

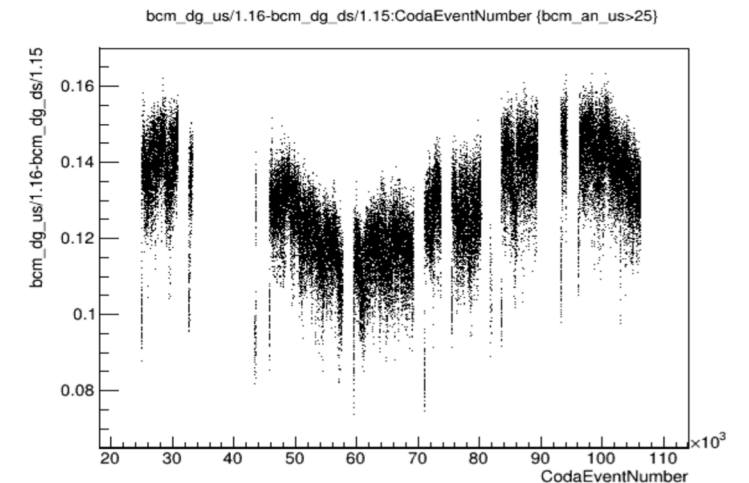
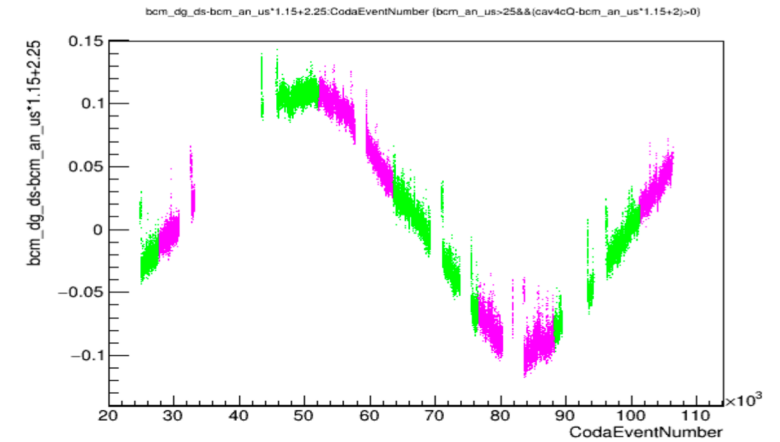
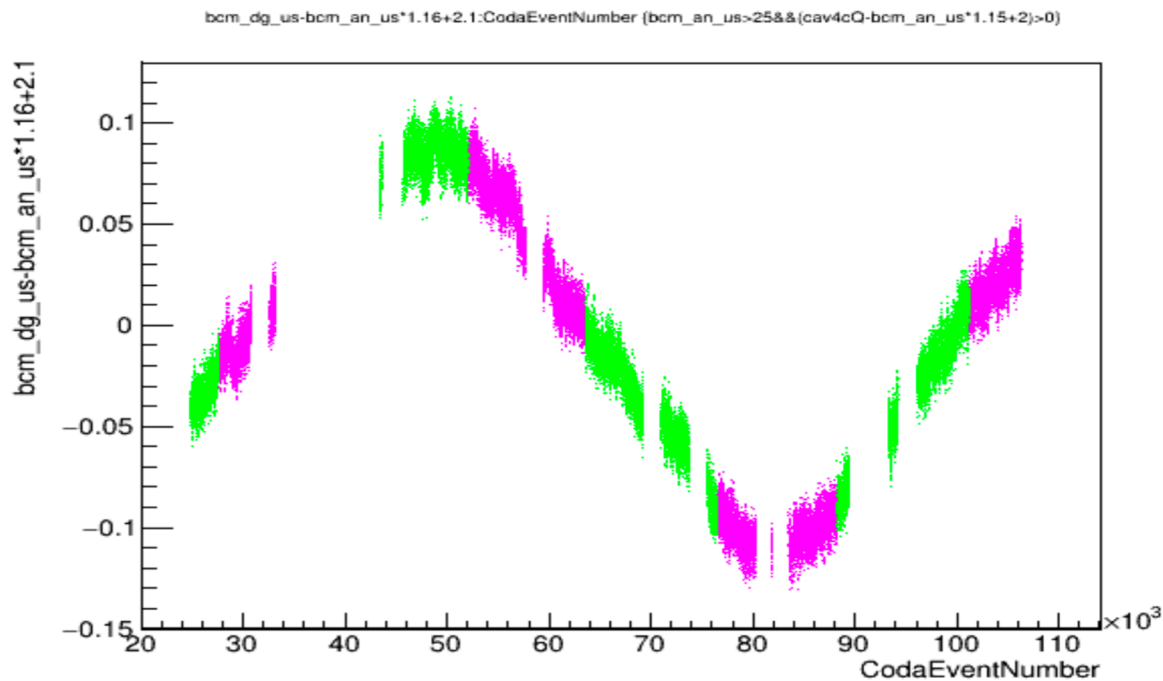
# Digital Receivers Theories

Caryn Palatchi

10/17/2023

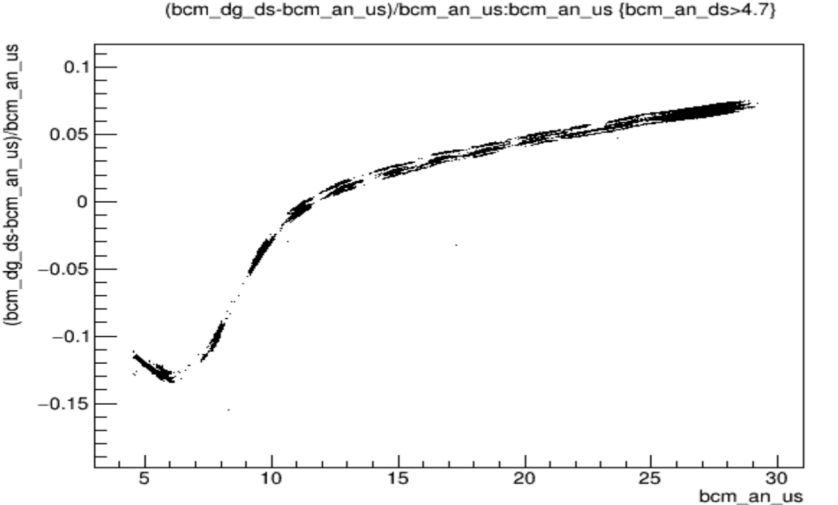
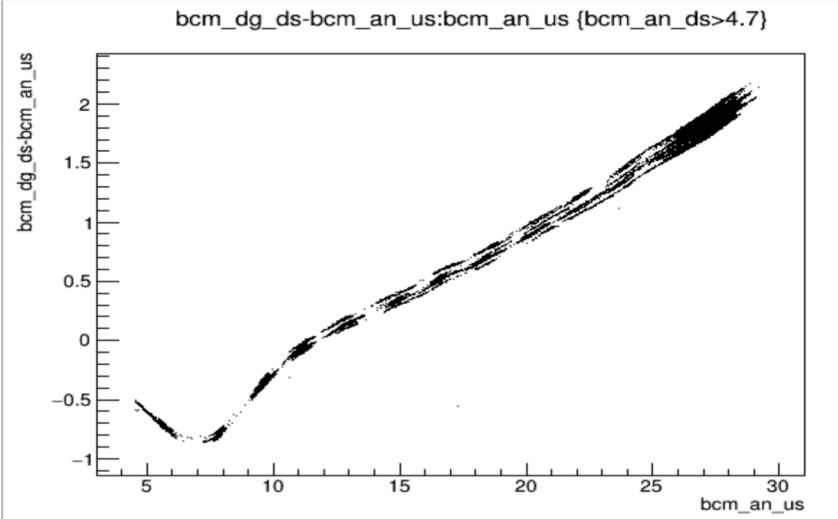
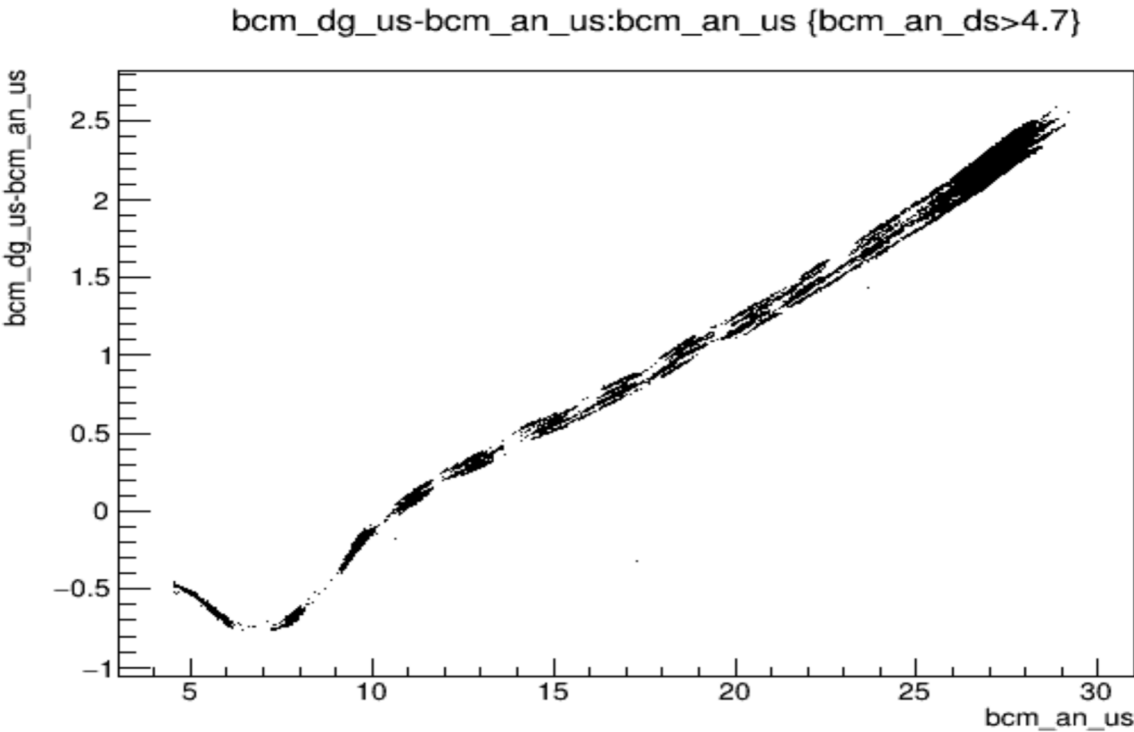
# Devi's Run12050 30uA 2023

- I think the gain of the digital receivers are oscillating (together) with a period on the order of 10-20min (I think these are the digitals not analogs because of oscillation in dgds-dgus)
- I think this could be the result of a slippage of 10MHz ref to 499MHz ref /1497MHz the cans resonate at



# Devi's Run12050 30uA 2023

- The reason I think it's the gain and not the pedestal of the receiver changing is the below graph where the "variations" are smaller in breadth for lower currents and seem normalized when divided by current.

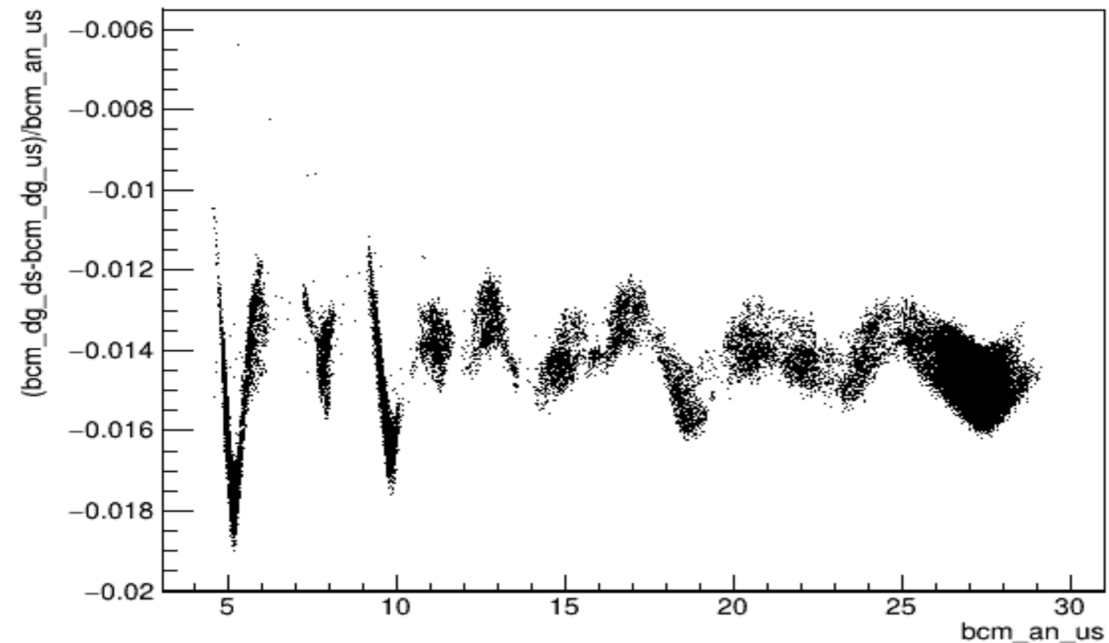


Normalized  
To current

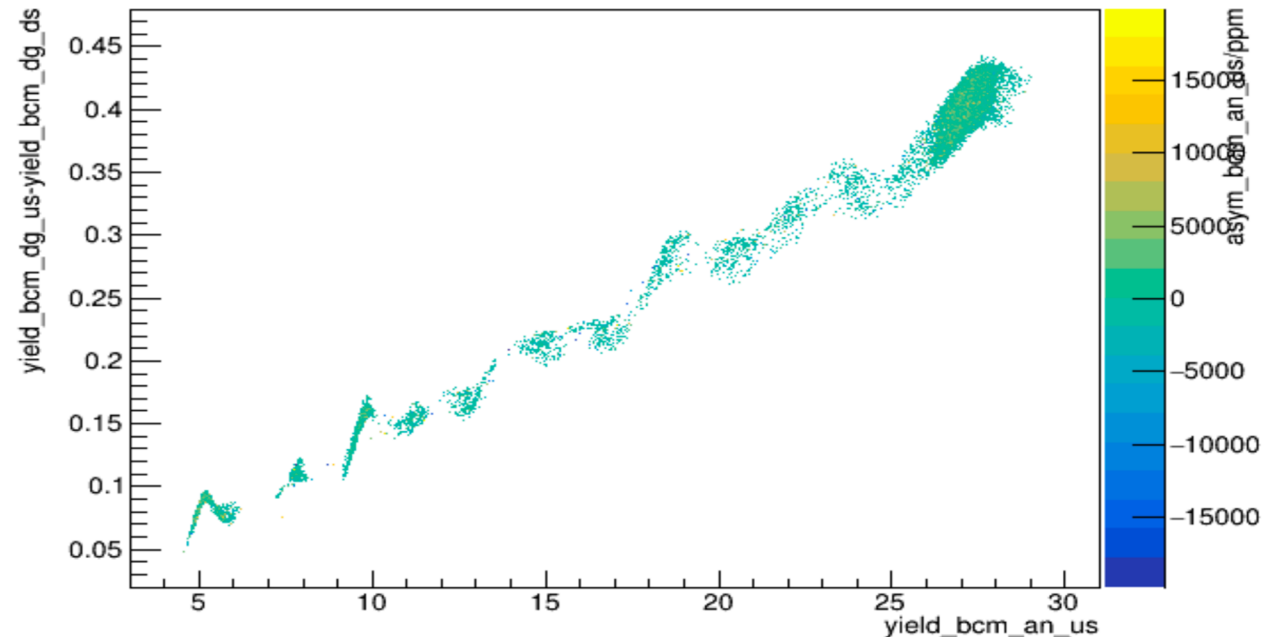
# Devi's Run12050 30uA 2023

- Oscillatory signal response
- When looking at dgds-dgus, can see a sinusoidal signal response to current. Maybe it's actually sinusoidal  $S=I+\text{asing}(k*I)$  or the bit resolution is observable in signal output and this is actually like a sawtooth.
- Note that for CREX, I think we wanted linearity at 150uA, so maybe 300uA  $I_{\text{max}}(??)$ , 12bit dac gives 0.07uA/bit, 14bit dac gives 0.035uA/bit.... If linear. But looks like period increasing with I so maybe logarithmic.

`(bcm_dg_ds-bcm_dg_us)/bcm_an_us:bcm_an_us {bcm_an_ds>4.7}`

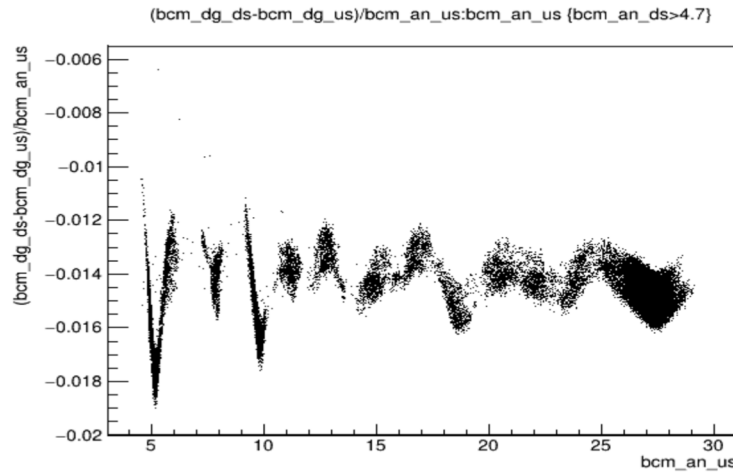


`yield_bcm_dg_us-yield_bcm_dg_ds:yield_bcm_an_us:asym_bcm_an_us/ppm (yield_bcm_an_ds>4.7&&abs(asym_bcm_an_us/ppm)<2000)`

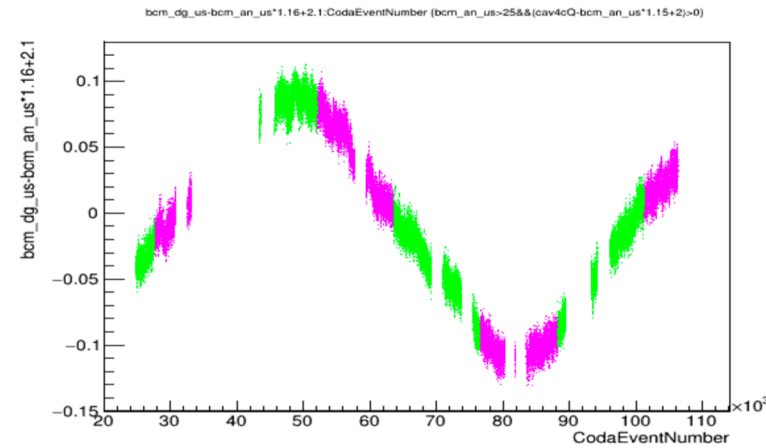


# Devi's Run12050 30uA 2023

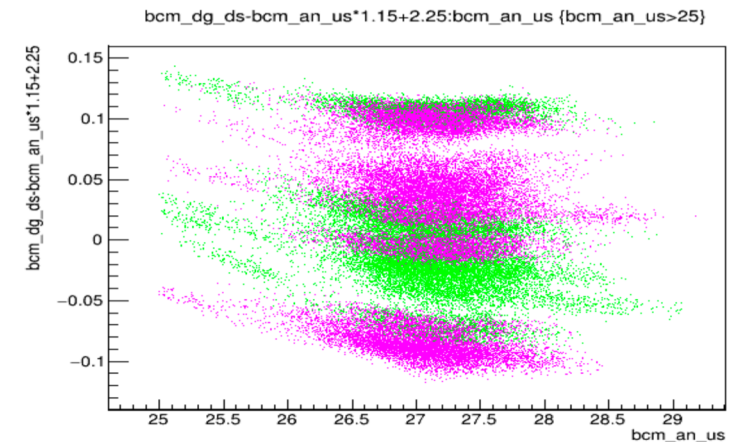
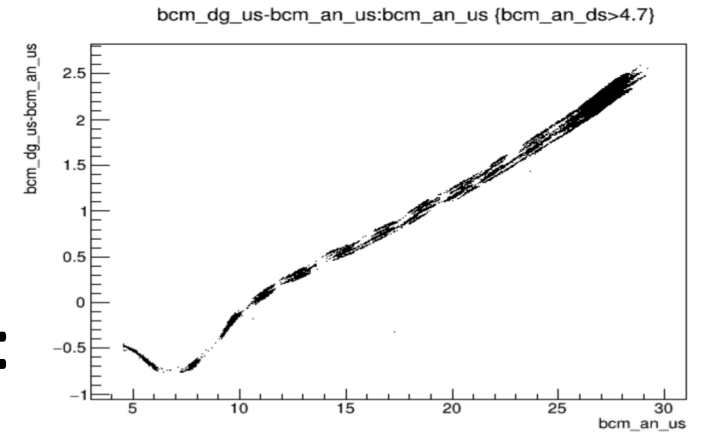
- Why are there stripes?
- I think there's two things: (1) the gain temporal oscillation + (2) sinusoidal signal response to current/bit resolution- observable in signal output



+



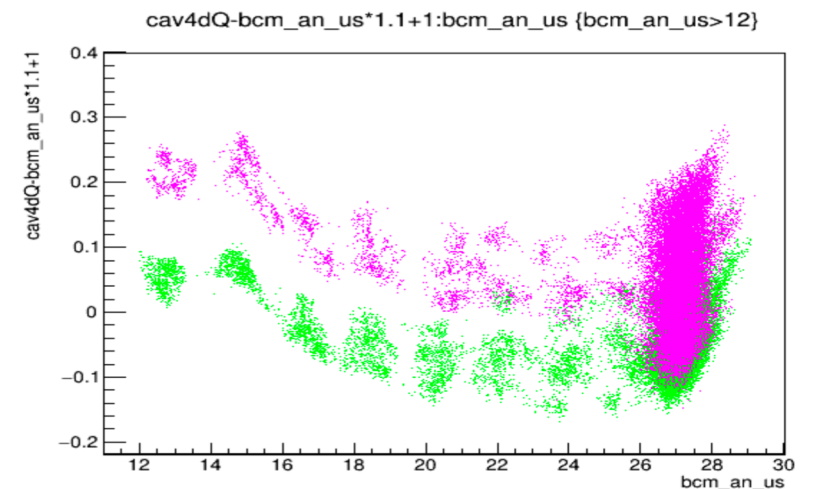
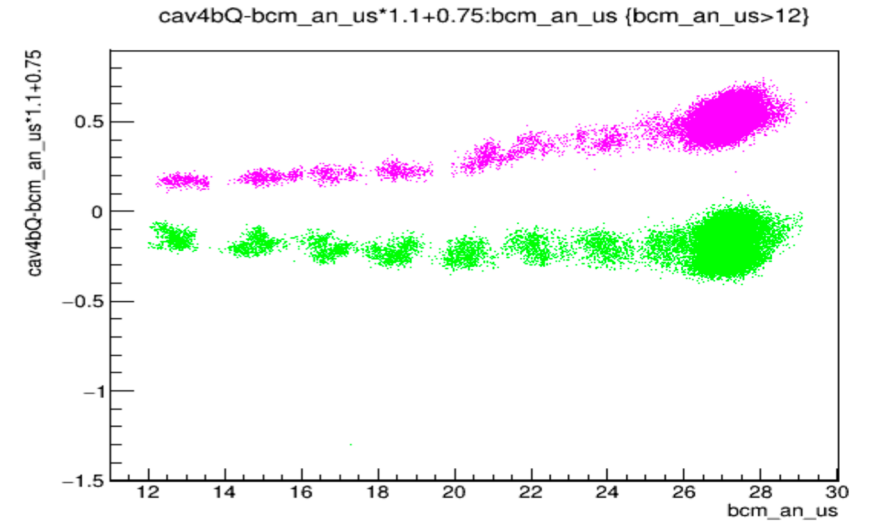
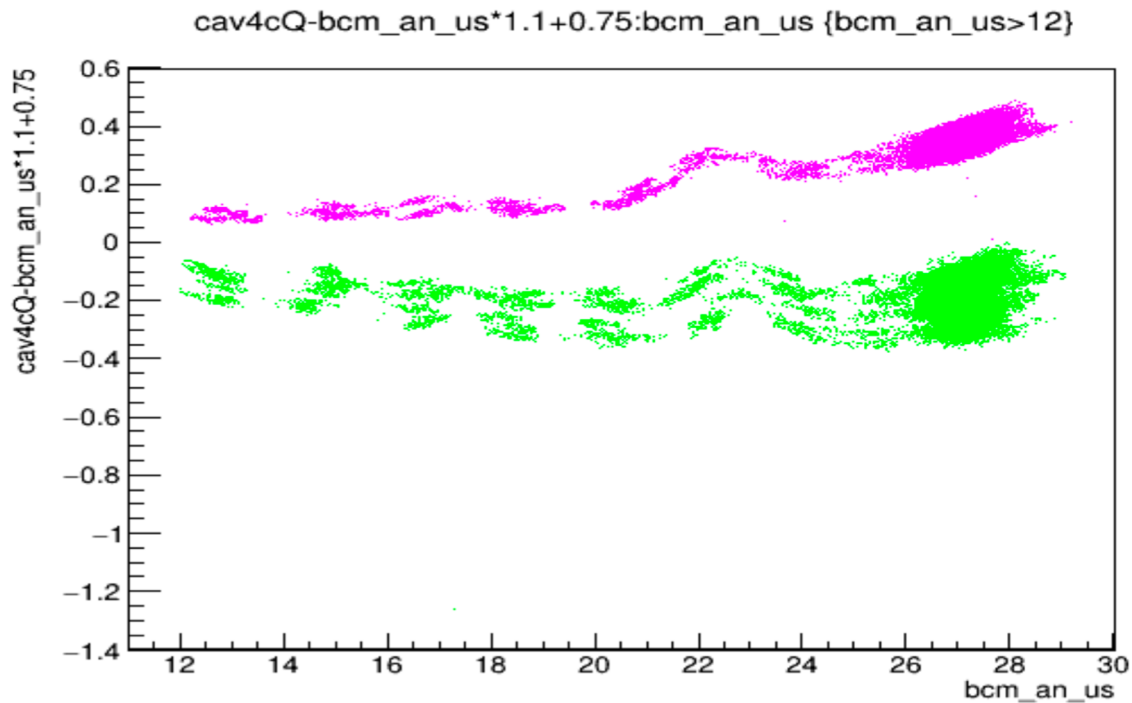
=





# Devi's Run12050 30uA 2023

- 3 things going on with the cavities:
- 1. Big jumps on slow time scale
- 2. Small stripes like the bcm digitals
- 3. Oscillatory response to current like the bcm digitals



# What's this have to do with PITA scans?

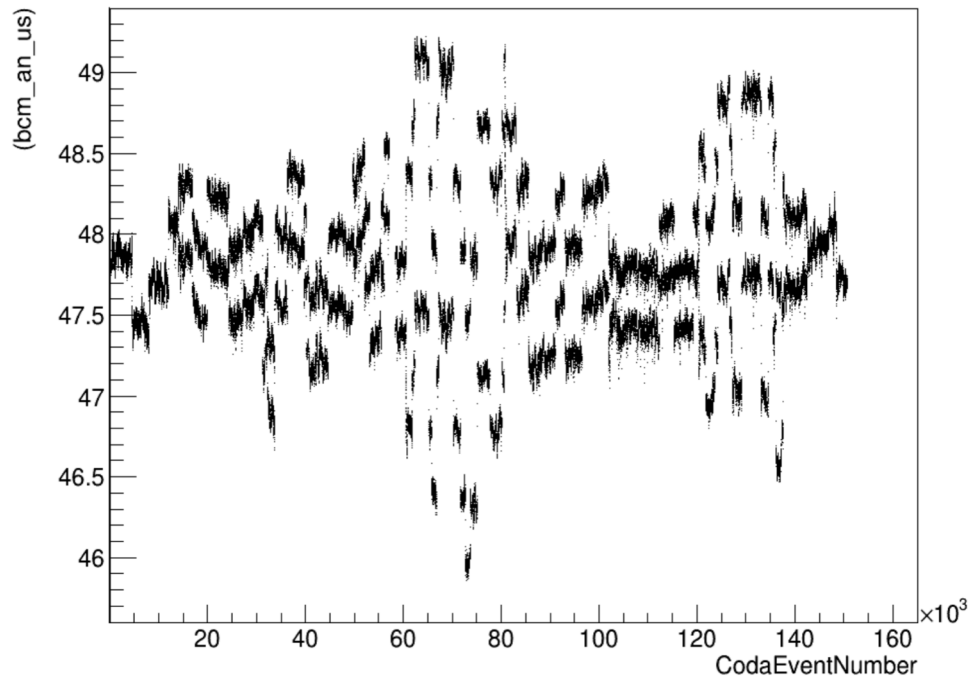
- PITA PREX Run3523 50uA

Current jumps (attenA lock?) probe Signal  
vs Current response

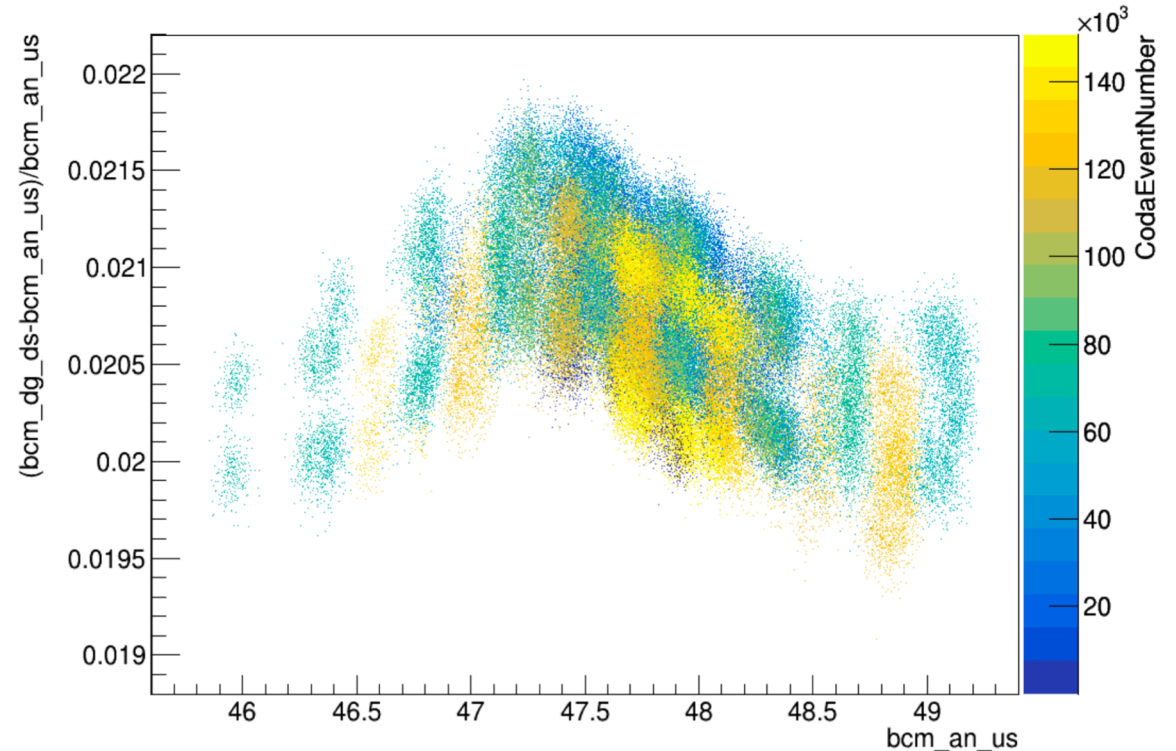
Signal vs Current response looks Oscillatory



(bcm\_an\_us):CodaEventNumber {ErrorFlag==0}



(bcm\_dg\_ds-bcm\_an\_us)/bcm\_an\_us:bcm\_an\_us:CodaEventNumber {ErrorFlag==0}





# What's this have to do with PITA scans?

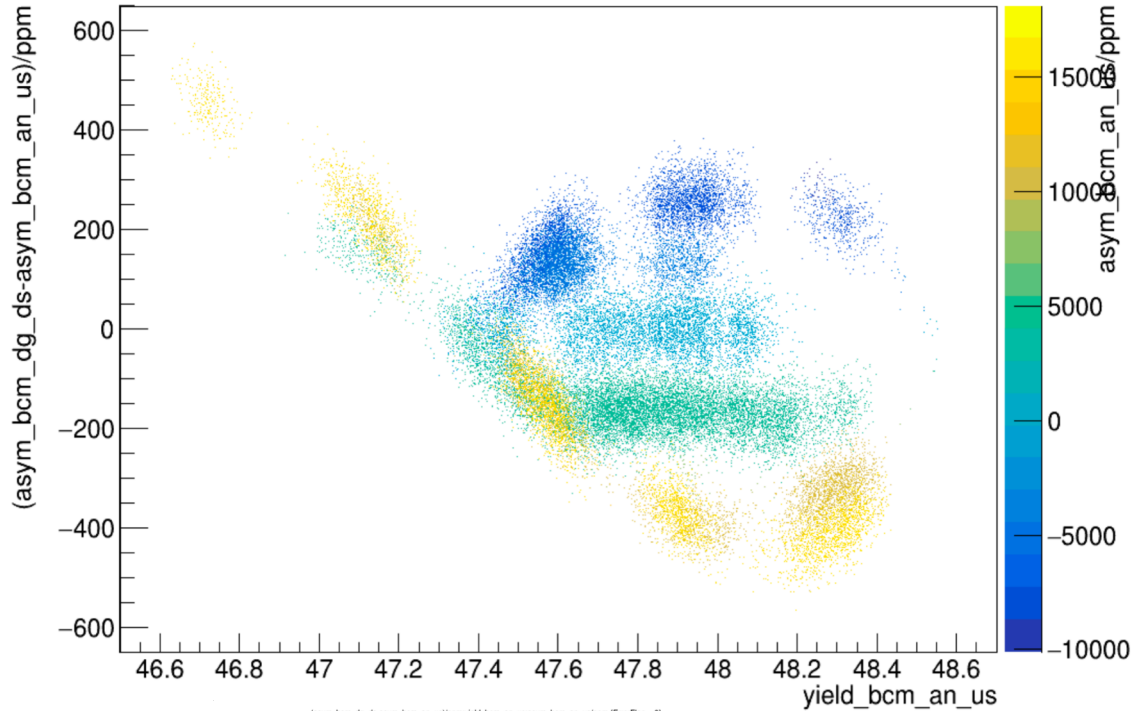
- PITA PREX Run3523 50uA

Weird Behavior Observed Before

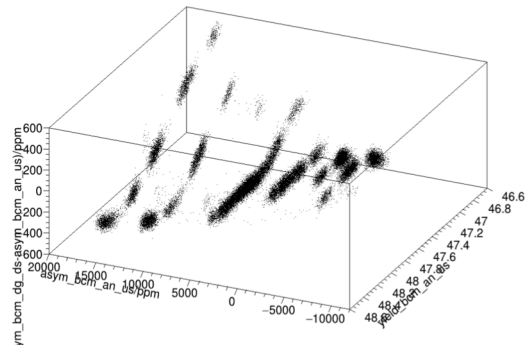
(asym\_bcm\_dg\_ds-asym\_bcm\_an\_us)/ppm:yield\_bcm\_an\_us:asym\_bcm\_an\_us/ppm (ErrorFlag==0)



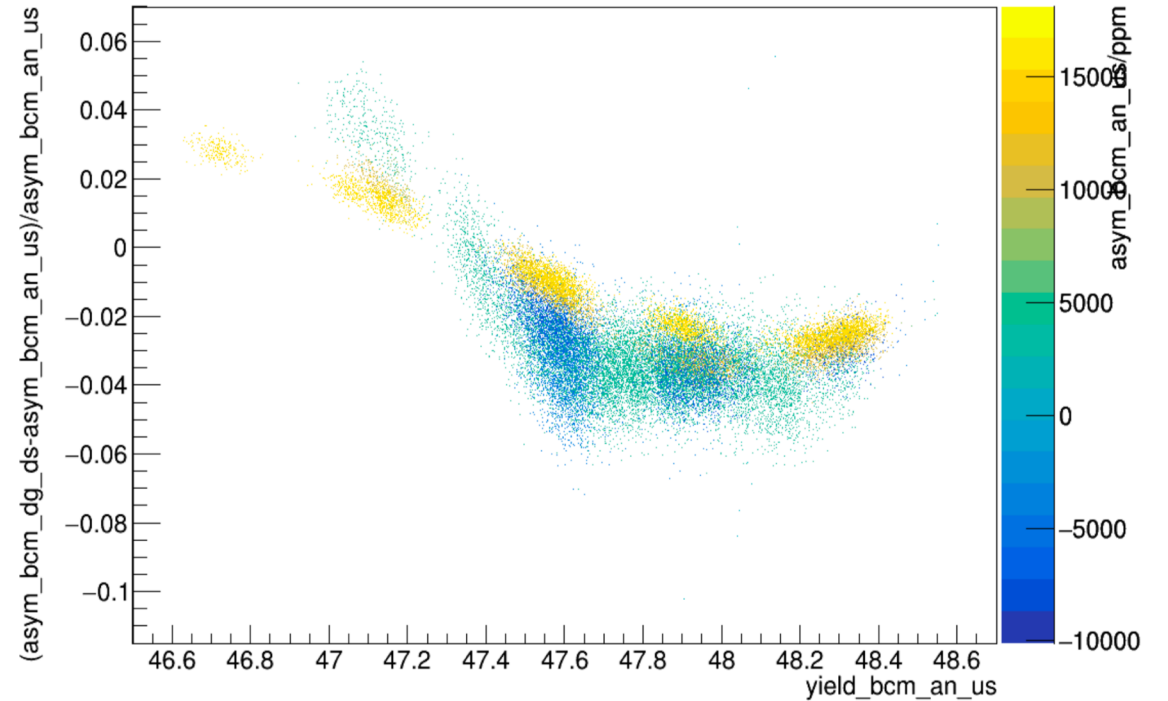
Normalize by Aq to make sense of this, see same oscillation



(asym\_bcm\_dg\_ds-asym\_bcm\_an\_us)/ppm:yield\_bcm\_an\_us:asym\_bcm\_an\_us/ppm (ErrorFlag=0)

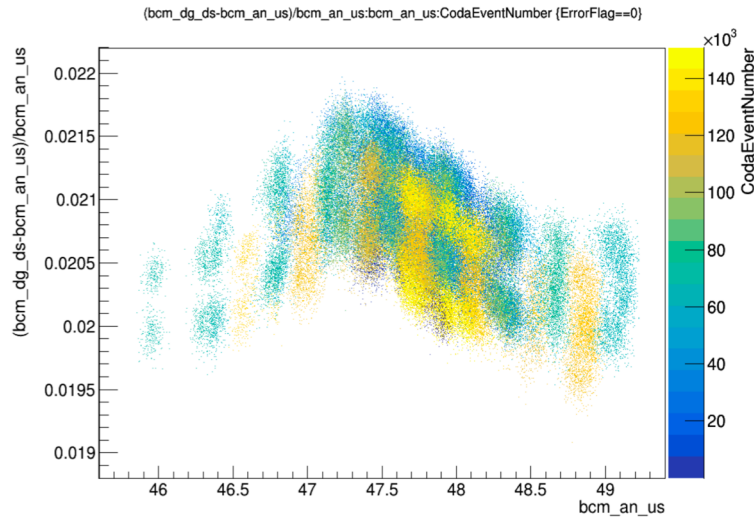


(asym\_bcm\_dg\_ds-asym\_bcm\_an\_us)/asym\_bcm\_an\_us:yield\_bcm\_an\_us:asym\_bcm\_an\_us/ppm (ErrorFlag==0&&abs(asym\_bcm\_an\_us/ppm)>1000)

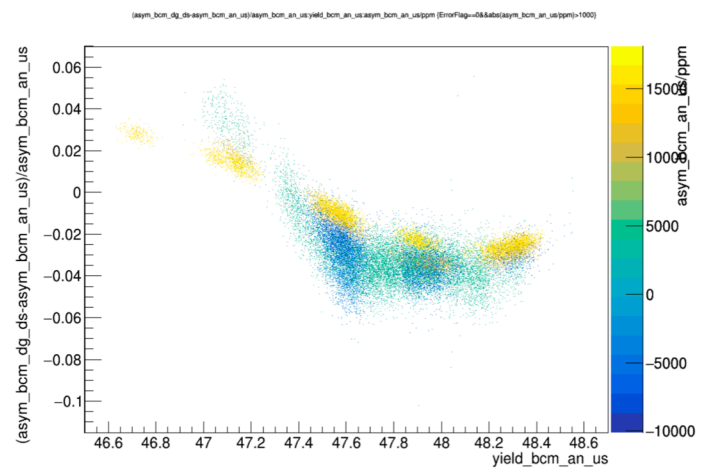
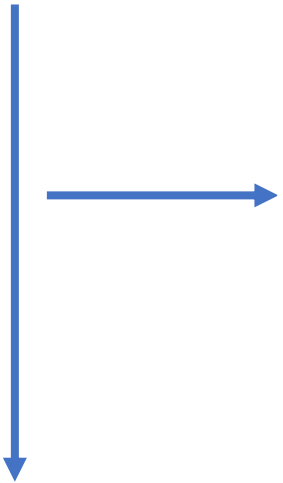


# What's this have to do with PITA scans?

- PITA PREX Run3572 70uA

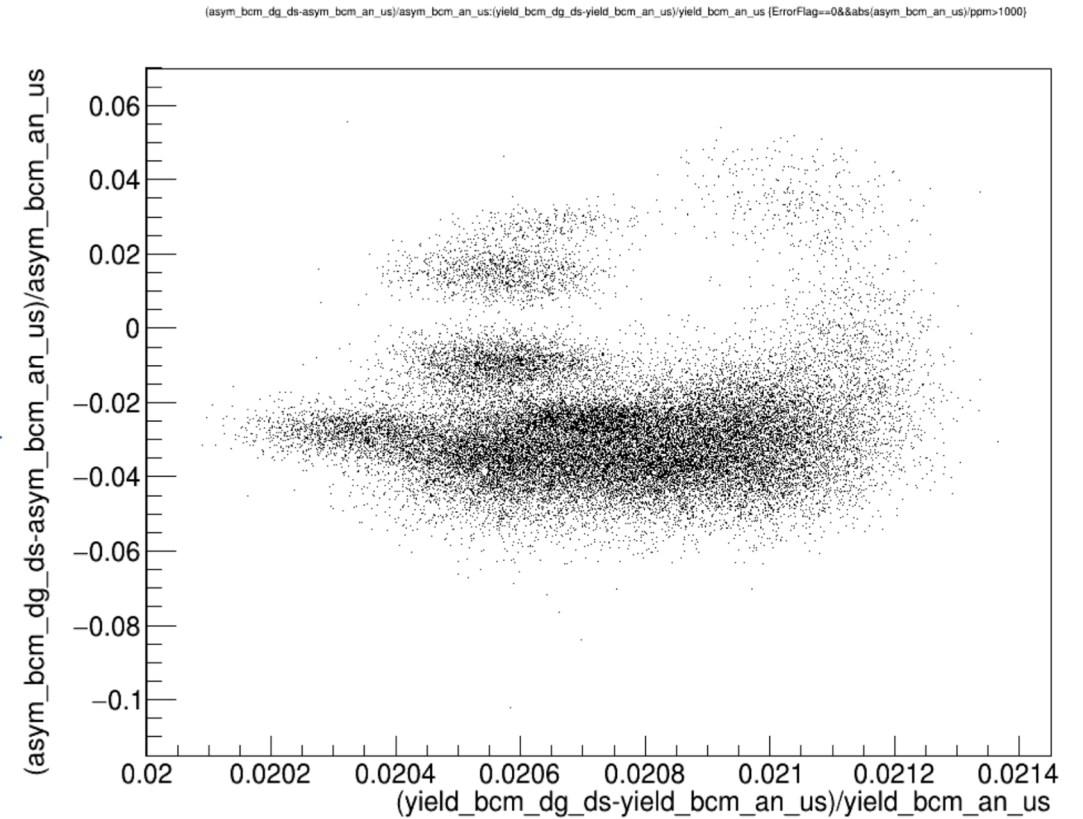


Sinusoidal response  
curve S vs I



Cosine-like Aq vs I

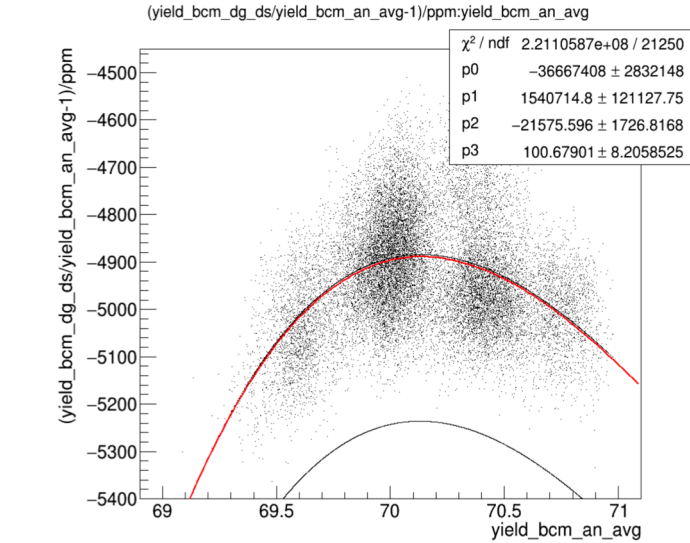
Ellipsoid?



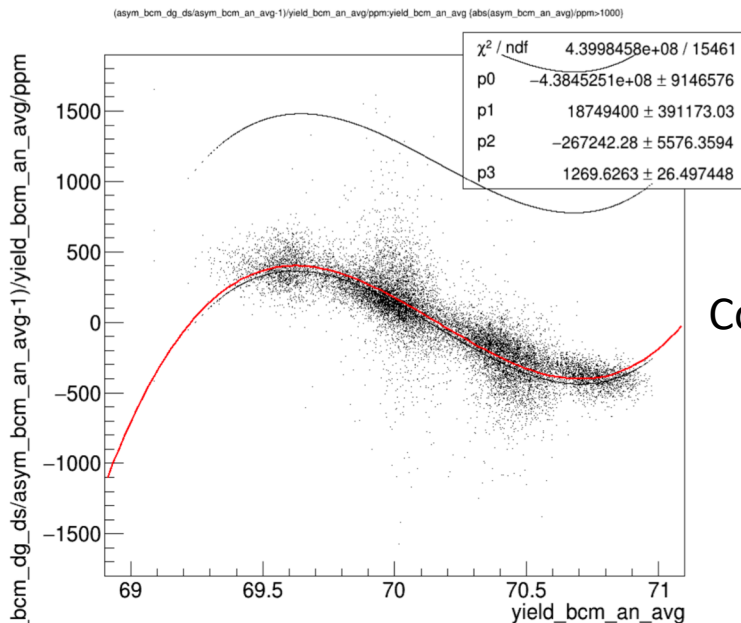
# What's this have to do with PITA scans?

- PITA PREX Run3572 70uA

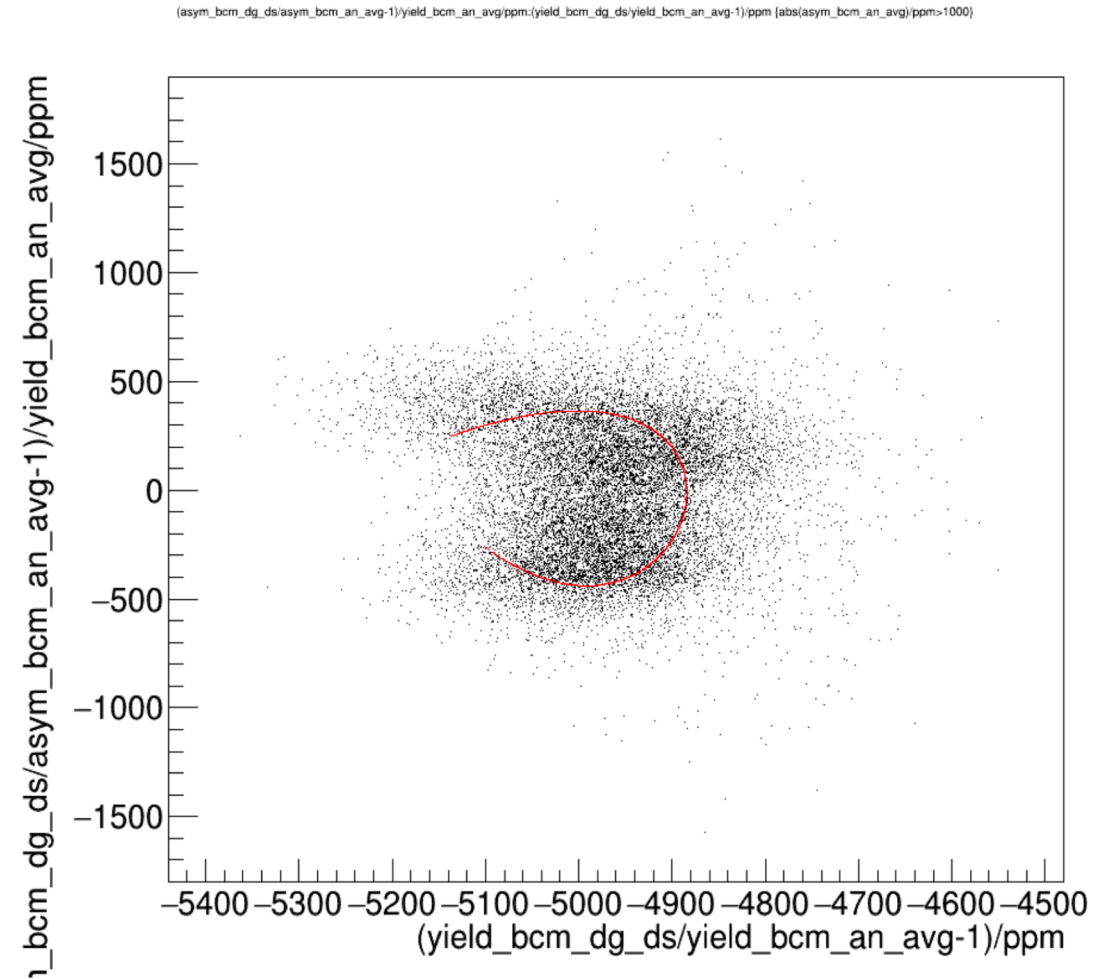
Parametrized Sine/Cosine -> Ellipsoid  
**OR BIT RESOLUTION!!!**



Sinusoidal response  
 curve S vs I

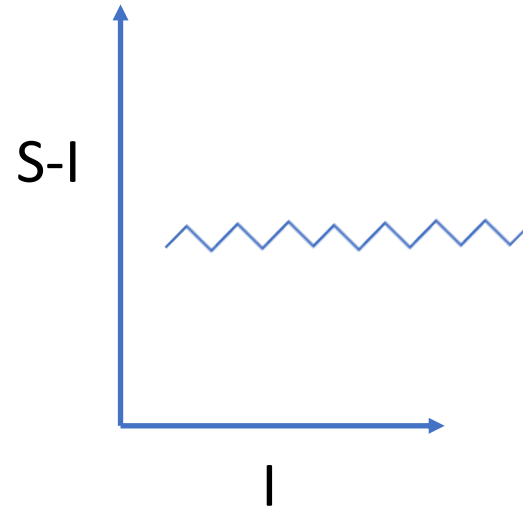
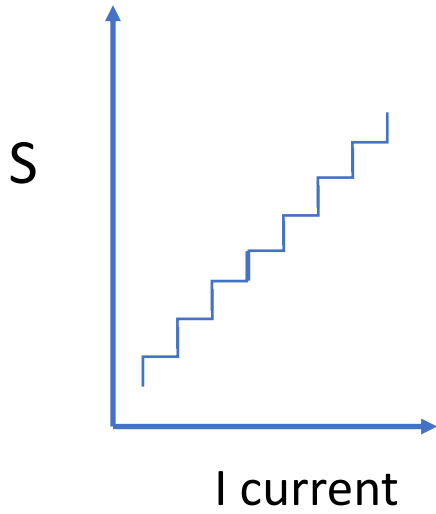


Cosine-like Aq vs I

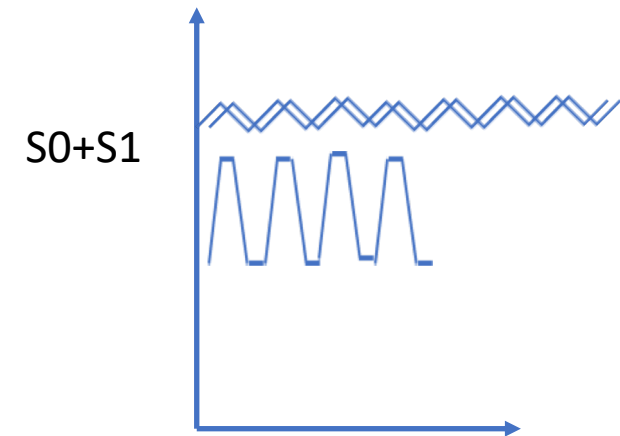
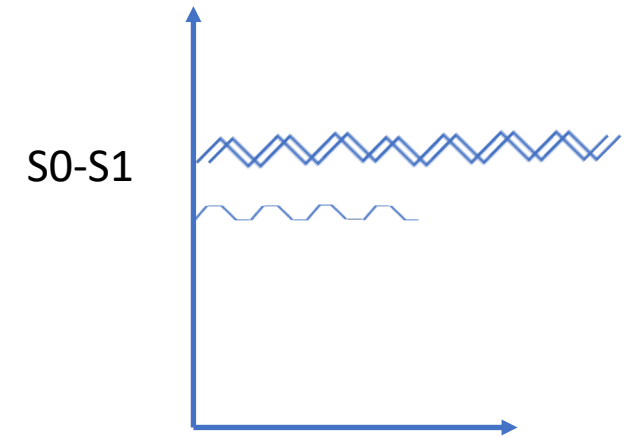


# What's this have to do with PITA scans?

BIT RESOLUTION = sawtooth S-I vs I



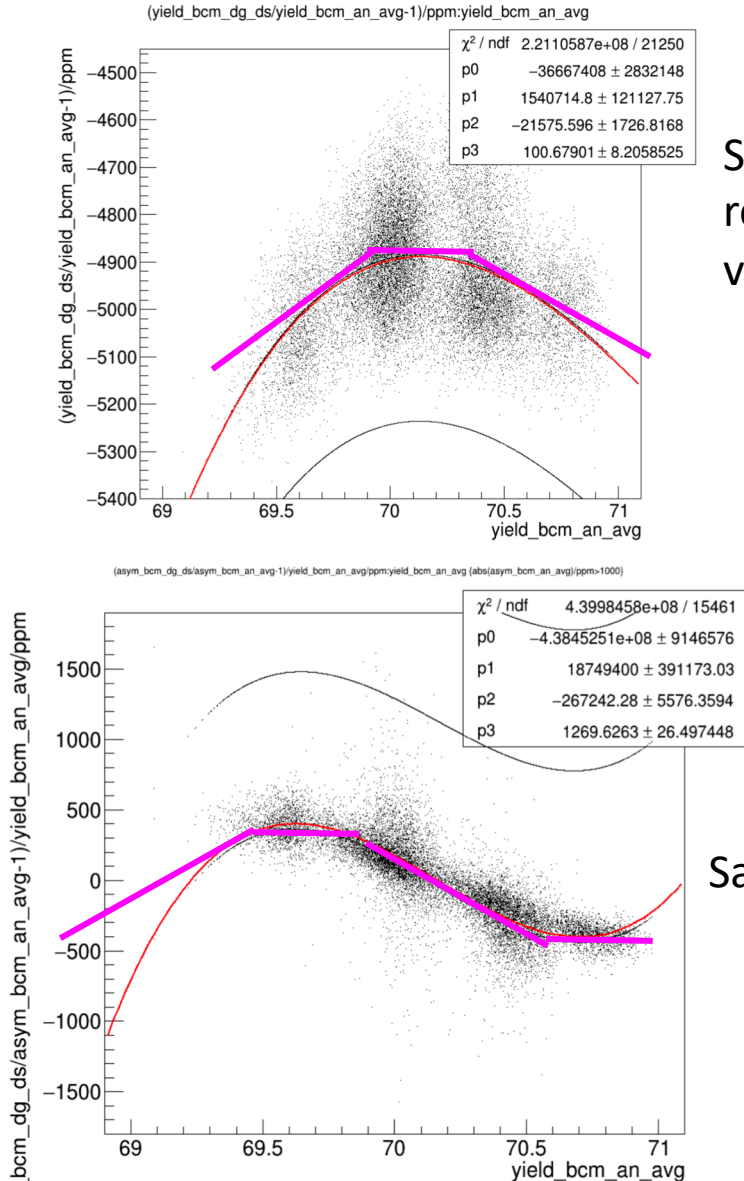
$$Aq = (S_0 - S_1) / (S_0 + S_1)$$
$$\langle S \rangle = (S_0 + S_1) / 2$$



# What's this have to do with PITA scans?

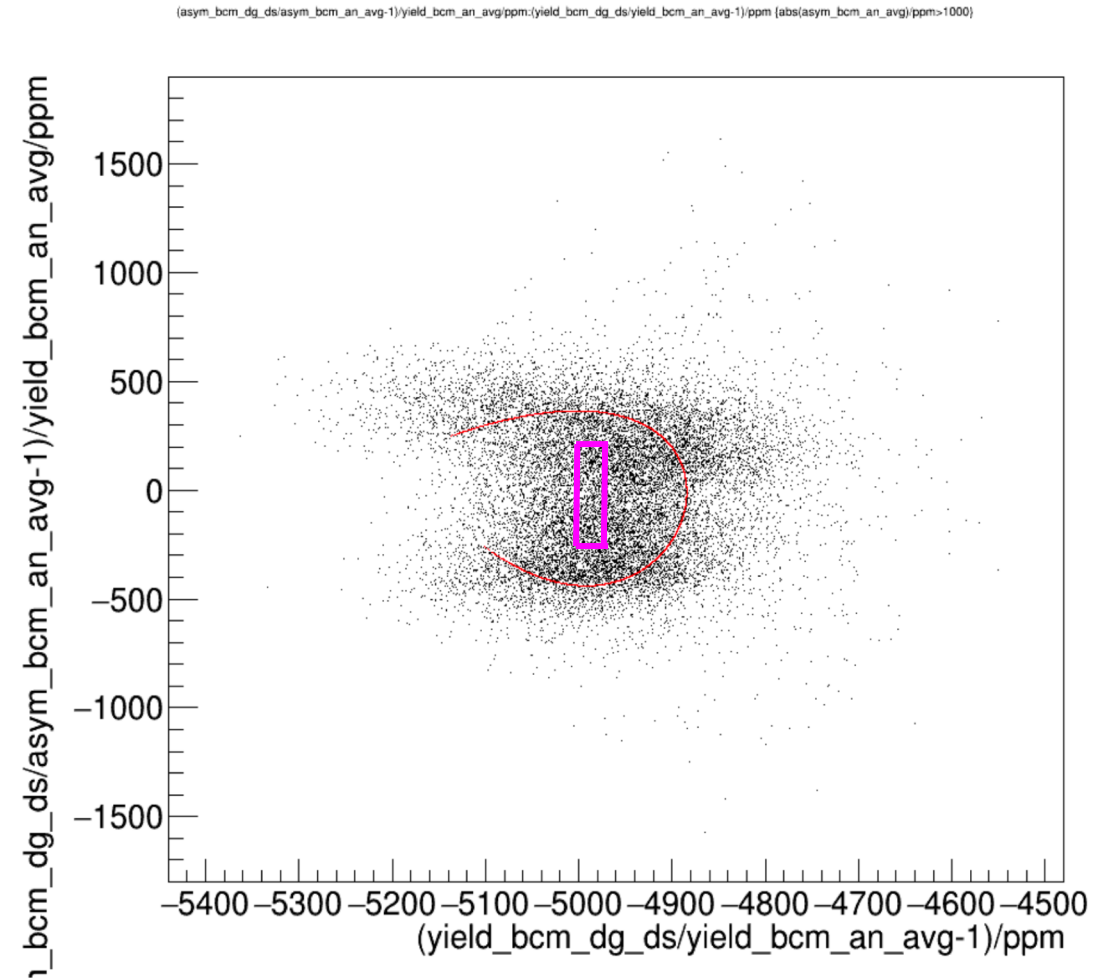
- PITA PREX Run3572 70uA **BIT RESOLUTION = sawtooth S-I vs I**

Parametrized Sawtooth-> Square



Sawtooth-like response curve <S> vs <I>

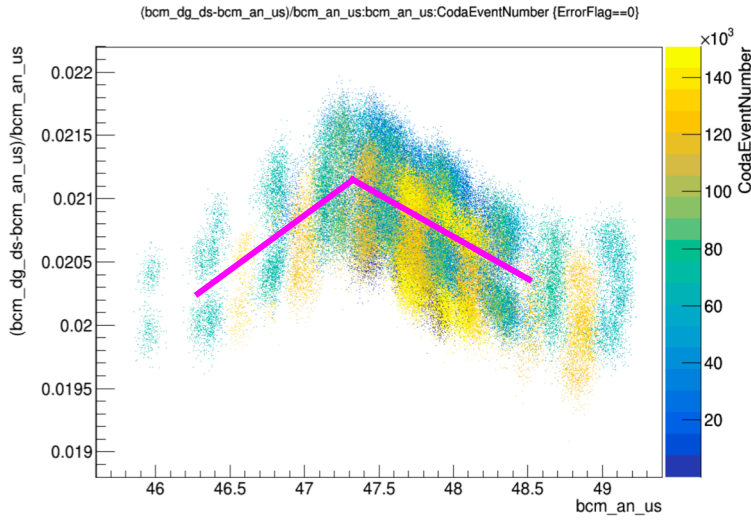
Sawtoothlike Aq vs I



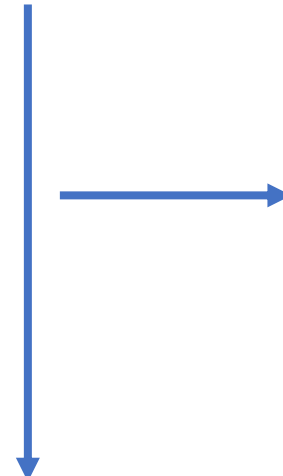
# What's this have to do with PITA scans?

- PITA PREX Run3572 70uA **BIT RESOLUTION = sawtooth S-I vs I**

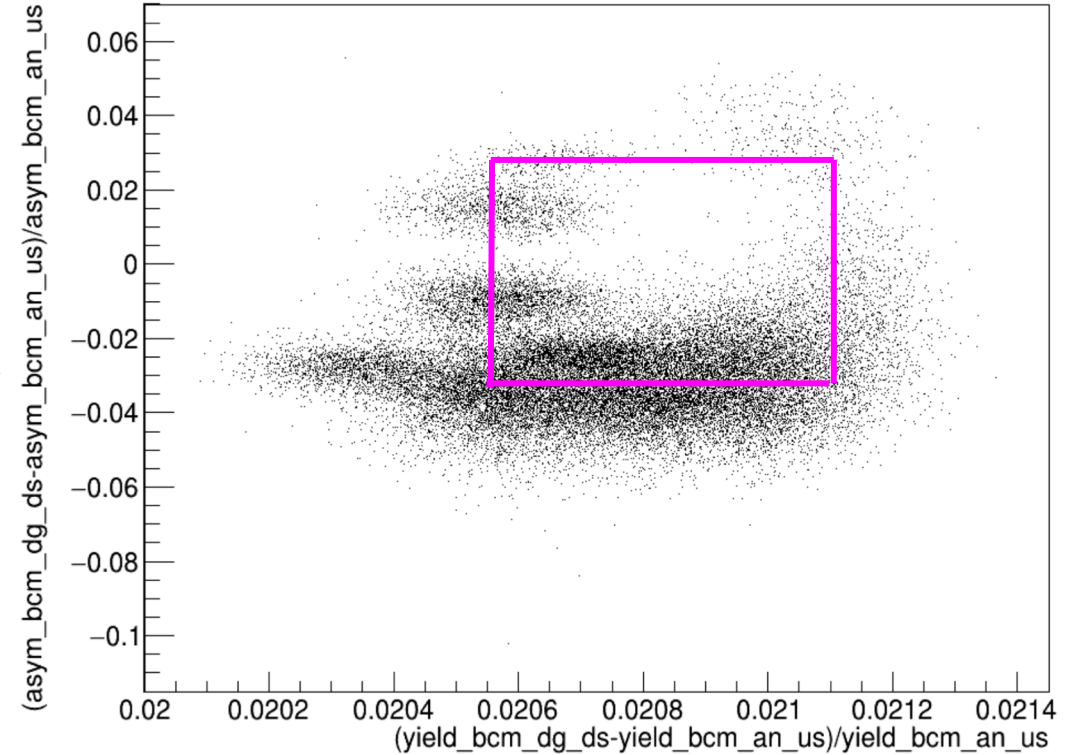
Parametrized Sawtooth-> Square



Sawtooth response curve S vs I



(asym\_bcm\_dg\_ds-asym\_bcm\_an\_us)/asym\_bcm\_an\_us:(yield\_bcm\_dg\_ds-yield\_bcm\_an\_us)/yield\_bcm\_an\_us (ErrorFlag==0&&abs(asym\_bcm\_an\_us)/ppm>1000)



Sawtooth-like Aq vs I

