

Inria

*Consortium Inria
for Shanoir*

Shanoir, as a tool
rencontres des ingénieurs de santé numérique

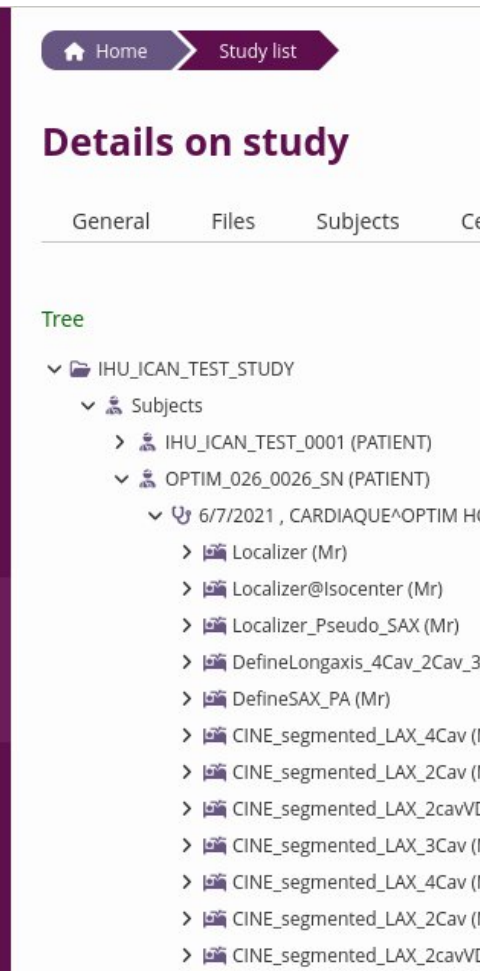
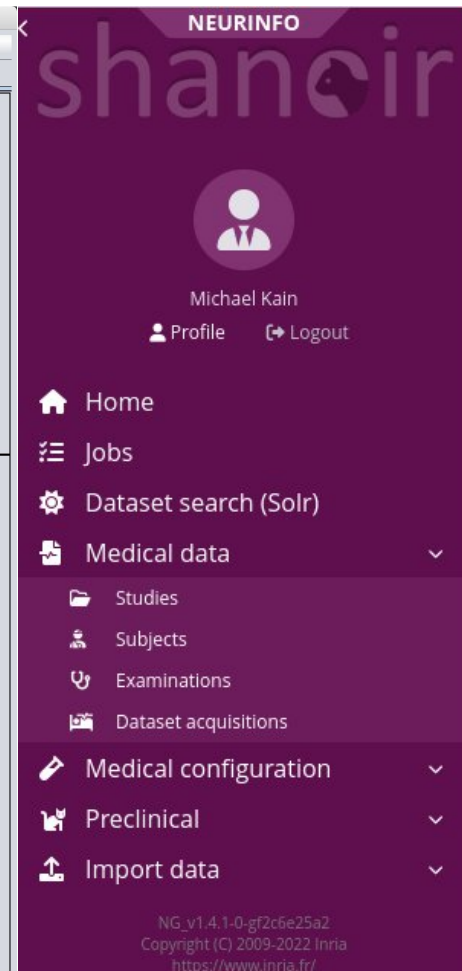
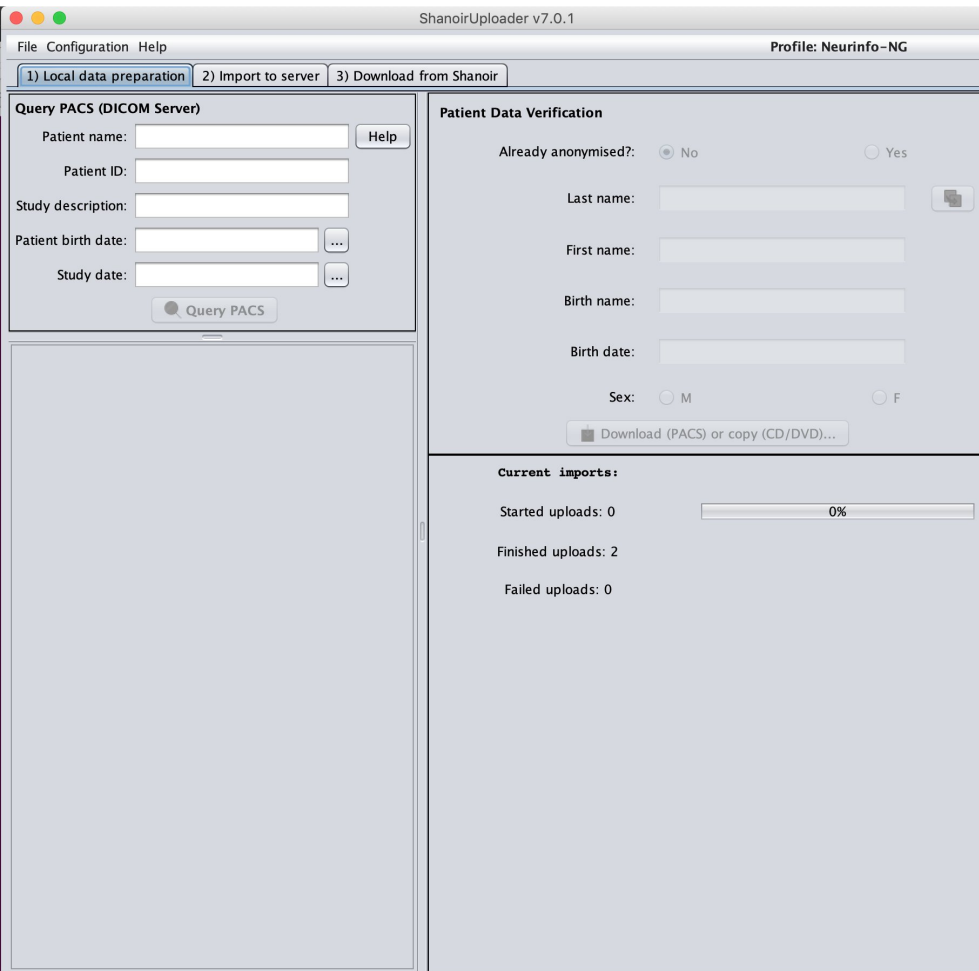
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Introduction - General

- **SHARing NeuroImaging Resources**
 - “Neuro” could be removed
 - As DICOM-based, we manage heart or other organ studies
- **Manage multi-center clinical and preclinical imaging studies for research**
 - OFSEP (Observatoire Français de la Sclérose en Plaques)
 - 7.000 patients, 26.000 exams, 28 hospitals connected
 - UCAN/ICAN (Prédire l'évolution anévrismale)
 - 4.000 patients
 - SAIN (Small Animal Imaging Network)
 - Image database of France Life Imaging
 - Information Analysis and Management (FLI-IAM)
 - Scientific responsible: Michel Dojat
- **Modalities: DICOM (MR, CT, PT, NM), Bruker, EEG (EDF/BrainVision), ECG**
 - Generates NIFTIs automatically during import
- **DICOM pseudonymization during import**
- **+10 years experience in managing images**



Client (ShanoirUploader + Browser) <-> Server



Tool box Shanoir - 1

- **Stack**

- Angular 11.0.5 (frontend)
- Spring Boot 2.6.6 (backend) and Java 11
 - 2023: migrate to Spring Boot 3
 - Important: introduce **Spring Native**
 - -> reduce memory consumption at least by 1/3 of today

- **DICOM handling**

- Read/write DICOM files (dcm4che3)
- Generate DICOMDIR from folder
- DICOM Query/Retrieve DIMSE (dcm4che3)
 - From Server
 - From ShanoirUploader
 - Patient-Root and Study-Root queries (C-FIND + C-MOVE)
- Suppl. 142 based DICOM-pseudonymization module is an independent Java project/jar
 - <https://github.com/fli-iam/shanoir-ng/tree/develop/shanoir-ng-anonymization>
 - Configurable via an Excel table
- DICOMWeb
 - Interface exposed by server, used by OHIF viewer
 - Clients calls to internal storage PACS (dcm4chee5)

OHIF viewer: visualize and annotate images

Open Health Imaging Foundation | Study List

INVESTIGATIONAL USE ONLY Options

Series Stack Scroll Zoom Levels Pan Length Annotate Angle Reset CINE More 2D MPR Layout

Measurements

0391d23b-c29e-47b4-95ff-cba32d6dc453
0391d23b-c29e-47b4-95ff-cba32d6dc453

ARF

QUALITE⁺ACR
Apr 24, 2018 Invalid date

StudyDate
24-Apr-18

Measurements 1

1
...
22.95 mm

RPH

22.95 mm

Ser: 4
Img: 1 1/27
480 x 512
Loc: -66.04 mm Thick: 4.00 mm

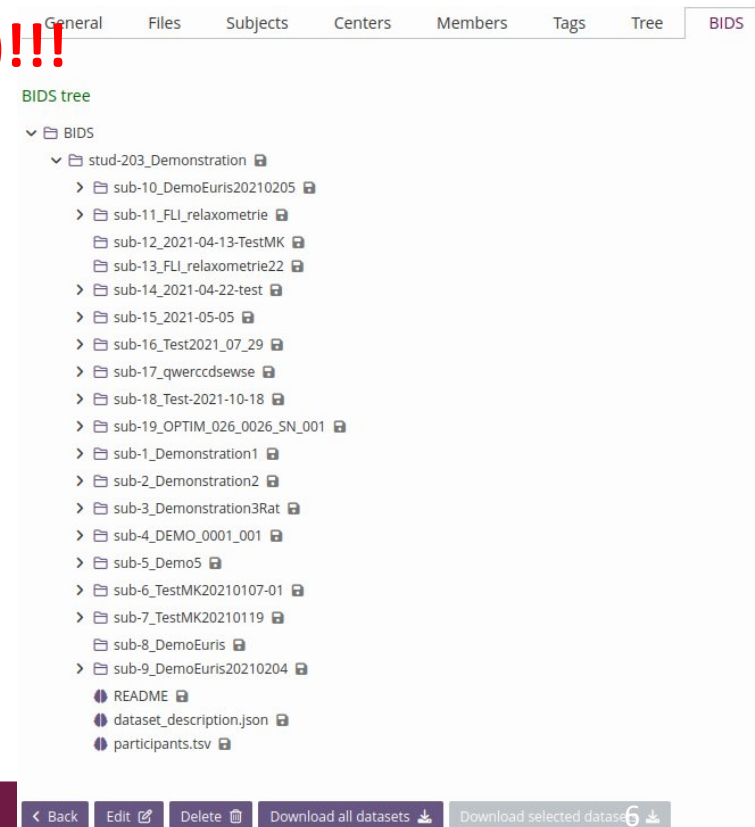
Zoom: 167%
W: 2748 L: 2776
Lossless / Uncompressed

STOW SR
Measurements saved successfully

Save measurements

Tool box Shanoir - 2

- Keycloak and OpenID Connect
- Microservices architecture
 - Rabbitmq as message bus
 - docker-compose to deploy
 - Spring Boot
 - Angular SPA
- **Brain Imaging Data Structure (BIDS)!!!**
 - auto-generates BIDS tree
- Apache Solr search



Browser: search and download interface

The screenshot displays the Shanoir Solr Search interface. The left sidebar contains navigation options: Home, Jobs, Solr search, Medical data, Medical configuration, Preclinical, Import data, Profile, and Logout. The main content area shows a search bar with the text "search in Shanoir ...", a "Reset" button, and a "Selection (0)" indicator. Below the search bar is a table of search results with the following columns: Id, Adm, Name, Tags, Type, Nature, Study, Subject, Center, Exam, Exam Date, Slice, Pixel, and Mag. strength. The table contains 20 rows of data, each with a checkbox for selection and a circular icon for actions.

| Id | Adm | Name | Tags | Type | Nature | Study | Subject | Center | Exam | Exam Date | Slice | Pixel | Mag. strength |
|--------|-----|-------------------|------|-------------|---------|----------------|----------------|-------------------|----------------|-----------|-------|-------|---------------|
| 422128 | | TETE_COU_AC... | | PET_DATASET | unknown | AP-HP-Demo-... | AP-HP-Demo-... | Hôpital Bicêtr... | QUALITE^ACR | 4/24/2018 | | | |
| 416860 | | t1_se_tra | | MR_DATASET | unknown | AP-HP-Demo-... | AP-HP-Demo-... | Hôpital Bicêtr... | QUALITE^ACR | 4/24/2018 | 4 | 250 | 3 |
| 416498 | | PosDisp: [7] t... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 7 | 320 | 3 |
| 416497 | | PosDisp: [7] t... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 7 | 320 | 3 |
| 416496 | | PosDisp: [7] t... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 7 | 320 | 3 |
| 416495 | | MPRAGE_iso_... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 1 | 238 | 3 |
| 416494 | | t1_se_tra_con... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 201 | 3 |
| 416493 | | ep2d_diff_md... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | | | |
| 416492 | | ep2d_diff_md... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 2 | 751 | 3 |
| 416491 | | ep2d_diff_md... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 2 | 751 | 3 |
| 416490 | | ep2d_diff_md... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 2 | 751 | 3 |
| 416489 | | ep2d_diff_md... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 2 | 751 | 3 |
| 416488 | | t1_se_tra_con... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 201 | 3 |
| 416487 | | T2STAR GRE3... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 260 | 3 |
| 416486 | | T2STAR GRE3... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 260 | 3 |
| 416485 | | T2STAR GRE3... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 260 | 3 |
| 416484 | | T2STAR GRE3... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 260 | 3 |
| 416483 | | T2STAR GRE3... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 260 | 3 |
| 416482 | | T2STAR GRE3... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 260 | 3 |
| 416481 | | T2STAR GRE3... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 260 | 3 |
| 416480 | | T2STAR GRE3... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 260 | 3 |
| 416479 | | T2STAR GRE3... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 260 | 3 |
| 416478 | | T2STAR GRE3... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 260 | 3 |
| 416477 | | loca_t2_tse_A... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 4 | 219 | 3 |
| 416476 | | T2_SE_MC TR... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 226 | 3 |
| 416475 | | T2_SE_MC TR... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 226 | 3 |
| 416474 | | T2_SE_MC TR... | | MR_DATASET | unknown | DouteauStu | Sujet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 226 | 3 |
| 416473 | | T2 SE MC TR... | | MR DATASET | unknown | DouteauStu | Suiet22 | GIN | RECHERCHE^A... | 8/10/2009 | 3 | 226 | 3 |

*today, we can search very rapidly in a subset of meta-data, implemented today
we can NOT search today in all DICOM meta-data

Quality control (upcoming)

- Harmonize sequence names (study cards)
 - cross-vendor
- Check for protocol conformity (Q4-2022)
 - E.g. each DICOM exam should contain at least one TOF + one GADO + each serie > 50 images

Details on study

General Files Subjects Centers Members Tags **Quality** BIDS Tree

Examination level

List of series MUST contain >> *T1*
T2
Localizer

OR

List of series MUST contain >> gadolinium
contrast

Rules on list of series

Series level

If0008,103E - SeriesDescription - CONTAINS - TOF
andIf0054,0081 - NumberOfSlices - SMALLER_THAN - 50 >> Error
+ Add a condition

If0008,103E - SeriesDescription - EQUALS - flgth
andIf0054,0081 - NumberOfSlices - BIGGER_THAN - 50 >> Valid
+ Add a condition

If0008,103E - SeriesDescription - EQUALS - contrast
andIf0008,0060 - Modality - EQUALS - CT >> Warning
+ Add a condition

Rules on unique sequences

Clinical data (eCRF) in/with Shanoir (upcoming)

- **RedCAP clinical data (eCRF) exist today in tabular format (csv)**
 - Example:
 - Patient,Poids (kg),Taille (cm),FC (bpm),PAS (mmHg),PAD (mmHg),Statut tabagique,"Si Fumeur ou Ancien fumeur, date de début","Si Ancien fumeur, date d'arrêt","Si Fumeur, quantité de tabac consommé (cigarettes/jour)","Si Fumeur ou Ancien fumeur, consommation globale (paquet/année)",Complete?
- **A) Possible extension in Shanoir**
 - Add a menu « Clinical data »
 - One table, entire Shanoir is today table-based
 - Import CSV into that table, using the same subject name
 - Link with subject name to existing subjects in Shanoir created during DICOM import
 - Extend search indexer for subject-related meta-data to search for, see above columns and add facets to do so
- **B) FSM project**
 - Interface with CleanWeb eCRF tool

Try yourself...

- Connect to <https://shanoir.irisa.fr> and click on Create an account
- Or use direct link:
<https://shanoir.irisa.fr/shanoir-ng/account-request>
- **All on GitHub**
 - <https://github.com/fli-iam/shanoir-ng>

