



dCache - Labels and Virtual Directories

dCache Workshop 2025
Marina Sahakyan for the dCache collaboration



HELMHOLTZ

RESEARCH FOR
GRAND CHALLENGES

- [illegible]

User Metadata/Labeling in dCache



Discover data via WebUI

User specific data

Archive Interface

Facet search

Search: [Text Search] [Clear]

Location: [Group]

Group: p18788 | 2300
p18762 | 10
p18761 | 49
p18748 | 147
p18675 | 18

My Data Public Data **All** Archivable Retrievable Work In Progress System Error User Error

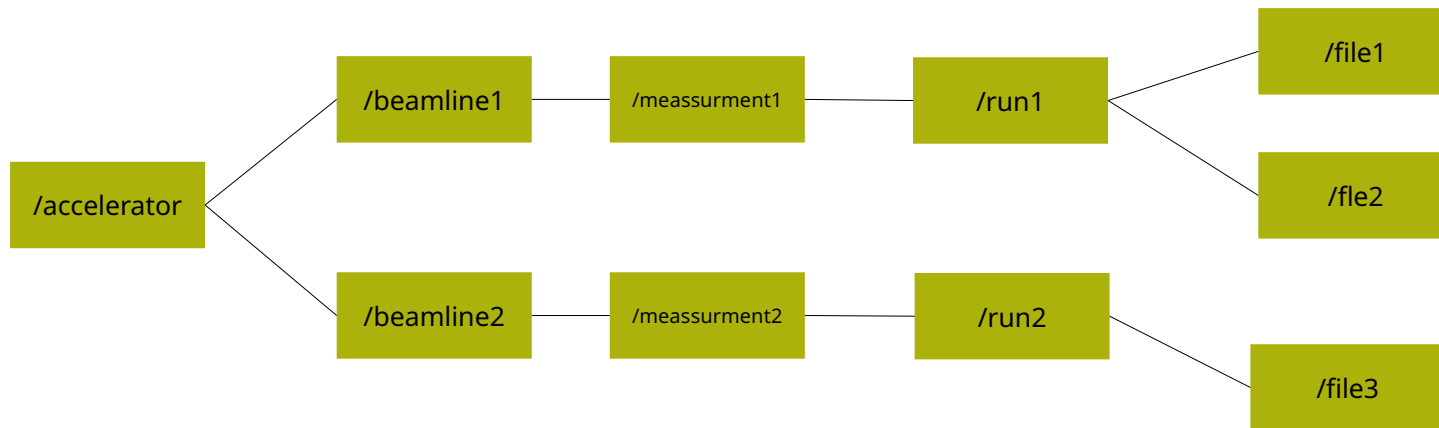
Items per page: 25 1 - 25 of 11122

Name	Source Folder	Size	Start Time	Type	Proposal ID	Group	Data Status
029_estailades1_q01_fw085_ss	...1_fw085_ss	1 TB	2020-12-23 Wed 00:05	derived		p17614	retrievable
020_estailades1_q01_fw085_us	...1_fw085_us	729 GB	2020-12-23 Wed 00:05	derived		p17614	retrievable
019_estailades1_q01_fw085_us	...1_fw085_us	376 GB	2020-12-23 Wed 00:05	derived		p17614	retrievable
018_estailades1_q01_fw085_us	...1_fw085_us	376 GB	2020-12-23 Wed 00:05	derived		p17614	retrievable
031_estailades1_q01_fw085_ss	...1_fw085_ss	4 TB	2020-12-22 Tue 22:02	derived		p17614	retrievable
20201214_ANAXAM/11_360_	...AM/11_360_	47 GB	2020-12-14 Mon 20:59	raw	unknown	p17896	archivable
20201214_ANAXAM/10_360_	...AM/10_360_	47 GB	2020-12-14 Mon 20:37	raw	unknown	p17896	archivable
09_360/09_360_513_	...9_360_513_	47 GB	2020-12-14 Mon 20:09	raw	unknown	p17896	archivable
09_360/09_360_512_	...9_360_512_	47 GB	2020-12-14 Mon 20:03	raw	unknown	p17896	archivable
09_360/09_360_511_	...9_360_511_	47 GB	2020-12-14 Mon 19:57	raw	unknown	p17896	archivable
09_360/09_360_510_	...9_360_510_	47 GB	2020-12-14 Mon 19:52	raw	unknown	p17896	archivable
09_360/09_360_509_	...9_360_509_	47 GB	2020-12-14 Mon 19:46	raw	unknown	p17896	archivable
09_360/09_360_508_	...9_360_508_	47 GB	2020-12-14 Mon 19:40	raw	unknown	p17896	archivable
09_360/09_360_507_	...9_360_507_	47 GB	2020-12-14 Mon 19:35	raw	unknown	p17896	archivable
09_360/09_360_506_	...9_360_506_	47 GB	2020-12-14 Mon 19:29	raw	unknown	p17896	archivable

Scientific Data Associated to Metadata



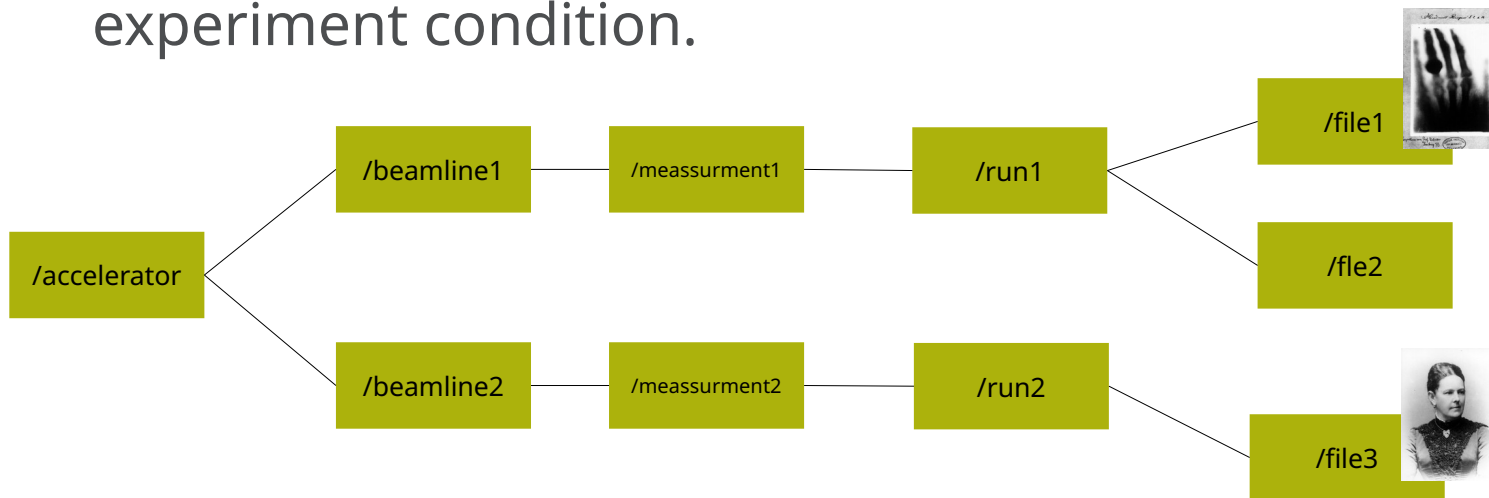
- Experimental data is coming into a file system.
- Traditional file systems group files in one of above mentioned criteria.



Scientific Data Associated to Metadata



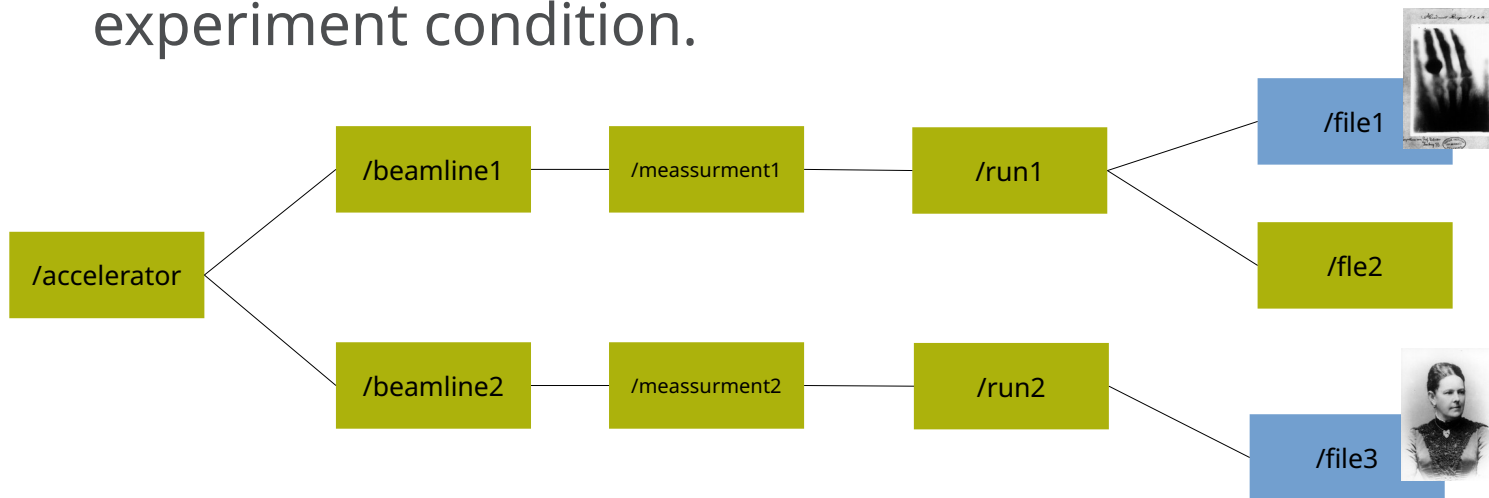
- Each file in a directory can belong to several logical groups, such as a special type or experiment condition.



Scientific Data Associated to Metadata



- Each file in a directory can belong to several logical groups, such as a special type or experiment condition.



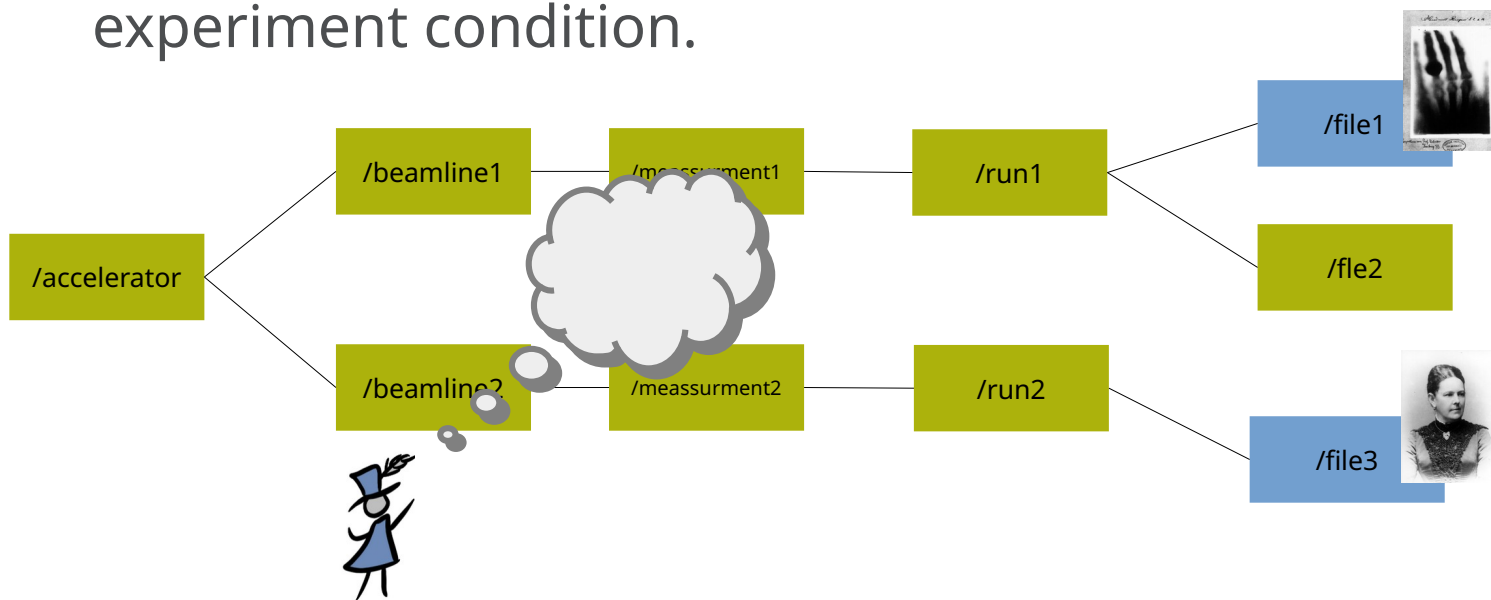
#Anna Bertha Ludwig



Scientific Data Associated to Metadata



- Each file in a directory can belong to several logical groups, such as a special type or experiment condition.
- A researcher searches files based on certain experiment condition.



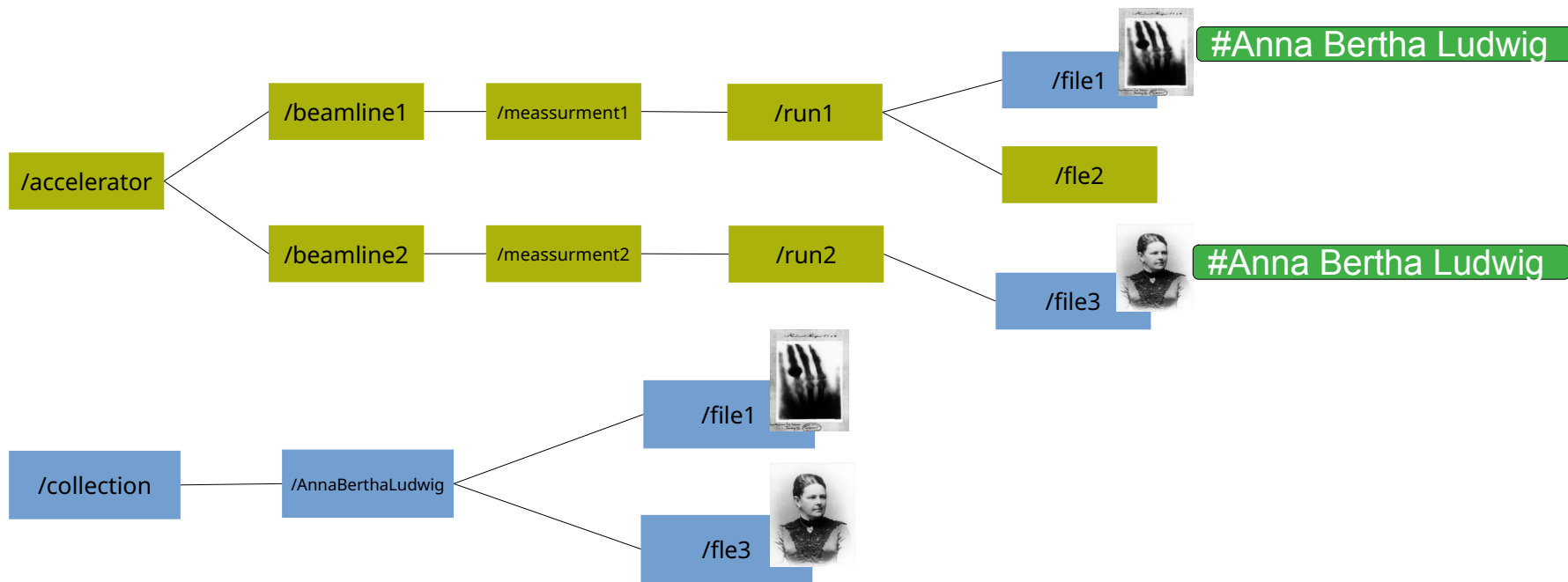
#Anna Bertha Ludwig



Scientific Data Associated to Metadata



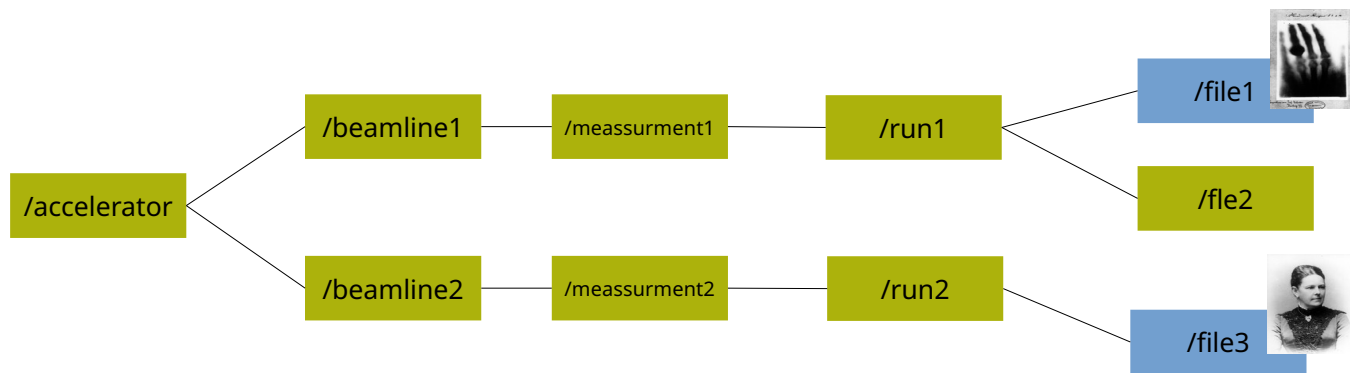
- We can have two views
 - File System tree as it is stored in the storage system.
 - Logical View logical tree grouped by particular attribute.



User Metadata/Labeling in dCache



- We can have two views
 - File System tree as it is stored in the storage system.
 - Logical View logical tree grouped by particular attribute.

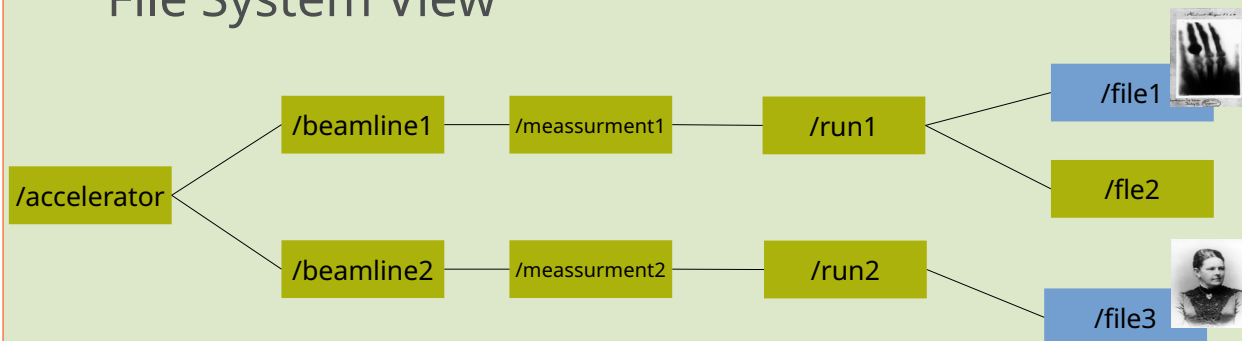


```
curl -X POST https://lhost:portnumber/namespace/path-to-file
'{
  "action" : "set-label",
  "label" : "AnnaBerthaLudwig"
}'
```

User Metadata/Labeling in dCache



- File System View

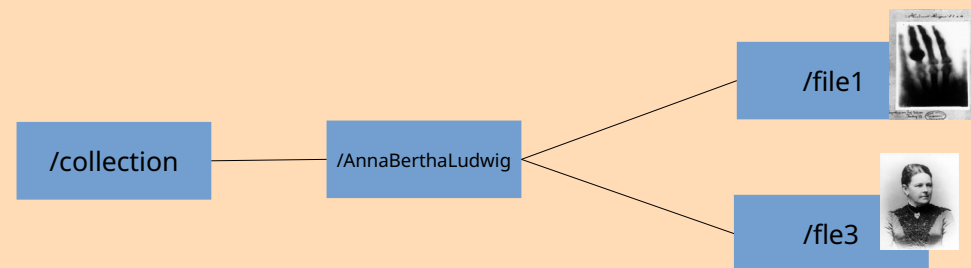


```
$ ls -l /dCache/accelerator/beamline1/meassurment1/run1
```

```
file1.jpg  
file2.jpg
```

```
$ ls -l /dCache/accelerator/beamline2/meassurment2/run2
```

```
file3.jpg
```



```
$ ls -l /dCache/.(collection)/AnnaBerthaLudwig
```

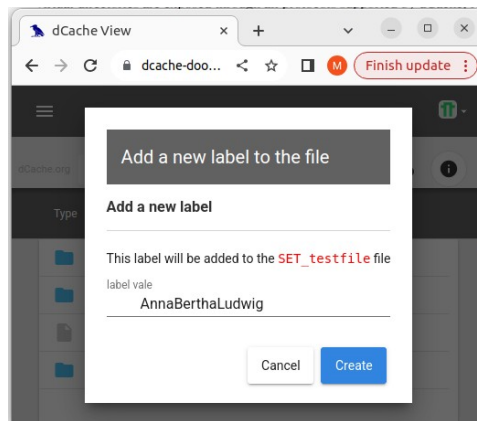
```
file1.jpg  
file3.jpg
```

- Virtual Directory View

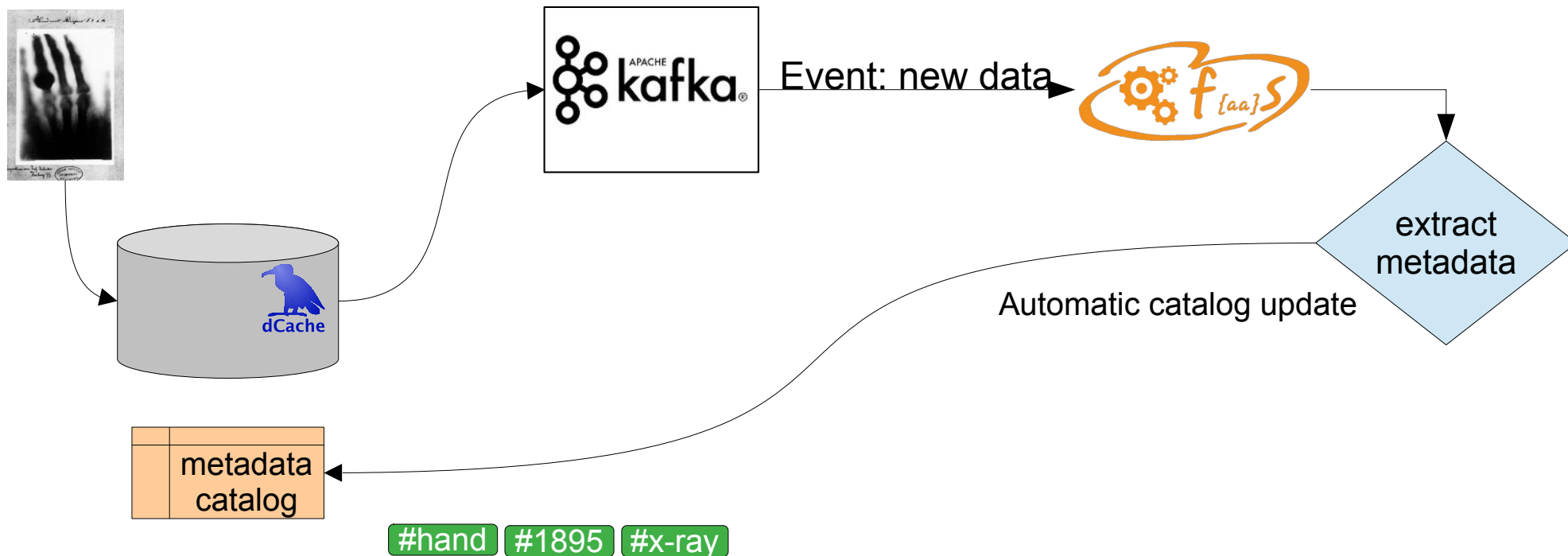
User Metadata/Labeling in dCache



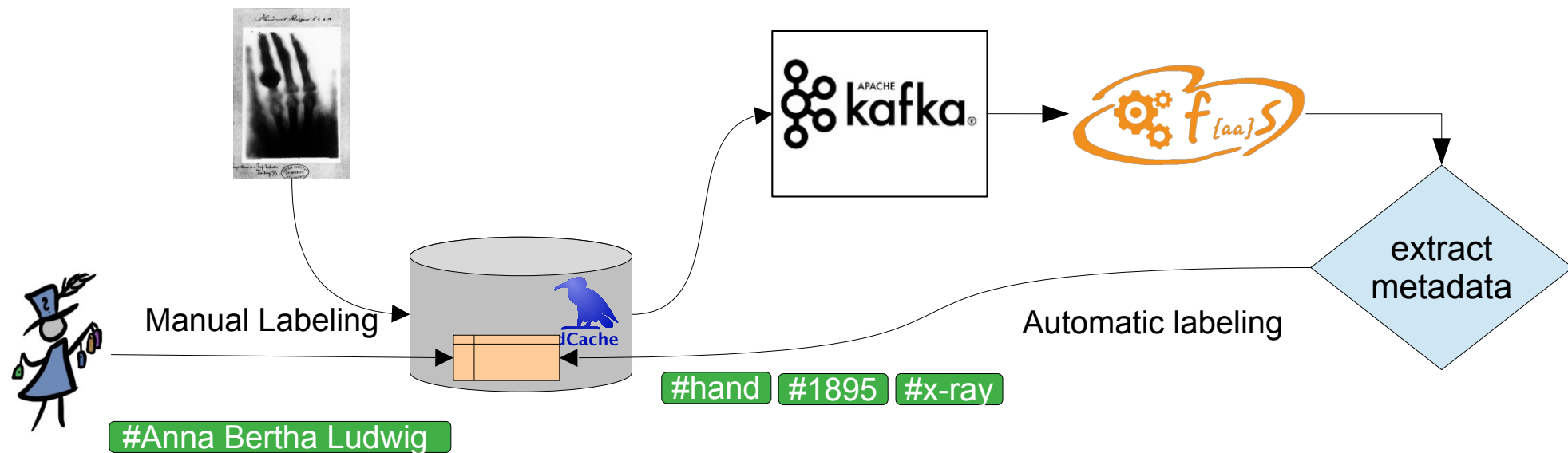
```
curl -X POST https://host:portnumber/namespace/path-to-file  
{  
  "action" : "set-label",  
  "label" : "AnnaBerthaLudwig"  
}
```



Automatic Metadata Population

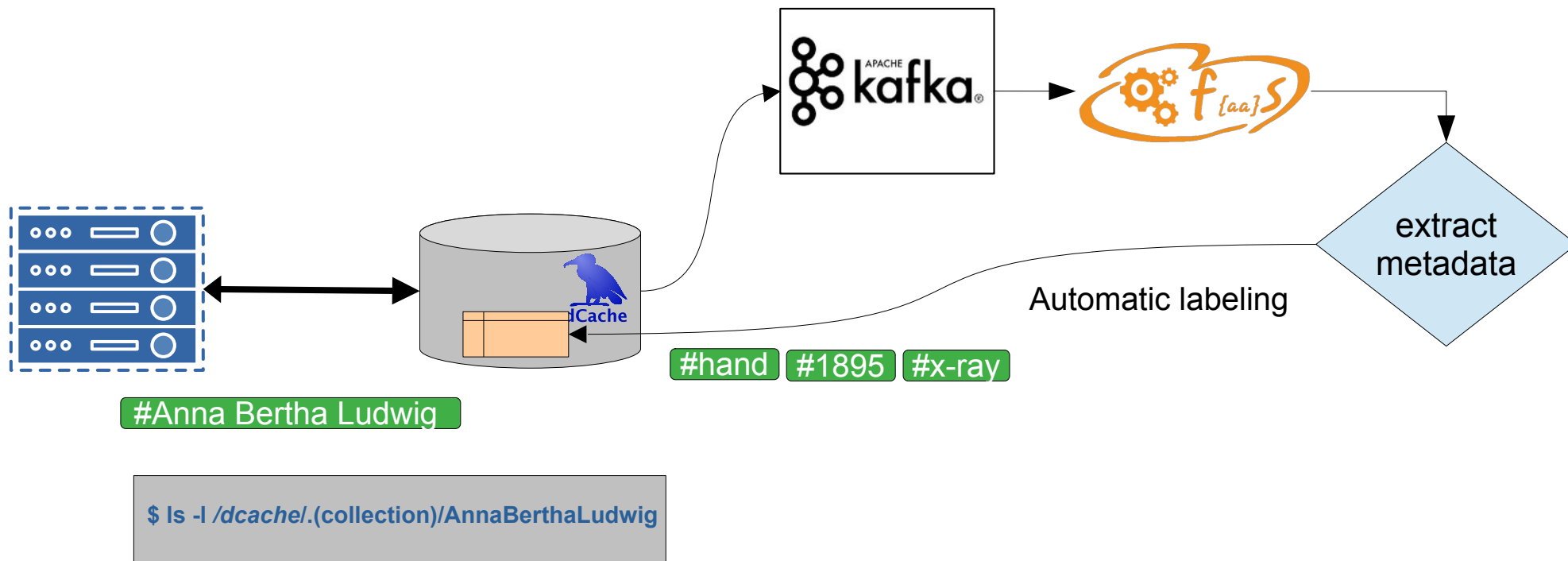


Automatic Metadata Population

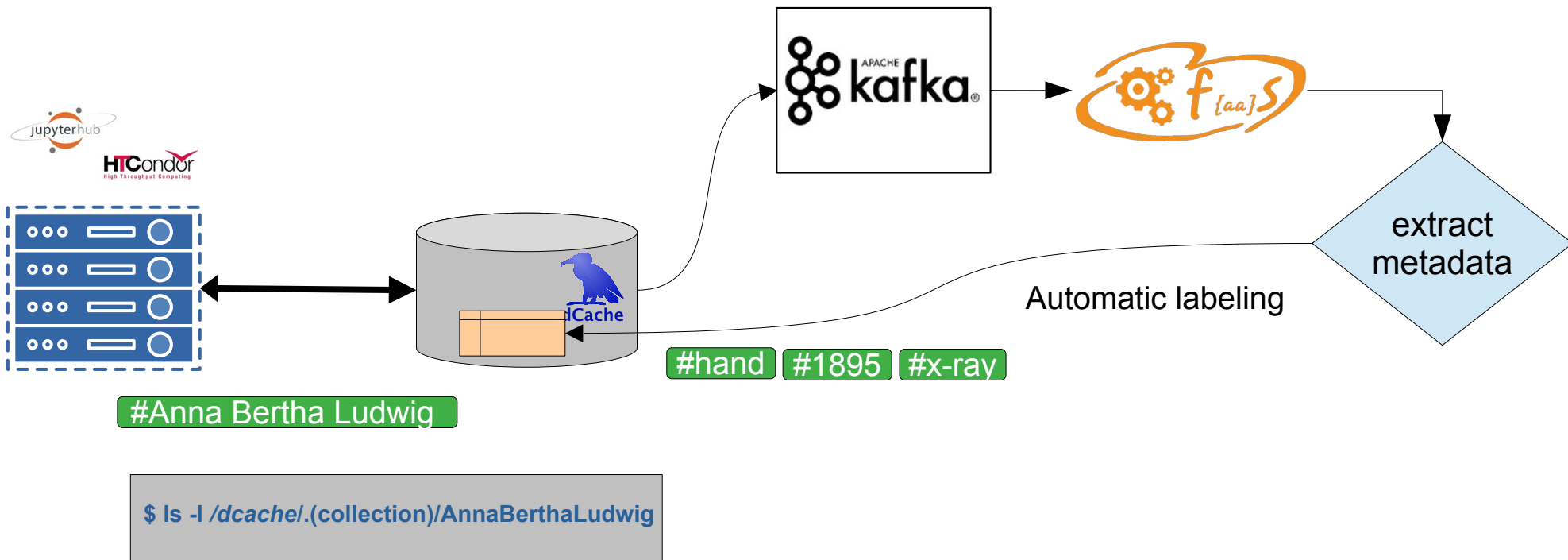


Up to now such catalogs were external to dCache.

Automatic Metadata Population



Automatic Metadata Population





Label-based virtual **read-only** directories (WIP)

- Add, remove or delete a label to any file
- List all files with a given label
- Exposed via NFS, WebDAV, REST
- List all existing labels
- dCache rules applies
 - Visible through all protocols
 - Respect file permissions

User Metadata/Labeling in dCache



```
→ curl -X POST https://host:portnumber/  
namespace/path-to-file  
{  
  "action" : "set-label",  
  "label" : "AnnaBerthaLudwig"  
}
```

User Metadata/Labeling in dCache



→ `curl -X POST https://host:portnumber/
namespace/path-to-file`

```
{  
  "action" : "set-label",  
  "label" : "AnnaBerthaLudwig"  
}
```

→ `chimera=# select * from t_labels;`

User Metadata/Labeling in dCache



```
→ chimera=# select * from t_labels;
```

```
→ curl -X POST https://host:portnumber/  
namespace/path-to-file  
{  
  "action" : "set-label",  
  "label" : "AnnaBerthaLudwig"  
}
```

label_id	labelname
1	AnnaBerthaLudwig

User Metadata/Labeling in dCache



```
→ chimera=# select * from t_labels;
```

```
→ chimera=# select * from t_labels_ref;
```

```
→ curl -X POST https://host:portnumber/  
namespace/path-to-file  
{  
  "action" : "set-label",  
  "label" : "AnnaBerthaLudwig"  
}
```

label_id	labelname
1	AnnaBerthaLudwig

User Metadata/Labeling in dCache



```
→ chimera=# select * from t_labels;
```

```
→ chimera=# select * from t_labels_ref;
```

```
→ curl -X POST https://host:portnumber/  
namespace/path-to-file  
{  
  "action" : "set-label",  
  "label" : "AnnaBerthaLudwig"  
}
```

label_id	labelname
1	AnnaBerthaLudwig

label_id	inumber
1	327

User Metadata/Labeling in dCache



→ chimera=# select * from t_labels;

→ chimera=# select * from t_labels_ref;

```
→ curl -X POST https://host:portnumber/  
namespace/path-to-file  
{  
  "action" : "set-label",  
  "label" : "Xray"  
}
```

label_id	labelname
1	AnnaBerthaLudwig

label_id	inumber
1	327

User Metadata/Labeling in dCache



→ chimera=# select * from t_labels;

→ chimera=# select * from t_labels_ref;

```
→ curl -X POST https://host:portnumber/  
namespace/path-to-file  
{  
  "action" : "set-label",  
  "label" : "Xray"  
}
```

label_id	labelname
1	AnnaBerthaLudwig
2	Xray

label_id	inumber
1	327

User Metadata/Labeling in dCache



```
→ chimera=# select * from t_labels;
```

```
→ chimera=# select * from t_labels_ref;
```

```
→ curl -X POST https://host:portnumber/  
namespace/path-to-file  
{  
  "action" : "set-label",  
  "label" : "Xray"  
}
```

label_id	labelname
1	AnnaBerthaLudwig
2	Xray

label_id	inumber
1	327
2	355

User Metadata/Labeling in dCache



→ `curl -X GET https://host:portnumber/labels`

User Metadata/Labeling in dCache



→ `curl -X GET https://host:portnumber/labels`

→ `chimera=# select * from t_labels;`

label_id	labelname
1	AnnaBerthaLudwig
2	Xray

```
{  
  "labels" : [ "AnnaBerthaLudwig", "XRay" ]  
}
```

User Metadata/Labeling in dCache



```
→ curl -X GET https://host:portnumber/labels/  
AnnaBerthaLudwig
```

```
{  
  "labels" : [ "AnnaBerthaLudwig", "XRay" ]  
}
```

User Metadata/Labeling in dCache



→ chimera=# select * from t_dirs ;

→ curl -X GET https://host:portnumber/labels/
AnnaBerthaLudwig

iparent	ichild	iname
325	327	Image.jpg
355	356	Image.jpg

User Metadata/Labeling in dCache



→ chimera=# select * from t_dirs ;

→ chimera=# select * from t_inodes ;

→ curl -X GET https://host:portnumber/labels/
AnnaBerthaLudwig

iparent	ichild	iname
325	327	Image.jpg
355	356	Image.jpg

ictime	ipsnfsid	inumber
2025-02-17	12	327
2025-03-17	23	356

User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325
```

```
image.jpg-355
```

label_id	labelname
1	AnnaBerthaLudwig
2	Xray

label_id	inumber
1	327

iparent	ichild	iname
325	327	Image.jpg
355	356	Image.jpg

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2025-02-17	12	327
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User Metadata/Labeling in dCache



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$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
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label_id	labelname
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User Metadata/Labeling in dCache



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```

```
image.jpg-325  
image.jpg-355
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label_id	labelname
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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
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image.jpg-325  
image.jpg-355
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label_id	labelname
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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325  
image.jpg-355
```

label_id	labelname
1	AnnaBerthaLudwig
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label_id	inumber
1	327

iparent	ichild	iname
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2025-02-17	12	327
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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325  
image.jpg-355
```

label_id	labelname
1	AnnaBerthaLudwig
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label_id	inumber
1	327

iparent	ichild	iname
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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325
```

```
image.jpg-355
```

label_id	labelname
1	AnnaBerthaLudwig
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label_id	inumber
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iparent	ichild	iname
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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325  
image.jpg-355
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label_id	labelname
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iparent	ichild	iname
325 355	327 356	Image.jpg Image.jpg

ictime	ipsnfsid	inumber
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2025-03-17	23	356

User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325
image.jpg-355
```

```
$ sha1sum /mnt/.\collection\/( image.jpg-325 )
```

label_id	labelname
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label_id	inumber
1	327

iparent	ichild	iname
325 355	327 356	Image.jpg Image.jpg

ictime	ipsnfsid	inumber
2025-02-17	12	327
2025-03-17	23	356

User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325
image.jpg-355
```

```
path(325) /public/sahakyan/image.jpg
path(355) /private/sahakyan/image.jpg
```

label_id	labelname
1	AnnaBerthaLudwig
2	Xray

label_id	inumber
1	327

iparent	ichild	iname
325 355	327 356	Image.jpg Image.jpg

ictime	ipsnfsid	inumber
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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325  
image.jpg-355
```

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325	327	Image.jpg
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ictime	ipsnfsid	inumber
2025-02-17	12	327
2025-03-17	23	356

User Metadata/Labeling in dCache



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$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
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```
image.jpg-325  
image.jpg-355
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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
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image.jpg-325  
image.jpg-355
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User Metadata/Labeling in dCache



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```
image.jpg-325  
image.jpg-355
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ictime	ipsnfsid	inumber
2025-02-17	12	327
2025-03-17	23	356

User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
total 1
-rw-r--r-- 1 sahakya sahakya 242 Feb  2 15:22 image.jpg-325
```

label_id	labelname
1	AnnaBerthaLudwig
2	Xray

label_id	inumber
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iparent	ichild	iname
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ictime	ipsnfsid	inumber
2025-02-17	12	327
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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325
```

```
image.jpg-355
```

```
path(325) /public/sahakyan/image.jpgg
```

```
path(355) /private/sahakyan/image.jg
```

label_id	labelname
1	AnnaBerthaLudwig
2	Xray

label_id	inumber
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iparent	ichild	iname
325	327	Image.jpg
355	356	Image.jpg

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2025-02-17	12	327
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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325
```

```
image.jpg-355
```

```
rm /public/sahakyan/image.jpgg
```

label_id	labelname
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325	327	Image.jpg
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User Metadata/Labeling in dCache



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```

```
image.jpg-325
```

```
image.jpg-355
```

```
rm /public/sahakyan/image.jgg
```

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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325
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```
image.jpg-355
```

```
rm /public/sahakyan/image.jgg
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label_id	labelname
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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
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```
image.jpg-325
```

```
image.jpg-355
```

```
rm /public/sahakyan/image.jgg
```

label_id	labelname
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iparent	ichild	iname
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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325
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```
image.jpg-355
```

```
rm /public/sahakyan/image.jgg
```

label_id	labelname
1	AnnaBerthaLudwig
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label_id	inumber
----------	---------

iparent	ichild	iname
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User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
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```

label_id	labelname
2	Xray

label_id	inumber
----------	---------

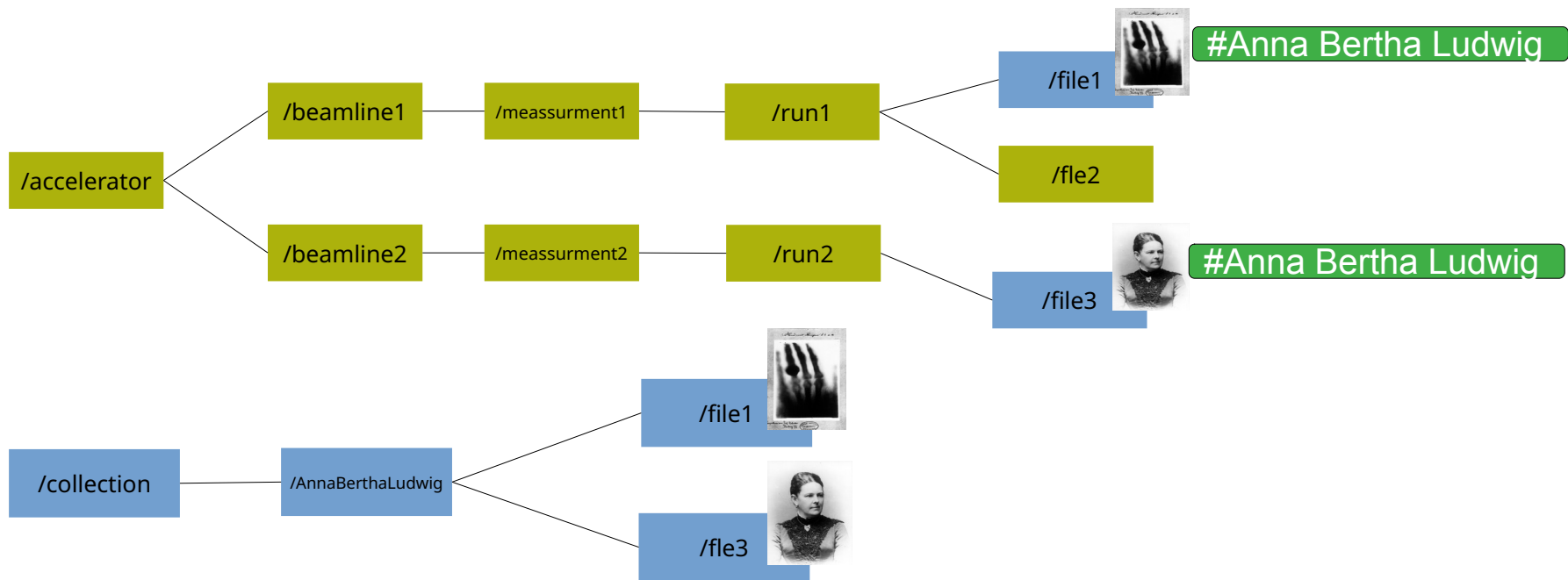
iparent	ichild	iname
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2025-03-17	23	356

Scientific Data Associated to Metadata



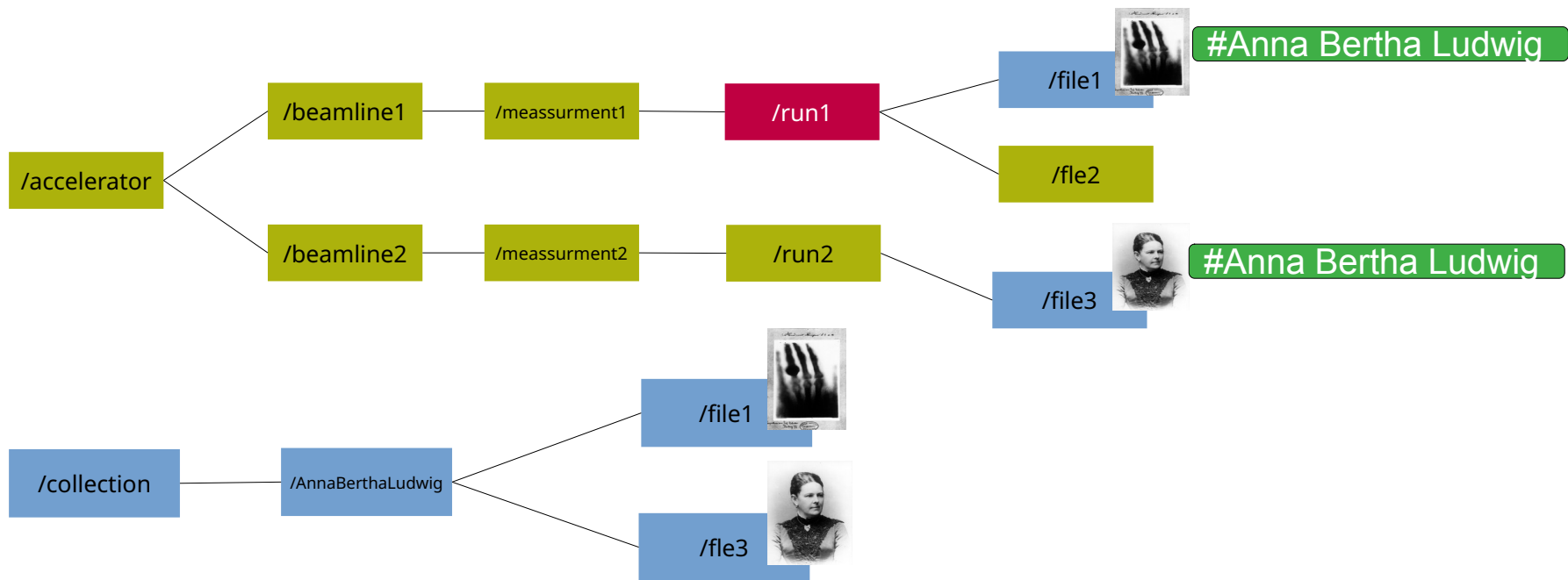
- **Permissions!** - Respect file permissions



Scientific Data Associated to Metadata



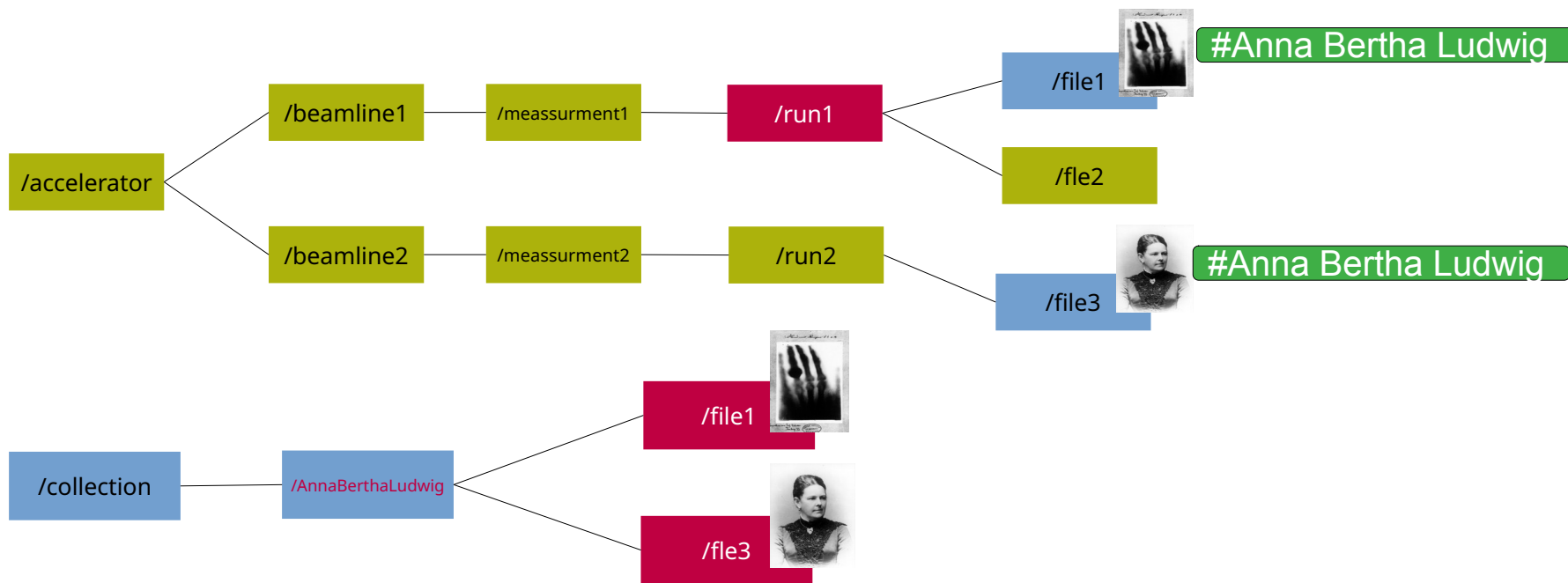
- **Permissions!** - Respect file permissions
 - On a directory



Scientific Data Associated to Metadata



- **Permissions!** - Respect file permissions
 - On a directory
 - Are in the list but only for read



Future changes to RESTAPI



```
→ curl -X GET https://host:portnumber/labels  
/AnnaBerthaLudwig
```



```
→ curl -X POST https://host:portnumber/  
namespace/path-to-file  
{  
  "action" : "set-label",  
  "label" : "Xray"  
}
```

Future changes to RESTAPI



```
→ curl -X GET https://host:portnumber/labels  
/AnnaBerthaLudwig
```



```
→ curl -X POST https://host:portnumber/  
namespace/path-to-file  
{  
  "action" : "set-label",  
  "label" : "Xray"  
}
```

Future changes to RESTAPI



→ **curl -X POST https://host:portnumber/labels
/AnnaBerthaLudwig**

Future changes to RESTAPI



→ **curl -X POST https://host:portnumber/labels/AnnaBerthaLudwig/? file = path-to-file**



- 1) Uploading files in dCache-view
- 2) Adding labels in dCache-view
- 3) Adding labels via RestAPI
- 4) ls - via nfs
- 5) ls - web-dav
- 6) Download files



- Label-based virtual **read-only** directories (WIP)
 - List all files with a given label
 - List all existing labels
- dCache rules applies
 - Visible through all protocols
 - Respect file/dir permissions
- Automatic metadata extraction to reduce manual effort



- Thank you

User Metadata/Labeling in dCache



Discover data via WebUI

User
specific
data

Archive
Interface

Facet
search

The screenshot shows the dCache WebUI interface. At the top, there is a blue header bar with the PSI logo and navigation links like 'Help' and 'About'. Below the header, there is a search bar and a list of tabs: 'My Data', 'Public Data', 'All', 'Archivable', 'Retrievable', 'Work In Progress', 'System Error', and 'User Error'. The 'All' tab is selected. On the left side, there is a 'Facet search' panel showing a list of groups: 'p18788 | 2300', 'p18762 | 10', 'p18761 | 49', 'p18748 | 147', and 'p18675 | 18'. The main area displays a table of search results with columns: 'Name', 'Source Folder', 'Size', 'Start Time', 'Type', 'Proposal ID', 'Group', and 'Data Status'. The table contains several rows of data, including entries for '029_estailades1_q01_fw085_ss', '020_estailades1_q01_fw085_us', '019_estailades1_q01_fw085_us', '018_estailades1_q01_fw085_us', '031_estailades1_q01_fw085_ss', and a series of raw data files from 2020-12-14. A red box highlights a subset of these raw data files in the table.

Name	Source Folder	Size	Start Time	Type	Proposal ID	Group	Data Status
029_estailades1_q01_fw085_ss	...1_fw085_ss	1 TB	2020-12-23 Wed 00:05	derived		p17614	retrievable
020_estailades1_q01_fw085_us	...1_fw085_us	729 GB	2020-12-23 Wed 00:05	derived		p17614	retrievable
019_estailades1_q01_fw085_us	...1_fw085_us	376 GB	2020-12-23 Wed 00:05	derived		p17614	retrievable
018_estailades1_q01_fw085_us	...1_fw085_us	376 GB	2020-12-23 Wed 00:05	derived		p17614	retrievable
031_estailades1_q01_fw085_ss	...1_fw085_ss	4 TB	2020-12-22 Tue 22:02	derived		p17614	retrievable
20201214_ANAXAM/11_360_	...AM/11_360_	47 GB	2020-12-14 Mon 20:59	raw	unknown	p17896	archivable
20201214_ANAXAM/10_360_	...AM/10_360_	47 GB	2020-12-14 Mon 20:37	raw	unknown	p17896	archivable
09_360/09_360_513_	...9_360_513_	47 GB	2020-12-14 Mon 20:09	raw	unknown	p17896	archivable
09_360/09_360_512_	...9_360_512_	47 GB	2020-12-14 Mon 20:03	raw	unknown	p17896	archivable
09_360/09_360_511_	...9_360_511_	47 GB	2020-12-14 Mon 19:57	raw	unknown	p17896	archivable
09_360/09_360_510_	...9_360_510_	47 GB	2020-12-14 Mon 19:52	raw	unknown	p17896	archivable
09_360/09_360_509_	...9_360_509_	47 GB	2020-12-14 Mon 19:46	raw	unknown	p17896	archivable
09_360/09_360_508_	...9_360_508_	47 GB	2020-12-14 Mon 19:40	raw	unknown	p17896	archivable
09_360/09_360_507_	...9_360_507_	47 GB	2020-12-14 Mon 19:35	raw	unknown	p17896	archivable
09_360/09_360_506_	...9_360_506_	47 GB	2020-12-14 Mon 19:29	raw	unknown	p17896	archivable

User Metadata/Labeling in dCache



→ chimera=# select * from t_labels_ref;

```
→ curl -X POST https://lhost:portnumber/  
namespace/path-to-file  
{  
  "action" : "set-label",  
  "label" : "AnnaBerthaLudwig"  
}
```

label_id	labelname
1	AnnaBerthaLudwig

label_id	inumber
1	327

User Metadata/Labeling in dCache



→ chimera=#

```
select inumber2path(inumber)
from t_inodes where inumber
in (select inumber
from t_labels_ref where label_id
in (select label_id from t_labels
where labelname=
'AnnaBerthaLudwig'));
```

→ curl -X GET https://lhost:portnumber/labels/
AnnaBerthaLudwig

iparent	ichild	iname
325	327	Image.jpg
355	356	Image.jpg

ipsnfsid	inumber
12	327
23	356

User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325  
image.jpg-355
```

label_id	labelname
1	AnnaBerthaLudwig
2	Xray

label_id	inumber
1	327

iparent	ichild	iname
325	327	Image.jpg
355	356	Image.jpg

ictime	ipsnfsid	inumber
2025-02-17	12	327
2025-03-17	23	356

User Metadata/Labeling in dCache



```
$ ls -l /dcache/.(collection)/AnnaBerthaLudwig
```

```
image.jpg-325
```

```
image.jpg-355
```

label_id	labelname
1	AnnaBerthaLudwig
2	Xray

label_id	inumber
1	327

iparent	ichild	iname
325	327	Image.jpg
355	356	Image.jpg

ictime	ipsnfsid	inumber
2025-02-17	12	327
2025-03-17	23	356