



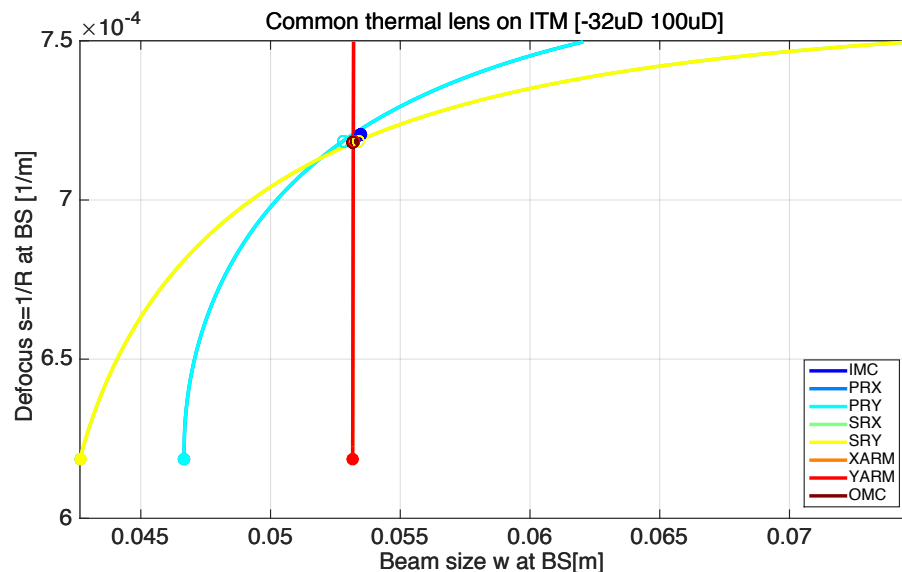
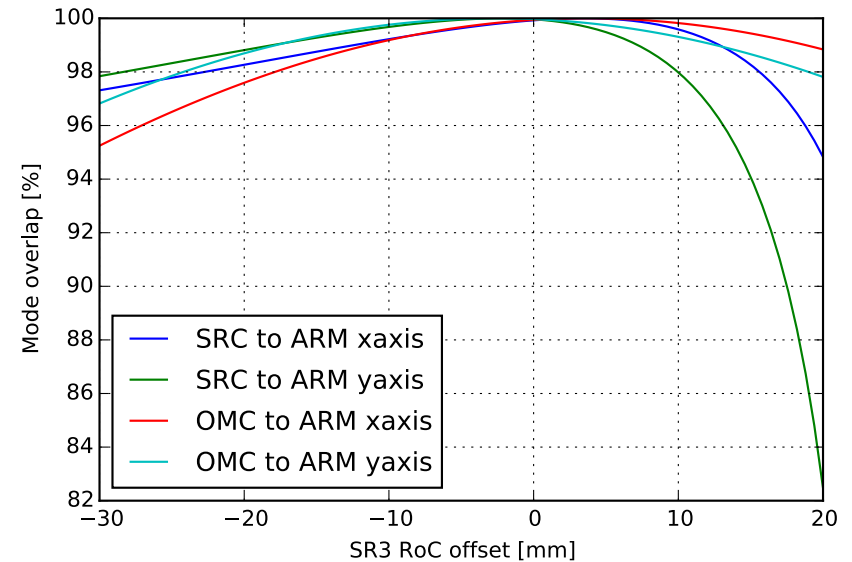
SRC mode matching review

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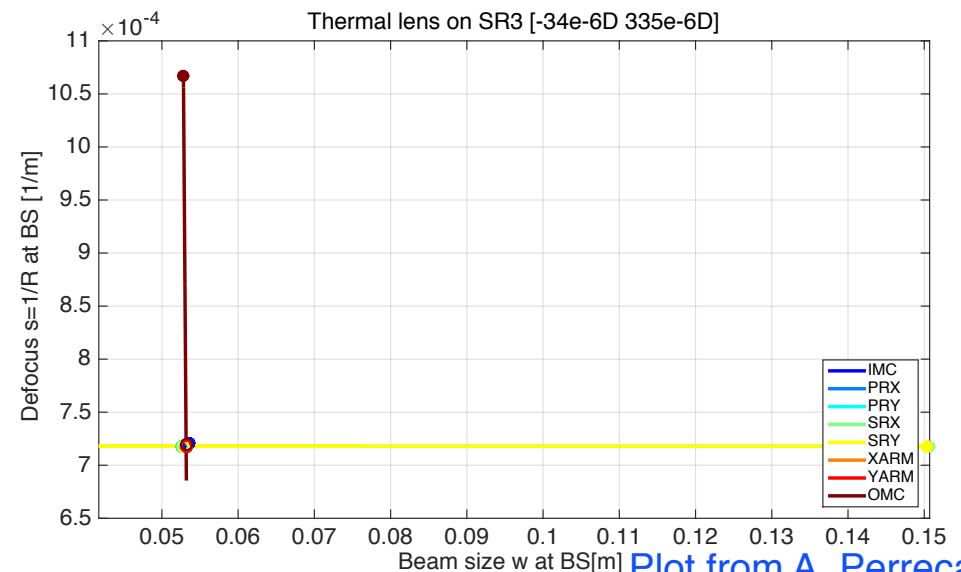


SRC mode matching – to what?

- Changes in the SRC affect SRC eigenmode, but also affect how other cavity eigenmodes match to the OMC.
- A SR3 RoC actuator will change overlap between ARMs and SRC, but also between *everything* and the OMC.



Plot from A. Perreca



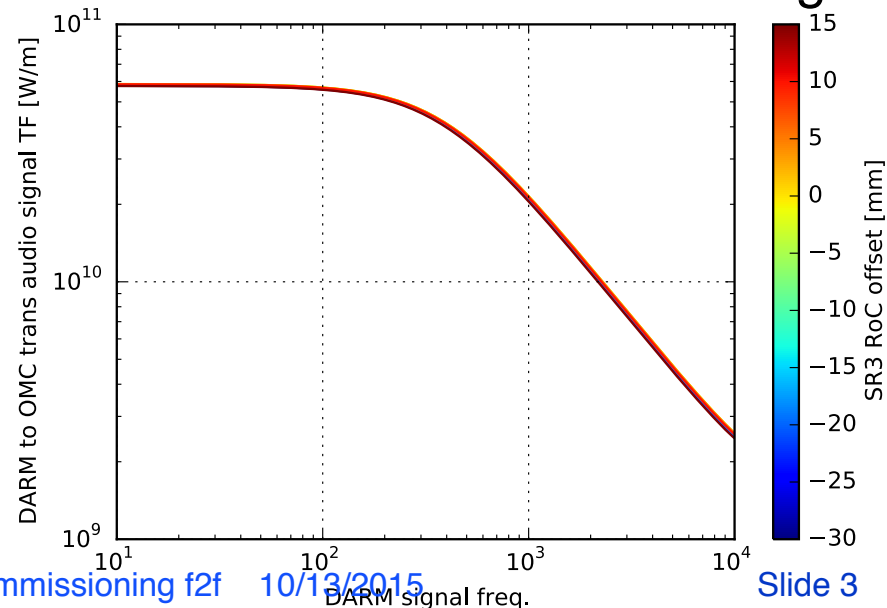
Plot from A. Perreca
Slide 2



Effects of SRC to ARM mode mismatch

- Hard to isolate from “everything to OMC” mismatch.
- Previous expectation – ARM to SRC mismatch causes a reduction in efficacy of RSE: DARM pole frequency is lowered. Maybe not...
- Carrier HG20/02 modes also anti-resonant(ish) in SRC.
- Is it necessary to worry about this mismatch then? Technical couplings (RIN), effects on ASC, LSC still an issue.
- Might expect bigger problems with squeezed light injection.
- Also would expect change DARM TF more in narrow band configuration.

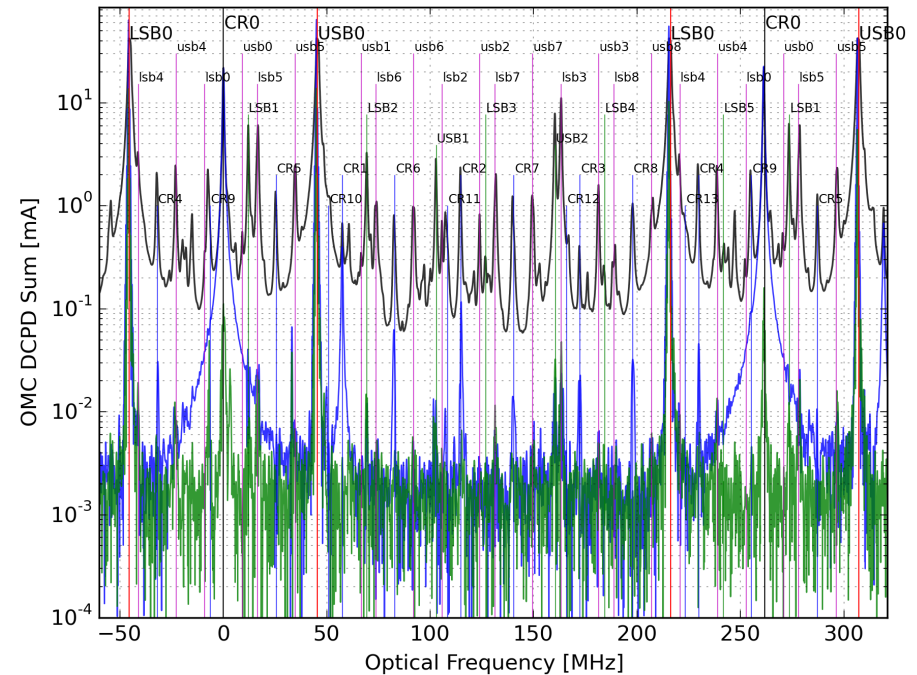
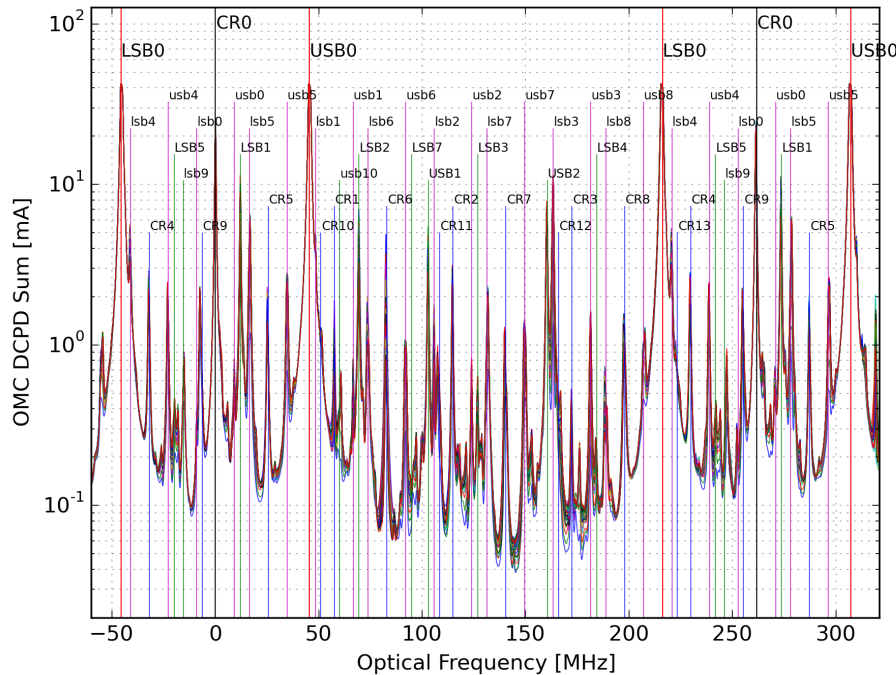
Common sense tells us it's important to have good matching between ARMs and SRC, but we still need a better understanding of how critical this is (with and without squeezing).



- If we get the actuator, what do we use it for?
 - » Matching the IFO to the OMC? (near term)
 - » In combination with OMC matching actuators to match SRC to ARMs? (post-squeezing)
- We need a sensor to go with the actuator.
- SRC matching sensing has so far proven very tricky:
 - » SRC Gouy phase measurement with subcarrier injection, finesse too low.
 - » SRC Gouy phase measurement with spot motion measurement – status?
- OMC scans looked like a good way of measuring matching ARMs to OMC, but also ARMs to SRC?

Sensing SRC mismatch

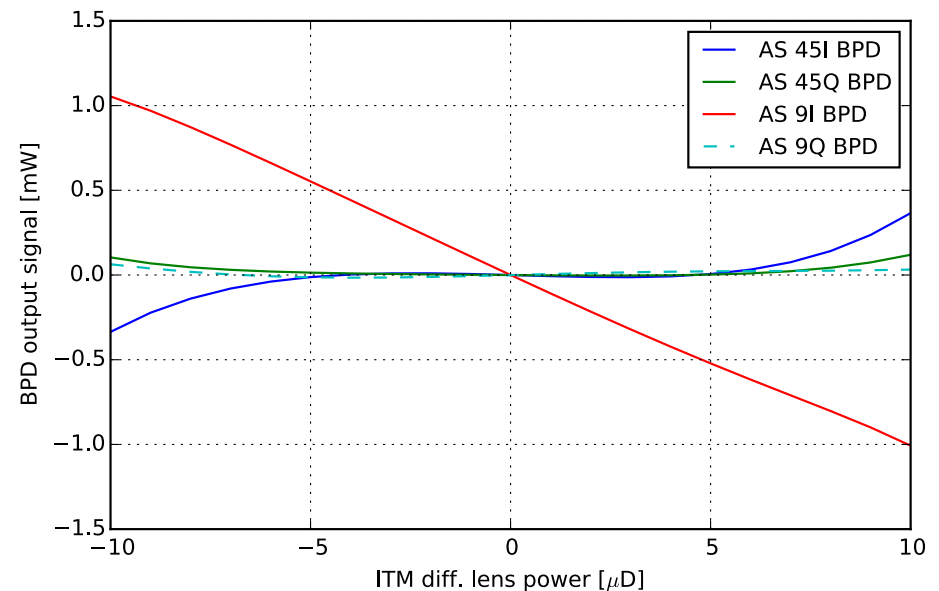
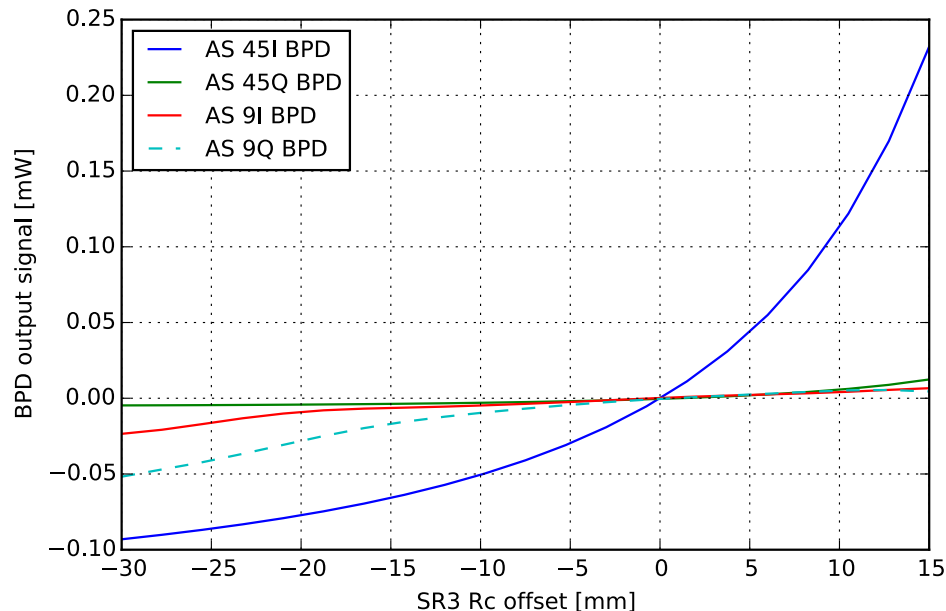
- Measurements by Dan Hoak (LHO aLOG 22175) showed outstanding mode matching from CARM to OMC (99.7%).



- Can we get info about ARMs to SRC matching here?
 - » HG20/HG00 ratio for carrier and 45MHz.
 - » Complicated by contrast defect.

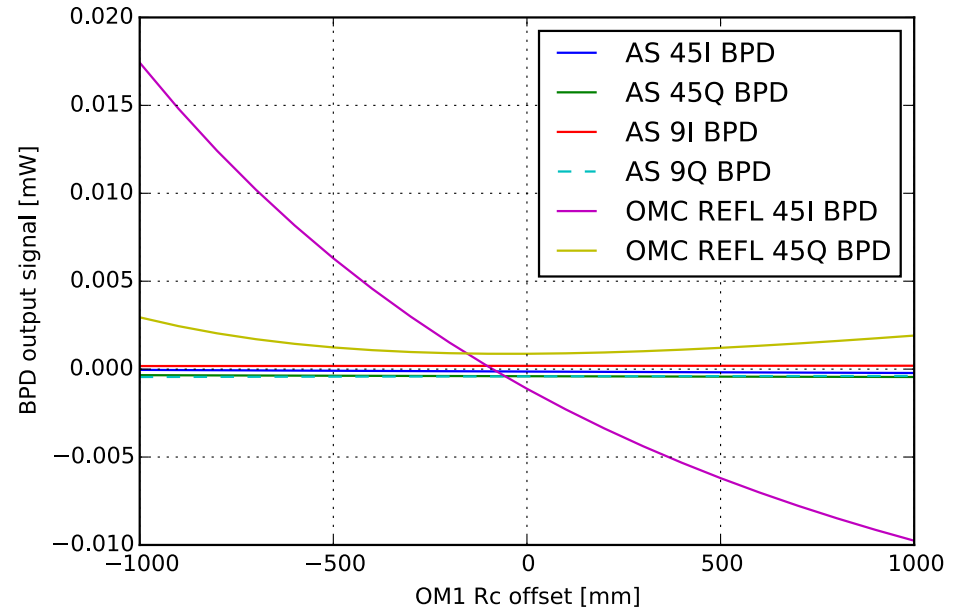
Bullseye photodetectors

- BPDs at AS port, 45MHz demod see mismatch between ARMs and SRC.
- Would also see “contrast defect” carrier HG20/02 modes beat with 45MHz HG00 mode though.
- Contrast defect from ITM diff. lens shows up well in AS 9MHz BPD though.



Bullseye PDs contd.

- BPD in reflection from OMC to measure CARM to OMC mismatch.
- Could be confused by contrast defect, use beacon demodulation like in OMC scan.
- Only one BPD put in at each port yet – should have two at each 45deg Gouy phase apart.



- Use this method to build an AWC matrix – see if we can get information for SRC-ARM matching that isn't swamped by other mismatch signals.

OMC mismatch only effect on OMC DARM TF

- This time just adjust OM1 Rc to create mismatch of all IFO eigenmodes to OMC.
- Here we see a reduction in sensing gain (even with DARM servoed to OMC DC).
- Not seen in SR3 Rc offset plot because ARM-OMC mismatch less than 5%
- Still no obvious effect on DARM pole frequency (didn't expect one).

