

# **More promising results in the effort to use new nescoil tools to reduce maximum surface current density**

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## **Goal of the effort this week**

Generate “good” surfaces with offsets from 15 to 25 cm in 1 cm steps

Do svd scan on each and find local minima in Jmax. See if solutions “track”

Estimate Jcoil using 14.5 cm inner limit and simple scaling with offset

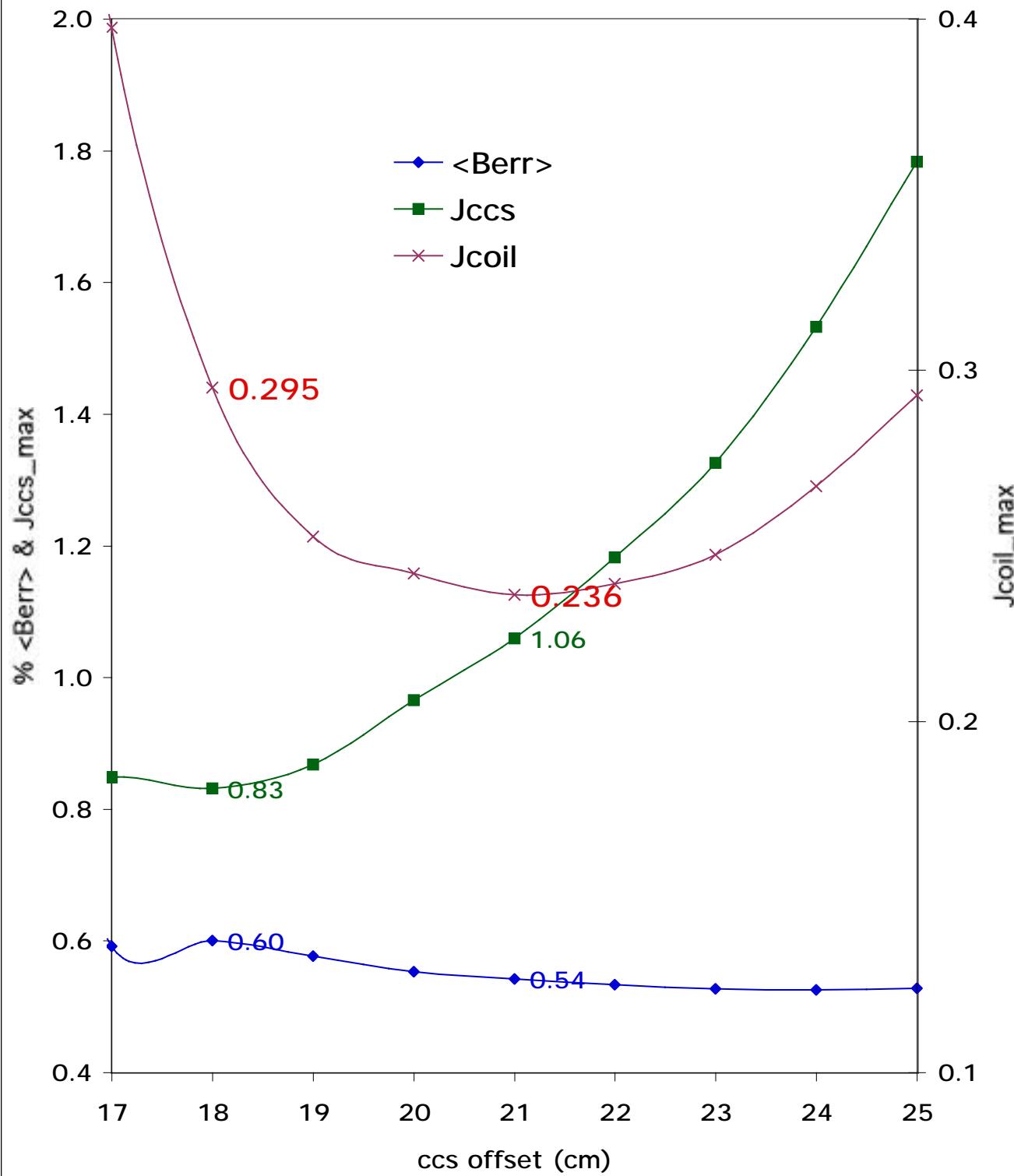
**Get “acceptable” accuracy with “better” surface currents**

## Promising results for c82 from last week

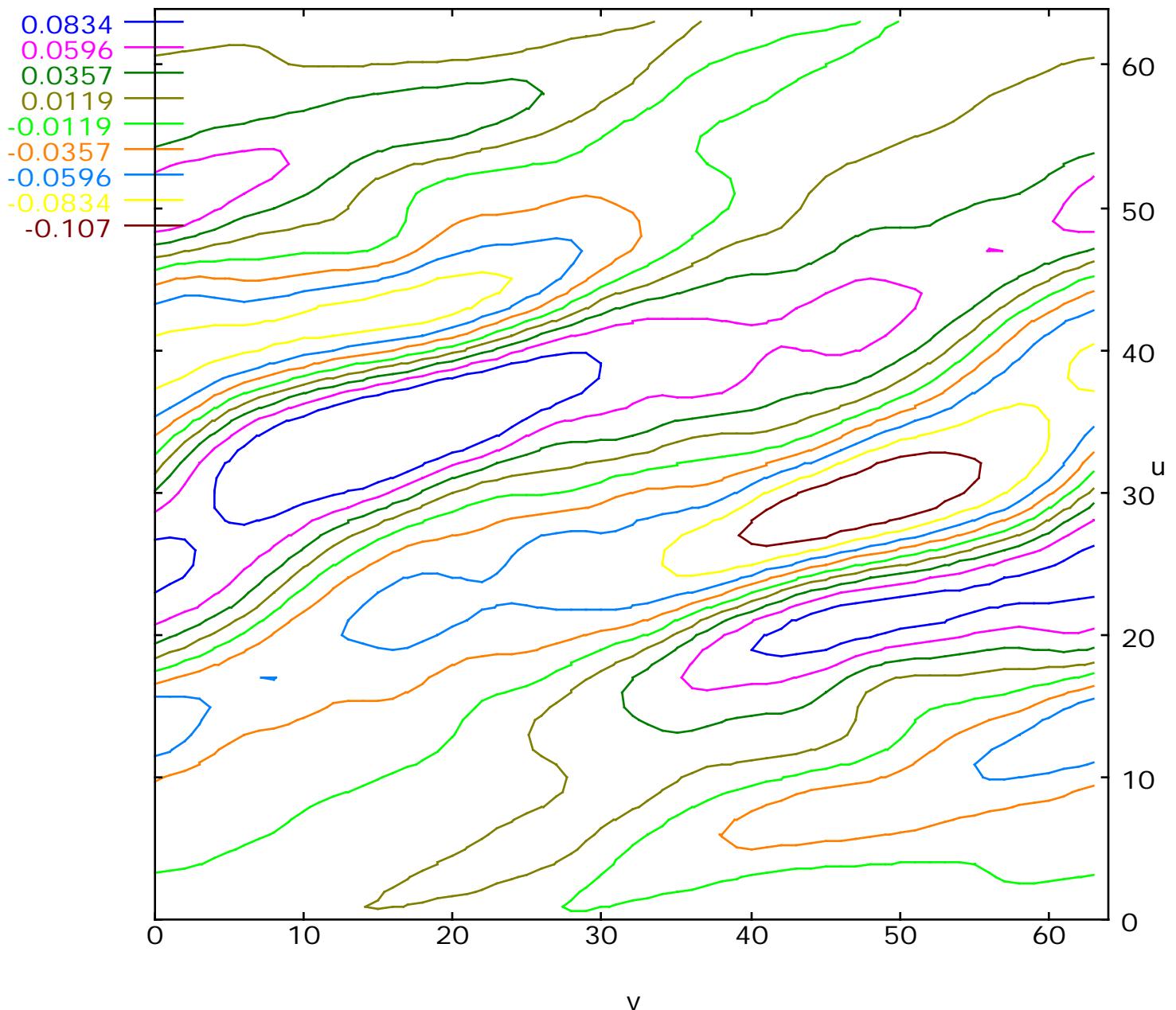
Mf,nf	Nsvd	$\langle \text{Berr} \rangle$	MaxBerr	Jmax	Complex	Comments
10,10	STD	0.11	1.65	0.88	2.96	C10 with old surface
10,10	STD	0.22	1.758	1.170	3.242	C82 New surf, no SVD
10,10	194	0.22	1.689	0.9356	3.139	Good. Better than STD
10,10	185	0.26	1.999	0.9240	3.244	Better than Case 2?
10,10 J	201	0.28	2.087	0.9116	3.210	Targeting J, a bit better?
8,8	121	0.60	6.714	0.8316	3.119	Great, but Berr too high?
20,20	286	0.22	2.643	1.384	3.942	Can't beat 10x10. Why?
32,32	300	0.19	2.429	1.346	4.535	No better. Why?

121 reconstructs well, has good transport, good current contours, low Jmax,  
 but is unstable at =? Can vertical field coils correct this?

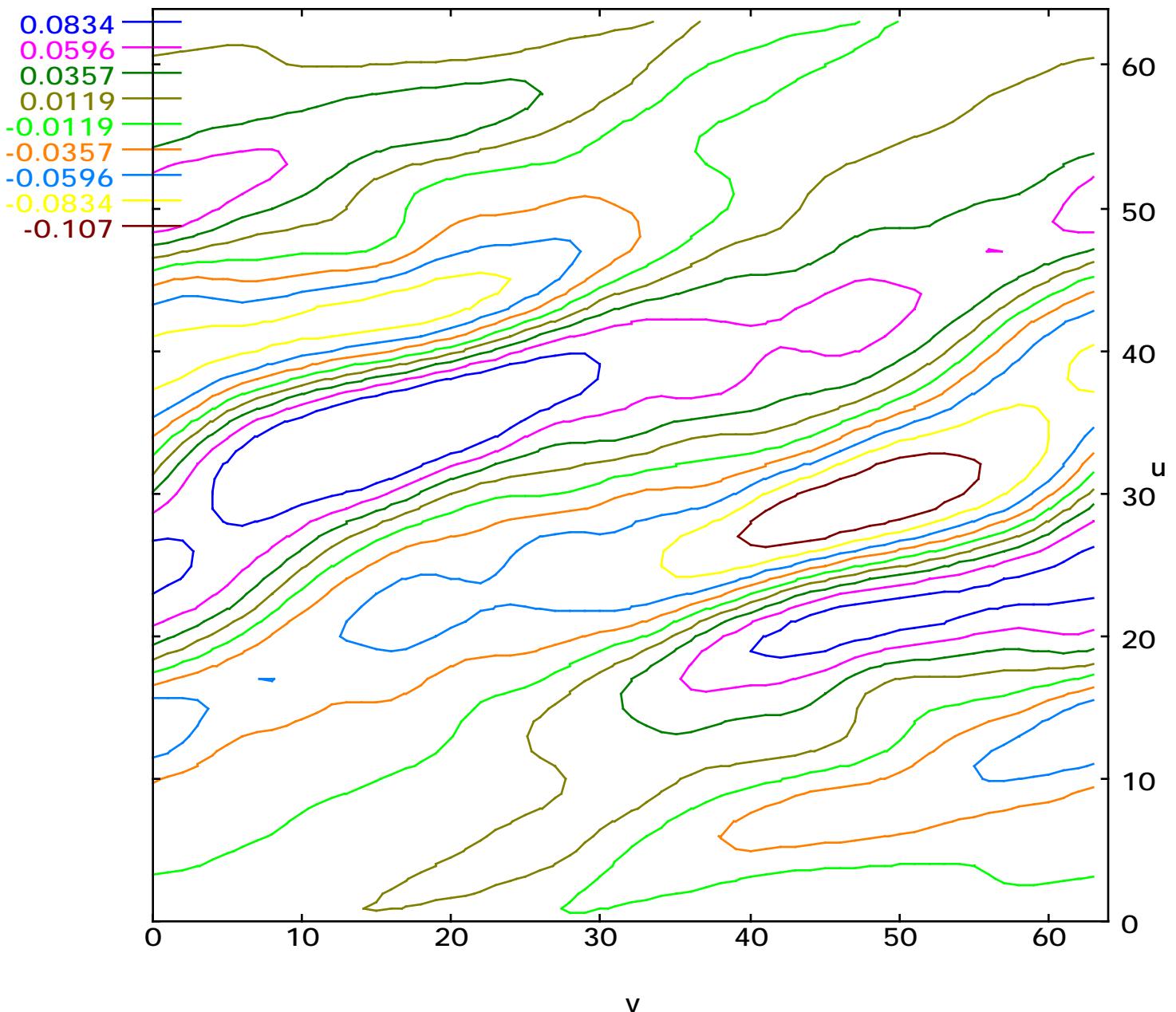
Offset scan c82.f8.121.64  
 Jcoil is minimized at 21 cm  
 It is 22% smaller than at 18 cm



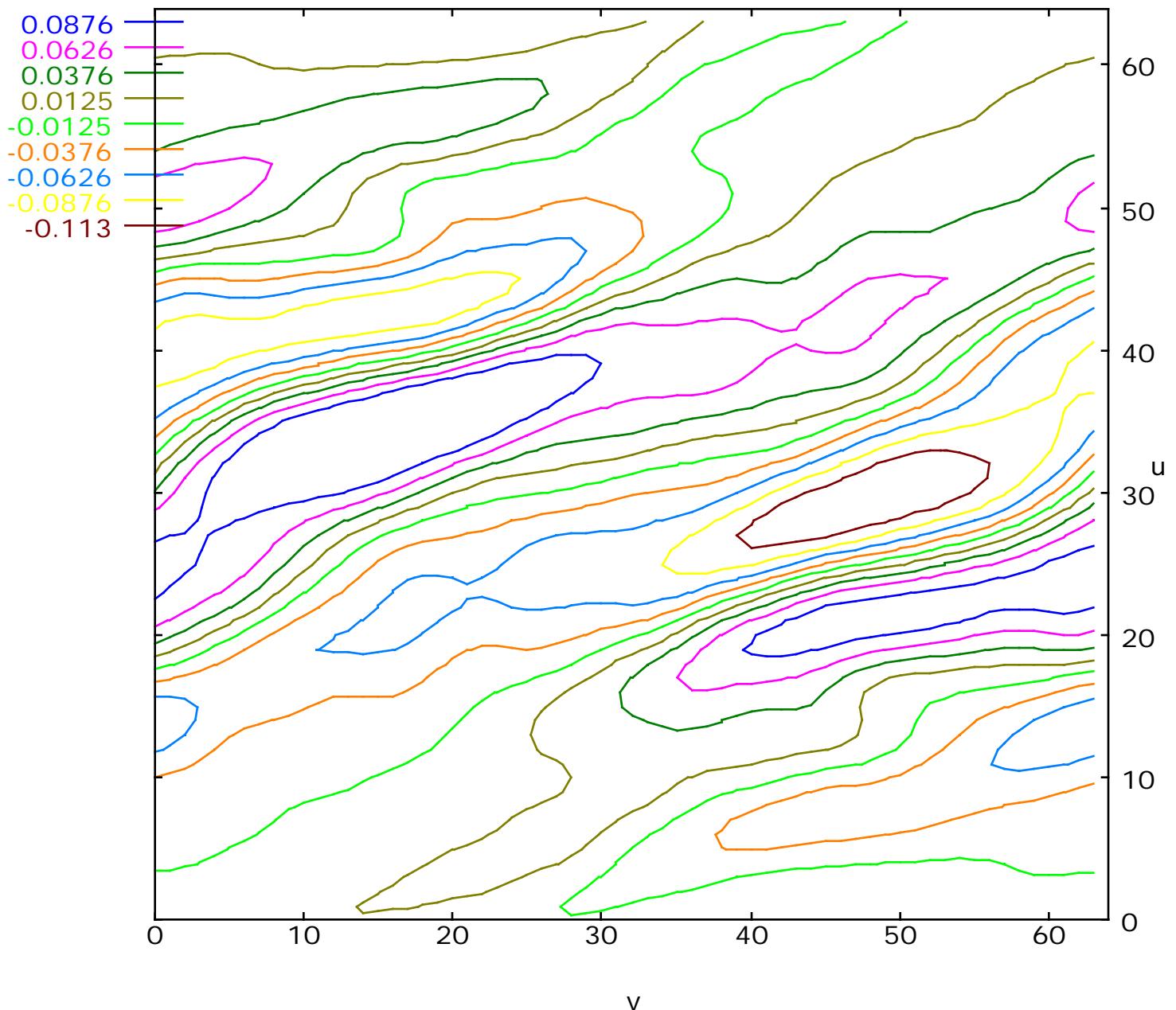
c82.f88.d15.4 with nsvd = 120



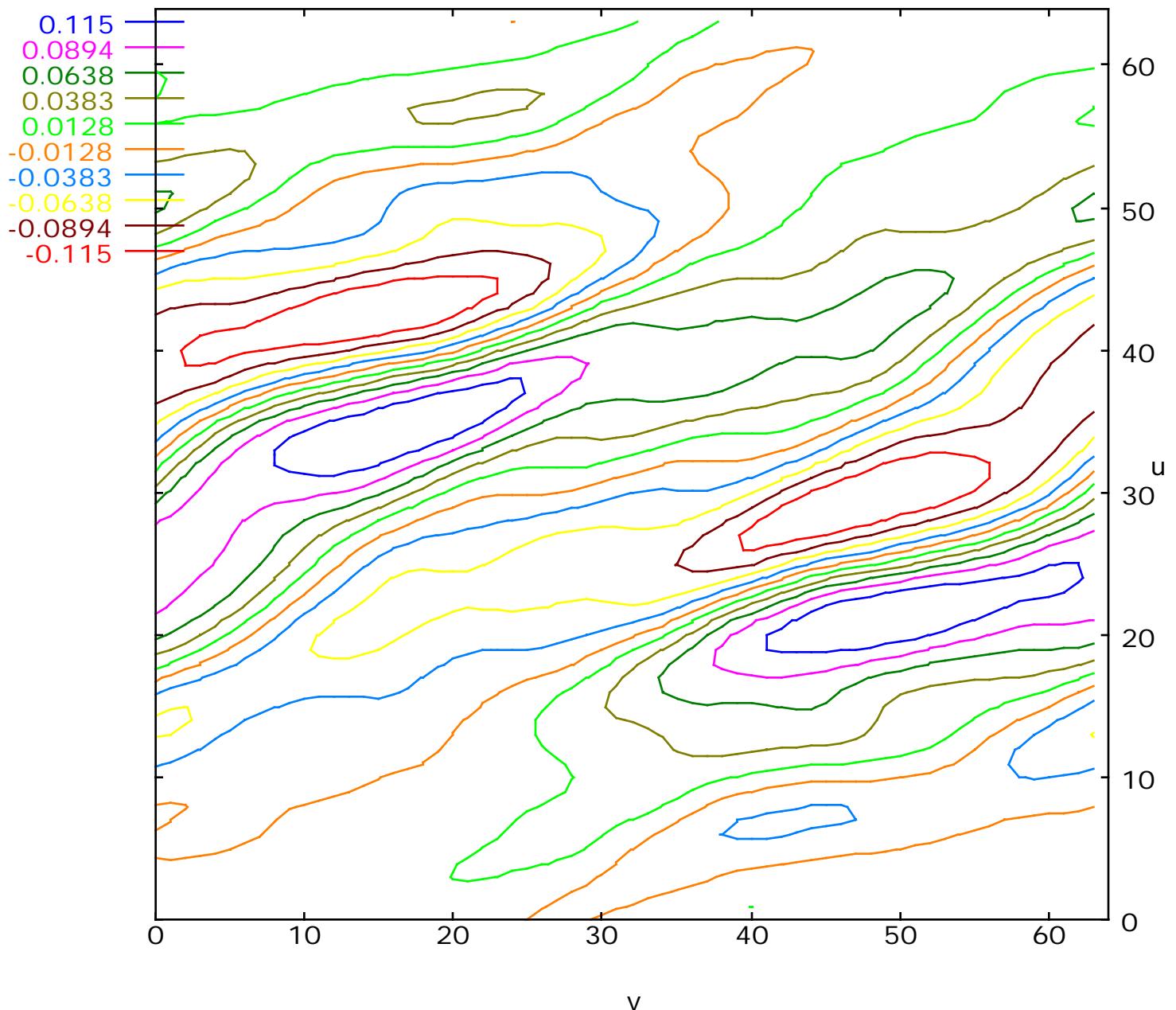
c82.f88.d15.4 with nsvd = 120



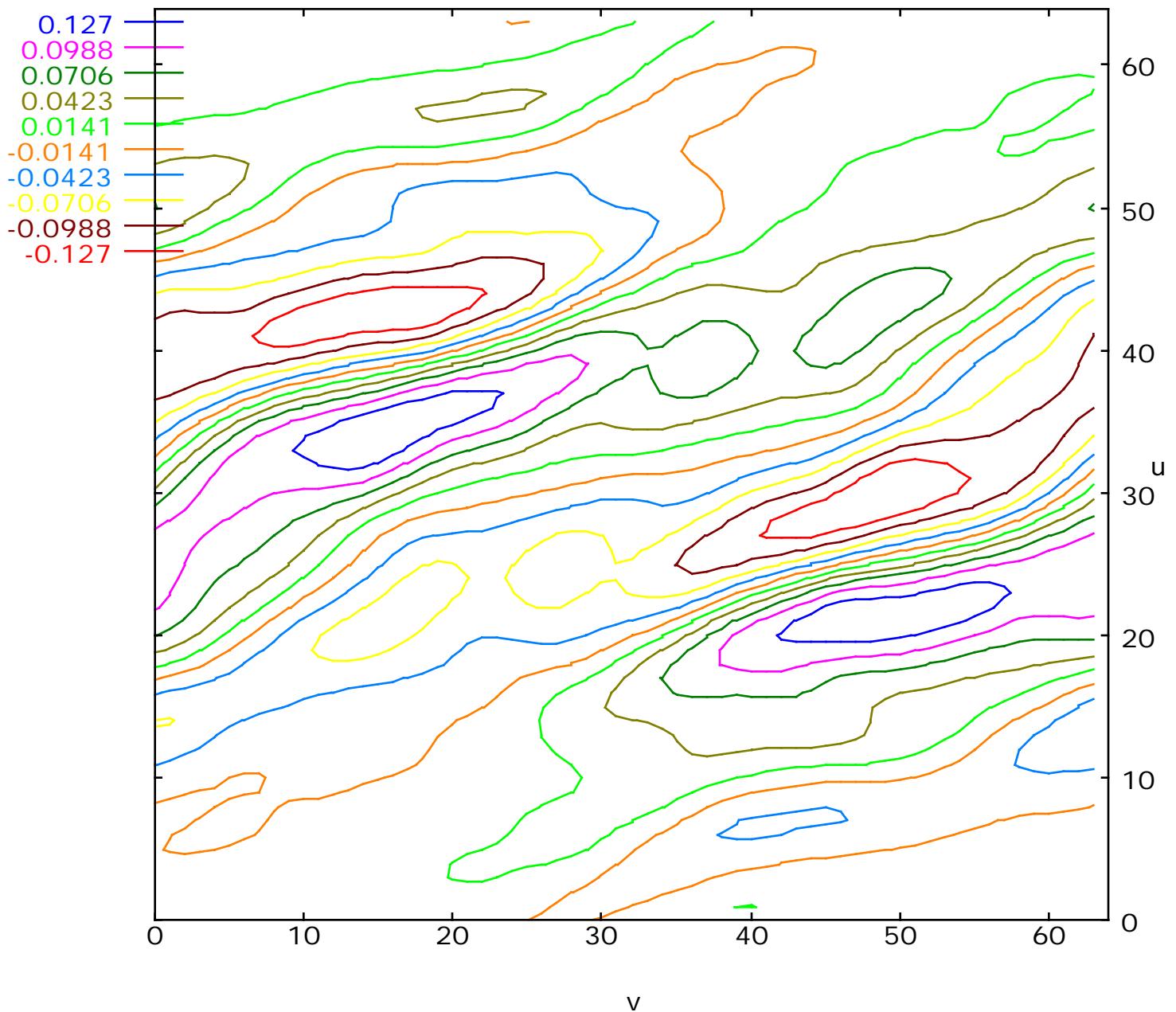
c82.f88.d16.5 with nsvd = 121



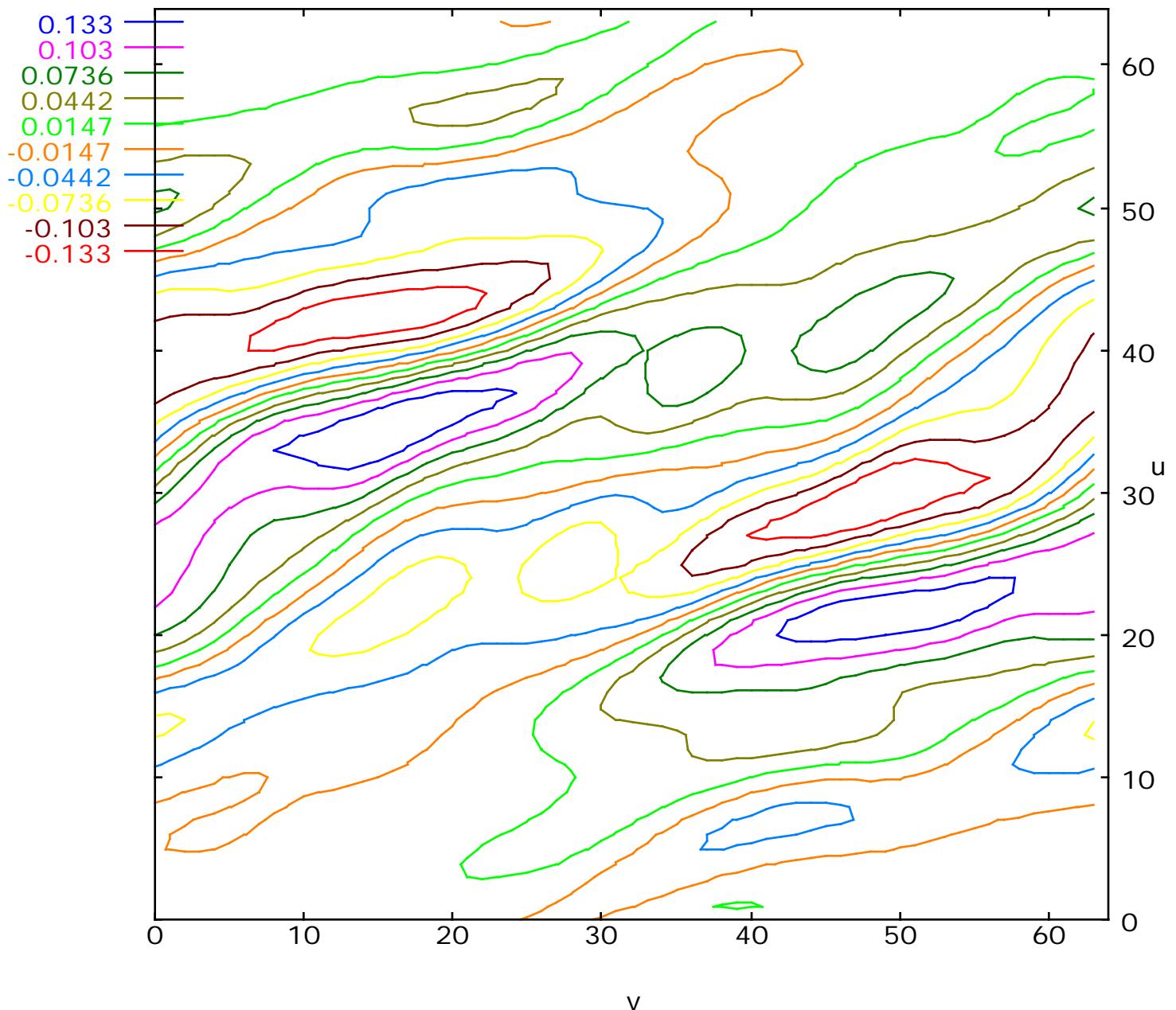
c82.f88.d17.6 with nsvd = 122



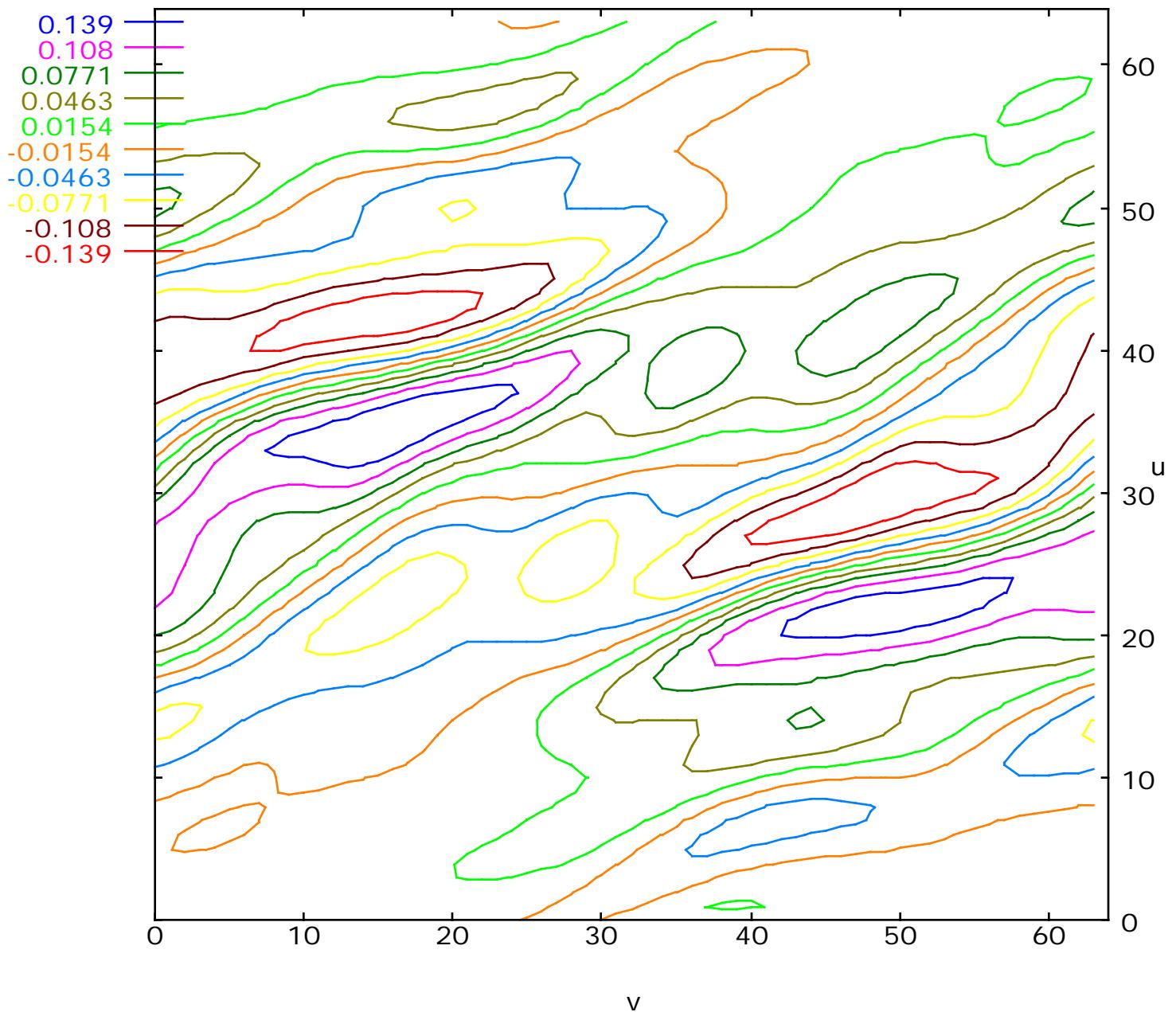
c82.f88.d18.3 with nsvd = 121



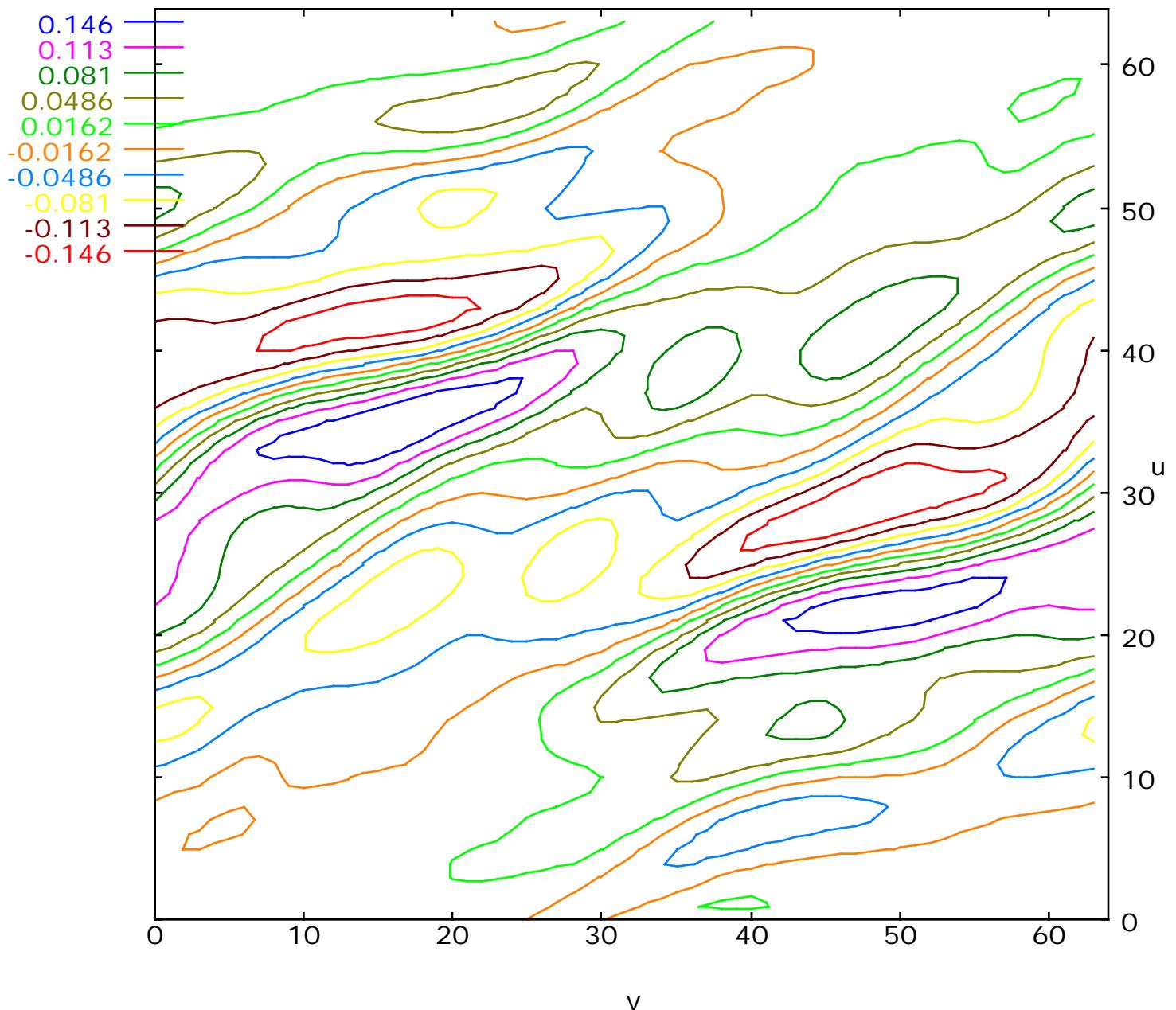
c82.f88.d19.7 with nsvd = 120



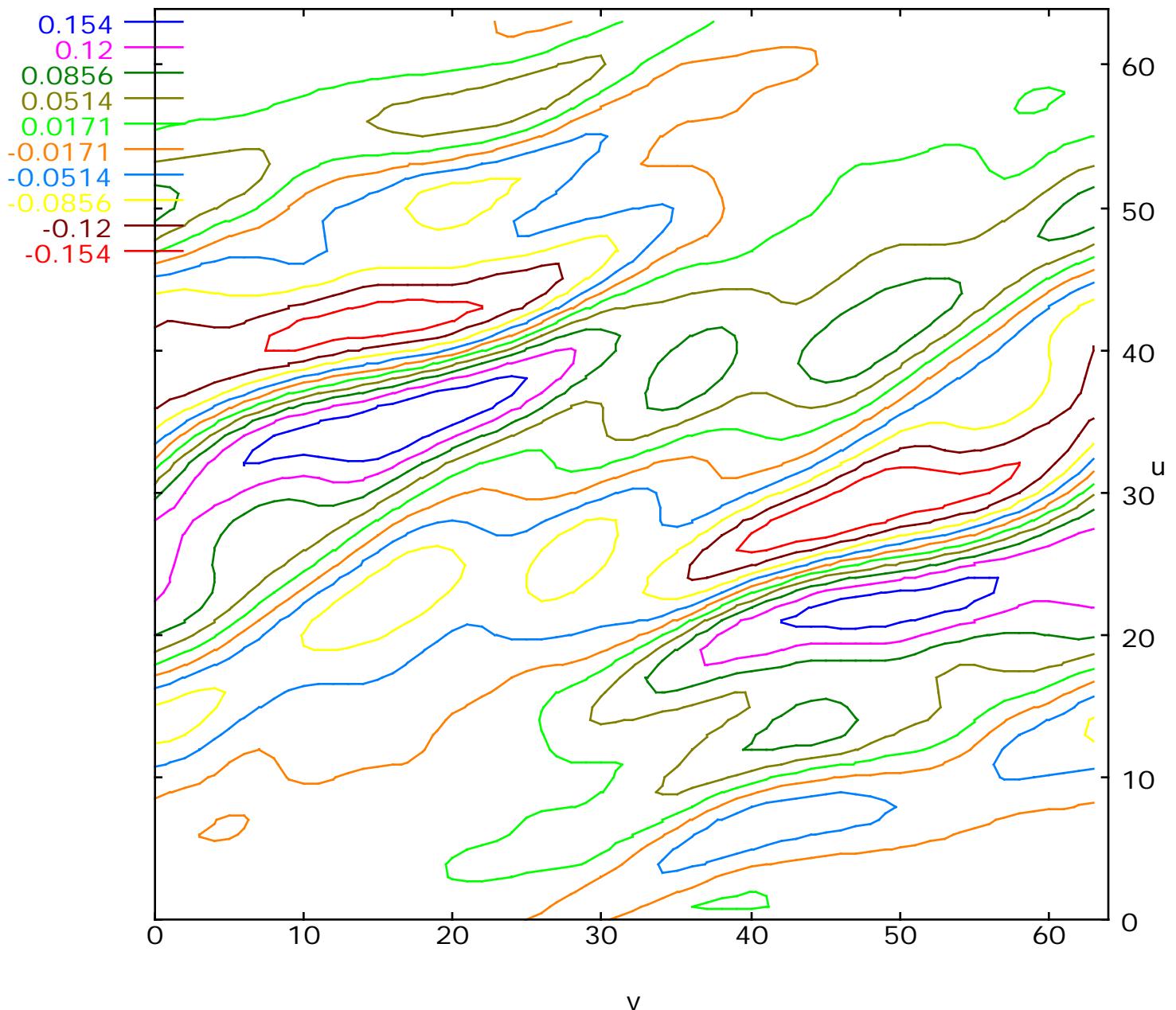
c82.f88.d20.8 with nsvd = 119



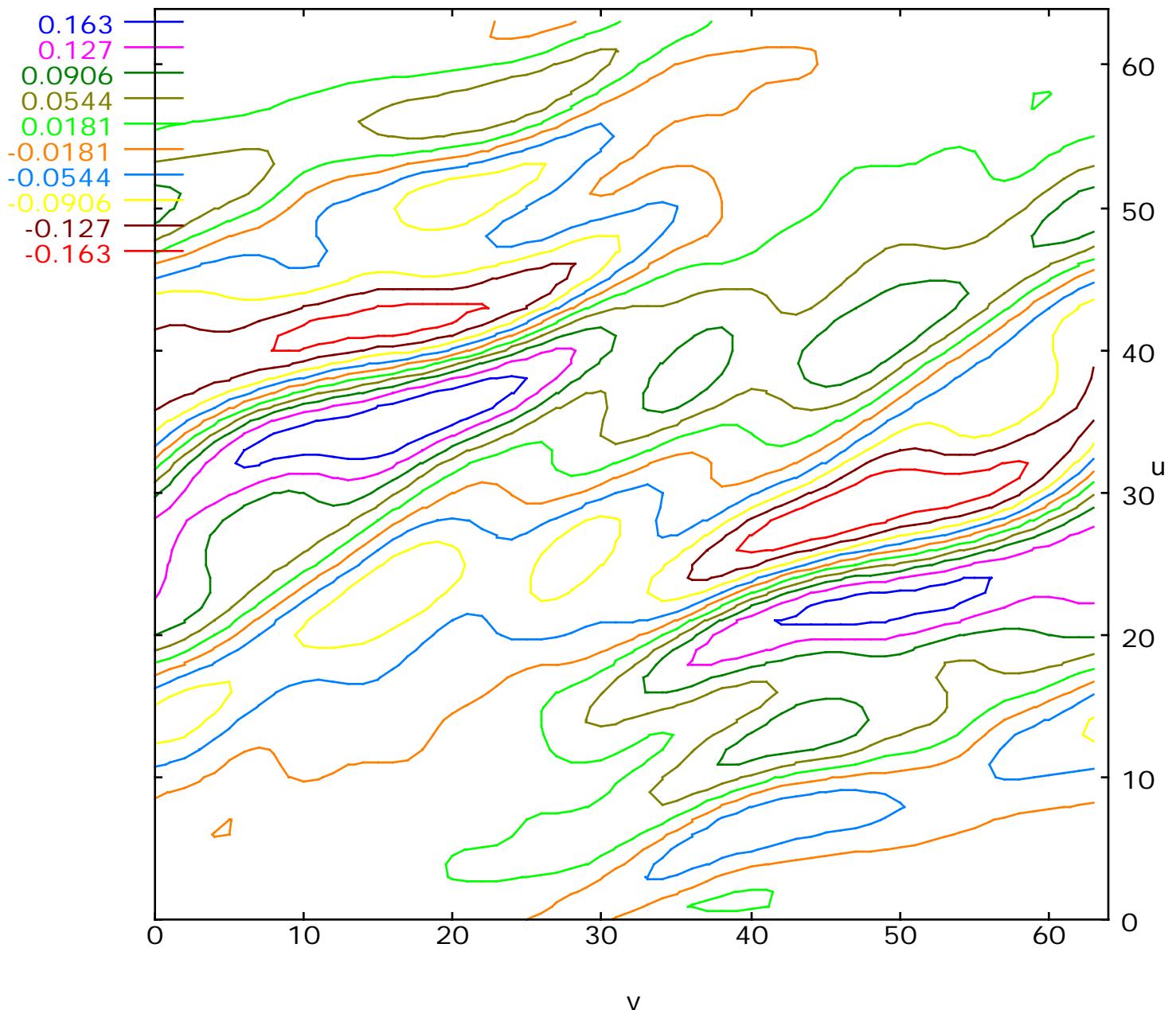
c82.f88.d21.9 with nsvd = 119



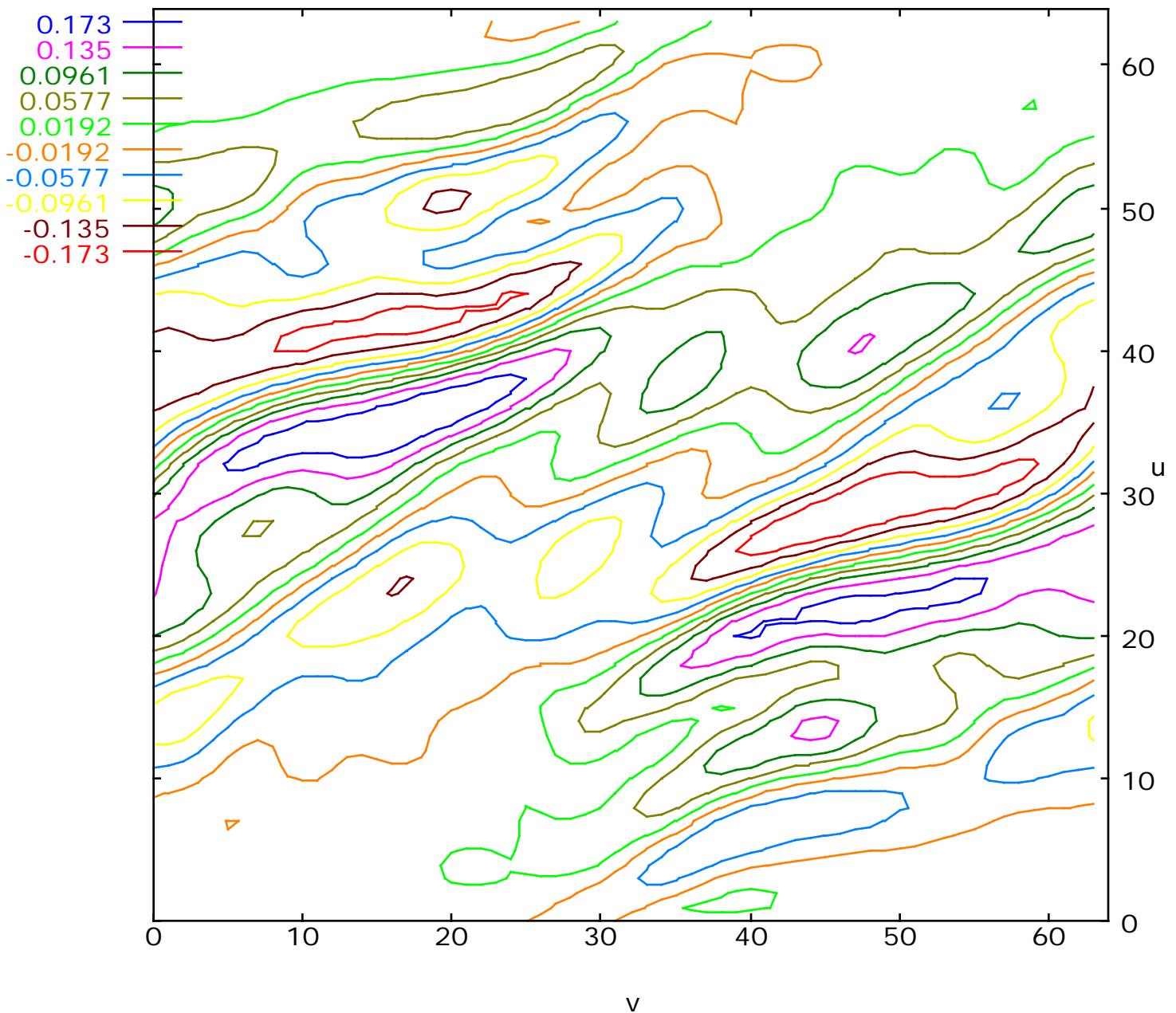
c82.f88.d22.10 with nsvd = 119



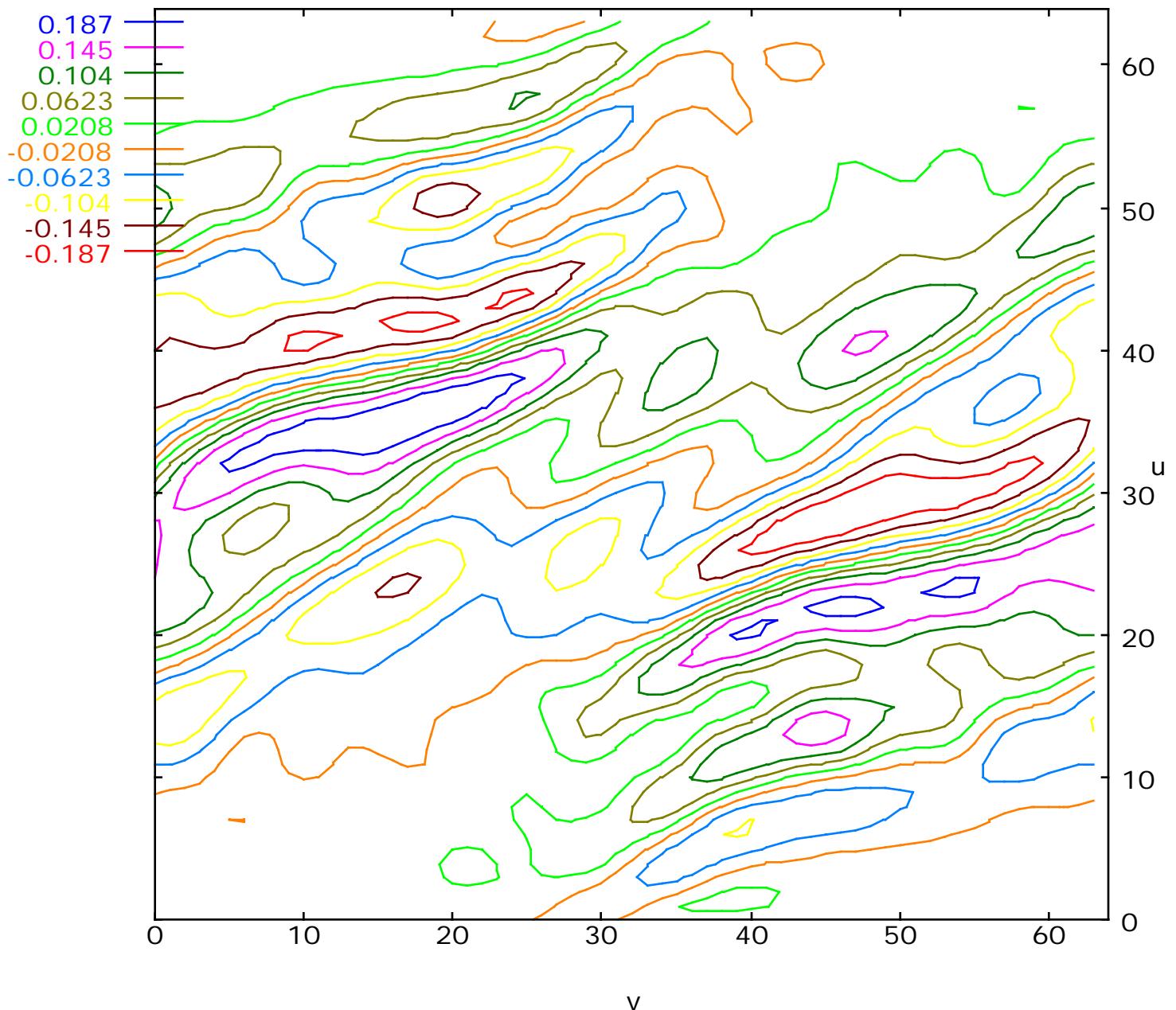
c82.f88.d23.11 with nsvd = 119



c82.f88.d24.12 with nsvd = 118



c82.f88.d25.13 with nsvd = 118



# Summary of offset scan results

All 3 (121,185,194) roots are robust in offset scan & efield scan

There are local minima in Jmax near the same three svd numbers at each offset

Each minimum shows expected offset-variation of Jmax,  $\langle M \rangle$ , Berr, etc

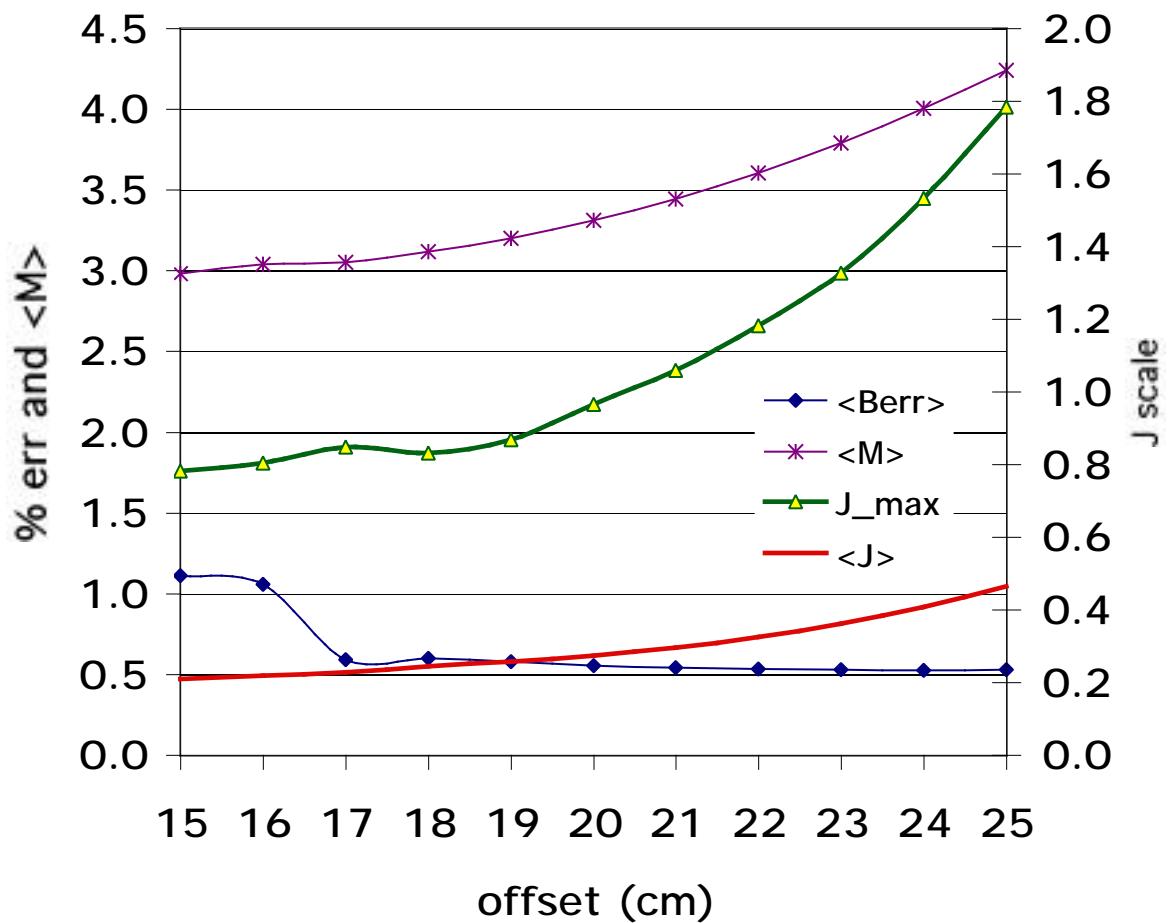
Surface current contours vary smoothly from 15 to 25 cm – no sharp changes

**“Sweet spot” in  $J_{coil\_max}$  at 21 cm**

Initial estimates of C82  $J_{coil}$  (*not surface*) current density using simple scaling from  $J_{surf}$  based on offset and 14.5 cm constraint shows that  $J_{coil\_max}$  can be further reduced by upto 22% below its value at 18 cm

c82.f88 with new surfaces, 121 branch pmv, Apr 27,99									14.5
dp	svd	<Berr>	B_max	J_max	<J>	<M>	Jc1	Jc2	%
15	120	1.11	21.78	0.78	0.21	2.98	1.565	1.619	138.3
16	121	1.06	21.97	0.80	0.22	3.04	0.536	0.591	66.9
17	122	0.59	7.77	0.85	0.23	3.05	0.339	0.398	29.6
18	121	0.60	6.71	0.83	0.24	3.12	0.238	0.295	0.0
19	120	0.58	5.95	0.87	0.26	3.20	0.193	0.253	-15.5
20	119	0.55	5.07	0.97	0.27	3.31	0.176	0.242	-19.7
21	119	0.54	4.29	1.06	0.30	3.44	0.163	0.236	-22.2
22	119	0.53	3.73	1.18	0.32	3.60	0.158	0.239	-20.9
23	119	0.53	3.38	1.33	0.36	3.79	0.156	0.247	-17.5
24	118	0.53	3.34	1.53	0.41	4.00	0.161	0.267	-10.0
25	118	0.53	3.30	1.78	0.46	4.24	0.170	0.293	-0.7

### c82.f8 scan nsvd~120, nu=nv=64

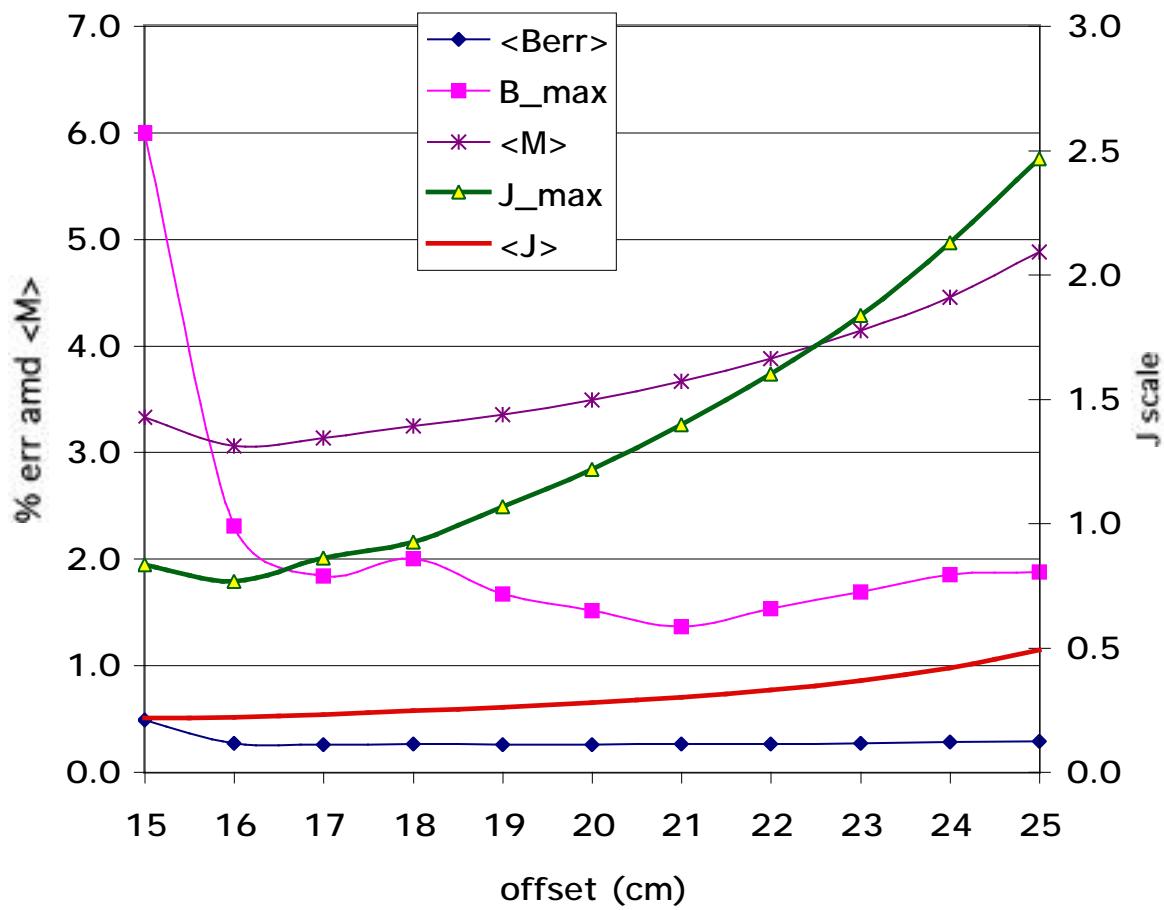


c82.f1010 with new surfaces, 185 branch pmv, Apr 27, 99

14.5

dp	svd	$\langle \text{Berr} \rangle$	B_max	J_max	$\langle J \rangle$	$\langle M \rangle$	Jc1	Jc2	%
15	183	0.4876	5.9940	0.8334	0.2182	3.3290	1.667	1.724	136.1
16	189	0.2693	2.3070	0.7663	0.2200	3.0620	0.511	0.564	52.9
17	189	0.2576	1.8390	0.8619	0.2305	3.1350	0.345	0.404	20.9
18	185	0.2624	1.9990	0.9240	0.2456	3.2440	0.264	0.328	0.0
19	183	0.2583	1.6720	1.0660	0.2600	3.3550	0.237	0.310	-5.4
20	184	0.2578	1.5110	1.2180	0.2780	3.4920	0.221	0.305	-7.0
21	184	0.2603	1.3630	1.3980	0.3009	3.6660	0.215	0.311	-5.1
22	184	0.2649	1.5330	1.6010	0.3302	3.8810	0.213	0.324	-1.2
23	184	0.2712	1.6880	1.8370	0.3679	4.1430	0.216	0.343	4.5
24	184	0.2785	1.8520	2.1280	0.4180	4.4570	0.224	0.371	12.3
25	185	0.2872	1.8780	2.4670	0.4897	4.8790	0.235	0.405	21.1

### c82.f10 scan nsvd~185, nu=nv=64



c82.f1010 with new surfaces, 195 branch pmv, Apr 27, 99

14.5

dp	svd	$\langle \text{Berr} \rangle$	B_max	J_max	$\langle J \rangle$	$\langle M \rangle$	Jc1	Jc2	%
15	195	0.2327	1.858	0.7234	0.2065	2.923	1.447	1.497	127.4
16	196	0.2191	1.64	0.7552	0.2141	2.971	0.503	0.556	50.4
17	194	0.221	1.565	0.8257	0.2251	3.047	0.330	0.387	15.4
18	194	0.2238	1.689	0.9356	0.2369	3.139	0.267	0.332	0.0
19	194	0.23	1.703	1.076	0.252	3.257	0.239	0.313	-5.7
20	196	0.2371	1.685	1.234	0.2716	3.407	0.224	0.309	-7.0
21	196	0.2456	1.579	1.419	0.2998	3.607	0.218	0.316	-4.8
22	196	0.2541	1.624	1.658	0.333	3.856	0.221	0.335	1.1
23	196	0.2628	1.676	1.945	0.3757	4.165	0.229	0.363	9.0
24	196	0.2718	1.716	2.317	0.432	4.542	0.244	0.404	19.5
25	195	0.2807	1.751	2.759	0.5077	4.986	0.263	0.453	30.9

### c82.f10 scan nsvd~196, nu=nv=64

