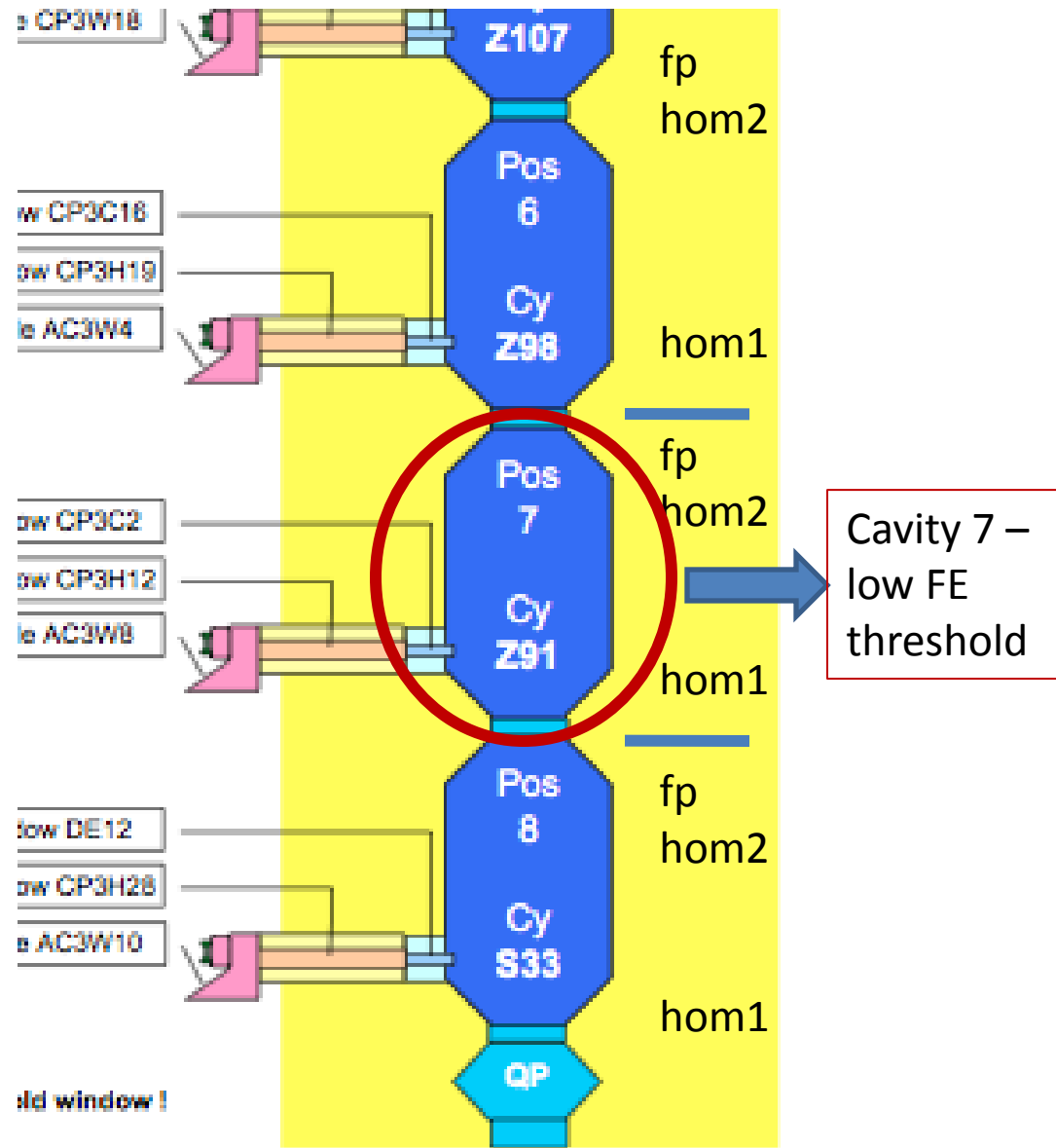


Dark Current in high gradient cavities

- Field emitted current shows non-linear increase as gradient is raised – roughly following ‘Fowler-Nordheim’ scheme.
- Field emission sites are defects: (e.g. scratches) or contaminants.
- A field emission point is a ‘diode’ →
 - dark current is ‘bunched’
- A bunched beam will radiate harmonics of the fundamental (up to $\omega \sim 1/\text{bunch length}$)

2nd / 3rd harmonic

- Experiment:
 - compare amplitude of harmonics above & below the FE threshold
- Check both HOM pickups and field probe for 2.6 / 3.9 GHz
 - cavity 7 (PXFEL3) CMTB appears to have been contaminated (string assy?) → low FE thres.
- → signal easily seen



2nd/3rd harmonic change:

- above – below FE threshold:
 - requires a change Klystron output by 20%

Voltage increase	Cav6 HOM1	Cav7 – FP	Cav7 – HOM2	Cav7 – HOM1	Cav8 FP
2.6 GHz	8db (x2.5)	8dB (x2.5)	0dB	3dB (x1.5)	-4dB
3.9GHz	-2dB	2dB	18 dB (x7.5)	-7.5dB	3dB

- Conclusion:
 - a strong signal; seems to respond above/below FE
 - but questions (modeling needed):
 - 2.6/3.9;
 - reduction (Cav7-Hom1)?