Evaluation of New Recipe: 900 C/deeper EP applied by RI – CAV0017, 18, and 19

Sam Posen, Anna Grassellino, Alex Melnychuk, Alex Romanenko, Dmitri Sergatskov

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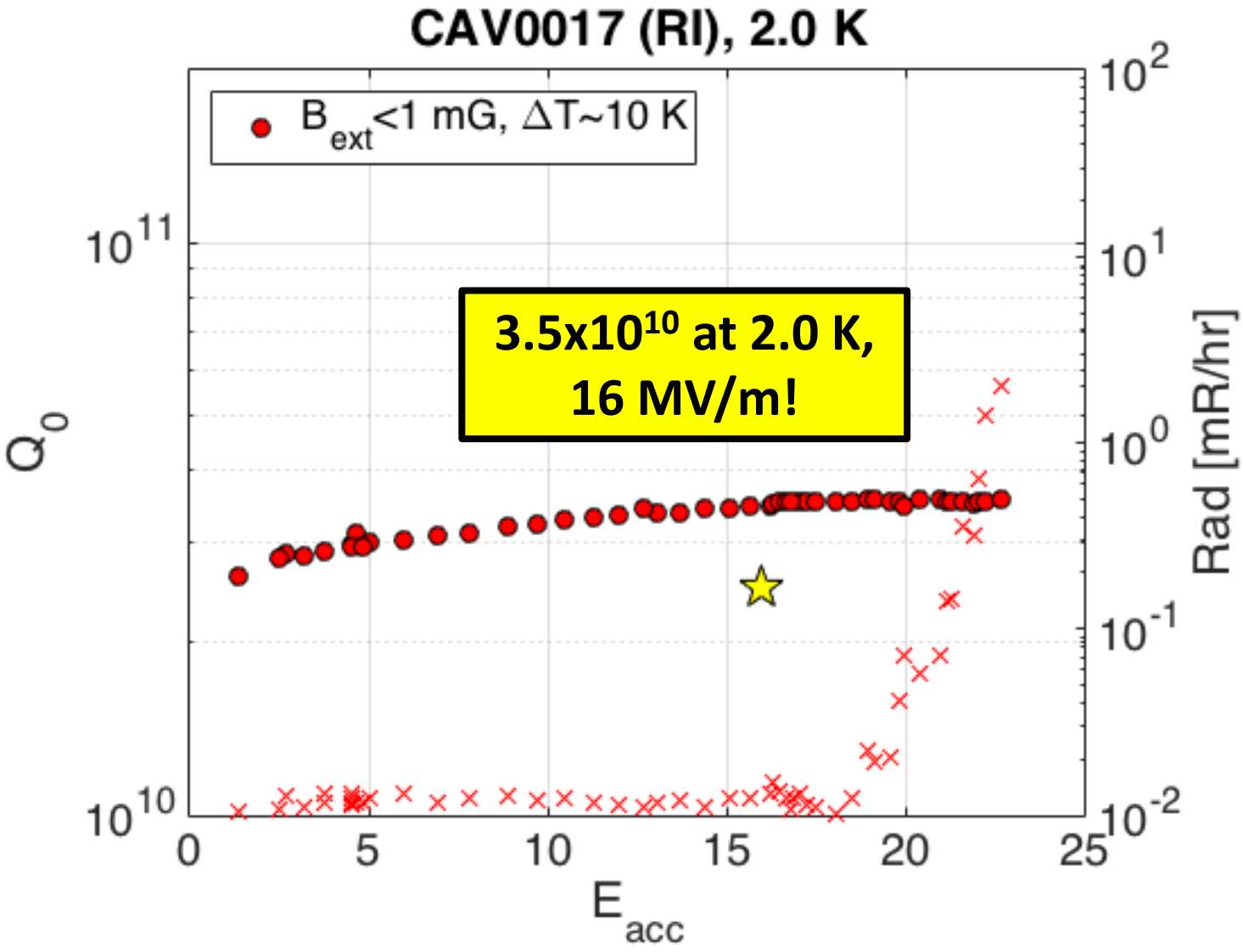
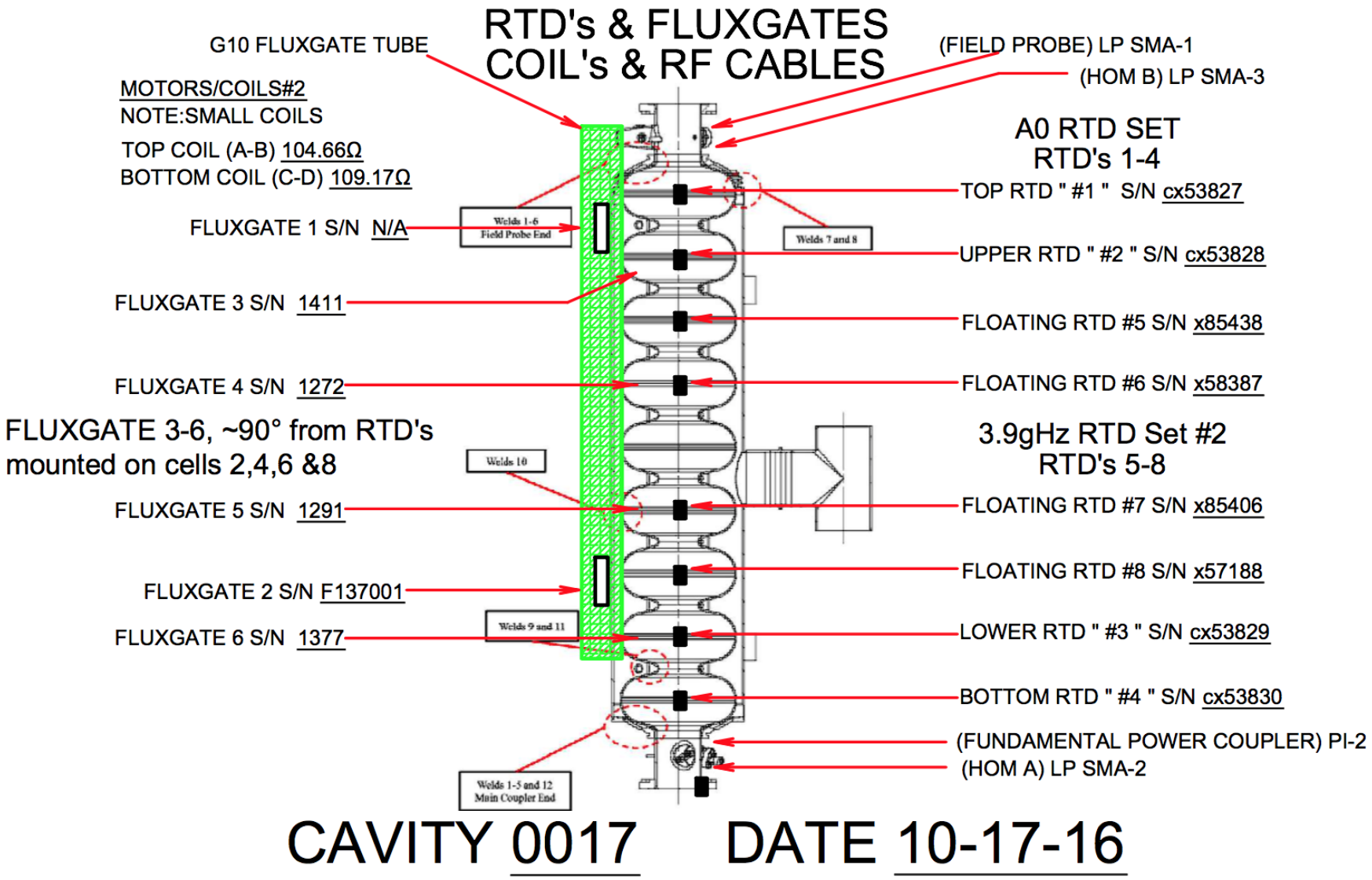
Cavities CAV0017 and CAV0018

- Manufactured by RI
- Receive modified LCLS-II recipe
  - **900 C** degas
  - Deeper EP
- **First evaluation of modified recipe** on 9-cell cavities made from LCLS-II production material
- No helium vessel: allows us to put fluxgates on equators to measure expulsion directly
- Cavities received at Fermilab Friday Oct 14th, testing of both cavities completed Saturday Oct 22nd – CAV17 in VTS-1, CAV18 in VTS-2 (VTS-1 has slightly smaller fields)
- Results presented here: Q vs E in zero field, expulsion, Q vs E in 5 mG fields

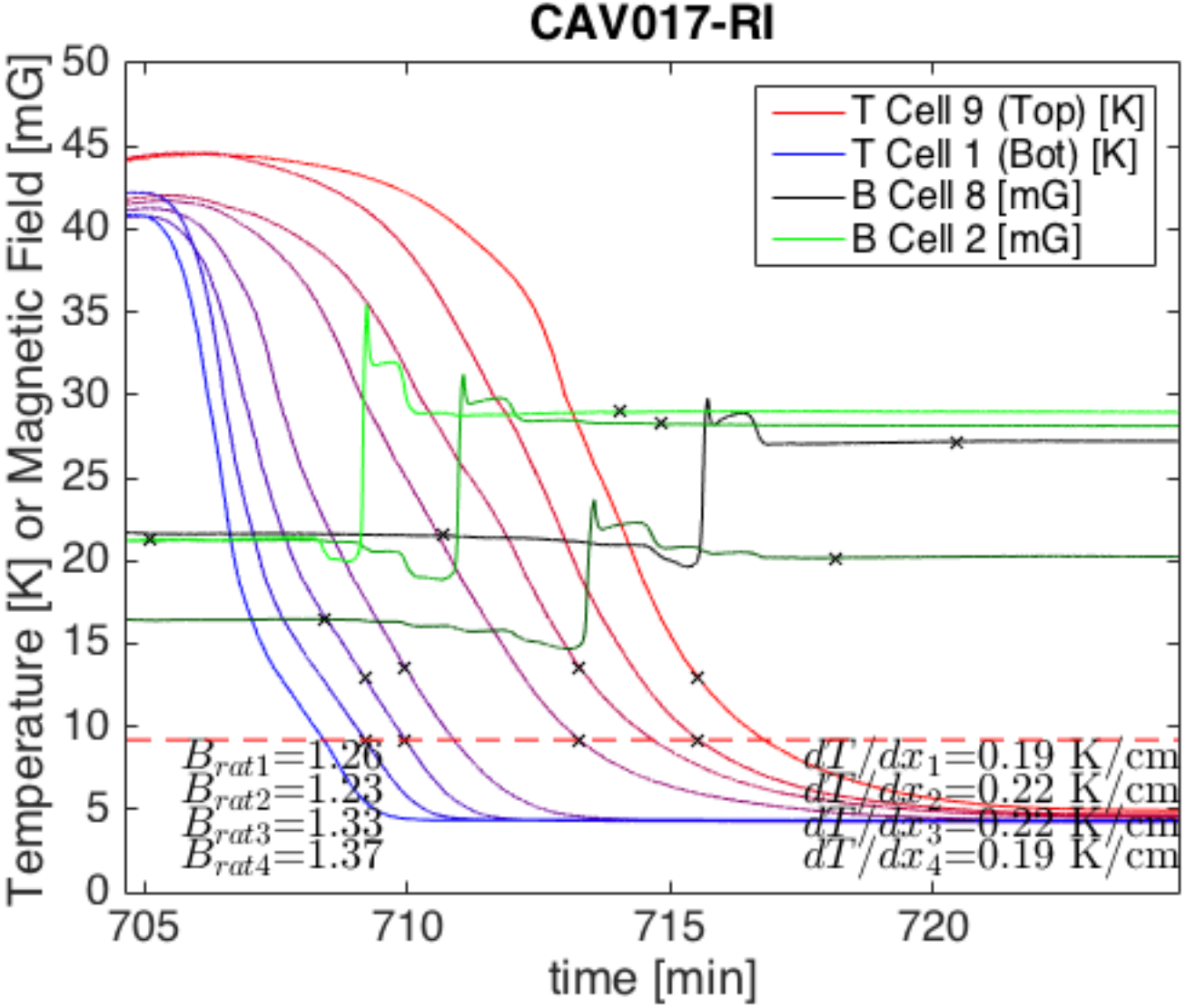
CAV0017 – Q vs E, Compensated Field through T_c



CAV0017 – Instrumentation



CAV0017 – Expulsion Measurement



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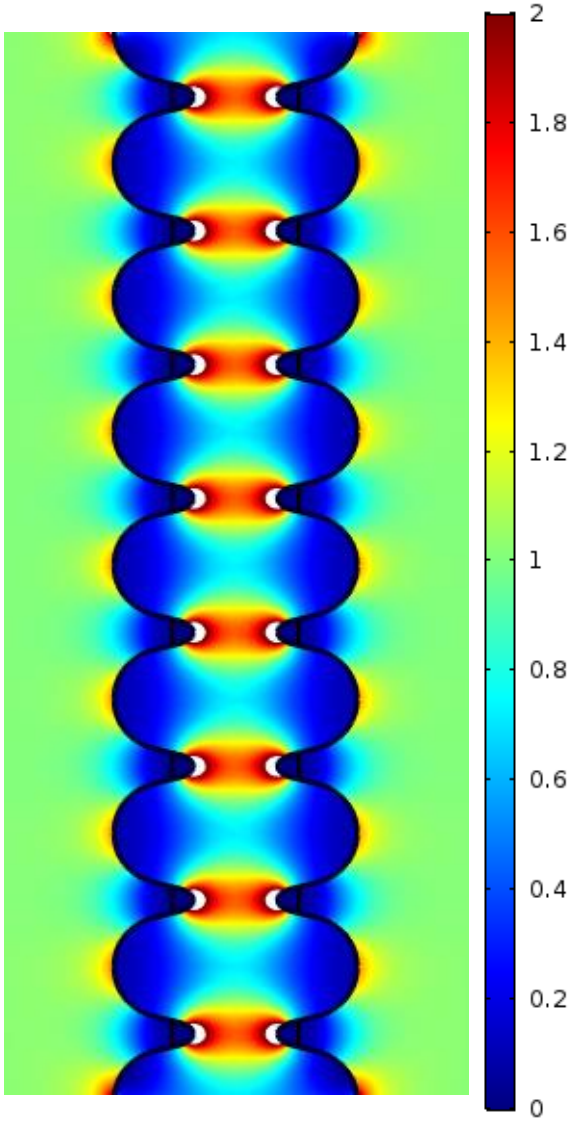
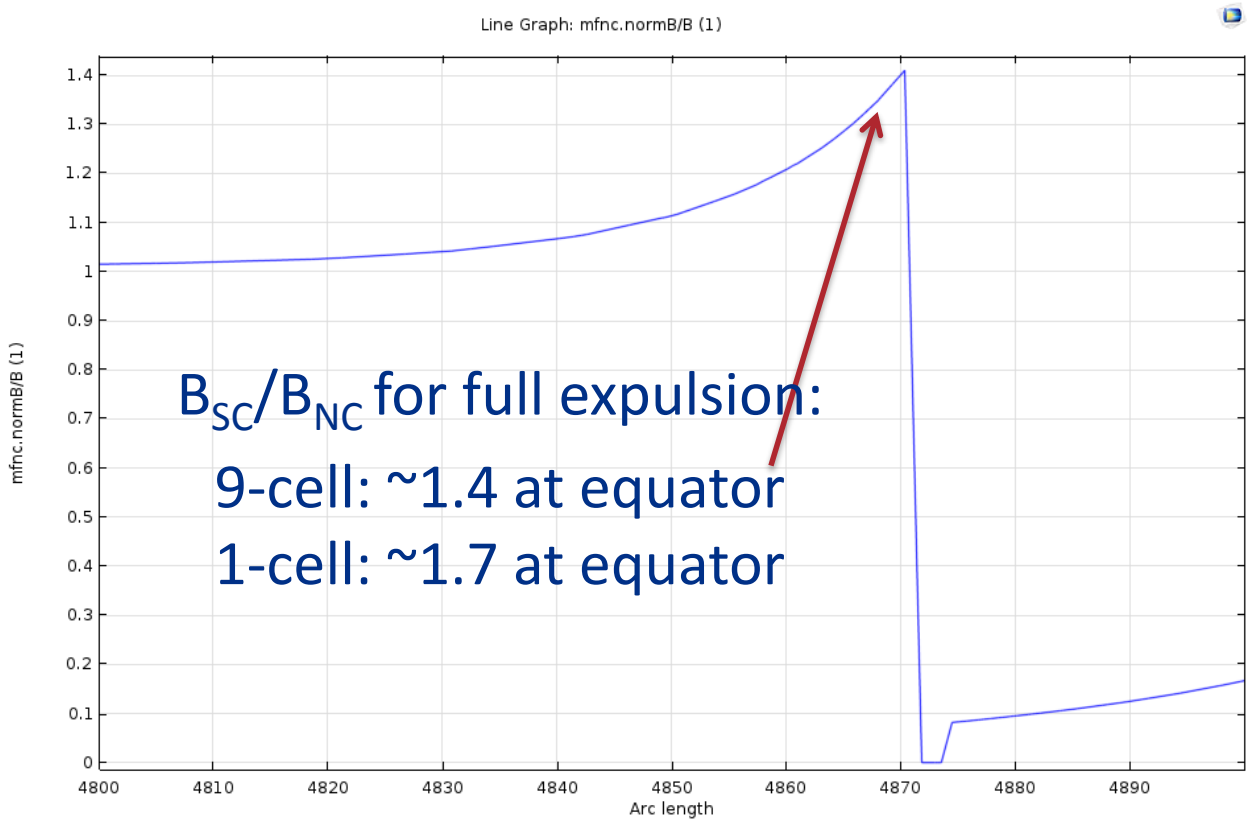
Simulation of Expulsion in 9-cell





B_{SC}/B_{NC} for full expulsion:

9-cell: ~1.4 at equator

1-cell: ~1.7 at equator

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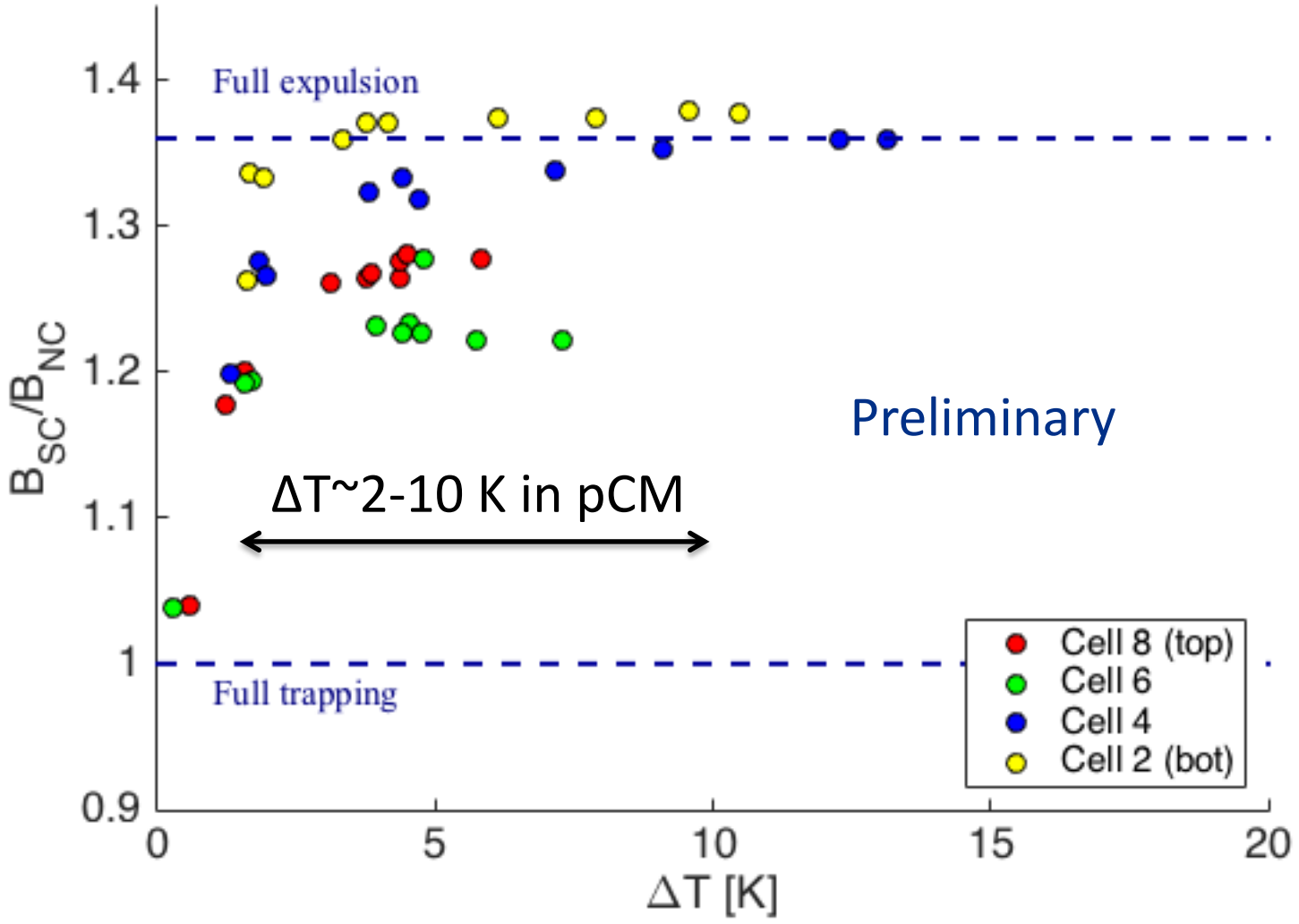
CAV0017 – Expulsion Survey



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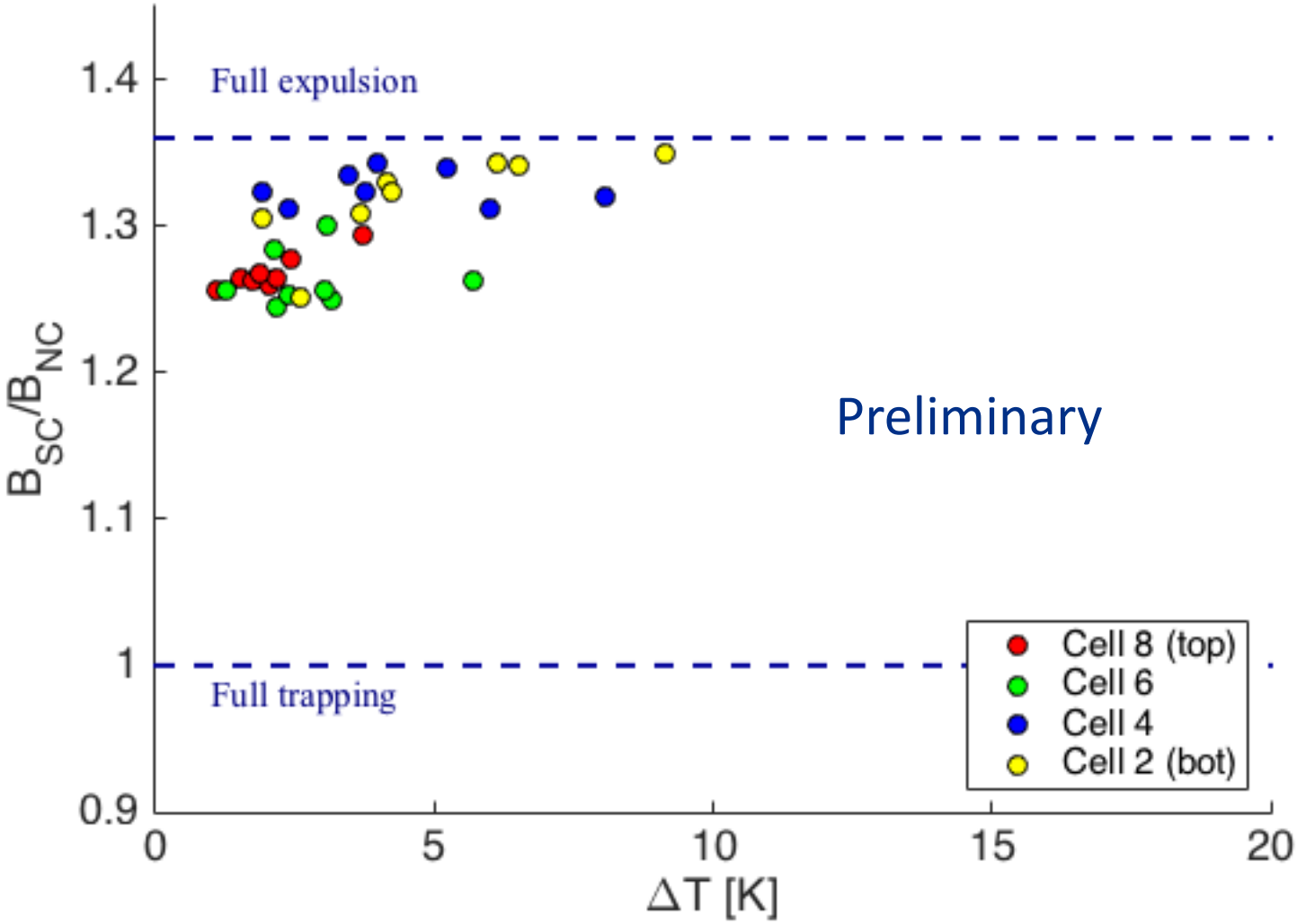
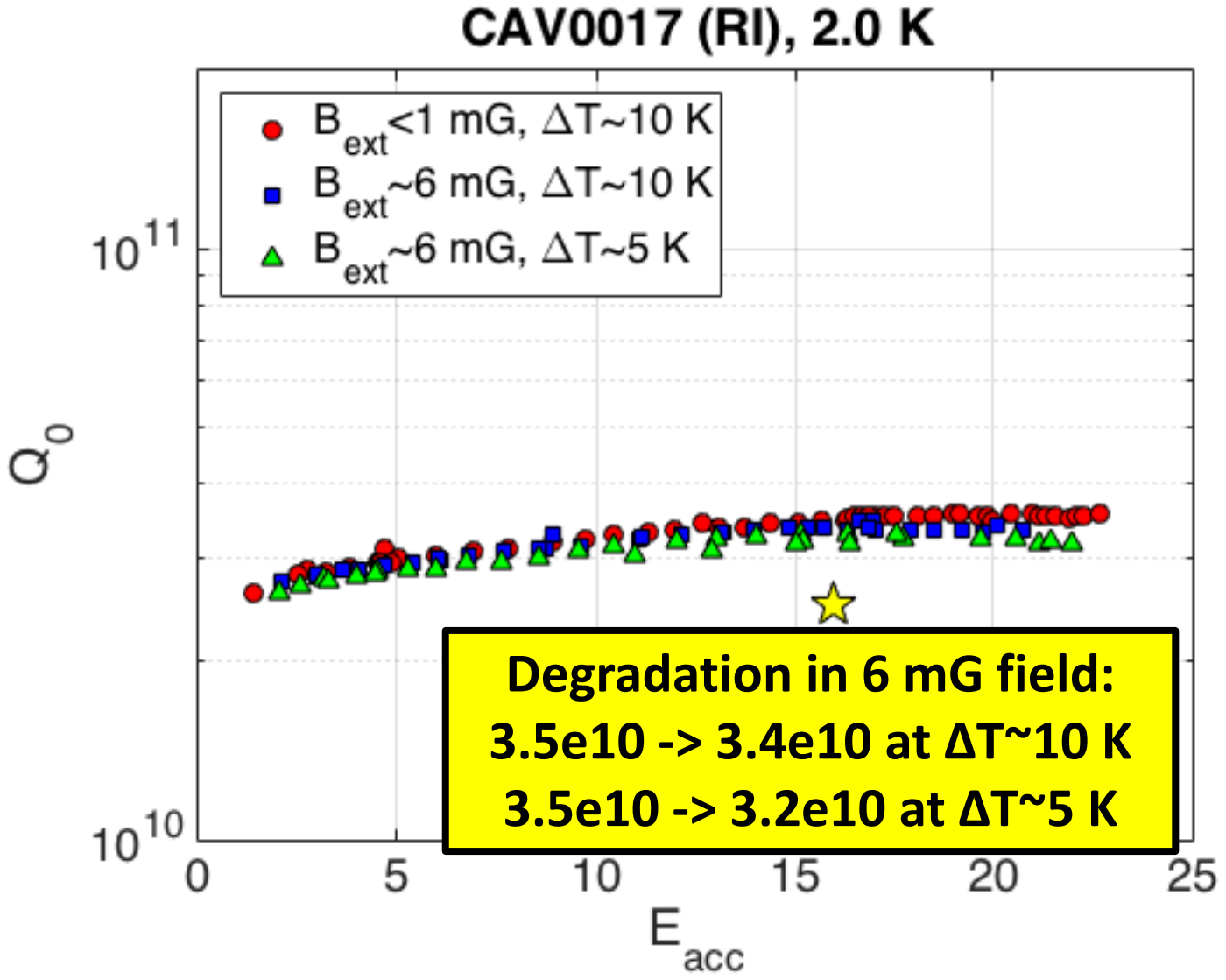
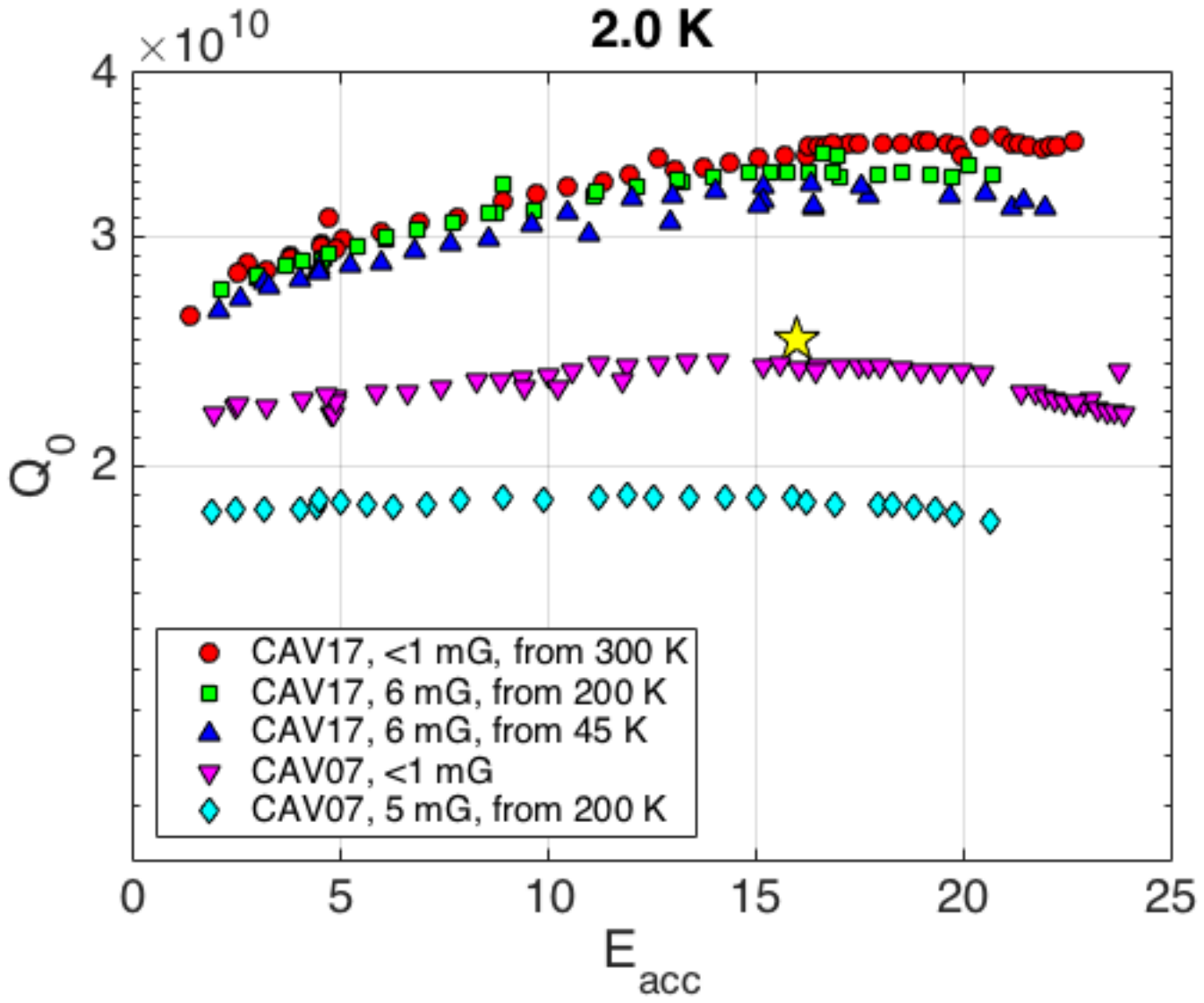
TB9AES017 – Expulsion Survey



CAV0017 – 5 mG Cooldown



CAV0017 – ~5 mG Comparison to CAV0007



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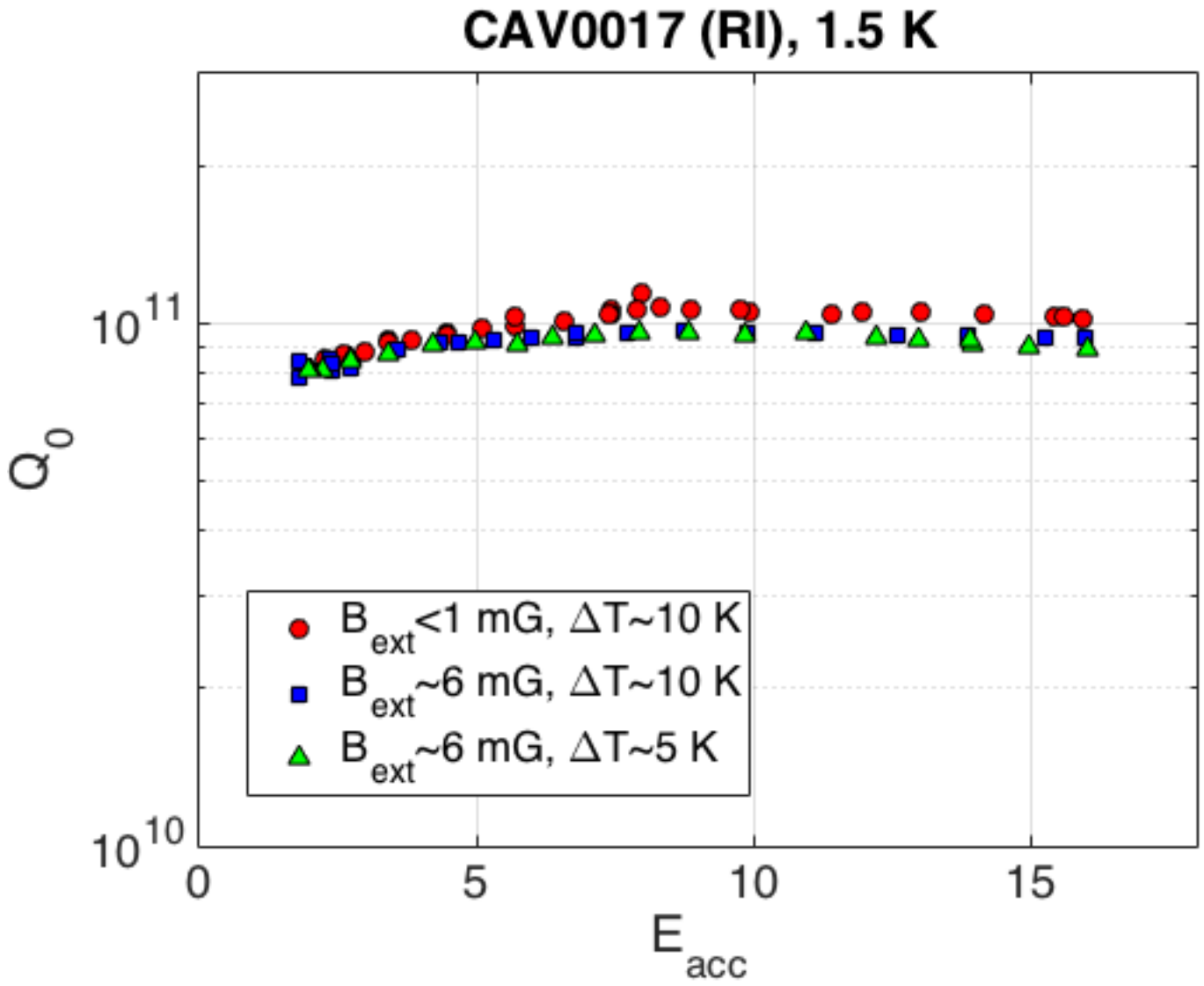
CAV0017 – Q vs E at 1.5 K



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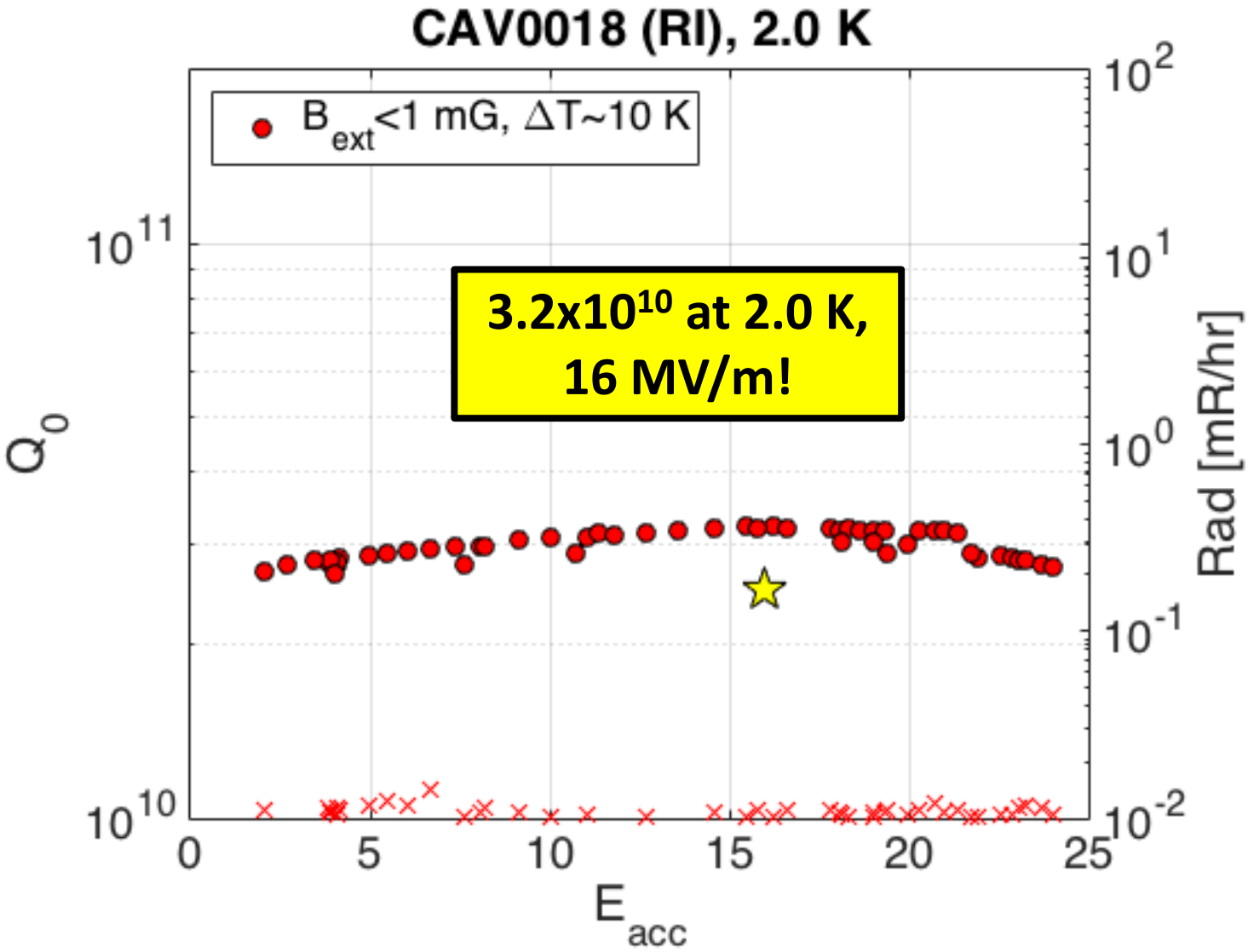
Frequency Shift During Transport

CAV#	COMMENT	Freq RI	Freq FNAL	Freq shift [kHz]	Temp @ RI	Temp @IB4	Freq @ IB4 temp corr [MHz]	Freq shift temp corrected [kHz]
CAV0003	Dressed	1298.325	1298.31714	-7.86	21.4	22.4	1298.327	2.14
CAV0006	Dressed	1298.271	1298.27869	7.69	24	22.2	1298.261	-10.31
CAV0007	Dressed	1298.334	1298.33142	-2.58	22.4	21.6	1298.323	-10.58
CAV0008	Dressed	1298.322	1298.33362	11.62	24	22.1	1298.315	-7.38
CAV0011	Dressed	1298.286	1298.25635	-29.65	22	21	1298.246	-39.65
CAV0013	Dressed	1298.267	1298.25195	-15.05	22	22	1298.252	-15.05
CAV0015	Dressed	1298.271	1298.26172	-9.28	22	21.5	1298.257	-14.28
CAV0016	Dressed	1298.283	1298.26831	-14.69	22	23.3	1298.281	-1.69
CAV0017	BARE- 900C caged	1298.167	1298.18152	14.52	22	21	1298.172	4.52
CAV0018	BARE- 900C caged	1298.169	1298.15466	-14.34	22	23.4	1298.169	-0.34
CAV0019	Dressed - 900C	1298.336	1298.30676	-29.24	22	23.7	1298.324	-12.24
CAV0020	Dressed - 900C	1298.287	1298.25562	-31.38	22	24.2	1298.278	-9.38

Courtesy Paolo Berrutti

CAV0018 – Q vs E, Compensated Field through T_c



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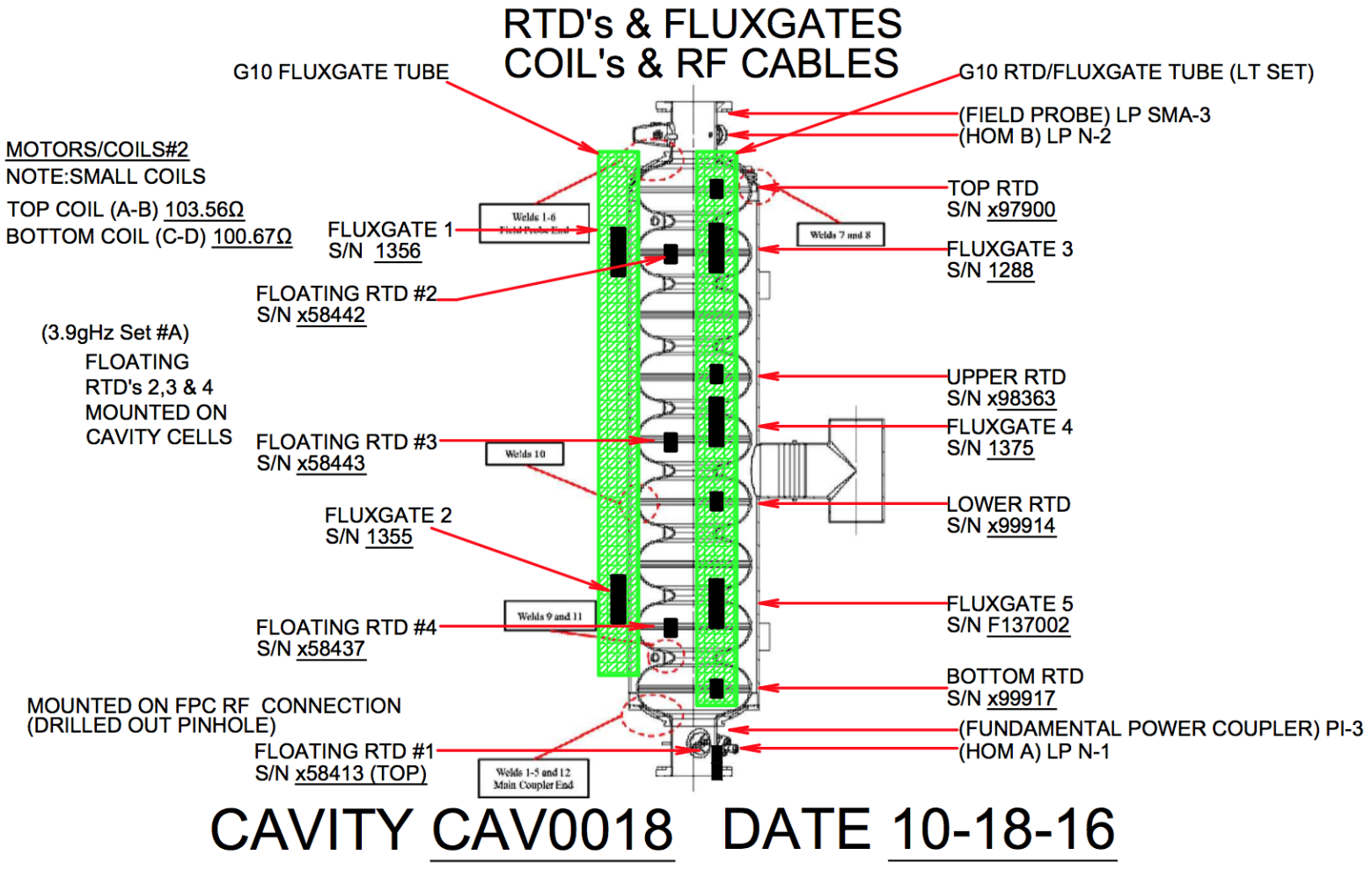
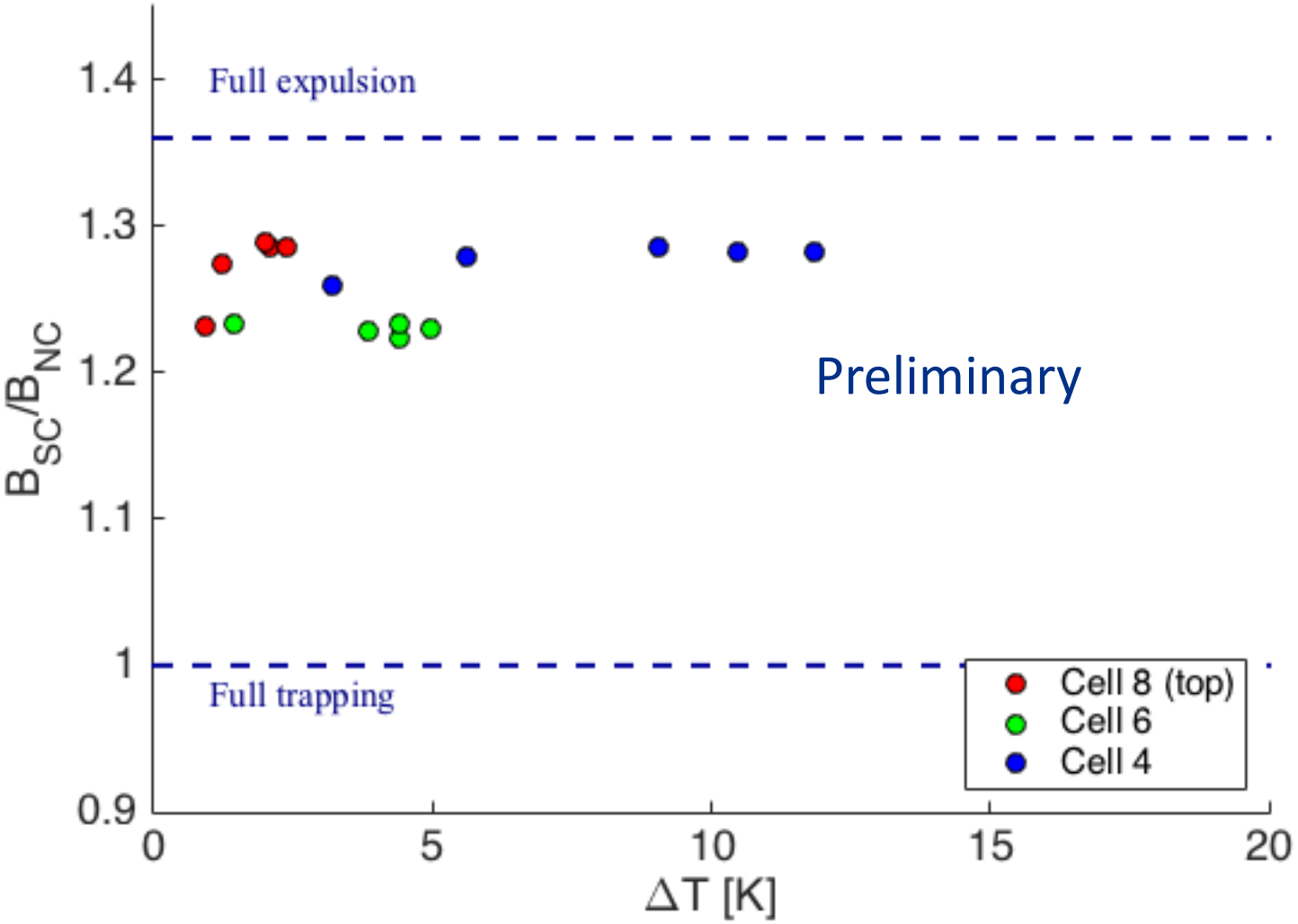
CAV0018 – Instrumentation



CAV0018 – Expulsion Survey



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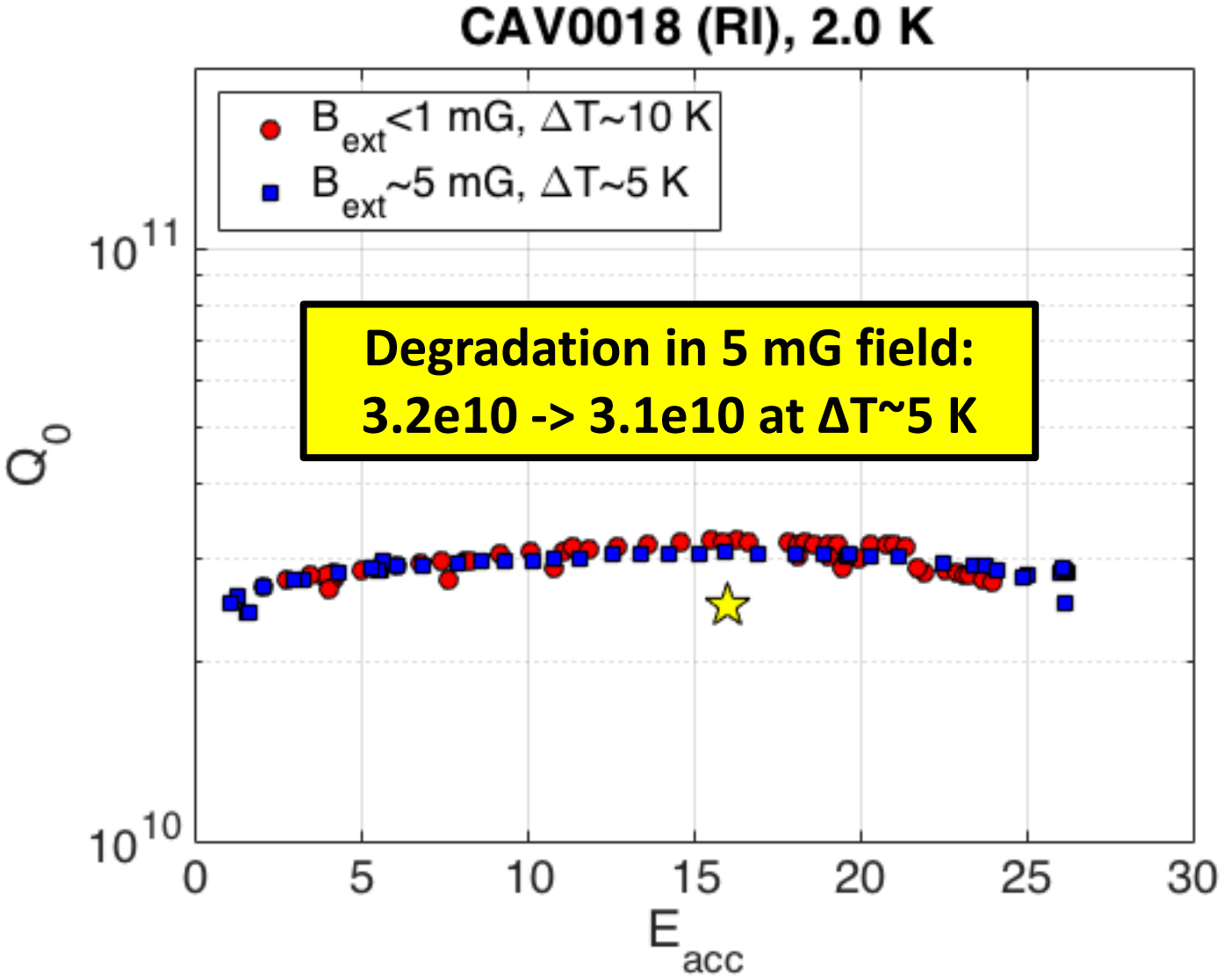
CAV0018 – 5 mG Cooldown



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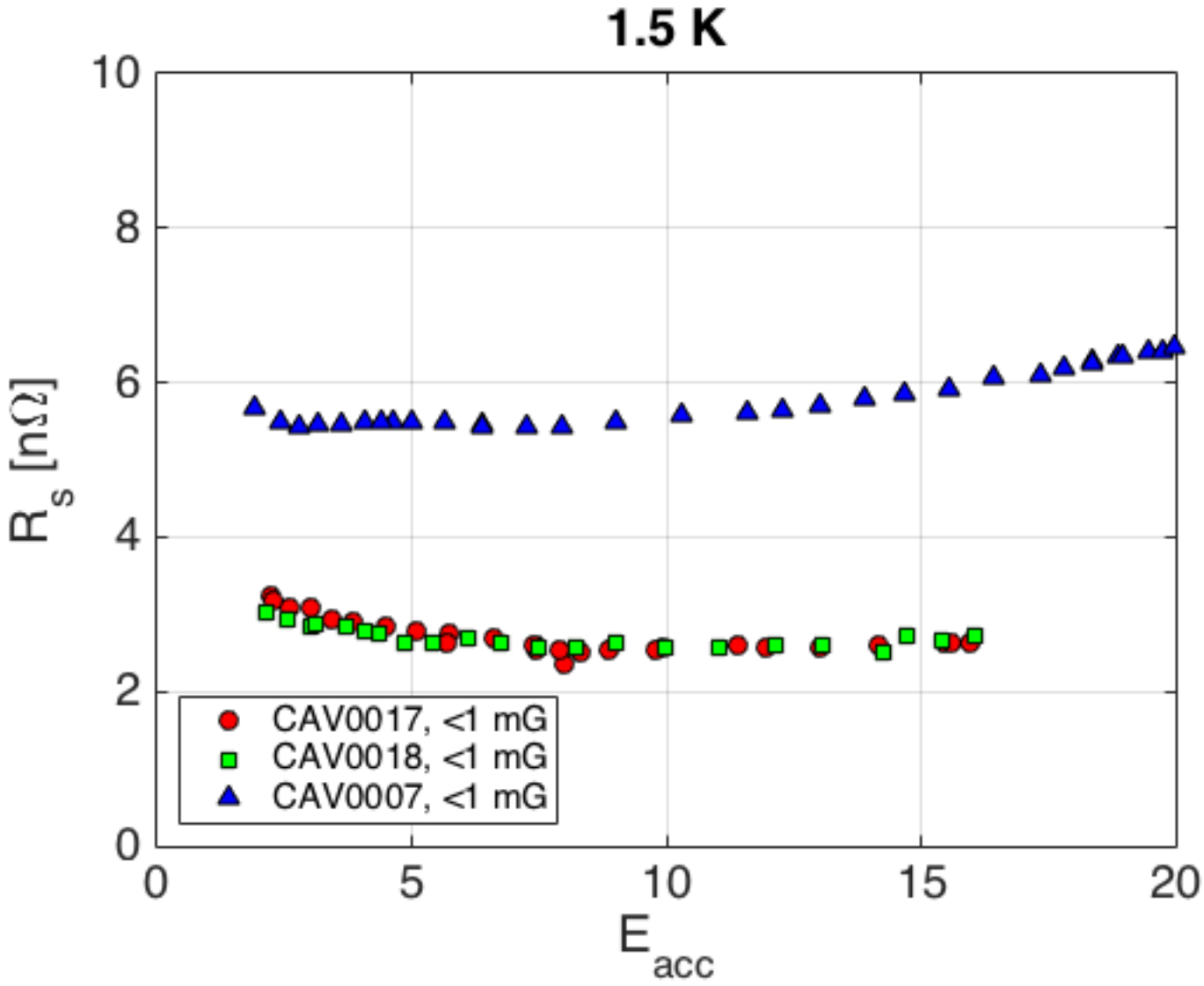
Intrinsic Residual (low T R_s in Compensated B)



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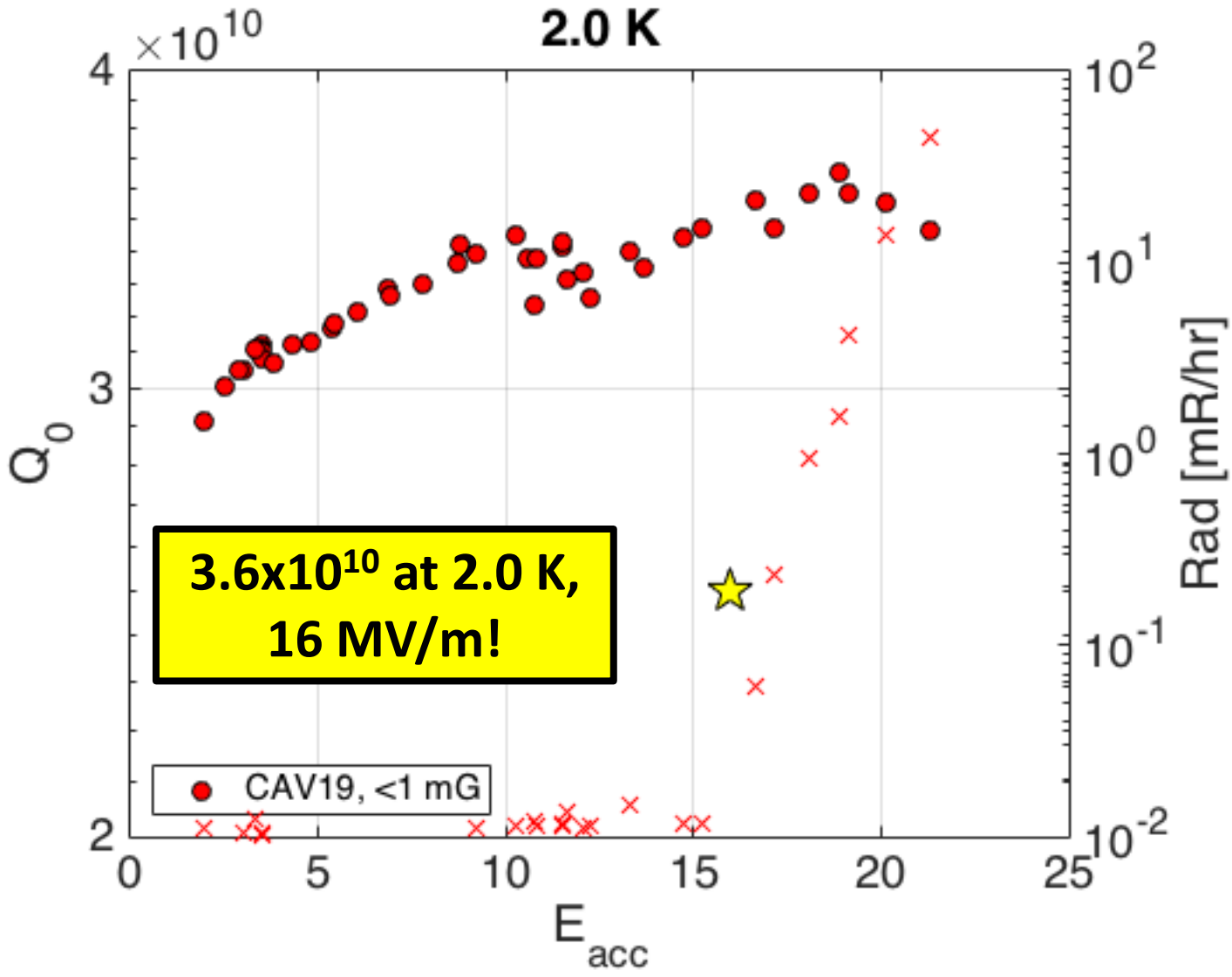
CAV0019

- First production cavity with 900 C, deeper EP

CAV0019 – Compensated Cooldown through Tc



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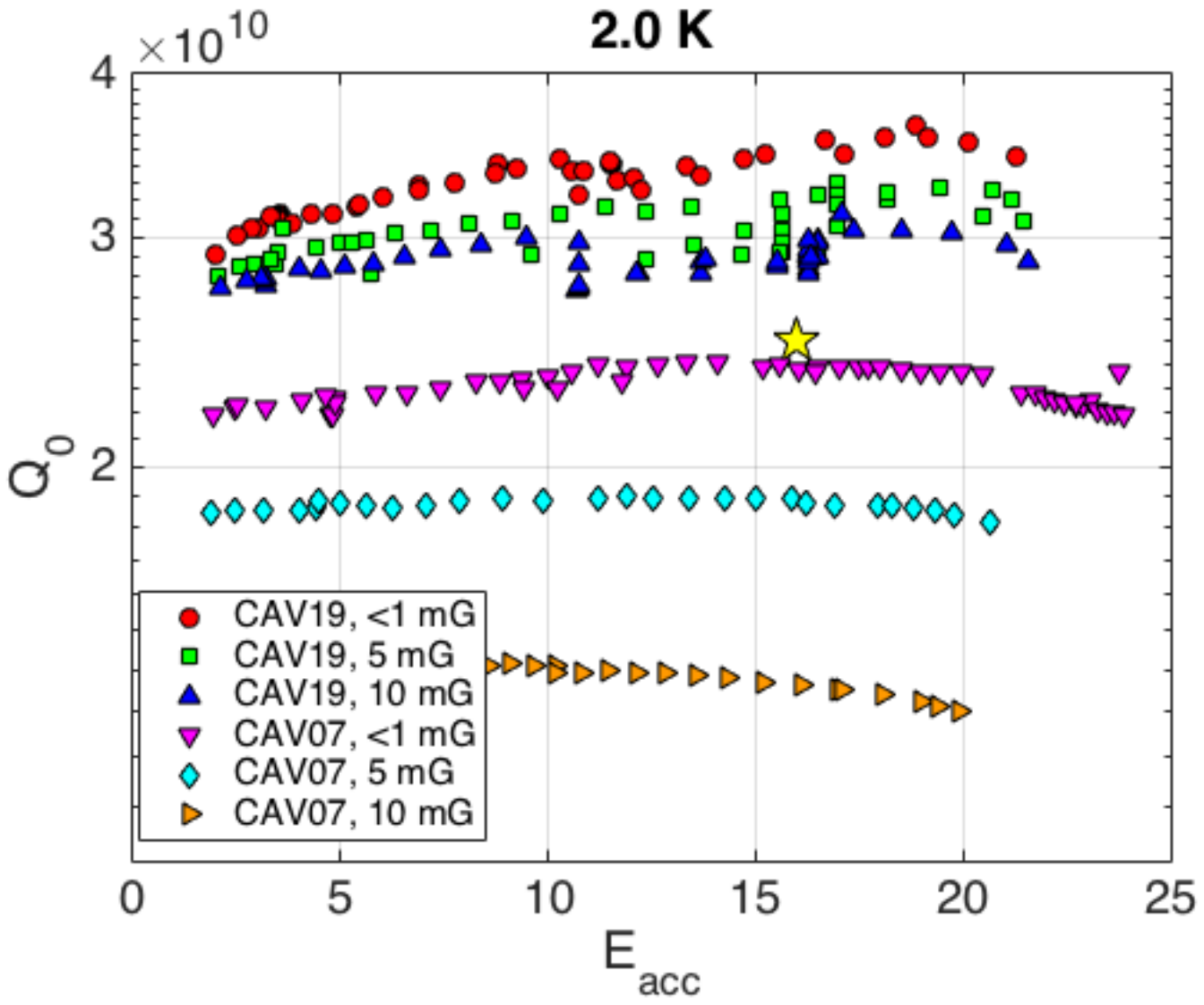
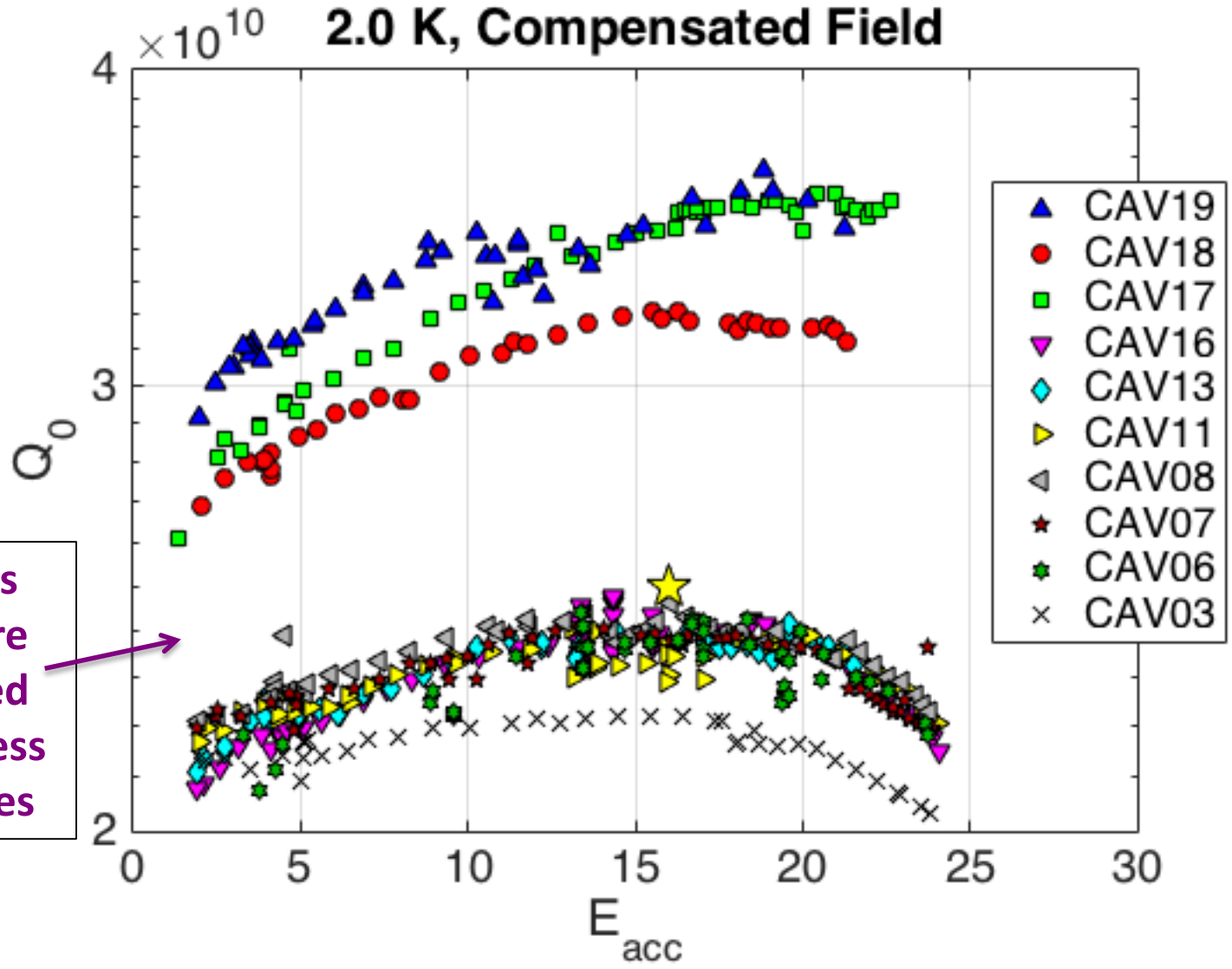
Cooldown in Magnetic Field Comparison



Comparison to Other Production Cavities @ FNAL



All cavities shown here were tested with stainless steel flanges

Summary

- **First cavities were tested with modified recipe**
- **Q_0 of 3.6e10, 3.5e10 and 3.2e10, significantly higher than production cavities tested to date**
- Performance is similar to cavities qualified for prototype cryomodules
- Maximum fields 22 MV/m, 23 MV/m, 27 MV/m
- Freq shift in transport similar to 800 C, ~30 kHz or less
- **Cooling through transition in ~5 mG field has minimal effect on performance**
- Far less vulnerability to ambient field than the other production cavity evaluated in external field
- Next cavity with modified recipe: CAV0020