



# Full wwPDB X-ray Structure Validation Report

Aug 7, 2014 – 11:16 PM EDT

PDB ID : 4ABT  
Title : Crystal structure of Type IIF restriction endonuclease NgoMIV with cognate uncleaved DNA  
Authors : Manakova, E.N.; Grazulis, S.; Zaremba, M.; Tamulaitiene, G.; Golovenko, D.; Siksnyys, V.  
Deposited on : 2011-12-11  
Resolution : 2.22 Å(reported)

This is a full wwPDB validation report for a publicly released PDB entry.  
We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)  
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

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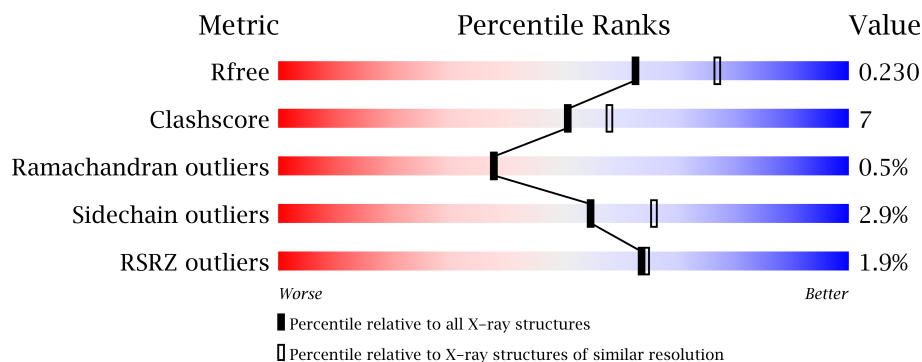
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.16 November 2013  
Xtriage (Phenix) : dev-1439  
EDS : stable23489  
Percentile statistics : 21963  
Refmac : 5.8.0049  
CCP4 : 6.3.0 (Settle)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable23489

# 1 Overall quality at a glance

The reported resolution of this entry is 2.22 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	66092	3340 (2.24-2.20)
Clashscore	79885	4208 (2.24-2.20)
Ramachandran outliers	78287	4135 (2.24-2.20)
Sidechain outliers	78261	4136 (2.24-2.20)
RSRZ outliers	66119	3341 (2.24-2.20)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	286	
1	B	286	
2	E	11	
2	G	11	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
3	CA	E	1000	-	X

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5188 atoms, of which 0 are hydrogen and 0 are deuterium.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called TYPE-2 RESTRICTION ENZYME NGOMIV.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	286	Total	C	N	O	S	118	2	0
			2249	1405	406	432	6			
1	B	286	Total	C	N	O	S	106	1	0
			2246	1404	407	429	6			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	EXPRESSION TAG	UNP P31032
A	2	GLN	-	EXPRESSION TAG	UNP P31032
B	1	MET	-	EXPRESSION TAG	UNP P31032
B	2	GLN	-	EXPRESSION TAG	UNP P31032

- Molecule 2 is a DNA chain called 5'-D(\*TP\*GP\*CP\*GP\*CP\*CP\*GP\*GP\*CP\*GP\*CP)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	E	11	Total	C	N	O	P	0	0	0
			222	105	42	65	10			
2	G	11	Total	C	N	O	P	0	0	0
			222	105	42	65	10			

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total	Ca	0	0
			1	1		
3	A	1	Total	Ca	0	0
			1	1		
3	E	1	Total	Ca	0	0
			1	1		

- Molecule 4 is water.

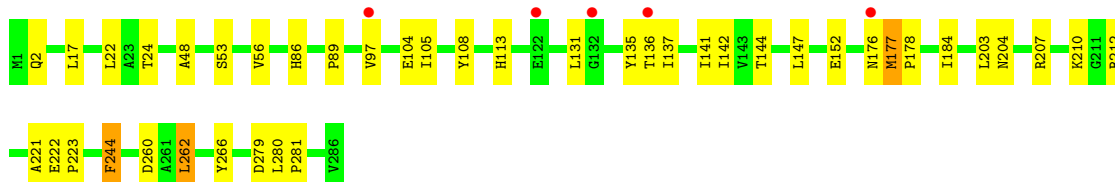
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	122	Total 122	O 122	0	0
4	B	91	Total 91	O 91	0	0
4	E	14	Total 14	O 14	0	0
4	G	19	Total 19	O 19	0	0

### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

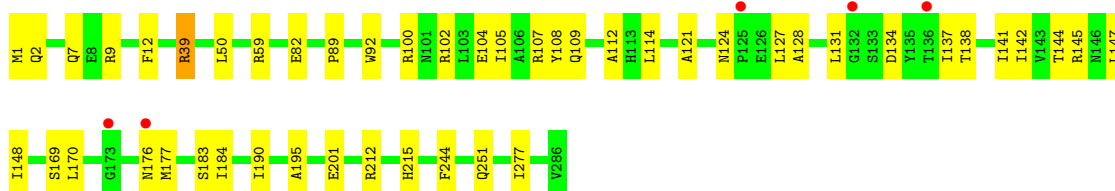
#### • Molecule 1: TYPE-2 RESTRICTION ENZYME NGOMIV

Chain A: 



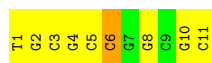
#### • Molecule 1: TYPE-2 RESTRICTION ENZYME NGOMIV

Chain B: 



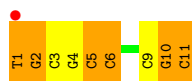
#### • Molecule 2: 5'-D(\*TP\*GP\*CP\*GP\*CP\*CP\*GP\*GP\*CP\*GP\*CP)-3'

Chain E: 



#### • Molecule 2: 5'-D(\*TP\*GP\*CP\*GP\*CP\*CP\*GP\*GP\*CP\*GP\*CP)-3'

Chain G: 



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	68.90Å 90.08Å 92.71Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	11.95 – 2.22 11.95 – 2.22	Depositor EDS
% Data completeness (in resolution range)	99.0 (11.95-2.22) 98.9 (11.95-2.22)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.71 (at 2.21Å)	Xtriage
Refinement program	REFMAC 5.5.0070	Depositor
R, $R_{free}$	0.180 , 0.235 0.177 , 0.230	Depositor DCC
$R_{free}$ test set	2859 reflections (11.00%)	DCC
Wilson B-factor (Å <sup>2</sup> )	25.5	Xtriage
Anisotropy	0.235	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.39 , 22.0	EDS
Estimated twinning fraction	0.015 for -h,l,k	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 28840 reflections	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	5188	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	21.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.79% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

## 5 Model quality i

### 5.1 Standard geometry i

Bond lengths and bond angles in the following residue types are not validated in this section: CA

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z  > 5$	RMSZ	$\# Z  > 5$
1	A	0.87	1/2289 (0.0%)	0.82	1/3102 (0.0%)
1	B	0.89	0/2286	0.85	2/3097 (0.1%)
2	E	1.47	1/248 (0.4%)	2.13	10/381 (2.6%)
2	G	1.73	1/248 (0.4%)	2.21	12/381 (3.1%)
All	All	0.98	3/5071 (0.1%)	1.07	25/6961 (0.4%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	E	11	DC	C3'-O3'	-6.07	1.36	1.44
1	A	152	GLU	CG-CD	-5.91	1.43	1.51
2	G	2	DG	C2-N3	5.05	1.36	1.32

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	E	10	DG	O4'-C1'-N9	-11.66	99.84	108.00
2	E	4	DG	P-O3'-C3'	9.10	130.62	119.70
2	G	10	DG	O4'-C1'-N9	-8.95	101.74	108.00
2	E	1	DT	N3-C4-O4	8.19	124.81	119.90
1	B	59	ARG	NE-CZ-NH2	-8.03	116.28	120.30
2	E	2	DG	O4'-C1'-N9	-7.98	102.41	108.00
2	G	6	DC	P-O3'-C3'	7.87	129.14	119.70
2	G	2	DG	O4'-C1'-N9	7.66	113.36	108.00
2	G	2	DG	P-O3'-C3'	7.48	128.68	119.70
2	E	1	DT	C5-C4-O4	-7.39	119.73	124.90
2	G	1	DT	P-O3'-C3'	7.27	128.42	119.70
2	G	1	DT	N3-C2-O2	-7.22	117.97	122.30
2	G	5	DC	O4'-C4'-C3'	-6.67	101.83	104.50
2	G	4	DG	P-O3'-C3'	5.93	126.82	119.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	59	ARG	NE-CZ-NH1	5.89	123.25	120.30
2	E	3	DC	O4'-C1'-N1	-5.88	103.89	108.00
2	G	9	DC	C5-C4-N4	5.82	124.27	120.20
2	E	6	DC	P-O3'-C3'	5.67	126.51	119.70
2	G	2	DG	P-O5'-C5'	5.47	129.65	120.90
2	E	8	DG	C5-C6-O6	-5.17	125.50	128.60
2	G	11	DC	C4-C5-C6	5.15	119.97	117.40
2	E	10	DG	P-O3'-C3'	5.11	125.83	119.70
2	E	8	DG	O4'-C1'-N9	5.07	111.55	108.00
2	G	1	DT	N1-C2-O2	5.05	127.14	123.10
1	A	279	ASP	CB-CG-OD1	-5.02	113.78	118.30

There are no chirality outliers.

There are no planarity outliers.

## 5.2 Close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2249	0	2244	29	0
1	B	2246	0	2247	34	0
2	E	222	0	124	1	0
2	G	222	0	124	6	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	E	1	0	0	0	0
4	A	122	0	0	2	0
4	B	91	0	0	1	0
4	E	14	0	0	0	0
4	G	19	0	0	1	1
All	All	5188	0	4739	68	1

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 7.

All (68) close contacts within the same asymmetric unit are listed below.



Atom-1	Atom-2	Distance(Å)	Clash(Å)
2:G:1:DT:H1'	2:G:2:DG:H5'	1.33	1.09
1:B:105:ILE:HD13	1:B:137:ILE:HD12	1.40	1.00
1:B:105:ILE:CD1	1:B:137:ILE:HD12	1.96	0.95
1:A:105:ILE:HD13	1:A:137:ILE:HB	1.52	0.88
1:A:105:ILE:CD1	1:A:137:ILE:HB	2.06	0.86
2:G:1:DT:C1'	2:G:2:DG:H5'	2.05	0.84
2:G:1:DT:H1'	2:G:2:DG:C5'	2.15	0.76
1:B:105:ILE:HD13	1:B:137:ILE:CD1	2.16	0.74
1:B:137:ILE:HG23	1:B:201:GLU:HG3	1.72	0.71
1:A:147:LEU:HD11	1:A:177:MET:O	1.92	0.69
1:B:112:ALA:HB2	1:B:177:MET:CE	2.25	0.67
2:G:10:DG:H2''	2:G:11:DC:C6	2.31	0.65
1:B:109:GLN:HE22	1:B:169:SER:CB	2.13	0.60
1:A:113:HIS:CG	1:A:210:LYS:HE3	2.36	0.60
1:A:147:LEU:CD1	1:A:176:ASN:HB3	2.35	0.56
1:A:212:ARG:CZ	1:B:212:ARG:HD3	2.36	0.56
1:B:39:ARG:HH11	1:B:39:ARG:HB3	1.72	0.55
1:B:39:ARG:HH11	1:B:39:ARG:CB	2.20	0.55
1:A:89:PRO:HD2	1:B:89:PRO:HD2	1.89	0.55
1:A:177:MET:HB2	1:A:178:PRO:CD	2.38	0.54
1:A:108:TYR:CE1	1:A:144:THR:HG21	2.43	0.54
1:B:104:GLU:O	1:B:107:ARG:HB2	2.07	0.53
1:B:112:ALA:HB2	1:B:177:MET:HE2	1.90	0.52
1:A:141:ILE:HB	1:A:184:ILE:HB	1.92	0.51
1:A:17:LEU:HD21	1:A:22:LEU:HD23	1.92	0.51
1:B:147:LEU:CD1	1:B:176:ASN:HB3	2.41	0.51
1:B:142:ILE:HD12	1:B:144:THR:CG2	2.40	0.51
1:B:215:HIS:HD2	4:B:2082:HOH:O	1.93	0.51
1:B:39:ARG:HH11	1:B:39:ARG:CG	2.23	0.51
1:B:112:ALA:HB2	1:B:177:MET:HE1	1.90	0.51
1:A:262:LEU:HD22	1:A:266:TYR:CE2	2.46	0.51
1:A:97:VAL:HG13	1:A:104:GLU:HG2	1.93	0.51
1:A:86:HIS:H	1:A:86:HIS:CD2	2.28	0.50
1:A:105:ILE:CD1	1:A:137:ILE:HD12	2.41	0.50
1:B:142:ILE:HD12	1:B:144:THR:HG23	1.94	0.49
2:G:3:DC:P	4:G:2009:HOH:O	2.71	0.49
1:B:9:ARG:O	1:B:12:PHE:HB3	2.12	0.48
1:A:280:LEU:HB3	1:A:281:PRO:HD3	1.95	0.48
1:B:190:ILE:HG23	1:B:195:ALA:HB2	1.94	0.47
1:A:203:LEU:HG	1:A:207:ARG:HD2	1.95	0.47
1:B:105:ILE:HD13	1:B:137:ILE:HB	1.97	0.47
1:A:48:ALA:HB1	1:A:53:SER:HB3	1.97	0.47
1:A:2:GLN:NE2	4:A:2001:HOH:O	2.47	0.47

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:92:TRP:CZ3	1:B:145:ARG:HB2	2.51	0.46
1:B:108:TYR:CE1	1:B:144:THR:HG21	2.51	0.46
1:B:124:ASN:HB3	1:B:127:LEU:HB3	1.98	0.46
1:B:141:ILE:HB	1:B:184:ILE:HB	1.98	0.45
1:A:222:GLU:CD	1:A:223:PRO:HD2	2.38	0.44
1:B:105:ILE:HD11	1:B:114:LEU:HD12	1.99	0.44
1:B:121:ALA:O	1:B:128:ALA:HB2	2.17	0.44
1:A:221:ALA:HA	1:A:244:PHE:CD1	2.53	0.44
1:A:177:MET:HE3	1:A:177:MET:HB3	1.87	0.43
1:B:2:GLN:HB3	1:B:7:GLN:HG3	1.99	0.43
1:A:97:VAL:CG1	1:A:104:GLU:HG2	2.48	0.43
1:A:137:ILE:HD11	1:A:204:ASN:HB3	2.01	0.43
1:A:24:THR:O	1:A:56:VAL:HA	2.18	0.42
1:A:177:MET:HB2	1:A:178:PRO:HD2	2.01	0.42
1:B:82:GLU:O	1:B:82:GLU:HG2	2.20	0.42
4:A:2096:HOH:O	1:B:215:HIS:HE1	2.02	0.41
2:G:5:DC:H2'	2:G:6:DC:C6	2.54	0.41
1:A:17:LEU:HD22	1:A:53:SER:HB2	2.01	0.41
1:B:183:SER:OG	1:B:201:GLU:OE2	2.33	0.41
1:B:112:ALA:CB	1:B:177:MET:HE1	2.50	0.41
1:B:148:ILE:HG12	1:B:170:LEU:HB3	2.03	0.41
1:A:142:ILE:HD12	1:A:144:THR:CG2	2.51	0.41
1:A:105:ILE:HD11	1:A:137:ILE:HB	1.95	0.41
2:E:5:DC:C4	2:E:6:DC:N4	2.89	0.41
1:B:50:LEU:HA	1:B:50:LEU:HD23	1.96	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
4:G:2006:HOH:O	4:G:2007:HOH:O[2_675]	2.12	0.08

## 5.3 Torsion angles

### 5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	286/286 (100%)	274 (96%)	11 (4%)	1 (0%)	50	53
1	B	285/286 (100%)	279 (98%)	4 (1%)	2 (1%)	30	28
All	All	571/572 (100%)	553 (97%)	15 (3%)	3 (0%)	38	38

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	135	TYR
1	B	134	ASP
1	B	102	ARG

### 5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution. The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	243/241 (101%)	237 (98%)	6 (2%)	60	71
1	B	242/241 (100%)	234 (97%)	8 (3%)	50	60
All	All	485/482 (101%)	471 (97%)	14 (3%)	55	66

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	131	LEU
1	A	136	THR
1	A	177	MET
1	A	244	PHE
1	A	260	ASP
1	A	262	LEU
1	B	1	MET
1	B	39	ARG
1	B	100	ARG
1	B	131	LEU
1	B	138	THR
1	B	244	PHE
1	B	251	GLN
1	B	277	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	67	ASN
1	A	85	GLN
1	A	86	HIS
1	A	109	GLN
1	A	146	ASN
1	A	156	ASN
1	A	251	GLN
1	B	7	GLN
1	B	20	ASN
1	B	109	GLN
1	B	146	ASN
1	B	215	HIS
1	B	270	ASN

### 5.3.3 RNA ⓘ

There are no RNA chains in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

Of 3 ligands modelled in this entry, 3 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 5.7 Other polymers ⓘ

There are no such residues in this entry.

## 5.8 Polymer linkage issues

There are no chain breaks in this entry.

## 6 Fit of model and data ⓘ

### 6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	274/286 (95%)	-0.57	5 (1%) 65 66	10, 18, 38, 52	9 (3%)
1	B	277/286 (96%)	-0.55	5 (1%) 65 66	8, 17, 44, 53	10 (3%)
2	E	11/11 (100%)	-0.91	0 100 100	11, 16, 31, 39	0
2	G	11/11 (100%)	-0.30	1 (9%) 9 9	11, 16, 43, 76	0
All	All	573/594 (96%)	-0.56	11 (1%) 64 64	8, 18, 41, 76	19 (3%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	136	THR	3.9
1	A	176	ASN	3.4
1	A	97	VAL	2.9
1	B	136	THR	2.9
1	B	173	GLY	2.9
1	B	132	GLY	2.8
1	B	176	ASN	2.8
1	A	122	GLU	2.2
1	A	132	GLY	2.2
2	G	1	DT	2.1
1	B	125	PRO	2.1

### 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

### 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 6.4 Ligands

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSR	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
3	CA	E	1000	1/1	0.10	4.22	30,30,30,30	1
3	CA	A	1287	1/1	0.08	1.23	28,28,28,28	0
3	CA	B	1287	1/1	0.03	-3.11	14,14,14,14	0

## 6.5 Other polymers

There are no such residues in this entry.