Motional Stark Effect Imaging on ASDEX Upgrade:

Notes from Jan 2015 -

O. P. Ford,[1] A. Burckhart, J. Howard,[2] R. Wolf,[1] M.Reich[1]

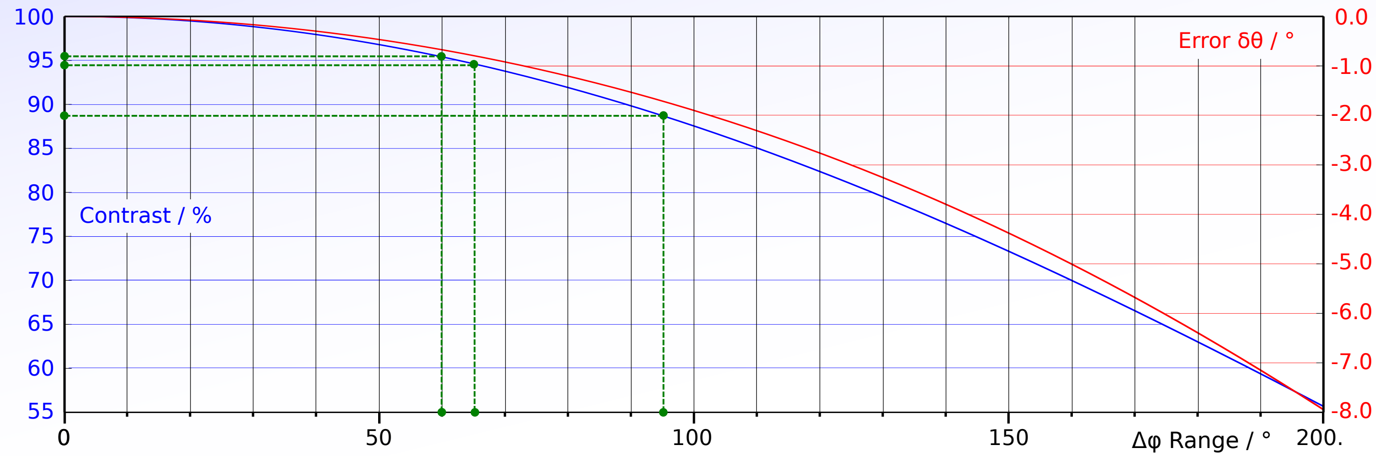
1: Max-Planck Institut für Plasmaphysik, Greifswald/Garching, Germany
2: Plasma Research Laboratory, Australian National University, Canberra

More magic number stuff

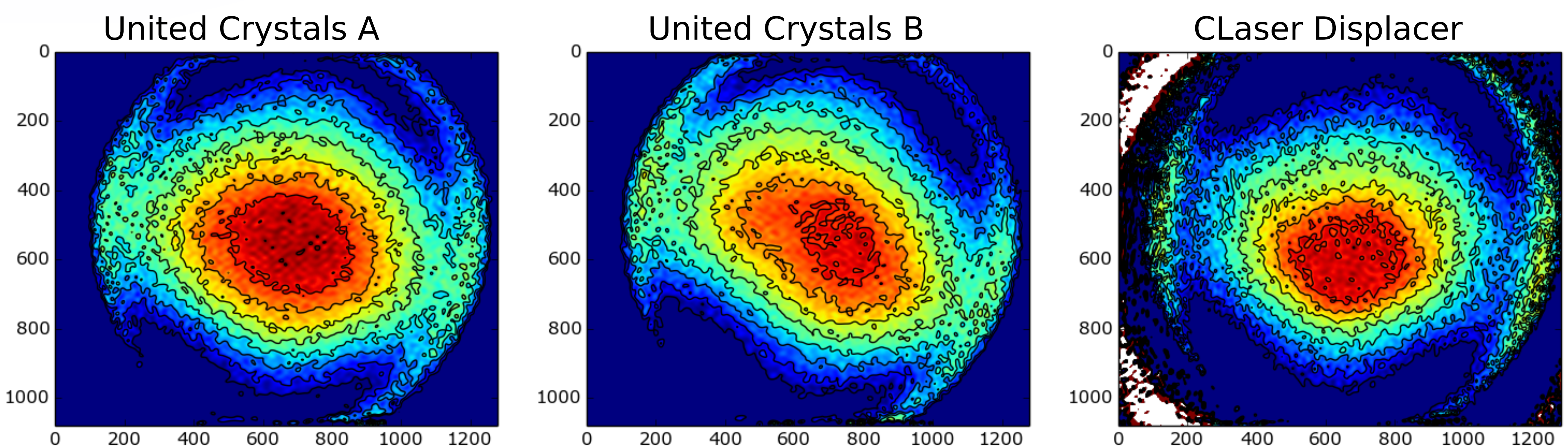
The return of the Magic Number

Oliver Ford
IPP Greifswald
gmds/AUG/75-97

The crystal parallelism isn't enough to explain all of the magic number. E.g. United Crystals plate A has < 60° and is very flat in the middle (< 5° variation). That should give a constrast of > 98%, but the measured constrast is always below 90%.



So, there is more to the story....
Using a big sphere to light all of the CCD/lens and looking at the full 16mm CCD shows a consistent pattern:



Tilting the plate doesn't have much effect, but rotating it 90° does rotate the pattern on the CCD.

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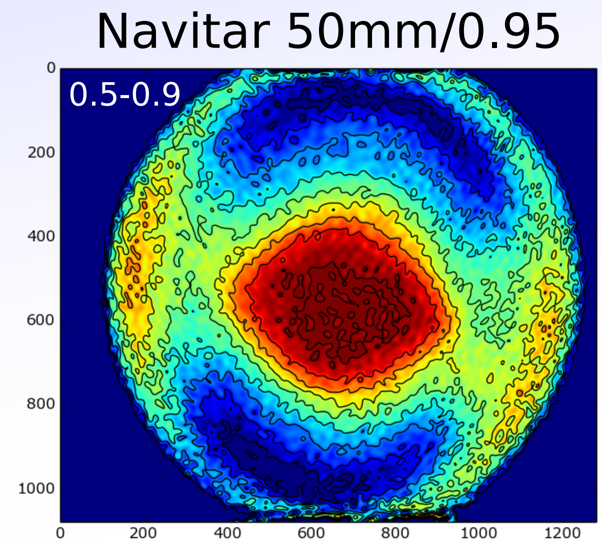
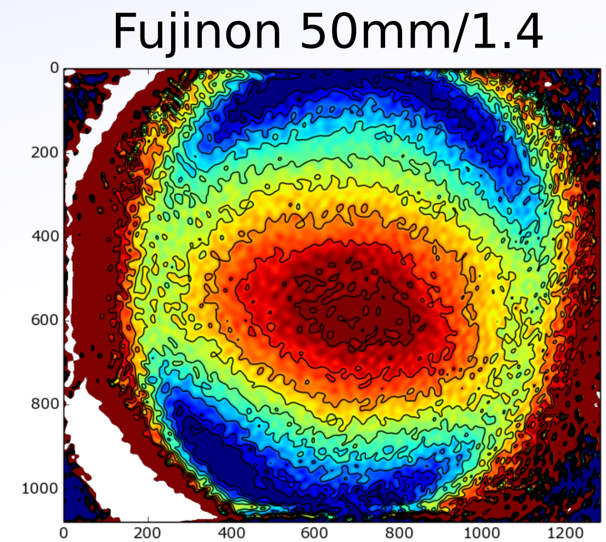
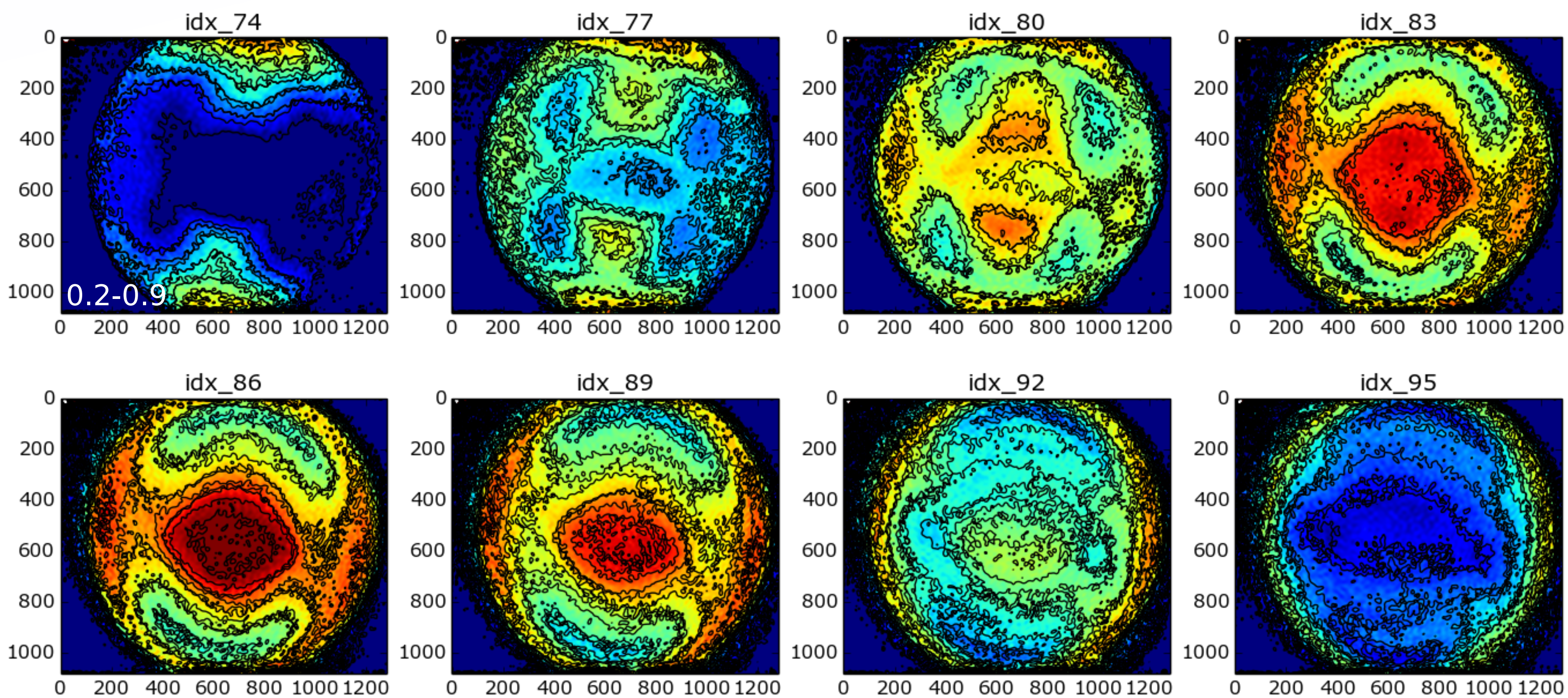
Changing to a different 50mm lens changes the shape a little, but doesn't change the broad shape of it.

(The new Navitar lens gets a 20% higher signal, but does have a steeper contrast falloff at the images edges.





Changing the focus of the lens does make a big difference:



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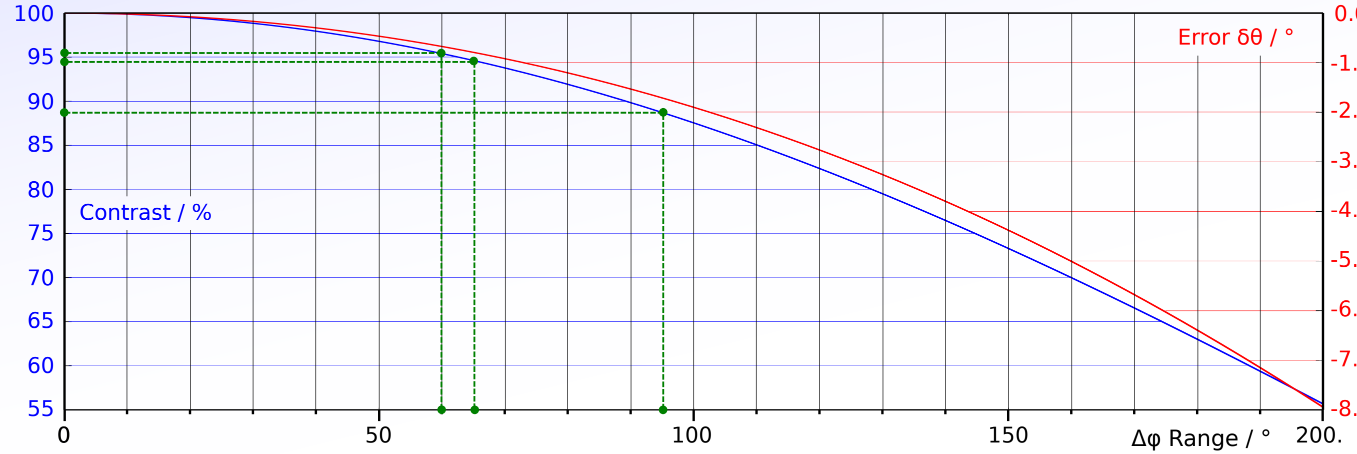

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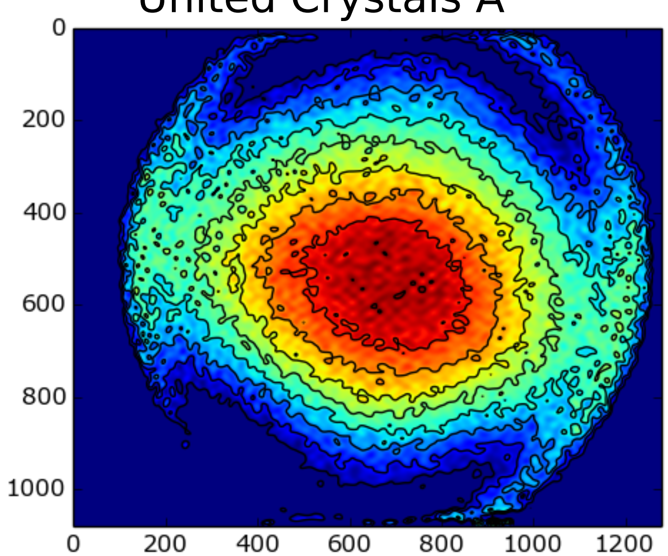
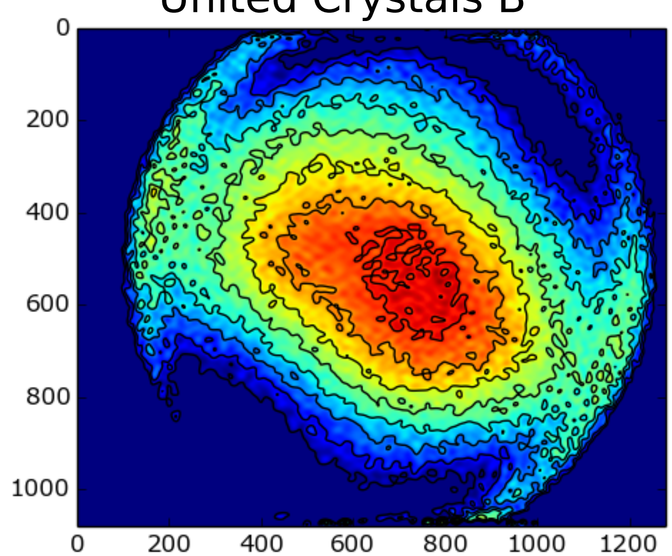
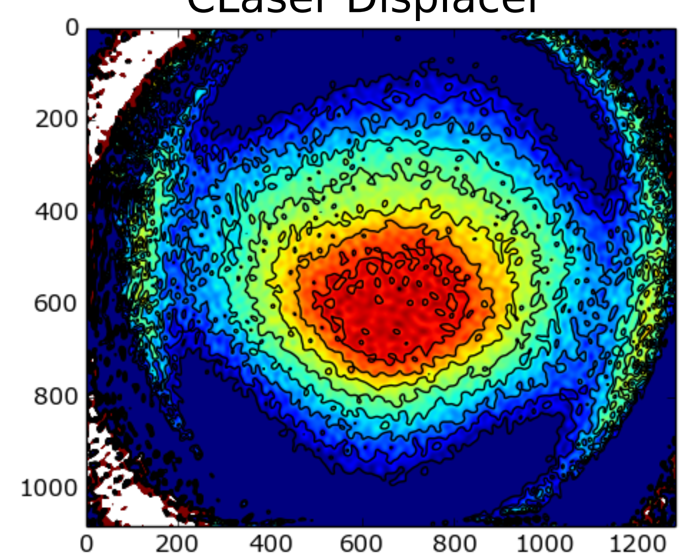
United Crystals A



United Crystals B



CLaser Displacer



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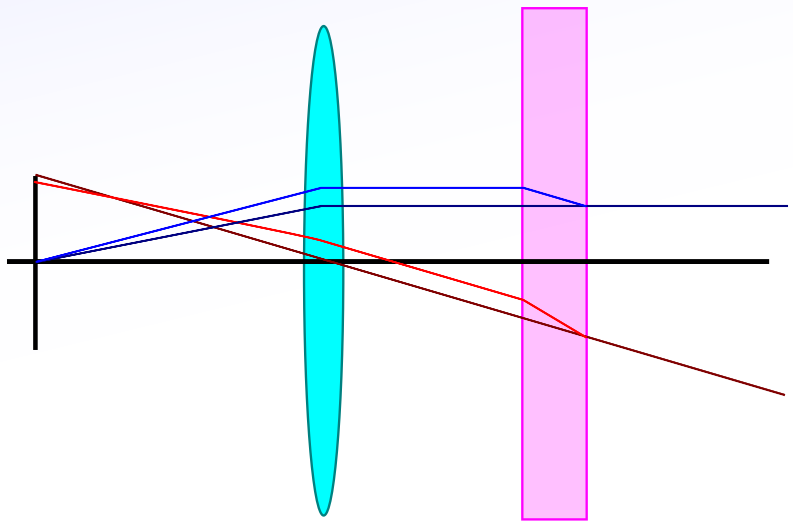
So, the pattern seems to be fairly fundamental - i.e. not just an aritfact of random non-ideal features within tolerance. The pattern appears to come mostly from the lens but aligns with the optic axis of the plates (rotating the lens does nothing).



One idea is that it might be to do with the lens' ability to recombine the split rays. If this varies with angle (and hence image position), the contrast could be a function of the image position and be different in the optic axis plane than parallel to it

The contrast will depend on the refocusing of the split rays only if the perpendicular spatial coherence is relatively short - < 0.5mm.
What this is, and how is depend on the light source, I have no idea - laser, plasma??

It could be partly a pure focusing effect - i.e. the ability of the lens to get all rays of the same angle at all positions, on the same pixel. This is supported by the fact that the focus doesn't reach a flat maximum'.
However, one would then expect the contrast to reach 100% when a small area is used, like in the phase surface scan measurement, but it doesn't. Also, it doesn't explain the difference with the paralell/perp to optic axis plane.