



wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 1, 2016 – 12:40 PM GMT

PDB ID : 3RHD
Title : Crystal structure of glyceraldehyde-3-phosphate dehydrogenase GapN from Methanocaldococcus jannaschii DSM 2661 complexed with NADP
Authors : Malashkevich, V.N.; Toro, R.; Seidel, R.; Garrett, S.; Foti, R.; Almo, S.C.; New York Structural Genomics Research Consortium (NYSGRG)
Deposited on : 2011-04-11
Resolution : 2.20 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 ⓘ 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

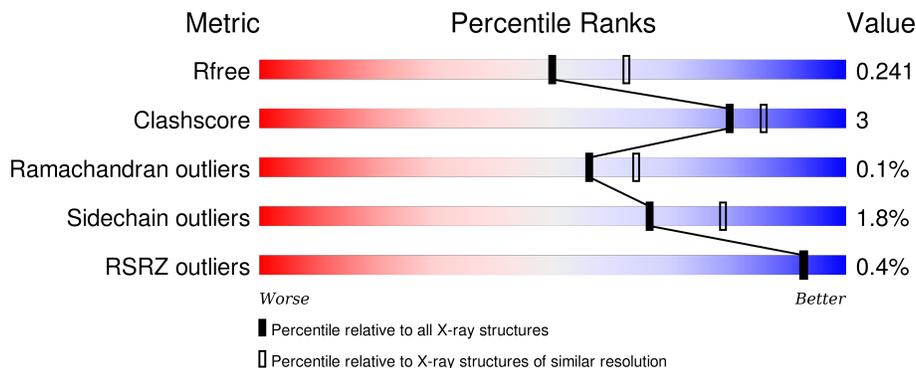
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	3774 (2.20-2.20)
Clashscore	102246	4477 (2.20-2.20)
Ramachandran outliers	100387	4404 (2.20-2.20)
Sidechain outliers	100360	4405 (2.20-2.20)
RSRZ outliers	91569	3781 (2.20-2.20)

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 ≥ 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 $\leq 5\%$. 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	486	 83% 10% 6%
1	B	486	 86% 8% 6%
1	C	486	 84% 10% 6%
1	D	486	 84% 10% 6%

2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 15019 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 Lactaldehyde dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	456	Total 3579	C 2299	N 596	O 668	S 16	0	8	0
1	B	456	Total 3580	C 2300	N 596	O 668	S 16	0	8	0
1	C	456	Total 3566	C 2290	N 594	O 667	S 15	0	6	0
1	D	456	Total 3560	C 2286	N 592	O 667	S 15	0	5	0

There are 92 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	VAL	-	EXPRESSION TAG	UNP Q58806
A	465	ALA	-	EXPRESSION TAG	UNP Q58806
A	466	GLU	-	EXPRESSION TAG	UNP Q58806
A	467	ASN	-	EXPRESSION TAG	UNP Q58806
A	468	LEU	-	EXPRESSION TAG	UNP Q58806
A	469	TYR	-	EXPRESSION TAG	UNP Q58806
A	470	PHE	-	EXPRESSION TAG	UNP Q58806
A	471	GLN	-	EXPRESSION TAG	UNP Q58806
A	472	SER	-	EXPRESSION TAG	UNP Q58806
A	473	HIS	-	EXPRESSION TAG	UNP Q58806
A	474	HIS	-	EXPRESSION TAG	UNP Q58806
A	475	HIS	-	EXPRESSION TAG	UNP Q58806
A	476	HIS	-	EXPRESSION TAG	UNP Q58806
A	477	HIS	-	EXPRESSION TAG	UNP Q58806
A	478	HIS	-	EXPRESSION TAG	UNP Q58806
A	479	TRP	-	EXPRESSION TAG	UNP Q58806
A	480	SER	-	EXPRESSION TAG	UNP Q58806
A	481	HIS	-	EXPRESSION TAG	UNP Q58806
A	482	PRO	-	EXPRESSION TAG	UNP Q58806
A	483	GLN	-	EXPRESSION TAG	UNP Q58806
A	484	PHE	-	EXPRESSION TAG	UNP Q58806

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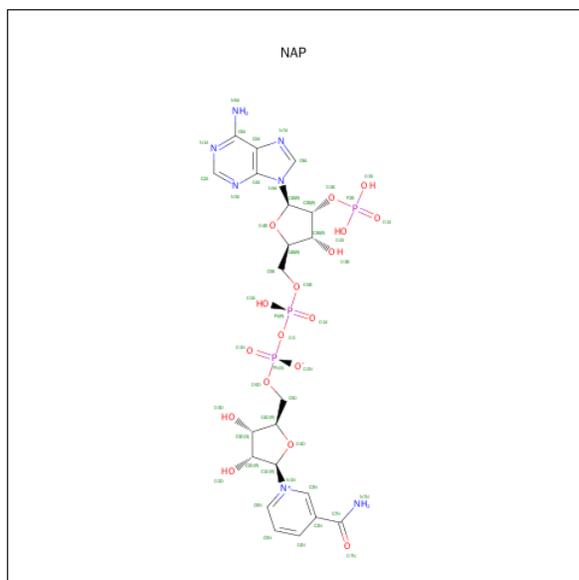
Chain	Residue	Modelled	Actual	Comment	Reference
A	485	GLU	-	EXPRESSION TAG	UNP Q58806
A	486	LYS	-	EXPRESSION TAG	UNP Q58806
B	1	VAL	-	EXPRESSION TAG	UNP Q58806
B	465	ALA	-	EXPRESSION TAG	UNP Q58806
B	466	GLU	-	EXPRESSION TAG	UNP Q58806
B	467	ASN	-	EXPRESSION TAG	UNP Q58806
B	468	LEU	-	EXPRESSION TAG	UNP Q58806
B	469	TYR	-	EXPRESSION TAG	UNP Q58806
B	470	PHE	-	EXPRESSION TAG	UNP Q58806
B	471	GLN	-	EXPRESSION TAG	UNP Q58806
B	472	SER	-	EXPRESSION TAG	UNP Q58806
B	473	HIS	-	EXPRESSION TAG	UNP Q58806
B	474	HIS	-	EXPRESSION TAG	UNP Q58806
B	475	HIS	-	EXPRESSION TAG	UNP Q58806
B	476	HIS	-	EXPRESSION TAG	UNP Q58806
B	477	HIS	-	EXPRESSION TAG	UNP Q58806
B	478	HIS	-	EXPRESSION TAG	UNP Q58806
B	479	TRP	-	EXPRESSION TAG	UNP Q58806
B	480	SER	-	EXPRESSION TAG	UNP Q58806
B	481	HIS	-	EXPRESSION TAG	UNP Q58806
B	482	PRO	-	EXPRESSION TAG	UNP Q58806
B	483	GLN	-	EXPRESSION TAG	UNP Q58806
B	484	PHE	-	EXPRESSION TAG	UNP Q58806
B	485	GLU	-	EXPRESSION TAG	UNP Q58806
B	486	LYS	-	EXPRESSION TAG	UNP Q58806
C	1	VAL	-	EXPRESSION TAG	UNP Q58806
C	465	ALA	-	EXPRESSION TAG	UNP Q58806
C	466	GLU	-	EXPRESSION TAG	UNP Q58806
C	467	ASN	-	EXPRESSION TAG	UNP Q58806
C	468	LEU	-	EXPRESSION TAG	UNP Q58806
C	469	TYR	-	EXPRESSION TAG	UNP Q58806
C	470	PHE	-	EXPRESSION TAG	UNP Q58806
C	471	GLN	-	EXPRESSION TAG	UNP Q58806
C	472	SER	-	EXPRESSION TAG	UNP Q58806
C	473	HIS	-	EXPRESSION TAG	UNP Q58806
C	474	HIS	-	EXPRESSION TAG	UNP Q58806
C	475	HIS	-	EXPRESSION TAG	UNP Q58806
C	476	HIS	-	EXPRESSION TAG	UNP Q58806
C	477	HIS	-	EXPRESSION TAG	UNP Q58806
C	478	HIS	-	EXPRESSION TAG	UNP Q58806
C	479	TRP	-	EXPRESSION TAG	UNP Q58806
C	480	SER	-	EXPRESSION TAG	UNP Q58806

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Chain	Residue	Modelled	Actual	Comment	Reference
C	481	HIS	-	EXPRESSION TAG	UNP Q58806
C	482	PRO	-	EXPRESSION TAG	UNP Q58806
C	483	GLN	-	EXPRESSION TAG	UNP Q58806
C	484	PHE	-	EXPRESSION TAG	UNP Q58806
C	485	GLU	-	EXPRESSION TAG	UNP Q58806
C	486	LYS	-	EXPRESSION TAG	UNP Q58806
D	1	VAL	-	EXPRESSION TAG	UNP Q58806
D	465	ALA	-	EXPRESSION TAG	UNP Q58806
D	466	GLU	-	EXPRESSION TAG	UNP Q58806
D	467	ASN	-	EXPRESSION TAG	UNP Q58806
D	468	LEU	-	EXPRESSION TAG	UNP Q58806
D	469	TYR	-	EXPRESSION TAG	UNP Q58806
D	470	PHE	-	EXPRESSION TAG	UNP Q58806
D	471	GLN	-	EXPRESSION TAG	UNP Q58806
D	472	SER	-	EXPRESSION TAG	UNP Q58806
D	473	HIS	-	EXPRESSION TAG	UNP Q58806
D	474	HIS	-	EXPRESSION TAG	UNP Q58806
D	475	HIS	-	EXPRESSION TAG	UNP Q58806
D	476	HIS	-	EXPRESSION TAG	UNP Q58806
D	477	HIS	-	EXPRESSION TAG	UNP Q58806
D	478	HIS	-	EXPRESSION TAG	UNP Q58806
D	479	TRP	-	EXPRESSION TAG	UNP Q58806
D	480	SER	-	EXPRESSION TAG	UNP Q58806
D	481	HIS	-	EXPRESSION TAG	UNP Q58806
D	482	PRO	-	EXPRESSION TAG	UNP Q58806
D	483	GLN	-	EXPRESSION TAG	UNP Q58806
D	484	PHE	-	EXPRESSION TAG	UNP Q58806
D	485	GLU	-	EXPRESSION TAG	UNP Q58806
D	486	LYS	-	EXPRESSION TAG	UNP Q58806

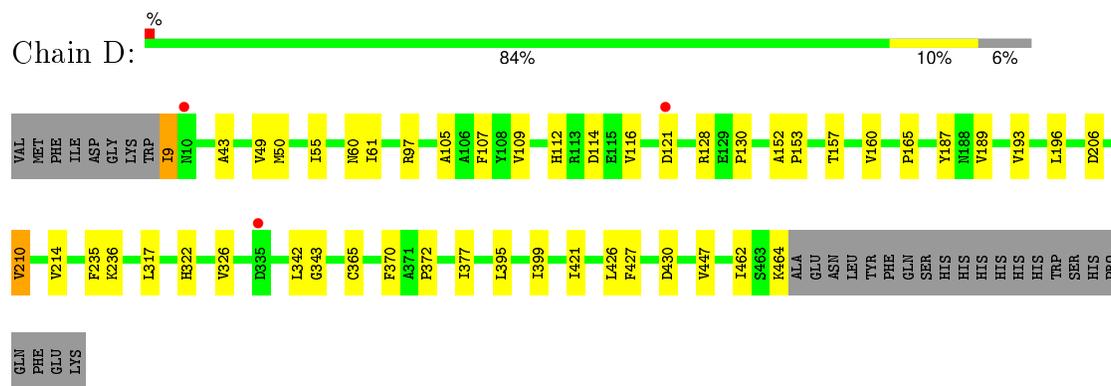
- Molecule 2 is NADP NICOTINAMIDE-ADENINE-DINUCLEOTIDE PHOSPHATE (three-letter code: NAP) (formula: C₂₁H₂₈N₇O₁₇P₃).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	31	10	5	13	3	0	0
2	B	1	31	10	5	13	3	0	0
2	C	1	31	10	5	13	3	0	0
2	D	1	31	10	5	13	3	0	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	170	170	170	0	0
3	B	181	181	181	0	0
3	C	152	152	152	0	0
3	D	107	107	107	0	0



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	164.24Å 77.38Å 167.39Å 90.00° 118.29° 90.00°	Depositor
Resolution (Å)	19.96 – 2.20 19.96 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.6 (19.96-2.20) 99.6 (19.96-2.20)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.62 (at 2.19Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.179 , 0.238 0.182 , 0.241	Depositor DCC
R_{free} test set	4688 reflections (5.27%)	DCC
Wilson B-factor (Å ²)	37.2	Xtriage
Anisotropy	0.030	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 33.5	EDS
Estimated twinning fraction	0.004 for h,-k,-h-l	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	1 of 93586 reflections (0.001%)	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	15019	wwPDB-VP
Average B, all atoms (Å ²)	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.06% of the height of the origin peak. No significant pseudotranslation is detected.*

¹ Intensities estimated from amplitudes.

² Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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: NAP

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	0.51	0/3658	0.60	0/4933
1	B	0.53	0/3659	0.61	1/4934 (0.0%)
1	C	0.48	0/3639	0.59	0/4909
1	D	0.47	0/3629	0.58	0/4895
All	All	0.50	0/14585	0.59	1/19671 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	228	LEU	CA-CB-CG	5.36	127.63	115.30

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	3579	0	3744	26	0
1	B	3580	0	3746	23	0
1	C	3566	0	3724	31	0
1	D	3560	0	3719	34	0
2	A	31	0	11	0	0
2	B	31	0	11	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	31	0	11	0	0
2	D	31	0	11	0	0
3	A	170	0	0	3	0
3	B	181	0	0	0	0
3	C	152	0	0	4	0
3	D	107	0	0	4	0
All	All	15019	0	14977	101	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 3.

The worst 5 of 101 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:365:CYS:SG	1:C:377:ILE:HD11	2.30	0.72
1:D:97:ARG:HD2	1:D:430:ASP:OD2	1.91	0.70
1:A:114[A]:ASP:HB2	1:D:116:VAL:HB	1.74	0.70
1:B:116:VAL:HB	1:C:114[A]:ASP:HB2	1.73	0.69
1:B:107[A]:PHE:CD1	1:D:107[A]:PHE:HB3	2.29	0.67

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	462/486 (95%)	447 (97%)	15 (3%)	0	100	100
1	B	462/486 (95%)	449 (97%)	13 (3%)	0	100	100
1	C	460/486 (95%)	448 (97%)	12 (3%)	0	100	100
1	D	459/486 (94%)	442 (96%)	16 (4%)	1 (0%)	52	59
All	All	1843/1944 (95%)	1786 (97%)	56 (3%)	1 (0%)	56	64

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	395	LEU

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	397/417 (95%)	382 (96%)	15 (4%)	40	49
1	B	397/417 (95%)	392 (99%)	5 (1%)	76	87
1	C	395/417 (95%)	390 (99%)	5 (1%)	76	87
1	D	394/417 (94%)	390 (99%)	4 (1%)	82	91
All	All	1583/1668 (95%)	1554 (98%)	29 (2%)	66	79

5 of 29 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	370	PHE
1	B	117	ILE
1	D	210	VAL
1	A	383	GLU
1	B	228	LEU

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

Mol	Chain	Res	Type
1	D	112	HIS

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](#)

4 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
2	NAP	A	500	-	27,33,52	1.35	3 (11%)	34,52,80	2.52	4 (11%)
2	NAP	B	500	-	27,33,52	1.33	3 (11%)	34,52,80	2.34	5 (14%)
2	NAP	C	500	-	27,33,52	1.34	3 (11%)	34,52,80	2.19	2 (5%)
2	NAP	D	500	-	27,33,52	1.36	3 (11%)	34,52,80	2.23	3 (8%)

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	NAP	A	500	-	-	0/17/37/67	0/3/3/5
2	NAP	B	500	-	-	0/17/37/67	0/3/3/5
2	NAP	C	500	-	-	0/17/37/67	0/3/3/5
2	NAP	D	500	-	-	0/17/37/67	0/3/3/5

The worst 5 of 12 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	500	NAP	C2A-N1A	2.26	1.38	1.33
2	C	500	NAP	C2A-N1A	2.31	1.38	1.33

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	500	NAP	C2A-N1A	2.64	1.38	1.33
2	A	500	NAP	C2A-N1A	2.94	1.39	1.33
2	A	500	NAP	C2A-N3A	3.28	1.38	1.32

The worst 5 of 14 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	500	NAP	N3A-C2A-N1A	-13.32	118.69	128.89
2	B	500	NAP	N3A-C2A-N1A	-11.95	119.75	128.89
2	C	500	NAP	N3A-C2A-N1A	-11.63	119.99	128.89
2	D	500	NAP	N3A-C2A-N1A	-11.55	120.05	128.89
2	D	500	NAP	C4A-C5A-N7A	-2.67	107.02	109.48

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	456/486 (93%)	-0.42	3 (0%) 89 88	24, 38, 55, 69	0
1	B	456/486 (93%)	-0.50	0 100 100	20, 34, 50, 71	0
1	C	456/486 (93%)	-0.38	2 (0%) 93 93	23, 41, 59, 86	0
1	D	456/486 (93%)	-0.29	3 (0%) 89 88	26, 44, 67, 80	0
All	All	1824/1944 (93%)	-0.40	8 (0%) 93 93	20, 39, 60, 86	0

The worst 5 of 8 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	9	ILE	3.3
1	A	10	ASN	2.6
1	C	10	ASN	2.6
1	A	85	GLY	2.5
1	D	10	ASN	2.5

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 carbohydrates 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. 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, 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	LLDF	B-factors(\AA^2)	Q<0.9
2	NAP	C	500	31/48	0.92	0.11	0.12	43,46,52,57	0
2	NAP	D	500	31/48	0.94	0.09	-0.34	42,44,49,56	0
2	NAP	A	500	31/48	0.96	0.08	-0.43	32,35,43,47	0
2	NAP	B	500	31/48	0.94	0.10	-0.52	35,36,43,47	0

6.5 Other polymers [i](#)

There are no such residues in this entry.