



Full wwPDB X-ray Structure Validation Report ⓘ

May 8, 2024 – 12:03 PM EDT

PDB ID : 8V10
Title : Structure of a *Saccharomyces cerevisiae* Mps1 peptide bound to dwarf Ndc80 Complex
Authors : Zahm, J.A.; Harrison, S.C.
Deposited on : 2023-11-19
Resolution : 3.02 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

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 2.36.2
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36.2

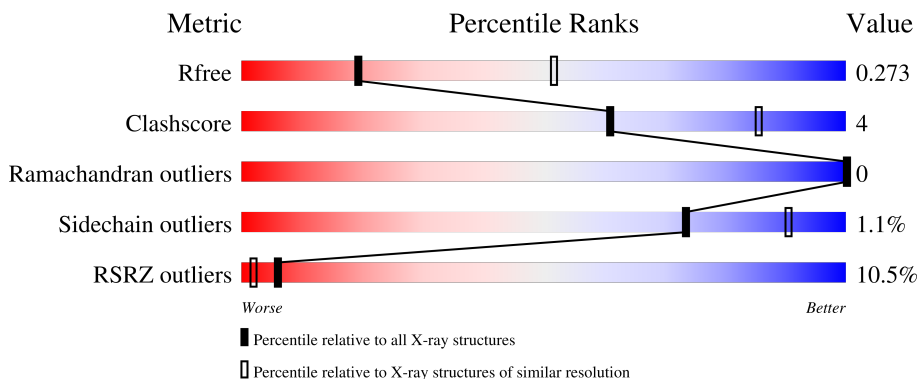
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.02 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}	130704	2399 (3.04-3.00)
Clashscore	141614	2734 (3.04-3.00)
Ramachandran outliers	138981	2640 (3.04-3.00)
Sidechain outliers	138945	2643 (3.04-3.00)
RSRZ outliers	127900	2287 (3.04-3.00)

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 of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. 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 $\leq 5\%$. 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	279	 8% 85% 10%
2	B	233	 17% 79% 14% 6%
3	C	100	 5% 83% 10% 7%
4	D	115	 6% 89% 11%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 5725 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 Kinetochore protein NDC80.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	268	2253	1446	380	421	6	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	111	SER	-	expression tag	UNP P40460
A	112	ASN	-	expression tag	UNP P40460
A	113	ALA	-	expression tag	UNP P40460

- Molecule 2 is a protein called Mps1/NUF2 chimera protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	218	1790	1127	303	348	12	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	136	MET	-	initiating methionine	UNP P54199

- Molecule 3 is a protein called Kinetochore protein SPC24.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	93	781	493	135	152	1	0	0	0

- Molecule 4 is a protein called Kinetochore protein SPC25.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	D	115	900	564	165	166	5	0	0	0

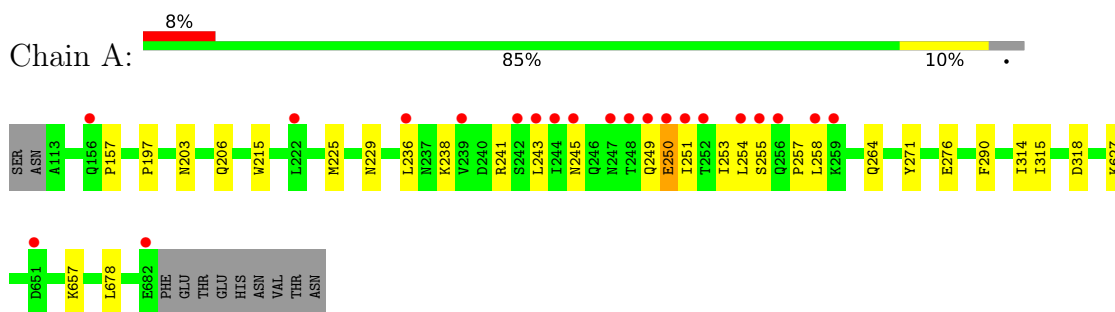
- Molecule 5 is NICKEL (II) ION (three-letter code: NI) (formula: Ni).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total Ni 1 1	0	0

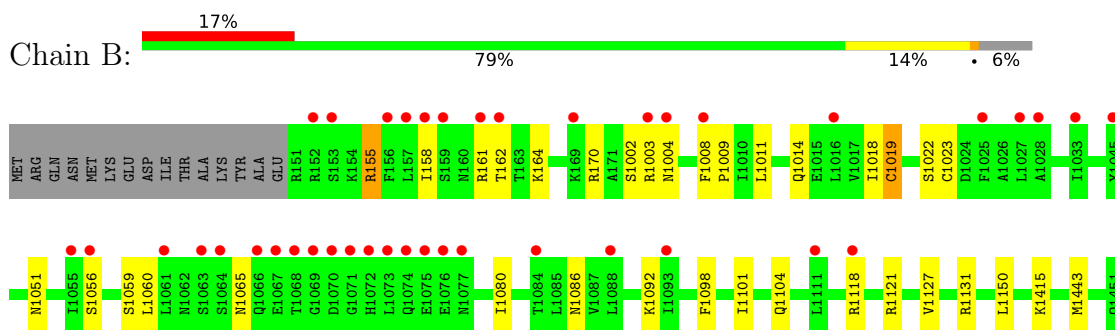
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes 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.

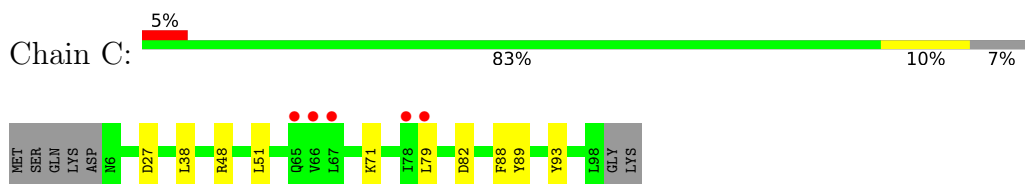
- Molecule 1: Kinetochores protein NDC80



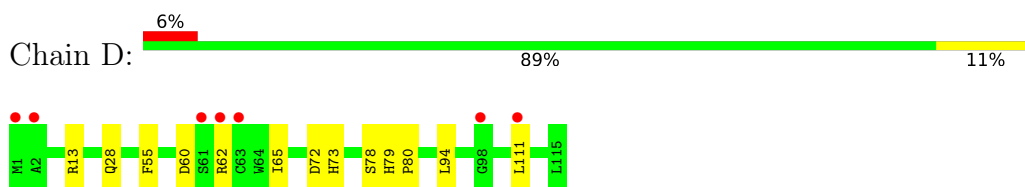
- Molecule 2: Mps1/NUF2 chimera protein



- Molecule 3: Kinetochores protein SPC24



- Molecule 4: Kinetochores protein SPC25



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	72.66Å 168.29Å 230.21Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	115.11 – 3.02 115.11 – 3.02	Depositor EDS
% Data completeness (in resolution range)	64.1 (115.11-3.02) 64.2 (115.11-3.02)	Depositor EDS
R_{merge}	0.15	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.81 (at 3.01Å)	Xtrriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.238 , 0.271 0.239 , 0.273	Depositor DCC
R_{free} test set	902 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	70.6	Xtrriage
Anisotropy	0.151	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 62.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.28$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	5725	wwPDB-VP
Average B, all atoms (Å ²)	89.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.96% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

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: NI

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	0.23	0/2296	0.39	0/3091
2	B	0.24	0/1815	0.43	0/2440
3	C	0.23	0/791	0.45	0/1066
4	D	0.23	0/916	0.45	0/1239
All	All	0.23	0/5818	0.42	0/7836

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 [i](#)

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	2253	0	2282	22	0
2	B	1790	0	1776	25	0
3	C	781	0	782	6	0
4	D	900	0	892	10	0
5	A	1	0	0	0	0
All	All	5725	0	5732	51	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 4.

All (51) 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:A:315:ILE:HG21	2:B:1150:LEU:HB3	1.69	0.74
2:B:1019:CYS:O	2:B:1023:CYS:N	2.22	0.70
2:B:162:THR:HB	2:B:164:LYS:HG2	1.78	0.66
2:B:1443:MET:HE1	4:D:13:ARG:HB3	1.77	0.66
1:A:197:PRO:HG3	2:B:1080:ILE:HG23	1.83	0.60
1:A:264:GLN:OE1	2:B:1415:LYS:NZ	2.36	0.58
1:A:251:ILE:HG22	1:A:255:SER:HB3	1.85	0.58
1:A:271:TYR:OH	1:A:318:ASP:OD2	2.25	0.55
4:D:73:HIS:HB2	4:D:94:LEU:HD13	1.87	0.55
1:A:225:MET:O	1:A:229:ASN:ND2	2.37	0.55
2:B:1002:SER:HB3	2:B:1003:ARG:HH21	1.74	0.53
4:D:65:ILE:HB	4:D:111:LEU:HD11	1.90	0.52
1:A:678:LEU:O	3:C:48:ARG:NH2	2.43	0.52
1:A:243:LEU:HD21	2:B:1060:LEU:HD11	1.91	0.51
2:B:1127:VAL:O	2:B:1131:ARG:HG2	2.10	0.51
1:A:250:GLU:OE1	1:A:251:ILE:N	2.42	0.51
4:D:65:ILE:HG13	4:D:78:SER:HB3	1.92	0.51
1:A:251:ILE:HG12	1:A:314:ILE:HG23	1.93	0.50
1:A:203:ASN:HB3	1:A:206:GLN:HG3	1.94	0.50
2:B:1118:ARG:HH21	2:B:1121:ARG:NH1	2.11	0.49
2:B:155:ARG:NH2	2:B:1051:ASN:OD1	2.45	0.49
2:B:1056:SER:HB3	2:B:1059:SER:HB3	1.95	0.48
1:A:657:LYS:NZ	3:C:27:ASP:OD2	2.37	0.47
1:A:257:PRO:HG3	1:A:627:LYS:HE2	1.96	0.46
2:B:1004:ASN:OD1	2:B:1004:ASN:N	2.49	0.46
1:A:245:ASN:O	1:A:249:GLN:NE2	2.49	0.45
1:A:276:GLU:OE2	2:B:155:ARG:NH1	2.49	0.45
1:A:258:LEU:HD22	1:A:264:GLN:HB2	1.97	0.45
3:C:82:ASP:N	3:C:82:ASP:OD1	2.47	0.45
2:B:158:ILE:HG22	2:B:161:ARG:HD2	1.98	0.45
2:B:1065:ASN:ND2	2:B:1086:ASN:OD1	2.43	0.45
4:D:80:PRO:HD2	4:D:111:LEU:HD22	1.99	0.44
4:D:62:ARG:O	4:D:79:HIS:ND1	2.50	0.44
4:D:60:ASP:N	4:D:60:ASP:OD1	2.49	0.44
1:A:253:ILE:HG22	1:A:254:LEU:HD23	1.99	0.43
2:B:1118:ARG:HH21	2:B:1121:ARG:HH11	1.66	0.43
2:B:1019:CYS:O	2:B:1022:SER:N	2.52	0.43
2:B:1098:PHE:HA	2:B:1101:ILE:HG12	1.99	0.43
3:C:79:LEU:HD12	3:C:93:TYR:HD2	1.84	0.43
3:C:38:LEU:HD22	4:D:28:GLN:HG3	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:D:79:HIS:HB3	4:D:80:PRO:HD3	2.00	0.43
2:B:1009:PRO:O	2:B:1011:LEU:HD22	2.19	0.42
1:A:290:PHE:CE1	2:B:170:ARG:HD3	2.55	0.41
2:B:1004:ASN:ND2	2:B:1008:PHE:O	2.53	0.41
1:A:236:LEU:HD11	2:B:1092:LYS:HG3	2.02	0.41
1:A:251:ILE:H	1:A:251:ILE:HG13	1.75	0.41
2:B:1014:GLN:O	2:B:1018:ILE:HG23	2.21	0.41
2:B:1104:GLN:H	2:B:1104:GLN:HG2	1.70	0.41
1:A:238:LYS:HA	1:A:241:ARG:HD2	2.03	0.41
3:C:51:LEU:HD21	4:D:55:PHE:HE2	1.87	0.40
1:A:157:PRO:HG3	1:A:215:TRP:CZ2	2.56	0.40

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	266/279 (95%)	259 (97%)	7 (3%)	0	100	100
2	B	216/233 (93%)	206 (95%)	10 (5%)	0	100	100
3	C	91/100 (91%)	88 (97%)	3 (3%)	0	100	100
4	D	113/115 (98%)	108 (96%)	5 (4%)	0	100	100
All	All	686/727 (94%)	661 (96%)	25 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	257/268 (96%)	256 (100%)	1 (0%)	91	97
2	B	204/217 (94%)	202 (99%)	2 (1%)	76	91
3	C	89/95 (94%)	86 (97%)	3 (3%)	37	72
4	D	96/96 (100%)	95 (99%)	1 (1%)	76	91
All	All	646/676 (96%)	639 (99%)	7 (1%)	73	90

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	250	GLU
2	B	155	ARG
2	B	1019	CYS
3	C	71	LYS
3	C	88	PHE
3	C	89	TYR
4	D	72	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 1 ligands modelled in this entry, 1 is 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.

No monomer is involved in short contacts.

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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, 95th 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	268/279 (96%)	0.52	21 (7%) 13 4	23, 79, 170, 231	0
2	B	218/233 (93%)	1.09	40 (18%) 1 0	16, 87, 177, 209	0
3	C	93/100 (93%)	0.48	5 (5%) 25 9	23, 87, 151, 179	0
4	D	115/115 (100%)	0.59	7 (6%) 21 7	35, 94, 148, 177	0
All	All	694/727 (95%)	0.70	73 (10%) 6 2	16, 85, 164, 231	0

All (73) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	1074	GLN	7.5
2	B	1028	ALA	7.5
1	A	248	THR	6.5
2	B	1071	GLY	6.3
2	B	1077	ASN	5.6
2	B	1004	ASN	5.4
2	B	1069	GLY	5.1
1	A	251	ILE	4.9
2	B	1070	ASP	4.9
2	B	1064	SER	4.5
4	D	1	MET	4.3
2	B	153	SER	4.3
2	B	1016	LEU	4.2
2	B	1072	HIS	4.2
2	B	1063	SER	4.1
1	A	259	LYS	4.0
2	B	1076	GLU	3.9
2	B	162	THR	3.9
2	B	1068	THR	3.9
4	D	2	ALA	3.8
2	B	161	ARG	3.8

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Mol	Chain	Res	Type	RSRZ
4	D	98	GLY	3.7
2	B	1055	ILE	3.6
1	A	243	LEU	3.6
2	B	1045	TYR	3.6
1	A	258	LEU	3.5
2	B	157	LEU	3.4
1	A	249	GLN	3.4
1	A	236	LEU	3.3
1	A	245	ASN	3.2
4	D	63	CYS	3.2
2	B	1111	LEU	3.2
1	A	247	ASN	3.1
2	B	1073	LEU	3.1
3	C	66	VAL	3.0
2	B	156	PHE	3.0
2	B	159	SER	3.0
3	C	78	ILE	2.9
2	B	1025	PHE	2.9
2	B	1056	SER	2.9
3	C	79	LEU	2.9
2	B	1033	ILE	2.8
2	B	169	LYS	2.8
2	B	1088	LEU	2.8
1	A	254	LEU	2.7
1	A	244	ILE	2.7
1	A	256	GLN	2.6
2	B	1075	GLU	2.6
4	D	61	SER	2.5
1	A	250	GLU	2.5
2	B	1093	ILE	2.5
2	B	158	ILE	2.5
2	B	1118	ARG	2.5
1	A	255	SER	2.4
3	C	65	GLN	2.3
1	A	239	VAL	2.3
2	B	1008	PHE	2.3
4	D	111	LEU	2.3
2	B	1066	GLN	2.2
2	B	1003	ARG	2.2
1	A	682	GLU	2.2
1	A	651	ASP	2.2
2	B	152	ARG	2.2

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Mol	Chain	Res	Type	RSRZ
2	B	1027	LEU	2.2
2	B	1067	GLU	2.1
1	A	252	THR	2.1
1	A	242	SER	2.1
2	B	1061	LEU	2.1
2	B	1084	THR	2.1
1	A	156	GLN	2.1
4	D	62	ARG	2.1
1	A	222	LEU	2.0
3	C	67	LEU	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands [i](#)

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. The B-factors column lists the minimum, median, 95th 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	B-factors(Å ²)	Q<0.9
5	NI	A	801	1/1	0.99	0.26	12,12,12,12	0

6.5 Other polymers [i](#)

There are no such residues in this entry.