Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 05:19 PM GMT

PDB ID	:	4HXD
Title	:	Diversity of ubiquitin and ISG15 specificity amongst nairoviruses viral ovarian tumor domain proteases
Authors	:	Capodagli, G.C.; Pegan, S.D.
Deposited on	:	2012-11-09
Resolution	:	2.85 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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 ⓘ symbol.

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

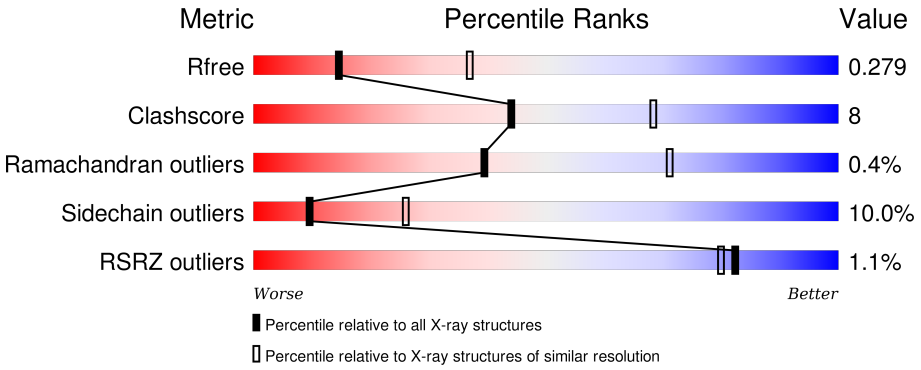
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

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 2.85 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	2228 (2.90-2.82)
Clashscore	102246	2499 (2.90-2.82)
Ramachandran outliers	100387	2439 (2.90-2.82)
Sidechain outliers	100360	2442 (2.90-2.82)
RSRZ outliers	91569	2236 (2.90-2.82)

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	75	4% 81% 17% •
1	C	75	% 84% 13% •
2	B	174	67% 22% • 10%
2	D	174	% 63% 22% • 10%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 3767 atoms, of which 0 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 Polyubiquitin-C.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	75	Total	C	N	O	S	0	0	0
			597	376	104	116	1			
1	C	75	Total	C	N	O	S	0	0	0
			597	376	104	116	1			

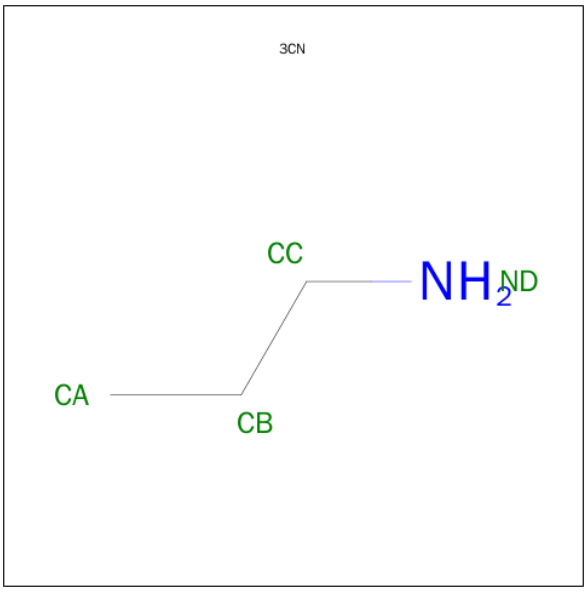
- Molecule 2 is a protein called RNA-directed RNA polymerase L.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	157	Total	C	N	O	S	0	0	0
			1256	806	206	239	5			
2	D	156	Total	C	N	O	S	0	0	0
			1248	802	205	236	5			

There are 12 discrepancies between the modelled and reference sequences:

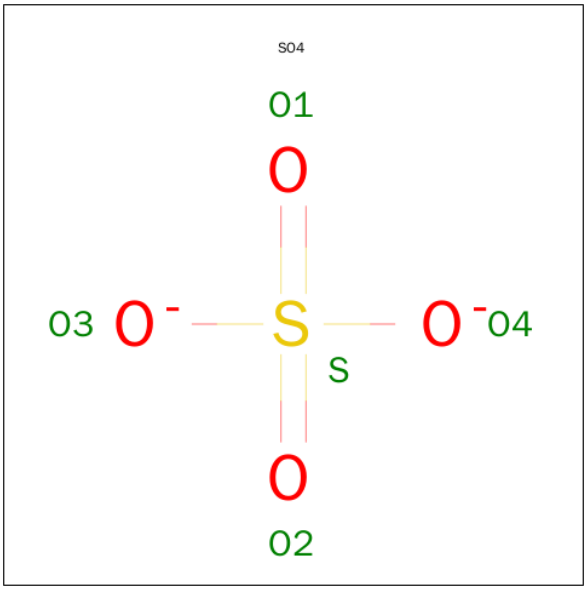
Chain	Residue	Modelled	Actual	Comment	Reference
B	170	HIS	-	EXPRESSION TAG	UNP Q66431
B	171	HIS	-	EXPRESSION TAG	UNP Q66431
B	172	HIS	-	EXPRESSION TAG	UNP Q66431
B	173	HIS	-	EXPRESSION TAG	UNP Q66431
B	174	HIS	-	EXPRESSION TAG	UNP Q66431
B	175	HIS	-	EXPRESSION TAG	UNP Q66431
D	170	HIS	-	EXPRESSION TAG	UNP Q66431
D	171	HIS	-	EXPRESSION TAG	UNP Q66431
D	172	HIS	-	EXPRESSION TAG	UNP Q66431
D	173	HIS	-	EXPRESSION TAG	UNP Q66431
D	174	HIS	-	EXPRESSION TAG	UNP Q66431
D	175	HIS	-	EXPRESSION TAG	UNP Q66431

- Molecule 3 is 3-AMINOPROPANE (three-letter code: 3CN) (formula: C_3H_9N).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C N 4 3 1	0	0
3	C	1	Total C N 4 3 1	0	0

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total O S 5 4 1	0	0
4	C	1	Total O S 5 4 1	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	D	1	Total O S 5 4 1	0	0

- Molecule 5 is water.

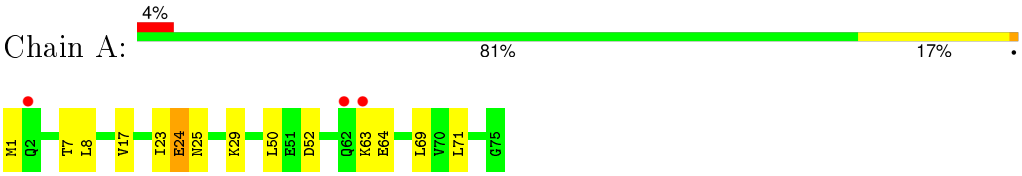
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	9	Total O 9 9	0	0
5	B	16	Total O 16 16	0	0
5	C	9	Total O 9 9	0	0
5	D	12	Total O 12 12	0	0

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.

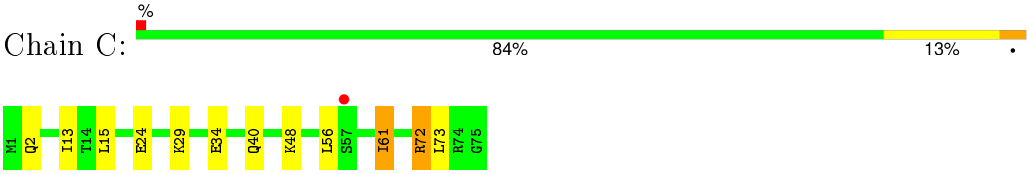
- Molecule 1: Polyubiquitin-C

Chain A:



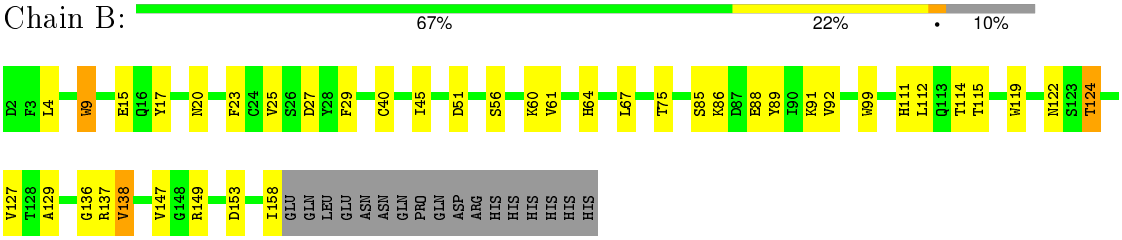
- Molecule 1: Polyubiquitin-C

Chain C:



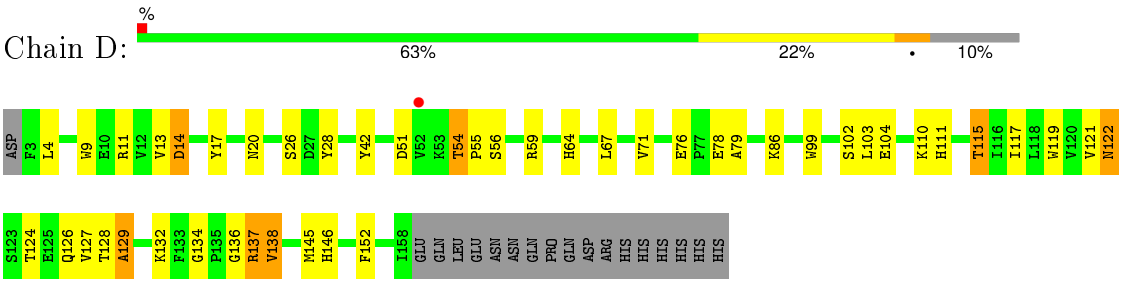
- Molecule 2: RNA-directed RNA polymerase L

Chain B:



- Molecule 2: RNA-directed RNA polymerase L

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	113.51Å 39.99Å 114.19Å 90.00° 97.33° 90.00°	Depositor
Resolution (Å)	50.00 – 2.85 48.02 – 2.83	Depositor EDS
% Data completeness (in resolution range)	95.2 (50.00-2.85) 95.2 (48.02-2.83)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	13.01 (at 2.81Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, R_{free}	0.210 , 0.278 0.210 , 0.279	Depositor DCC
R_{free} test set	561 reflections (5.00%)	DCC
Wilson B-factor (Å^2)	25.5	Xtriage
Anisotropy	0.121	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 30.8	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.44$, $< L^2 > = 0.27$	Xtriage
Outliers	0 of 11868 reflections	Xtriage
F_o,F_c correlation	0.89	EDS
Total number of atoms	3767	wwPDB-VP
Average B, all atoms (Å^2)	20.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.93% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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: 3CN, SO4

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	0.35	0/603	0.58	0/811
1	C	0.36	0/603	0.61	0/811
2	B	0.53	3/1286 (0.2%)	0.59	0/1746
2	D	0.53	2/1278 (0.2%)	0.58	0/1735
All	All	0.48	5/3770 (0.1%)	0.59	0/5103

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	9	TRP	CD2-CE2	5.39	1.47	1.41
2	B	9	TRP	CD2-CE2	5.24	1.47	1.41
2	B	99	TRP	CD2-CE2	5.23	1.47	1.41
2	D	119	TRP	CD2-CE2	5.12	1.47	1.41
2	B	119	TRP	CD2-CE2	5.10	1.47	1.41

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	597	0	626	10	0
1	C	597	0	626	8	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	1256	0	1222	17	0
2	D	1248	0	1218	28	0
3	A	4	0	6	1	0
3	C	4	0	6	1	0
4	A	5	0	0	0	0
4	C	5	0	0	0	0
4	D	5	0	0	0	0
5	A	9	0	0	0	0
5	B	16	0	0	0	0
5	C	9	0	0	0	0
5	D	12	0	0	0	0
All	All	3767	0	3704	59	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 8.

All (59) 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)
2:D:64:HIS:HD2	2:D:111:HIS:CE1	1.80	0.98
2:D:64:HIS:HD2	2:D:111:HIS:HE1	0.97	0.95
2:D:64:HIS:CD2	2:D:111:HIS:HE1	1.88	0.90
1:C:72:ARG:HH11	1:C:72:ARG:CG	1.93	0.80
2:D:64:HIS:CD2	2:D:111:HIS:CE1	2.70	0.75
1:C:72:ARG:HH11	1:C:72:ARG:HG2	1.53	0.73
2:B:115:THR:HG21	2:B:136:GLY:H	1.54	0.72
2:D:122:ASN:HB2	2:D:126:GLN:HB3	1.74	0.70
1:C:56:LEU:HD22	1:C:61:ILE:HD12	1.74	0.70
2:D:115:THR:HG21	2:D:136:GLY:HA3	1.73	0.70
2:D:17:TYR:HB2	2:D:132:LYS:HB3	1.76	0.66
1:C:72:ARG:NH1	1:C:72:ARG:HG2	2.13	0.63
2:D:117:ILE:HG12	2:D:132:LYS:HG3	1.82	0.61
1:A:24:GLU:HG2	1:A:52:ASP:HB3	1.83	0.60
2:D:132:LYS:HE3	2:D:134:GLY:O	2.01	0.60
2:D:4:LEU:HB3	2:D:138:VAL:HG21	1.83	0.59
2:B:4:LEU:HB3	2:B:138:VAL:HG21	1.86	0.58
2:B:64:HIS:HD2	2:B:111:HIS:HE1	1.51	0.57
2:B:45:ILE:HG21	2:B:61:VAL:HG21	1.87	0.57
1:A:8:LEU:HG	2:B:129:ALA:HB1	1.85	0.57
2:B:115:THR:HG21	2:B:136:GLY:N	2.19	0.57
2:D:137:ARG:HD3	2:D:137:ARG:H	1.70	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:85:SER:HB3	2:B:88:GLU:HG2	1.88	0.56
2:D:4:LEU:HD21	2:D:28:TYR:HB3	1.88	0.54
2:B:111:HIS:CD2	2:D:137:ARG:HH21	2.27	0.53
2:B:9:TRP:HB3	2:B:17:TYR:HB3	1.91	0.52
2:D:78:GLU:CD	2:D:102:SER:HG	2.12	0.51
1:A:1:MET:HB3	1:A:17:VAL:O	2.10	0.51
1:C:73:LEU:HD22	2:D:146:HIS:CD2	2.46	0.50
1:A:23:ILE:HD12	1:A:50:LEU:HD23	1.92	0.50
2:D:79:ALA:HB2	2:D:103:LEU:HD11	1.94	0.49
2:B:122:ASN:HB3	2:B:124:THR:H	1.78	0.49
2:B:23:PHE:CZ	2:B:127:VAL:HG11	2.48	0.48
2:D:54:THR:HG22	2:D:55:PRO:HD2	1.94	0.48
2:D:76:GLU:OE2	2:D:110:LYS:NZ	2.47	0.48
2:D:4:LEU:HB3	2:D:138:VAL:CG2	2.44	0.47
1:A:23:ILE:HG13	1:A:50:LEU:HB3	1.97	0.47
2:D:128:THR:O	2:D:129:ALA:HB2	2.15	0.47
1:C:72:ARG:HH11	1:C:72:ARG:HG3	1.77	0.47
1:A:63:LYS:HA	1:A:63:LYS:HD2	1.75	0.47
3:A:101:3CN:HA2	2:B:40:CYS:H	1.81	0.46
2:D:11:ARG:NH1	2:D:14:ASP:O	2.43	0.45
2:B:25:VAL:HG12	2:B:29:PHE:HB2	1.97	0.45
2:D:42:TYR:OH	2:D:104:GLU:HG2	2.16	0.45
1:A:63:LYS:HG3	1:A:64:GLU:HG2	1.98	0.44
2:D:121:VAL:HG13	2:D:126:GLN:H	1.84	0.43
2:B:89:TYR:O	2:B:92:VAL:HG12	2.18	0.42
2:D:145:MET:O	2:D:152:PHE:HA	2.20	0.42
2:B:111:HIS:CD2	2:D:137:ARG:NH2	2.88	0.42
1:A:23:ILE:CD1	1:A:50:LEU:HD23	2.50	0.41
2:B:85:SER:HB3	2:B:88:GLU:CG	2.49	0.41
2:D:56:SER:HB2	2:D:59:ARG:HH11	1.85	0.41
1:C:13:ILE:HD13	1:C:34:GLU:HG3	2.01	0.41
1:A:7:THR:HG22	1:A:69:LEU:HD23	2.02	0.41
1:A:8:LEU:HD12	1:A:8:LEU:HA	1.95	0.41
2:B:147:VAL:HG21	2:B:153:ASP:OD2	2.21	0.41
3:C:101:3CN:HC1	2:D:99:TRP:CD1	2.56	0.40
2:D:78:GLU:OE2	2:D:102:SER:OG	2.38	0.40
1:C:2:GLN:HA	1:C:15:LEU:O	2.22	0.40

There are no symmetry-related clashes.

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	73/75 (97%)	67 (92%)	6 (8%)	0	100	100
1	C	73/75 (97%)	70 (96%)	3 (4%)	0	100	100
2	B	155/174 (89%)	143 (92%)	12 (8%)	0	100	100
2	D	154/174 (88%)	140 (91%)	12 (8%)	2 (1%)	15	42
All	All	455/498 (91%)	420 (92%)	33 (7%)	2 (0%)	39	71

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	D	14	ASP
2	D	129	ALA

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	68/68 (100%)	64 (94%)	4 (6%)	24	54
1	C	68/68 (100%)	62 (91%)	6 (9%)	12	33
2	B	138/155 (89%)	121 (88%)	17 (12%)	6	15
2	D	137/155 (88%)	123 (90%)	14 (10%)	9	25
All	All	411/446 (92%)	370 (90%)	41 (10%)	9	26

All (41) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	24	GLU
1	A	25	ASN
1	A	29	LYS
1	A	71	LEU
2	B	15	GLU
2	B	20	ASN
2	B	27	ASP
2	B	51	ASP
2	B	56	SER
2	B	60	LYS
2	B	67	LEU
2	B	75	THR
2	B	86	LYS
2	B	91	LYS
2	B	112	LEU
2	B	114	THR
2	B	124	THR
2	B	137	ARG
2	B	138	VAL
2	B	149	ARG
2	B	158	ILE
1	C	24	GLU
1	C	29	LYS
1	C	40	GLN
1	C	48	LYS
1	C	61	ILE
1	C	72	ARG
2	D	13	VAL
2	D	20	ASN
2	D	26	SER
2	D	51	ASP
2	D	54	THR
2	D	67	LEU
2	D	71	VAL
2	D	86	LYS
2	D	115	THR
2	D	122	ASN
2	D	124	THR
2	D	127	VAL
2	D	137	ARG
2	D	138	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	62	GLN
2	B	39	ASN
2	B	64	HIS
2	B	111	HIS
2	B	122	ASN
1	C	2	GLN
1	C	25	ASN
1	C	40	GLN
1	C	68	HIS
2	D	64	HIS
2	D	111	HIS
2	D	122	ASN

5.3.3 RNA

There are no RNA molecules 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

5 ligands are modelled in this entry.

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	$\#\|Z\| > 2$
3	3CN	A	101	1,2	3,3,3	0.53	0	0,2,2	0.00	-
4	SO4	A	102	-	4,4,4	0.40	0	6,6,6	0.18	0
3	3CN	C	101	1,2	3,3,3	0.59	0	0,2,2	0.00	-

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
4	SO4	C	102	-	4,4,4	0.37	0	6,6,6	0.08	0
4	SO4	D	201	-	4,4,4	0.36	0	6,6,6	0.10	0

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
3	3CN	A	101	1,2	-	0/1/1/1	0/0/0/0
4	SO4	A	102	-	-	0/0/0/0	0/0/0/0
3	3CN	C	101	1,2	-	0/1/1/1	0/0/0/0
4	SO4	C	102	-	-	0/0/0/0	0/0/0/0
4	SO4	D	201	-	-	0/0/0/0	0/0/0/0

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.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	101	3CN	1	0
3	C	101	3CN	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	75/75 (100%)	0.12	3 (4%) 42 34	17, 28, 42, 50	0
1	C	75/75 (100%)	0.00	1 (1%) 79 77	14, 23, 35, 37	0
2	B	157/174 (90%)	-0.34	0 100 100	13, 18, 28, 35	0
2	D	156/174 (89%)	-0.51	1 (0%) 90 89	11, 15, 24, 29	0
All	All	463/498 (92%)	-0.27	5 (1%) 82 80	11, 19, 36, 50	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	52	VAL	2.7
1	A	63	LYS	2.4
1	C	57	SER	2.1
1	A	62	GLN	2.1
1	A	2	GLN	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^{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
3	3CN	A	101	4/4	0.96	0.16	0.12	17,17,17,17	0
4	SO4	A	102	5/5	0.93	0.16	-0.28	41,41,42,42	0
3	3CN	C	101	4/4	0.96	0.12	-1.21	15,15,15,15	0
4	SO4	C	102	5/5	0.84	0.29	-	29,29,30,30	5
4	SO4	D	201	5/5	0.94	0.15	-	52,52,53,53	0

6.5 Other polymers (i)

There are no such residues in this entry.