wwPDB X-ray Structure Validation Summary Report (i)

Jun 14, 2016 – 11:17 AM EDT

PDB ID	:	5C37
Title	:	Structure of the beta-ketoacyl reductase domain of human fatty acid synthase bound to a spiro-imidazolone inhibitor
Authors	:	Schubert, C.; Milligan, C.M.; Vo, K.; Grasberger, B.
Deposited on	:	2015-06-17
Resolution	:	2.30 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at
http://wwpdb.org/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

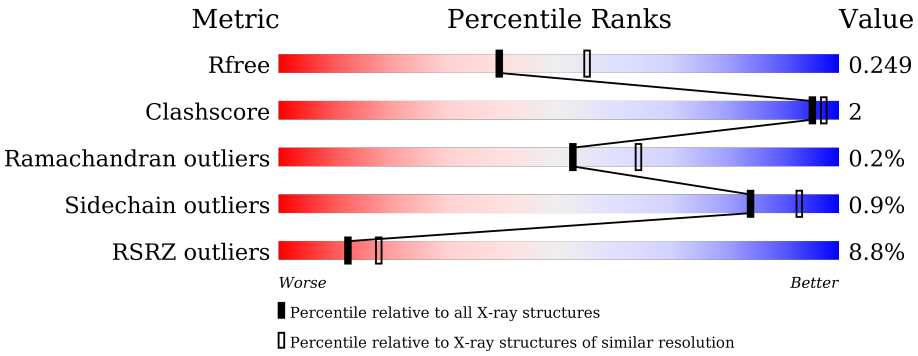
MolProbity	:	4.02b-467
Mogul	:	1.7.1 (RC1), CSD as537be (2016)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20027790
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	rb-20027790

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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}	91344	3852 (2.30-2.30)
Clashscore	102246	4452 (2.30-2.30)
Ramachandran outliers	100387	4410 (2.30-2.30)
Sidechain outliers	100360	4409 (2.30-2.30)
RSRZ outliers	91569	3857 (2.30-2.30)

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 >=3, 2, 1 and 0 types of geometric quality criteria. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	664	8% 91% · 5%
1	C	664	9% 89% 5% 6%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 19001 atoms, of which 9299 are hydrogens and 0 are deuteriums.

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.

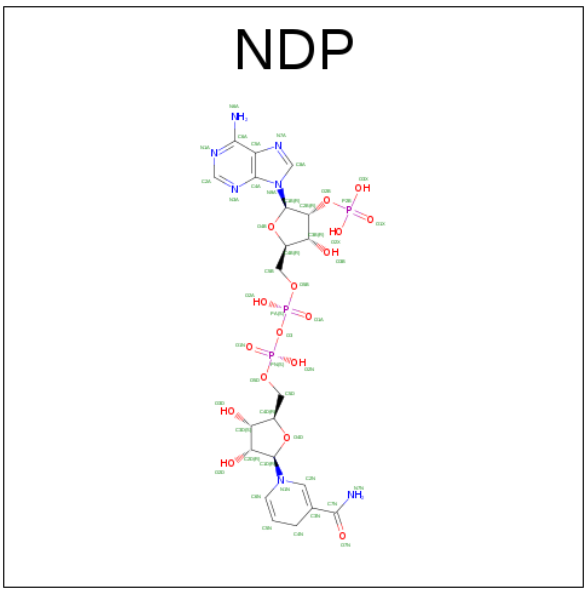
- Molecule 1 is a protein called Fatty acid synthase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	632	Total	C	H	N	O	S	0	0	0
			9294	2959	4617	822	872	24			
1	C	624	Total	C	H	N	O	S	0	0	0
			9179	2922	4564	813	856	24			

There are 6 discrepancies between the modelled and reference sequences:

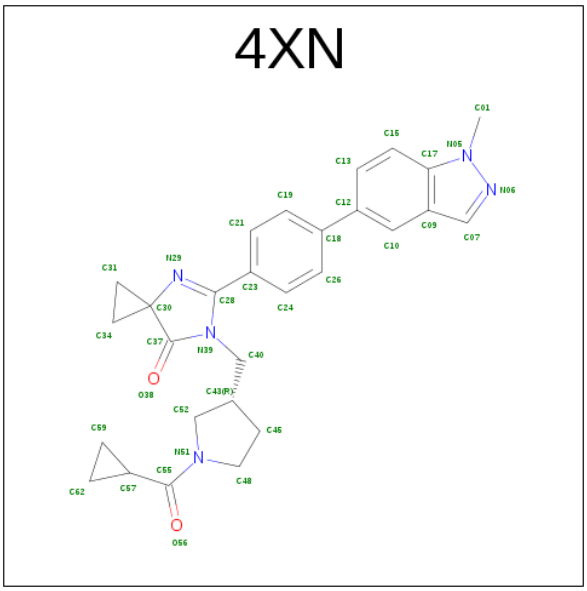
Chain	Residue	Modelled	Actual	Comment	Reference
A	1875	GLY	-	linker	UNP P49327
A	1876	GLY	-	linker	UNP P49327
A	1880	GLY	PHE	engineered mutation	UNP P49327
C	1875	GLY	-	linker	UNP P49327
C	1876	GLY	-	linker	UNP P49327
C	1880	GLY	PHE	engineered mutation	UNP P49327

- Molecule 2 is NADPH DIHYDRO-NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (three-letter code: NDP) (formula: $C_{21}H_{30}N_7O_{17}P_3$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
2	A	1	Total	C	H	N	O	P	0	0
			74	21	26	7	17	3		
2	C	1	Total	C	H	N	O	P	0	0
			74	21	26	7	17	3		

- Molecule 3 is 6-{[(3R)-1-(cyclopropylcarbonyl)pyrrolidin-3-yl]methyl}-5-[4-(1-methyl-1H-indazol-5-yl)phenyl]-4,6-diazaspiro[2.4]hept-4-en-7-one (three-letter code: 4XN) (formula: $C_{28}H_{29}N_5O_2$).

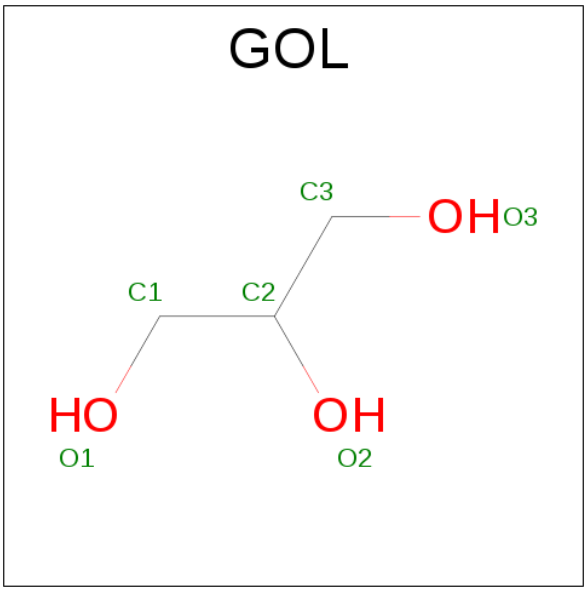


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	H	N	O	0	0
			64	28	29	5	2		
3	C	1	Total	C	H	N	O	0	0
			64	28	29	5	2		

- Molecule 4 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Cl	0	0
			1	1		
4	C	2	Total	Cl	0	0
			2	2		

- Molecule 5 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	C	1	Total	C	H	O	0	0
			14	3	8	3		

- Molecule 6 is water.

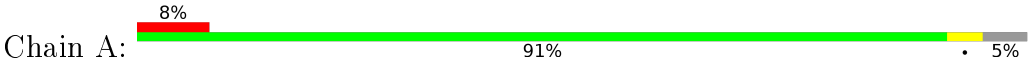
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	107	Total	O	0	0
			107	107		
6	C	128	Total	O	0	0
			128	128		

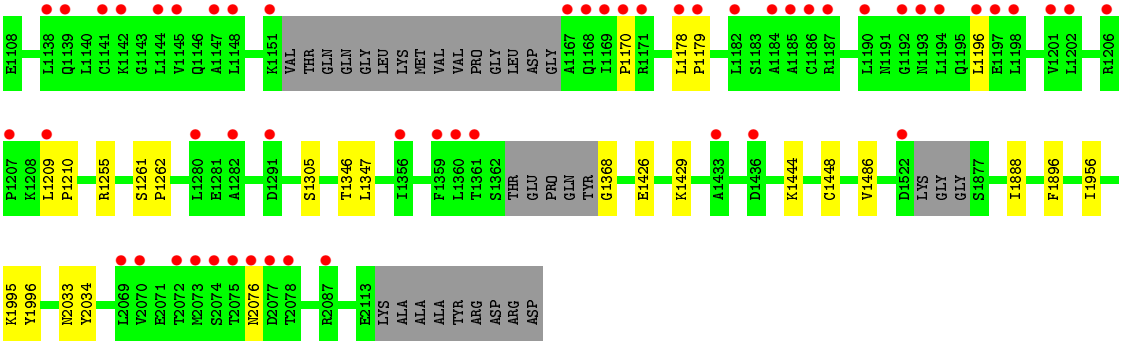
3 Residue-property plots (i)

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: Fatty acid synthase

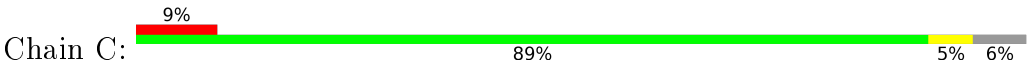
Chain A:

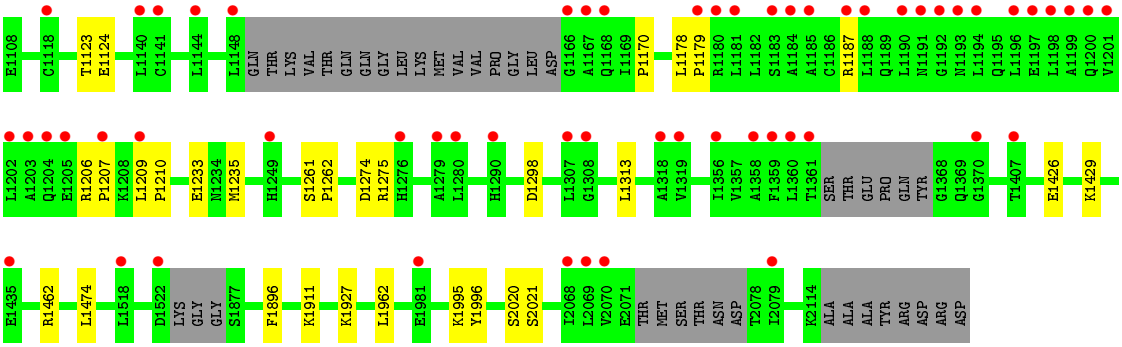




- Molecule 1: Fatty acid synthase

Chain C:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	94.08Å 80.52Å 96.53Å 90.00° 116.90° 90.00°	Depositor
Resolution (Å)	47.00 – 2.30 47.00 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.2 (47.00-2.30) 92.9 (47.00-2.30)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.98 (at 2.29Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.9_1692)	Depositor
R, R_{free}	0.210 , 0.251 0.208 , 0.249	Depositor DCC
R_{free} test set	1904 reflections (3.58%)	DCC
Wilson B-factor (Å^2)	42.9	Xtriage
Anisotropy	0.471	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.40 , 56.2	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.010 for l,-k,h	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	19001	wwPDB-VP
Average B, all atoms (Å^2)	67.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 29.16 % of the origin peak, indicating pseudo translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo translational symmetry is equal to 1.6267e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: 4XN, GOL, NDP, CL

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	0.22	0/4765	0.40	0/6484
1	C	0.22	0/4703	0.39	0/6397
All	All	0.22	0/9468	0.39	0/12881

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-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 hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	4677	4617	4616	12	0
1	C	4615	4564	4558	16	0
2	A	48	26	26	0	0
2	C	48	26	26	0	0
3	A	35	29	0	0	0
3	C	35	29	0	0	0
4	A	1	0	0	0	0
4	C	2	0	0	1	0
5	C	6	8	8	1	0
6	A	107	0	0	4	0
6	C	128	0	0	8	0
All	All	9702	9299	9234	29	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 2.

The worst 5 of 29 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:1233:GLU:OE2	6:C:2301:HOH:O	2.03	0.76
1:C:1298:ASP:OD1	6:C:2302:HOH:O	2.05	0.73
1:A:1444:LYS:NZ	1:A:1486:VAL:O	2.22	0.73
4:C:2205:CL:CL	6:C:2424:HOH:O	2.43	0.73
1:A:1255:ARG:NH1	6:A:2301:HOH:O	2.22	0.70

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

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	624/664 (94%)	589 (94%)	33 (5%)	2 (0%)	46	57
1	C	614/664 (92%)	584 (95%)	29 (5%)	1 (0%)	52	64
All	All	1238/1328 (93%)	1173 (95%)	62 (5%)	3 (0%)	52	64

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	2076	ASN
1	C	1170	PRO
1	A	1170	PRO

5.3.2 Protein sidechains (i)

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	488/548 (89%)	484 (99%)	4 (1%)	86 94
1	C	481/548 (88%)	476 (99%)	5 (1%)	82 91
All	All	969/1096 (88%)	960 (99%)	9 (1%)	84 93

5 of 9 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	1313	LEU
1	C	1996	TYR
1	C	1927	LYS
1	A	1995	LYS
1	C	1896	PHE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	1204	GLN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no carbohydrates in this entry.

5.6 Ligand geometry (i)

Of 8 ligands modelled in this entry, 3 are monoatomic - leaving 5 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
2	NDP	A	2201	-	44,52,52	1.01	3 (6%)	55,80,80	1.14	6 (10%)
3	4XN	A	2202	-	38,41,41	1.02	3 (7%)	46,63,63	1.38	5 (10%)
2	NDP	C	2201	-	44,52,52	1.01	2 (4%)	55,80,80	1.27	4 (7%)
5	GOL	C	2202	-	5,5,5	0.29	0	5,5,5	0.36	0
3	4XN	C	2203	-	38,41,41	1.02	3 (7%)	46,63,63	1.37	5 (10%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the chemical component dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NDP	A	2201	-	-	0/30/77/77	0/5/5/5
3	4XN	A	2202	-	-	0/20/54/54	0/5/7/7
2	NDP	C	2201	-	-	0/30/77/77	0/5/5/5
5	GOL	C	2202	-	-	0/4/4/4	0/0/0/0
3	4XN	C	2203	-	-	0/20/54/54	0/5/7/7

The worst 5 of 11 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	2202	4XN	C37-N39	-2.29	1.34	1.38
3	A	2202	4XN	C30-N29	-2.23	1.44	1.47
3	C	2203	4XN	C37-N39	-2.22	1.34	1.38
3	C	2203	4XN	C30-N29	-2.18	1.44	1.47
2	A	2201	NDP	C8A-N7A	-2.09	1.30	1.34

The worst 5 of 20 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	2201	NDP	C4B-O4B-C1B	-5.81	103.48	109.64
3	C	2203	4XN	N39-C28-N29	-5.73	111.15	116.03
3	A	2202	4XN	N39-C28-N29	-5.69	111.19	116.03

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	2201	NDP	C4B-O4B-C1B	-4.20	105.19	109.64
2	C	2201	NDP	O4B-C1B-C2B	-2.87	101.44	106.60

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	C	2202	GOL	1	0

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

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^{th} 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^2)	Q<0.9
1	A	632/664 (95%)	0.58	53 (8%)	14	19	29, 60, 110, 157	0
1	C	624/664 (93%)	0.65	57 (9%)	11	17	30, 56, 109, 179	0
All	All	1256/1328 (94%)	0.61	110 (8%)	12	18	29, 58, 110, 179	0

The worst 5 of 110 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	2070	VAL	14.4
1	C	1166	GLY	8.4
1	C	1196	LEU	8.3
1	A	1202	LEU	7.4
1	A	2075	THR	6.7

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^{th} 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	RSCC	RSR	LLDF	B-factors(Å^2)	Q<0.9
4	CL	A	2203	1/1	0.89	0.23	1.65	69,69,69,69	0
5	GOL	C	2202	6/6	0.86	0.21	0.70	51,61,67,72	0
3	4XN	A	2202	35/35	0.96	0.15	-0.40	29,41,52,52	0
3	4XN	C	2203	35/35	0.94	0.14	-0.45	40,50,60,61	0
2	NDP	C	2201	48/48	0.96	0.14	-0.53	36,47,61,61	0
2	NDP	A	2201	48/48	0.97	0.13	-0.55	33,48,63,69	0
4	CL	C	2204	1/1	0.66	0.14	-1.26	69,69,69,69	0
4	CL	C	2205	1/1	0.94	0.19	-	77,77,77,77	0

6.5 Other polymers (i)

There are no such residues in this entry.