

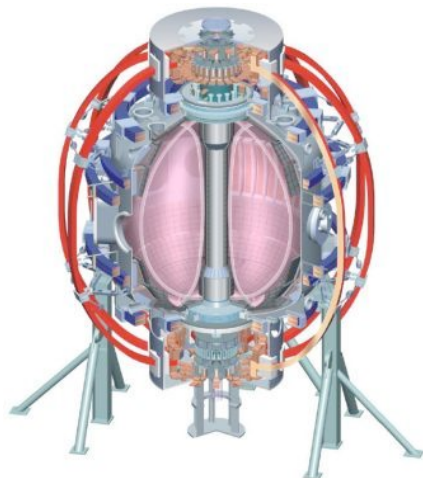
XP-950: Dependence of metallic impurity accumulation on I_p and the outer gap in the presence of lithium deposition

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Motivation, and what we did

- Li-conditioned ELM-free scenarios are known to suffer from massive radiated power if they achieve long pulse.
- Speculation/lore what that large outer gap or high I_p would limit the impurity accumulation, that source mix might matter.
 - Test this hypothesis with systematic scans.
 - Try, if possible, to diagnose the difference impurities, impurity sources, and provide operations/infrastructure guidance.
- Scanned I_p , outer gap, and source mix
 - Shots at [I_p (kA), B_T (T)] pairs of [700,0.45] and [1200,0.5]
 - For $I_p=700$ kA, did gap_out=[5,10,15,20] cm, for $I_p=1.2$ MA , did [10,15, 20] cm.
 - For each case, did A+B and A+C
 - Left the early beams, early shape, current ramp rate alone.
 - Did 2 shots with all fixed except for LFS puffing during the flat top.
- Not always fully ELM-free
 - We thought that bay-K LITER was on the verge of running out, and so rationed the usage.
 - Ended the day with negative Li in Bay-K LITER.
- Diagnostics used:
 - Bolometry
 - Z_{eff} from bremsstrahlung
 - Carbon dynamics from CHERS
 - SPRED, XEUS, LoWEUS
 - Visible cameras

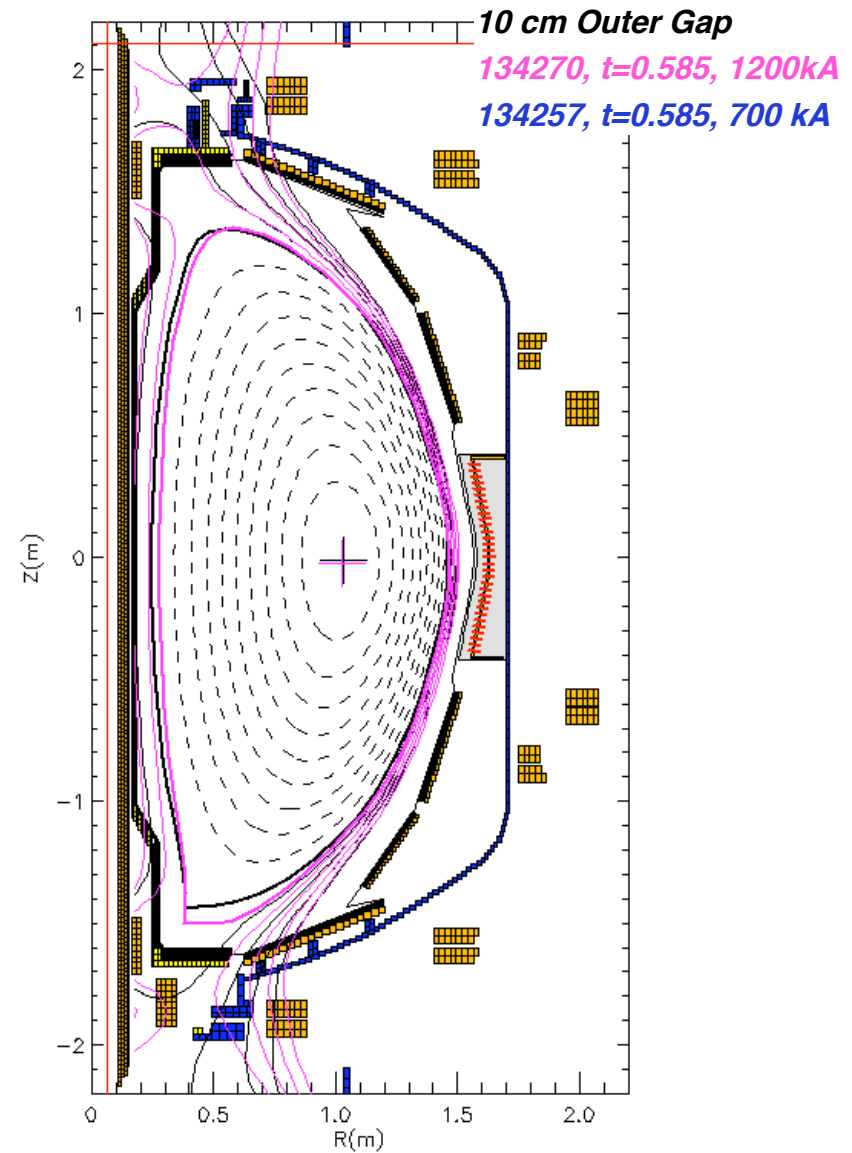
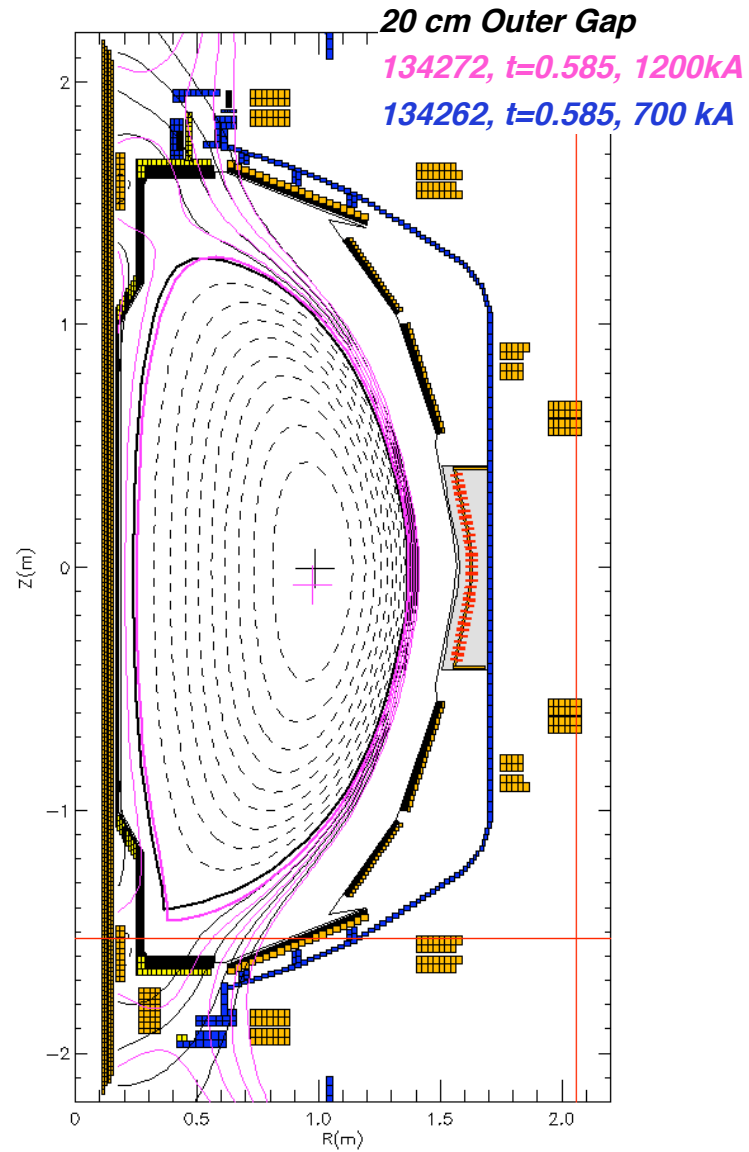
Here is the Shot List

1200kA Cases have BT=0.5 T						
700kA Cases have BT=0.45 T						
FT Gas= LFS Fueling Rate During the Flat Top (TL/s)						
= Shots with A+B						
= Shots that are not useful						
shot	Ip	Outer Gap	Sources	LI Evaporated	FT Gas	Comment
134256	700	10	A+B	247	0	
134257	700	10	A+B	251	0	
134258	700	10	A+C	206	0	
134259	700	15	A+C	195	0	
134260	700	15	A+B	208	0	No CHERS, so repeat
134261	700	15	A+B	186	0	No CHERS
134262	700	20	A+B	192	0	
134263	700	20	A+C	204	0	
134264	700	5	C Only	203	0	Source C Only
134265	700	4	A+C	202	0	
134266	700	5	A+B	202	0	
134267	1200	15	A+B	202	0	
134268	1200	15	A+C	202	0	
134269	1200	10	A+C	200	0	
134270	1200	10	A+B	202	0	
134271	1200	20	A Only	202	0	Source A Only
134272	1200	20	A+B	202	0	
134273	1200	20	A+C	202	0	Disrupts During Ramp
134274	1200	20	A+C	202	0	
134275				202	0	No Fields
134276	700	15	A+C	202	20	
134277	700	15	A+C	202	40	Reduced Prad, probably because ELMs come back
134278	700	15	A+C	202	0, then 20	

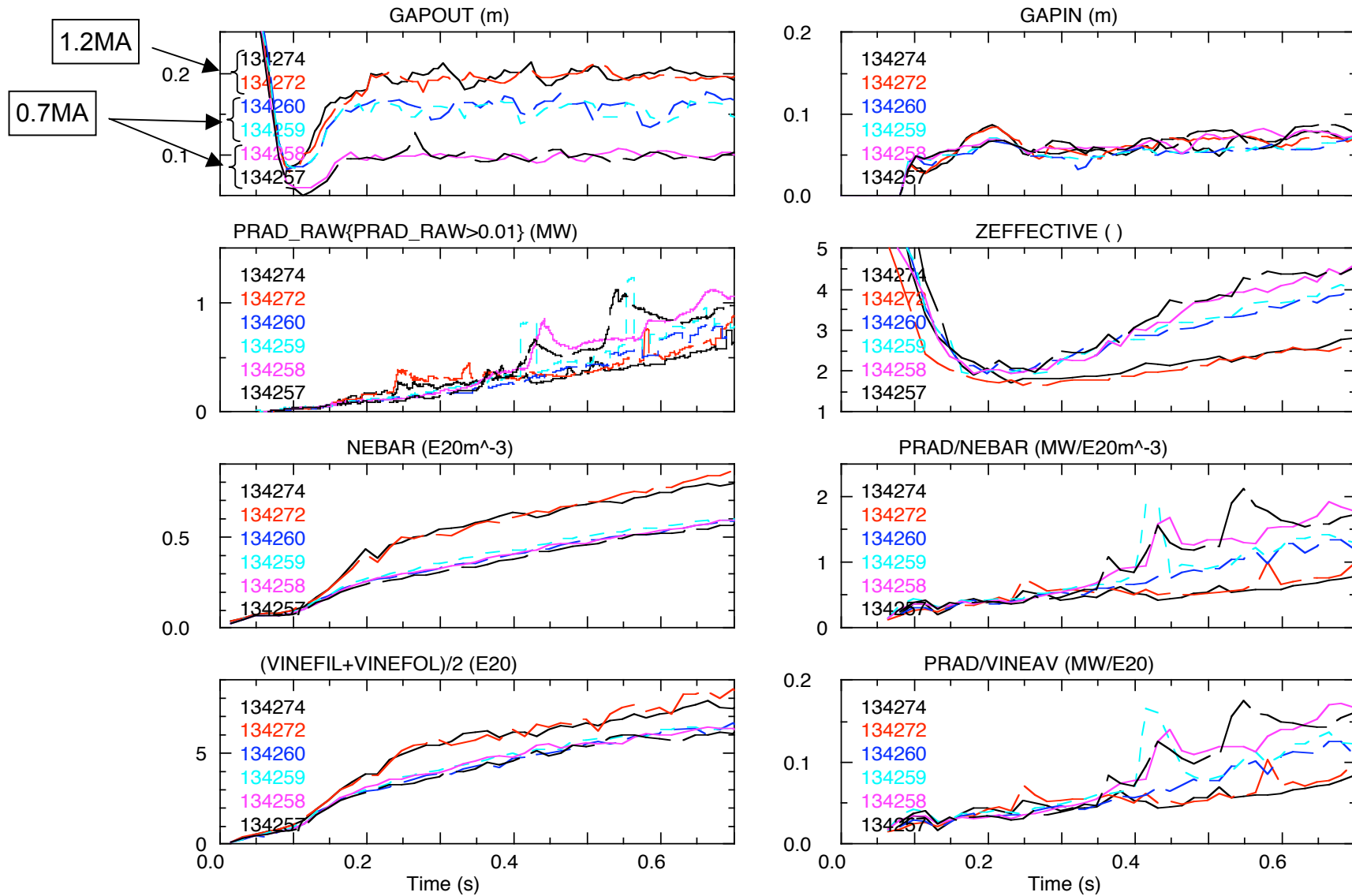
This data is not “proprietary” data for the XP authors.

The table is here to encourage all team members to contribute to the analysis

Shapes in This XP

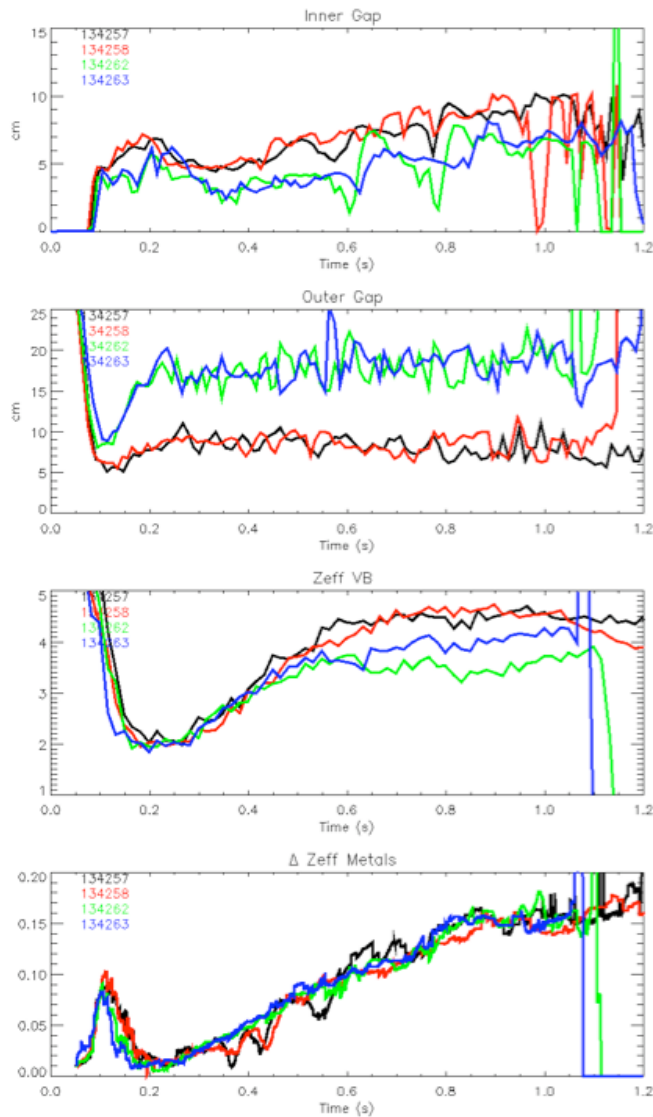


Impurity Accumulation Reduced at large values of I_p and Outer Gap

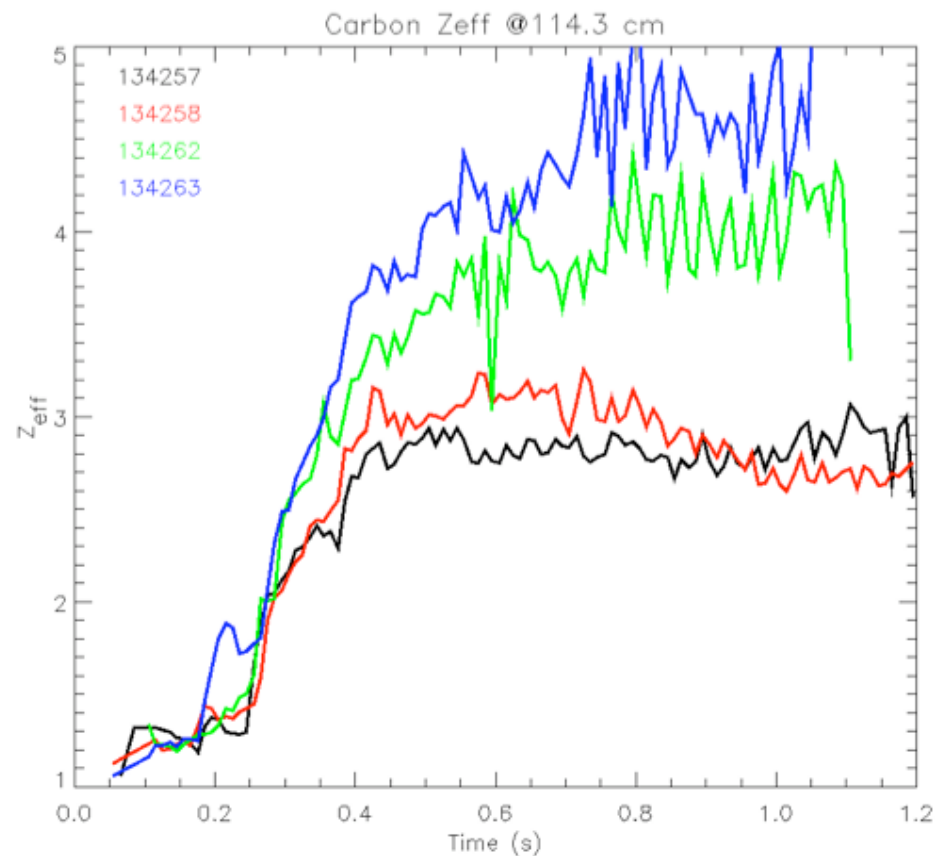


Analysis By M. Bell

Carbon Increases when the Outer Gap Became Large

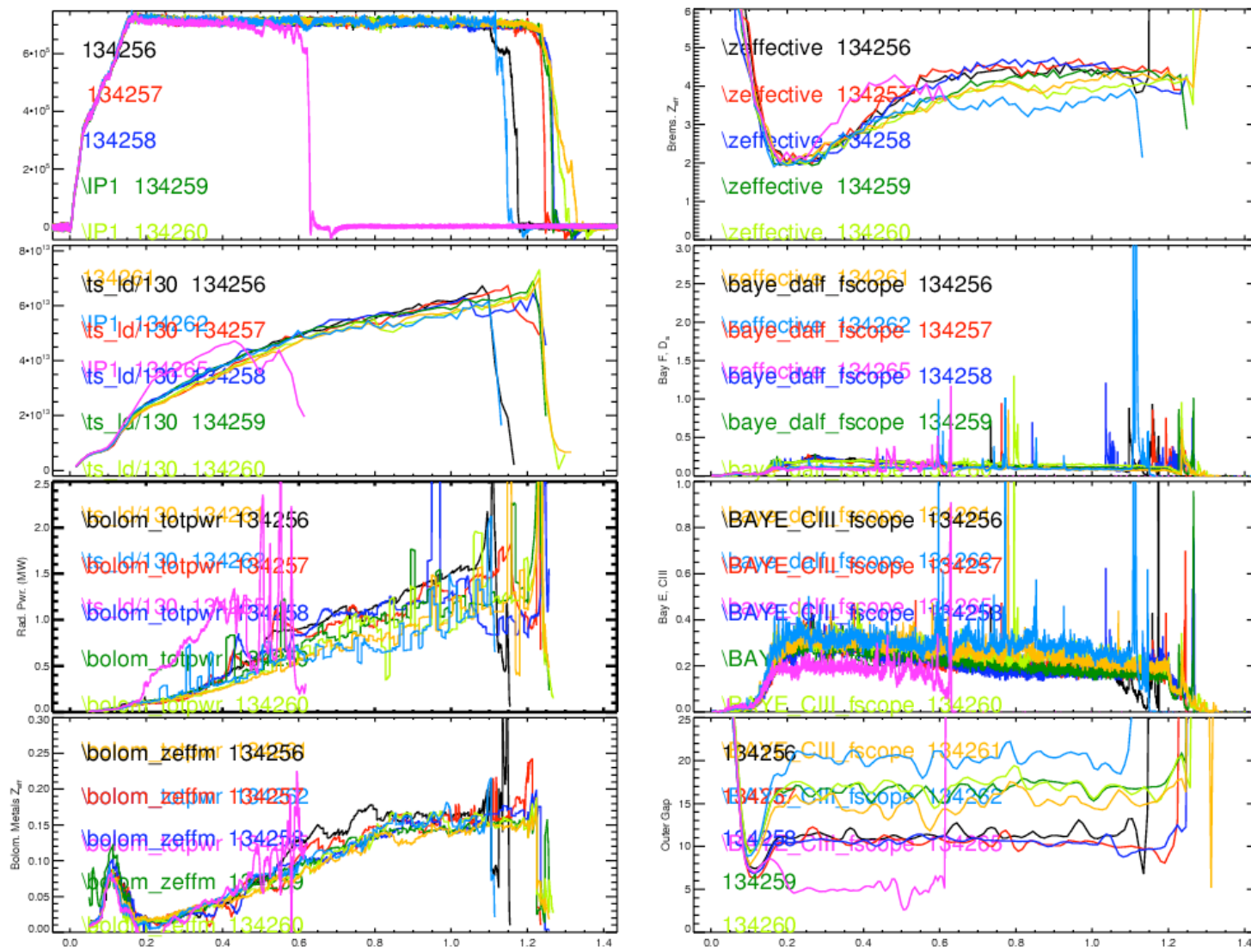


- All 700 kA shots
- *Zeff from VB and from local carbon show opposite trends*

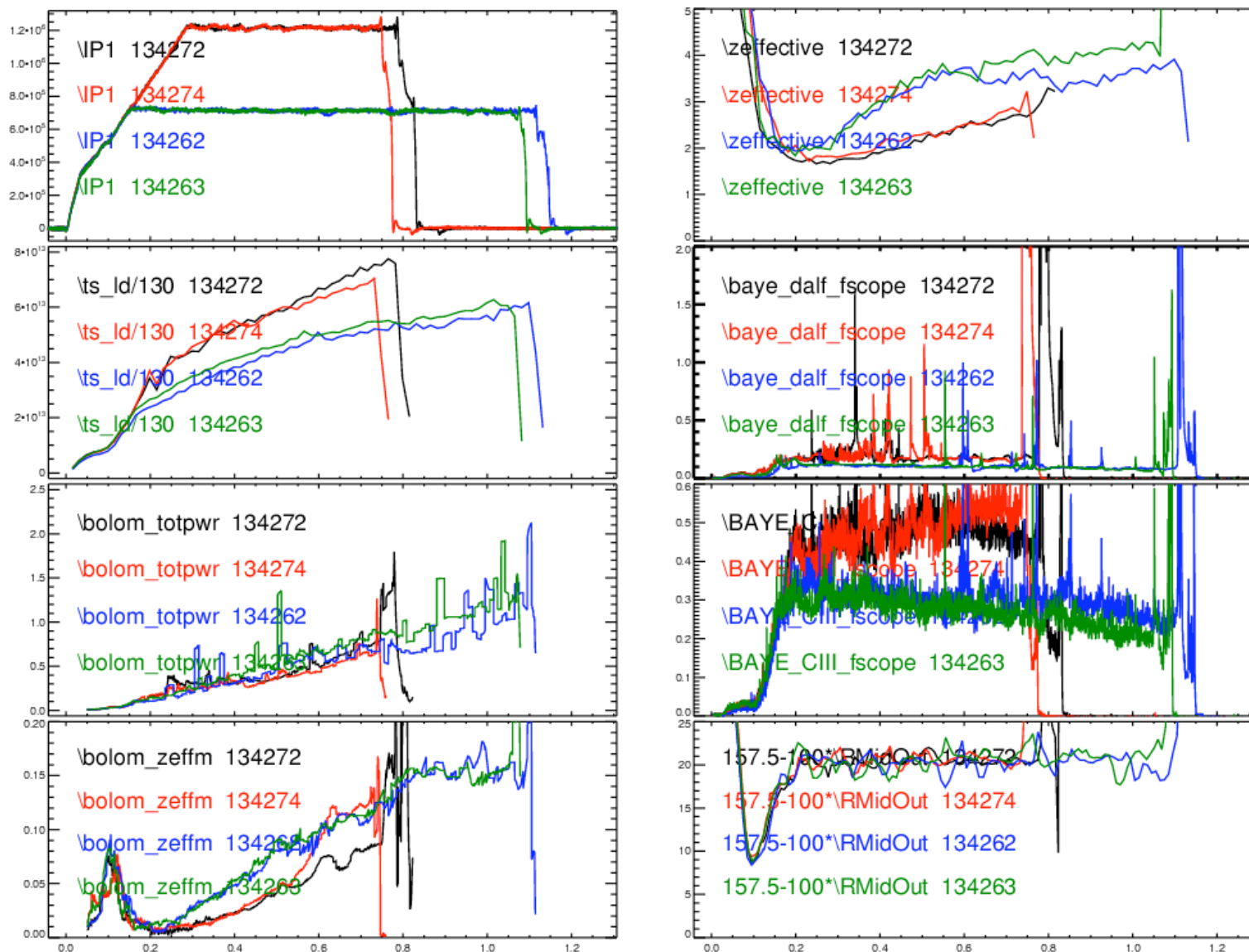


Analysis By R. Bell

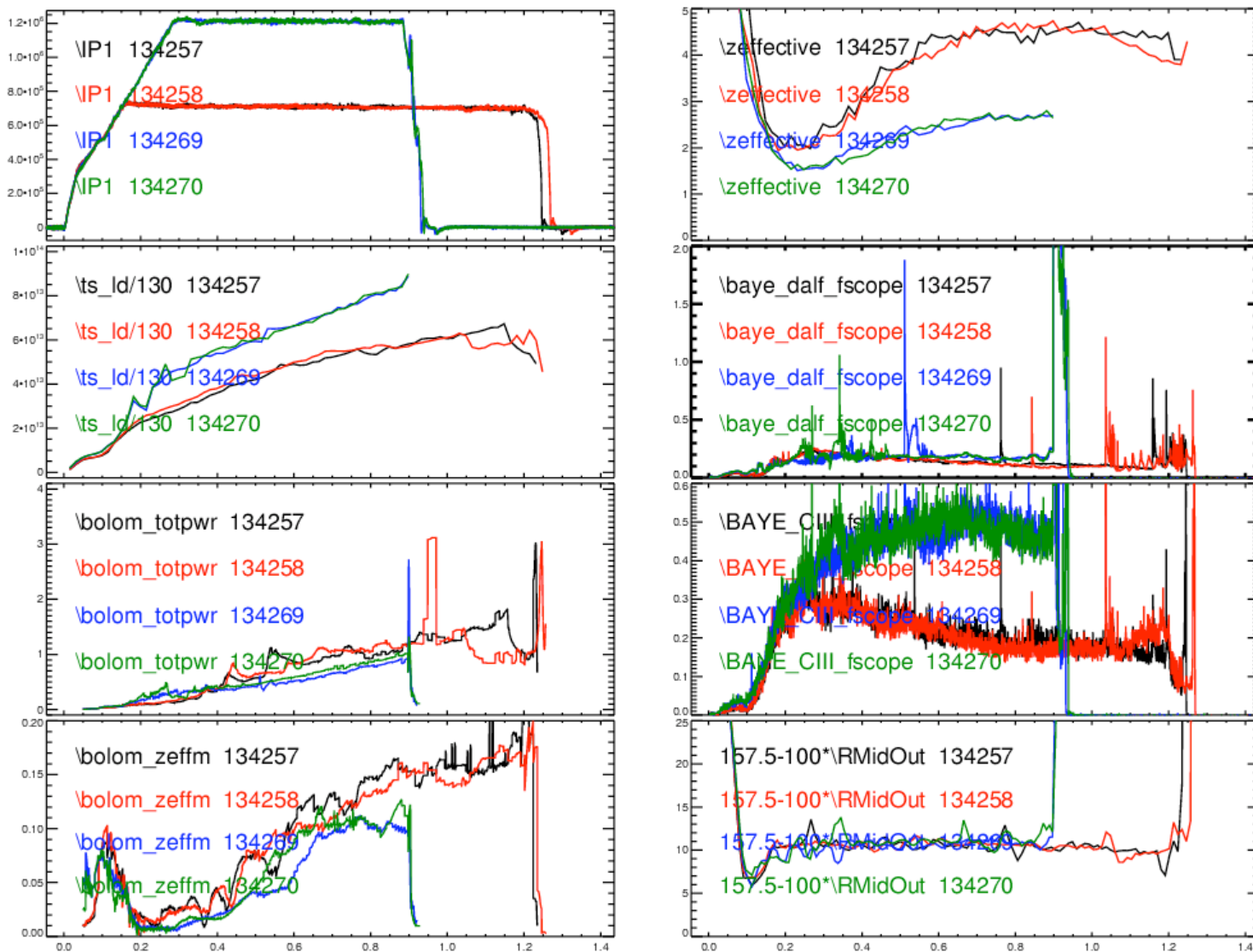
Total Radiated Power Reduced with Increasing Outer Gap At $I_p=700\text{kA}$



For Fixed Gap of 20 cm, high- I_p Had Less P_{rad} , but Similar Rate of Rise, but ELMs may Complicate Analysis



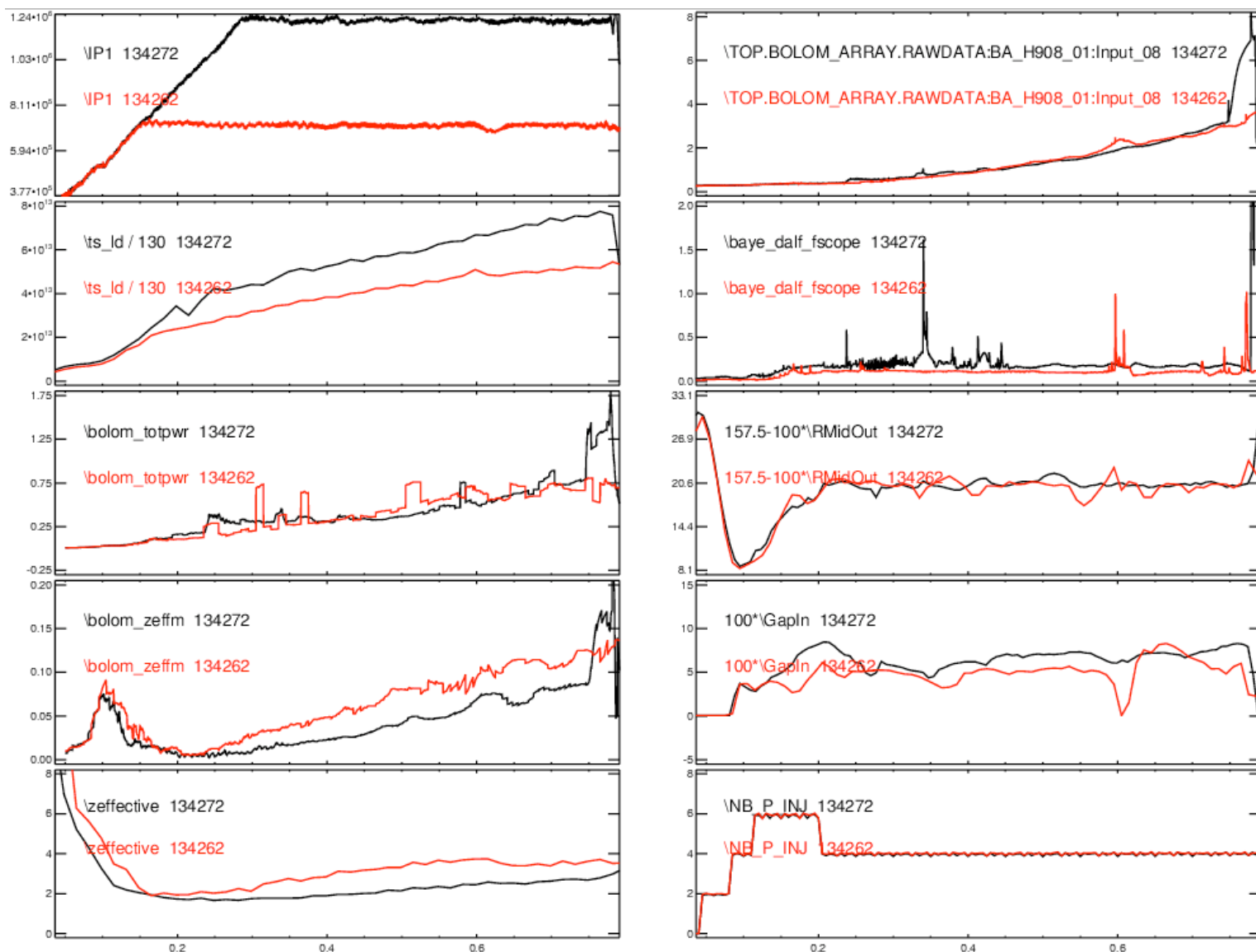
For Fixed Gap of 10 cm, high- I_p Had Less P_{rad} , but Similar Rate of Rise, but ELMs may Complicate Analysis



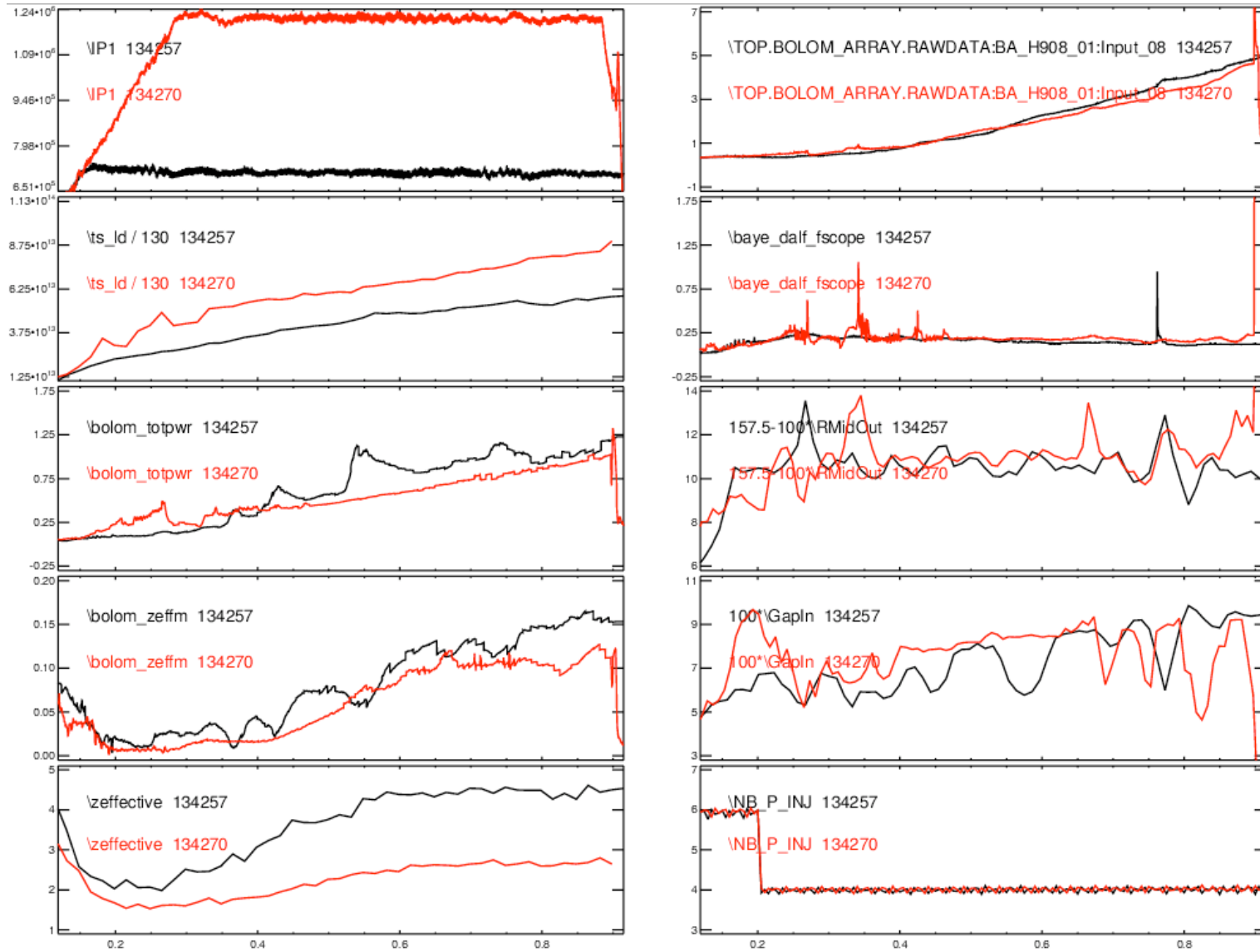
Need lots of (real) analysis ...

- Need to compare the P_{rad} profiles for different parameters
 - Reconstruct the radiated power profiles, integrals with better equilibria than efit01.
 - Does the location of maximum radiation shift when I_p is modified.
- Need to make comparative studies of spectra from XEUS, LoWEUS, SPRED
- Need analysis of the fast-ion loss physics.
- Need to look at metals vs C contribution to Z_{eff} and P_{rad} .
- Need to inspect movies in more detail.

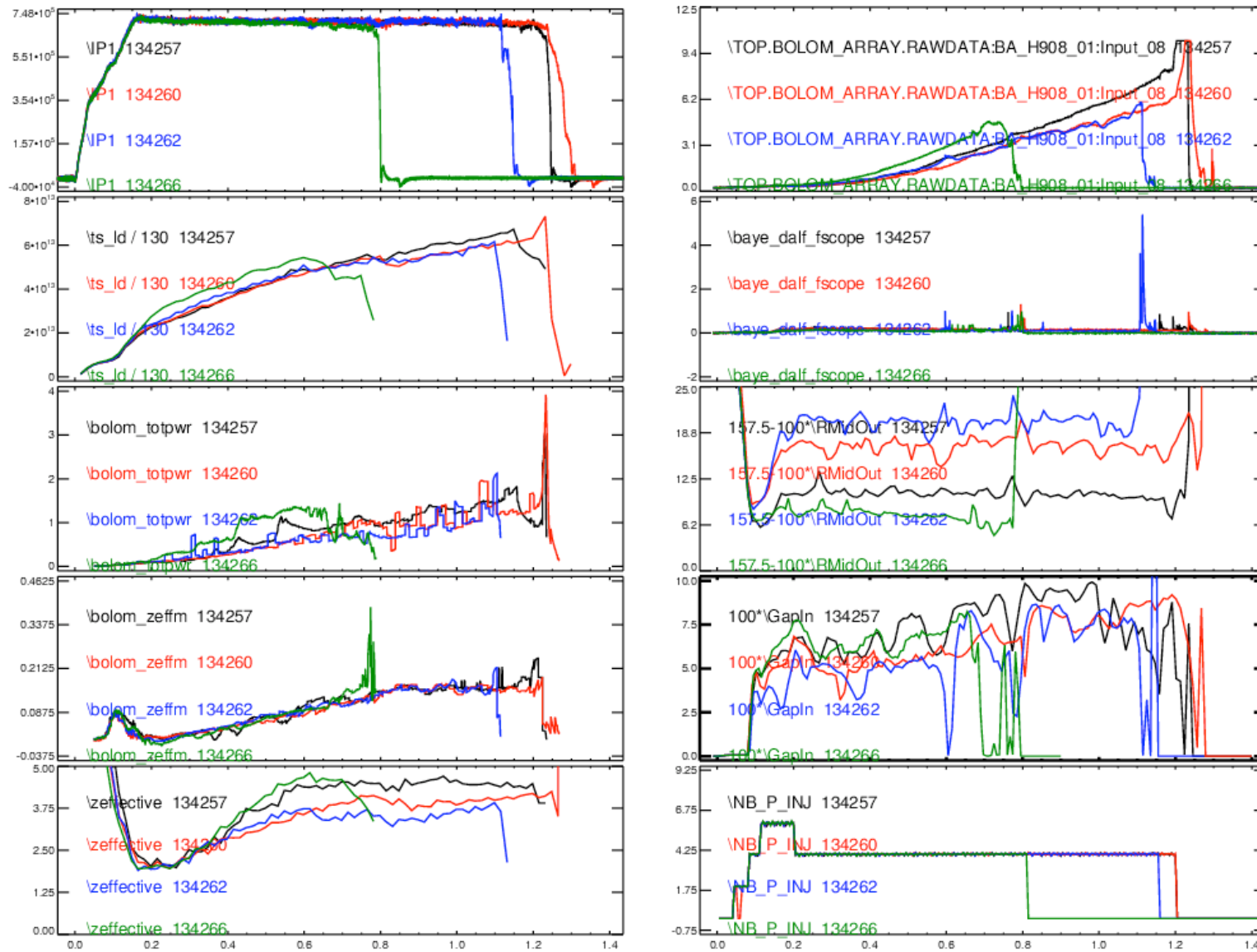
Compare A+B, 20 cm outer gap, different I_p



Compare A+B, 10 cm gap, different I_p



Compare A+B, gap scan at 700 kA



Compare A+B, gap scan at 1200 kA

