



wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 1, 2016 – 02:34 AM GMT

PDB ID : 2HPA
Title : STRUCTURAL ORIGINS OF L(+)-TARTRATE INHIBITION OF HUMAN PROSTATIC ACID PHOSPHATASE
Authors : Lacount, M.W.; Handy, G.; Lebioda, L.
Deposited on : 1998-09-11
Resolution : 2.90 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) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk26865

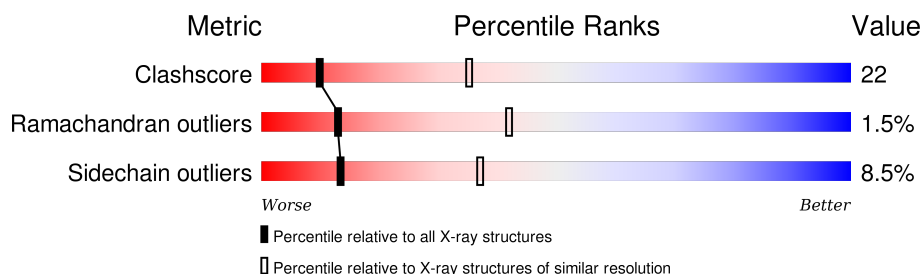
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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))
Clashscore	102246	1668 (2.90-2.90)
Ramachandran outliers	100387	1630 (2.90-2.90)
Sidechain outliers	100360	1632 (2.90-2.90)

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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	342	
1	B	342	
1	C	342	
1	D	342	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
7	PT3	B	2345	-	-	X	-
7	PT3	D	4345	-	-	X	-

2 Entry composition [i](#)

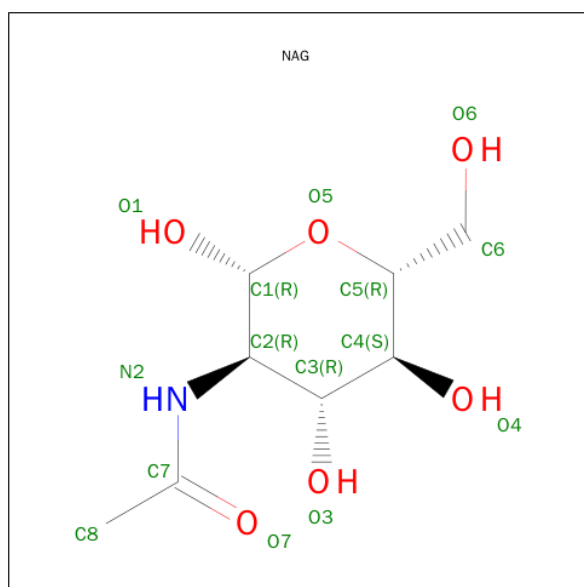
There are 8 unique types of molecules in this entry. The entry contains 11766 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 PROTEIN (ACID PHOSPHATASE).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	342	Total	C	N	O	S	0	0	0
			2801	1807	461	517	16			
1	B	342	Total	C	N	O	S	0	0	0
			2801	1807	461	517	16			
1	C	342	Total	C	N	O	S	0	0	0
			2801	1807	461	517	16			
1	D	342	Total	C	N	O	S	0	0	0
			2801	1807	461	517	16			

- Molecule 2 is SUGAR (N-ACETYL-D-GLUCOSAMINE) (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).



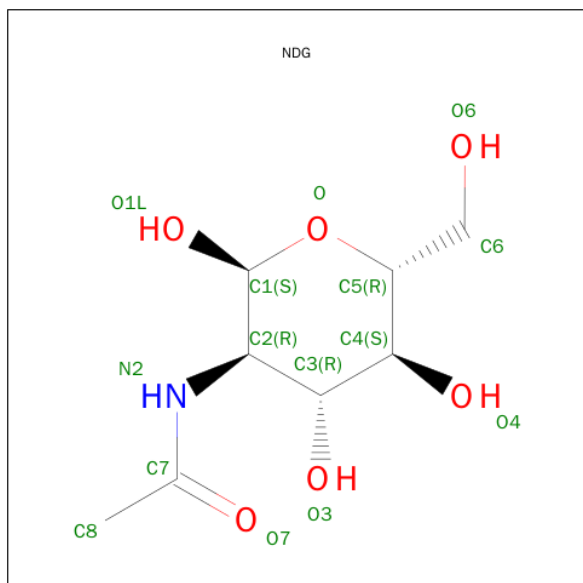
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	C	1	Total	C	N	O	0	0
			14	8	1	5		
2	C	1	Total	C	N	O	0	0
			14	8	1	5		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	B	1	Total	C	N	O	0	0
			14	8	1	5		
2	C	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 3 is SUGAR (2-(ACETYLAMINO)-2-DEOXY-A-D-GLUCOPYRANOSE) (three-letter code: NDG) (formula: $C_8H_{15}NO_6$).



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

- Molecule 4 is a polymer of unknown type called SUGAR (NAG-MAN-MAN).

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	3	Total	C	N	O	0	0
			36	20	1	15		

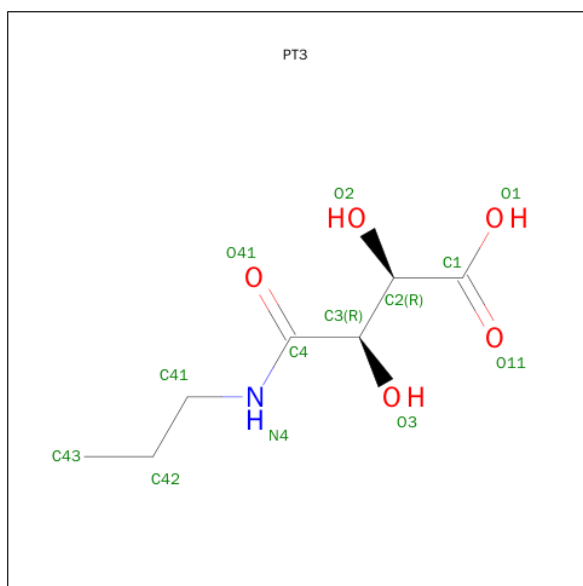
- Molecule 5 is a polymer of unknown type called SUGAR (NAG-NAG).

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	2	Total	C	N	O	0	0
			28	16	2	10		

- Molecule 6 is a polymer of unknown type called SUGAR (NAG-NAG-MAN).

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	D	3	Total	C	N	O	0	0
			39	22	2	15		

- Molecule 7 is N-PROPYL-TARTRAMIC ACID (three-letter code: PT3) (formula: C₇H₁₃NO₅).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	A	1	Total	C	N	O	0	0
			13	7	1	5		
7	B	1	Total	C	N	O	0	0
			13	7	1	5		
7	D	1	Total	C	N	O	0	0
			13	7	1	5		

- Molecule 8 is water.

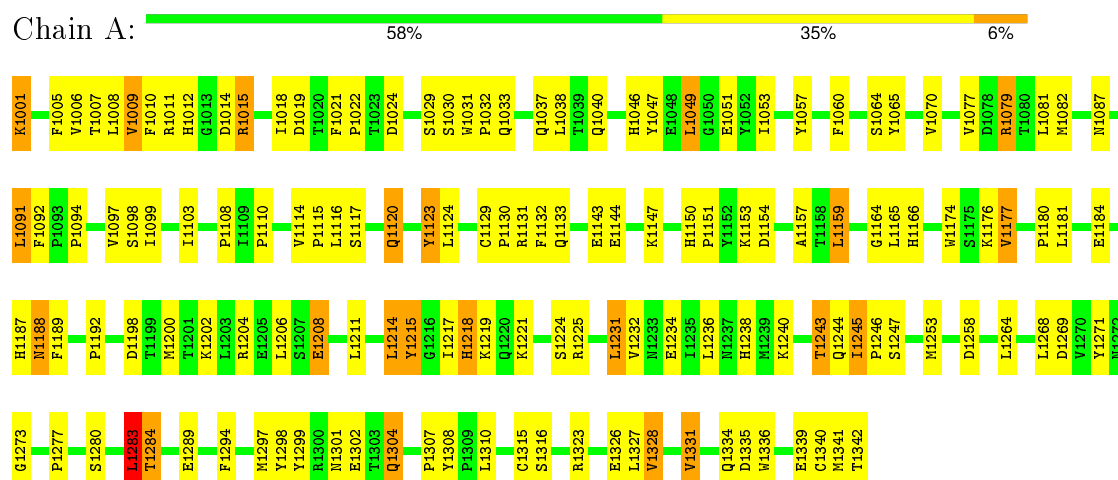
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	150	Total	O	0	0
			150	150		
8	B	84	Total	O	0	0
			84	84		
8	C	79	Total	O	0	0
			79	79		
8	D	37	Total	O	0	0
			37	37		

3 Residue-property plots

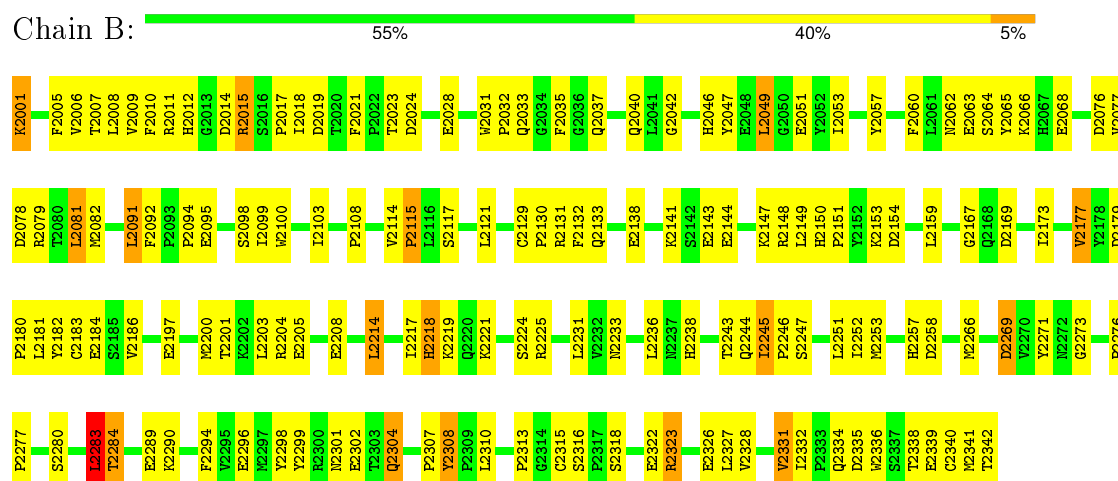
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according 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.

Note EDS was not executed.

• Molecule 1: PROTEIN (ACID PHOSPHATASE)

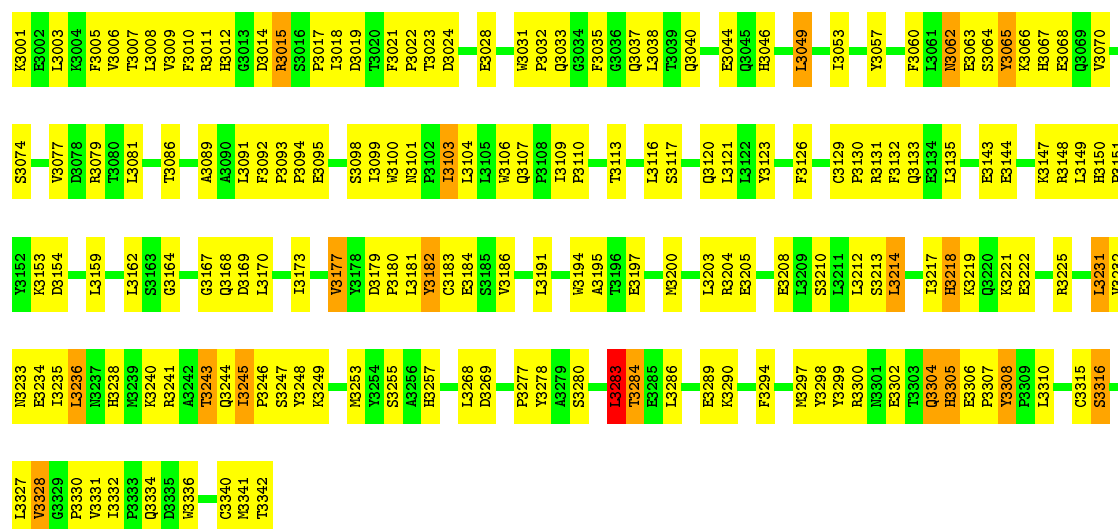


• Molecule 1: PROTEIN (ACID PHOSPHATASE)



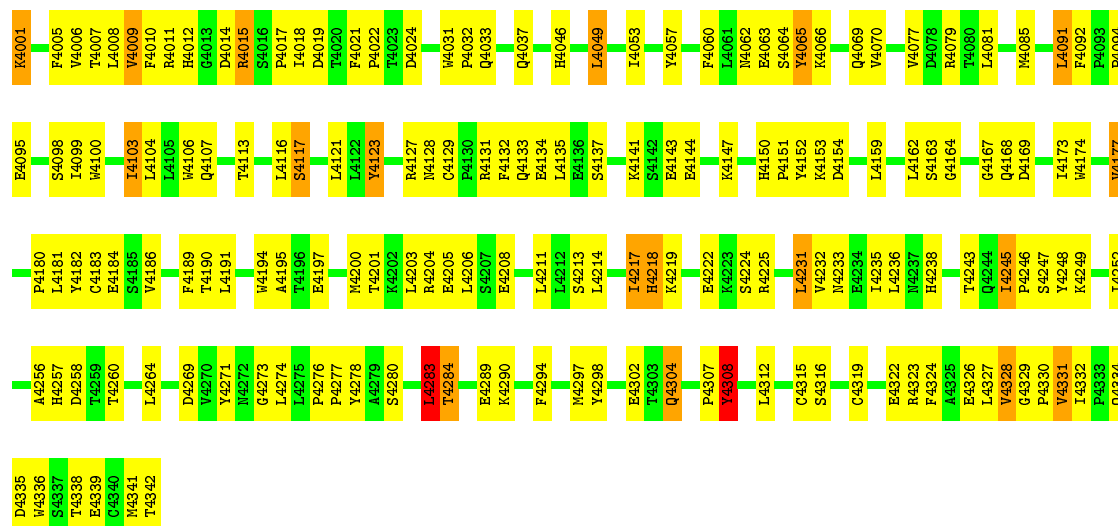
• Molecule 1: PROTEIN (ACID PHOSPHATASE)





• Molecule 1: PROTEIN (ACID PHOSPHATASE)

Chain D: 51% 43% 5% •



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section will therefore be incomplete.

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	119.86Å 202.68Å 71.11Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 2.90	Depositor
% Data completeness (in resolution range)	88.3 (8.00-2.90)	Depositor
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 3.851	Depositor
R, R_{free}	0.211 , 0.308	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	11766	wwPDB-VP
Average B, all atoms (Å ²)	17.0	wwPDB-VP

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: BMA, PT3, NAG, NDG, MAN

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	0.63	4/2883 (0.1%)	0.79	3/3914 (0.1%)
1	B	0.63	1/2883 (0.0%)	0.77	2/3914 (0.1%)
1	C	0.59	2/2883 (0.1%)	0.78	1/3914 (0.0%)
1	D	0.64	2/2883 (0.1%)	0.79	3/3914 (0.1%)
All	All	0.62	9/11532 (0.1%)	0.78	9/15656 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
1	B	0	1
1	C	0	1
1	D	0	2
All	All	0	5

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	4308	TYR	CB-CG	-9.05	1.38	1.51
1	D	4308	TYR	CD2-CE2	-7.59	1.27	1.39
1	B	2184	GLU	CG-CD	-7.06	1.41	1.51
1	A	1208	GLU	CD-OE2	6.99	1.33	1.25
1	A	1208	GLU	CG-CD	-5.81	1.43	1.51

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	3283	LEU	CA-CB-CG	8.35	134.51	115.30
1	A	1208	GLU	OE1-CD-OE2	7.40	132.18	123.30
1	B	2283	LEU	CA-CB-CG	6.76	130.86	115.30
1	D	4283	LEU	CA-CB-CG	6.65	130.59	115.30
1	D	4308	TYR	N-CA-CB	-6.56	98.79	110.60

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	1215	TYR	Sidechain
1	B	2308	TYR	Sidechain
1	C	3182	TYR	Sidechain
1	D	4065	TYR	Sidechain
1	D	4308	TYR	Sidechain

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	2801	0	2746	121	0
1	B	2801	0	2747	121	0
1	C	2801	0	2745	152	0
1	D	2801	0	2747	124	0
2	B	14	0	13	0	0
2	C	42	0	39	2	0
3	A	14	0	13	5	0
4	A	36	0	31	3	0
5	A	28	0	25	0	0
6	D	39	0	34	6	0
7	A	13	0	12	2	0
7	B	13	0	12	6	0
7	D	13	0	12	6	0
8	A	150	0	0	11	0
8	B	84	0	0	4	0
8	C	79	0	0	7	0
8	D	37	0	0	0	0
All	All	11766	0	11176	499	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 22.

The worst 5 of 499 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:1189:PHE:CE1	1:C:3245:ILE:HG22	1.99	0.97
1:D:4033:GLN:HB3	1:D:4037:GLN:HG2	1.49	0.92
1:C:3305:HIS:CE1	1:C:3306:GLU:HG2	2.08	0.88
1:C:3033:GLN:HB3	1:C:3037:GLN:HG2	1.56	0.87
1:B:2225:ARG:HH22	1:B:2334:GLN:HG2	1.41	0.84

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	340/342 (99%)	309 (91%)	27 (8%)	4 (1%)	16	48
1	B	340/342 (99%)	313 (92%)	22 (6%)	5 (2%)	13	42
1	C	340/342 (99%)	306 (90%)	29 (8%)	5 (2%)	13	42
1	D	340/342 (99%)	312 (92%)	22 (6%)	6 (2%)	11	37
All	All	1360/1368 (99%)	1240 (91%)	100 (7%)	20 (2%)	13	42

5 of 20 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	3218	HIS
1	A	1064	SER
1	A	1218	HIS
1	B	2064	SER
1	C	3064	SER

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	314/314 (100%)	287 (91%)	27 (9%)	13	36
1	B	314/314 (100%)	287 (91%)	27 (9%)	13	36
1	C	314/314 (100%)	288 (92%)	26 (8%)	14	38
1	D	314/314 (100%)	287 (91%)	27 (9%)	13	36
All	All	1256/1256 (100%)	1149 (92%)	107 (8%)	13	37

5 of 107 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	2284	THR
1	C	3091	LEU
1	D	4245	ILE
1	B	2304	GLN
1	C	3001	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 26 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	2237	ASN
1	B	2305	HIS
1	D	4265	GLN
1	B	2244	GLN
1	B	2265	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 ⓘ

8 carbohydrates 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	$\# Z > 2$
4	NAG	A	1372	4	14,14,15	1.63	2 (14%)	15,19,21	1.45	2 (13%)
4	BMA	A	1373	4	11,11,12	2.50	4 (36%)	14,15,17	1.19	2 (14%)
4	MAN	A	1374	4	11,11,12	2.28	4 (36%)	14,15,17	1.18	1 (7%)
5	NAG	A	1381	1,5	14,14,15	1.44	2 (14%)	15,19,21	1.56	2 (13%)
5	NAG	A	1382	5	14,14,15	1.57	1 (7%)	15,19,21	1.71	2 (13%)
6	NAG	D	4381	1,6	14,14,15	1.74	2 (14%)	15,19,21	1.86	2 (13%)
6	NAG	D	4382	6	14,14,15	1.86	2 (14%)	15,19,21	1.89	3 (20%)
6	BMA	D	4383	6	11,11,12	2.22	4 (36%)	14,15,17	1.35	2 (14%)

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
4	NAG	A	1372	4	-	0/6/23/26	0/1/1/1
4	BMA	A	1373	4	-	0/2/19/22	0/1/1/1
4	MAN	A	1374	4	-	0/2/19/22	0/1/1/1
5	NAG	A	1381	1,5	-	0/6/23/26	0/1/1/1
5	NAG	A	1382	5	-	0/6/23/26	0/1/1/1
6	NAG	D	4381	1,6	-	0/6/23/26	0/1/1/1
6	NAG	D	4382	6	-	0/6/23/26	0/1/1/1
6	BMA	D	4383	6	-	0/2/19/22	0/1/1/1

The worst 5 of 21 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	D	4381	NAG	O5-C1	-2.80	1.39	1.43
5	A	1381	NAG	O5-C1	-2.72	1.39	1.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	D	4382	NAG	O5-C1	-2.19	1.40	1.43
6	D	4383	BMA	C6-C5	2.07	1.59	1.51
6	D	4383	BMA	O5-C1	2.11	1.47	1.43

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	D	4382	NAG	C2-N2-C7	-5.44	116.05	123.04
5	A	1382	NAG	C2-N2-C7	-4.62	117.10	123.04
4	A	1372	NAG	C2-N2-C7	-3.70	118.29	123.04
6	D	4381	NAG	C2-N2-C7	-3.62	118.39	123.04
6	D	4383	BMA	O2-C2-C3	-2.69	104.70	110.12

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	1372	NAG	2	0
4	A	1373	BMA	2	0
6	D	4381	NAG	6	0
6	D	4382	NAG	3	0

5.6 Ligand geometry [i](#)

8 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	$\# Z > 2$
7	PT3	A	1345	-	8,12,12	1.44	1 (12%)	11,15,15	2.11	3 (27%)
3	NDG	A	1371	1	14,14,15	1.73	3 (21%)	15,19,21	1.63	2 (13%)
7	PT3	B	2345	-	8,12,12	1.60	2 (25%)	11,15,15	1.73	5 (45%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	NAG	B	2381	1	14,14,15	1.70	2 (14%)	15,19,21	1.79	2 (13%)
2	NAG	C	3361	1	14,14,15	4.58	9 (64%)	15,19,21	2.56	6 (40%)
2	NAG	C	3371	1	14,14,15	1.81	2 (14%)	15,19,21	1.02	1 (6%)
2	NAG	C	3381	1	14,14,15	1.90	3 (21%)	15,19,21	1.51	2 (13%)
7	PT3	D	4345	-	8,12,12	1.58	1 (12%)	11,15,15	1.98	4 (36%)

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
7	PT3	A	1345	-	-	0/12/16/16	0/0/0/0
3	NDG	A	1371	1	-	0/6/23/26	0/1/1/1
7	PT3	B	2345	-	-	0/12/16/16	0/0/0/0
2	NAG	B	2381	1	-	0/6/23/26	0/1/1/1
2	NAG	C	3361	1	-	0/6/23/26	0/1/1/1
2	NAG	C	3371	1	-	0/6/23/26	0/1/1/1
2	NAG	C	3381	1	-	0/6/23/26	0/1/1/1
7	PT3	D	4345	-	-	0/12/16/16	0/0/0/0

The worst 5 of 23 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	3361	NAG	O5-C1	-11.43	1.24	1.43
7	D	4345	PT3	O41-C4	-3.48	1.16	1.23
7	A	1345	PT3	O41-C4	-2.75	1.18	1.23
2	C	3371	NAG	O5-C1	-2.69	1.39	1.43
2	C	3361	NAG	O5-C5	-2.59	1.37	1.43

The worst 5 of 25 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	3361	NAG	C4-C3-C2	-4.44	104.33	111.23
3	A	1371	NDG	C2-N2-C7	-4.36	117.44	123.04
2	C	3361	NAG	C2-N2-C7	-4.08	117.79	123.04
7	A	1345	PT3	C1-C2-C3	-4.00	105.16	113.35
2	B	2381	NAG	C2-N2-C7	-3.63	118.37	123.04

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

6 monomers are involved in 21 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	A	1345	PT3	2	0
3	A	1371	NDG	5	0
7	B	2345	PT3	6	0
2	C	3361	NAG	1	0
2	C	3371	NAG	1	0
7	D	4345	PT3	6	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 ⓘ

EDS was not executed - this section will therefore be empty.

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

EDS was not executed - this section will therefore be empty.

6.3 Carbohydrates ⓘ

EDS was not executed - this section will therefore be empty.

6.4 Ligands ⓘ

EDS was not executed - this section will therefore be empty.

6.5 Other polymers ⓘ

EDS was not executed - this section will therefore be empty.