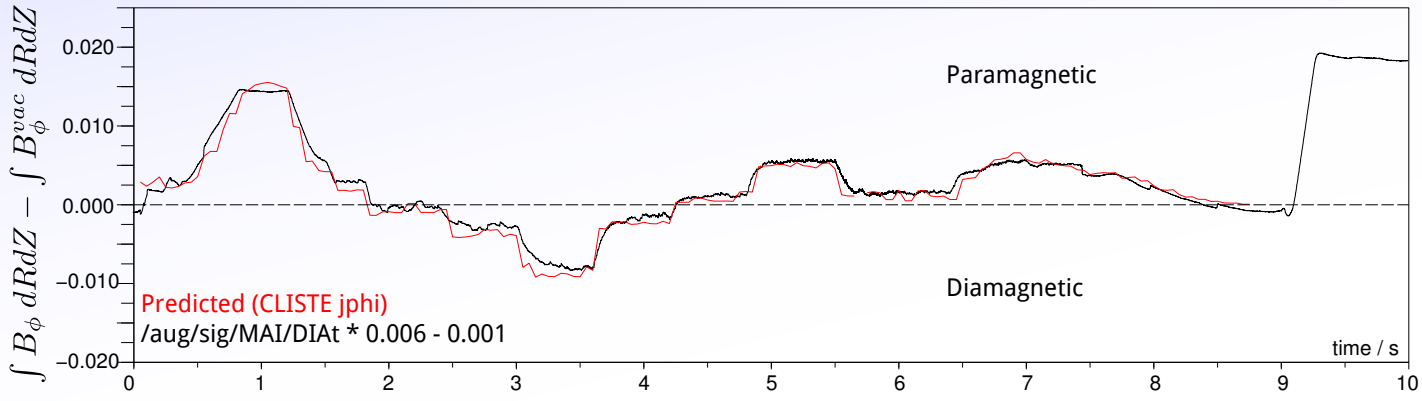
Para/Diamagnetics Possibilities

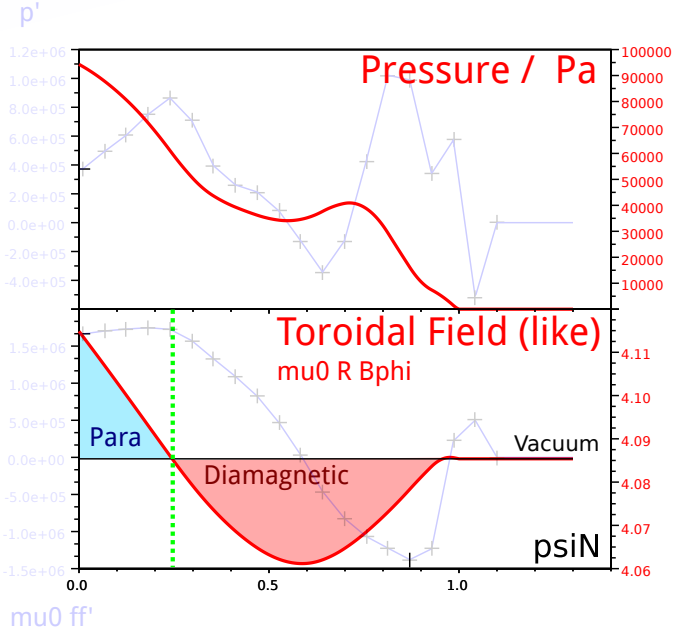
Is the plasma dia- or paramagnetic?

The diamagnetic loop (/aug/sig/MAI/DIAt - outside vessel) measures total field through loop, but is uncalibrated. Assume linear and adjust scaling and offset to match CLISTE prediction.



i.e: Variation of integrated toroidal field matches calculation from poloidal field, GS equ and CLISTE's assumptions. We can very probably trust that the integral is really diamagnetic.

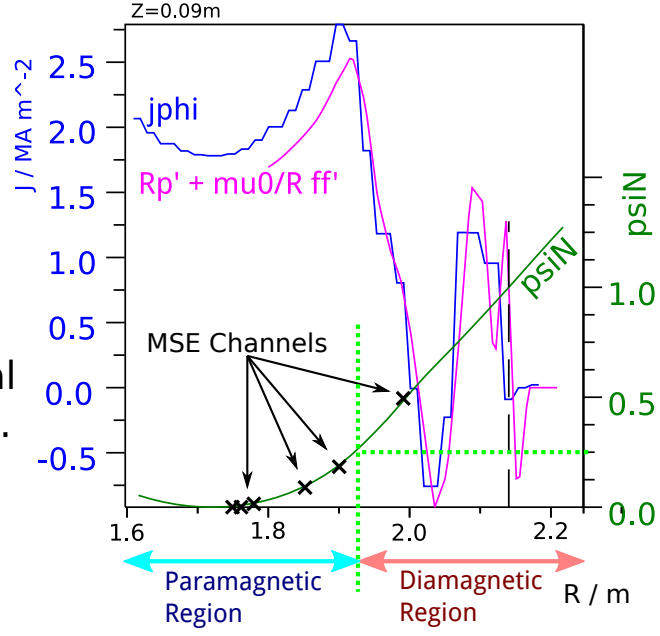
But... That does not imply paramagnetic local measurements disagree with equilibrium.
We can find GS solutions that match the observations and the integral, e.g:



Core is paramagnetic and edge strongly diamagnetic.

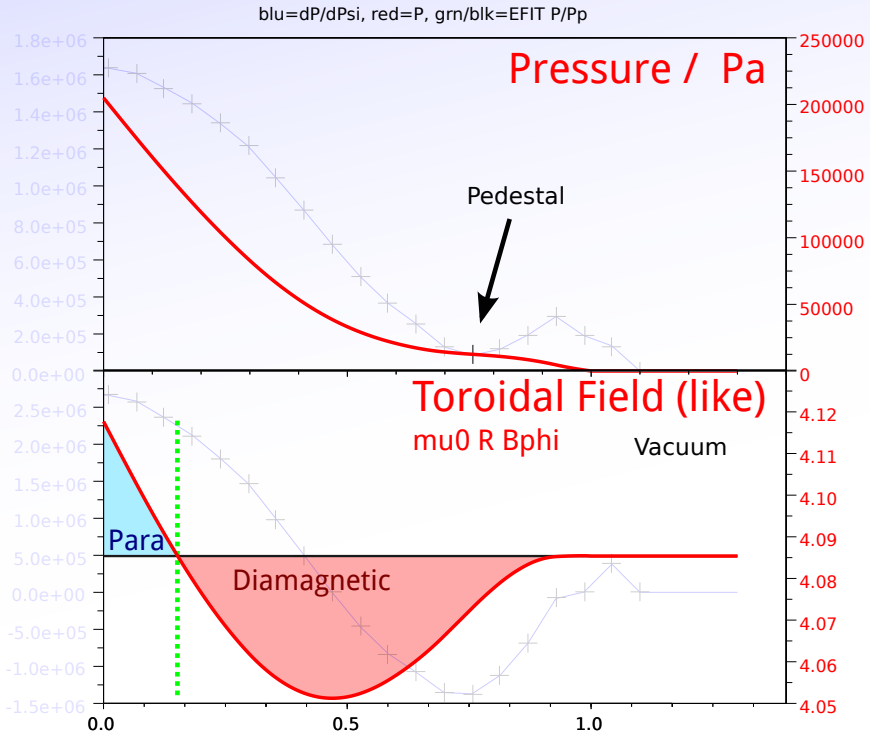
Paramagnetic region covers a large part of radial space - all but 1 of the MSE channels.

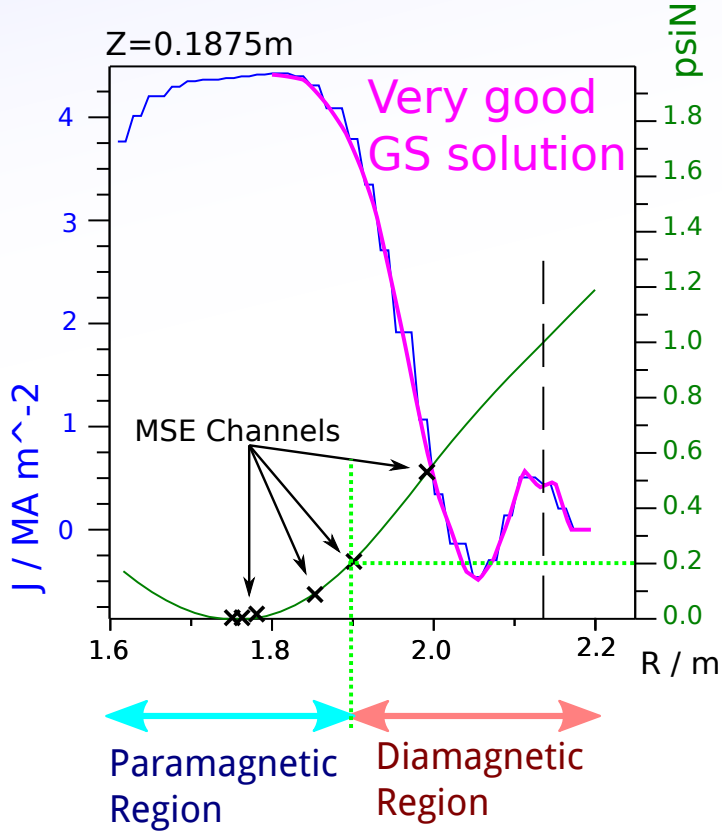
However, the pedestal has a huge poloidal plane area, so integral is still diamagnetic. and plasma matches observations.



Para/Diamagnetics Possibilities

There are many possible solutions that match. A smooth one:, for example:





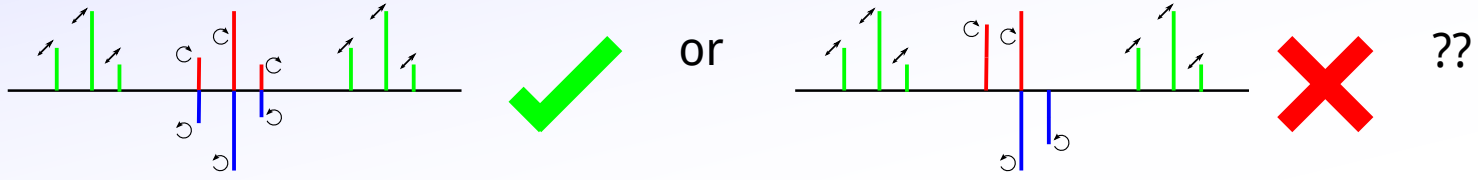
- No strange turning points or -ve pressure gradient.
- Very small current/pressure pedestal.
- Smaller paramagnetic region.
- Much better GS solution.
- All but last 2 MSE points still in paramagnetic region.

Conclusion: It is probably possible to find (many) GS solutions that match paramagnetic MSE measurements, while also satistfying everything else.

Of course, this doesn't imply this is happening, or even can happen.

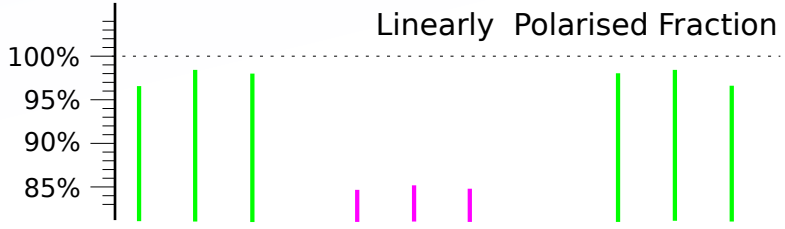
MSE / Zeeman Emission.

a) My question: Do the sigma_1 L/R cancel? (Incoherent addition to nett unpolarised light)
Marteen De Bock says: For pure stark - definitely yes.

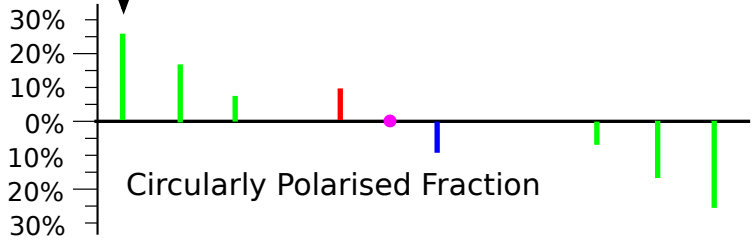


However, the Zeeman effect changes it...

Marteen's simulation for MAST: (Similar beam energy, B ~ 0.3T)
Almost no modification to total intensity of pi or sigma components,
but significant changes to degree of linear/circular polarisations:



sin 2χ = 25%
cos 2χ = 97%
--> 7º ellipticity angle.



His analysis also shows a ~0.1º angle change for this component, (but he said he was not sure about it).
CMOD's analysis of this gives for their system: π: < 0.007º, $\sigma_0 = 0$, σ_1 < 0.0007º

John Howard has also done some analysis of this for the K-STAR IMSE system where he measured significant unexpected ellipticity. He says:

> "*... ellipticity, and π/σ component non-orthogonality that arise from the combined Zeeman-Stark effect. It is found that while the net ellipticity is not insignificant, the deduced polarization orientation is only weakly influenced by the Zeeman effect.*"

So....
a) How strong is the effect at AUG?
b) How will it effect the interpretation of all three MSE systems?