



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 07:44 PM UTC

PDB ID : 2FF5 / pdb_00002ff5
Title : Synthesis of C-D-Glycopyranosyl-Hydroquinones and-Benzoquinones. Inhibition of PTP1B. Inhibition of and binding to glycogen phosphorylase in the crystal
Authors : Chrygina, E.D.; Kosmopoulou, M.N.; Leonidas, D.D.; Oikonomakos, N.G.
Deposited on : 2005-12-19
Resolution : 2.03 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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtrriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

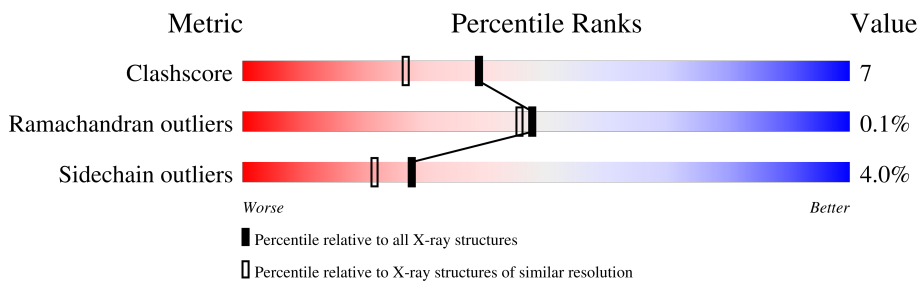
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.03 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	190562	1022 (2.02-2.02)
Ramachandran outliers	187476	1014 (2.02-2.02)
Sidechain outliers	187428	1014 (2.02-2.02)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	842	 78% 16% . .

2 Entry composition [i](#)

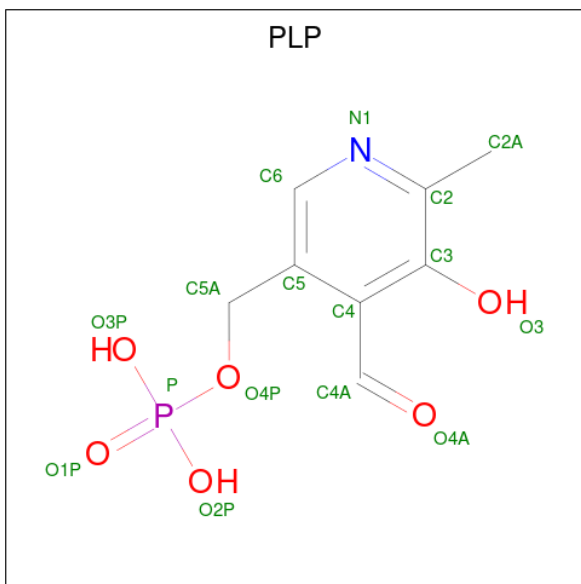
There are 4 unique types of molecules in this entry. The entry contains 6827 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Glycogen phosphorylase, muscle form.

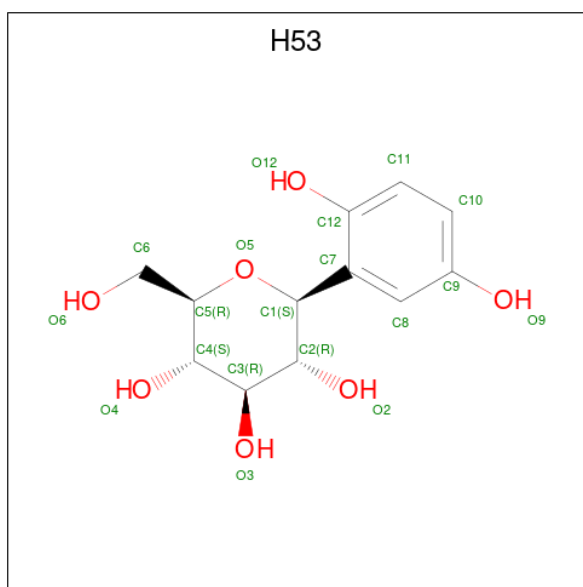
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	807	6558	4180	1155	1194	29	0	0	0

- Molecule 2 is PYRIDOXAL-5'-PHOSPHATE (CCD ID: PLP) (formula: C₈H₁₀NO₆P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	15	8	1	5	1	0	0

- Molecule 3 is (1S)-1,5-anhydro-1-(2,5-dihydroxyphenyl)-D-glucitol (CCD ID: H53) (formula: C₁₂H₁₆O₇).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf	
3	A	1	Total	C	O	0	0
			19	12	7		

- Molecule 4 is water.

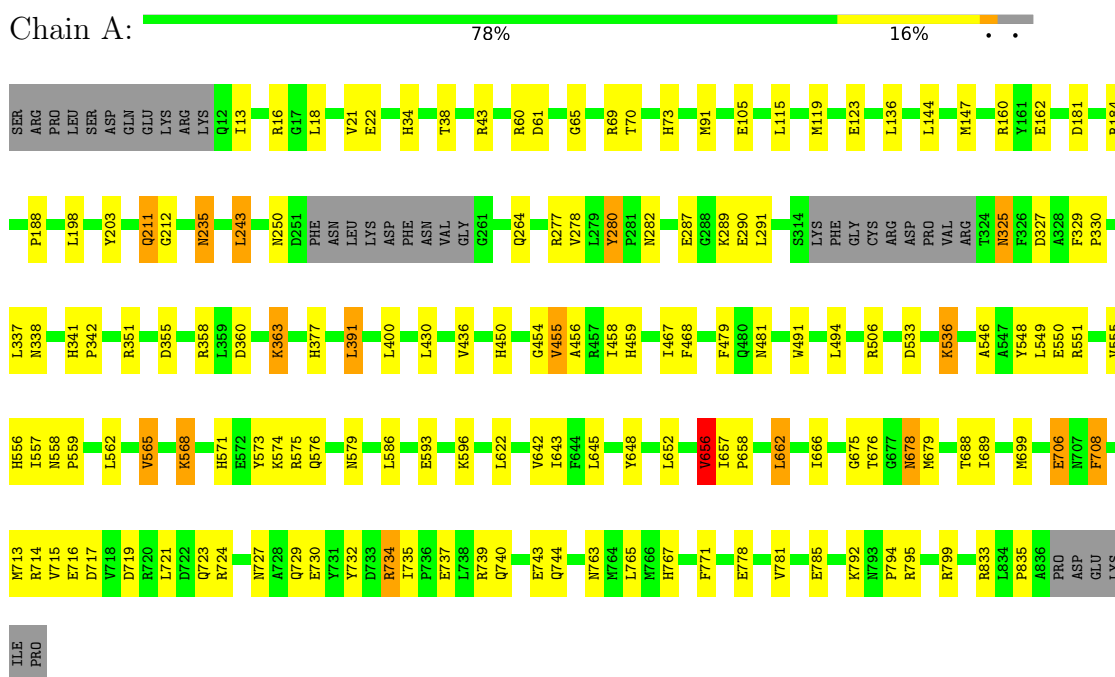
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	235	Total	O	0	0
			235	235		

3 Residue-property plots

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. 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. 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: Glycogen phosphorylase, muscle form



4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	128.17Å 128.17Å 115.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	21.36 – 2.03	Depositor
% Data completeness (in resolution range)	97.7 (21.36-2.03)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.06	Depositor
Refinement program	CNS	Depositor
R, R_{free}	0.187 , 0.212	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	6827	wwPDB-VP
Average B, all atoms (Å ²)	39.0	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: PLP, H53

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	0.38	0/6704	0.91	27/9073 (0.3%)

There are no bond length outliers.

All (27) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	675	GLY	N-CA-C	-7.43	103.49	112.48
1	A	565	VAL	N-CA-C	6.89	118.41	108.48
1	A	91	MET	N-CA-C	6.64	118.60	111.36
1	A	455	VAL	N-CA-C	6.56	118.40	112.17
1	A	278	VAL	N-CA-C	6.55	116.99	108.35
1	A	575	ARG	N-CA-C	6.45	120.29	111.39
1	A	593	GLU	CA-C-N	6.20	125.68	119.24
1	A	593	GLU	C-N-CA	6.20	125.68	119.24
1	A	430	LEU	N-CA-C	-6.18	105.23	112.89
1	A	105	GLU	N-CA-C	6.03	117.52	111.07
1	A	212	GLY	N-CA-C	5.91	119.47	112.33
1	A	454	GLY	N-CA-C	-5.83	103.67	112.89
1	A	491	TRP	N-CA-C	5.74	119.90	113.02
1	A	714	ARG	N-CA-C	-5.72	102.30	110.59
1	A	676	THR	N-CA-C	-5.70	108.12	114.62
1	A	479	PHE	N-CA-C	5.57	117.76	109.25
1	A	576	GLN	N-CA-C	-5.50	105.38	111.71
1	A	280	TYR	CA-C-N	5.44	126.64	119.84
1	A	280	TYR	C-N-CA	5.44	126.64	119.84
1	A	558	ASN	CA-C-N	5.33	125.04	119.82
1	A	558	ASN	C-N-CA	5.33	125.04	119.82
1	A	771	PHE	N-CA-C	5.20	119.59	112.88
1	A	688	THR	N-CA-C	5.18	117.41	109.07
1	A	666	ILE	N-CA-C	5.13	120.01	109.34

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	203	TYR	CB-CA-C	-5.06	110.76	116.63
1	A	250	ASN	N-CA-C	5.06	118.71	112.54
1	A	656	VAL	N-CA-C	5.01	115.78	110.72

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	6558	0	6501	89	0
2	A	15	0	7	0	0
3	A	19	0	14	0	0
4	A	235	0	0	6	0
All	All	6827	0	6522	89	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 7.

All (89) 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:69:ARG:HH12	1:A:835:PRO:HB2	1.09	1.09
1:A:69:ARG:NH1	1:A:835:PRO:HB2	1.83	0.94
1:A:455:VAL:H	1:A:459:HIS:HD2	1.29	0.80
1:A:652:LEU:O	1:A:656:VAL:HG23	1.90	0.72
1:A:549:LEU:HB3	1:A:555:VAL:HG23	1.72	0.70
1:A:763:ASN:ND2	1:A:767:HIS:HD2	1.89	0.70
1:A:506:ARG:NH2	1:A:533:ASP:OD2	2.25	0.67
1:A:678:ASN:HD22	1:A:679:MET:H	1.40	0.67
1:A:730:GLU:O	1:A:734:ARG:HG3	1.96	0.66
1:A:329:PHE:HB3	1:A:330:PRO:HD3	1.78	0.65
1:A:235:ASN:H	1:A:235:ASN:HD22	1.44	0.64
1:A:235:ASN:HA	1:A:833:ARG:HG3	1.79	0.64
1:A:536:LYS:HB3	1:A:536:LYS:NZ	2.13	0.63

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:699:MET:HE2	1:A:708:PHE:HZ	1.67	0.60
1:A:34:HIS:HD2	1:A:38:THR:OG1	1.87	0.58
1:A:549:LEU:HB3	1:A:555:VAL:CG2	2.34	0.58
1:A:34:HIS:HE1	1:A:61:ASP:OD1	1.87	0.58
1:A:719:ASP:O	1:A:723:GLN:HG2	2.04	0.58
1:A:235:ASN:HA	1:A:833:ARG:CD	2.35	0.57
1:A:678:ASN:HD22	1:A:678:ASN:N	2.03	0.56
1:A:713:MET:HB3	1:A:717:ASP:HB2	1.87	0.56
1:A:739:ARG:O	1:A:743:GLU:HG3	2.06	0.56
1:A:549:LEU:HD12	1:A:557:ILE:HD13	1.87	0.55
1:A:557:ILE:O	1:A:559:PRO:HD3	2.07	0.54
1:A:325:ASN:OD1	1:A:327:ASP:HB2	2.07	0.54
1:A:648:TYR:HA	1:A:652:LEU:HD23	1.88	0.54
1:A:160:ARG:HB2	1:A:243:LEU:HB3	1.88	0.54
1:A:282:ASN:HB2	4:A:1162:HOH:O	2.08	0.53
1:A:144:LEU:HD23	1:A:147:MET:CE	2.38	0.53
1:A:550:GLU:HG2	1:A:555:VAL:O	2.09	0.53
1:A:568:LYS:HG3	1:A:574:LYS:HD3	1.89	0.53
1:A:43:ARG:NH2	1:A:115:LEU:HB3	2.23	0.52
1:A:290:GLU:HG3	1:A:391:LEU:HD21	1.90	0.52
1:A:136:LEU:C	1:A:136:LEU:HD23	2.34	0.52
1:A:678:ASN:HD22	1:A:679:MET:N	2.07	0.52
1:A:706:GLU:H	1:A:706:GLU:CD	2.17	0.52
1:A:795:ARG:O	1:A:799:ARG:HG3	2.09	0.52
1:A:678:ASN:ND2	1:A:679:MET:H	2.06	0.51
1:A:360:ASP:OD1	1:A:363:LYS:HB2	2.10	0.51
1:A:536:LYS:HB3	1:A:536:LYS:HZ2	1.74	0.51
1:A:65:GLY:O	1:A:69:ARG:HG3	2.10	0.51
1:A:235:ASN:HA	1:A:833:ARG:CG	2.42	0.50
1:A:562:LEU:HD21	1:A:662:LEU:HB2	1.94	0.49
1:A:735:ILE:HD13	1:A:778:GLU:HG3	1.93	0.49
1:A:740:GLN:O	1:A:744:GLN:HG3	2.13	0.49
1:A:341:HIS:HB2	1:A:342:PRO:HD3	1.94	0.48
1:A:568:LYS:HE2	4:A:1029:HOH:O	2.13	0.48
1:A:467:ILE:HG22	1:A:468:PHE:CD2	2.48	0.48
1:A:181:ASP:HB3	1:A:184:ARG:NH2	2.28	0.48
1:A:494:LEU:C	1:A:494:LEU:HD23	2.38	0.47
1:A:450:HIS:HE1	4:A:1125:HOH:O	1.97	0.47
1:A:571:HIS:HD2	1:A:573:TYR:H	1.62	0.47
1:A:287:GLU:HG2	1:A:289:LYS:HG2	1.95	0.47
1:A:724:ARG:NH2	4:A:1227:HOH:O	2.48	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:458:ILE:HD11	1:A:715:VAL:HG21	1.97	0.47
1:A:450:HIS:HD2	4:A:1182:HOH:O	1.98	0.47
1:A:18:LEU:N	1:A:18:LEU:HD22	2.31	0.46
1:A:162:GLU:OE2	1:A:277:ARG:NH2	2.45	0.46
1:A:280:TYR:OH	1:A:291:LEU:HB3	2.16	0.46
1:A:716:GLU:H	1:A:716:GLU:CD	2.24	0.46
1:A:467:ILE:HG22	1:A:468:PHE:CE2	2.51	0.45
1:A:678:ASN:N	1:A:678:ASN:ND2	2.62	0.45
1:A:732:TYR:CZ	1:A:739:ARG:HG3	2.52	0.45
1:A:549:LEU:O	1:A:555:VAL:HG22	2.17	0.44
1:A:579:ASN:C	1:A:579:ASN:HD22	2.25	0.44
1:A:60:ARG:HD2	1:A:188:PRO:O	2.18	0.44
1:A:727:ASN:OD1	1:A:729:GLN:HB3	2.18	0.44
1:A:338:ASN:OD1	1:A:377:HIS:NE2	2.51	0.43
1:A:781:VAL:O	1:A:785:GLU:HG3	2.18	0.43
1:A:562:LEU:C	1:A:562:LEU:HD23	2.44	0.43
1:A:351:ARG:O	1:A:355:ASP:HB2	2.19	0.43
1:A:70:THR:O	1:A:73:HIS:HB3	2.19	0.43
1:A:455:VAL:H	1:A:459:HIS:CD2	2.21	0.43
1:A:546:ALA:HA	1:A:557:ILE:HD11	2.00	0.42
1:A:642:VAL:C	1:A:643:ILE:HD12	2.44	0.42
1:A:657:ILE:HB	1:A:658:PRO:HD3	2.01	0.42
1:A:737:GLU:HG3	4:A:1142:HOH:O	2.20	0.42
1:A:363:LYS:HA	1:A:363:LYS:HE2	2.01	0.42
1:A:689:ILE:HG23	1:A:689:ILE:O	2.19	0.42
1:A:456:ALA:C	1:A:481:ASN:HD21	2.28	0.41
1:A:792:LYS:O	1:A:794:PRO:HD3	2.20	0.41
1:A:235:ASN:HD22	1:A:235:ASN:N	2.07	0.41
1:A:119:MET:O	1:A:123:GLU:HG3	2.21	0.41
1:A:678:ASN:ND2	1:A:679:MET:N	2.67	0.41
1:A:13:ILE:CG1	1:A:16:ARG:HG3	2.52	0.41
1:A:43:ARG:NH2	1:A:115:LEU:O	2.52	0.41
1:A:548:TYR:CD1	1:A:548:TYR:C	2.99	0.41
1:A:550:GLU:OE2	1:A:556:HIS:ND1	2.49	0.40
1:A:211:GLN:O	1:A:358:ARG:NH1	2.54	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	801/842 (95%)	773 (96%)	27 (3%)	1 (0%)	48	45

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	551	ARG

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	697/731 (95%)	669 (96%)	28 (4%)	28	22

All (28) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	VAL
1	A	22	GLU
1	A	198	LEU
1	A	211	GLN
1	A	235	ASN
1	A	243	LEU
1	A	264	GLN
1	A	325	ASN
1	A	337	LEU
1	A	363	LYS

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Mol	Chain	Res	Type
1	A	391	LEU
1	A	400	LEU
1	A	436	VAL
1	A	536	LYS
1	A	565	VAL
1	A	568	LYS
1	A	586	LEU
1	A	596	LYS
1	A	622	LEU
1	A	645	LEU
1	A	656	VAL
1	A	662	LEU
1	A	678	ASN
1	A	706	GLU
1	A	708	PHE
1	A	721	LEU
1	A	734	ARG
1	A	765	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (19) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	23	ASN
1	A	34	HIS
1	A	72	GLN
1	A	73	HIS
1	A	208	HIS
1	A	211	GLN
1	A	235	ASN
1	A	282	ASN
1	A	412	ASN
1	A	450	HIS
1	A	459	HIS
1	A	481	ASN
1	A	484	ASN
1	A	566	GLN
1	A	571	HIS
1	A	579	ASN
1	A	678	ASN
1	A	763	ASN
1	A	767	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 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	PLP	A	999	1	15,15,16	1.43	3 (20%)	21,22,23	1.28	4 (19%)
3	H53	A	998	-	20,20,20	3.94	7 (35%)	28,29,29	0.80	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
2	PLP	A	999	1	-	1/6/6/8	0/1/1/1
3	H53	A	998	-	-	1/6/26/26	0/2/2/2

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	998	H53	C12-C7	8.67	1.50	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	998	H53	C8-C9	7.12	1.49	1.39
3	A	998	H53	C11-C12	6.63	1.51	1.39
3	A	998	H53	O9-C9	-6.62	1.22	1.37
3	A	998	H53	O12-C12	-6.22	1.23	1.36
3	A	998	H53	C10-C9	5.66	1.49	1.39
2	A	999	PLP	C4A-C4	3.00	1.57	1.51
3	A	998	H53	O5-C1	2.59	1.47	1.43
2	A	999	PLP	C3-C2	-2.24	1.38	1.41
2	A	999	PLP	O3-C3	2.19	1.41	1.36

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	999	PLP	O3P-P-O1P	2.70	121.36	110.83
2	A	999	PLP	C6-C5-C4	2.34	120.02	118.10
2	A	999	PLP	O3P-P-O4P	2.32	112.73	106.67
2	A	999	PLP	O2P-P-O4P	-2.10	101.18	106.67

There are no chirality outliers.

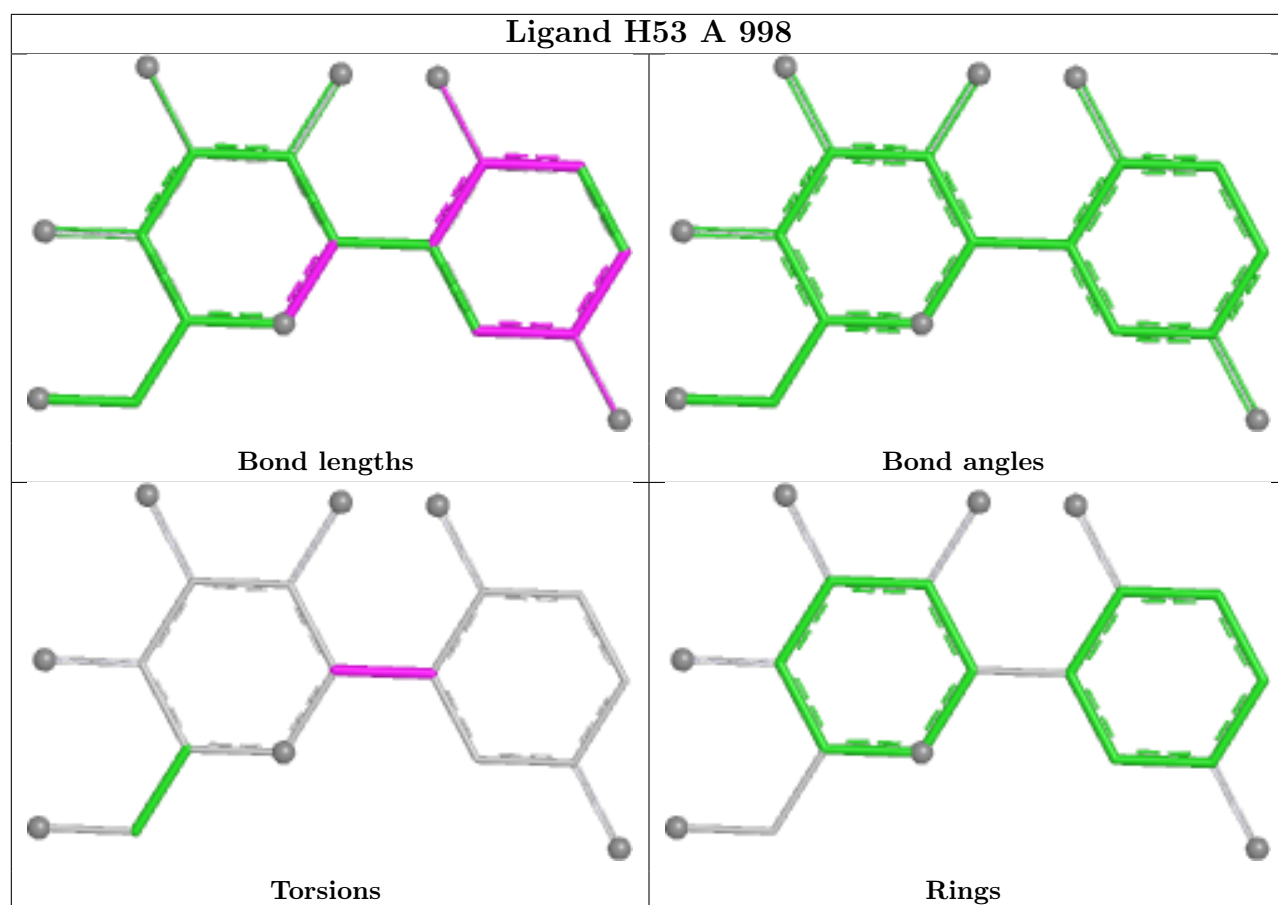
All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	999	PLP	C4-C5-C5A-O4P
3	A	998	H53	C2-C1-C7-C8

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



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 is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.