



# wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 13, 2024 – 01:19 am BST

PDB ID : 1H1P  
Title : Structure of human Thr160-phospho CDK2/cyclin A complexed with the inhibitor NU2058  
Authors : Davies, T.G.; Noble, M.E.M.; Endicott, J.A.; Johnson, L.N.  
Deposited on : 2002-07-21  
Resolution : 2.10 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](mailto: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>.

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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	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

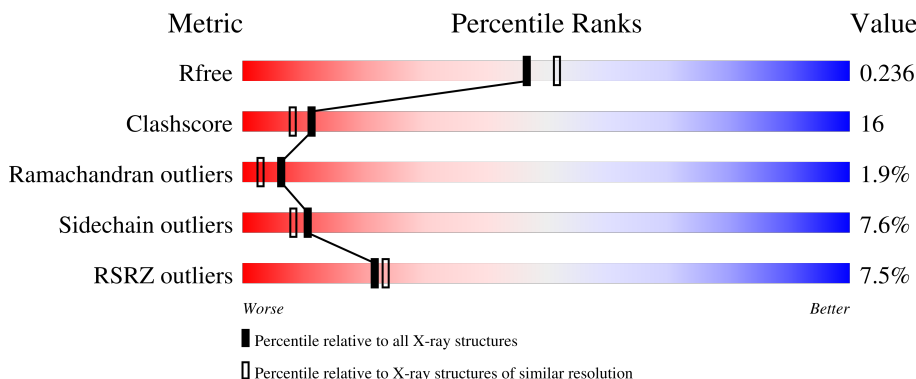
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.10 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))
$R_{free}$	164625	6234 (2.10-2.10)
Clashscore	180529	6893 (2.10-2.10)
Ramachandran outliers	177936	6839 (2.10-2.10)
Sidechain outliers	177891	6840 (2.10-2.10)
RSRZ outliers	164620	6234 (2.10-2.10)

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  $\geq 3$ , 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	303	<div> <div>7%</div> <div>56%</div> <div>28%</div> <div>8%</div> <div>6%</div> <div>.</div> </div>
1	C	303	<div> <div>11%</div> <div>61%</div> <div>28%</div> <div>6%</div> <div>.</div> <div>.</div> </div>
2	B	258	<div> <div>5%</div> <div>64%</div> <div>28%</div> <div>6%</div> <div>.</div> </div>
2	D	258	<div> <div>6%</div> <div>65%</div> <div>26%</div> <div>7%</div> <div>.</div> </div>

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 9388 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.

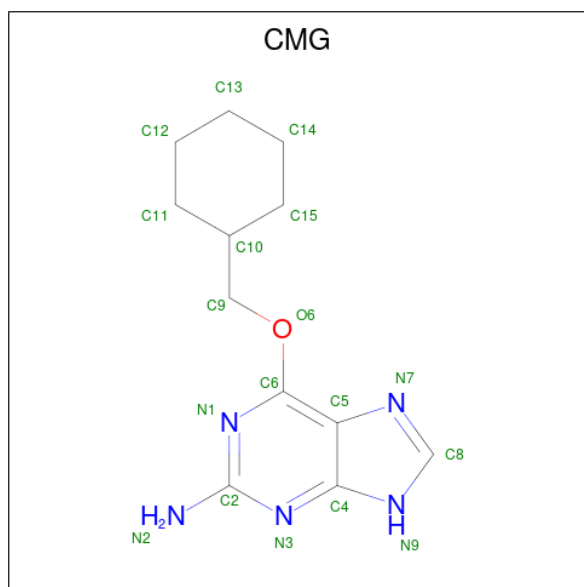
- Molecule 1 is a protein called CELL DIVISION PROTEIN KINASE 2.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	297	Total	C	N	O	P	S	0	0	0
			2388	1550	404	425	1	8			
1	C	297	Total	C	N	O	P	S	0	0	0
			2388	1550	404	425	1	8			

- Molecule 2 is a protein called CYCLIN A2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	258	Total	C	N	O	S	0	0	0
			2083	1350	339	383	11			
2	D	258	Total	C	N	O	S	0	0	0
			2083	1350	339	383	11			

- Molecule 3 is 6-O-CYCLOHEXYLMETHYL GUANINE (three-letter code: CMG) (formula:  $C_{12}H_{17}N_5O$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			18	12	5	1		
3	C	1	Total	C	N	O	0	0
			18	12	5	1		

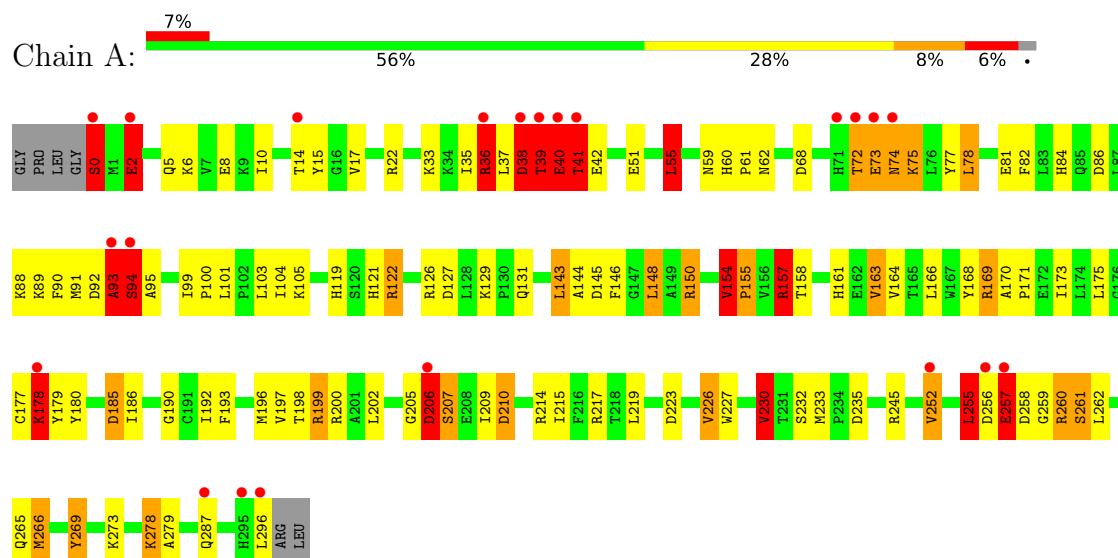
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	105	Total	O	0	0
			105	105		
4	B	106	Total	O	0	0
			106	106		
4	C	107	Total	O	0	0
			107	107		
4	D	92	Total	O	0	0
			92	92		

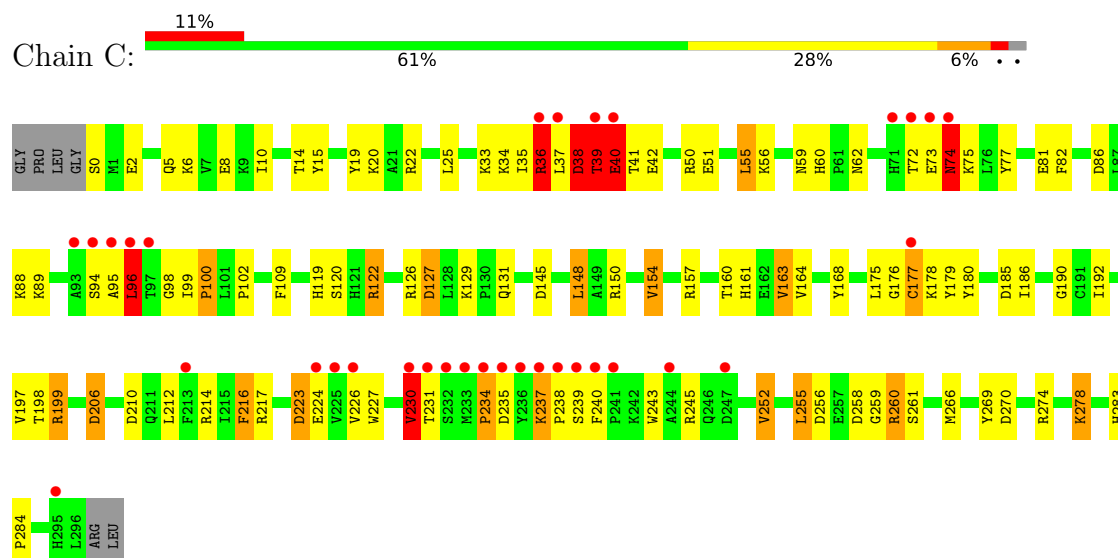
### 3 Residue-property plots

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 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: CELL DIVISION PROTEIN KINASE 2

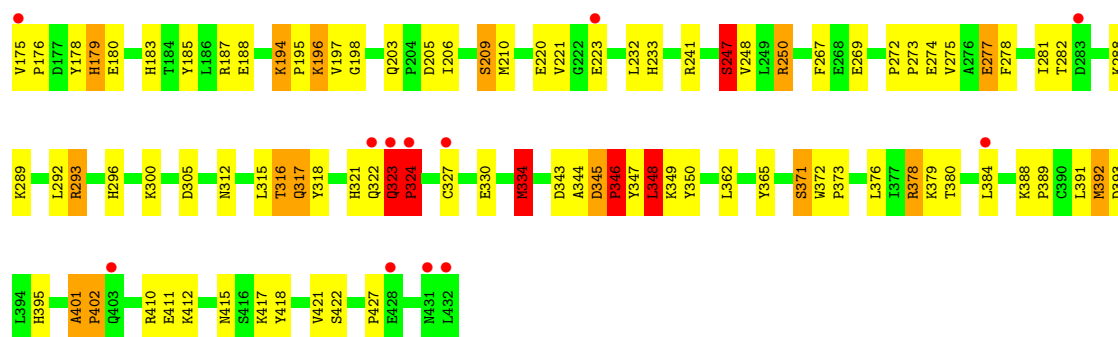


#### • Molecule 1: CELL DIVISION PROTEIN KINASE 2

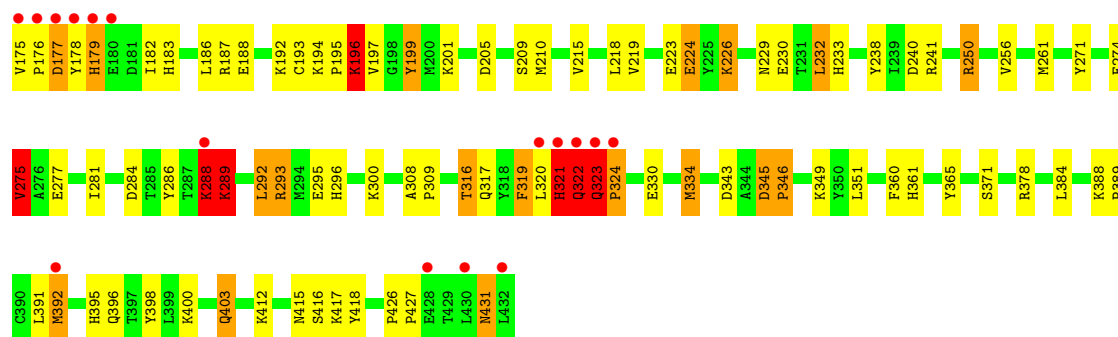


#### • Molecule 2: CYCLIN A2





### • Molecule 2: CYCLIN A2



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	124.03Å 193.83Å 157.49Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.10 20.00 – 2.10	Depositor EDS
% Data completeness (in resolution range)	92.5 (20.00-2.10) 92.2 (20.00-2.10)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.56 (at 2.10Å)	Xtriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.222 , 0.258 0.204 , 0.236	Depositor DCC
$R_{free}$ test set	5068 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	32.5	Xtriage
Anisotropy	0.490	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.42 , 55.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	9388	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	44.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.38% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: TPO, CMG

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	1.00	2/2438 (0.1%)	2.15	105/3308 (3.2%)
1	C	0.91	2/2438 (0.1%)	1.90	64/3308 (1.9%)
2	B	0.95	1/2133 (0.0%)	1.95	64/2897 (2.2%)
2	D	0.95	1/2133 (0.0%)	2.09	67/2897 (2.3%)
All	All	0.95	6/9142 (0.1%)	2.03	300/12410 (2.4%)

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	6
1	C	0	4
2	B	0	7
2	D	0	4
All	All	0	21

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	198	GLY	N-CA	7.17	1.56	1.46
1	A	93	ALA	C-N	6.66	1.49	1.34
1	A	93	ALA	CA-C	5.48	1.67	1.52
1	C	177	CYS	CB-SG	5.18	1.91	1.82
2	D	275	VAL	CB-CG2	-5.16	1.42	1.52

The worst 5 of 300 bond angle outliers are listed below:



Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	322	GLN	C-N-CA	20.08	171.91	121.70
1	A	217	ARG	NE-CZ-NH2	18.57	129.58	120.30
2	B	378	ARG	NE-CZ-NH2	-17.88	111.36	120.30
2	D	323	GLN	N-CA-CB	17.10	141.39	110.60
1	A	217	ARG	NE-CZ-NH1	-16.95	111.83	120.30

There are no chirality outliers.

5 of 21 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	0	SER	Mainchain
1	A	100	PRO	Mainchain
1	A	154	VAL	Mainchain,Peptide
1	A	206	ASP	Mainchain
1	A	93	ALA	Mainchain

## 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	2388	0	2430	92	3
1	C	2388	0	2430	88	2
2	B	2083	0	2107	60	0
2	D	2083	0	2105	71	1
3	A	18	0	17	0	0
3	C	18	0	17	0	0
4	A	105	0	0	4	0
4	B	106	0	0	12	0
4	C	107	0	0	8	0
4	D	92	0	0	3	0
All	All	9388	0	9106	287	3

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 16.

The worst 5 of 287 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)
2:D:323:GLN:HB3	2:D:324:PRO:CD	1.78	1.10
2:D:323:GLN:HB3	2:D:324:PRO:HD3	1.38	1.06
1:C:252:VAL:HG11	1:C:255:LEU:HD22	1.41	0.99
1:A:178:LYS:HD2	1:A:179:TYR:CZ	1.98	0.98
1:C:39:THR:HG21	2:D:289:LYS:HE3	1.42	0.98

All (3) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:94:SER:N	1:C:237:LYS:NZ[6_555]	1.96	0.24
1:A:93:ALA:CA	1:C:237:LYS:NZ[6_555]	2.12	0.08
1:A:207:SER:N	2:D:226:LYS:NZ[6_555]	2.15	0.05

## 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	A	294/303 (97%)	278 (95%)	8 (3%)	8 (3%)	<div>4</div> <div>1</div>
1	C	294/303 (97%)	275 (94%)	14 (5%)	5 (2%)	<div>7</div> <div>4</div>
2	B	256/258 (99%)	247 (96%)	6 (2%)	3 (1%)	<div>11</div> <div>7</div>
2	D	256/258 (99%)	245 (96%)	6 (2%)	5 (2%)	<div>6</div> <div>3</div>
All	All	1100/1122 (98%)	1045 (95%)	34 (3%)	21 (2%)	<div>6</div> <div>3</div>

5 of 21 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	39	THR
1	A	41	THR
1	A	94	SER
2	D	177	ASP

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Mol	Chain	Res	Type
2	D	322	GLN

### 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	261/265 (98%)	236 (90%)	25 (10%)	7	4
1	C	261/265 (98%)	245 (94%)	16 (6%)	15	13
2	B	232/232 (100%)	218 (94%)	14 (6%)	16	14
2	D	232/232 (100%)	212 (91%)	20 (9%)	8	6
All	All	986/994 (99%)	911 (92%)	75 (8%)	11	8

5 of 75 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	D	192	LYS
2	D	384	LEU
2	D	224	GLU
2	D	292	LEU
1	A	278	LYS

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

Mol	Chain	Res	Type
2	B	431	ASN
1	C	71	HIS
2	D	396	GLN
1	C	60	HIS
1	C	113	GLN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

2 non-standard protein/DNA/RNA residues 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	$\# Z  > 2$
1	TPO	C	160	1	8,10,11	1.08	0	10,14,16	1.62	2 (20%)
1	TPO	A	160	1	8,10,11	1.00	0	10,14,16	0.88	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
1	TPO	C	160	1	-	0/9/11/13	-
1	TPO	A	160	1	-	0/9/11/13	-

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	C	160	TPO	O-C-CA	-3.31	116.09	124.78
1	C	160	TPO	CG2-CB-CA	2.22	117.55	113.16

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates ⓘ

There are no oligosaccharides 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
3	CMG	C	1298	-	17,20,20	2.32	4 (23%)	18,27,27	3.89	10 (55%)
3	CMG	A	1298	-	17,20,20	1.99	4 (23%)	18,27,27	4.25	10 (55%)

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
3	CMG	C	1298	-	-	0/5/13/13	0/3/3/3
3	CMG	A	1298	-	-	3/5/13/13	0/3/3/3

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	1298	CMG	C2-N1	6.07	1.46	1.35
3	A	1298	CMG	C2-N1	4.77	1.43	1.35
3	C	1298	CMG	C4-N3	3.83	1.44	1.36
3	A	1298	CMG	C6-N1	-3.62	1.25	1.31
3	A	1298	CMG	C4-N3	3.14	1.42	1.36

The worst 5 of 20 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1298	CMG	O6-C6-N1	8.09	127.11	120.12
3	A	1298	CMG	N3-C2-N1	-7.76	116.88	127.22
3	A	1298	CMG	C2-N1-C6	7.47	128.07	116.08
3	C	1298	CMG	N3-C2-N1	-7.31	117.47	127.22
3	A	1298	CMG	C4-C5-N7	-7.06	102.04	109.40

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1298	CMG	C15-C10-C9-O6
3	A	1298	CMG	C5-C6-O6-C9
3	A	1298	CMG	N1-C6-O6-C9

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	296/303 (97%)	0.16	22 (7%) 22 24	29, 40, 63, 88	0
1	C	296/303 (97%)	0.41	33 (11%) 12 12	31, 43, 74, 87	0
2	B	258/258 (100%)	0.07	12 (4%) 37 39	29, 40, 60, 81	0
2	D	258/258 (100%)	0.37	16 (6%) 28 30	30, 44, 66, 92	0
All	All	1108/1122 (98%)	0.26	83 (7%) 22 23	29, 42, 66, 92	0

The worst 5 of 83 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	93	ALA	9.3
2	D	175	VAL	8.4
2	B	175	VAL	7.6
1	C	234	PRO	7.0
2	D	322	GLN	6.9

### 6.2 Non-standard residues in protein, DNA, RNA chains [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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	TPO	A	160	11/12	0.98	0.06	32,35,37,37	0
1	TPO	C	160	11/12	0.98	0.06	30,34,39,39	0

### 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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
3	CMG	C	1298	18/18	0.96	0.07	39,42,44,45	0
3	CMG	A	1298	18/18	0.97	0.06	41,43,52,52	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.