

# Package ‘HiCExperiment’

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

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**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.

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**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

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'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'  
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|           |                                |
|-----------|--------------------------------|
| .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*


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**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](#)

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