

AUG Monday Morning Meeting 30/11/2015

## Permanent IMSE 2015 - November 2015

$\pm B\phi$  Calibration shots  
Sawteeth shots

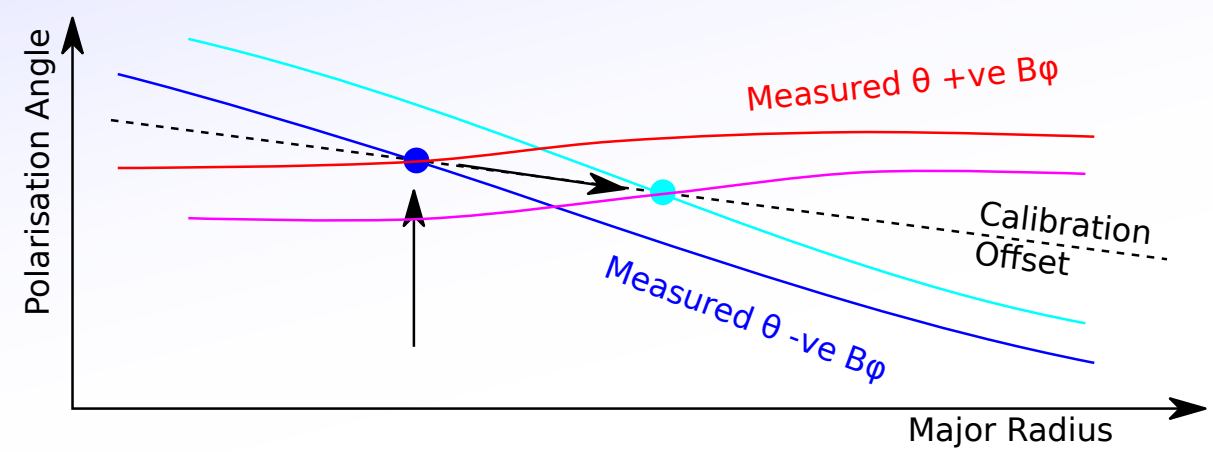
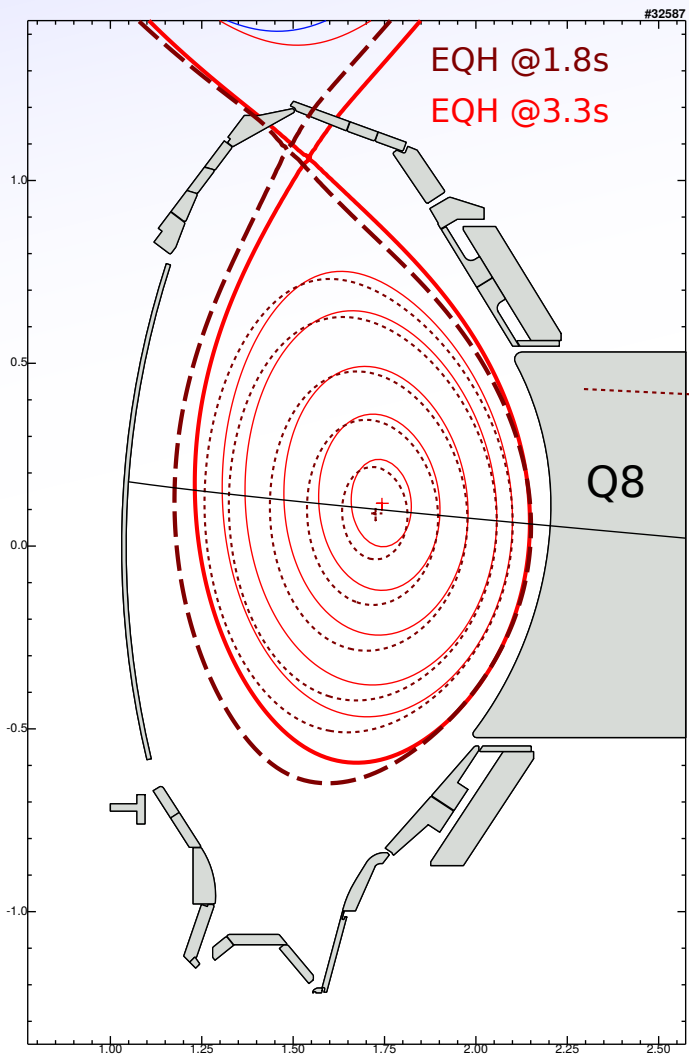
O. P. Ford,<sup>1</sup> A. Burckhart<sup>1</sup>

1: Max-Planck Institut für Plasmaphysik, Greifswald/Garching, Germany



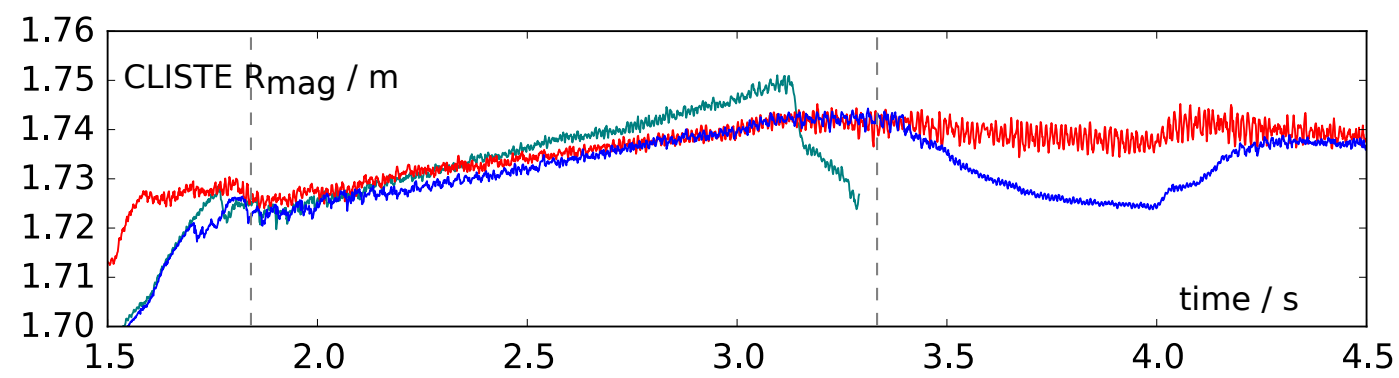
# IMSE Reverse Bφ Calibration

Pitch of the magnetic axis is 0 by definition, but we need to know where axis is to use this:



Slowly scan magnetic axis position as far as possible in R with  $\pm B\phi$ . Try to keep pulses the same (difficult with unfavorable drift in +ve  $B\phi$ ) and density as low as possible for good S/N.

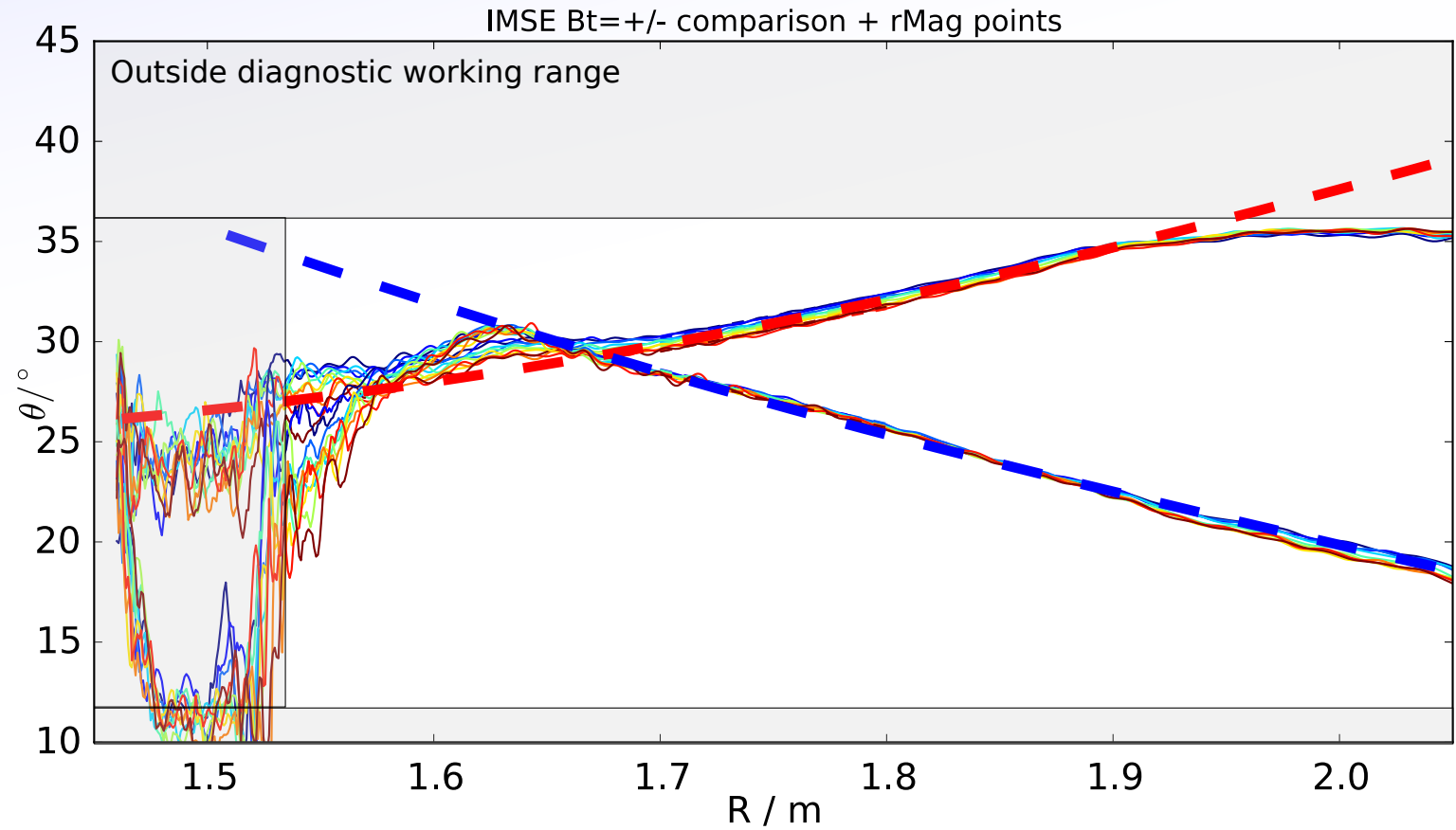
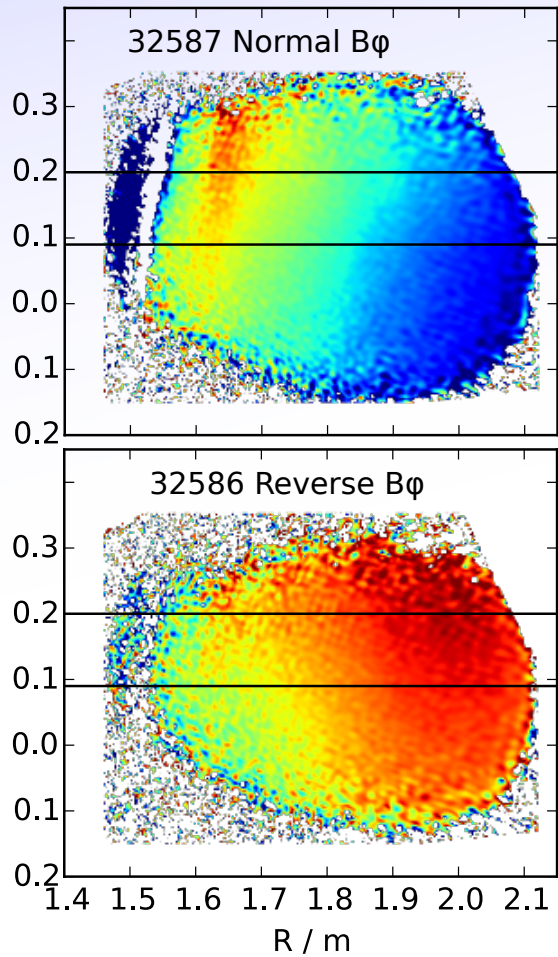
- 32585: Normal  $B\phi$ . Rmag scan different, disrupts early.
- 32586: Reverse  $B\phi$ . Good shot. (+Q5 data + Q3 for MSE)
- 32587: Normal  $B\phi$ . Good shot. (+Q5 data + Q3 for MSE)



# IMSE Reverse $B_\phi$ Calibration

Good IMSE data despite relatively high electron density (H-1:  $6 - 10 \times 10^{19}$ ):

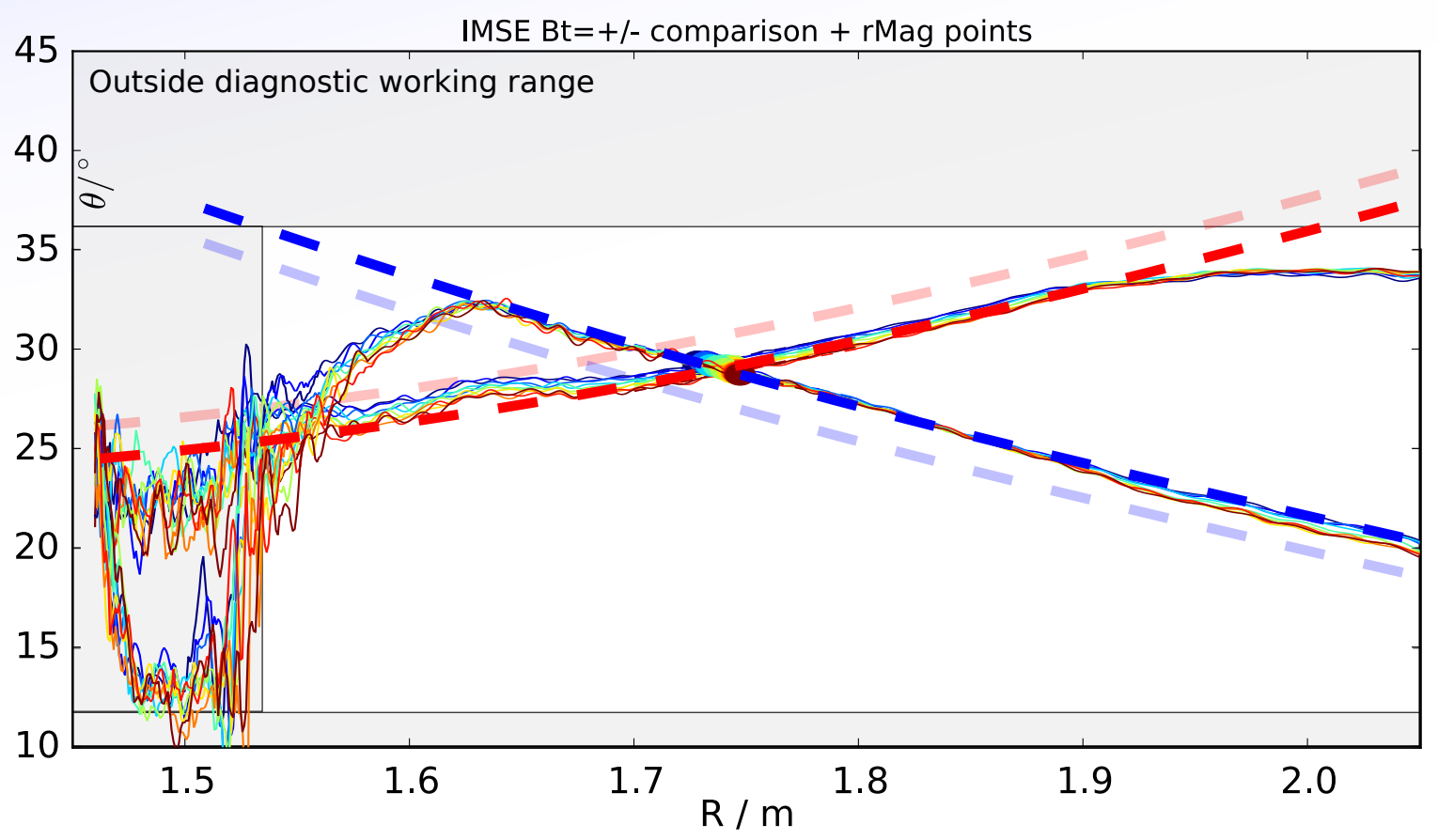
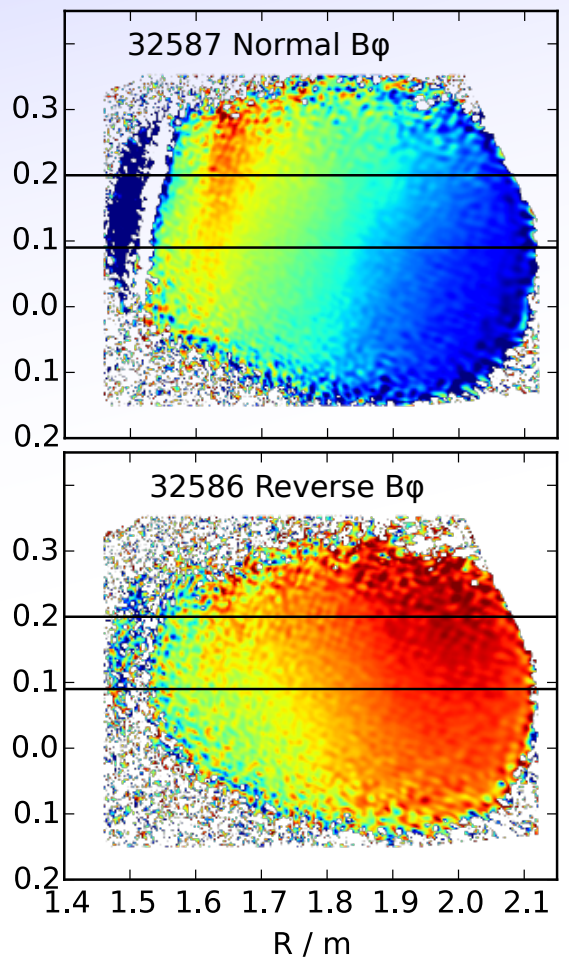
Polarisation  $\theta$



# IMSE Reverse $B_\phi$ Calibration

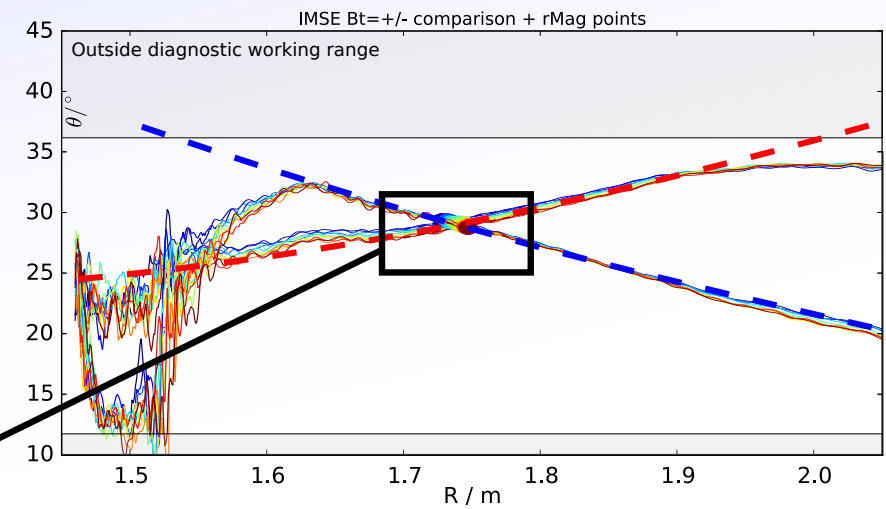
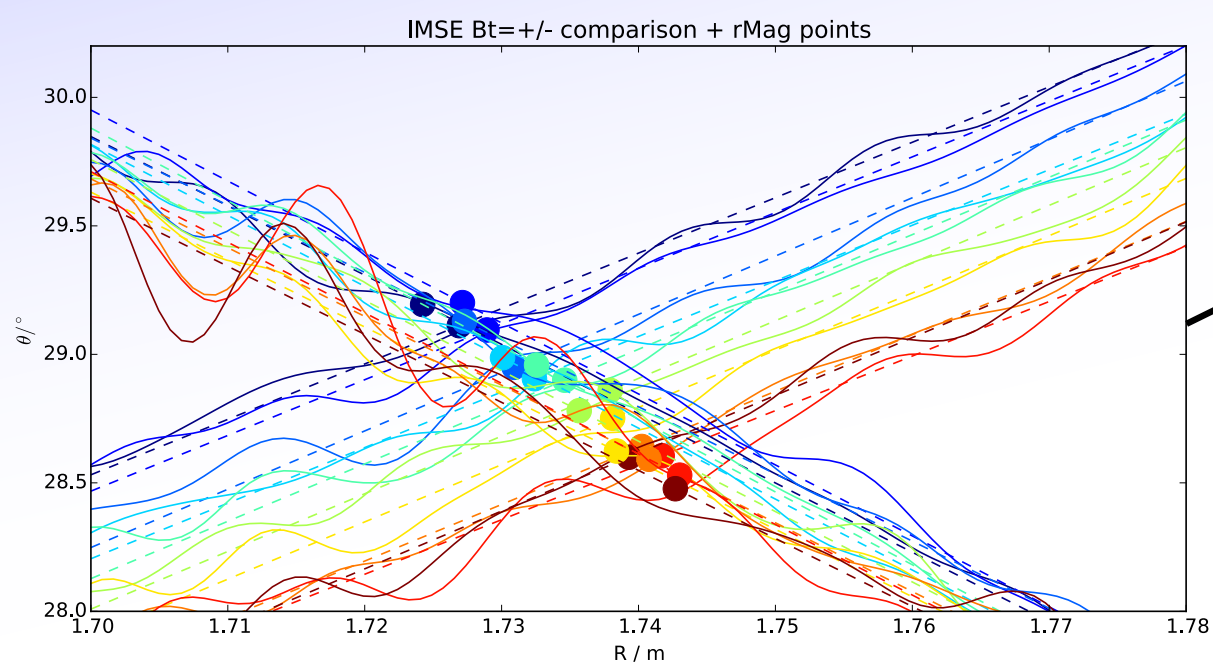
Good IMSE data despite relatively high electron density (H-1:  $6 - 10 \times 10^{19}$ ):

Need to take account of inverted Faraday rotation due to TF:



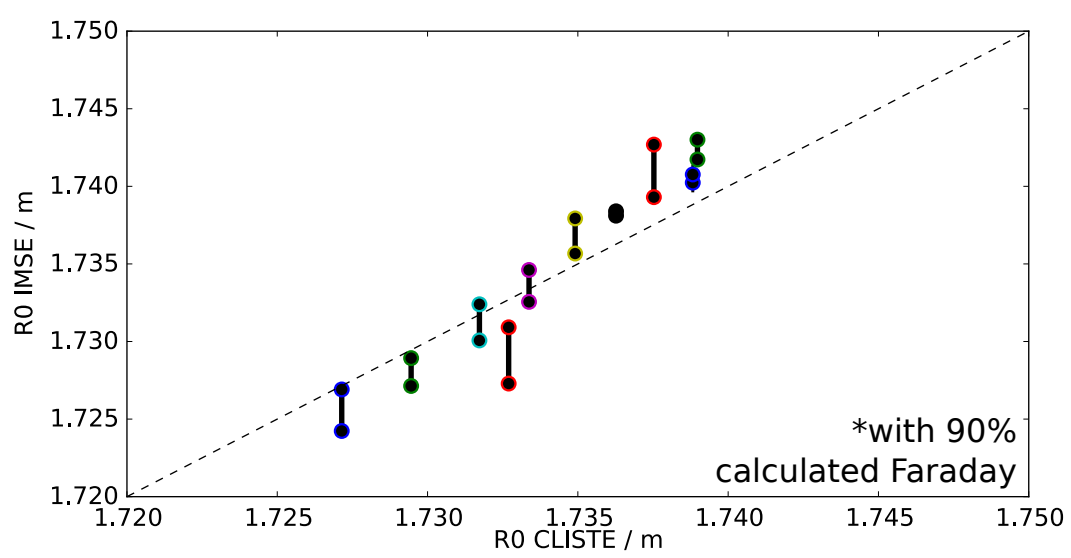
# IMSE Reverse $B\phi$ Calibration

Only had scan  $1.71 < R_{\text{mag}} < 1.75$ :



Agreement with CLISTE  $R_{\text{mag}}$  is surprisingly good, although it would be good to confirm  $R_{\text{mag}}$  with another diagnostic.

Not sure why the polarisation angle in the normal  $B\phi$  shot decreases though - Calculated PF Faraday is not enough to explain it - need to check lamps.



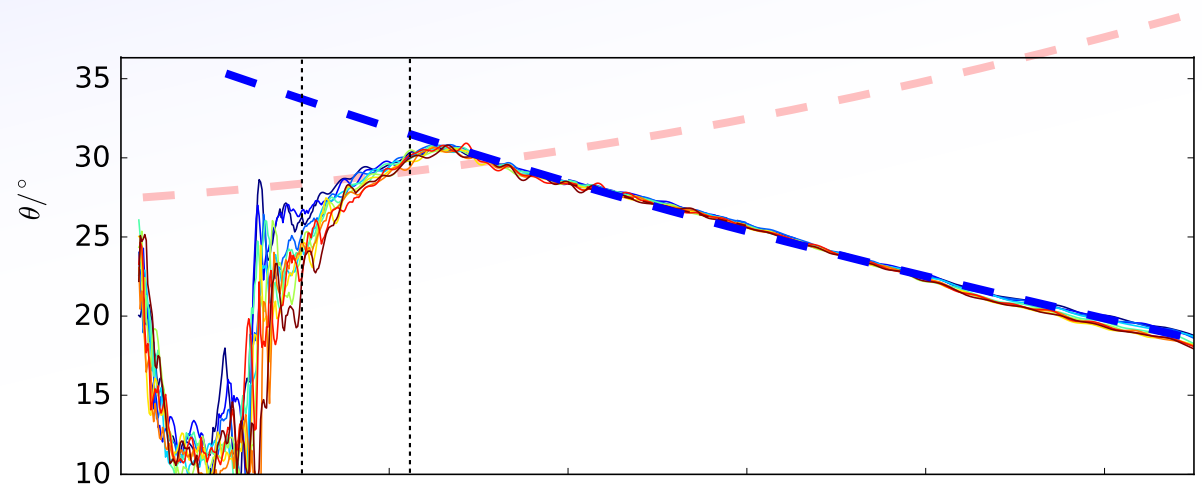
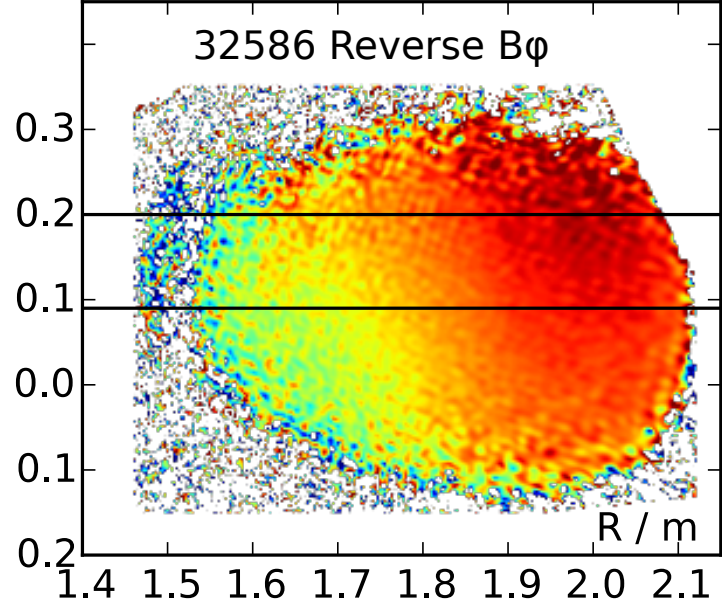
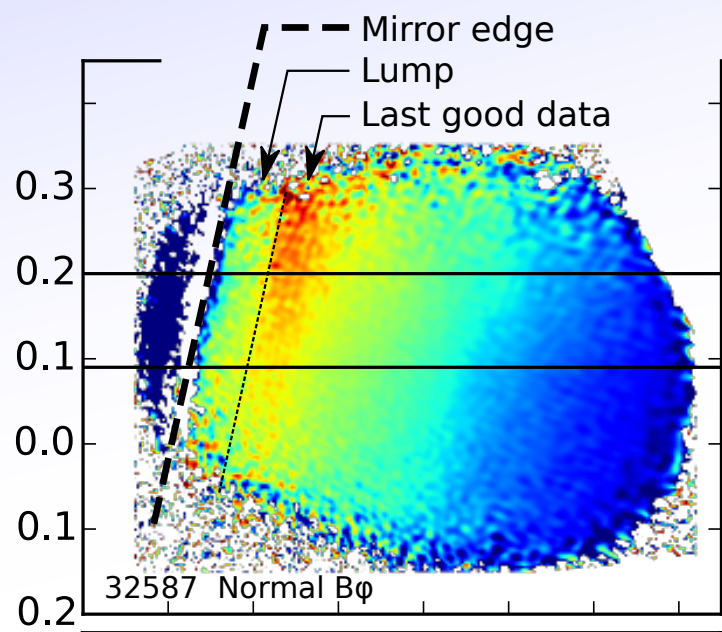
This has been the most successful calibration exercise so far - we definitely want to further develop the shot.

- Bigger scan of  $R_{\text{mag}}$ .
- Better control of density.
- Q5 & Q7

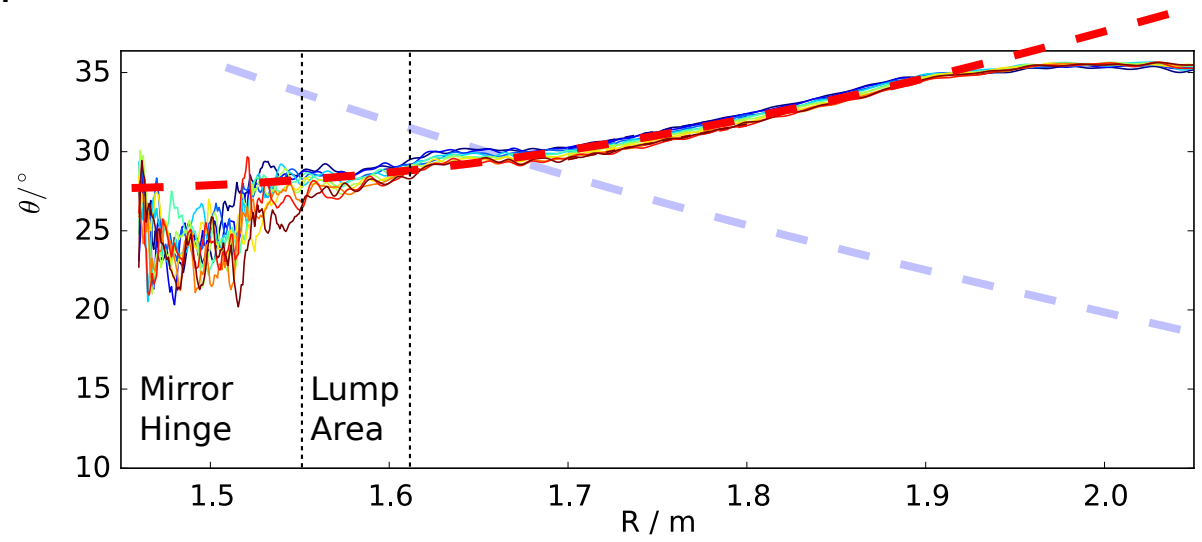
We should also check the MSE data (no  $R_{\text{mag}}$  scan).

# IMSE - Core/Edge contamination

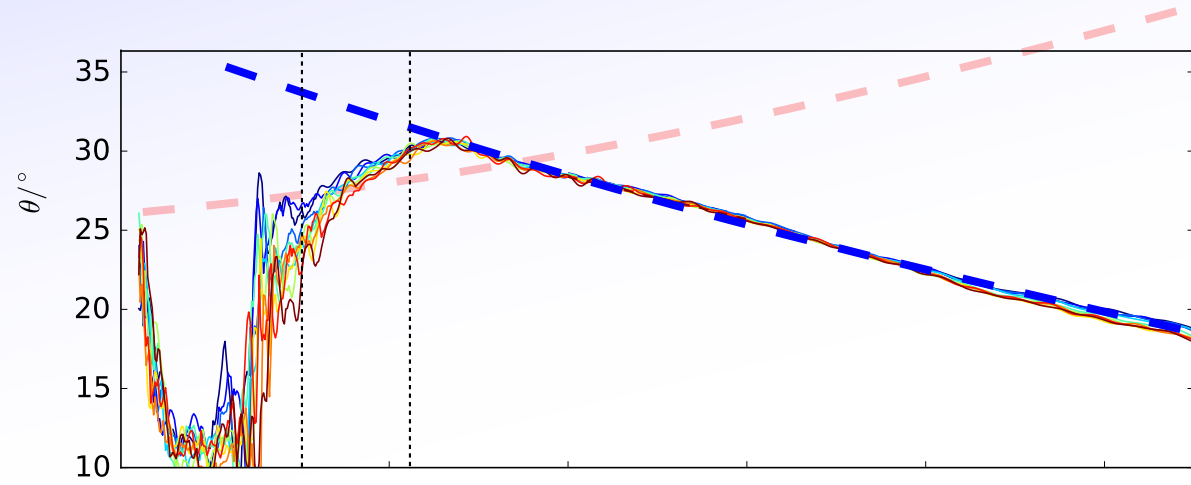
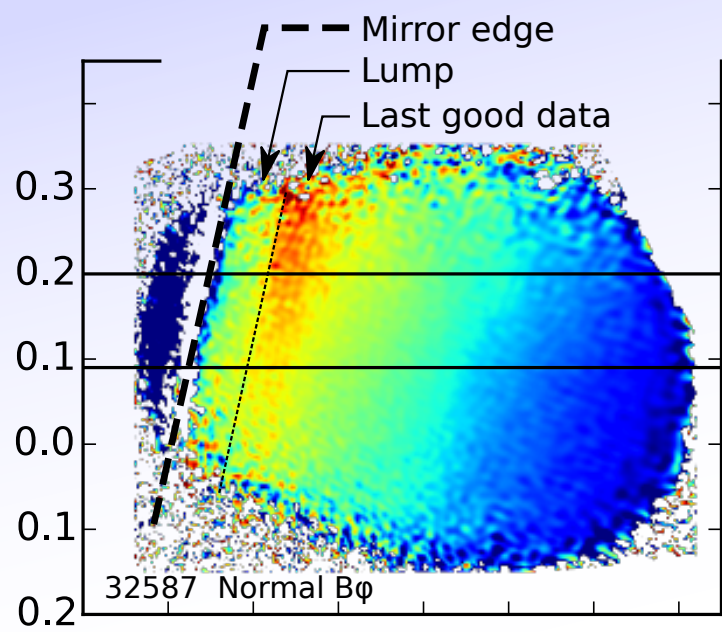
Returning to the raw data, we've always had problems with data in  $1.55 < R < 1.6$ :  
(variations with  $>2$ nd order in R). This was much less of an effect in reverse  $B_\phi$ .



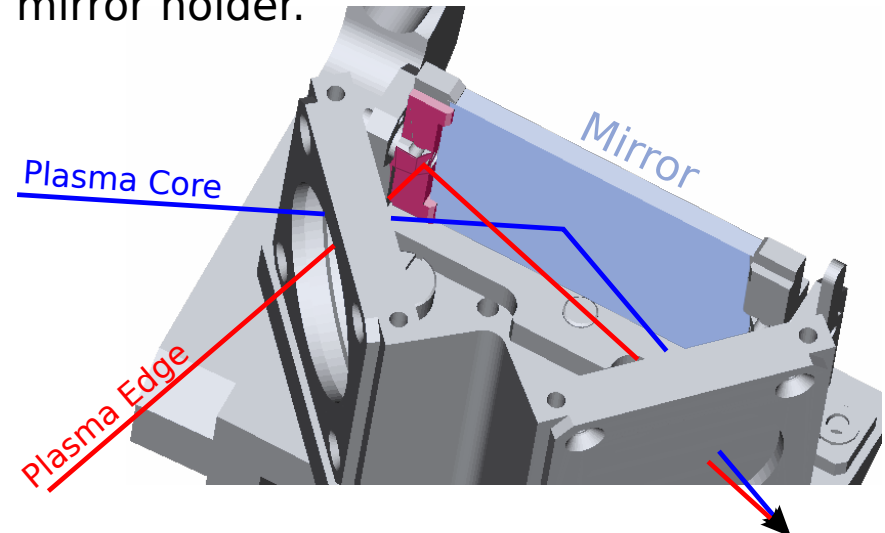
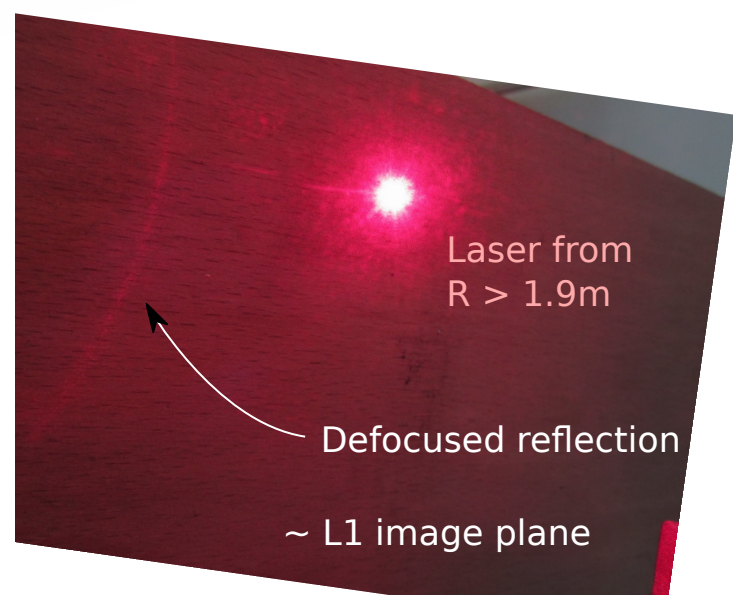
Reflection from the mirror hinge and the lump seem to be some edge light (which is much brighter) reflected onto the core image.



# IMSE - Core/Edge contamination



Building mock-up in lab this week and we can see something that might cause this: defocused reflection from the in-vessel mirror holder.



- 1) Don't use data at  $R < 1.62\text{m}$  from 2015.
- 2) Mechanically fix next opening for future campaigns.
- 3) For 2016, see if it's possible to spectrally filter out edge light from core image area.



## PermIMSE - Sawteeth

Attempted to measure the sawteeth shots on Tuesday with the IMSE since this had worked well with the prototype system, except that it couldn't see to the core.

Use reduced ROI (for Q8 only), dropping frame period to 7ms (normally 13ms).

32566: Good - Irregular sawteeth but clear data.

32568: Q8 tripped.

32569: 3 Sawteeth only.

32570: Camera failed, and no Sawteeth with Q8.

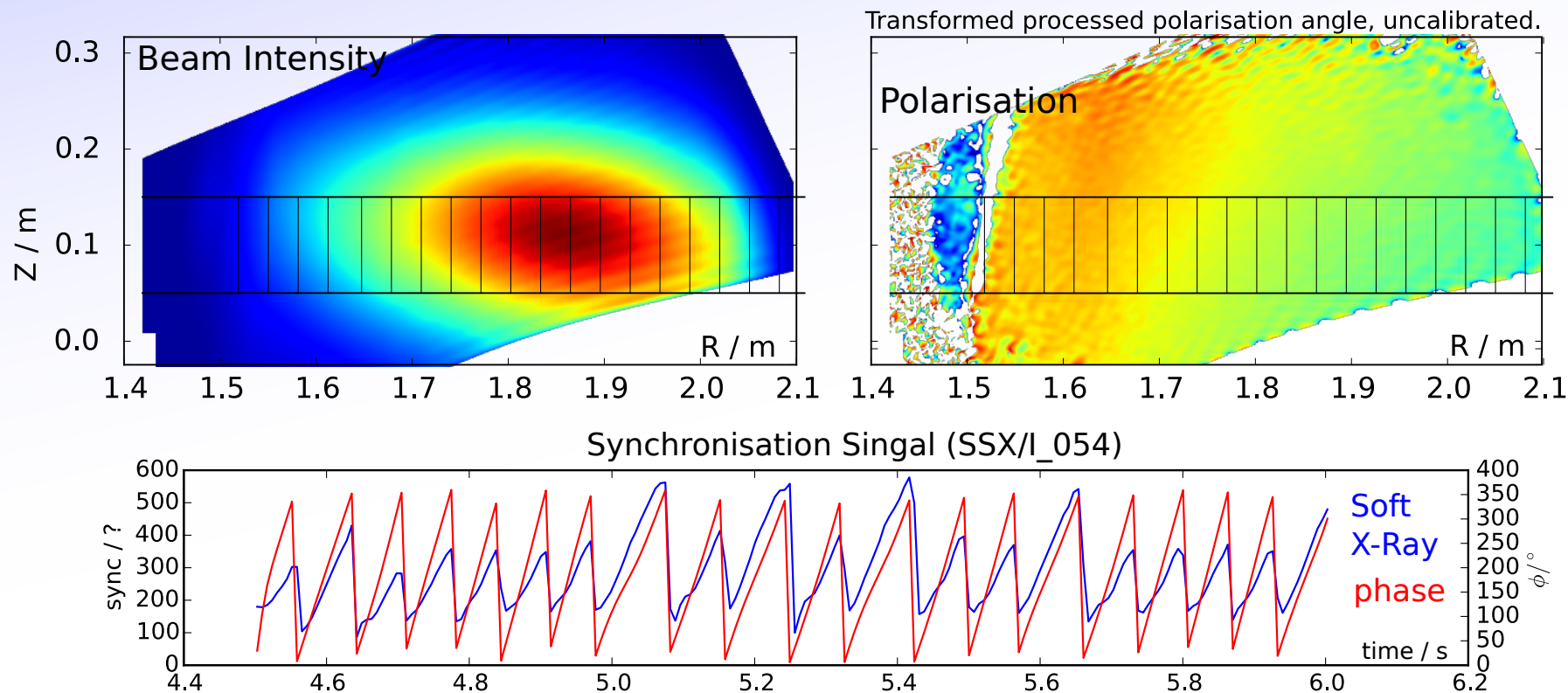
32571: No sawteeth.

32573: No sawteeth (intentionally)

32574: No Q8



# PermIMSE - Sawteeth

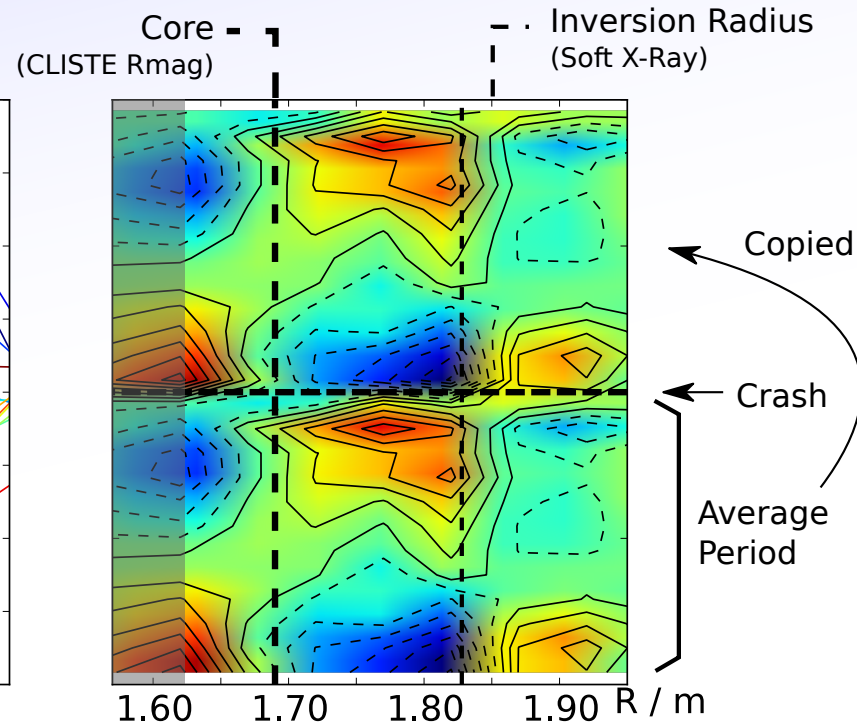
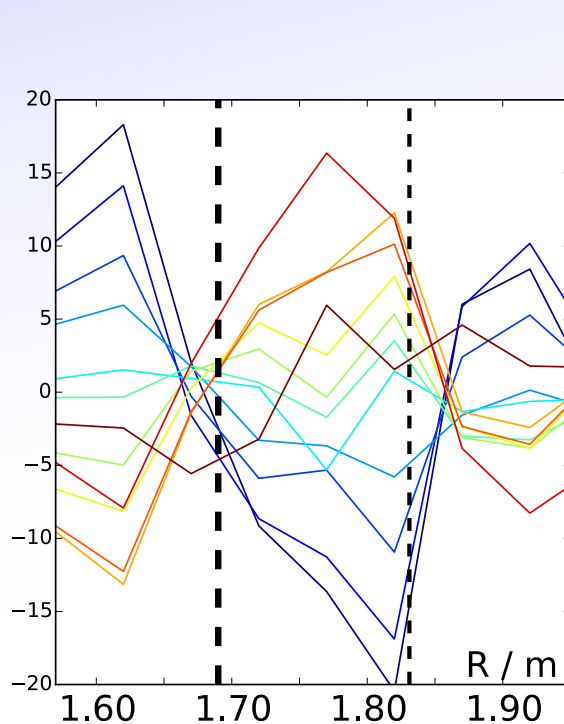


To first approximation in the core, the plasma current goes as  $d\theta/dR$ .

- Collect image  $d\theta/dR$  in bins of  $R$  and sawtooth phase
- Average in bins (over  $R$ ,  $Z$  and  $t$ )
- Subtract average for each  $R$  bin to show the dynamics over sawtooth phase.

## PermIMSE - Sawteeth

Gradient of intensity  
( $\sim dn_e/dR$ ) shows us that  
our spatial calibration matches  
the approximate core position  
and inversion radius from  
ECE.



Gradient of polarisation  
( $d\theta/dR \sim j\phi$ ) gives current  
dynamics.

Clearly see the build-up  
and expulsion of current  
from the centre outwards.

