



# Full wwPDB X-ray Structure Validation Report ⓘ

Jan 31, 2016 – 10:26 PM GMT

PDB ID : 1TPH  
Title : 1.8 ANGSTROMS CRYSTAL STRUCTURE OF WILD TYPE CHICKEN  
TRIOSEPHOSPHATE ISOMERASE-PHOSPHOGLYCOLOHYDROXAMA  
TE COMPLEX  
Authors : Zhang, Z.; Sugio, S.; Komives, E.A.; Liu, K.D.; Knowles, J.R.; Petsko, G.A.;  
Ringe, D.  
Deposited on : 1993-12-22  
Resolution : 1.80 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](mailto: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.

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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

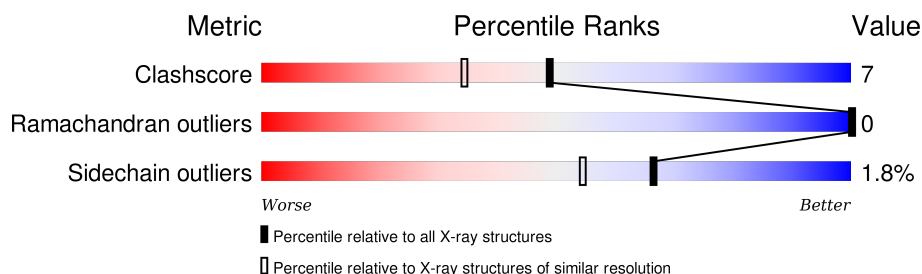
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.80 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	5383 (1.80-1.80)
Ramachandran outliers	100387	5320 (1.80-1.80)
Sidechain outliers	100360	5319 (1.80-1.80)

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  $\geq 3$ , 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	1	247	 81% 17% ..
1	2	247	 78% 19% ..

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 3981 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.

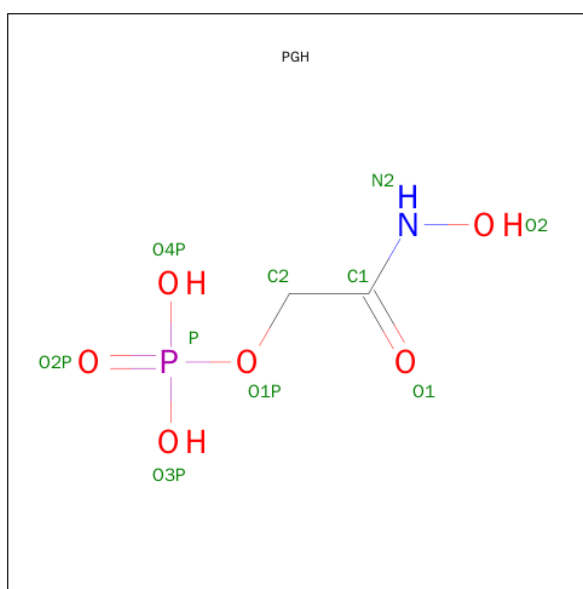
- Molecule 1 is a protein called TRIOSEPHOSPHATE ISOMERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	1	245	Total	C	N	O	S	0	0	0
			1856	1176	325	349	6			
1	2	245	Total	C	N	O	S	0	0	0
			1856	1176	325	349	6			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
1	194	THR	SER	CONFLICT	UNP P00940
2	194	THR	SER	CONFLICT	UNP P00940

- Molecule 2 is PHOSPHOGLYCOLOHYDROXAMIC ACID (three-letter code: PGH) (formula: C<sub>2</sub>H<sub>6</sub>NO<sub>6</sub>P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	1	1	Total	C	N	O	P	0	0
			10	2	1	6	1		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	2	1	Total	C	N	O	P	0	0
			10	2	1	6	1		

- Molecule 3 is water.

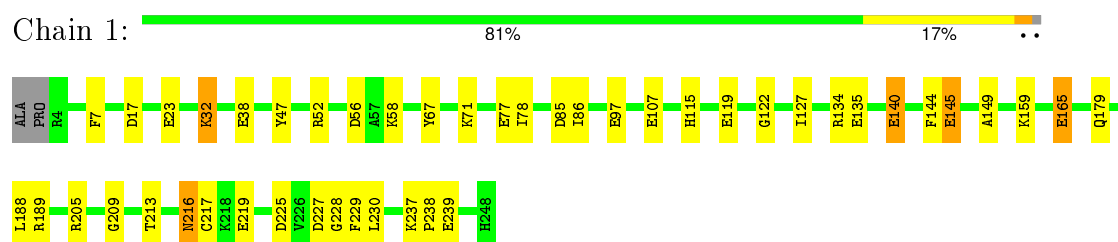
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	1	119	Total	O	0	0
			119	119		
3	2	130	Total	O	0	0
			130	130		

### 3 Residue-property plots

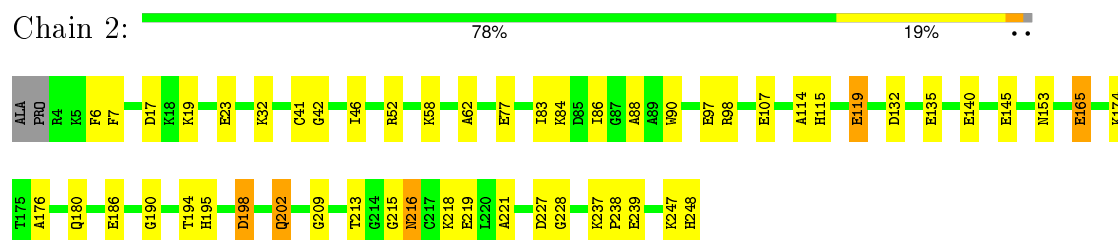
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according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



#### • Molecule 1: TRIOSEPHOSPHATE ISOMERASE



## 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, $\alpha$ , $\beta$ , $\gamma$	136.40 Å   74.00 Å   57.20 Å 90.00°   90.00°   90.00°	Depositor
Resolution (Å)	6.00 – 1.80	Depositor
% Data completeness (in resolution range)	(Not available) (6.00-1.80)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	PROLSQ	Depositor
R, $R_{free}$	0.185 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3981	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	15.0	wwPDB-VP

## 5 Model quality ⓘ

### 5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: PGH

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	1	1.13	12/1891 (0.6%)	1.51	15/2552 (0.6%)
1	2	1.13	13/1891 (0.7%)	1.50	12/2552 (0.5%)
All	All	1.13	25/3782 (0.7%)	1.51	27/5104 (0.5%)

All (25) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	1	97	GLU	CD-OE2	8.85	1.35	1.25
1	1	145	GLU	CD-OE2	8.10	1.34	1.25
1	2	23	GLU	CD-OE2	7.94	1.34	1.25
1	1	239	GLU	CD-OE1	7.05	1.33	1.25
1	2	216	ASN	CA-CB	6.91	1.71	1.53
1	2	77	GLU	CD-OE1	6.81	1.33	1.25
1	2	145	GLU	CD-OE2	6.53	1.32	1.25
1	1	135	GLU	CD-OE2	6.33	1.32	1.25
1	2	140	GLU	CD-OE1	6.30	1.32	1.25
1	2	97	GLU	CD-OE2	6.14	1.32	1.25
1	2	107	GLU	CD-OE1	6.08	1.32	1.25
1	2	165	GLU	CD-OE1	6.07	1.32	1.25
1	1	219	GLU	CD-OE1	5.87	1.32	1.25
1	1	23	GLU	CD-OE2	5.77	1.32	1.25
1	2	135	GLU	CD-OE2	5.76	1.31	1.25
1	1	38	GLU	CD-OE2	5.72	1.31	1.25
1	1	77	GLU	CD-OE1	5.63	1.31	1.25
1	1	119	GLU	CD-OE1	5.55	1.31	1.25
1	2	77	GLU	CD-OE2	-5.46	1.19	1.25
1	1	107	GLU	CD-OE1	5.36	1.31	1.25
1	2	239	GLU	CD-OE2	-5.34	1.19	1.25
1	2	186	GLU	CD-OE1	5.29	1.31	1.25
1	2	119	GLU	CD-OE1	5.22	1.31	1.25
1	1	140	GLU	CD-OE1	5.11	1.31	1.25

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	1	165	GLU	CD-OE1	5.05	1.31	1.25

All (27) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	1	205	ARG	NE-CZ-NH1	13.75	127.17	120.30
1	2	216	ASN	CB-CA-C	-8.17	94.05	110.40
1	2	215	GLY	C-N-CA	8.14	142.06	121.70
1	1	227	ASP	CB-CG-OD2	7.97	125.48	118.30
1	2	41	CYS	O-C-N	7.21	135.46	123.20
1	1	189	ARG	NE-CZ-NH1	-7.17	116.72	120.30
1	1	47	TYR	CB-CG-CD2	6.69	125.02	121.00
1	2	227	ASP	CB-CG-OD2	6.25	123.92	118.30
1	2	17	ASP	CB-CG-OD1	6.24	123.92	118.30
1	2	98	ARG	CD-NE-CZ	-6.22	114.89	123.60
1	1	229	PHE	CB-CG-CD1	-6.19	116.47	120.80
1	1	67	TYR	CB-CG-CD1	6.12	124.67	121.00
1	1	52	ARG	NE-CZ-NH1	5.96	123.28	120.30
1	1	97	GLU	CG-CD-OE1	5.91	130.12	118.30
1	2	198	ASP	CB-CG-OD2	-5.80	113.08	118.30
1	1	227	ASP	CB-CG-OD1	-5.74	113.14	118.30
1	2	90	TRP	O-C-N	5.67	131.77	122.70
1	2	132	ASP	CB-CG-OD2	5.62	123.36	118.30
1	2	198	ASP	CA-CB-CG	-5.46	101.40	113.40
1	1	149	ALA	CB-CA-C	5.38	118.18	110.10
1	1	134	ARG	NE-CZ-NH1	-5.27	117.67	120.30
1	2	219	GLU	OE1-CD-OE2	5.26	129.61	123.30
1	2	52	ARG	NE-CZ-NH1	5.25	122.92	120.30
1	1	17	ASP	CB-CG-OD2	-5.12	113.69	118.30
1	1	67	TYR	CB-CG-CD2	-5.10	117.94	121.00
1	1	225	ASP	CB-CG-OD1	5.07	122.87	118.30
1	1	85	ASP	CB-CG-OD2	-5.06	113.75	118.30

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	1	1856	0	1863	26	0
1	2	1856	0	1862	30	0
2	1	10	0	4	0	0
2	2	10	0	4	1	0
3	1	119	0	0	2	0
3	2	130	0	0	4	0
All	All	3981	0	3733	54	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 (54) 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)
1:1:32:LYS:H	1:1:32:LYS:CE	1.91	0.84
1:1:32:LYS:H	1:1:32:LYS:HE3	1.45	0.82
1:1:145:GLU:HG3	3:1:481:HOH:O	1.84	0.77
1:2:176:ALA:HB1	1:2:180:GLN:HG3	1.72	0.72
1:1:216:ASN:HD22	1:1:216:ASN:C	1.94	0.71
1:1:32:LYS:CD	1:1:32:LYS:H	2.06	0.69
1:2:202:GLN:HE21	1:2:202:GLN:HA	1.58	0.69
1:2:198:ASP:O	1:2:202:GLN:HG2	1.95	0.67
1:2:190:GLY:O	1:2:194:THR:HG23	1.98	0.62
1:1:32:LYS:O	1:1:32:LYS:HD2	2.02	0.60
1:1:32:LYS:N	1:1:32:LYS:HE3	2.13	0.60
1:2:32:LYS:HD3	1:2:32:LYS:O	2.01	0.59
1:1:213:THR:H	1:1:216:ASN:HD21	1.50	0.59
1:2:247:LYS:C	1:2:248:HIS:HD2	2.08	0.57
1:1:140:GLU:HG2	1:1:144:PHE:CE2	2.39	0.56
1:1:115:HIS:HD2	3:1:459:HOH:O	1.89	0.56
1:2:174:LYS:HG3	1:2:174:LYS:O	2.07	0.54
1:2:247:LYS:C	1:2:248:HIS:CD2	2.82	0.54
1:1:179:GLN:NE2	1:1:179:GLN:H	2.07	0.53
1:2:7:PHE:O	1:2:228:GLY:HA3	2.09	0.52
1:1:7:PHE:O	1:1:228:GLY:HA3	2.10	0.52
1:1:32:LYS:H	1:1:32:LYS:HD2	1.74	0.51
1:2:19:LYS:HE2	3:2:544:HOH:O	2.08	0.51
1:2:213:THR:H	1:2:216:ASN:HB2	1.76	0.51
1:1:213:THR:H	1:1:216:ASN:ND2	2.09	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:1:237:LYS:HB3	1:1:238:PRO:HD2	1.94	0.50
1:1:78:ILE:HD12	1:2:46:ILE:HD11	1.93	0.49
1:1:32:LYS:HD2	1:1:32:LYS:N	2.28	0.49
1:1:32:LYS:CD	1:1:32:LYS:N	2.72	0.48
1:2:84:LYS:HD2	1:2:119:GLU:O	2.14	0.47
1:1:78:ILE:HG21	1:2:46:ILE:HG13	1.95	0.47
1:2:237:LYS:HB3	1:2:238:PRO:HD2	1.97	0.46
1:1:56:ASP:OD1	1:1:58:LYS:HB2	2.15	0.46
1:1:216:ASN:HD22	1:1:217:CYS:N	2.12	0.46
1:2:165:GLU:OE2	2:2:250:PGH:N2	2.49	0.45
1:2:180:GLN:HB3	1:2:180:GLN:HE21	1.37	0.44
1:2:165:GLU:OE2	1:2:209:GLY:HA3	2.18	0.44
1:2:247:LYS:HE2	3:2:369:HOH:O	2.18	0.43
1:2:46:ILE:HG22	1:2:46:ILE:O	2.18	0.43
1:1:122:GLY:HA2	1:1:159:LYS:HB3	1.98	0.43
1:2:6:PHE:CE1	1:2:228:GLY:HA2	2.54	0.43
1:2:115:HIS:HD2	3:2:461:HOH:O	2.02	0.43
1:1:165:GLU:OE2	1:1:209:GLY:HA3	2.18	0.42
1:2:221:ALA:O	1:2:247:LYS:NZ	2.50	0.42
1:1:230:LEU:HD12	1:1:230:LEU:HA	1.83	0.42
1:1:216:ASN:ND2	1:1:216:ASN:C	2.68	0.42
1:2:194:THR:OG1	1:2:195:HIS:ND1	2.52	0.42
1:2:247:LYS:O	1:2:248:HIS:CD2	2.73	0.41
1:2:218:LYS:HE2	3:2:412:HOH:O	2.20	0.41
1:2:202:GLN:HA	1:2:202:GLN:NE2	2.32	0.41
1:2:42:GLY:HA2	1:2:62:ALA:O	2.21	0.41
1:2:83:ILE:HG23	1:2:88:ALA:HB3	2.03	0.40
1:2:114:ALA:HB2	1:2:153:ASN:HB3	2.01	0.40
1:1:127:ILE:HD11	1:1:188:LEU:HD11	2.04	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	1	243/247 (98%)	236 (97%)	7 (3%)	0	100	100
1	2	243/247 (98%)	235 (97%)	8 (3%)	0	100	100
All	All	486/494 (98%)	471 (97%)	15 (3%)	0	100	100

There are no Ramachandran outliers to report.

### 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	1	191/192 (100%)	187 (98%)	4 (2%)	61	47
1	2	191/192 (100%)	188 (98%)	3 (2%)	70	59
All	All	382/384 (100%)	375 (98%)	7 (2%)	66	54

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

Mol	Chain	Res	Type
1	1	32	LYS
1	1	71	LYS
1	1	86	ILE
1	1	216	ASN
1	2	58	LYS
1	2	86	ILE
1	2	202	GLN

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

Mol	Chain	Res	Type
1	1	111	GLN
1	1	115	HIS
1	1	179	GLN
1	1	202	GLN
1	1	216	ASN
1	2	53	GLN

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Mol	Chain	Res	Type
1	2	100	HIS
1	2	111	GLN
1	2	115	HIS
1	2	179	GLN
1	2	202	GLN
1	2	248	HIS

### 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 ⓘ

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	PGH	1	250	-	9,9,9	3.00	5 (55%)	10,12,12	2.89	6 (60%)
2	PGH	2	250	-	9,9,9	3.16	5 (55%)	10,12,12	1.36	2 (20%)

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	PGH	1	250	-	-	0/8/8/8	0/0/0/0
2	PGH	2	250	-	-	0/8/8/8	0/0/0/0

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	1	250	PGH	O1P-C2	-3.58	1.40	1.43
2	2	250	PGH	C1-N2	-2.06	1.30	1.32
2	2	250	PGH	P-O3P	2.50	1.63	1.54
2	1	250	PGH	P-O4P	3.38	1.66	1.54
2	2	250	PGH	P-O1P	3.76	1.72	1.60
2	1	250	PGH	P-O2P	3.80	1.63	1.51
2	2	250	PGH	O1P-C2	3.96	1.45	1.43
2	1	250	PGH	P-O3P	4.23	1.69	1.54
2	1	250	PGH	P-O1P	4.63	1.75	1.60
2	2	250	PGH	P-O4P	6.64	1.78	1.54

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	1	250	PGH	O3P-P-O2P	-3.34	99.83	110.58
2	1	250	PGH	C2-C1-N2	-2.33	112.12	116.21
2	1	250	PGH	O3P-P-O1P	-2.17	100.33	106.56
2	2	250	PGH	O2-N2-C1	-2.07	116.42	119.56
2	1	250	PGH	O4P-P-O2P	2.33	118.08	110.58
2	2	250	PGH	O1-C1-N2	2.48	126.47	123.53
2	1	250	PGH	O4P-P-O1P	3.29	116.03	106.56
2	1	250	PGH	O1-C1-N2	6.38	131.08	123.53

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	2	250	PGH	1	0

## 5.7 Other polymers ⓘ

There are no such residues in this entry.

## 5.8 Polymer linkage issues ⓘ

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.