



PermIMSE 2015 - First campaign

Installation

Calibration

Future design work

(Hopefully) first results :s

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Installation / Calibration

Thursday 30/04/2015 - IMSE Alignment and calibration.

Alignment -

Ok, view only just wide enough. Lamps a bit high.

Can see lamps, nearly all of Q8, most of Q7 but only the upper half of Q5.

Future: Need a really bright LED at one of the virtual image planes for backlighting.

FARO measurements of mirror box, lamp images after L1, lamp beams and background points done.

Calibration -

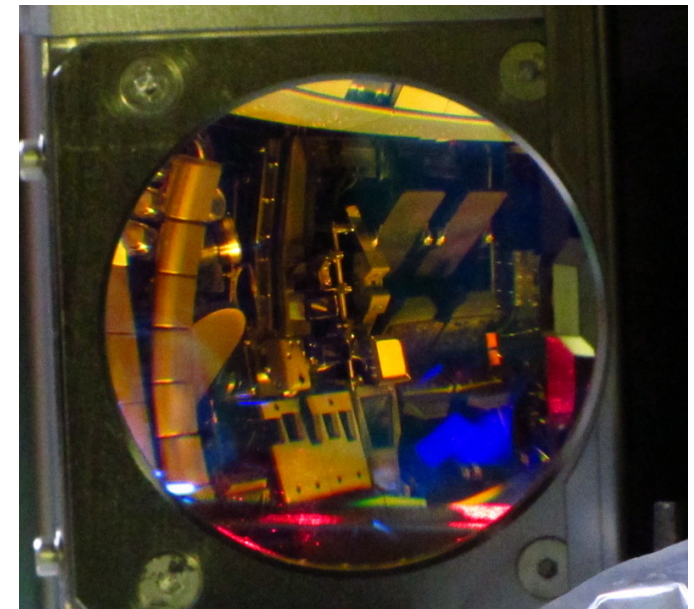
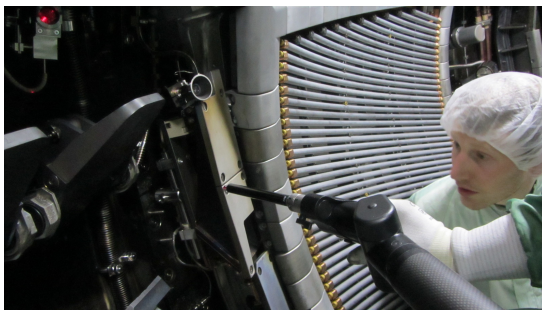
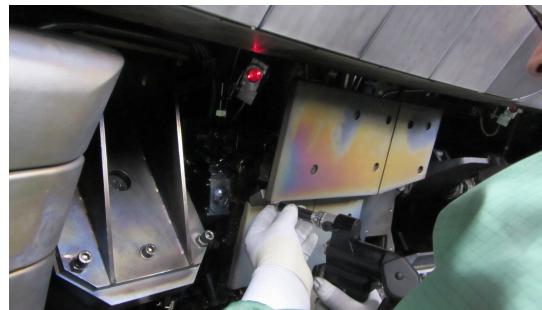
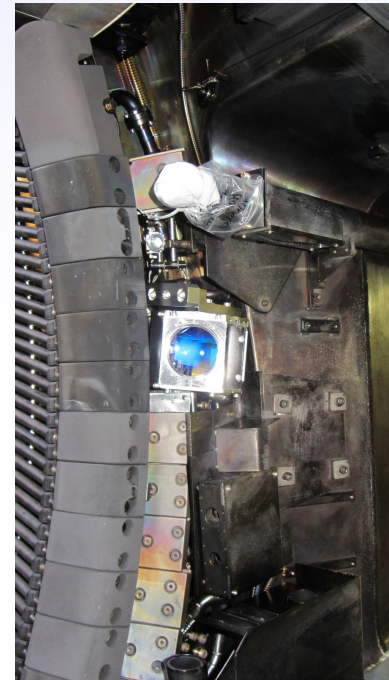
No backend system to measure with.

Lamps aligned by pointing laser level vertical at polariser rotation stage, getting it polarised horizontal and rotating to the left by approx 5degrees.

Inner lamp is approx 5° CCW of projected up, outer approx 3°, (camera POV)

Future: Need a tool for rotating the polarisers in the lamps.

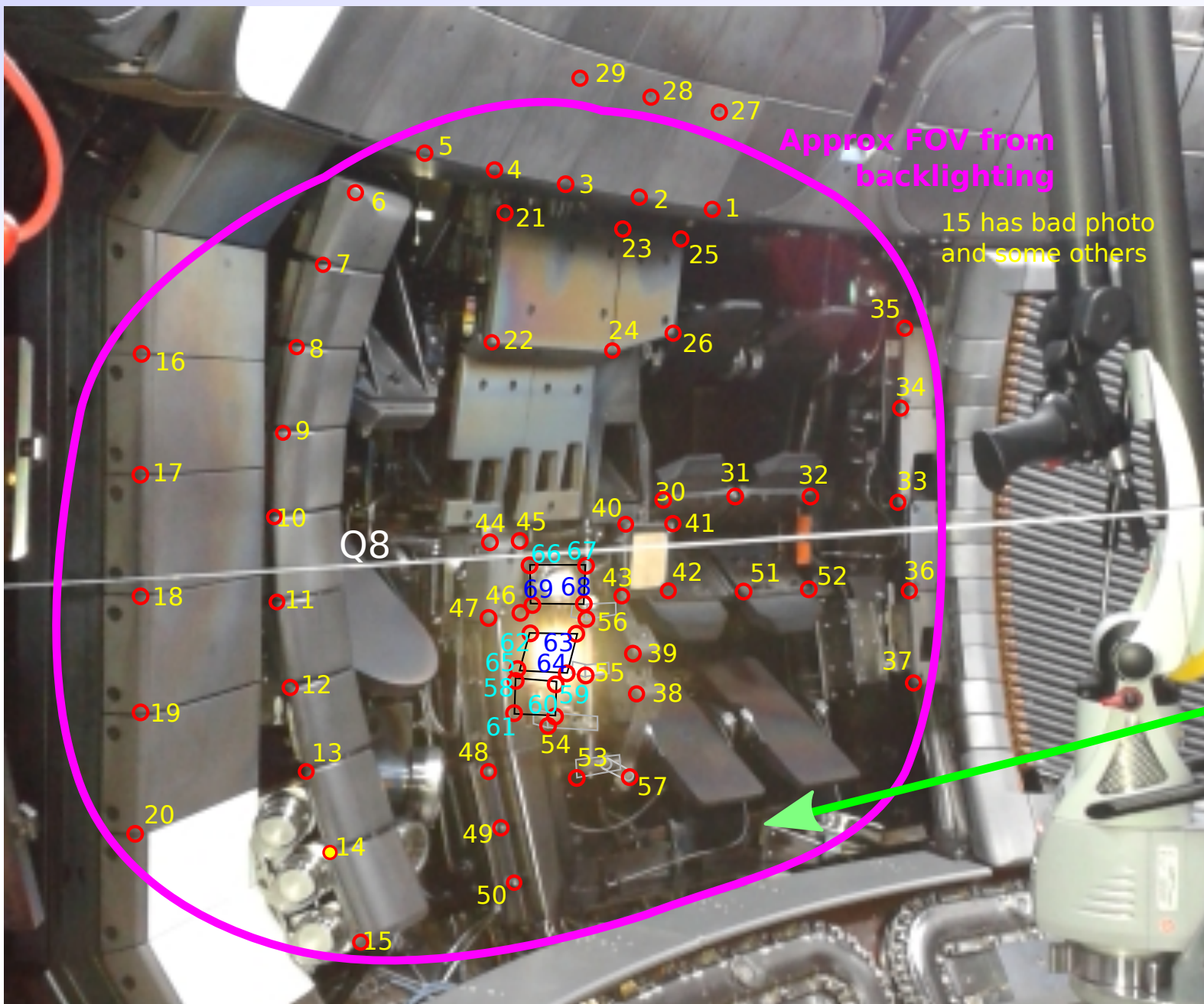
Not enough time to measure this by comparison to Brewster calibration.



This does not show full FOV!



2015 FARO Background measurements



Approx FOV from
backlighting

15 has bad photo
and some others

Need more
points here
next time

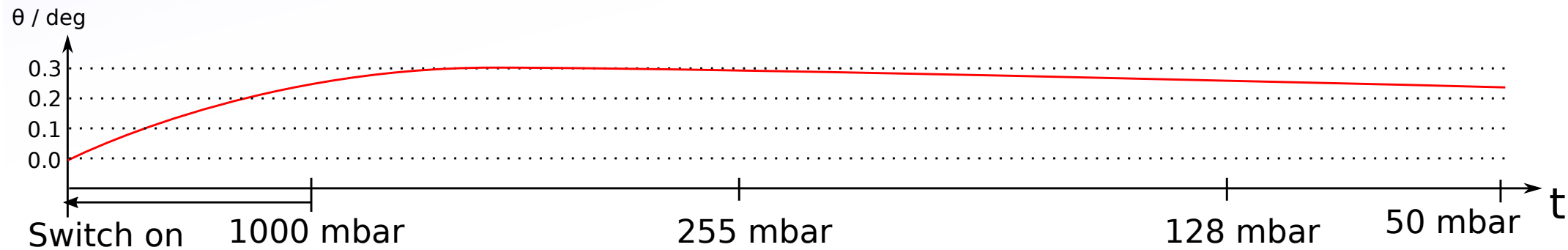
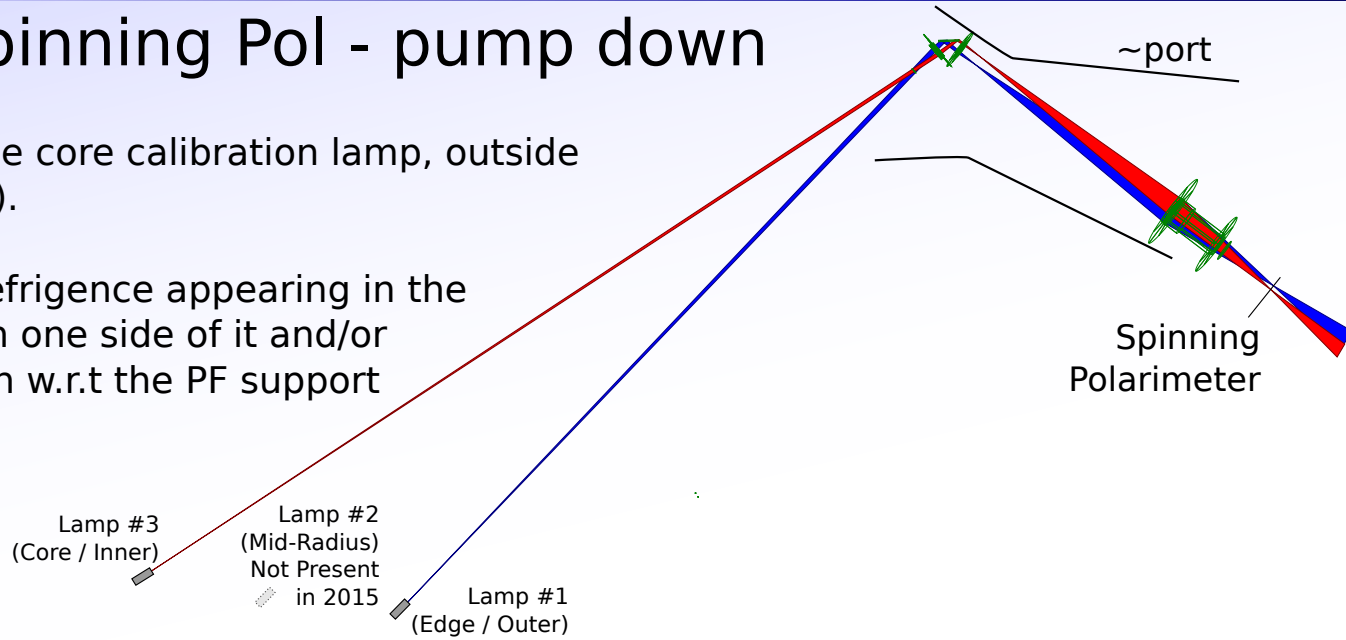


Spinning Pol - pump down

Measuring the change in polarisation of the core calibration lamp, outside the vessel at the image after Lens2 (Boris).

First, during pump down, to check for birefringence appearing in the vacuum window due to the air pressure on one side of it and/or mechanical change of the lamp orientation w.r.t the PF support where the polarimeter is mounted.

Data didn't save. Grrrr.
From memory, the plot looked like this:



The change from start-up to stable was about 0.3°. This might have included a bit of the early pump-down, maybe to ~700mbar, but it almost certainly just warm-up of the low-pass filter.

There was a slow change from ~500mbar to 0.3mbar of about 0.075° which could be the vessel changing shape or the pressure effect of the glass.

In any case, it's far smaller than our best hopes

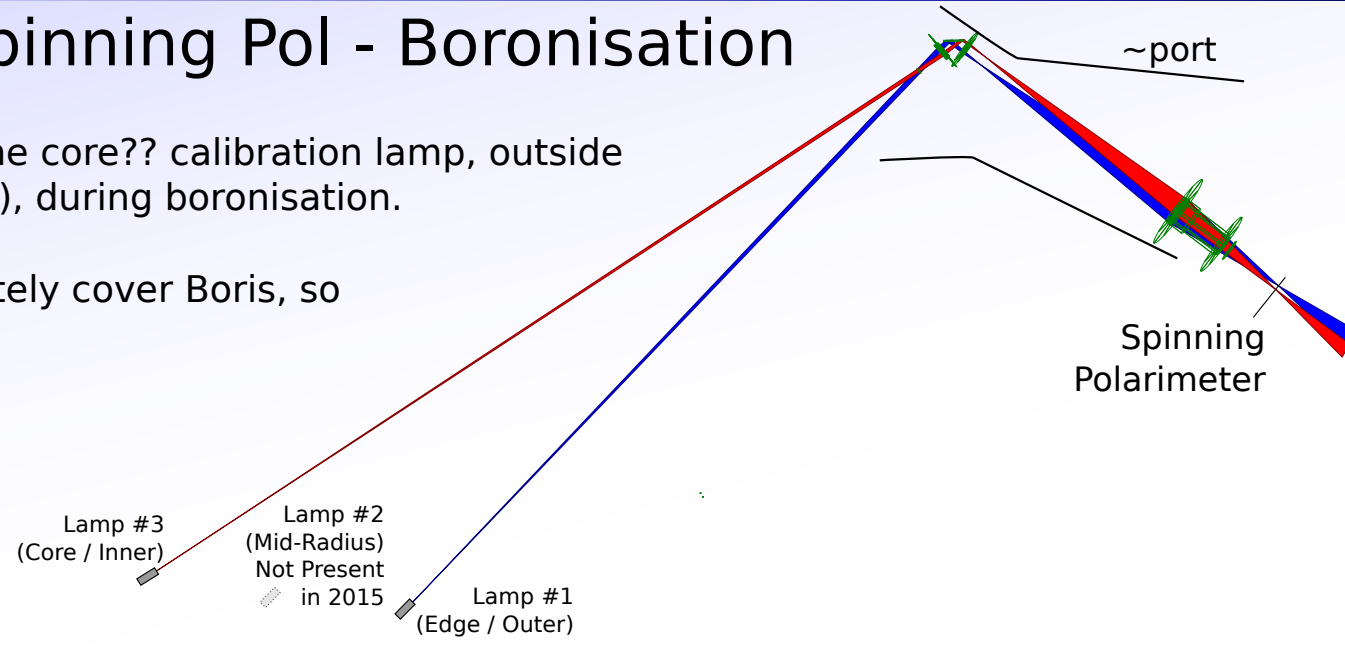
So, air pressure on vacuum window causing birefringence = Not a problem :)



Spinning Pol - Boronisation

Measuring the change in polarisation of the core?? calibration lamp, outside the vessel at the image after Lens2 (Boris), during boronisation.

ECE shutter is closed, but doesn't completely cover Boris, so we get /some/ signal.



There was no detectable change in the spinning pol measurements. So we think the effect is at worst $< 0.1^\circ$, probably $< 0.02^\circ$.

Hmm.. need to check is again one day.

Permanent IMSE - Ex-vessel Installation

IMSELAB/23 - 28

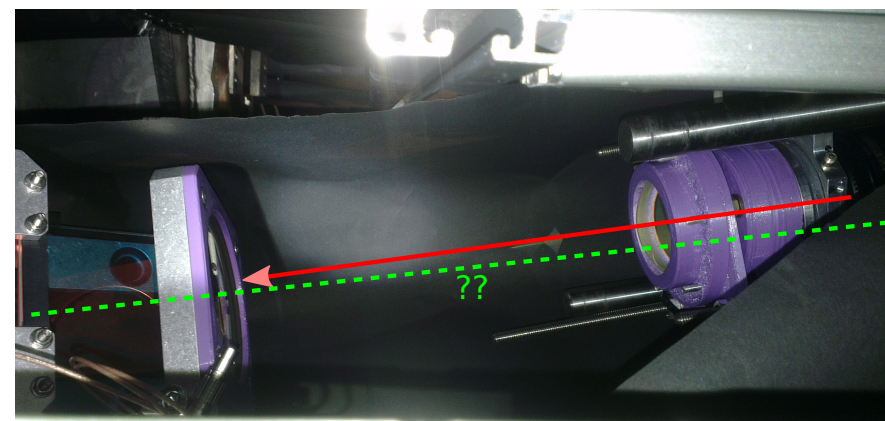
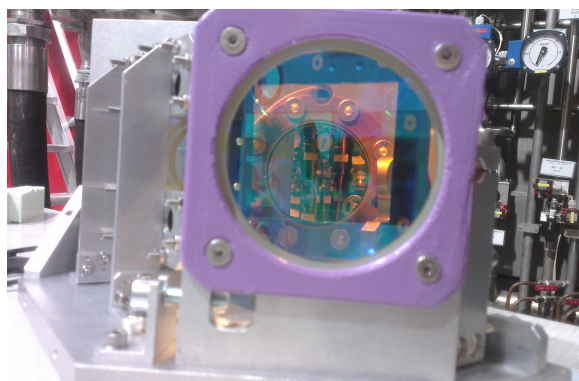
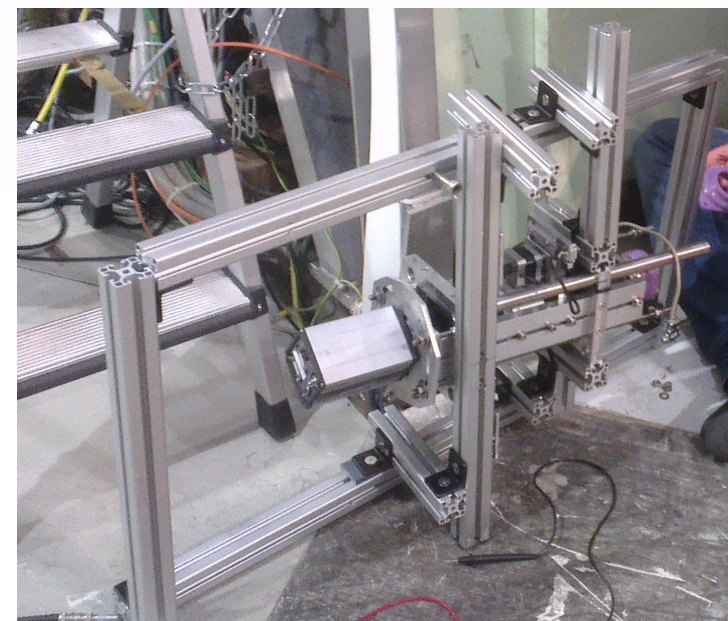
Wednesday 15th July 2015: Installed the ex-vessel optics and support structure for IMSE back-end in Sector 9.

- Prototype IMSE back-end (2013/14).
- Lots of 3D printed parts.
- Temporary support structure.

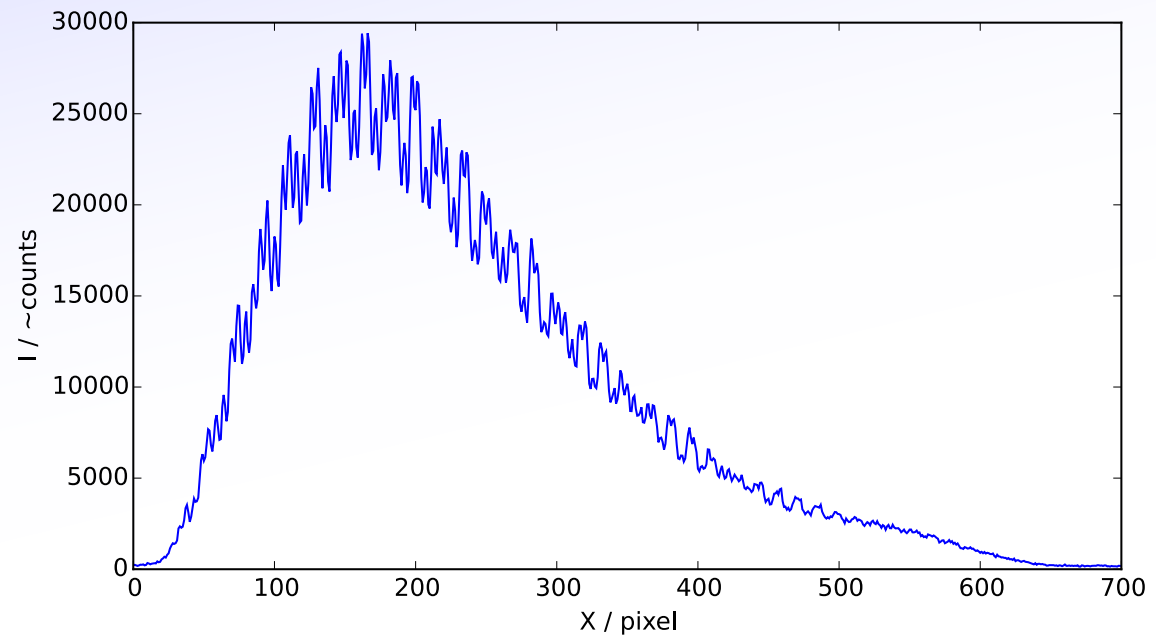
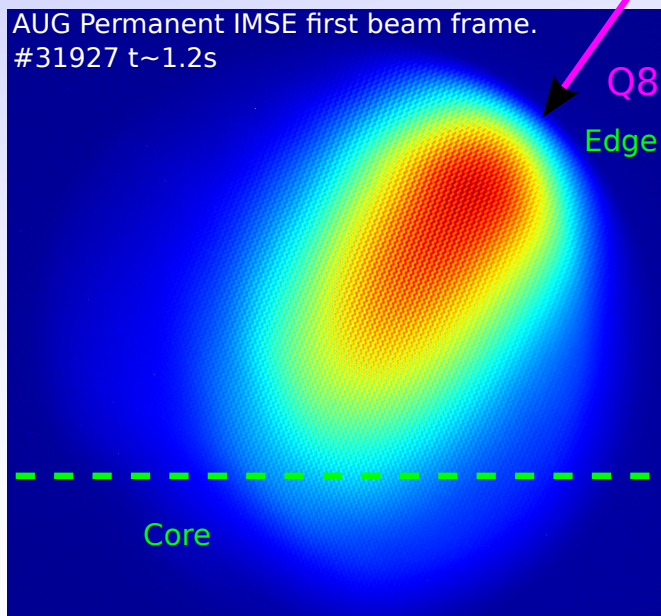
Only enough time to install, so:

- No optics alignment.
- Arbitrary focus setting.
- No filter optimisation.
- No internal linearity calibration.
- No polarisation alignment.
- No control systems (focus, filters, polariser)
- No trigger (post-processed timing only).
- Borrowed optic fibres from MSE ex-vessel calibration.

Didn't expect much more than seeing some light!



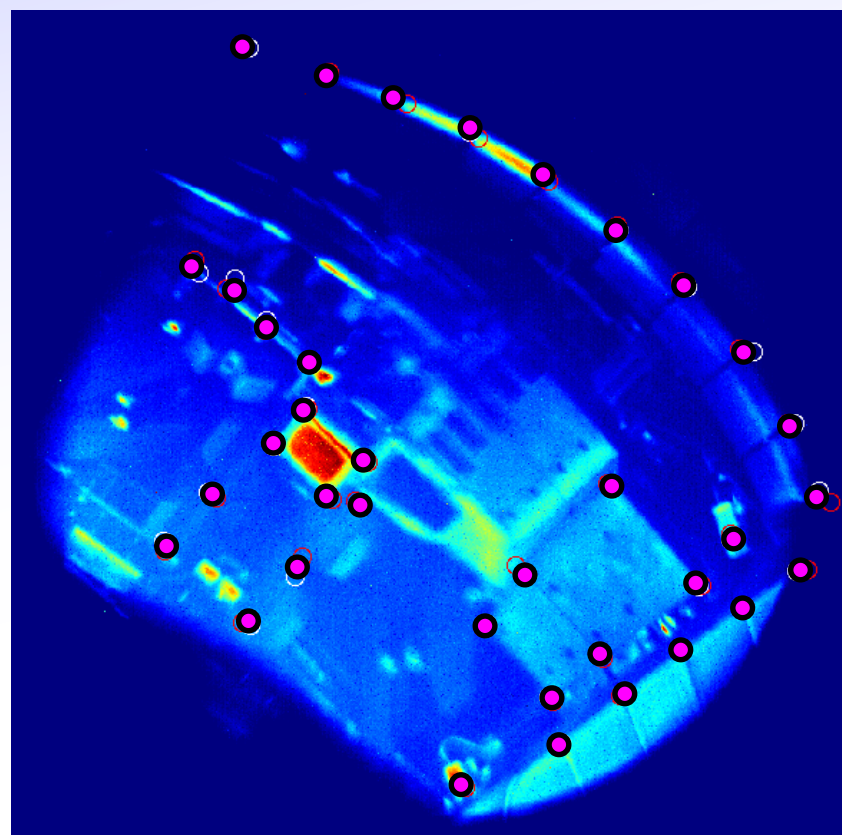
First Light



- Good beam image, about the same light intensity as prototype IMSE.
- Much wider FOV.
- Better beam penetration (higher energy beams).
- Good fringes (S/N) - should get even better with filter optimisation.
- Very lucky choice of orientation - plasma in best operating range!

Field of View

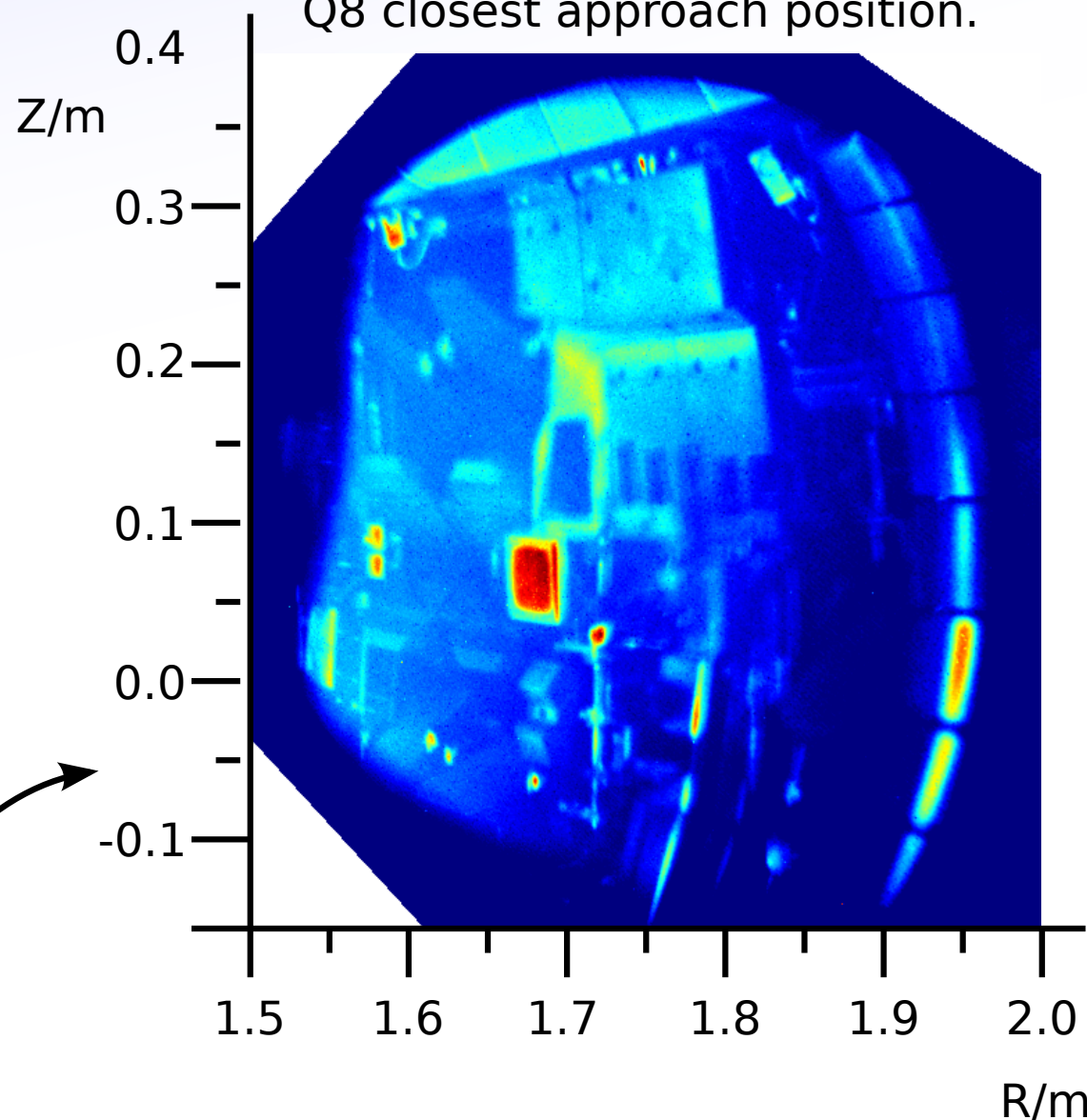
Transform gives us automatic spatial calibration, and tells us our field of view:



+

~40 FARO
Measurements

Q8 closest approach position.



Much better FOV - should be able to see past core when beam penetration is good.

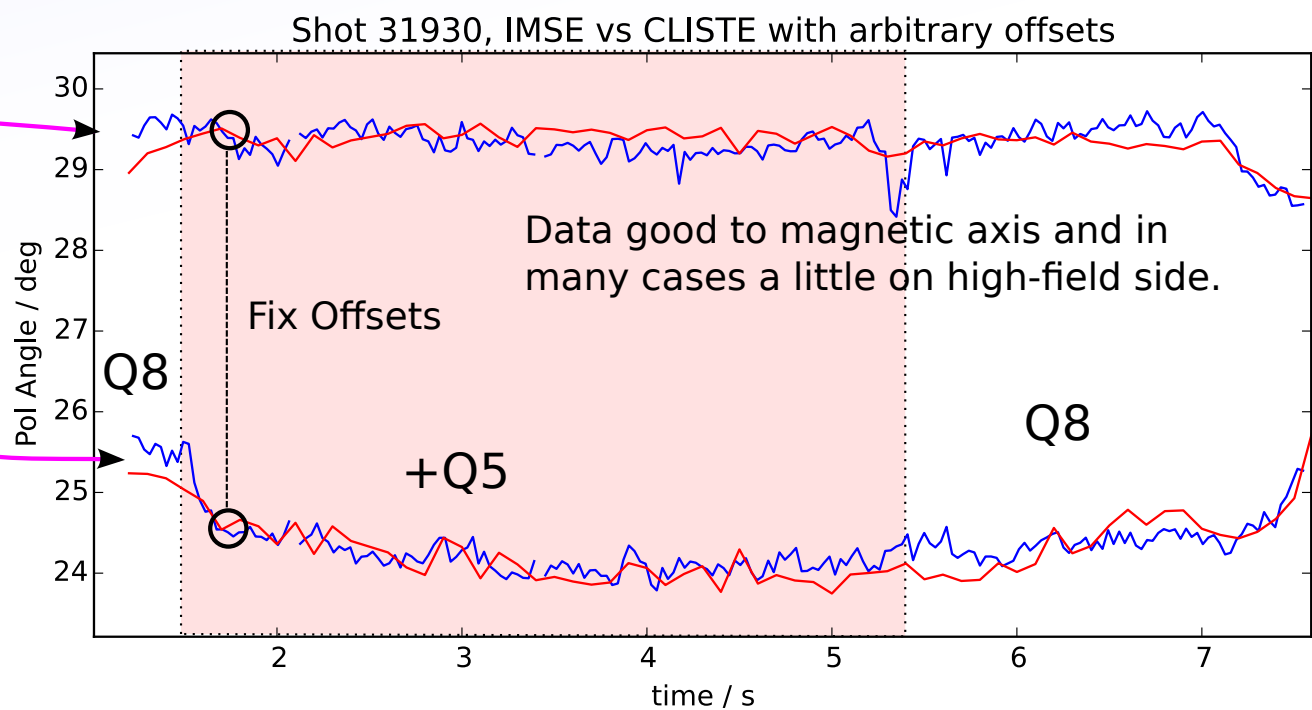
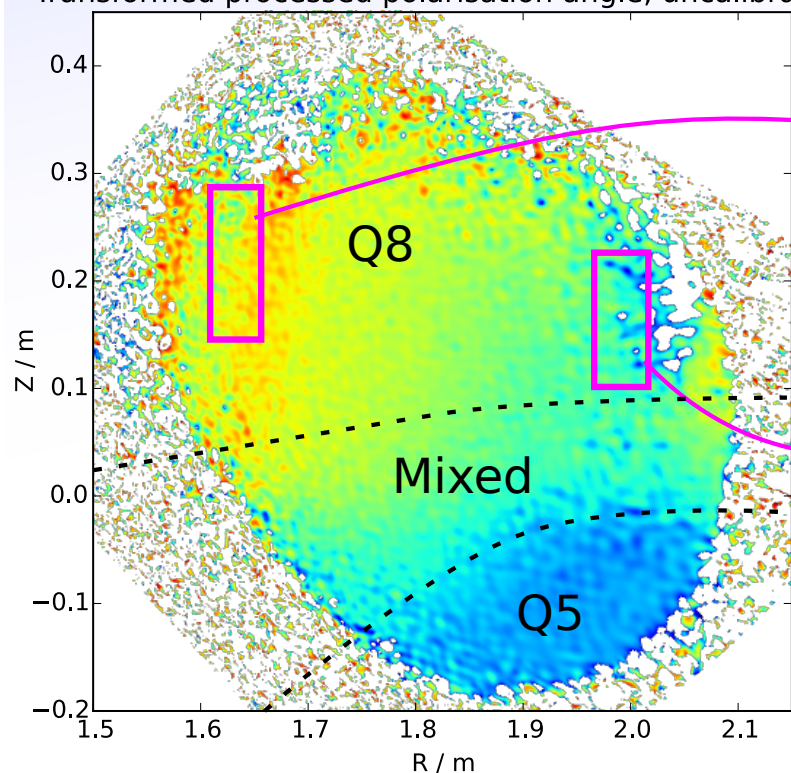


Match to equilibrium

The IMSE has the usual offsets and spatial deformations that need to be calibrated (will be done next week), but we can already look at first order comparison to CLISTE:

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Transformed processed polarisation angle, uncalibrated.

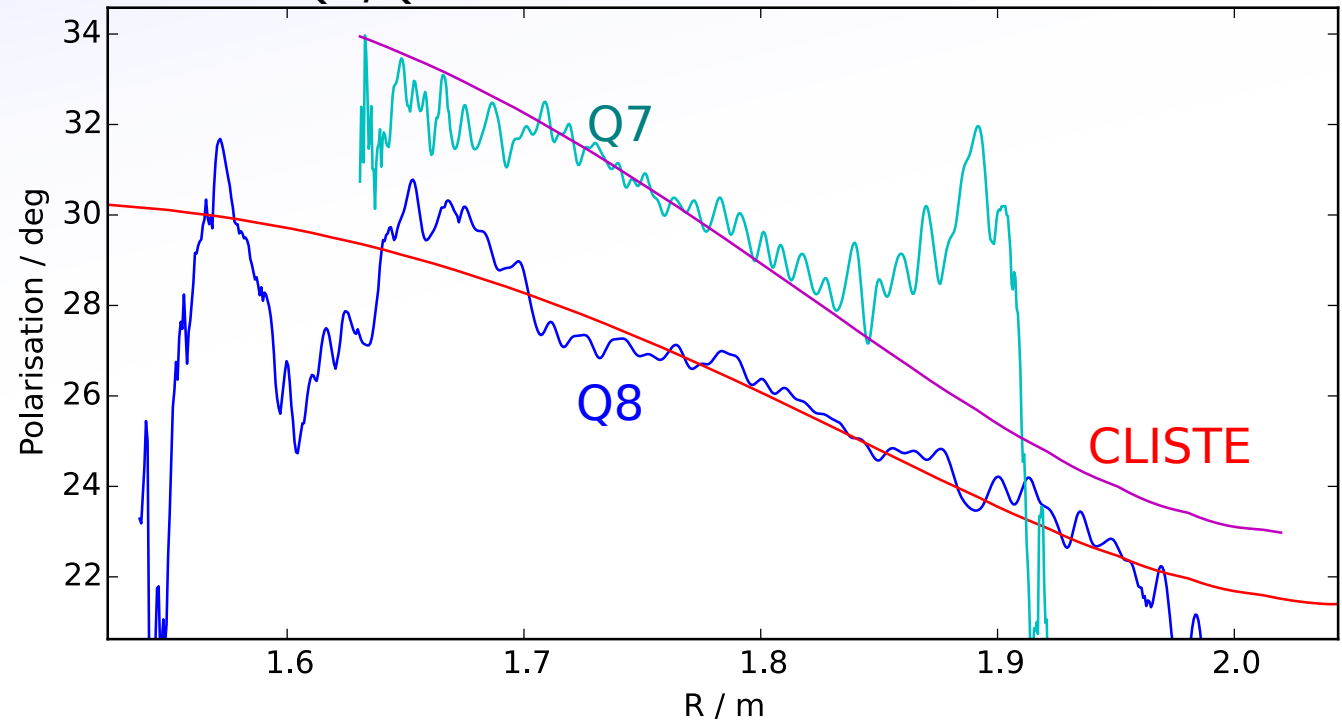
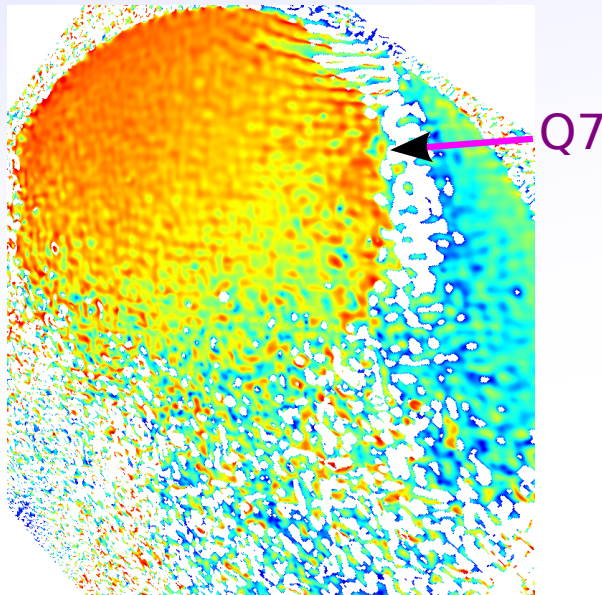


Data is good quality within at least $1.6 < R < 2.05\text{m}$, possible down to 1.556m .
Data crossing the magnetic axis is most important for constraining the equilibrium.

Current drive beams

Data is also good quality for Q7.

Q7/Q8 vs CLISTE with same offsets.



Switching between Q8/Q7 shows the expected angle jump due to beam geometry.

We can use Q8, Q5 or Q7 and a lot of the image area is useable for Q5+8 configuration. There may be some Er info in the mixed Q5/8 configuration.