

# Package ‘HiCExperiment’

May 13, 2024

**Title** Bioconductor class for interacting with Hi-C files in R

**Version** 1.5.0

**Date** 2022-11-10

**Description** R generic interface to Hi-C contact matrices in `.(m)cool`, `.hic` or HiC-Pro derived formats, as well as other Hi-C processed file formats. Contact matrices can be partially parsed using a random access method, allowing a memory-efficient representation of Hi-C data in R. The `HiCExperiment` class stores the Hi-C contacts parsed from local contact matrix files. `HiCExperiment` instances can be further investigated in R using the `HiContacts` analysis package.

**License** MIT + file LICENSE

**URL** <https://github.com/js2264/HiCExperiment>

**BugReports** <https://github.com/js2264/HiCExperiment/issues>

**Depends** R (>= 4.2)

**Imports** InteractionSet, strawr, GenomeInfoDb, GenomicRanges, IRanges, S4Vectors, BiocGenerics, BiocIO, BiocParallel, methods, rhdf5, Matrix, vroom, dplyr, stats

**Suggests** HiContacts, HiContactsData, BiocFileCache, rtracklayer, testthat (>= 3.0.0), BiocStyle, knitr, rmarkdown

**biocViews** HiC, DNA3DStructure, DataImport

**Encoding** UTF-8

**VignetteBuilder** knitr

**LazyData** false

**Roxygen** list(markdown = TRUE)

**RoxygenNote** 7.2.3

**Config/testthat/edition** 3

**Collate** 'HiCExperiment-class.R' 'AggrHiCExperiment-class.R'  
'AllGenerics.R' 'HiCExperiment-methods.R'  
'AggrHiCExperiment-methods.R' 'PairsFile-class.R'  
'ContactsFile-class.R' 'ContactsFile-methods.R'

'CoolFile-class.R' 'CoolFile-methods.R' 'HicFile-class.R'  
 'HicFile-methods.R' 'HicproFile-class.R' 'HicproFile-methods.R'  
 'PairsFile-methods.R' 'import-methods.R' 'available.R' 'bin.R'  
 'checks.R' 'coerce.R' 'data.R' 'export-methods.R' 'globals.R'  
 'parse-cool.R' 'parse-hic.R' 'parse-hicpro.R' 'parse-pairs.R'  
 'parse-slices.R' 'reexports.R' 'utils.R' 'zzz.R'

**git\_url** <https://git.bioconductor.org/packages/HiCExperiment>

**git\_branch** devel

**git\_last\_commit** 6d01259

**git\_last\_commit\_date** 2024-04-30

**Repository** Bioconductor 3.20

**Date/Publication** 2024-05-13

**Author** Jacques Serizay [aut, cre] (<<https://orcid.org/0000-0002-4295-0624>>)

**Maintainer** Jacques Serizay <jacquesserizay@gmail.com>

## Contents

.pairs2gi . . . . .	3
AggrHiCExperiment . . . . .	3
AllGenerics . . . . .	5
as . . . . .	6
bin-methods . . . . .	7
checks . . . . .	8
ContactsFile-class . . . . .	9
CoolFile-class . . . . .	10
data . . . . .	11
export-methods . . . . .	11
HiCExperiment . . . . .	12
HiCExperiment utils . . . . .	18
HicFile-class . . . . .	19
HicproFile-class . . . . .	20
import-methods . . . . .	21
multi2Query . . . . .	23
PairsFile-class . . . . .	24
parse-cool . . . . .	24
parse-hic . . . . .	25
parse-hicpro . . . . .	26
reexports . . . . .	26
<b>Index</b>	<b>27</b>

---

.pairs2gi	<i>Pairs parsing functions</i>
-----------	--------------------------------

---

## Description

Pairs parsing functions

## Usage

```
.pairs2gi(  
  file,  
  chr1.field = NULL,  
  start1.field = NULL,  
  chr2.field = NULL,  
  start2.field = NULL,  
  strand1.field = NULL,  
  strand2.field = NULL,  
  frag1.field = NULL,  
  frag2.field = NULL,  
  nThread = 1,  
  nrows = Inf  
)
```

## Arguments

file	pairs file. Default formatting is <readname>\t<chr1>\t<start1>\t<chr2>\t<start2>.
chr1.field, start1.field, chr2.field, start2.field, strand1.field, strand2.field, frag1.field, frag2.field	Index of the column in which each field is contained in the pairs file.
nThread	Number of CPUs to use to import the pairs file in R
nrows	Number of pairs to import

## Value

a GInteractions object

---

AggrHiCExperiment	AggrHiCExperiment <i>S4 class</i>
-------------------	-----------------------------------

---

## Description

The AggrHiCExperiment extends HiCExperiment class.

**Usage**

```

AggrHiCExperiment(
  file,
  resolution = NULL,
  targets,
  flankingBins = 50,
  metadata = list(),
  topologicalFeatures = S4Vectors::SimpleList(),
  pairsFile = NULL,
  bed = NULL,
  maxDistance = NULL,
  BPPARAM = BiocParallel::bpparam()
)

## S4 method for signature 'AggrHiCExperiment,missing'
slices(x)

## S4 method for signature 'AggrHiCExperiment,character'
slices(x, name)

## S4 method for signature 'AggrHiCExperiment,numeric'
slices(x, name)

## S4 method for signature 'AggrHiCExperiment'
show(object)

```

**Arguments**

<code>file</code>	CoolFile or plain path to a Hi-C contact file
<code>resolution</code>	Resolution to use with the Hi-C contact file
<code>targets</code>	Set of chromosome coordinates for which interaction counts are extracted from the Hi-C contact file, provided as a GRanges object (for diagonal-centered loci) or as a GInteractions object (for off-diagonal coordinates).
<code>flankingBins</code>	Number of bins on each flank of the bins containing input targets.
<code>metadata</code>	list of metadata
<code>topologicalFeatures</code>	topologicalFeatures provided as a named SimpleList
<code>pairsFile</code>	Path to an associated .pairs file
<code>bed</code>	Path to regions file generated by HiC-Pro
<code>maxDistance</code>	Maximum distance to use when compiling distance decay
<code>BPPARAM</code>	BiocParallel parameters
<code>x, object</code>	A AggrHiCExperiment object.
<code>name</code>	The name/index of slices to extract.

**Value**

An AggrHiCExperiment object.

**Slots**

fileName Path of Hi-C contact file  
 resolutions Resolutions available in the Hi-C contact file.  
 resolution Current resolution  
 interactions Genomic Interactions extracted from the Hi-C contact file  
 scores Available interaction scores.  
 slices Available interaction slices.  
 topologicalFeatures Topological features associated with the dataset (e.g. loops (`\<Pairs\>`),  
 borders (`\<GRanges\>`), viewpoints (`\<GRanges\>`), etc...)  
 pairsFile Path to the .pairs file associated with the Hi-C contact file  
 metadata metadata associated with the Hi-C contact file.

**See Also**

[HiCExperiment\(\)](#)

**Examples**

```
fpath <- HiContactsData::HiContactsData('yeast_wt', 'mcool')
data(centros_yeast)
x <- AggrHiCExperiment(
  file = fpath,
  resolution = 8000,
  targets = centros_yeast[c(4, 7)]
)
x
slices(x, 'count')[1:10, 1:10, 1]
```

---

AllGenerics

*Generic functions*


---

**Description**

Generics functions created in HiCExperiment package.

**Arguments**

x	Passed to corresponding method
name	Passed to corresponding method
value	Passed to corresponding method
...	Passed to corresponding method

---

as *Coercing functions*

---

## Description

Coercing functions available for HiCExperiment objects.

## Usage

```
## S4 method for signature 'HiCExperiment'
as.matrix(x, use.scores = "balanced", sparse = FALSE)

## S4 method for signature 'HiCExperiment'
as.data.frame(x)

gi2cm(gi, use.scores = "score")

cm2matrix(cm, replace_NA = NA, sparse = FALSE)

df2gi(
  df,
  seqnames1 = "seqnames1",
  start1 = "start1",
  end1 = "end1",
  seqnames2 = "seqnames2",
  start2 = "start2",
  end2 = "end2"
)
```

## Arguments

x	HiCExperiment object
use.scores	Which scores to use to inflate GInteractions
sparse	Whether to return the contact matrix as a sparse matrix
gi	GInteractions object
cm	A ContactMatrix object
replace_NA	Replace NA values
df	A data.frame object
seqnames1, start1, end1, seqnames2, start2, end2	Names (as strings) of columns containing corresponding information in a data.frame parsed into GInteractions (default: FALSE)

**Examples**

```

mcoolPath <- HiContactsData::HiContactsData('yeast_wt', 'mcool')
contacts <- import(mcoolPath, focus = 'XVI', resolution = 16000, format = 'cool')
gis <- interactions(contacts)
cm <- gi2cm(gis, 'balanced')
cm
cm2matrix(cm)[1:10, 1:10]
df2gi(data.frame(
  chr1 = 'I', start1 = 10, end1 = 100,
  chr2 = 'I', start2 = 40, end2 = 1000,
  score = 12,
  weight = 0.234,
  filtered = TRUE
), seqnames1 = 'chr1', seqnames2 = 'chr2')

```

bin-methods

*HiCExperiment binning methods***Description**

HiCExperiment binning methods

**Usage**

```

## S4 method for signature 'GInteractions,numeric'
bin(x, resolution, seqinfo = NULL)

## S4 method for signature 'PairsFile,numeric'
bin(x, resolution, seqinfo = NULL)

```

**Arguments**

x	A PairsFile or GInteractions object
resolution	Which resolution to use to bin the interactions
seqinfo	Seqinfo object

**Examples**

```

pairsf <- HiContactsData::HiContactsData('yeast_wt', 'pairs.gz')
pf <- PairsFile(pairsf)

```

checks

*Checks functions***Description**

Internal functions to validate the nature/structure of (m)cool files or HiCExperiment objects. All these check functions should return a logical.

**Usage**

```
.check_cool_file(path)

.check_cool_format(path, resolution, ...)

.is_mcool(path)

.is_cool(path)

.check_hic_file(path)

.check_hic_format(path, resolution, ...)

.is_hic(path)

.check_hicpro_files(path, bed)

.is_hicpro_matrix(path)

.is_hicpro_regions(bed)

.check_resolution(contacts, resolution)

.check_scores(contacts, use.scores)

.is_square(pair)
```

**Arguments**

path	Path of a (m)cool file
resolution	Resolution
...	HiCExperiment object, arguments passed on by other functions
bed	Path to regions file generated by HiC-Pro
contacts	A HiCExperiment object
use.scores	Name of scores to check
pair	Pairs object with length of 1



## Value

Logical

---

ContactsFile-class	ContactsFile <i>S4 class</i>
--------------------	------------------------------

---

## Description

The ContactsFile class describes a BiocFile object, pointing to the location of an Hi-C matrix file (cool, mcool, hic, hicpro, ...) and containing additional slots:

1. resolution: at which resolution the associated mcool file should be parsed
2. pairsFile: the path (in plain character) to an optional pairs file (stored as a PairsFile object);
3. metadata: a list. If the CoolFile is created by HiCool, it will contain two elements: log (path to HiCool processing log file) and stats (aggregating some stats from HiCool mapping).

ContactsFile methods.

## Arguments

path	String; path to an Hi-C matrix file (cool, mcool, hic, hicpro)
resolution	numeric; resolution to use with Hi-C matrix file
pairsFile	String; path to a pairs file
metadata	list.
object	A ContactsFile object.
x	A ContactsFile object.

## Slots

resolution	numeric value or NULL
pairsFile	PairsFile object
metadata	list

## See Also

[CoolFile\(\)](#), [HicFile\(\)](#), [HicproFile\(\)](#)

---

CoolFile-class	CoolFile <i>S4 class</i>
----------------	--------------------------

---

## Description

The CoolFile class describes a BiocFile object, pointing to the location of an Hi-C matrix file (cool, mcool, hic, hicpro, ...) and containing additional slots:

1. resolution: at which resolution the associated mcool file should be parsed
2. pairsFile: the path (in plain character) to an optional pairs file (stored as a PairsFile object);
3. metadata: a list. If the CoolFile is created by HiCool, it will contain two elements: log (path to HiCool processing log file) and stats (aggregating some stats from HiCool mapping).

CoolFile methods.

## Arguments

path	String; path to a (m)cool file
resolution	numeric; resolution to use with mcool file
pairsFile	String; path to a pairs file
metadata	list; if the CoolFile object was generated by HiCool::HiCool, this list contains the path to log file, some statistics regarding the number of pairs obtained by hicstuff as well as the arguments and the hash ID used by HiCool.
object	A CoolFile object.

## See Also

[HicFile\(\)](#), [HicproFile\(\)](#)

## Examples

```
mcoolPath <- HiContactsData::HiContactsData('yeast_wt', 'mcool')
pairsPath <- HiContactsData::HiContactsData('yeast_wt', 'pairs.gz')
cf <- CoolFile(
  mcoolPath,
  resolution = 2000,
  pairsFile = pairsPath,
  metadata = list(info = 'Yeast WT Hi-C exp.')
)
cf
resolution(cf)
pairsFile(cf)
metadata(cf)
```

---

data	<i>Example datasets provided in HiCExperiment &amp; HiContactsData</i>
------	--

---

**Description**

Example datasets provided in HiCExperiment & HiContactsData

**Usage**

```
data(centros_yeast)

contacts_yeast(full = FALSE)

contacts_yeast_eco1(full = FALSE)
```

**Arguments**

full	Whether to import all interactions
------	------------------------------------

**Format**

An object of class "GRanges".

**Source**

HiContacts

**Examples**

```
data(centros_yeast)
centros_yeast
contacts_yeast()
```

---

export-methods	<i>HiCExperiment export methods</i>
----------------	-------------------------------------

---

**Description**

Export methods to save a HiCExperiment object into a set of HiC-Pro-style files (matrix & regions files)

**Usage**

```
## S4 method for signature 'HiCExperiment,missing,character'
export(object, prefix, format, ...)
```

**Arguments**

object	A HiCExperiment object
prefix	Prefix used when generating output file(s).
format	File format. Available: cool and HiC-Pro.
...	Extra arguments to use when exporting to cool. Can be metadata <string> or chunksize <integer>.

**Value**

Path to saved files

**Examples**

```
#####
## ----- Importing .(m)cool contact matrices ----- ##
#####

mcoolPath <- HiContactsData::HiContactsData('yeast_wt', 'mcool')
hic <- import(mcoolPath, format = 'mcool', resolution = 16000)
export(hic["II"], prefix = 'subset_chrII', format = 'cool')
export(hic["II"], prefix = 'subset_chrII', format = 'HiC-Pro')
```

---

HiCExperiment	HiCExperiment <i>S4 class</i>
---------------	-------------------------------

---

**Description**

The HiCExperiment class describes Hi-C contact files imported in R, either through the HiCExperiment constructor function or using the import method implemented by HiCExperiment package.

**Usage**

```
HiCExperiment(
  file,
  resolution = NULL,
  focus = NULL,
  metadata = list(),
  topologicalFeatures = S4Vectors::SimpleList(compartments = GenomicRanges::GRanges(),
    borders = GenomicRanges::GRanges(), loops =
    InteractionSet::GInteractions(GenomicRanges::GRanges(), GenomicRanges::GRanges()),
    viewpoints = GenomicRanges::GRanges()),
  pairsFile = NULL,
  bed = NULL
)

makeHiCExperimentFromGInteractions(gi)
```

```
## S4 method for signature 'HiCExperiment'
resolutions(x)

## S4 method for signature 'HiCExperiment'
resolution(x)

## S4 method for signature 'HiCExperiment'
focus(x)

## S4 replacement method for signature 'HiCExperiment,character'
focus(x) <- value

## S4 method for signature 'HiCExperiment,numeric'
zoom(x, resolution)

## S4 method for signature 'HiCExperiment,character'
refocus(x, focus)

## S4 method for signature 'HiCExperiment,missing'
scores(x)

## S4 method for signature 'HiCExperiment,character'
scores(x, name)

## S4 method for signature 'HiCExperiment,numeric'
scores(x, name)

## S4 replacement method for signature 'HiCExperiment,character,numeric'
scores(x, name) <- value

## S4 method for signature 'HiCExperiment,missing'
topologicalFeatures(x)

## S4 method for signature 'HiCExperiment,character'
topologicalFeatures(x, name)

## S4 method for signature 'HiCExperiment,numeric'
topologicalFeatures(x, name)

## S4 replacement method for signature 'HiCExperiment,character,GRangesOrGInteractions'
topologicalFeatures(x, name) <- value

## S4 method for signature 'HiCExperiment'
pairsFile(x)

## S4 replacement method for signature 'HiCExperiment,character'
pairsFile(x) <- value
```

```
## S4 replacement method for signature 'HiCExperiment,list'  
metadata(x) <- value  
  
## S4 method for signature 'HiCExperiment,numeric'  
subsetByOverlaps(x, ranges)  
  
## S4 method for signature 'HiCExperiment,logical'  
subsetByOverlaps(x, ranges)  
  
## S4 method for signature 'HiCExperiment,GRanges'  
subsetByOverlaps(x, ranges, type = c("within", "any"))  
  
## S4 method for signature 'HiCExperiment,GInteractions'  
subsetByOverlaps(x, ranges)  
  
## S4 method for signature 'HiCExperiment,Pairs'  
subsetByOverlaps(x, ranges)  
  
## S4 method for signature 'HiCExperiment,numeric,ANY,ANY'  
x[i]  
  
## S4 method for signature 'HiCExperiment,GRanges,ANY,ANY'  
x[i]  
  
## S4 method for signature 'HiCExperiment,logical,ANY,ANY'  
x[i]  
  
## S4 method for signature 'HiCExperiment,GInteractions,ANY,ANY'  
x[i]  
  
## S4 method for signature 'HiCExperiment,Pairs,ANY,ANY'  
x[i]  
  
## S4 method for signature 'HiCExperiment,character,ANY,ANY'  
x[i]  
  
## S4 method for signature 'HiCExperiment'  
fileName(object)  
  
## S4 method for signature 'HiCExperiment'  
interactions(x, fillout.regions = FALSE)  
  
## S4 replacement method for signature 'HiCExperiment,GInteractions'  
interactions(x) <- value  
  
## S4 method for signature 'HiCExperiment'  
length(x)
```

```
## S4 replacement method for signature 'HiCExperiment'
x$name <- value

## S4 method for signature 'HiCExperiment'
x$name

## S4 method for signature 'HiCExperiment'
seqinfo(x)

## S4 method for signature 'HiCExperiment'
bins(x)

## S4 method for signature 'HiCExperiment'
anchors(x)

## S4 method for signature 'HiCExperiment'
regions(x)

## S4 method for signature 'HiCExperiment'
cis(x)

## S4 method for signature 'HiCExperiment'
trans(x)
```

### Arguments

file	CoolFile or plain path to a Hi-C contact file
resolution	Resolution to use with the Hi-C contact file
focus	Chromosome coordinates for which interaction counts are extracted from the Hi-C contact file, provided as a character string (e.g. "II:4001-5000"). If not provided, the entire Hi-C contact file will be imported.
metadata	list of metadata
topologicalFeatures	topologicalFeatures provided as a named SimpleList
pairsFile	Path to an associated .pairs file (optional)
bed	Path to regions file generated by HiC-Pro (optional)
gi	GInteractions object
x	A HiCExperiment object.
value	Value to add to topologicalFeatures, scores, pairsFile or metadata slots.
name	Name of the element to access in topologicalFeatures or scores SimpleLists.
type	any of within or any, to subset interactions by overlap with a provided GRanges.
i, ranges	a GRanges, coordinates in character, or boolean vector to subset a HiCExperiment
object	A HiCExperiment object.
fillout.regions	Whether to add missing regions to GInteractions' regions?

**Value**

An HiCExperiment object.

**Slots**

fileName Path of Hi-C contact file

focus Chr. coordinates for which interaction counts are extracted from the Hi-C contact file.

resolutions Resolutions available in the Hi-C contact file.

resolution Current resolution

interactions Genomic Interactions extracted from the Hi-C contact file

scores Available interaction scores.

topologicalFeatures Topological features associated with the dataset (e.g. loops (\<GInteractions\>), borders (\<GRanges\>), viewpoints (\<GRanges\>), etc...)

pairsFile Path to the .pairs file associated with the Hi-C contact file

metadata metadata associated with the Hi-C contact file.

**See Also**

[AggrHiCExperiment\(\)](#), [CoolFile\(\)](#), [HicFile\(\)](#), [HicproFile\(\)](#), [PairsFile\(\)](#)

**Examples**

```
#####
## Create a HiCExperiment object from a disk-stored contact matrix ##
#####

mcool_file <- HiContactsData::HiContactsData("yeast_wt", "mcool")
pairs_file <- HiContactsData::HiContactsData("yeast_wt", "pairs.gz")
contacts <- HiCExperiment(
  file = mcool_file,
  resolution = 8000L,
  pairsFile = pairs_file
)
contacts

#####
## ----- Manually create a HiCExperiment from GInteractions ----- ##
#####

gis <- interactions(contacts)[1:1000]
contacts2 <- makeHiCExperimentFromGInteractions(gis)
contacts2

#####
## ----- Slots present in an HiCExperiment object ----- ##
#####

fileName(contacts)
```



```

focus(contacts)
resolutions(contacts)
resolution(contacts)
interactions(contacts)
scores(contacts)
topologicalFeatures(contacts)
pairsFile(contacts)

#####
## ----- Slot getters ----- ##
#####

scores(contacts, 1) |> head()
scores(contacts, 'balanced') |> head()
topologicalFeatures(contacts, 1)

#####
## ----- Slot setters ----- ##
#####

scores(contacts, 'random') <- runif(length(contacts))
topologicalFeatures(contacts, 'loops') <- InteractionSet::GInteractions(
  GenomicRanges::GRanges('II:15324'),
  GenomicRanges::GRanges('II:24310')
)
pairsFile(contacts) <- HiContactsData('yeast_wt', 'pairs.gz')

#####
## ----- Subsetting functions ----- ##
#####

contacts[1:100]
contacts['II']
contacts[c('II', 'III')]
contacts['II|III']
contacts['II:10001-30000|III:50001-90000']

#####
## ----- Utils functions ----- ##
#####
## Adapted from other packages

seqinfo(contacts)
bins(contacts)
anchors(contacts)
regions(contacts)

#####
## ----- Coercing HiCExperiment objects ----- ##
#####

as(contacts, 'GInteractions')
as(contacts, 'ContactMatrix')

```

```
as(contacts, 'matrix')[seq_len(10), seq_len(10)]
as(contacts, 'data.frame')[seq_len(10), seq_len(10)]
```

---

HiCExperiment utils      *Utils functions*

---

## Description

Utilities to facilitate parsing/handling of coordinates, GInteractions, Pairs, ... These functions are not exported.

## Usage

```
splitCoords(coords)

coords2char(coords, big.mark = ",")

char2coords(char)

sortPairs(pairs)

asGInteractions(df)

sdiag(A, k = 0)

.df2symmmat(diag, score)

distanceDecay(dump, threshold = NULL)

detrendingModel(file, resolution)

.fixRegions(gis, bins, coords)
```

## Arguments

<code>coords</code>	A set of genomic coordinates (either as a GRanges object or as a character string)
<code>big.mark</code>	Separator for thousands when printing out genomic coordinates as character
<code>char</code>	char (e.g. "II:30001-50000" or "II:30001-50000 II:60001-80000")
<code>pairs</code>	Pairs object
<code>df</code>	a data.frame to turn into a GInteraction object.
<code>A</code>	Numerical matrix
<code>k</code>	secondary diagonal k
<code>diag</code>	vector of distances to diagonal
<code>score</code>	scores to parse into symmetrical matrix

dump	dumped contacts as GInteractions, e.g. from .dumpCool
threshold	maximum distance to compute distance decay for
file	path to a HiC contact matrix file
resolution	Resolution to use with the HiC contact matrix file
gis	GInteractions object
bins	Larger set of regions (usually bins from HiCExperiment)

**Value**

Reformatted coordinates or GInteractions.

---

HicFile-class	HicFile <i>S4</i> class
---------------	-------------------------

---

**Description**

The HicFile class describes a BiocFile object, pointing to the location of a .hic file (usually created with juicer) and containing 3 additional slots:

1. resolution: at which resolution the associated .hic file should be parsed;
2. pairsFile: the path (in plain character) to an optional pairs file (stored as a PairsFile object);
3. metadata: a list metadata

HicFile methods.

**Arguments**

path	String; path to a .hic file
resolution	numeric; resolution to use with mcool file
pairsFile	String; path to a pairs file
metadata	list.
object	A HicFile object.

**See Also**

[CoolFile\(\)](#), [HicproFile\(\)](#)

**Examples**

```

hicPath <- HiContactsData::HiContactsData('yeast_wt', 'hic')
pairsPath <- HiContactsData::HiContactsData('yeast_wt', 'pairs.gz')
hic <- HicFile(
  hicPath,
  resolution = 16000,
  pairsFile = pairsPath,
  metadata = list(type = 'example')
)
hic
resolution(hic)
pairsFile(hic)
metadata(hic)

```

---

HicproFile-class	HicproFile <i>S4</i> class
------------------	----------------------------

---

**Description**

The HicproFile class describes a BiocFile object, pointing to the location of a HiC-Pro-generated matrix file and containing 4 additional slots:

1. bed: path to the matching .bed file generated by HiC-Pro;
2. resolution: at which resolution the associated mcool file should be parsed ;
3. pairsFile: the path (in plain character) to an optional pairs file (stored as a PairsFile object);
4. metadata: a list metadata

HicproFile methods.

**Arguments**

path	String; path to the HiC-Pro output .matrix file (matrix file)
bed	String; path to the HiC-Pro output .bed file (regions file)
pairsFile	String; path to a pairs file
metadata	list.
object	A HicproFile object.

**Slots**

bed Path to the matching .bed file generated by HiC-Pro

**See Also**

[CoolFile\(\)](#), [HicFile\(\)](#)

**Examples**

```

hicproMatrixPath <- HiContactsData::HiContactsData('yeast_wt', 'hicpro_matrix')
hicproBedPath <- HiContactsData::HiContactsData('yeast_wt', 'hicpro_bed')
pairsPath <- HiContactsData::HiContactsData('yeast_wt', 'pairs.gz')
hicpro <- HicproFile(
  hicproMatrixPath, bed = hicproBedPath, pairs = pairsPath ,
  metadata = list(type = 'example')
)
hicpro
resolution(hicpro)
pairsFile(hicpro)
metadata(hicpro)

```

import-methods

*HiCExperiment import methods***Description**

Import methods to parse Hi-C files (.m)cool, .hic, HiC-Pro derived matrices, pairs files) into data structures implemented in the HiCExperiment package.

**Usage**

```

import(con, format, text, ...)

## S4 method for signature 'ANY'
availableResolutions(x, ...)

## S4 method for signature 'CoolFile'
availableResolutions(x)

## S4 method for signature 'HicFile'
availableResolutions(x)

## S4 method for signature 'HicproFile'
availableResolutions(x)

## S4 method for signature 'ANY'
availableChromosomes(x, ...)

## S4 method for signature 'CoolFile'
availableChromosomes(x)

## S4 method for signature 'HicFile'
availableChromosomes(x)

## S4 method for signature 'HicproFile'
availableChromosomes(x)

```

**Arguments**

...	Extra parameters to pass to format-specific methods. A list of possible arguments is provided in the next section.
con, x	Path or connection to a cool, mcool, .hic or HiC-Pro derived files. Can also be a path to a pairs file.
format	The format of the output. If missing and 'con' is a filename, the format is derived from the file extension. This argument is unnecessary when files are directly provided as CoolFile, HicFile, HicproFile or PairsFile.
text	If 'con' is missing, this can be a character vector directly providing the string data to import.

**Value**

A HiCExperiment or GInteractions object

**import arguments for ContactFile class**

ContactFile class gathers CoolFile, HicFile and HicproFile classes. When importing a ContactFile object in R, two main arguments can be provided besides the ContactFile itself:

- resolution: Resolutions available in the disk-stored contact matrix can be listed using `availableResolutions(file)`
- focus: A genomic locus (or pair of loci) provided as a string. It can be any of the following string structures:
  - "II" or "II:20001-30000": this will extract a symmetrical square HiCExperiment object, of an entire chromosome or an portion of it.
  - "II|III" or "II:20001-30000|III:40001-90000": this will extract a non-symmetrical HiCExperiment object, with an entire or portion of different chromosomes on each axis.

**Examples**

```
#####
## ----- Importing .(m)cool contact matrices ----- ##
#####

mcoolPath <- HiContactsData::HiContactsData('yeast_wt', 'mcool')
availableResolutions(mcoolPath)
availableChromosomes(mcoolPath)
import(mcoolPath, resolution = 16000, focus = 'XVI', format = 'cool')

#####
## ----- Importing .hic contact matrices ----- ##
#####

hicPath <- HiContactsData::HiContactsData('yeast_wt', 'hic')
availableResolutions(hicPath)
availableChromosomes(hicPath)
import(hicPath, resolution = 16000, focus = 'XVI', format = 'hic')

#####
```

```
## ----- Importing HiC-Pro derived contact matrices ----- ##
#####

hicproMatrixPath <- HiContactsData::HiContactsData('yeast_wt', 'hicpro_matrix')
hicproBedPath <- HiContactsData::HiContactsData('yeast_wt', 'hicpro_bed')
availableResolutions(hicproMatrixPath, hicproBedPath)
availableChromosomes(hicproMatrixPath, hicproBedPath)
import(hicproMatrixPath, bed = hicproBedPath, format = 'hicpro')
```

---

multi2Query

*Querying multiple slices of a contact matrix*


---

## Description

These functions are the workhorse internal functions used to extract counts from multiple genomic coordinates in a Hi-C contact matrix.

## Usage

```
.multi2DQuery(
  file,
  resolution,
  pairs,
  maxDistance = NULL,
  bed = NULL,
  BPPARAM = BiocParallel::bpparam()
)
```

## Arguments

file	path to a Hi-C contact file (can be any format, (m)cool, .hic, or HiC-Pro-derived)
resolution	resolution to use to import matrix over specified targets
pairs	slices to read, provided as a Pairs object
maxDistance	Maximum distance to use when compiling distance decay
bed	associated bed file for HiC-Pro derived contact matrix.
BPPARAM	BiocParallel parameters

## Value

a GInteractions object with count, balanced, detrended and expected scores

---

PairsFile-class

PairsFile *S4 class*


---

### Description

The PairsFile class describes a BiocFile object, pointing to the location of pairs file, typically generated by `HiCool::HiCool()`.

PairsFile methods

### Arguments

x                      Path to a pairs file

### See Also

[CoolFile\(\)](#), [HicFile\(\)](#), [HicproFile\(\)](#)

### Examples

```
pairsPath <- HiContactsData::HiContactsData('yeast_wt', 'pairs.gz')
pf <- PairsFile(pairsPath)
pf
pairsFile(pf)
```

---

parse-cool

*Parsing (m)cool files*


---

### Description

These functions are the workhorse internal functions used to import a .(m)cool file as GInteractions (wrapped into a HiCExperiment object by `HiCExperiment()` function).

### Usage

```
.getCoolAnchors(file, resolution = NULL, balanced = "cooler")
.getCountsFromPair(file, pair, anchors, resolution = NULL)
.getCounts(file, coords, anchors, resolution = NULL)
.fetchCool(file, path, resolution = NULL, idx = NULL, ...)
.dumpCool(file, resolution = NULL)
.lsCoolFiles(file, verbose = FALSE)
```



```
.lsCoolResolutions(file, verbose = FALSE)

.cool2seqinfo(file, resolution = NULL)

.cool2gi(file, coords = NULL, resolution = NULL)
```

### Arguments

file	path to a Hi-C contact file (in (m)cool format)
resolution	resolution of the contact matrix
balanced	import balancing scores
pair	Genomic coordinates to extract contacts for, stored as a Pairs of GRanges (e.g. S4Vectors::Pairs(GRanges("II:200000-300000"), GRanges("II:70000-100000"))).
anchors	anchors from .getCoolAnchors()
coords	Genomic coordinates to extract contacts for, stored as a GRanges object
path	Internal path of the cool file to check
idx	Index to extract from the cool (HDF5) file
...	Other arguments passed to .fetchCool
verbose	Print resolutions in the console

### Value

Silently, a numerical vector of resolutions stored in the cool file

---

parse-hic	<i>Parsing hic files</i>
-----------	--------------------------

---

### Description

These functions are the workhorse internal functions used to import a .hic file as GInteractions (wrapped into a HiCExperiment object by HiCExperiment() function).

### Usage

```
.hic2gi(file, coords = NULL, resolution = NULL)

.lsHicResolutions(file, verbose = FALSE)

.getHicAnchors(file, resolution = NULL)

.hic2seqinfo(file)

.dumpHic(file, resolution = NULL)
```

**Arguments**

file	path to a Hi-C contact file in .hic format
coords	NULL, character, or GRanges. Can also be a Pairs object of paired GRanges (length of 1).
resolution	resolution of the contact matrix to use
verbose	Print resolutions in the console

**Value**

a GInteractions object  
vector

---

parse-hicpro	<i>Parsing hicpro files (matrix &amp; bed)</i>
--------------	--

---

**Description**

These functions are the workhorse internal functions used to import HiC-Pro .matrix and .bed files as GInteractions (wrapped into a HiCExperiment object by HiCExperiment() function).

**Usage**

```
.hicpro2gi(file, bed)
.getHicproAnchors(bed)
.hicpro2seqinfo(bed)
.dumpHicpro(file, bed)
```

**Arguments**

file	path to a matrix file from HiC-Pro
bed	path to the regions file generated by HiC-Pro

**Value**

a GInteractions object

---

reexports	<i>Objects exported from other packages</i>
-----------	---

---

**Description**

These objects are imported from other packages. Follow the links below to see their documentation.

**S4Vectors** [metadata](#)

# Index

## \* internal

- .pairs2gi, 3
- AllGenerics, 5
- checks, 8
- HiCExperiment utils, 18
- multi2Query, 23
- parse-cool, 24
- parse-hic, 25
- parse-hicpro, 26
- reexports, 26
- .check\_cool\_file (checks), 8
- .check\_cool\_format (checks), 8
- .check\_hic\_file (checks), 8
- .check\_hic\_format (checks), 8
- .check\_hicpro\_files (checks), 8
- .check\_resolution (checks), 8
- .check\_scores (checks), 8
- .cool2gi (parse-cool), 24
- .cool2seqinfo (parse-cool), 24
- .df2symmmat (HiCExperiment utils), 18
- .dumpCool (parse-cool), 24
- .dumpHic (parse-hic), 25
- .dumpHicpro (parse-hicpro), 26
- .fetchCool (parse-cool), 24
- .fixRegions (HiCExperiment utils), 18
- .getCoolAnchors (parse-cool), 24
- .getCounts (parse-cool), 24
- .getCountsFromPair (parse-cool), 24
- .getHicAnchors (parse-hic), 25
- .getHicproAnchors (parse-hicpro), 26
- .hic2gi (parse-hic), 25
- .hic2seqinfo (parse-hic), 25
- .hicpro2gi (parse-hicpro), 26
- .hicpro2seqinfo (parse-hicpro), 26
- .is\_cool (checks), 8
- .is\_hic (checks), 8
- .is\_hicpro\_matrix (checks), 8
- .is\_hicpro\_regions (checks), 8
- .is\_mcool (checks), 8
- .is\_square (checks), 8
- .lsCoolFiles (parse-cool), 24
- .lsCoolResolutions (parse-cool), 24
- .lsHicResolutions (parse-hic), 25
- .multi2DQuery (multi2Query), 23
- .pairs2gi, 3
- [,HiCExperiment,GInteractions,ANY,ANY-method  
(HiCExperiment), 12
- [,HiCExperiment,GRanges,ANY,ANY-method  
(HiCExperiment), 12
- [,HiCExperiment,Pairs,ANY,ANY-method  
(HiCExperiment), 12
- [,HiCExperiment,character,ANY,ANY-method  
(HiCExperiment), 12
- [,HiCExperiment,logical,ANY,ANY-method  
(HiCExperiment), 12
- [,HiCExperiment,numeric,ANY,ANY-method  
(HiCExperiment), 12
- [,HiCExperiment-method (HiCExperiment),  
12
- \$,HiCExperiment-method (HiCExperiment),  
12
- \$<-,HiCExperiment-method  
(HiCExperiment), 12
- AggrHiCExperiment, 3
- AggrHiCExperiment(), 16
- AggrHiCExperiment-class  
(AggrHiCExperiment), 3
- AllGenerics, 5
- anchors,HiCExperiment-method  
(HiCExperiment), 12
- as, 6
- asGInteractions (HiCExperiment utils),  
18
- availableChromosomes (AllGenerics), 5
- availableChromosomes,ANY-method  
(import-methods), 21
- availableChromosomes,CoolFile-method  
(import-methods), 21

- availableChromosomes,HicFile-method  
(import-methods), 21
- availableChromosomes,HicproFile-method  
(import-methods), 21
- availableResolutions (AllGenerics), 5
- availableResolutions,ANY-method  
(import-methods), 21
- availableResolutions,CoolFile-method  
(import-methods), 21
- availableResolutions,HicFile-method  
(import-methods), 21
- availableResolutions,HicproFile-method  
(import-methods), 21
  
- bin (AllGenerics), 5
- bin,GInteractions,character-method  
(bin-methods), 7
- bin,GInteractions,numeric-method  
(bin-methods), 7
- bin,PairsFile,numeric-method  
(bin-methods), 7
- bin-methods, 7
- bins (AllGenerics), 5
- bins,HiCExperiment-method  
(HiCExperiment), 12
  
- centros\_yeast (data), 11
- char2coords (HiCExperiment utils), 18
- checks, 8
- cis (AllGenerics), 5
- cis,HiCExperiment-method  
(HiCExperiment), 12
- cm2matrix (as), 6
- coerce,HiCExperiment,ContactMatrix-method  
(as), 6
- coerce,HiCExperiment,data.frame-method  
(as), 6
- coerce,HiCExperiment,GInteractions-method  
(as), 6
- coerce,HiCExperiment,InteractionSet-method  
(as), 6
- coerce,HiCExperiment,matrix-method  
(as), 6
- contacts\_yeast (data), 11
- contacts\_yeast\_ecol (data), 11
- ContactsFile (ContactsFile-class), 9
- ContactsFile-class, 9
- ContactsFile-methods  
(ContactsFile-class), 9
  
- CoolFile (CoolFile-class), 10
- CoolFile(), 9, 16, 19, 20, 24
- CoolFile-class, 10
- CoolFile-methods (CoolFile-class), 10
- coords2char (HiCExperiment utils), 18
  
- data, 11
- detrendingModel (HiCExperiment utils),  
18
- df2gi (as), 6
- distanceDecay (HiCExperiment utils), 18
  
- export (export-methods), 11
- export,HiCExperiment,missing,character-method  
(export-methods), 11
- export-methods, 11
  
- fileName,HiCExperiment-method  
(HiCExperiment), 12
- focus (AllGenerics), 5
- focus,HiCExperiment-method  
(HiCExperiment), 12
- focus<- (AllGenerics), 5
- focus<-,HiCExperiment,character-method  
(HiCExperiment), 12
- focus<-,HiCExperiment-method  
(HiCExperiment), 12
  
- gi2cm (as), 6
  
- HiCExperiment, 12
- HiCExperiment utils, 18
- HiCExperiment(), 5
- HiCExperiment-class (HiCExperiment), 12
- HicFile (HicFile-class), 19
- HicFile(), 9, 10, 16, 20, 24
- HicFile-class, 19
- HicFile-methods (HicFile-class), 19
- HicproFile (HicproFile-class), 20
- HicproFile(), 9, 10, 16, 19, 24
- HicproFile-class, 20
- HicproFile-methods (HicproFile-class),  
20
  
- import (import-methods), 21
- import,CoolFile,ANY,ANY-method  
(import-methods), 21
- import,CoolFile-method  
(import-methods), 21

import,HicFile,ANY,ANY-method  
(import-methods), 21  
import,HicFile-method (import-methods),  
21  
import,HicproFile,ANY,ANY-method  
(import-methods), 21  
import,HicproFile-method  
(import-methods), 21  
import,PairsFile,ANY,ANY-method  
(import-methods), 21  
import,PairsFile-method  
(import-methods), 21  
import-methods, 21  
interactions,HiCExperiment-method  
(HiCExperiment), 12  
interactions<-,HiCExperiment,GInteractions-method  
(HiCExperiment), 12  
interactions<-,HiCExperiment-method  
(HiCExperiment), 12  
length,HiCExperiment-method  
(HiCExperiment), 12  
makeHiCExperimentFromGInteractions  
(HiCExperiment), 12  
McoolFile-class (CoolFile-class), 10  
metadata, 26  
metadata (reexports), 26  
metadata<- (AllGenerics), 5  
metadata<-,ContactsFile,list-method  
(ContactsFile-class), 9  
metadata<-,ContactsFile-method  
(ContactsFile-class), 9  
metadata<-,HiCExperiment,list-method  
(HiCExperiment), 12  
metadata<-,HiCExperiment-method  
(HiCExperiment), 12  
multi2Query, 23  
PairsFile (PairsFile-class), 24  
pairsFile (AllGenerics), 5  
PairsFile(), 16  
pairsFile,ContactsFile-method  
(ContactsFile-class), 9  
pairsFile,HiCExperiment-method  
(HiCExperiment), 12  
pairsFile,PairsFile-method  
(PairsFile-class), 24  
PairsFile-class, 24  
pairsFile<- (AllGenerics), 5  
pairsFile<-,HiCExperiment,character-method  
(HiCExperiment), 12  
pairsFile<-,HiCExperiment-method  
(HiCExperiment), 12  
parse-cool, 24  
parse-hic, 25  
parse-hicpro, 26  
reexports, 26  
refocus (AllGenerics), 5  
refocus,HiCExperiment,character-method  
(HiCExperiment), 12  
regions,HiCExperiment-method  
(HiCExperiment), 12  
resolution (AllGenerics), 5  
resolution,ContactsFile-method  
(ContactsFile-class), 9  
resolution,HiCExperiment-method  
(HiCExperiment), 12  
resolutions (AllGenerics), 5  
resolutions,HiCExperiment-method  
(HiCExperiment), 12  
scores (AllGenerics), 5  
scores,HiCExperiment,character-method  
(HiCExperiment), 12  
scores,HiCExperiment,missing-method  
(HiCExperiment), 12  
scores,HiCExperiment,numeric-method  
(HiCExperiment), 12  
scores,HiCExperiment-method  
(HiCExperiment), 12  
scores<- (AllGenerics), 5  
scores<-,HiCExperiment,character,numeric-method  
(HiCExperiment), 12  
scores<-,HiCExperiment-method  
(HiCExperiment), 12  
sdiag (HiCExperiment utils), 18  
seqinfo,HiCExperiment-method  
(HiCExperiment), 12  
show,AggrHiCExperiment-method  
(AggrHiCExperiment), 3  
show,CoolFile-method (CoolFile-class),  
10  
show,HiCExperiment-method  
(HiCExperiment), 12  
show,HicFile-method (HicFile-class), 19

show, HicproFile-method  
    (HicproFile-class), 20

slices (AllGenerics), 5

slices, AggrHiCExperiment, character-method  
    (AggrHiCExperiment), 3

slices, AggrHiCExperiment, missing-method  
    (AggrHiCExperiment), 3

slices, AggrHiCExperiment, numeric-method  
    (AggrHiCExperiment), 3

sortPairs (HiCExperiment utils), 18

splitCoords (HiCExperiment utils), 18

subsetByOverlaps, HiCExperiment, GInteractions-method  
    (HiCExperiment), 12

subsetByOverlaps, HiCExperiment, GRanges-method  
    (HiCExperiment), 12

subsetByOverlaps, HiCExperiment, logical-method  
    (HiCExperiment), 12

subsetByOverlaps, HiCExperiment, numeric-method  
    (HiCExperiment), 12

subsetByOverlaps, HiCExperiment, Pairs-method  
    (HiCExperiment), 12

topologicalFeatures (AllGenerics), 5

topologicalFeatures, HiCExperiment, character-method  
    (HiCExperiment), 12

topologicalFeatures, HiCExperiment, missing-method  
    (HiCExperiment), 12

topologicalFeatures, HiCExperiment, numeric-method  
    (HiCExperiment), 12

topologicalFeatures, HiCExperiment-method  
    (HiCExperiment), 12

topologicalFeatures<- (AllGenerics), 5

topologicalFeatures<-, HiCExperiment, character, GRangesOrGInteractions-method  
    (HiCExperiment), 12

topologicalFeatures<-, HiCExperiment-method  
    (HiCExperiment), 12

trans (AllGenerics), 5

trans, HiCExperiment-method  
    (HiCExperiment), 12

zoom (AllGenerics), 5

zoom, HiCExperiment, numeric-method  
    (HiCExperiment), 12