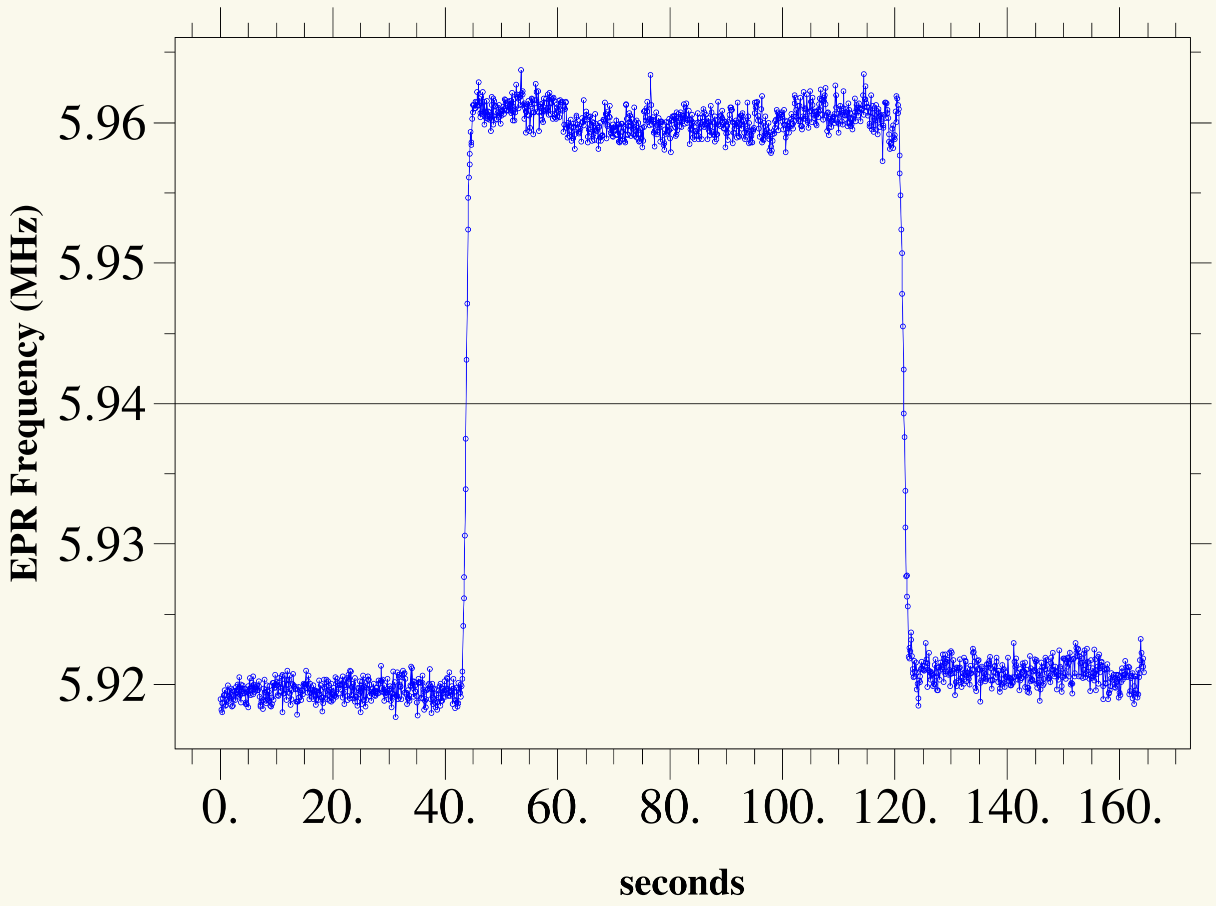
1. No effort was made to optimize (laser power, spot size, oven temp, etc.)
2. Only one of the two (combined) beams from the cube was used.
3. Three lasers combined to give 30 W total with peak intensities of (0.75 & 1.20) $\frac{\mathrm{W}}{\mathrm{cm}^2}$ for LARGE and small pumping chambers.
4. We could successfully do K EPR on all three cells and Rb EPR on two cells.
5. Plans for optimization, lifetimes, and hybrid SEOP diagnostics are underway...



Barbara, First Spinup
Polarization
hours
0.
0.1
0.2
0.3
0.4
0.
5.
10.
15.
20.
NMR
EPR
T_{set} = 235 °C
P_{meas} = 31.5 W
ρ = 7.56 amg
Max Pol = 0.433
Large PC, Hybrid


Barbara, EPR at Potassium-39 Frequency
EPR Frequency (MHz)
8.52
8.51
8.5
8.49
8.48
8.47
0.
10.
20.
30.
40.
50.
60.
70.
80.
90.
seconds
T_{set} = 235 °C
P_{meas} = 31.5 W
ρ = 7.56 amg
Pol = 0.429
Field = 12.85 Gauss
Large PC, Hybrid

Barbara, EPR at Rubidium-85 Frequency



T_{set} = 235 ^{o}C

P_{meas} = 31.5 W

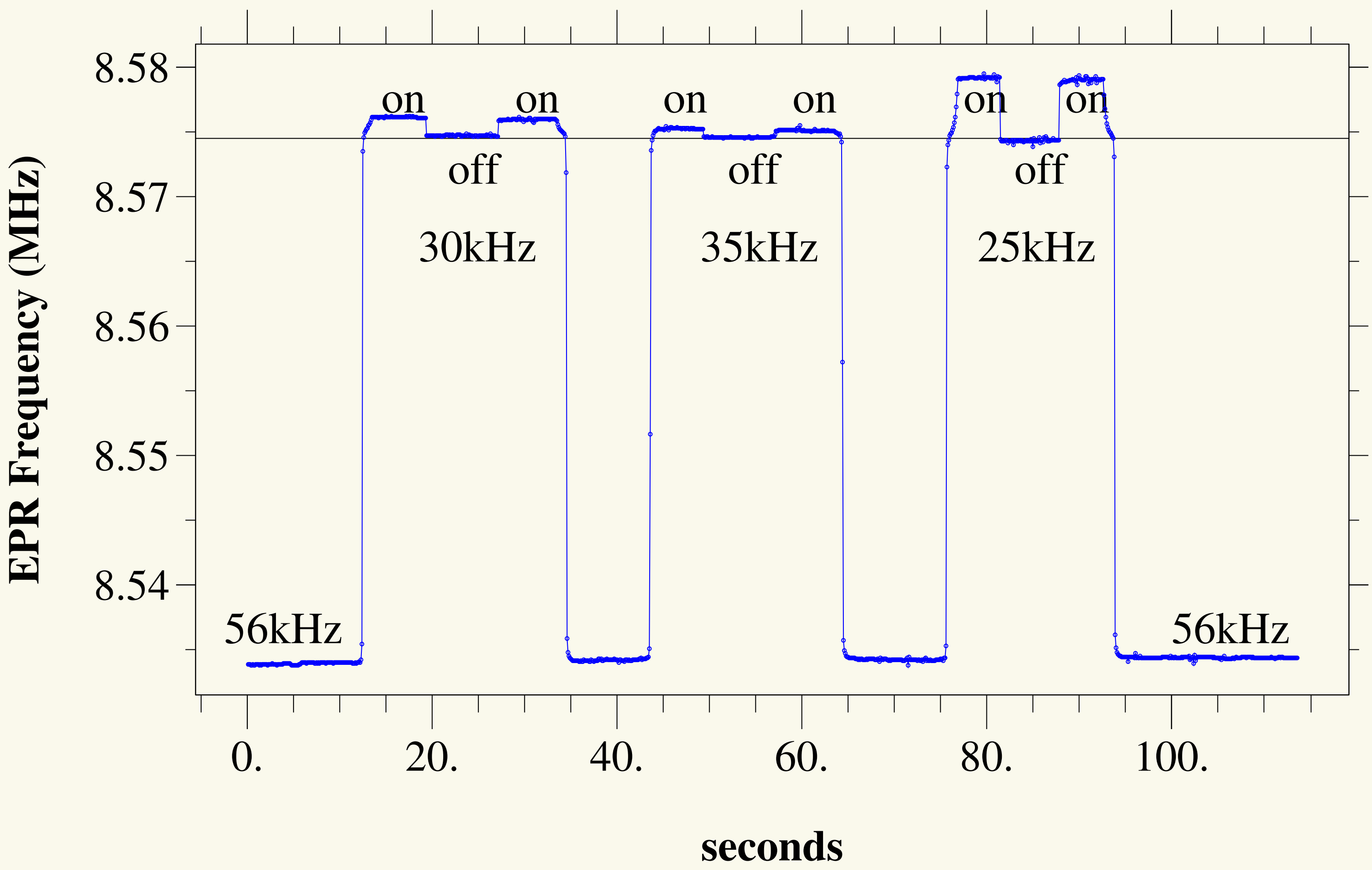
ρ = 7.56 amg

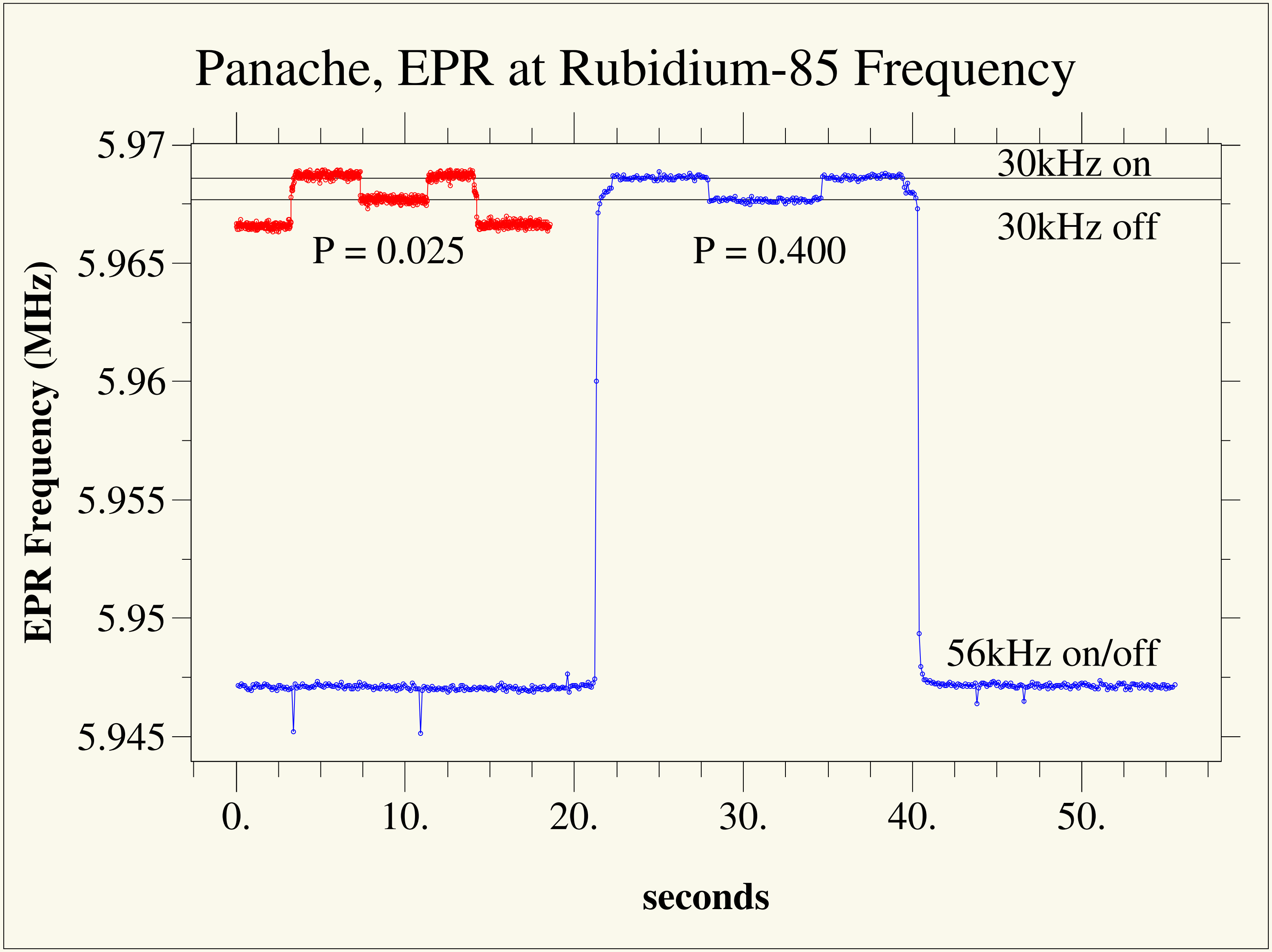
Pol = 0.391

Field = 12.85 Gauss

Large PC, Hybrid

Panache, EPR at Potassium-39 Frequency




Panache, EPR at Rubidium-85 Frequency
EPR Frequency (MHz)
5.97
5.965
5.96
5.955
5.95
5.945
30kHz on
30kHz off
P = 0.025
P = 0.400
56kHz on/off
0.
10.
20.
30.
40.
50.
seconds

RF Shift Issue

1. EPR frequency seems to depend on presence of RF field.
2. EPR frequency shifts when NMR RF field is turned on and off.
3. Happens for both pure Rb and hybrid cells.
4. Occurs for both Rb EPR and K EPR.
5. Size of RF shift is proportional to H_1.
6. Size of RF shift may be dependant on RF frequency.
7. Size of RF shift doesn't appear to be ^{3}He polarization dependant.
8. More studies to come.

κ_0 for Various Alkali Metals

Romalis and Cates, PRA 58, 3004 (1998)

$$
\begin{aligned}
{}^{85}\mathrm{Rb}: \ \kappa_0(T) &= 4.52 + 0.00934 \cdot T(^{\circ}\mathrm{C}) \\
& \quad 110\ ^{\circ}\mathrm{C} \leq T \leq 172\ ^{\circ}\mathrm{C}
\end{aligned}
$$

Babcock et al, PRA 71, 013414 (2005):

$$
\begin{aligned}
{}^{23}\mathrm{Na}: \ \kappa_0(T) &= 4.84 + 0.00914 \cdot (T - 200\ ^{\circ}\mathrm{C}) \\
& \quad 200\ ^{\circ}\mathrm{C} \leq T \leq 350\ ^{\circ}\mathrm{C} \\
{}^{39}\mathrm{K}: \ \kappa_0(T) &= 5.99 + 0.0086 \cdot (T - 200\ ^{\circ}\mathrm{C}) \\
& \quad 150\ ^{\circ}\mathrm{C} \leq T \leq 225\ ^{\circ}\mathrm{C} \\
{}^{85}\mathrm{Rb}: \ \kappa_0(T) &= 6.39 + 0.00914 \cdot (T - 200\ ^{\circ}\mathrm{C}) \\
& \quad 172\ ^{\circ}\mathrm{C} \leq T \leq 350\ ^{\circ}\mathrm{C}
\end{aligned}
$$