

# **Resonant Errors, Reconstruction, Nescoil, and all that II**

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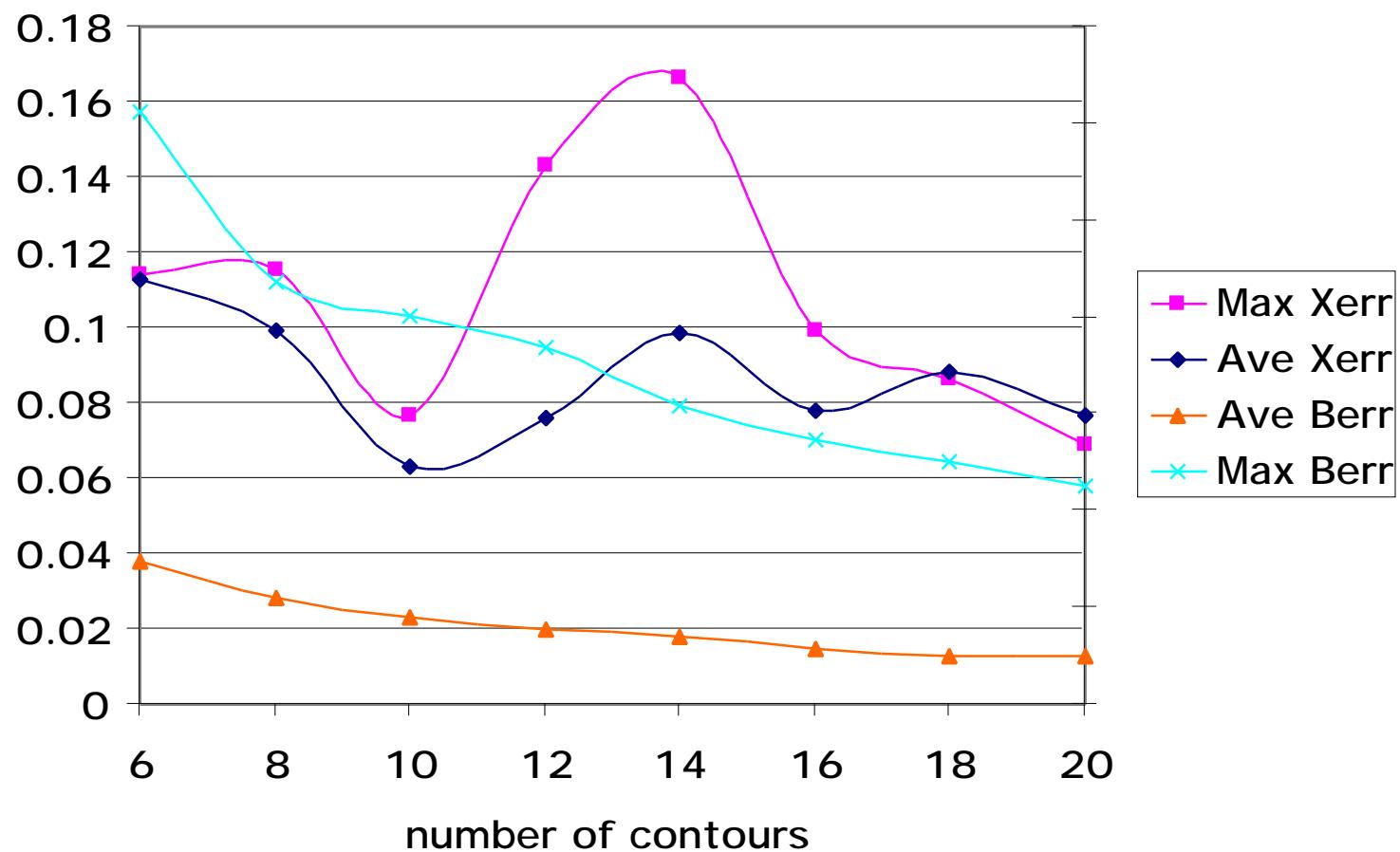
- **Progress from last week:**

1. Carefully examined the mystery of (32,5) mode and after two-day search found one bug in code – number of field periods (nfp) was used wrong in one place leading to the aliasing effect. This nfp bug has now been squashed.
2. The (32,5) mode is now gone. The (7,1) and (6,1) modes dominate. Qualitatively results still look the same. There is still a min of  $\langle X_{err} \rangle$  at 16 as before.
3. Now all basic tests (berr fourier test,    test) agree to machine precision.

4. The average error in  $B_o \cdot X_{err} = berr$  is now down to 7% and the number of points at which it is not satisfied to better than 50% is now down to about 50-80 points out of 2112, rather than  $\sim 200$  points. Both  $berr$  and  $xerr$  are small there.
5. A more detailed scan shows minima in  $\langle X_{err} \rangle$  at 10 and 16. Art's  $\langle M \rangle$  VMEC shows minima at 8 and 16. Why the difference at 10?
6. mod2050.100.10 vs sad18ef.16/18 cases : have same  $\langle M \rangle$  ( $\sim 2.3$ ) , but mod case reconstructs better than sad and the  $X_{err}$  for mod is 1/3 that of sad. So in this case,  $X_{err}$  is a better indicator of reconstructability. This needs confirmation from the physics group.
7. Corrected `berr_2_xerr` code has been implemented within nescoil.

## B and Xerrors for sad18ef

Note: Xerr Max and Ave are on different scales  
 $\langle Xerr \rangle = 3.07e-3$  and  $XerrMax = 1.5e-2$  for current sheet



m,	n	1. / (m*i+n)	xmn	m,	n	1. / (m*i+n)	xmn	Case	<Xerr>	Xuv max	
sad18ef.6		<M> Vmec = 2.707		sad18ef.16		<M> Vmec = 2.301		Current Sheet:	3.07E-03	1.50E-02	
7	1	3.544	5.83E-02	6	1	-5.356	3.89E-02	sad18ef.6:	4.39E-02	0.11412792	
6	1	-5.356	-3.86E-02	7	1	3.544	-2.10E-02	sad18ef.8:	3.87E-02	0.11516199	
19	3	-10.96	5.65E-03	13	2	10.48	-4.04E-03	sad18ef.10:	2.46E-02	7.65E-02	
13	2	10.48	-5.18E-03	26	4	5.238	7.68E-04	sad18ef.12:	2.95E-02	0.14335462	
25	4	-3.597	7.15E-04	19	3	-10.96	-2.48E-04	sad18ef.14:	3.83E-02	0.16630988	
26	4	5.238	4.03E-04	25	4	-3.597	-1.71E-04	sad18ef.16:	3.04E-02	9.96E-02	
sad18ef.8		<M> Vmec = 2.548		sad18ef.18		<M> Vmec = 2.317		sad18ef.18:	3.43E-02	8.62E-02	
7	1	3.544	3.69E-02	6	1	-5.356	4.62E-02	sad18ef.20:	2.99E-02	6.88E-02	
6	1	-5.356	-2.92E-02	7	1	3.544	-2.10E-02	mod2050.100.10:	1.11E-02	3.63E-02	
19	3	-10.96	-1.28E-02	19	3	-10.96	3.20E-03	Case	<Berr>	Buv max	
13	2	10.48	-3.43E-03	13	2	10.48	2.95E-03	Current Sheet:	1.15E-03	1.65E-02	
26	4	5.238	1.87E-03	26	4	5.238	6.38E-04	sad18ef.10:	9.01E-03	4.02E-02	
25	4	-3.597	-3.15E-04	25	4	-3.597	-1.27E-04	sad18ef.12:	7.72E-03	3.69E-02	
sad18ef.10		<M> Vmec = 2.86		sad18ef.20		<M> Vmec = 2.349		sad18ef.14:	7.04E-03	3.09E-02	
6	1	-5.356	-1.69E-02	6	1	-5.356	3.73E-02	sad18ef.16:	5.87E-03	2.74E-02	
7	1	3.544	1.24E-02	7	1	3.544	-1.81E-02	sad18ef.18:	5.09E-03	2.50E-02	
19	3	-10.96	-6.63E-03	13	2	10.48	1.00E-02	sad18ef.20:	4.93E-03	2.25E-02	
13	2	10.48	-5.29E-03	19	3	-10.96	4.07E-03	sad18ef.6:	1.48E-02	6.11E-02	
25	4	-3.597	9.11E-04	26	4	5.238	6.21E-04	sad18ef.8:	1.10E-02	4.38E-02	
26	4	5.238	2.12E-05	25	4	-3.597	-4.79E-04	mod2050.100.10:	4.65E-03	3.28E-02	
sad18ef.12		<M> Vmec = 3.192		Current sheet case, ie., sad18ef63							
6	1	-5.356	2.38E-02	6	1	-5.356	5.06E-03	Notes:			
13	2	10.48	-1.95E-02	7	1	3.544	-2.92E-03	sad16 and sad 20 vs mod2050 cases:			
7	1	3.544	1.15E-02	13	2	10.48	7.90E-04	Their Berr and <M> are about same (2.3)			
26	4	5.238	-1.27E-03	19	3	-10.96	3.87E-04	Their Xerr are different			
25	4	-3.597	1.10E-03	25	4	-3.597	-3.11E-04	mod Xerr = 1/3 sad Xerr			
19	3	-10.96	-9.81E-04	26	4	5.238	-1.94E-06	mod reconstructs better than sad			
sad18ef.14		<M> Vmec = 2.483		mod2050.100.10, <M> = 2.3							
6	1	-5.356	4.48E-02	13	2	10.48	1.14E-02	In mod, (6,1) and (7,1) are well suppressed			
13	2	10.48	-2.38E-02	26	4	5.238	5.95E-03	even below the already small modes			
19	3	-10.96	-7.45E-03	25	4	-3.597	2.93E-03	The dominant modes in all these cases are:			
25	4	-3.597	7.55E-04	7	1	3.544	2.14E-03	(6,1) and (7,1) and (13,2)			
26	4	5.238	-5.99E-04	6	1	-5.356	2.09E-03	The spurious (32,5) has vanished after nfp			
7	1	3.544	4.90E-04	19	3	-10.96	-2.08E-03	bug was fixed in berr_to_xerr_pp routine			