**Project title:** Implications of Medical Low Dose Radiation Exposure

**Grant Agreement:** 755523

**Call identifier:** NFRP-2016-2017

**Topic:** NFRP-9

# Documentation of predefined SPARQL queries

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**Work Package:** WP2

**Estimated delivery:** 28 September 2020

**Actual delivery:** 28 September 2020

**Type:** Report

**Dissemination level:** Public

**Version :** V1.0

# 1. Introduction

This document provides a documentation of the predefined SPARQL queries that are implemented in the IRDBB system. It constitutes the main documentation of the content of the Semantic graph.

## History of versions

| Version | Date | Description |
|---|---|---|
| V1.0 | 28/09/2020 | First version corresponding to the distribution of the Semantic translator package SEMANTIC_TRANSLATOR_TAG = 0.0.70 containing the SEMANTICTRANSLATOR_VERSION="0.8.10" based on ONTOLOGY_VERSION="1.3.15" |

## 2. Methodology

27 predefined queries were written to enable the retrieval of data from the semantic database of the IRDBB system (the full list is provided in Table 1).

For an introduction to the IRDBB semantic database, see the presentation available at: https://eibir.teamwork.com/#/files/4620923

| Template ID | Root template | | |
|---|---|---|---|
| Request1 | Clinical research studies | Request15 | Internal radiotherapy CT images used |
| Request2 | CT Datasets and main acquisition parameters | Request16 | Internal radiotherapy NM tomo image used |
| Request3 | CT Datasets and all acquisition parameters | Request17 | Case Report Forms for WP3 T3.3 |
| Request4 | PET Datasets and main acquisition parameters | Request18 | DICOM SR Dose reports:doses of individual acquisitions |
| Request5 | PET Datasets and all acquisition parameters | Request19 | DICOM SR Dose reports: Cumulated doses |
| Request6 | NM Datasets and main acquisition parameters | Request20 | Calibration coefficients |
| Request7 | NM Datasets and all acquisition parameters | Request21 | Recovery coefficient curves |
| Request8 | Relations image datasets with Clinical research studies | Request22 | Elements of recovery coefficient curves |
| Request9 | 3D Dose Maps and provenance data | Request23 | CT number calibration curves |
| Request10 | Volumes Of Interest and organs | Request24 | Elements of CT number calibration curves |
| Request11 | Mean absorbed doses in organs | Request25 | NM phantom |
| Request12 | Non DICOM datasets and handles | Request26 | CT Calibration |
| Request13 | Internal radiotherapy radiopharmaceutical administration | Request27 | SPECT Calibration |
| Request14 | Internal radiotherapy total absorbed doses | | |

Table 1. List of predefined SPARQL queries

A Graphviz diagram has been produced associated to each query.

The purpose of these Graphviz diagrams is to represent the portion of the Semantic graph used in the SPARQL query, i.e.:

- the instances and the class they belong to,
- the relationships between the instances (using object properties of the ontology)
- and their attributes (i.e. names and values taken by data properties).

The conventions used in the Graphviz diagrams are the following:

- **nodes** as **ovals in blue**: denote instances of the class, whose name is denoted in the oval
- **nodes** as **ovals in green**: denote values taken by a data property
- **nodes** as **ovals in red**: denote an instance which is also a class (this mode of representation is called “punning” in the OWL language); the name of the class is shown inside the oval; for example, this is used for image formats, for units of measure, for sex
- **nodes** as **hexagons in black**: instance of a subclass of the class denoted in the oval; for example, this is used for the anatomical structures ( because it is impossible to list all possible classes, so it is more simple to mention the name of a class subsuming all the classes that may be found)
- **nodes** as **hexagons in red**: use of punning of a subclass of the class denoted in the oval); for example, this is used for the radionuclides, the radiopharmaceuticals
- **edges** in **black**: object property connecting two instances
- **edges** in **green**: data property connecting an instance to the value taken
- **edges** in **red**: object property connecting an instance to the value taken in punning mode
- **labels**: when labels of classes or properties are numbers, we show both the IRI and the label

The names of the classes and relationships make use of a prefix. They are listed in Table 2.

| Prefix | Full IRI |
|---|---|
| rdf: | <http://www.w3.org/1999/02/22-rdf-syntax-ns#> |
| owl: | <http://www.w3.org/2002/07/owl#> |
| dfs: | <http://www.w3.org/2000/01/rdf-schema#> |
| xsd: | <http://www.w3.org/2001/XMLSchema#> |
| skos: | <http://www.w3.org/2004/02/skos/core#> |
| ontomedirad: | PREFIX ontomedirad: <http://medicis.univ-rennes1.fr/ontologies/ontospm/OntoMEDIRAD.owl#> |
| purl: | <http://purl.obolibrary.org/obo/> |

| | |
|---|---|
| dcm: | <http://dicom.nema.org/resources/ontology/DCM/> |
| radionuclides: | <http://medicis.univ-rennes1.fr/ontologies/ontospm/Radionuclides_for_OntoMEDIRAD.owl#> |
| snmi: | <http://purl.bioontology.org/ontology/SNMI/> |

Table 2. List of prefixes

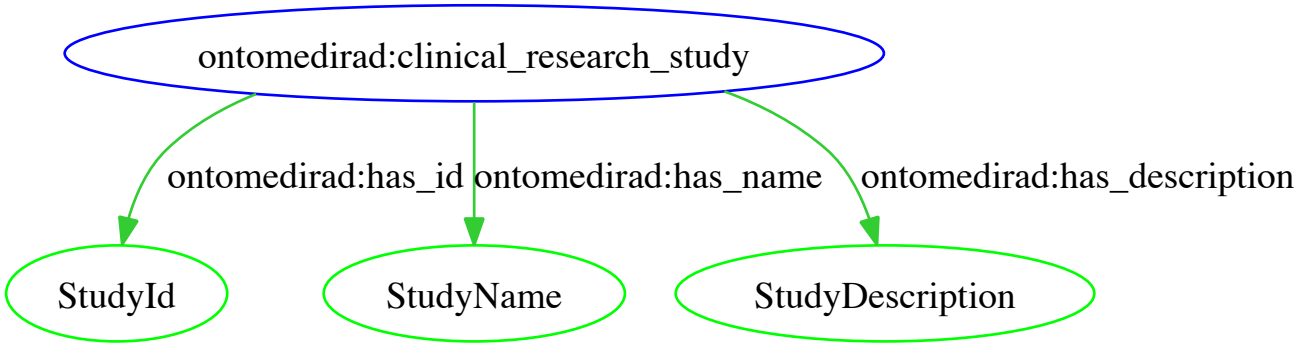
Note: Since the diagrams were documented manually, there may be some errors. Please report any errors to the author of this document: bernard.gibaud@univ-rennes1.fr

Thank you

## 3. Graphviz diagrams of the SPARQL queries

### Query 1 - Clinical research studies

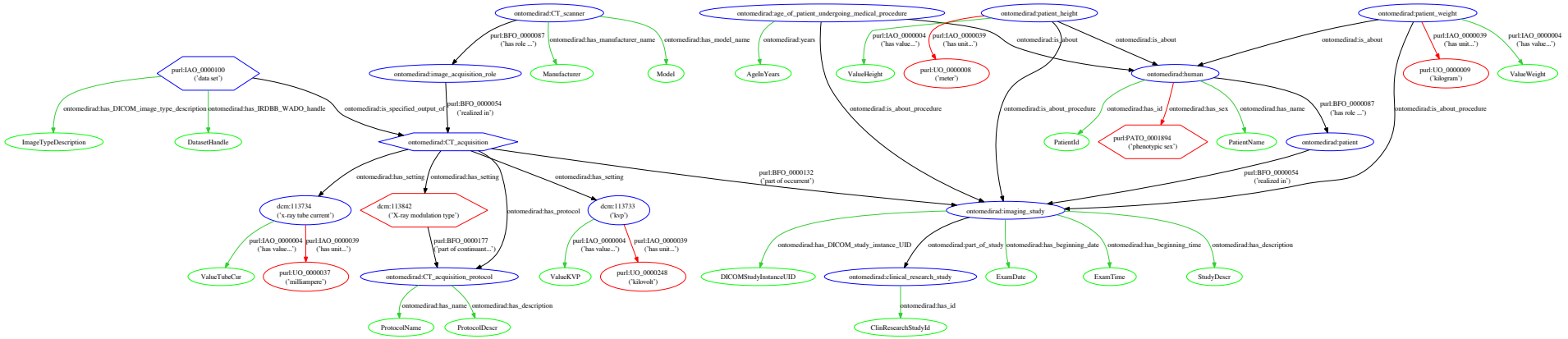
```
SELECT DISTINCT ?ClinResearchStudy ?StudyId ?StudyName ?StudyDescription
WHERE { ?ClinResearchStudy rdf:type ontomedirad:clinical_research_study .
 ?ClinResearchStudy ontomedirad:has_id ?StudyId .
 ?ClinResearchStudy ontomedirad:has_name ?StudyName .
 ?ClinResearchStudy ontomedirad:has_description ?StudyDescription  }
```



## Query 2 - CT Datasets and main acquisition parameters

```
SELECT DISTINCT ?ClinResearchStudyId ?PatientName ?LabelSex ?AgeInYears ?StudyDescr ?ProtocolName ?ProtocolDescr ?ExamDate ?ExamTime ?ValueWeight
?LabelUnitWeight ?CTAcqClass ?ValueKVP ?LabelUnitKVP ?ValueTubeCur ?LabelUnitTubeCur ?LabelXRayModulationType ?Dataset ?DatasetClassLabel
?ImageTypeDescription ?DatasetHandle ?Model ?Manufacturer
 WHERE {
 ?RolePat purl:BFO_0000054 ?Exam .
 ?Human purl:BFO_0000087 ?RolePat .
 ?Human ontomedirad:has_name ?PatientName .
 ?CTAcq purl:BFO_0000132 ?Exam .
 ?Exam ontomedirad:part_of_study ?ClinResearchStudy .
 ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId .
 ?CTAcq rdf:type ?CTAcqClass .
 ?CTAcqClass rdfs:subClassOf* ontomedirad:CT_acquisition .
 ?Dataset ontomedirad:is_specified_output_of ?CTAcq .
 ?Dataset ontomedirad:has_DICOM_image_type_description ?ImageTypeDescription .
 ?Dataset rdf:type ?Datasetclass .
 ?Datasetclass skos:prefLabel ?DatasetClassLabel .
 ?CTAcq ontomedirad:has_protocol ?Protocol .
 ?Scanner rdf:type ontomedirad:CT_scanner .
 ?AcqRole rdf:type ontomedirad:image_acquisition_role .
 ?Scanner purl:BFO_0000087 ?AcqRole.
 ?AcqRole purl:BFO_0000054 ?CTAcq .
 OPTIONAL { ?Scanner ontomedirad:has_manufacturer_name ?Manufacturer .
            ?Scanner ontomedirad:has_model_name ?Model .}
 OPTIONAL { ?Protocol ontomedirad:has_name ?ProtocolName .
           ?Protocol ontomedirad:has_description ?ProtocolDescr . }
 OPTIONAL { ?Exam ontomedirad:has_beginning_date ?ExamDate .
            ?Exam ontomedirad:has_beginning_time ?ExamTime . }
 OPTIONAL { ?Exam ontomedirad:has_description ?StudyDescr }
 OPTIONAL { ?Human ontomedirad:has_sex ?PatientSex .
            ?PatientSex rdfs:label ?LabelSex . }
 OPTIONAL { ?PatientAge rdf:type ontomedirad:age_of_patient_undergoing_medical_procedure .
            ?PatientAge ontomedirad:is_about_procedure ?Exam .
            ?PatientAge ontomedirad:is_about ?Human .
            ?PatientAge ontomedirad:years ?AgeInYears . }
 OPTIONAL { ?PatientWeight rdf:type ontomedirad:patient_weight .
            ?PatientWeight ontomedirad:is_about_procedure ?Exam .
            ?PatientWeight ontomedirad:is_about ?Human .
            ?PatientWeight purl:IAO_0000004 ?ValueWeight .
            ?PatientWeight purl:IAO_0000039 ?UnitWeight .
            ?UnitWeight rdfs:label ?LabelUnitWeight . }
 OPTIONAL { ?CTAcq ontomedirad:has_protocol ?Protocol .
            ?XRayModulationType purl:BFO_0000177 ?Protocol .
            ?XRayModulationType rdfs:subClassOf dcm:113842 .
            ?XRayModulationType skos:prefLabel ?LabelXRayModulationType . }
 OPTIONAL { ?CTAcq ontomedirad:has_setting ?KVP .
            ?KVP rdf:type dcm:113733 .
```

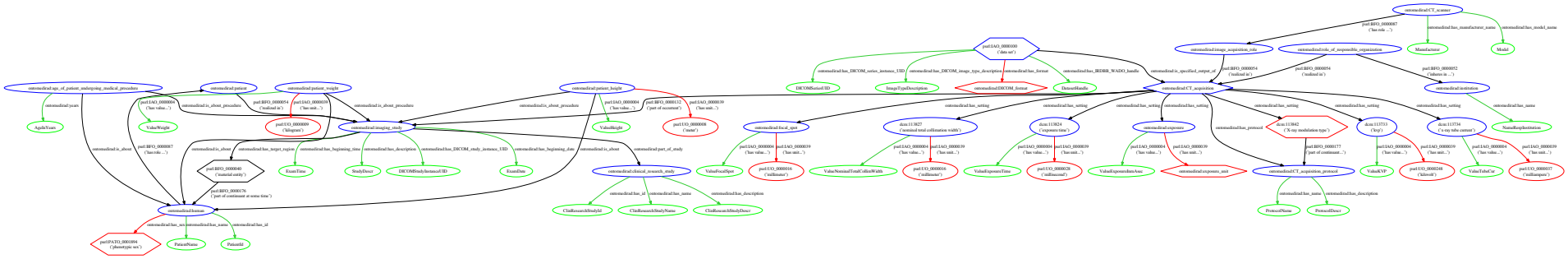
```
            ?KVP purl:IAO_0000004 ?ValueKVP .
            ?KVP purl:IAO_0000039 ?UnitKVP .
            ?UnitKVP rdfs:label ?LabelUnitKVP.}
 OPTIONAL { ?CTAcq ontomedirad:has_setting ?TubeCur .
            ?TubeCur rdf:type dcm:113734 .
            ?TubeCur purl:IAO_0000004 ?ValueTubeCur .
            ?TubeCur purl:IAO_0000039 ?UnitTubeCur.
            ?UnitTubeCur rdfs:label ?LabelUnitTubeCur .}
 OPTIONAL { ?Dataset ontomedirad:has_IRDBB_WADO_handle ?DatasetHandle .}
} ORDER BY ?ClinResearchStudyId ?PatientName
```



## Query 3 - CT Datasets and all acquisition parameters

```
SELECT DISTINCT ?ClinResearchStudyId ?PatientName ?LabelSex ?AgeInYears ?ValueWeight ?LabelUnitWeight ?ValueHeight ?LabelUnitHeight ?StudyDescr
?LabelOrgan ?ProtocolName ?ProtocolDescr ?ExamDate ?ExamTime ?CTAcqClass ?NameRespInstitution ?ValueKVP ?LabelUnitKVP ?ValueTubeCur
?LabelUnitTubeCur ?LabelXRayModulationType ?ValueFocalSpot ?LabelUnitFocalSpot ?ValueNominalTotalCollimWidth ?LabelUnitNominalTotalCollimWidth
?XRayFilterClassLabel ?ValueExposureTime ?LabelUnitExposureTime ?ValueExposureInmAsec ?LabelUnitExposureInmAsec ?Dataset ?DatasetClassLabel
?ImageTypeDescription ?DatasetHandle ?ImageFormat ?Model ?Manufacturer
 WHERE {
 ?RolePat purl:BFO_0000054 ?Exam .
 ?Human purl:BFO_0000087 ?RolePat .
 ?Human ontomedirad:has_name ?PatientName .
 ?CTAcq purl:BFO_0000132 ?Exam .
 ?Exam ontomedirad:part_of_study ?ClinResearchStudy .
 ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId .
 ?CTAcq rdf:type ?CTAcqClass .
 ?CTAcqClass rdfs:subClassOf* ontomedirad:CT_acquisition .
 ?Dataset ontomedirad:is_specified_output_of ?CTAcq .
 ?Dataset ontomedirad:has_DICOM_image_type_description ?ImageTypeDescription .
 ?Dataset rdf:type ?Datasetclass .
 ?Datasetclass skos:prefLabel ?DatasetClassLabel .
 ?CTAcq ontomedirad:has_protocol ?Protocol .
 ?Scanner rdf:type ontomedirad:CT_scanner .
 ?AcqRole rdf:type ontomedirad:image_acquisition_role .
 ?Scanner purl:BFO_0000087 ?AcqRole.
 ?AcqRole purl:BFO_0000054 ?CTAcq .
 OPTIONAL { ?Scanner ontomedirad:has_manufacturer_name ?Manufacturer .
            ?Scanner ontomedirad:has_model_name ?Model .}
 OPTIONAL { ?Protocol ontomedirad:has_name ?ProtocolName .
           ?Protocol ontomedirad:has_description ?ProtocolDescr . }
 OPTIONAL { ?Exam ontomedirad:has_beginning_date ?ExamDate .
            ?Exam ontomedirad:has_beginning_time ?ExamTime . }
 OPTIONAL { ?Exam ontomedirad:has_description ?StudyDescr }
 OPTIONAL { ?Exam ontomedirad:has_target_region ?TargetRegion .
            ?TargetRegion rdf:type ?OrganClass .
            ?OrganClass rdfs:label ?LabelOrgan . }
 OPTIONAL { ?Human ontomedirad:has_sex ?PatientSex .
            ?PatientSex rdfs:label ?LabelSex . }
 OPTIONAL { ?PatientAge rdf:type ontomedirad:age_of_patient_undergoing_medical_procedure .
            ?PatientAge ontomedirad:is_about_procedure ?Exam .
            ?PatientAge ontomedirad:is_about ?Human .
            ?PatientAge ontomedirad:years ?AgeInYears . }
 OPTIONAL { ?XRayModulationType purl:BFO_0000177 ?Protocol .
            ?XRayModulationType rdfs:subClassOf dcm:113842 .
            ?XRayModulationType skos:prefLabel ?LabelXRayModulationType . }
 OPTIONAL { ?CTAcq ontomedirad:has_setting ?KVP .
            ?KVP rdf:type dcm:113733 .
            ?KVP purl:IAO_0000004 ?ValueKVP .
            ?KVP purl:IAO_0000039 ?UnitKVP .
```

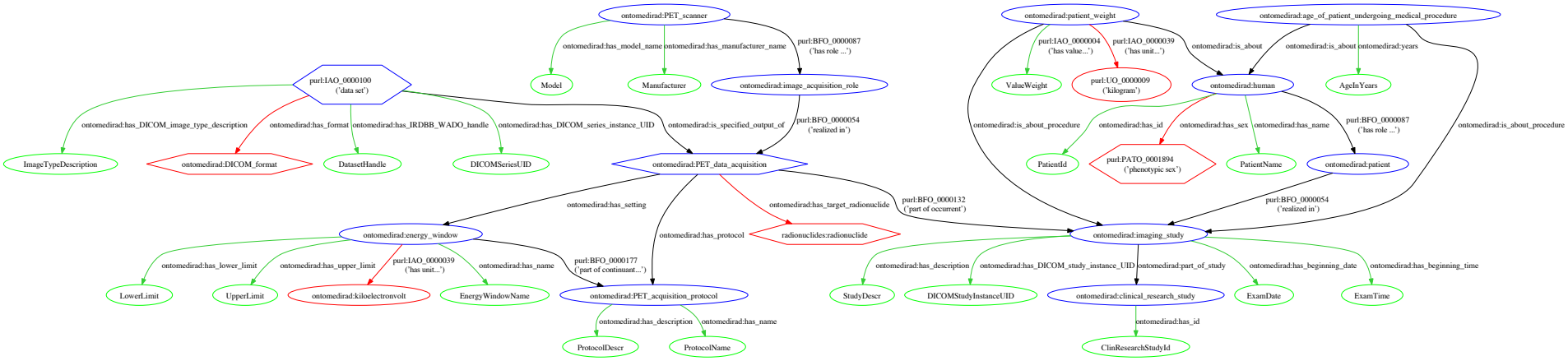
```
            ?UnitKVP rdfs:label ?LabelUnitKVP.}
 OPTIONAL { ?CTAcq ontomedirad:has_setting ?TubeCur .
            ?TubeCur rdf:type dcm:113734 .
            ?TubeCur purl:IAO_0000004 ?ValueTubeCur .
            ?TubeCur purl:IAO_0000039 ?UnitTubeCur.
            ?UnitTubeCur rdfs:label ?LabelUnitTubeCur .}
 OPTIONAL { ?CTAcq ontomedirad:has_setting ?FocalSpot .
            ?FocalSpot rdf:type ontomedirad:focal_spot .
            ?FocalSpot purl:IAO_0000004 ?ValueFocalSpot .
            ?FocalSpot purl:IAO_0000039 ?UnitFocalSpot .
            ?UnitFocalSpot rdfs:label ?LabelUnitFocalSpot .}
 OPTIONAL { ?CTAcq ontomedirad:has_setting ?NominalTotalCollimWidth .
            ?NominalTotalCollimWidth rdf:type dcm:113827 .
            ?NominalTotalCollimWidth purl:IAO_0000004 ?ValueNominalTotalCollimWidth .
            ?NominalTotalCollimWidth purl:IAO_0000039 ?UnitNominalTotalCollimWidth .
            ?UnitNominalTotalCollimWidth rdfs:label ?LabelUnitNominalTotalCollimWidth .}
 OPTIONAL { ?CTAcq ontomedirad:has_setting ?ExposureTime .
            ?ExposureTime rdf:type dcm:113824 .
            ?ExposureTime purl:IAO_0000004 ?ValueExposureTime .
            ?ExposureTime purl:IAO_0000039 ?UnitExposureTime .
            ?UnitExposureTime rdfs:label ?LabelUnitExposureTime .}
 OPTIONAL { ?CTAcq ontomedirad:has_setting ?ExposureInmAsec .
            ?ExposureInmAsec rdf:type ontomedirad:exposure .
            ?ExposureInmAsec purl:IAO_0000004 ?ValueExposureInmAsec .
            ?ExposureInmAsec purl:IAO_0000039 ?UnitExposureInmAsec .
            ?UnitExposureInmAsec rdfs:label ?LabelUnitExposureInmAsec .}
 OPTIONAL { ?Dataset ontomedirad:has_IRDBB_WADO_handle ?DatasetHandle .}
 OPTIONAL { ?Dataset ontomedirad:has_format ?ImageFormat .}
 OPTIONAL { ?XRayFilter purl:BFO_0000177  ?Scanner .
            ?XRayFilter rdf:type ?XRayFilterClass .
           ?XRayFilterClass rdfs:subClassOf* dcm:113771 .
           ?XRayFilterClass skos:prefLabel ?XRayFilterClassLabel . }
 OPTIONAL { ?RespInstitution rdf:type ontomedirad:institution .
            ?RespInstitution ontomedirad:has_name ?NameRespInstitution .
            ?RespInstitutionrole rdf:type ontomedirad:role_of_responsible_organization .
            ?RespInstitutionrole purl:BFO_0000054 ?CTAcq .
            ?RespInstitutionrole purl:BFO_0000052 ?RespInstitution .}
 OPTIONAL { ?PatientWeight rdf:type ontomedirad:patient_weight .
            ?PatientWeight ontomedirad:is_about_procedure ?Exam .
            ?PatientWeight ontomedirad:is_about ?Human .
            ?PatientWeight purl:IAO_0000004 ?ValueWeight .
            ?PatientWeight purl:IAO_0000039 ?UnitWeight .
            ?UnitWeight rdfs:label ?LabelUnitWeight . }
 OPTIONAL { ?PatientHeight rdf:type ontomedirad:patient_height .
            ?PatientHeight ontomedirad:is_about_procedure ?Exam .
            ?PatientHeight ontomedirad:is_about ?Human .
            ?PatientHeight purl:IAO_0000004 ?ValueHeight .
            ?PatientHeight purl:IAO_0000039 ?UnitHeight .
            ?UnitHeight rdfs:label ?LabelUnitHeight . }
} ORDER BY ?ClinResearchStudyId ?PatientName
```



## Query 4 - PET Datasets and main acquisition parameters

```
SELECT DISTINCT ?ClinResearchStudyId ?PatientName ?LabelSex ?AgeInYears ?ValueWeight ?LabelUnitWeight ?StudyDescr ?ProtocolName ?ProtocolDescr
?ExamDate ?ExamTime ?RadioNuclLabel ?LowerLimit ?UpperLimit ?LabelUnitEnergyWindow ?Dataset ?DatasetClassLabel ?ImageTypeDescription ?DatasetHandle
?Model ?Manufacturer
 WHERE {
 ?PETAcq rdf:type* ontomedirad:PET_data_acquisition .
 ?PETAcq purl:BFO_0000132 ?Exam .
 ?Exam ontomedirad:part_of_study ?ClinResearchStudy .
 ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId .
 ?RolePat purl:BFO_0000054 ?Exam .
 ?Human purl:BFO_0000087 ?RolePat .
 ?Human ontomedirad:has_name ?PatientName .
 ?Dataset ontomedirad:is_specified_output_of ?PETAcq .
 ?Dataset ontomedirad:has_DICOM_image_type_description ?ImageTypeDescription .
 ?Dataset rdf:type ontomedirad:PET_recon_tomo_dataset .
 ?Dataset rdf:type ?Datasetclass .
 ?Datasetclass skos:prefLabel ?DatasetClassLabel .
 ?Scanner rdf:type ontomedirad:PET_scanner .
 ?AcqRole rdf:type ontomedirad:image_acquisition_role .
 ?Scanner purl:BFO_0000087 ?AcqRole.
 ?AcqRole purl:BFO_0000054 ?PETAcq .
 OPTIONAL { ?Scanner ontomedirad:has_manufacturer_name ?Manufacturer .
            ?Scanner ontomedirad:has_model_name ?Model .}
 OPTIONAL { ?PETAcq ontomedirad:has_protocol ?Protocol .
           OPTIONAL { ?Protocol ontomedirad:has_name ?ProtocolName .}
           ?Protocol ontomedirad:has_description ?ProtocolDescr . }
 OPTIONAL { ?Exam ontomedirad:has_beginning_date ?ExamDate .
            ?Exam ontomedirad:has_beginning_time ?ExamTime . }
 OPTIONAL {?Exam ontomedirad:has_description ?StudyDescr }
 OPTIONAL {?PETAcq rdfs:subClassOf* ontomedirad:PET_data_acquisition}
 OPTIONAL { ?PatientWeight rdf:type ontomedirad:patient_weight .
            ?PatientWeight ontomedirad:is_about_procedure ?Exam .
            ?PatientWeight ontomedirad:is_about ?Human .
            ?PatientWeight purl:IAO_0000004 ?ValueWeight .
            ?PatientWeight purl:IAO_0000039 ?UnitWeight .
            ?UnitWeight rdfs:label ?LabelUnitWeight . }
 OPTIONAL { ?Human ontomedirad:has_sex ?PatientSex .
            ?PatientSex rdfs:label ?LabelSex . }
 OPTIONAL { ?PatientAge rdf:type ontomedirad:age_of_patient_undergoing_medical_procedure .
            ?PatientAge ontomedirad:is_about_procedure ?Exam .
            ?PatientAge ontomedirad:is_about ?Human .
            ?PatientAge ontomedirad:years ?AgeInYears . }
 OPTIONAL { ?PETAcq ontomedirad:has_target_radionuclide ?RadioNucl .
            ?RadioNucl rdfs:label ?RadioNuclLabel .}
 OPTIONAL { ?PETAcq ontomedirad:has_setting ?EnergyWindow .
           ?EnergyWindow purl:BFO_0000177 ?AcqProtocol .
            ?EnergyWindow ontomedirad:has_lower_limit ?LowerLimit .
```

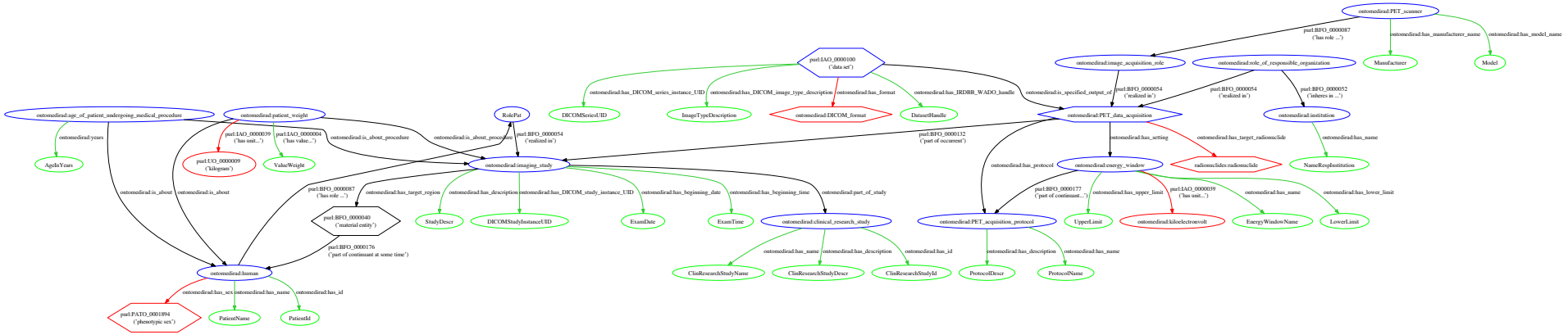
```
            ?EnergyWindow ontomedirad:has_upper_limit ?UpperLimit .
            ?EnergyWindow purl:IAO_0000039 ?UnitEnergyWindow .
            ?UnitEnergyWindow rdfs:label ?LabelUnitEnergyWindow }
 OPTIONAL { ?Dataset ontomedirad:has_IRDBB_WADO_handle ?DatasetHandle .}
} ORDER BY ?ClinResearchStudyId ?PatientName
```



## Query 5 - PET Datasets and all acquisition parameters

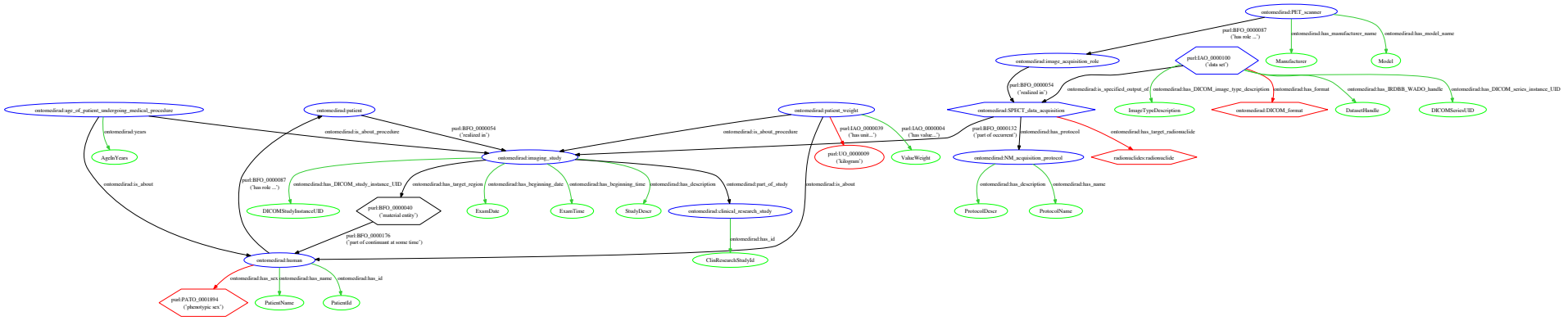
```
SELECT DISTINCT ?ClinResearchStudyId ?PatientName ?LabelSex ?AgeInYears ?ValueWeight ?LabelUnitWeight ?ValueHeight ?LabelUnitHeight ?StudyDescr
?LabelOrgan ?ProtocolName ?ProtocolDescr ?ExamDate ?ExamTime ?NameRespInstitution ?RadioNuclLabel ?LowerLimit ?UpperLimit ?LabelUnitEnergyWindow
?Dataset ?DatasetClassLabel ?ImageTypeDescription ?DatasetHandle ?ImageFormat ?Model ?Manufacturer
 WHERE {
 ?PETAcq rdf:type* ontomedirad:PET_data_acquisition .
 ?PETAcq purl:BFO_0000132 ?Exam .
 ?Exam ontomedirad:part_of_study ?ClinResearchStudy .
 ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId .
 ?RolePat purl:BFO_0000054 ?Exam .
 ?Human purl:BFO_0000087 ?RolePat .
 ?Human ontomedirad:has_name ?PatientName .
 ?Dataset ontomedirad:is_specified_output_of ?PETAcq .
 ?Dataset ontomedirad:has_DICOM_image_type_description ?ImageTypeDescription .
 ?Dataset rdf:type ontomedirad:PET_recon_tomo_dataset .
 ?Dataset rdf:type ?Datasetclass .
 ?Datasetclass skos:prefLabel ?DatasetClassLabel .
 ?Scanner rdf:type ontomedirad:PET_scanner .
 ?AcqRole rdf:type ontomedirad:image_acquisition_role .
 ?Scanner purl:BFO_0000087 ?AcqRole.
 ?AcqRole purl:BFO_0000054 ?PETAcq .
 OPTIONAL { ?Scanner ontomedirad:has_manufacturer_name ?Manufacturer .
            ?Scanner ontomedirad:has_model_name ?Model .}
 OPTIONAL { ?PETAcq ontomedirad:has_protocol ?Protocol .
           OPTIONAL { ?Protocol ontomedirad:has_name ?ProtocolName .}
            ?Protocol ontomedirad:has_description ?ProtocolDescr . }
 OPTIONAL { ?Exam ontomedirad:has_beginning_date ?ExamDate .
            ?Exam ontomedirad:has_beginning_time ?ExamTime . }
 OPTIONAL { ?Exam ontomedirad:has_description ?StudyDescr }
 OPTIONAL { ?Exam ontomedirad:has_target_region ?TargetRegion .
            ?TargetRegion rdf:type ?OrganClass .
            ?OrganClass rdfs:label ?LabelOrgan . }
 OPTIONAL { ?PETAcq rdfs:subClassOf* ontomedirad:PET_data_acquisition}
 OPTIONAL { ?Human ontomedirad:has_sex ?PatientSex .
            ?PatientSex rdfs:label ?LabelSex . }
 OPTIONAL { ?PatientAge rdf:type ontomedirad:age_of_patient_undergoing_medical_procedure .
            ?PatientAge ontomedirad:is_about_procedure ?Exam .
            ?PatientAge ontomedirad:is_about ?Human .
            ?PatientAge ontomedirad:years ?AgeInYears . }
 OPTIONAL { ?PETAcq ontomedirad:has_target_radionuclide ?RadioNucl .
            ?RadioNucl rdfs:label ?RadioNuclLabel .}
 OPTIONAL { ?PETAcq ontomedirad:has_setting ?EnergyWindow .
            ?EnergyWindow ontomedirad:has_lower_limit ?LowerLimit .
            ?EnergyWindow ontomedirad:has_upper_limit ?UpperLimit .
```

```
            ?EnergyWindow purl:IAO_0000039 ?UnitEnergyWindow .
            ?UnitEnergyWindow rdfs:label ?LabelUnitEnergyWindow }
 OPTIONAL { ?Dataset ontomedirad:has_IRDBB_WADO_handle ?DatasetHandle .}
 OPTIONAL { ?Dataset ontomedirad:has_format ?ImageFormat .}
 OPTIONAL { ?RespInstitution rdf:type ontomedirad:institution .
            ?RespInstitution ontomedirad:has_name ?NameRespInstitution .
            ?RespInstitutionrole rdf:type ontomedirad:role_of_responsible_organization .
            ?RespInstitutionrole purl:BFO_0000054 ?PETAcq .
            ?RespInstitutionrole purl:BFO_0000052 ?RespInstitution .}
 OPTIONAL { ?PatientWeight rdf:type ontomedirad:patient_weight .
            ?PatientWeight ontomedirad:is_about_procedure ?Exam .
            ?PatientWeight ontomedirad:is_about ?Human .
            ?PatientWeight purl:IAO_0000004 ?ValueWeight .
            ?PatientWeight purl:IAO_0000039 ?UnitWeight .
            ?UnitWeight rdfs:label ?LabelUnitWeight . }
 OPTIONAL { ?PatientHeight rdf:type ontomedirad:patient_height .
            ?PatientHeight ontomedirad:is_about_procedure ?Exam .
            ?PatientHeight ontomedirad:is_about ?Human .
            ?PatientHeight purl:IAO_0000004 ?ValueHeight .
            ?PatientHeight purl:IAO_0000039 ?UnitHeight .
            ?UnitHeight rdfs:label ?LabelUnitHeight . }
} ORDER BY ?ClinResearchStudyId ?PatientName
```



## Query 6 - NM Datasets and main acquisition parameters

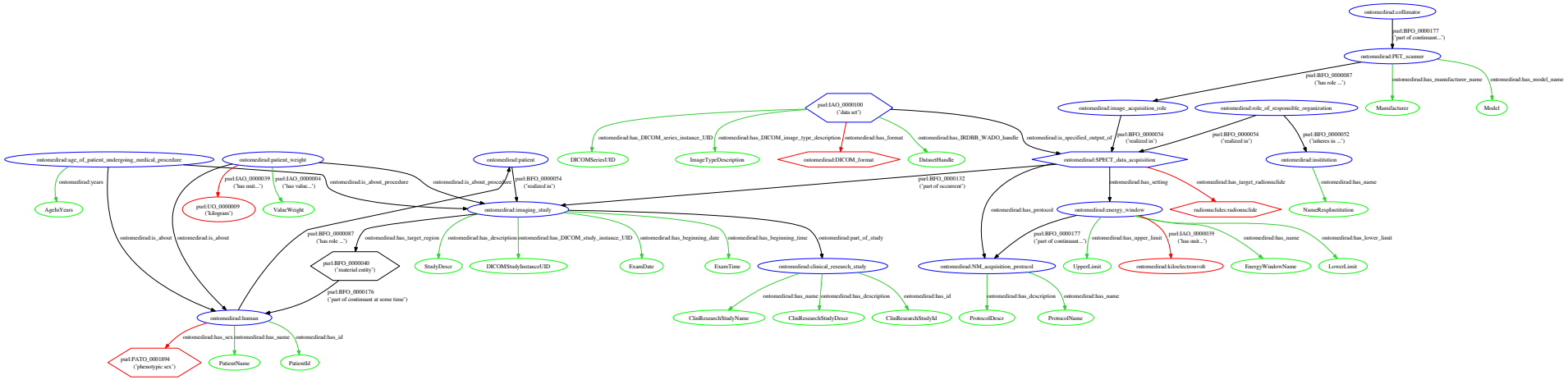
```
SELECT DISTINCT ?ClinResearchStudyId ?PatientName ?LabelSex ?AgeInYears ?ValueWeight ?LabelUnitWeight ?StudyDescr ?ExamDate ?ExamTime ?StudyDescr
?RadioNuclLabel ?ProtocolName ?ProtocolDescr ?Dataset ?DatasetClassLabel ?ImageTypeDescription ?DatasetHandle ?Model ?Manufacturer
 WHERE {
 ?SPECTAcq purl:BFO_0000132 ?Exam .
 ?SPECTAcq rdf:type ?SPECTAcqClass .
 ?SPECTAcqClass rdfs:subClassOf* ontomedirad:SPECT_data_acquisition .
 ?RolePat purl:BFO_0000054 ?Exam .
 ?Exam ontomedirad:part_of_study ?ClinResearchStudy .
 ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId .
 ?Human purl:BFO_0000087 ?RolePat .
 ?Human ontomedirad:has_name ?PatientName .
 ?Dataset ontomedirad:is_specified_output_of ?SPECTAcq .
 ?Dataset ontomedirad:has_DICOM_image_type_description ?ImageTypeDescription .
 ?Dataset rdf:type ?Datasetclass .
 ?Datasetclass skos:prefLabel ?DatasetClassLabel .
 ?Scanner rdf:type ontomedirad:SPECT_scanner .
 ?AcqRole rdf:type ontomedirad:image_acquisition_role .
 ?Scanner purl:BFO_0000087 ?AcqRole.
 ?AcqRole purl:BFO_0000054 ?SPECTAcq .
 OPTIONAL { ?Scanner ontomedirad:has_manufacturer_name ?Manufacturer .
            ?Scanner ontomedirad:has_model_name ?Model .}
 OPTIONAL { ?SPECTAcq ontomedirad:has_protocol ?Protocol .
           OPTIONAL { ?Protocol ontomedirad:has_name ?ProtocolName .}
           ?Protocol ontomedirad:has_description ?ProtocolDescr . }
 OPTIONAL { ?Exam ontomedirad:has_beginning_date ?ExamDate .
            ?Exam ontomedirad:has_beginning_time ?ExamTime . }
 OPTIONAL { ?Exam ontomedirad:has_description ?StudyDescr .}
 OPTIONAL { ?PatientWeight rdf:type ontomedirad:patient_weight .
            ?PatientWeight ontomedirad:is_about_procedure ?Exam .
            ?PatientWeight ontomedirad:is_about ?Human .
            ?PatientWeight purl:IAO_0000004 ?ValueWeight .
            ?PatientWeight purl:IAO_0000039 ?UnitWeight .
            ?UnitWeight rdfs:label ?LabelUnitWeight . }
 OPTIONAL { ?Human ontomedirad:has_sex ?PatientSex .
            ?PatientSex rdfs:label ?LabelSex . }
 OPTIONAL { ?PatientAge rdf:type ontomedirad:age_of_patient_undergoing_medical_procedure .
            ?PatientAge ontomedirad:is_about_procedure ?Exam .
            ?PatientAge ontomedirad:is_about ?Human .
            ?PatientAge ontomedirad:years ?AgeInYears . }
 OPTIONAL { ?SPECTAcq ontomedirad:has_target_radionuclide ?RadioNucl .
            ?RadioNucl rdfs:label ?RadioNuclLabel .}
 OPTIONAL { ?Dataset ontomedirad:has_IRDBB_WADO_handle ?DatasetHandle .}
} ORDER BY ?ClinResearchStudyId ?PatientName
```


ontomedirad:age_of_patient_undergoing_medical_procedure
ontomedirad:years
AgeInYears
ontomedirad:is_about
ontomedirad:patient
ontomedirad:is_about_procedure
purl:BFO_0000054
('realized in')
purl:BFO_0000087
('has role ...')
ontomedirad:has_DICOM_study_instance_UID
DICOMStudyInstanceUID
purl:BFO_0000040
('material entity')
purl:BFO_0000176
('part of continuant at some time')
ontomedirad:imaging_study
ontomedirad:has_target_region
ontomedirad:has_beginning_date
ontomedirad:has_beginning_time
ExamDate
ExamTime
StudyDescr
ontomedirad:has_description
ontomedirad:part_of_study
ontomedirad:clinical_research_study
ontomedirad:has_id
ClinResearchStudyId
ontomedirad:human
ontomedirad:has_sex
ontomedirad:has_name
ontomedirad:has_id
purl:PATO_0001894
('phenotypic sex')
PatientName
PatientId
ontomedirad:patient_weight
ontomedirad:is_about_procedure
purl:IAO_0000039
('has unit...')
purl:IAO_0000004
('has value...')
purl:UO_0000009
('kilogram')
ValueWeight
ontomedirad:is_about
ontomedirad:PET_scanner
purl:BFO_0000087
('has role ...')
ontomedirad:has_manufacturer_name
ontomedirad:has_model_name
ontomedirad:image_acquisition_role
purl:IAO_0000100
('data set')
Manufacturer
Model
purl:BFO_0000054
('realized in')
ontomedirad:is_specified_output_of
ontomedirad:has_DICOM_image_type_description
ontomedirad:has_format
ontomedirad:has_IRDBB_WADO_handle
ontomedirad:has_DICOM_series_instance_UID
ontomedirad:SPECT_data_acquisition
ImageTypeDescription
ontomedirad:DICOM_format
DatasetHandle
DICOMSeriesUID
purl:BFO_0000132
('part of occurrent')
ontomedirad:has_protocol
ontomedirad:has_target_radionuclide
ontomedirad:NM_acquisition_protocol
radionuclides:radionuclide
ontomedirad:has_description
ontomedirad:has_name
ProtocolDescr
ProtocolName

## Query 7 - NM Datasets and all acquisition parameters

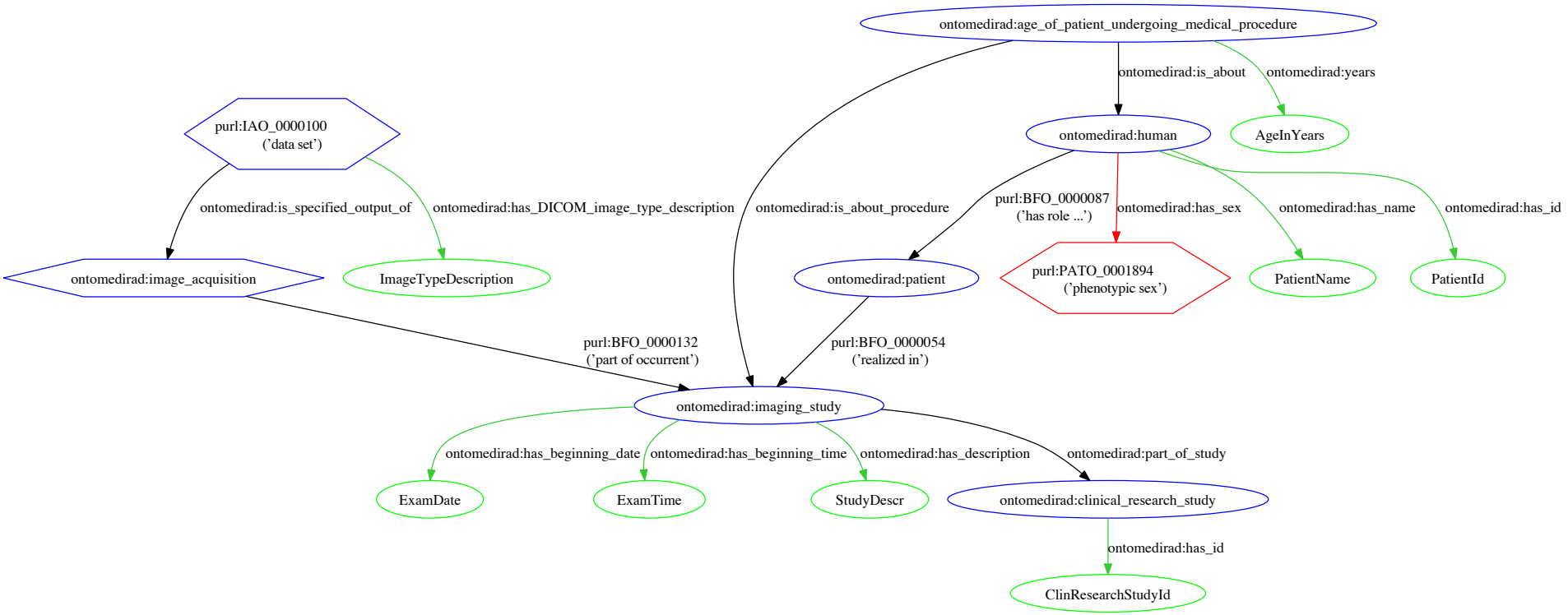
```
SELECT DISTINCT ?ClinResearchStudyId ?PatientName ?LabelSex ?AgeInYears ?ValueWeight ?LabelUnitWeight ?ValueHeight ?LabelUnitHeight ?StudyDescr
?LabelOrgan ?ExamDate ?ExamTime ?SPECTAcqClass ?NameRespInstitution ?RadioNuclLabel ?ProtocolName ?ProtocolDescr ?CollimatorClassLabel ?Dataset
?DatasetClassLabel ?ImageTypeDescription ?DatasetHandle ?ImageFormat ?Model ?Manufacturer
 WHERE {
 ?SPECTAcq purl:BFO_0000132 ?Exam .
 ?SPECTAcq rdf:type ?SPECTAcqClass .
 ?SPECTAcqClass rdfs:subClassOf* ontomedirad:SPECT_data_acquisition .
 ?RolePat purl:BFO_0000054 ?Exam .
 ?Exam ontomedirad:part_of_study ?ClinResearchStudy .
 ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId .
 ?Human purl:BFO_0000087 ?RolePat .
 ?Human ontomedirad:has_name ?PatientName .
 ?Dataset ontomedirad:is_specified_output_of ?SPECTAcq .
 ?Dataset ontomedirad:has_DICOM_image_type_description ?ImageTypeDescription .
 ?Dataset rdf:type ?Datasetclass .
 ?Datasetclass skos:prefLabel ?DatasetClassLabel .
 ?Scanner rdf:type ontomedirad:SPECT_scanner .
 ?AcqRole rdf:type ontomedirad:image_acquisition_role .
 ?Scanner purl:BFO_0000087 ?AcqRole.
 ?AcqRole purl:BFO_0000054 ?SPECTAcq .
 OPTIONAL { ?Scanner ontomedirad:has_manufacturer_name ?Manufacturer .
            ?Scanner ontomedirad:has_model_name ?Model .}
 OPTIONAL { ?SPECTAcq ontomedirad:has_protocol ?Protocol .
           OPTIONAL { ?Protocol ontomedirad:has_name ?ProtocolName .}
           ?Protocol ontomedirad:has_description ?ProtocolDescr . }
 OPTIONAL { ?Exam ontomedirad:has_beginning_date ?ExamDate .
            ?Exam ontomedirad:has_beginning_time ?ExamTime . }
 OPTIONAL { ?Exam ontomedirad:has_description ?StudyDescr .}
 OPTIONAL { ?Exam ontomedirad:has_target_region ?TargetRegion .
            ?TargetRegion rdf:type ?OrganClass .
            ?OrganClass rdfs:label ?LabelOrgan . }
 OPTIONAL { ?Human ontomedirad:has_sex ?PatientSex .
            ?PatientSex rdfs:label ?LabelSex . }
 OPTIONAL { ?PatientAge rdf:type ontomedirad:age_of_patient_undergoing_medical_procedure .
            ?PatientAge ontomedirad:is_about_procedure ?Exam .
            ?PatientAge ontomedirad:is_about ?Human .
            ?PatientAge ontomedirad:years ?AgeInYears . }
 OPTIONAL { ?SPECTAcq ontomedirad:has_target_radionuclide ?RadioNucl .
            ?RadioNucl rdfs:label ?RadioNuclLabel . }
 OPTIONAL { ?Dataset ontomedirad:has_IRDBB_WADO_handle ?DatasetHandle .}
 OPTIONAL { ?Dataset ontomedirad:has_format ?ImageFormat .}
 OPTIONAL { ?Collimator purl:BFO_0000177  ?Scanner .
            ?Collimator rdf:type ?CollimatorClass .
           ?CollimatorClass rdfs:subClassOf* ontomedirad:collimator .
           ?CollimatorClass skos:prefLabel ?CollimatorClassLabel .
            ?Collimator purl:BFO_0000177  ?Scanner .}
 OPTIONAL { ?RespInstitution rdf:type ontomedirad:institution .
```

```
            ?RespInstitution ontomedirad:has_name ?NameRespInstitution .
            ?RespInstitutionrole rdf:type ontomedirad:role_of_responsible_organization .
            ?RespInstitutionrole purl:BFO_0000054 ?SPECTAcq .
            ?RespInstitutionrole purl:BFO_0000052 ?RespInstitution .}
 OPTIONAL { ?PatientWeight rdf:type ontomedirad:patient_weight .
            ?PatientWeight ontomedirad:is_about_procedure ?Exam .
            ?PatientWeight ontomedirad:is_about ?Human .
            ?PatientWeight purl:IAO_0000004 ?ValueWeight .
            ?PatientWeight purl:IAO_0000039 ?UnitWeight .
            ?UnitWeight rdfs:label ?LabelUnitWeight . }
 OPTIONAL { ?PatientHeight rdf:type ontomedirad:patient_height .
            ?PatientHeight ontomedirad:is_about_procedure ?Exam .
            ?PatientHeight ontomedirad:is_about ?Human .
            ?PatientHeight purl:IAO_0000004 ?ValueHeight .
            ?PatientHeight purl:IAO_0000039 ?UnitHeight .
            ?UnitHeight rdfs:label ?LabelUnitHeight . }
} ORDER BY ?ClinResearchStudyId ?PatientName
```



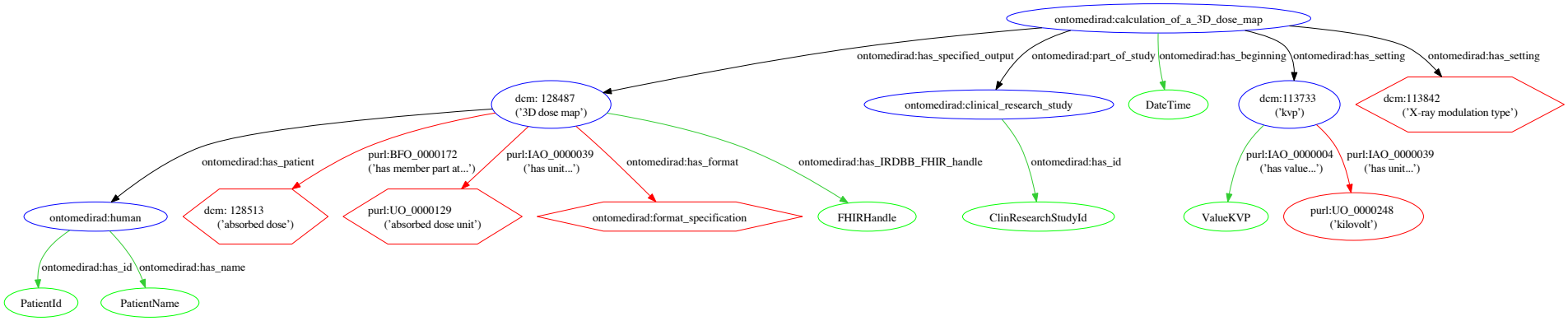
## Query 8 - Relations image datasets with Clinical research studies

```
SELECT DISTINCT ?ClinResearchStudyId ?PatientName ?ExamDate ?ExamTime ?Dataset ?ImageTypeDescription ?DatasetClassLabel ?LabelSex ?AgeInYears
 WHERE {
 ?Human rdf:type ontomedirad:human .
 ?Human purl:BFO_0000087 ?RolePat .
 ?Human ontomedirad:has_name ?PatientName .
 ?RolePat purl:BFO_0000054 ?Exam .
 ?Acq purl:BFO_0000132 ?Exam .
 ?Dataset ontomedirad:is_specified_output_of ?Acq .
 ?Dataset ontomedirad:has_DICOM_image_type_description ?ImageTypeDescription .
 ?Dataset rdf:type ?Datasetclass .
 ?Datasetclass skos:prefLabel ?DatasetClassLabel .
 ?Exam ontomedirad:part_of_study ?ClinResearchStudy .
 ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId .
 OPTIONAL { ?Exam ontomedirad:has_beginning_date ?ExamDate .
            ?Exam ontomedirad:has_beginning_time ?ExamTime . }
 OPTIONAL { ?Exam ontomedirad:has_description ?StudyDescr .}
 OPTIONAL { ?Human ontomedirad:has_sex ?PatientSex .
            ?PatientSex rdfs:label ?LabelSex . }
 OPTIONAL { ?PatientAge rdf:type ontomedirad:age_of_patient_undergoing_medical_procedure .
           ?PatientAge ontomedirad:is_about_procedure ?Exam .
            ?PatientAge ontomedirad:is_about ?Human .
            ?PatientAge ontomedirad:years ?AgeInYears . }
} ORDER BY ?ClinResearchStudyId ?PatientName
```


ontomedirad:age_of_patient_undergoing_medical_procedure
ontomedirad:is_about
ontomedirad:years
purl:IAO_0000100
('data set')
ontomedirad:human
AgeInYears
ontomedirad:is_specified_output_of
ontomedirad:has_DICOM_image_type_description
ontomedirad:is_about_procedure
purl:BFO_0000087
('has role ...')
ontomedirad:has_sex
ontomedirad:has_name
ontomedirad:has_id
ontomedirad:image_acquisition
ImageTypeDescription
ontomedirad:patient
purl:PATO_0001894
('phenotypic sex')
PatientName
PatientId
purl:BFO_0000132
('part of occurrent')
purl:BFO_0000054
('realized in')
ontomedirad:imaging_study
ontomedirad:has_beginning_date
ontomedirad:has_beginning_time
ontomedirad:has_description
ontomedirad:part_of_study
ExamDate
ExamTime
StudyDescr
ontomedirad:clinical_research_study
ontomedirad:has_id
ClinResearchStudyId

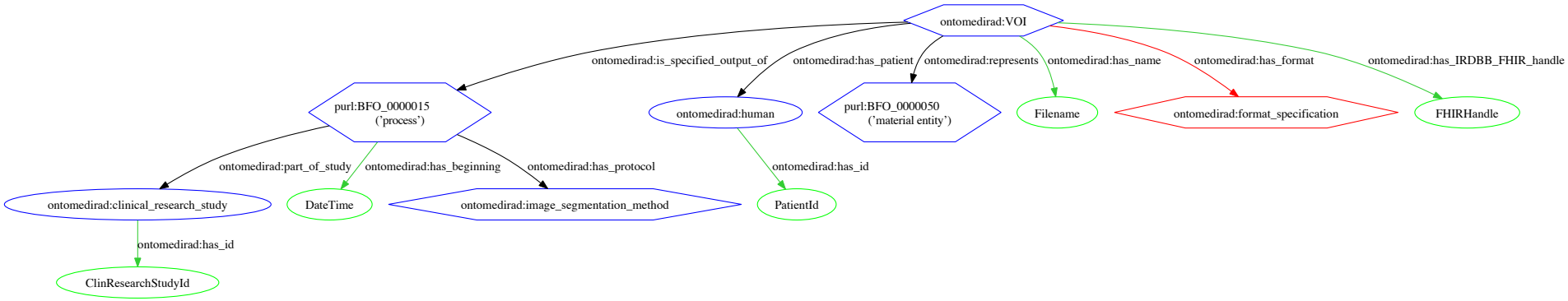
## Query 9 - 3D Dose Maps and provenance data

```
SELECT DISTINCT  ?ClinResearchStudyId ?PatientName ?PatientId ?DoseMap ?DoseMapClassLabel ?DoseMapFormatTypeLabel ?DoseInVoxelClassLabel
?DoseUnitClassLabel ?Process ?Date ?Time ?ValueKVP ?LabelXRayModulationType ?FHIRHandle
WHERE {
 ?DoseMap rdf:type ?DoseMapClass .
 ?DoseMapClass rdfs:subClassOf* dcm:128487 .
 ?DoseMapClass skos:prefLabel ?DoseMapClassLabel .
 ?Process ontomedirad:has_specified_output ?DoseMap .
 ?DoseMap ontomedirad:has_patient ?Human .
 ?Human ontomedirad:has_id ?PatientId .
 OPTIONAL { ?Human ontomedirad:has_name ?PatientName . }
 ?DoseMap purl:BFO_0000172 ?DoseInVoxelClass .
 ?DoseInVoxelClass skos:prefLabel ?DoseInVoxelClassLabel .
 ?DoseMap purl:IAO_0000039 ?DoseUnit .
 ?DoseUnit rdf:type ?DoseUnitClass .
 ?DoseUnitClass rdfs:label ?DoseUnitClassLabel .
 ?DoseMap ontomedirad:has_format ?DoseMapFormat .
 ?DoseMapFormat rdf:type ?DoseMapFormatType .
 ?DoseMapFormatType skos:prefLabel ?DoseMapFormatTypeLabel .
 OPTIONAL {?Process ontomedirad:part_of_study ?ClinResearchStudy .
           ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId } .
 OPTIONAL {?Process ontomedirad:has_beginning ?DateTime .
           BIND (substr(?DateTime,1,8) AS ?Date) .
           BIND (substr(?DateTime,10,4) AS ?Time) .}
 OPTIONAL {?Process ontomedirad:has_setting ?KVP .
           ?KVP rdf:type dcm:113733 .
           ?KVP purl:IAO_0000004 ?ValueKVP }
 OPTIONAL {?Process ontomedirad:has_setting ?XRayModulation .
           ?XRayModulation rdf:type ?XRayModulationType .
           ?XRayModulationType rdfs:subClassOf* dcm:113842 .
           ?XRayModulationType skos:prefLabel ?LabelXRayModulationType . }
 OPTIONAL  { ?DoseMap ontomedirad:has_IRDBB_FHIR_handle ?FHIRHandle . }
} ORDER BY ?ClinResearchStudyId ?PatientName
```


ontomedirad:calculation_of_a_3D_dose_map
ontomedirad:has_specified_output
ontomedirad:part_of_study
ontomedirad:has_beginning
ontomedirad:has_setting
ontomedirad:has_setting
dcm: 128487
('3D dose map')
ontomedirad:clinical_research_study
DateTime
dcm:113733
('kvp')
dcm:113842
('X-ray modulation type')
ontomedirad:has_patient
purl:BFO_0000172
('has member part at...')
purl:IAO_0000039
('has unit...')
ontomedirad:has_format
ontomedirad:has_IRDBB_FHIR_handle
ontomedirad:has_id
purl:IAO_0000004
('has value...')
purl:IAO_0000039
('has unit...')
ontomedirad:human
dcm: 128513
('absorbed dose')
purl:UO_0000129
('absorbed dose unit')
ontomedirad:format_specification
FHIRHandle
ClinResearchStudyId
ValueKVP
purl:UO_0000248
('kilovolt')
ontomedirad:has_id
ontomedirad:has_name
PatientId
PatientName

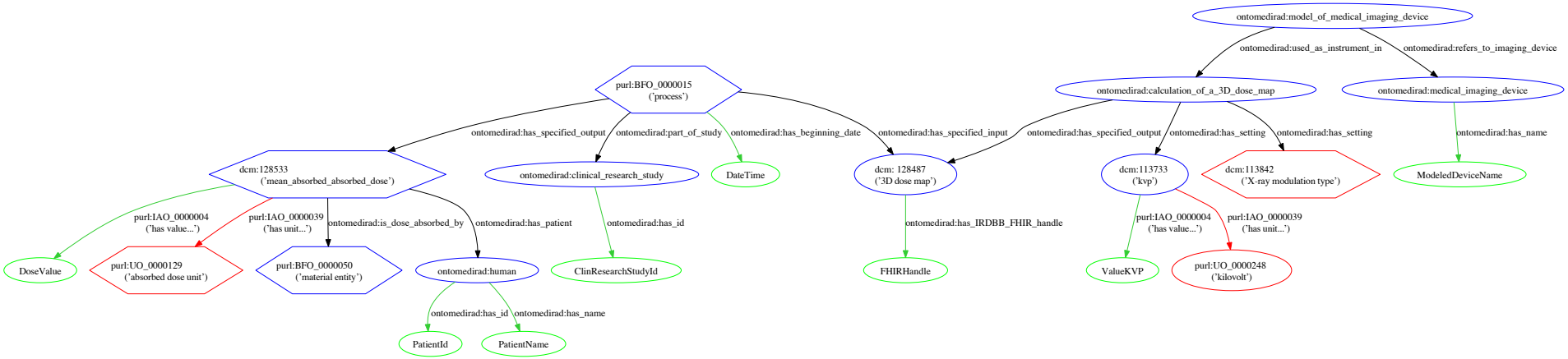
## Query 10 - Volumes Of Interest and organs

```
SELECT ?ClinResearchStudyId ?PatientName ?Filename ?MaterialEntityClassLabel ?VOIClass ?Format  ?ProcessClass ?MethodClassLabel ?Date ?Time
?FHIRHandle
WHERE {
 ?Dataset rdf:type ?VOIClass .
 ?Dataset ontomedirad:has_patient ?Human .
 OPTIONAL { ?Human ontomedirad:has_name ?PatientName .}
 ?VOIClass rdfs:subClassOf* ontomedirad:VOI .
 ?Dataset ontomedirad:represents ?MaterialEntity .
 ?MaterialEntity rdf:type ?MaterialEntityClass .
 ?MaterialEntityClass rdfs:label ?MaterialEntityClassLabel .
 ?Dataset ontomedirad:is_specified_output_of ?Process .
 ?Process rdf:type ?ProcessClass .
 ?ProcessClass rdfs:subClassOf* purl:BFO_0000015 .
 OPTIONAL { ?Dataset ontomedirad:has_name ?Filename } .
 OPTIONAL { ?Dataset ontomedirad:has_format ?Format } .
 OPTIONAL {?Process ontomedirad:part_of_study ?ClinResearchStudy .
           ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId }.
 OPTIONAL {?Process ontomedirad:has_beginning ?DateTime .
           BIND (substr(?DateTime,1,8) AS ?Date) .
           BIND (substr(?DateTime,10,4) AS ?Time) .}
 OPTIONAL { ?Process ontomedirad:has_protocol ?Method .
            ?Method rdf:type ?MethodClass .
            ?MethodClass skos:prefLabel ?MethodClassLabel } .
 OPTIONAL  { ?Dataset ontomedirad:has_IRDBB_FHIR_handle ?FHIRHandle . }
 } ORDER BY ?ClinResearchStudy ?PatientName ?MaterialEntity
```



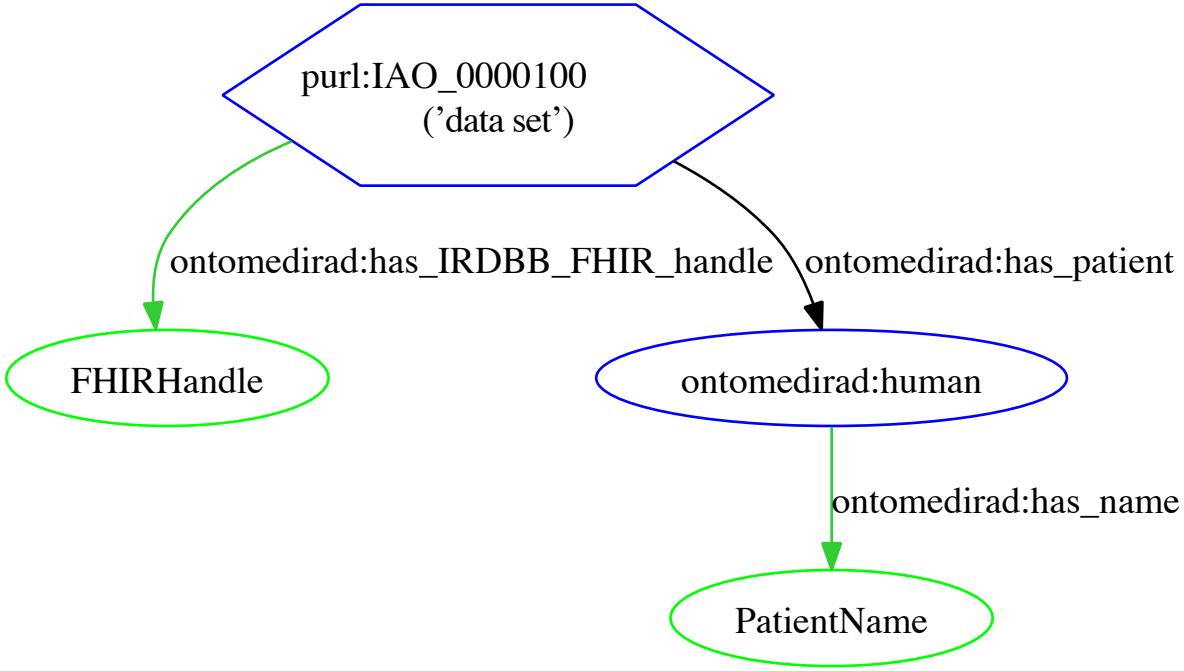
## Query 11 - Mean absorbed doses in organs

```
SELECT DISTINCT ?ClinResearchStudyId ?PatientName ?PatientId ?MaterialEntityClassLabel ?DoseClassLabel ?ProcessClass ?Date ?Time ?DoseValue
?DoseUnitClassLabel ?DoseMap ?FHIRHandle ?ValueKVP ?LabelUnitKVP ?LabelXRayModulationType ?ModeledDeviceName
WHERE {
 ?Dose rdf:type ?DoseClass .
 ?DoseClass rdfs:subClassOf* dcm:128533 .
 ?DoseClass skos:prefLabel ?DoseClassLabel .
 ?Dose purl:IAO_0000004 ?DoseValue .
 ?Dose purl:IAO_0000039 ?DoseUnit .
 ?DoseUnit rdf:type ?DoseUnitClass .
 ?DoseUnitClass rdfs:label ?DoseUnitClassLabel .
 ?Dose ontomedirad:is_dose_absorbed_by ?MaterialEntity .
 ?MaterialEntity rdf:type ?MaterialEntityClass .
 ?MaterialEntityClass rdfs:label ?MaterialEntityClassLabel .
 ?Dose ontomedirad:has_patient ?Human .
 ?Human ontomedirad:has_id ?PatientId .
 ?Process ontomedirad:has_specified_output ?Dose .
 ?Process rdf:type ?ProcessClass .
 ?ProcessClass rdfs:subClassOf* purl:BFO_0000015 .
 ?Process ontomedirad:has_specified_input ?DoseMap .
 OPTIONAL  { ?DoseMap ontomedirad:has_IRDBB_FHIR_handle ?FHIRHandle . }
 OPTIONAL { ?ModelOfImagingDevice ontomedirad:used_as_instrument_in ?ProcessCalcDoseMap .
 ?ModelOfImagingDevice ontomedirad:refers_to_device ?ImagingDevice .
 ?ImagingDevice ontomedirad:has_name ?ModeledDeviceName .
 ?ProcessCalcDoseMap ontomedirad:has_specified_output ?DoseMap }
 OPTIONAL { ?ProcessCalcDoseMap ontomedirad:has_setting ?KVP .
 ?KVP rdf:type dcm:113733 .
 ?KVP purl:IAO_0000004 ?ValueKVP .
 ?KVP purl:IAO_0000039 ?UnitKVP .
 ?UnitKVP rdfs:label ?LabelUnitKVP }
 OPTIONAL { ?ProcessCalcDoseMap ontomedirad:has_setting ?XRayModulationType .
 ?XRayModulationType rdfs:subClassOf* dcm:113842 .
 ?XRayModulationType skos:prefLabel ?LabelXRayModulationType .  }
 OPTIONAL {?Process ontomedirad:part_of_study ?ClinResearchStudy .
          ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId }
 OPTIONAL {?Process ontomedirad:has_beginning ?DateTime .
                 BIND (substr(?DateTime,1,8) AS ?Date) .
                 BIND (substr(?DateTime,10,4) AS ?Time) } .
 OPTIONAL { ?Human ontomedirad:has_name ?PatientName } .
 OPTIONAL {?Process ontomedirad:has_specified_input ?DoseMap .
           ?DoseMap rdf:type ?DoseMapClass .
           ?DoseMapClass rdfs:subClassOf* dcm:128487 .
           ?DoseMapClass skos:prefLabel ?DoseMapClassLabel }.
} ORDER BY ?ClinResearchStudyId ?PatientId ?MaterialEntity
```


ontomedirad:model_of_medical_imaging_device
ontomedirad:used_as_instrument_in
ontomedirad:refers_to_imaging_device
purl:BFO_0000015
('process')
ontomedirad:calculation_of_a_3D_dose_map
ontomedirad:medical_imaging_device
ontomedirad:has_specified_output
ontomedirad:part_of_study
ontomedirad:has_beginning_date
ontomedirad:has_specified_input
ontomedirad:has_specified_output
ontomedirad:has_setting
ontomedirad:has_setting
ontomedirad:has_name
dcm:128533
('mean_absorbed_absorbed_dose')
ontomedirad:clinical_research_study
DateTime
dcm: 128487
('3D dose map')
dcm:113733
('kvp')
dcm:113842
('X-ray modulation type')
ModeledDeviceName
purl:IAO_0000004
('has value...')
purl:IAO_0000039
('has unit...')
ontomedirad:is_dose_absorbed_by
ontomedirad:has_patient
ontomedirad:has_id
ontomedirad:has_IRDBB_FHIR_handle
purl:IAO_0000004
('has value...')
purl:IAO_0000039
('has unit...')
DoseValue
purl:UO_0000129
('absorbed dose unit')
purl:BFO_0000050
('material entity')
ontomedirad:human
ClinResearchStudyId
FHIRHandle
ValueKVP
purl:UO_0000248
('kilovolt')
ontomedirad:has_id
ontomedirad:has_name
PatientId
PatientName

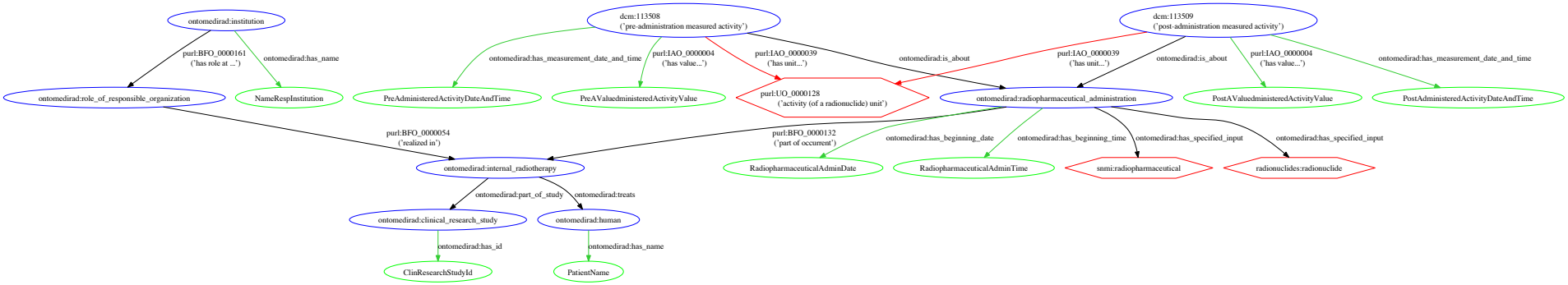
## Query 12 - Non DICOM datasets and handles

```
SELECT DISTINCT ?PatientName ?Dataset ?DatasetClassLabel ?FHIRHandle
WHERE {
 ?Dataset ontomedirad:has_IRDBB_FHIR_handle ?FHIRHandle .
 ?Dataset rdf:type ?DatasetClass .
 ?DatasetClass rdfs:subClassOf* purl:IAO_0000100 .
 OPTIONAL {?DatasetClass skos:prefLabel ?DatasetClassLabel } .
 OPTIONAL { ?Dataset ontomedirad:has_patient ?Human .
  ?Human ontomedirad:has_name ?PatientName }.
 } ORDER BY ?Dataset
```



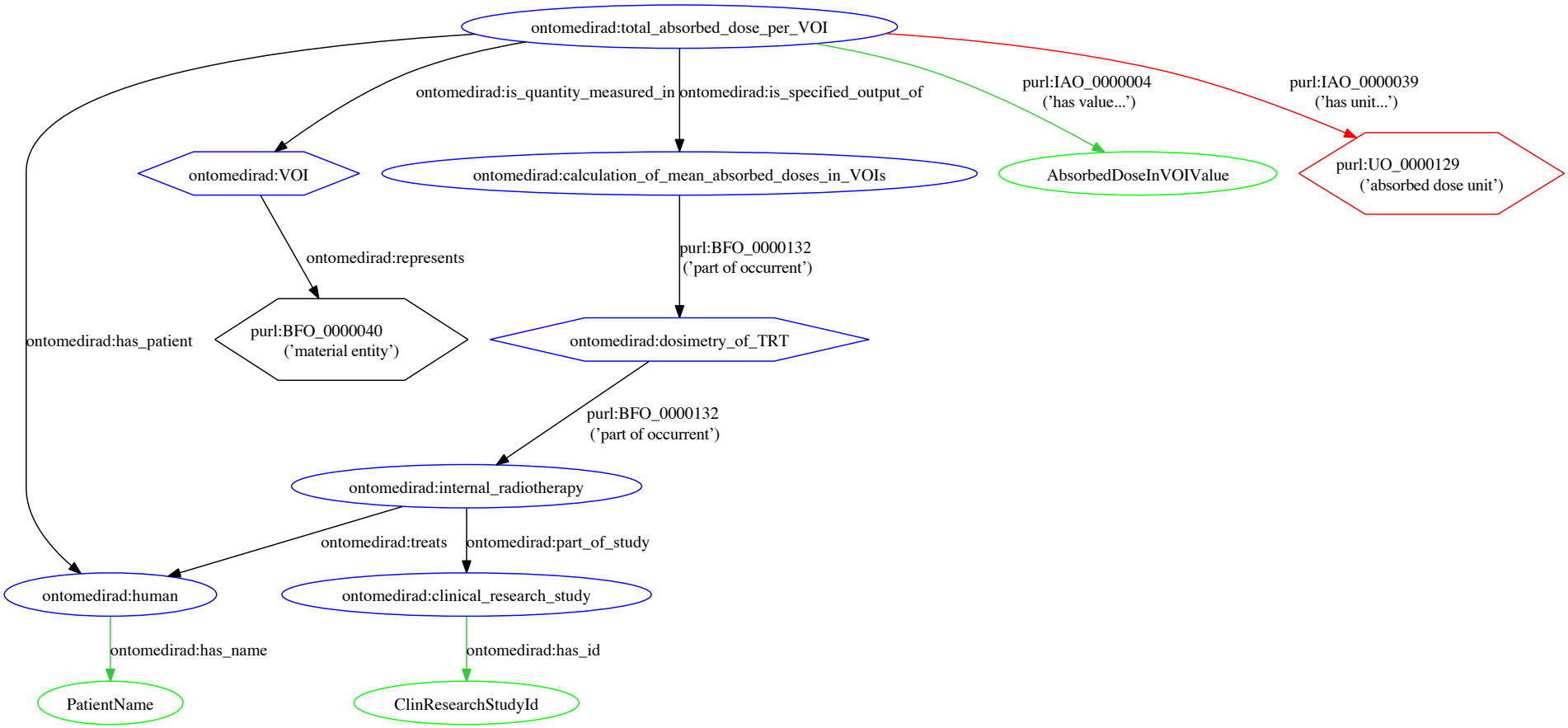
## Query 13 - Internal radiotherapy radiopharmaceutical administration

```
SELECT DISTINCT ?ClinResearchStudyId ?InternalRadiotherapy ?PatientName ?NameRespInstitution
 ?RadiopharmaceuticalClassLabel ?RadionuclideClassLabel
 ?PreAValuedministeredActivityValue ?PostAValuedministeredActivityValue ?AdministeredActivityUnitLabel
 WHERE {
  ?InternalRadiotherapy rdf:type ontomedirad:internal_radiotherapy .
  ?InternalRadiotherapy ontomedirad:part_of_study ?ClinResearchStudy .
  ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId .
  ?InternalRadiotherapy ontomedirad:treats ?Human .
  ?Human ontomedirad:has_name ?PatientName .
  ?RespInstitution rdf:type ontomedirad:institution .
  ?RespInstitution ontomedirad:has_name ?NameRespInstitution .
  ?RespInstitutionRole purl:BFO_0000054 ?InternalRadiotherapy .
  ?RespInstitution purl:BFO_0000161 ?RespInstitutionRole .
  ?RadiopharmaceuticalAdmin rdf:type ontomedirad:radiopharmaceutical_administration .
  ?RadiopharmaceuticalAdmin purl:BFO_0000132 ?InternalRadiotherapy .
  ?RadiopharmaceuticalAdmin ontomedirad:has_beginning_date ?RadiopharmaceuticalAdminDate .
  ?RadiopharmaceuticalAdmin ontomedirad:has_beginning_time ?RadiopharmaceuticalAdminTime .
  ?RadiopharmaceuticalAdmin ontomedirad:has_specified_input ?Radiopharmaceutical .
  ?Radiopharmaceutical rdf:type ?RadiopharmaceuticalClass .
  ?RadiopharmaceuticalClass rdfs:subClassOf snmi:radiopharmaceutical .
  ?RadiopharmaceuticalClass skos:prefLabel ?RadiopharmaceuticalClassLabel .
  ?RadiopharmaceuticalAdmin ontomedirad:has_specified_input ?Radionuclide .
  ?Radionuclide rdf:type ?RadionuclideClass .
  ?RadionuclideClass rdfs:subClassOf radionuclides:radionuclide .
  ?RadionuclideClass skos:prefLabel ?RadionuclideClassLabel .
  ?PreAdministeredActivity ontomedirad:is_about ?RadiopharmaceuticalAdmin .
  ?PreAdministeredActivity rdf:type dcm:113508 .
  ?PreAdministeredActivity ontomedirad:has_measurement_date_and_time ?PreAdministeredActivityDateAndTime .
  ?PreAdministeredActivity purl:IAO_0000004 ?PreAValuedministeredActivityValue .
  ?PreAdministeredActivity purl:IAO_0000039 ?AdministeredActivityUnit .
  ?AdministeredActivityUnit skos:prefLabel ?AdministeredActivityUnitLabel .
  ?PostAdministeredActivity ontomedirad:is_about ?RadiopharmaceuticalAdmin .
  ?PostAdministeredActivity rdf:type dcm:113509 .
  ?PostAdministeredActivity ontomedirad:has_measurement_date_and_time ?PostAdministeredActivityDateAndTime .
  ?PostAdministeredActivity purl:IAO_0000004 ?PostAValuedministeredActivityValue .
  ?PostAdministeredActivity purl:IAO_0000039 ?AdministeredActivityUnit .
 } ORDER BY ?ClinResearchStudyId ?PatientName
```


ontomedirad:institution
purl:BFO_0000161
('has role at ...')
ontomedirad:has_name
ontomedirad:role_of_responsible_organization
NameRespInstitution
dcm:113508
('pre-administration measured activity')
ontomedirad:has_measurement_date_and_time
purl:IAO_0000004
('has value...')
purl:IAO_0000039
('has unit...')
ontomedirad:is_about
PreAdministeredActivityDateAndTime
PreAValuedministeredActivityValue
purl:UO_0000128
('activity (of a radionuclide) unit')
dcm:113509
('post-administration measured activity')
purl:IAO_0000039
('has unit...')
ontomedirad:is_about
purl:IAO_0000004
('has value...')
ontomedirad:has_measurement_date_and_time
ontomedirad:radiopharmaceutical_administration
PostAValuedministeredActivityValue
PostAdministeredActivityDateAndTime
purl:BFO_0000054
('realized in')
purl:BFO_0000132
('part of occurrent')
ontomedirad:has_beginning_date
ontomedirad:has_beginning_time
ontomedirad:has_specified_input
ontomedirad:has_specified_input
ontomedirad:internal_radiotherapy
RadiopharmaceuticalAdminDate
RadiopharmaceuticalAdminTime
snmi:radiopharmaceutical
radionuclides:radionuclide
ontomedirad:part_of_study
ontomedirad:treats
ontomedirad:clinical_research_study
ontomedirad:human
ontomedirad:has_id
ontomedirad:has_name
ClinResearchStudyId
PatientName

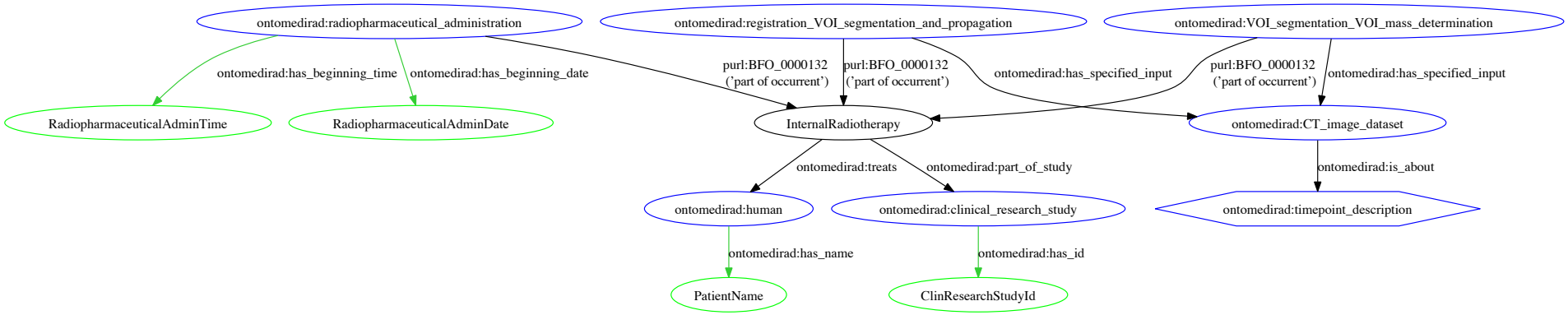
## Query 14 - Internal radiotherapy total absorbed doses

```
SELECT DISTINCT ?ClinResearchStudyId ?InternalRadiotherapy ?PatientName ?3DDosimetryOfTRTClassLabel ?AbsorbedDoseInVOIValue
?AbsorbedDoseInVOIUnitLabel ?OrganOrTissueClassLabel
 WHERE {
  ?InternalRadiotherapy rdf:type ontomedirad:internal_radiotherapy .
  ?InternalRadiotherapy ontomedirad:part_of_study ?ClinResearchStudy .
  ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId .
  ?InternalRadiotherapy ontomedirad:treats ?Human .
  ?Human ontomedirad:has_name ?PatientName .
  ?AbsorbedDoseInVOI ontomedirad:has_patient ?Human .
  ?AbsorbedDoseInVOI rdf:type ontomedirad:total_absorbed_dose_per_VOI .
  ?AbsorbedDoseInVOI ontomedirad:is_quantity_measured_in ?VOI.
  ?VOI ontomedirad:represents ?OrganOrTissue .
  ?OrganOrTissue rdf:type ?OrganOrTissueClass .
  ?OrganOrTissueClass rdfs:label ?OrganOrTissueClassLabel .
  ?AbsorbedDoseCalculationInVOI ontomedirad:has_specified_output ?AbsorbedDoseInVOI .
  ?AbsorbedDoseCalculationInVOI rdf:type ontomedirad:calculation_of_mean_absorbed_doses_in_VOIs .
  ?AbsorbedDoseCalculationInVOI purl:BFO_0000132 ?3DDosimetryOfTRT .
  ?3DDosimetryOfTRT rdf:type ?3DDosimetryOfTRTClass .
  ?3DDosimetryOfTRTClass skos:prefLabel ?3DDosimetryOfTRTClassLabel .
  ?3DDosimetryOfTRTClass rdfs:subClassOf* ontomedirad:dosimetry_of_TRT .
  ?3DDosimetryOfTRT purl:BFO_0000132 ?InternalRadiotherapy .
  ?AbsorbedDoseCalculationInVOI purl:BFO_0000132 ?InternalRadiotherapy .
  ?AbsorbedDoseInVOI purl:IAO_0000004 ?AbsorbedDoseInVOIValue .
  ?AbsorbedDoseInVOI purl:IAO_0000039 ?AbsorbedDoseInVOIUnit .
  ?AbsorbedDoseInVOIUnit rdfs:label ?AbsorbedDoseInVOIUnitLabel .
 } ORDER BY ?ClinResearchStudyId ?PatientName ?OrganOrTissue ?3DDosimetryOfTRTClassLabel
```


ontomedirad:total_absorbed_dose_per_VOI
ontomedirad:is_quantity_measured_in
ontomedirad:is_specified_output_of
purl:IAO_0000004
('has value...')
purl:IAO_0000039
('has unit...')
ontomedirad:VOI
ontomedirad:calculation_of_mean_absorbed_doses_in_VOIs
AbsorbedDoseInVOIValue
purl:UO_0000129
('absorbed dose unit')
ontomedirad:represents
purl:BFO_0000132
('part of occurrent')
ontomedirad:has_patient
purl:BFO_0000040
('material entity')
ontomedirad:dosimetry_of_TRT
purl:BFO_0000132
('part of occurrent')
ontomedirad:internal_radiotherapy
ontomedirad:treats
ontomedirad:part_of_study
ontomedirad:human
ontomedirad:clinical_research_study
ontomedirad:has_name
ontomedirad:has_id
PatientName
ClinResearchStudyId

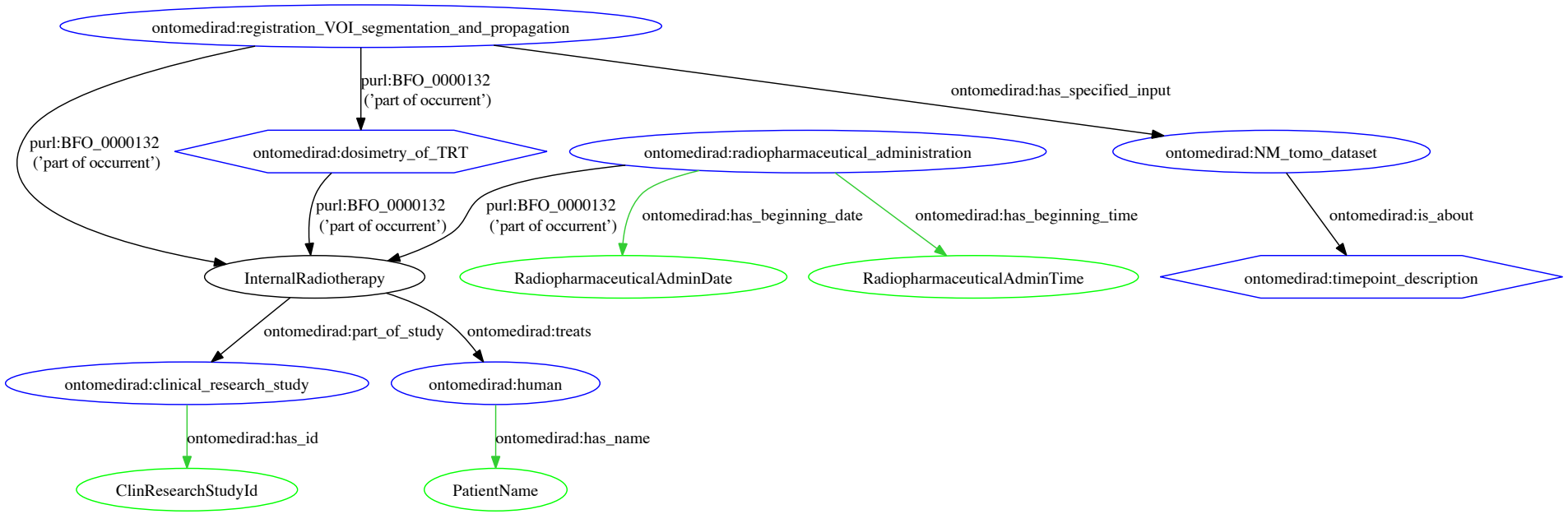
## Query 15- Internal radiotherapy CT images used

```
SELECT DISTINCT ?ClinResearchStudyId ?InternalRadiotherapy ?PatientName ?RadiopharmaceuticalAdminDate ?RadiopharmaceuticalAdminTime ?CTDataset
?TimepointClassLabel
 WHERE {
  ?InternalRadiotherapy rdf:type ontomedirad:internal_radiotherapy .
  ?InternalRadiotherapy ontomedirad:part_of_study ?ClinResearchStudy .
  ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId .
  ?InternalRadiotherapy ontomedirad:treats ?Human .
  ?Human ontomedirad:has_name ?PatientName .
  ?RadiopharmaceuticalAdmin rdf:type ontomedirad:radiopharmaceutical_administration .
  ?RadiopharmaceuticalAdmin purl:BFO_0000132 ?InternalRadiotherapy .
  ?RadiopharmaceuticalAdmin ontomedirad:has_beginning_date ?RadiopharmaceuticalAdminDate .
  ?RadiopharmaceuticalAdmin ontomedirad:has_beginning_time ?RadiopharmaceuticalAdminTime .
  { ?RegistrationVOISegmentationAndPropagation purl:BFO_0000132 ?InternalRadiotherapy .
    ?RegistrationVOISegmentationAndPropagation ontomedirad:has_specified_input ?CTDataset .
    ?RegistrationVOISegmentationAndPropagation rdf:type ontomedirad:registration_VOI_segmentation_and_propagation .
    ?CTDataset rdf:type ontomedirad:CT_image_dataset .
    ?CTDataset ontomedirad:is_about ?Timepoint .
    ?Timepoint rdf:type ?TimepointClass .
    ?TimepointClass rdfs:subClassOf* ontomedirad:timepoint_description .
    ?TimepointClass skos:prefLabel ?TimepointClassLabel .
  }
   UNION
  {
    ?VOISegmentationVOIMassDetermination purl:BFO_0000132 ?InternalRadiotherapy .
    ?VOISegmentationVOIMassDetermination ontomedirad:has_specified_input ?CTDataset.
    ?VOISegmentationVOIMassDetermination rdf:type ontomedirad:VOI_segmentation_VOI_mass_determination .
    ?CTDataset rdf:type ontomedirad:CT_image_dataset .
    ?CTDataset ontomedirad:is_about ?Timepoint .
    ?Timepoint rdf:type ?TimepointClass .
    ?TimepointClass rdfs:subClassOf* ontomedirad:timepoint_description .
    ?TimepointClass skos:prefLabel ?TimepointClassLabel .
  }
 } ORDER BY ?ClinResearchStudyId ?PatientName
```


ontomedirad:radiopharmaceutical_administration
ontomedirad:registration_VOI_segmentation_and_propagation
ontomedirad:VOI_segmentation_VOI_mass_determination
ontomedirad:has_beginning_time
ontomedirad:has_beginning_date
purl:BFO_0000132 ('part of occurrent')
purl:BFO_0000132 ('part of occurrent')
ontomedirad:has_specified_input
purl:BFO_0000132 ('part of occurrent')
ontomedirad:has_specified_input
RadiopharmaceuticalAdminTime
RadiopharmaceuticalAdminDate
InternalRadiotherapy
ontomedirad:CT_image_dataset
ontomedirad:treats
ontomedirad:part_of_study
ontomedirad:is_about
ontomedirad:human
ontomedirad:clinical_research_study
ontomedirad:timepoint_description
ontomedirad:has_name
ontomedirad:has_id
PatientName
ClinResearchStudyId

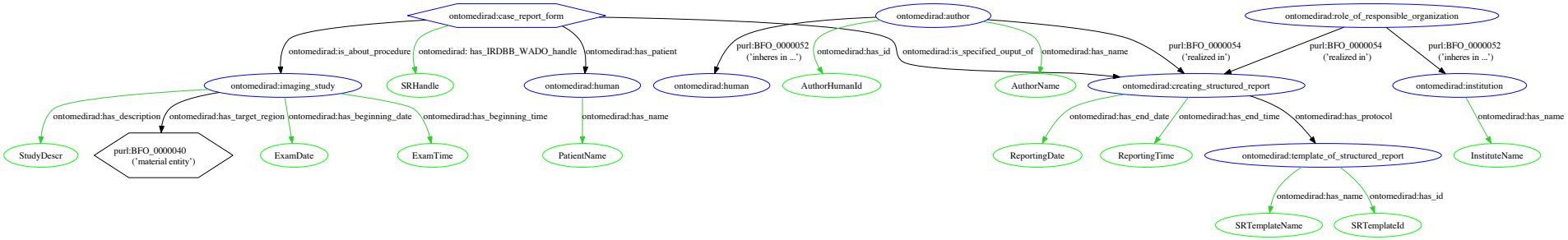
## Query 16- Internal radiotherapy NM tomo image used

```
SELECT DISTINCT ?ClinResearchStudyId ?InternalRadiotherapy ?PatientName ?RadiopharmaceuticalAdminDate ?RadiopharmaceuticalAdminTime
?DosimetryOfTRTClassLabel ?SPECTDataset ?TimepointClassLabel
 WHERE {
  ?InternalRadiotherapy rdf:type ontomedirad:internal_radiotherapy .
  ?InternalRadiotherapy ontomedirad:part_of_study ?ClinResearchStudy .
  ?ClinResearchStudy ontomedirad:has_id ?ClinResearchStudyId .
  ?InternalRadiotherapy ontomedirad:treats ?Human .
  ?Human ontomedirad:has_name ?PatientName .
  ?RadiopharmaceuticalAdmin rdf:type ontomedirad:radiopharmaceutical_administration .
  ?RadiopharmaceuticalAdmin purl:BFO_0000132 ?InternalRadiotherapy .
  ?RadiopharmaceuticalAdmin ontomedirad:has_beginning_date ?RadiopharmaceuticalAdminDate .
  ?RadiopharmaceuticalAdmin ontomedirad:has_beginning_time ?RadiopharmaceuticalAdminTime .
  ?RegistrationVOISegmentationAndPropagation purl:BFO_0000132 ?InternalRadiotherapy .
  ?RegistrationVOISegmentationAndPropagation ontomedirad:has_specified_input ?SPECTDataset .
  ?SPECTDataset rdf:type ontomedirad:NM_tomo_dataset .
  ?SPECTDataset ontomedirad:is_about ?Timepoint .
  ?Timepoint rdf:type ?TimepointClass .
  ?TimepointClass rdfs:subClassOf* ontomedirad:timepoint_description .
  ?TimepointClass skos:prefLabel ?TimepointClassLabel .
  OPTIONAL {?RegistrationVOISegmentationAndPropagation purl:BFO_0000132 ?DosimetryOfTRT .
  ?DosimetryOfTRT purl:BFO_0000132 ?InternalRadiotherapy .
  ?DosimetryOfTRT rdf:type ?DosimetryOfTRTClass .
  ?DosimetryOfTRTClass skos:prefLabel ?DosimetryOfTRTClassLabel .
  ?DosimetryOfTRTClass rdfs:subClassOf ontomedirad:dosimetry_of_TRT .
  }
 } ORDER BY ?ClinResearchStudyId ?PatientName ?DosimetryOfTRTClassLabel
```


ontomedirad:registration_VOI_segmentation_and_propagation
purl:BFO_0000132
('part of occurrent')
ontomedirad:has_specified_input
purl:BFO_0000132
('part of occurrent')
ontomedirad:dosimetry_of_TRT
ontomedirad:radiopharmaceutical_administration
ontomedirad:NM_tomo_dataset
purl:BFO_0000132
('part of occurrent')
purl:BFO_0000132
('part of occurrent')
ontomedirad:has_beginning_date
ontomedirad:has_beginning_time
ontomedirad:is_about
InternalRadiotherapy
RadiopharmaceuticalAdminDate
RadiopharmaceuticalAdminTime
ontomedirad:timepoint_description
ontomedirad:part_of_study
ontomedirad:treats
ontomedirad:clinical_research_study
ontomedirad:human
ontomedirad:has_id
ontomedirad:has_name
ClinResearchStudyId
PatientName

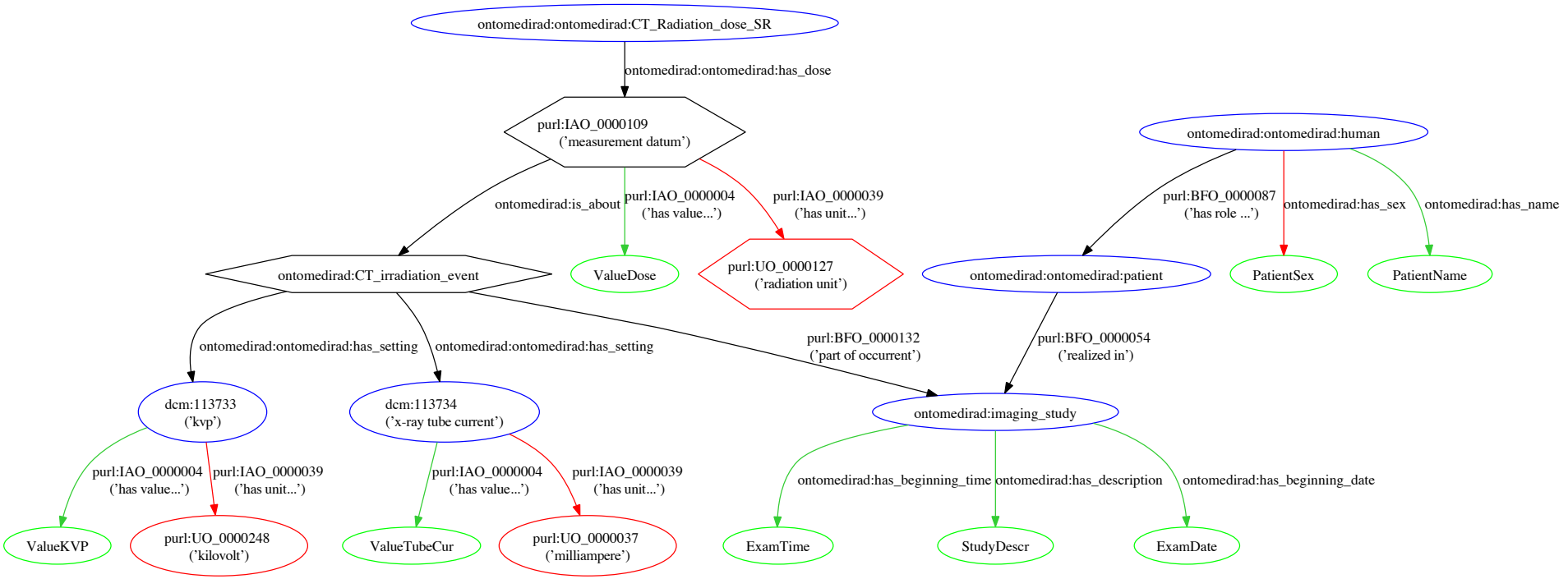
## Query 17- Case Report Forms for WP3 T3.3

```
SELECT DISTINCT ?CRFReport ?Exam  ?ExamDate ?ExamTime ?StudyDescr ?TargetRegion  ?LabelOrgan ?CRFReportClassLabel ?SRTemplateName ?SRTemplateId
?PatientName ?AuthorName ?AuthorHumanId ?InstituteName ?InstituteRoleClassLabel ?ReportingDate ?ReportingTime ?SRHandle
WHERE {
?CRFReport rdf:type ?CRFReportClass .
?CRFReportClass rdfs:subClassOf* ontomedirad:case_report_form .
?CRFReportClass skos:prefLabel ?CRFReportClassLabel .
?CRFReport ontomedirad:has_patient ?Human .
OPTIONAL { ?Human ontomedirad:has_name ?PatientName . }
?CRFReport ontomedirad:is_specified_output_of ?ReportCreatingProcess .
FILTER (STRENDS(?CRFReportClassLabel,'version')) .
OPTIONAL { ?CRFReport ontomedirad:is_about_procedure ?Exam .
           OPTIONAL { ?Exam ontomedirad:has_beginning_date ?ExamDate .
                      ?Exam ontomedirad:has_beginning_time ?ExamTime . }
           OPTIONAL { ?Exam ontomedirad:has_description ?StudyDescr }
           OPTIONAL { ?Exam ontomedirad:has_target_region ?TargetRegion .
                      ?TargetRegion rdf:type ?OrganClass .
                      ?OrganClass rdfs:label ?LabelOrgan . } }
OPTIONAL { ?CRFReport ontomedirad:has_IRDBB_WADO_handle ?SRHandle .}
OPTIONAL { ?AuthorRole rdf:type ontomedirad:author .
           ?AuthorRole purl:BFO_0000052 ?Author .
           ?Author ontomedirad:has_id ?AuthorHumanId .
           ?AuthorRole purl:BFO_0000054 ?ReportCreatingProcess .
           ?AuthorRole ontomedirad:has_name ?AuthorName .
           OPTIONAL {?ReportCreatingProcess ontomedirad:has_end_date ?ReportingDate .
                     ?ReportCreatingProcess ontomedirad:has_end_time ?ReportingTime .}
           OPTIONAL {?InstituteRole purl:BFO_0000052 ?Institute .
                     ?InstituteRole purl:BFO_0000054 ?ReportCreatingProcess .
                     ?InstituteRole rdf:type ?InstituteRoleClass .
                     ?InstituteRoleClass skos:prefLabel ?InstituteRoleClassLabel .
                     ?Institute ontomedirad:has_name ?InstituteName .}
           OPTIONAL { ?ReportCreatingProcess ontomedirad:has_protocol ?SRTemplate .
                      ?SRTemplate ontomedirad:has_name ?SRTemplateName  .
                      ?SRTemplate ontomedirad:has_id ?SRTemplateId } } }
```



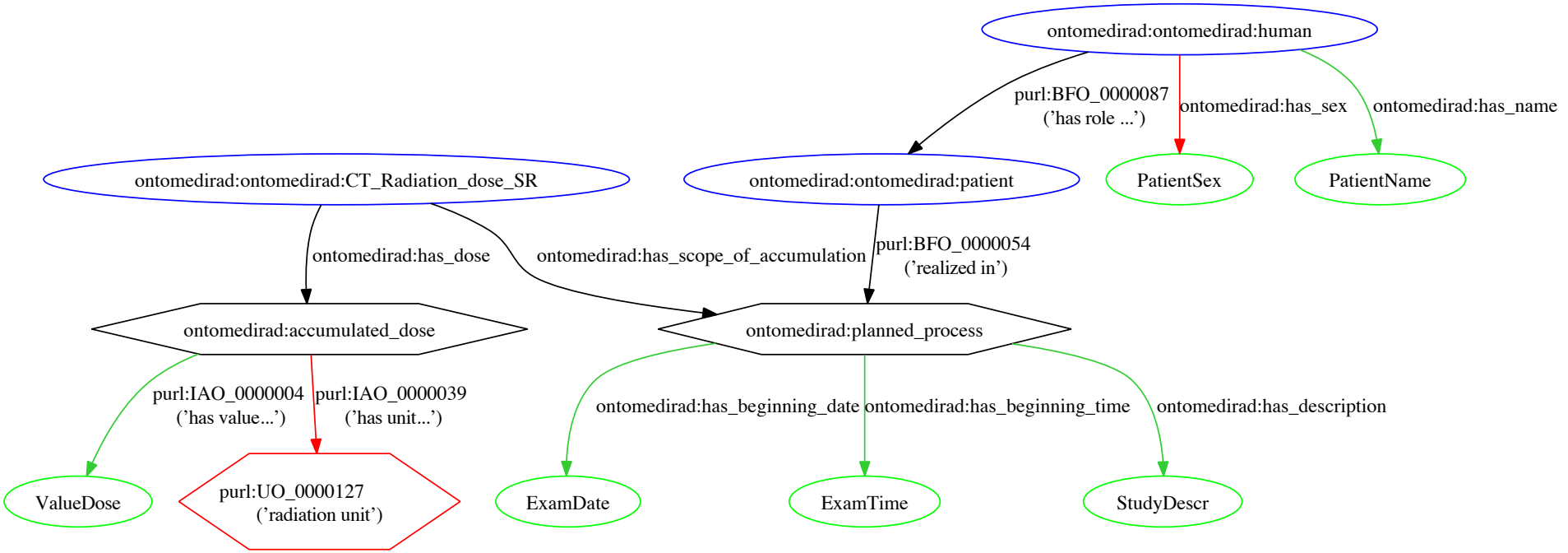
## Query 18 - DICOM SR Dose reports:doses of individual acquisitions

```
SELECT DISTINCT ?StructuredReport ?StructuredReportClassLabel ?Exam ?StudyDescr ?ExamDate ?ExamTime ?Human ?PatientName ?LabelSex ?IrradEvent ?Dose
?DoseClassLabel ?ValueDose ?UnitDoseLabel ?ValueKVP ?LabelUnitKVP ?ValueTubeCur ?LabelUnitTubeCur
       WHERE {
 ?StructuredReport ontomedirad:has_dose ?Dose .
 ?StructuredReport rdf:type ?StructuredReportClass .
 ?StructuredReportClass skos:prefLabel ?StructuredReportClassLabel .
 ?Dose ontomedirad:is_about_irradiation_event ?IrradEvent .
 ?IrradEvent rdf:type ?IrradEventClass .
 ?IrradEventClass skos:prefLabel ?IrradEventClassLabel .
 ?IrradEvent purl:BFO_0000132 ?Exam .
 ?Dose purl:IAO_0000004 ?ValueDose .
 ?Dose purl:IAO_0000039 ?UnitDose .
 ?UnitDose rdfs:label ?UnitDoseLabel .
 ?Dose rdf:type ?DoseClass .
 ?DoseClass skos:prefLabel ?DoseClassLabel .
 ?DoseClass rdfs:subClassOf* purl:IAO_0000109 .
 ?IrradEvent purl:BFO_0000132 ?Exam .
 ?IrradEvent ontomedirad:has_setting ?KVP .
 ?KVP rdf:type dcm:113733 .
 ?KVP purl:IAO_0000004 ?ValueKVP .
 ?KVP purl:IAO_0000039 ?UnitKVP .
 ?UnitKVP rdfs:label ?LabelUnitKVP.
 ?IrradEvent ontomedirad:has_setting ?TubeCur .
 ?TubeCur rdf:type dcm:113734 .
 ?TubeCur purl:IAO_0000004 ?ValueTubeCur .
 ?TubeCur purl:IAO_0000039 ?UnitTubeCur.
 ?UnitTubeCur rdfs:label ?LabelUnitTubeCur .
 ?RolePat purl:BFO_0000054 ?Exam .
 ?Human purl:BFO_0000087 ?RolePat .
 OPTIONAL { ?Exam ontomedirad:has_beginning_date ?ExamDate .
            ?Exam ontomedirad:has_beginning_time ?ExamTime . }
 OPTIONAL { ?Exam ontomedirad:has_description ?StudyDescr }
 OPTIONAL { ?Human ontomedirad:has_sex ?PatientSex .
            ?PatientSex rdfs:label ?LabelSex . }
 OPTIONAL { ?Human ontomedirad:has_name ?PatientName }
} ORDER BY ?Human ?Exam ?IrradEvent
```


ontomedirad:ontomedirad:CT_Radiation_dose_SR
ontomedirad:ontomedirad:has_dose
purl:IAO_0000109
('measurement datum')
ontomedirad:is_about
purl:IAO_0000004
('has value...')
purl:IAO_0000039
('has unit...')
ontomedirad:CT_irradiation_event
ValueDose
purl:UO_0000127
('radiation unit')
ontomedirad:ontomedirad:human
purl:BFO_0000087
('has role ...')
ontomedirad:has_sex
ontomedirad:has_name
ontomedirad:ontomedirad:patient
PatientSex
PatientName
ontomedirad:ontomedirad:has_setting
ontomedirad:ontomedirad:has_setting
purl:BFO_0000132
('part of occurrent')
purl:BFO_0000054
('realized in')
dcm:113733
('kvp')
dcm:113734
('x-ray tube current')
ontomedirad:imaging_study
purl:IAO_0000004
('has value...')
purl:IAO_0000039
('has unit...')
purl:IAO_0000004
('has value...')
purl:IAO_0000039
('has unit...')
ontomedirad:has_beginning_time
ontomedirad:has_description
ontomedirad:has_beginning_date
ValueKVP
purl:UO_0000248
('kilovolt')
ValueTubeCur
purl:UO_0000037
('milliampere')
ExamTime
StudyDescr
ExamDate

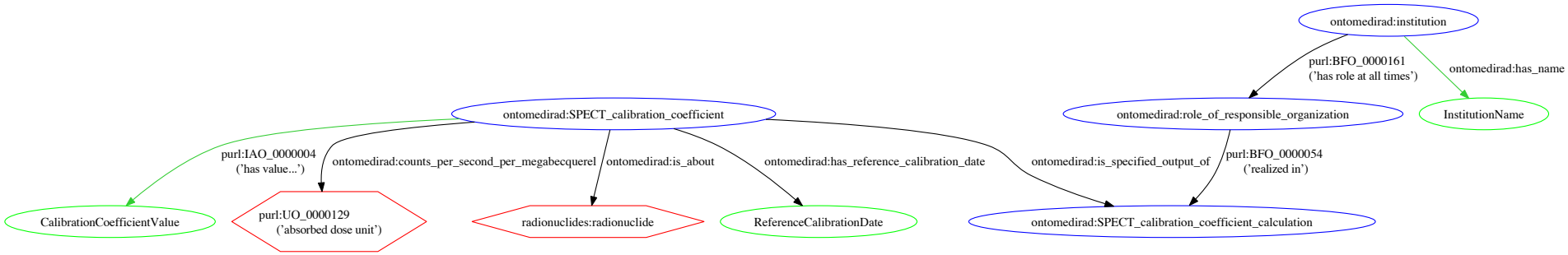
## Query 19 - DICOM SR Dose reports: Cumulated doses

```
SELECT DISTINCT ?StructuredReport ?StructuredReportClassLabel ?ScopeOfAccumul ?ScopeOfAccumul ?StudyDescr ?ExamDate ?ExamTime ?Human ?PatientName
?LabelSex ?Dose ?DoseClassLabel ?ValueDose ?UnitDoseLabel
        WHERE {
 ?StructuredReport ontomedirad:has_dose ?Dose .
 ?Dose purl:IAO_0000004 ?ValueDose .
 ?Dose purl:IAO_0000039 ?UnitDose .
 ?UnitDose rdfs:label ?UnitDoseLabel .
 ?Dose rdf:type ?DoseClass .
 ?DoseClass skos:prefLabel ?DoseClassLabel .
 ?DoseClass rdfs:subClassOf* ontomedirad:accumulated_dose .
 ?StructuredReport rdf:type ?StructuredReportClass .
 ?StructuredReportClass skos:prefLabel ?StructuredReportClassLabel .
 ?StructuredReport ontomedirad:has_scope_of_accumulation ?ScopeOfAccumul .
 ?ScopeOfAccumul rdf:type ?ScopeOfAccumulClass .
 ?ScopeOfAccumulClass skos:prefLabel ?ScopeOfAccumulClassLabel .
 ?RolePat purl:BFO_0000054 ?ScopeOfAccumul .
 ?Human purl:BFO_0000087 ?RolePat .
 OPTIONAL { ?ScopeOfAccumul ontomedirad:has_beginning_date ?ExamDate .
            ?ScopeOfAccumul ontomedirad:has_beginning_time ?ExamTime .
           ?ScopeOfAccumul ontomedirad:has_description ?StudyDescr . }
 OPTIONAL { ?Human ontomedirad:has_sex ?PatientSex .
            ?PatientSex rdfs:label ?LabelSex .
           ?Human ontomedirad:has_name ?PatientName .}
} ORDER BY ?Human ?Exam ?IrradEvent
```


ontomedirad:ontomedirad:human
purl:BFO_0000087
('has role ...')
ontomedirad:has_sex
ontomedirad:has_name
ontomedirad:ontomedirad:CT_Radiation_dose_SR
ontomedirad:ontomedirad:patient
PatientSex
PatientName
ontomedirad:has_dose
ontomedirad:has_scope_of_accumulation
purl:BFO_0000054
('realized in')
ontomedirad:accumulated_dose
ontomedirad:planned_process
purl:IAO_0000004
('has value...')
purl:IAO_0000039
('has unit...')
ontomedirad:has_beginning_date
ontomedirad:has_beginning_time
ontomedirad:has_description
ValueDose
purl:UO_0000127
('radiation unit')
ExamDate
ExamTime
StudyDescr

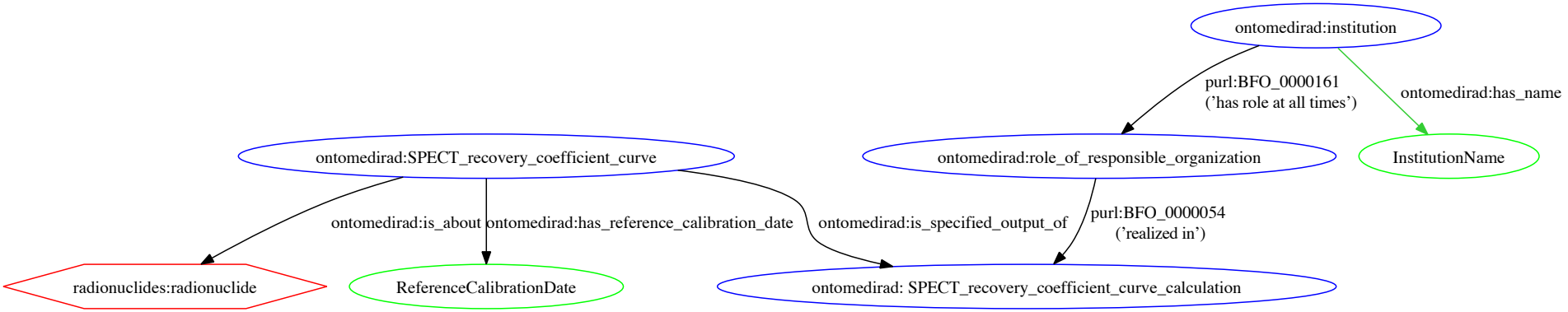
## Query 20 - Calibration coefficients

```
SELECT DISTINCT ?CalibrationCoefficient ?RadionuclideLabel ?ReferenceCalibrationDate ?InstitutionName ?CalibrationCoefficientValue
?CalibrationCoefficientUnitLabel ?CalibrationCoefficientCalculation
        WHERE {
 ?CalibrationCoefficient rdf:type ontomedirad:SPECT_calibration_coefficient .
 ?CalibrationCoefficient ontomedirad:is_specified_output_of ?CalibrationCoefficientCalculation .
 ?RoleOfRespInstitution purl:BFO_0000054 ?CalibrationCoefficientCalculation .
 ?Institution purl:BFO_0000161 ?RoleOfRespInstitution .
 ?Institution ontomedirad:has_name ?InstitutionName .
 ?CalibrationCoefficient purl:IAO_0000004 ?CalibrationCoefficientValue .
 ?CalibrationCoefficient purl:IAO_0000039 ?CalibrationCoefficientUnit .
 ?CalibrationCoefficientUnit rdfs:label ?CalibrationCoefficientUnitLabel .
 ?CalibrationCoefficient ontomedirad:is_about ?Radionuclide .
 ?Radionuclide rdf:type ?RadionuclideClass .
 ?RadionuclideClass rdfs:subClassOf* radionuclides:radionuclide .
 ?RadionuclideClass rdfs:label ?RadionuclideLabel .
 ?CalibrationCoefficient ontomedirad:has_reference_calibration_date ?ReferenceCalibrationDate .
} ORDER BY ?InstitutionName ?RadionuclideLabel
```



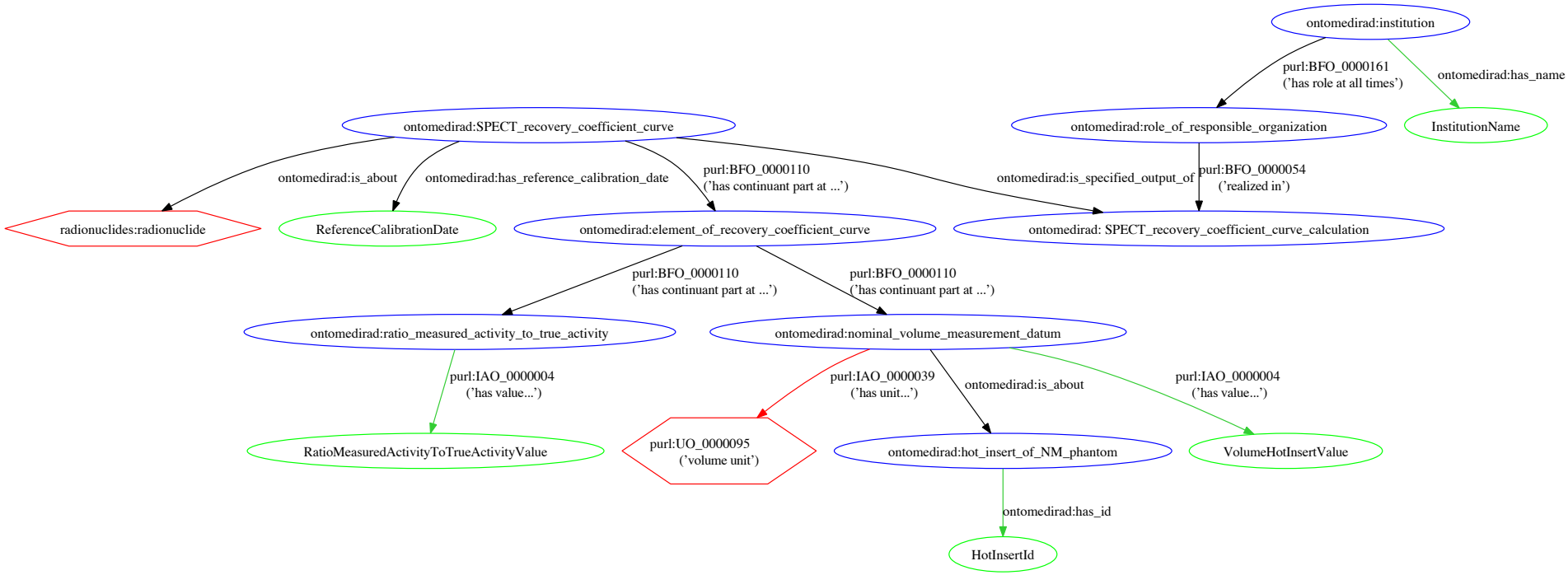
## Query 21 - Recovery coefficient curves

```
SELECT DISTINCT ?RecoveryCoefficientCurve ?RadionuclideLabel ?ReferenceCalibrationDate ?InstitutionName ?RecoveryCoefficientCurveCalculation
       WHERE {
 ?RecoveryCoefficientCurve rdf:type ontomedirad:SPECT_recovery_coefficient_curve .
 ?RecoveryCoefficientCurve ontomedirad:is_specified_output_of ?RecoveryCoefficientCurveCalculation .
 ?RoleOfRespInstitution purl:BFO_0000054 ?RecoveryCoefficientCurveCalculation .
 ?Institution purl:BFO_0000161 ?RoleOfRespInstitution .
 ?Institution ontomedirad:has_name ?InstitutionName .
 ?RecoveryCoefficientCurve ontomedirad:is_about ?Radionuclide .
 ?Radionuclide rdf:type ?RadionuclideClass .
 ?RadionuclideClass rdfs:subClassOf* radionuclides:radionuclide .
 ?RadionuclideClass rdfs:label ?RadionuclideLabel .
 ?RecoveryCoefficientCurve ontomedirad:has_reference_calibration_date ?ReferenceCalibrationDate .
} ORDER BY ?InstitutionName ?RadionuclideLabel
```



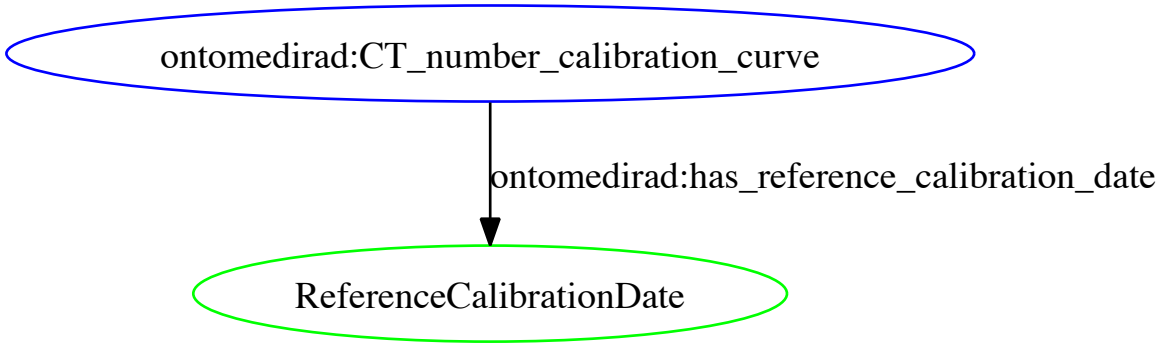
## Query 22 - Elements of recovery coefficient curves

```
SELECT DISTINCT ?RecoveryCoefficientCurve ?RadionuclideLabel ?ReferenceCalibrationDate ?InstitutionName ?ElementOfRecoveryCoefficientCurve
?RatioMeasuredActivityToTrueActivityValue ?VolumeHotInsertValue ?VolumeHotInsertUnitLabel ?HotInsertId
       WHERE {
 ?RecoveryCoefficientCurve rdf:type ontomedirad:SPECT_recovery_coefficient_curve .
 ?RecoveryCoefficientCurve ontomedirad:is_specified_output_of ?RecoveryCoefficientCurveCalculation .
 ?RoleOfRespInstitution purl:BFO_0000054 ?RecoveryCoefficientCurveCalculation .
 ?Institution purl:BFO_0000161 ?RoleOfRespInstitution .
 ?Institution ontomedirad:has_name ?InstitutionName .
 ?RecoveryCoefficientCurve ontomedirad:is_about ?Radionuclide .
 ?Radionuclide rdf:type ?RadionuclideClass .
 ?RadionuclideClass rdfs:subClassOf* radionuclides:radionuclide .
 ?RadionuclideClass rdfs:label ?RadionuclideLabel .
 ?RecoveryCoefficientCurve ontomedirad:has_reference_calibration_date ?ReferenceCalibrationDate .
 ?RecoveryCoefficientCurve purl:BFO_0000110 ?ElementOfRecoveryCoefficientCurve .
 ?ElementOfRecoveryCoefficientCurve rdf:type ontomedirad:element_of_recovery_coefficient_curve .
 ?ElementOfRecoveryCoefficientCurve purl:BFO_0000110 ?RatioMeasuredActivityToTrueActivity .
 ?RatioMeasuredActivityToTrueActivity  rdf:type ontomedirad:ratio_measured_activity_to_true_activity .
 ?RatioMeasuredActivityToTrueActivity purl:IAO_0000004 ?RatioMeasuredActivityToTrueActivityValue .
 ?ElementOfRecoveryCoefficientCurve purl:BFO_0000110 ?VolumeHotInsert .
 ?VolumeHotInsert rdf:type ontomedirad:nominal_volume_measurement_datum .
 ?VolumeHotInsert purl:IAO_0000004 ?VolumeHotInsertValue .
 ?VolumeHotInsert purl:IAO_0000039 ?VolumeHotInsertUnit .
 ?VolumeHotInsertUnit rdfs:label ?VolumeHotInsertUnitLabel .
 ?VolumeHotInsert ontomedirad:is_about ?HotInsert .
 ?HotInsert rdf:type ontomedirad:hot_insert_of_NM_phantom .
 ?HotInsert ontomedirad:has_id ?HotInsertId .
} ORDER BY ?InstitutionName ?RadionuclideLabel
```


ontomedirad:institution
purl:BFO_0000161
('has role at all times')
ontomedirad:has_name
InstitutionName
ontomedirad:role_of_responsible_organization
ontomedirad:SPECT_recovery_coefficient_curve
ontomedirad:is_about
ontomedirad:has_reference_calibration_date
purl:BFO_0000110
('has continuant part at ...')
ontomedirad:is_specified_output_of
purl:BFO_0000054
('realized in')
radionuclides:radionuclide
ReferenceCalibrationDate
ontomedirad:element_of_recovery_coefficient_curve
ontomedirad: SPECT_recovery_coefficient_curve_calculation
purl:BFO_0000110
('has continuant part at ...')
purl:BFO_0000110
('has continuant part at ...')
ontomedirad:ratio_measured_activity_to_true_activity
ontomedirad:nominal_volume_measurement_datum
purl:IAO_0000004
('has value...')
purl:IAO_0000039
('has unit...')
ontomedirad:is_about
purl:IAO_0000004
('has value...')
RatioMeasuredActivityToTrueActivityValue
purl:UO_0000095
('volume unit')
ontomedirad:hot_insert_of_NM_phantom
VolumeHotInsertValue
ontomedirad:has_id
HotInsertId

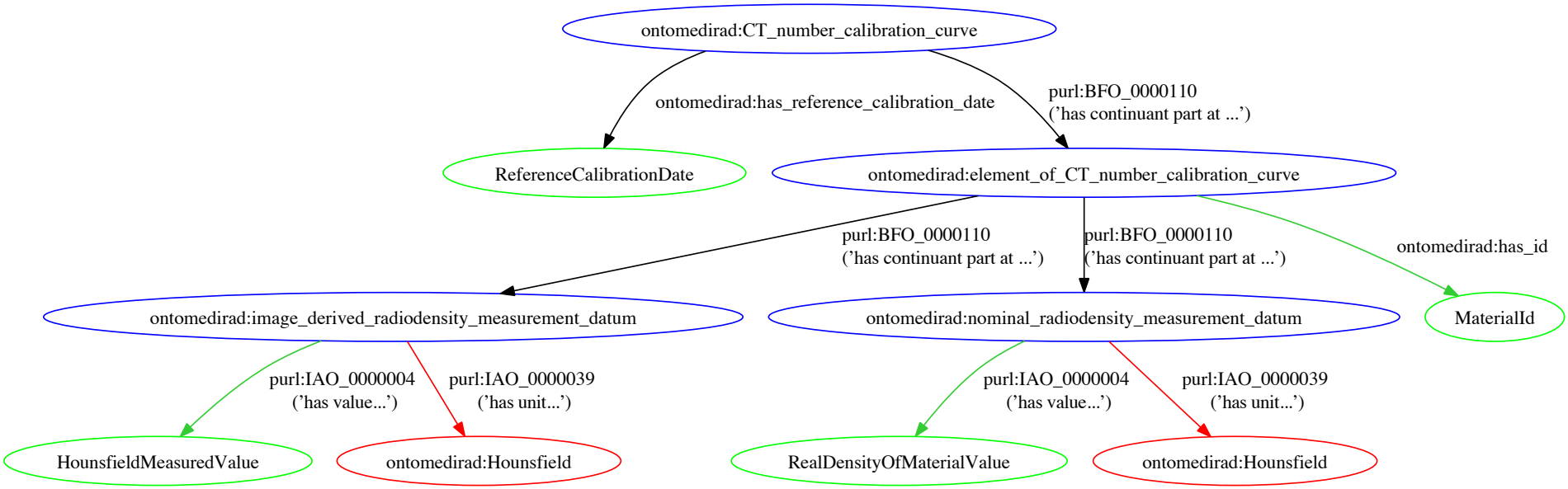
## Query 23 - CT number calibration curves

```
SELECT DISTINCT ?CTNumberCalibrationCurve ?ReferenceCalibrationDate
       WHERE {
 ?CTNumberCalibrationCurve rdf:type ontomedirad:CT_number_calibration_curve .
 ?CTNumberCalibrationCurve ontomedirad:has_reference_calibration_date ?ReferenceCalibrationDate .
 }
```



## Query 24 - Elements of CT number calibration curves

```
SELECT DISTINCT ?CTNumberCalibrationCurve ?ReferenceCalibrationDate ?ElementOfCTNumberCalibrationCurve ?HounsfieldMeasuredValue
?HounsfieldMeasuredUnitLabel ?RealDensityOfMaterialValue ?RealDensityOfMaterialUnitLabel ?MaterialId
       WHERE {
 ?CTNumberCalibrationCurve rdf:type ontomedirad:CT_number_calibration_curve .
 ?CTNumberCalibrationCurve ontomedirad:has_reference_calibration_date ?ReferenceCalibrationDate .
 ?CTNumberCalibrationCurve purl:BFO_0000110 ?ElementOfCTNumberCalibrationCurve .
 ?ElementOfCTNumberCalibrationCurve rdf:type ontomedirad:element_of_CT_number_calibration_curve .
 ?ElementOfCTNumberCalibrationCurve purl:BFO_0000110 ?ImageDerivedRadiodensityMeasurement .
 ?ImageDerivedRadiodensityMeasurement  rdf:type ontomedirad:image_derived_radiodensity_measurement_datum .
 ?ImageDerivedRadiodensityMeasurement purl:IAO_0000004 ?HounsfieldMeasuredValue .
 ?ImageDerivedRadiodensityMeasurement purl:IAO_0000039 ?HounsfieldMeasuredUnit .
 ?HounsfieldMeasuredUnit rdfs:label ?HounsfieldMeasuredUnitLabel .
 ?ElementOfCTNumberCalibrationCurve purl:BFO_0000110 ?NominalRadiodensityMeasurement .
 ?NominalRadiodensityMeasurement rdf:type ontomedirad:nominal_radiodensity_measurement_datum .
 ?NominalRadiodensityMeasurement purl:IAO_0000004 ?RealDensityOfMaterialValue .
 ?NominalRadiodensityMeasurement purl:IAO_0000039 ?RealDensityOfMaterialUnit .
 ?RealDensityOfMaterialUnit rdfs:label ?RealDensityOfMaterialUnitLabel .
 ?ElementOfCTNumberCalibrationCurve ontomedirad:has_id ?MaterialId .
}
```



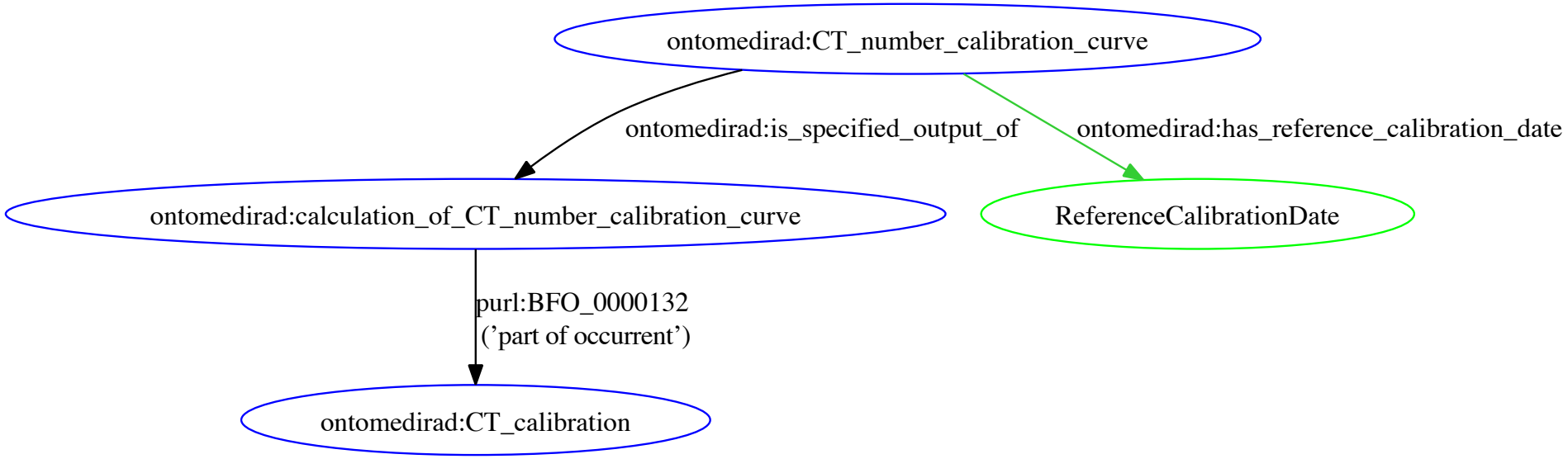
## Query 25 - NM phantom

```
SELECT DISTINCT ?Phantom ?PhantomId ?PhantomName
?HotInsertId ?VolumeHotInsertValue ?VolumeHotInsertUnitLabel ?RadionuclideHotInsertClassLabel ?PreAdminActivityHotInsertValue
?PreAdminActivityHotInsertUnitLabel ?PreAdminActivityHotInsertTimestamp ?PostAdminActivityHotInsertValue ?PostAdminActivityHotInsertUnitLabel
?PostAdminActivityHotInsertTimestamp
?ColdInsertId ?VolumeColdInsertValue ?VolumeColdInsertUnitLabel
?TankId ?VolumeTankValue ?VolumeTankUnitLabel ?RadionuclideTankClassLabel ?PreAdminActivityTankValue ?PreAdminActivityTankUnitLabel
?PreAdminActivityTankTimestamp ?PostAdminActivityTankValue ?PostAdminActivityTankUnitLabel ?PostAdminActivityTankTimestamp
       WHERE {
 ?Phantom rdf:type ontomedirad:NM_phantom_device .
 ?Phantom ontomedirad:has_id ?PhantomId .
 ?Phantom ontomedirad:has_name ?PhantomName .
 {
    ?Phantom purl:BFO_0000110 ?HotInsert .
    ?HotInsert rdf:type ontomedirad:hot_insert_of_NM_phantom .
    ?HotInsert ontomedirad:has_id ?HotInsertId .
    ?VolumeHotInsert rdf:type ontomedirad:nominal_volume_measurement_datum .
    ?VolumeHotInsert purl:IAO_0000004 ?VolumeHotInsertValue .
    ?VolumeHotInsert purl:IAO_0000039 ?VolumeHotInsertUnit .
    ?VolumeHotInsertUnit rdfs:label ?VolumeHotInsertUnitLabel .
    ?VolumeHotInsert ontomedirad:is_about ?HotInsert .
    ?HotInsert purl:BFO_0000110 ?RadiopharmaceuticalHotInsert .
    ?RadiopharmaceuticalHotInsert rdf:type snmi:radiopharmaceutical .
    ?RadiopharmaceuticalHotInsert purl:BFO_0000110 ?RadionuclideHotInsert .
    ?RadionuclideHotInsert rdf:type ?RadionuclideHotInsertClass .
    ?RadionuclideHotInsertClass rdfs:subClassOf* radionuclides:radionuclide .
    ?RadionuclideHotInsertClass rdfs:label ?RadionuclideHotInsertClassLabel .
    ?PreAdminActivityHotInsert ontomedirad:is_about ?RadiopharmaceuticalHotInsert .
    ?PreAdminActivityHotInsert rdf:type dcm:113508 .
    ?PreAdminActivityHotInsert purl:IAO_0000004 ?PreAdminActivityHotInsertValue .
    ?PreAdminActivityHotInsert purl:IAO_0000039 ?PreAdminActivityHotInsertUnit .
    ?PreAdminActivityHotInsertUnit rdfs:label ?PreAdminActivityHotInsertUnitLabel .
    ?PreAdminActivityHotInsert ontomedirad:has_measurement_date_and_time ?PreAdminActivityHotInsertTimestamp .
    ?PostAdminActivityHotInsert ontomedirad:is_about ?RadiopharmaceuticalHotInsert .
    ?PostAdminActivityHotInsert rdf:type dcm:113509 .
    ?PostAdminActivityHotInsert purl:IAO_0000004 ?PostAdminActivityHotInsertValue .
    ?PostAdminActivityHotInsert purl:IAO_0000039 ?PostAdminActivityHotInsertUnit .
    ?PostAdminActivityHotInsertUnit rdfs:label ?PostAdminActivityHotInsertUnitLabel .
    ?PostAdminActivityHotInsert ontomedirad:has_measurement_date_and_time ?PostAdminActivityHotInsertTimestamp .
 }
  UNION {
    ?Phantom purl:BFO_0000110 ?ColdInsert .
    ?ColdInsert rdf:type ontomedirad:cold_insert_of_NM_phantom .
    ?ColdInsert ontomedirad:has_id ?ColdInsertId .
    ?VolumeColdInsert rdf:type ontomedirad:nominal_volume_measurement_datum .
    ?VolumeColdInsert purl:IAO_0000004 ?VolumeColdInsertValue .
    ?VolumeColdInsert purl:IAO_0000039 ?VolumeColdInsertUnit .
    ?VolumeColdInsertUnit rdfs:label ?VolumeColdInsertUnitLabel .
    ?VolumeColdInsert ontomedirad:is_about ?ColdInsert .
 }
```

```
  UNION {
    ?Phantom purl:BFO_0000110 ?Tank .
    ?Tank rdf:type ontomedirad:tank_of_NM_phantom .
    ?Tank ontomedirad:has_id ?TankId .
    ?VolumeTank rdf:type ontomedirad:nominal_volume_measurement_datum .
    ?VolumeTank purl:IAO_0000004 ?VolumeTankValue .
    ?VolumeTank purl:IAO_0000039 ?VolumeTankUnit .
    ?VolumeTankUnit rdfs:label ?VolumeTankUnitLabel .
    ?VolumeTank ontomedirad:is_about ?Tank .
    ?Tank purl:BFO_0000110 ?RadiopharmaceuticalTank .
    ?RadiopharmaceuticalTank rdf:type snmi:radiopharmaceutical .
    ?RadiopharmaceuticalTank purl:BFO_0000110 ?RadionuclideTank .
    ?RadionuclideTank rdf:type ?RadionuclideTankClass .
    ?RadionuclideTankClass rdfs:subClassOf* radionuclides:radionuclide .
    ?RadionuclideTankClass rdfs:label ?RadionuclideTankClassLabel .
    ?RadiopharmaceuticalTank rdf:type snmi:radiopharmaceutical .
    ?PreAdminActivityTank ontomedirad:is_about ?RadiopharmaceuticalTank.
    ?PreAdminActivityTank rdf:type dcm:113508 .
    ?PreAdminActivityTank purl:IAO_0000004 ?PreAdminActivityTankValue .
    ?PreAdminActivityTank purl:IAO_0000039 ?PreAdminActivityTankUnit .
    ?PreAdminActivityTankUnit rdfs:label ?PreAdminActivityTankUnitLabel .
    ?PreAdminActivityTank ontomedirad:has_measurement_date_and_time ?PreAdminActivityTankTimestamp .
    ?PostAdminActivityTank ontomedirad:is_about ?RadiopharmaceuticalTank.
    ?PostAdminActivityTank rdf:type dcm:113509 .
    ?PostAdminActivityTank purl:IAO_0000004 ?PostAdminActivityTankValue .
    ?PostAdminActivityTank purl:IAO_0000039 ?PostAdminActivityTankUnit .
    ?PostAdminActivityTankUnit rdfs:label ?PostAdminActivityTankUnitLabel .
    ?PostAdminActivityTank ontomedirad:has_measurement_date_and_time ?PostAdminActivityTankTimestamp .
 }
} ORDER BY ?Phantom ?HotInsert ?ColdInsert ?Tank
```

## Query 26 - CT Calibration

```
SELECT DISTINCT ?CTCalibration ?ReferenceCalibrationDate ?CTNumberCalibrationCurve
  WHERE {
        ?CTCalibration rdf:type ontomedirad:CT_calibration .
        ?CTNumberCalibrationCurve rdf:type ontomedirad:CT_number_calibration_curve .
        ?CTNumberCalibrationCurve ontomedirad:is_specified_output_of ?CTNumberCalibrationCurveCalculation .
        ?CTNumberCalibrationCurveCalculation rdf:type ontomedirad:calculation_of_CT_number_calibration_curve .
        ?CTNumberCalibrationCurveCalculation purl:BFO_0000132 ?CTCalibration .
        ?CTNumberCalibrationCurve ontomedirad:has_reference_calibration_date ?ReferenceCalibrationDate .
        }
```



## Query 27 - SPECT Calibration

```
SELECT DISTINCT ?SPECTCalibration ?ReferenceCalibrationDate ?Radionuclide ?RadionuclideLabel ?CalibrationCoefficient ?RecoveryCoefficientCurve
?IdOfSPECTCalibration
  WHERE {
        ?SPECTCalibration rdf:type ontomedirad:SPECT_CT_calibration .
        ?CalibrationCoefficient rdf:type ontomedirad:SPECT_calibration_coefficient .
        ?CalibrationCoefficient ontomedirad:is_specified_output_of ?CalibrationCoefficientCalculation .
        ?CalibrationCoefficientCalculation rdf:type ontomedirad:SPECT_calibration_coefficient_calculation .
        ?CalibrationCoefficientCalculation purl:BFO_0000132 ?SPECTCalibration .
        ?CalibrationCoefficient ontomedirad:has_reference_calibration_date ?ReferenceCalibrationDate .
        ?CalibrationCoefficient ontomedirad:is_about ?Radionuclide .
        ?RecoveryCoefficientCurve rdf:type ontomedirad:SPECT_recovery_coefficient_curve .
        ?RecoveryCoefficientCurve ontomedirad:is_specified_output_of ?RecoveryCoefficientCurveCalculation .
        ?RecoveryCoefficientCurveCalculation rdf:type ontomedirad:SPECT_recovery_coefficient_curve_calculation .
        ?RecoveryCoefficientCurveCalculation purl:BFO_0000132 ?SPECTCalibration .
        ?RecoveryCoefficientCurve ontomedirad:has_reference_calibration_date ?ReferenceCalibrationDate .
        ?RecoveryCoefficientCurve ontomedirad:is_about ?Radionuclide .
         ?Radionuclide rdf:type ?RadionuclideClass .
        ?RadionuclideClass rdfs:subClassOf* radionuclides:radionuclide .
        ?RadionuclideClass rdfs:label ?RadionuclideLabel .
        ?SPECTCalibration ontomedirad:has_id ?IdOfSPECTCalibration
}
```