

# The EM Glossary:

a community effort towards a harmonized terminology in electron microscopy

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*and > 20 contributors from the EM community*

2024 HMC Conference



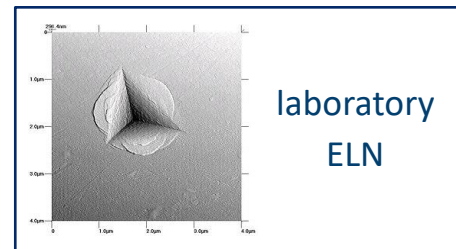
# Applied Metadata in Electron Microscopy



instruments



human  
community



laboratory  
ELN

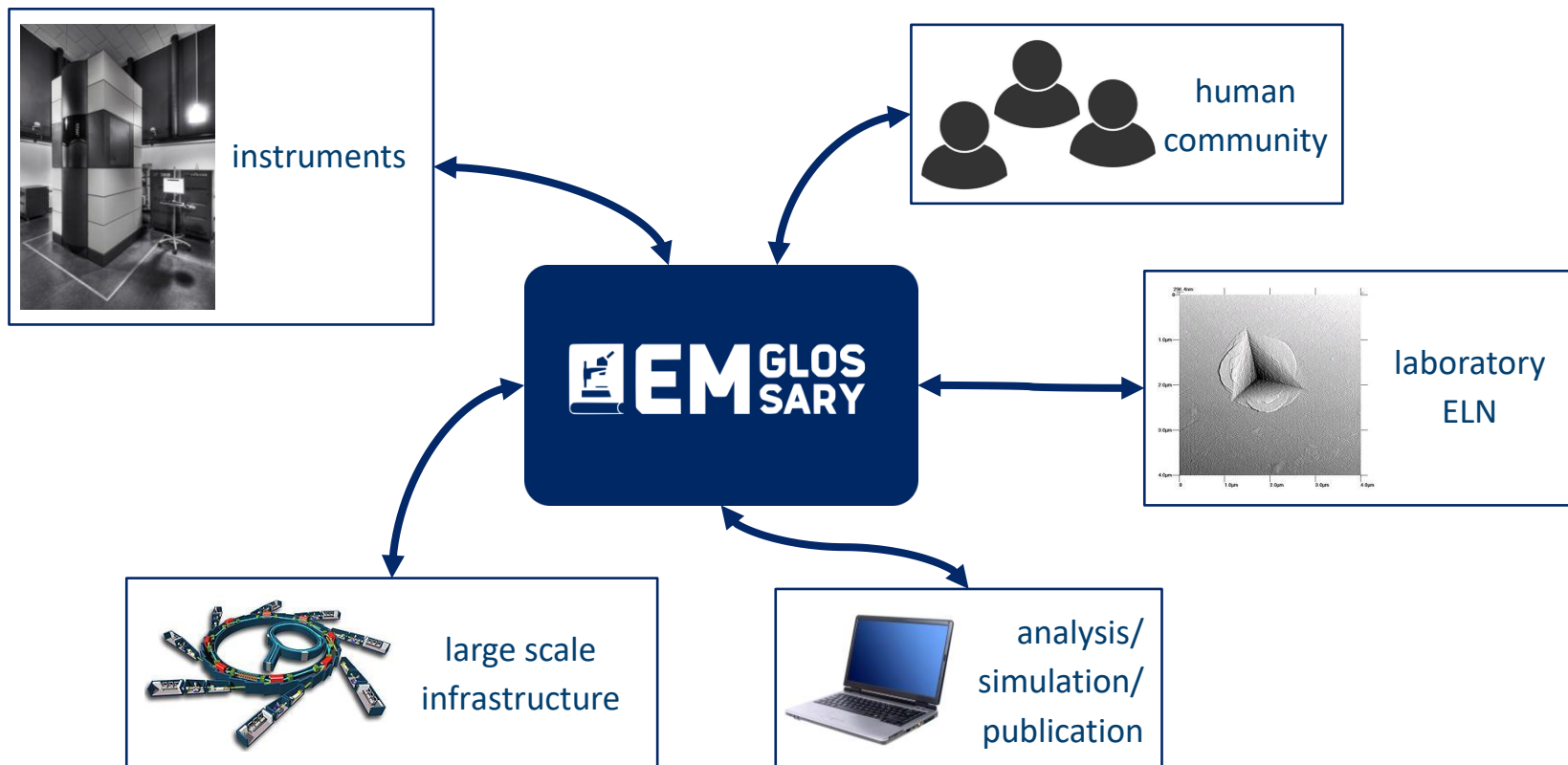


large scale  
infrastructure



analysis/  
simulation/  
publication

# The EM Glossary connects applications on the domain level



# EM Glossary objectives



## Improve interoperability

- Machine and human readable glossary
- Semantic glue technology between microscopy applications

## Networking

- Prevent siloing of initiatives
- Forum for exchange on best practices

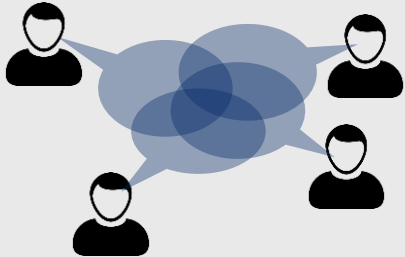
## Guided by the following philosophy



- **Transparent**  
open & fully documented development in GitLab  
microcredits for contributors
- **Relevant & community accepted**  
strategic term prioritization based on relevant data and projects  
consensus on terms and their meaning across a broad community
- **Machine actionable & FAIR**  
ensure compatibility with semantic web standards  
easy crosswalks to other relevant projects
- **Persistent**  
HMC implemented and maintained  
continuous development with community

# EM Glossary has 4 elements developed in parallel

scientific content  
development



semantic artifact  
in OWL



web explorer



application-level  
adoption support



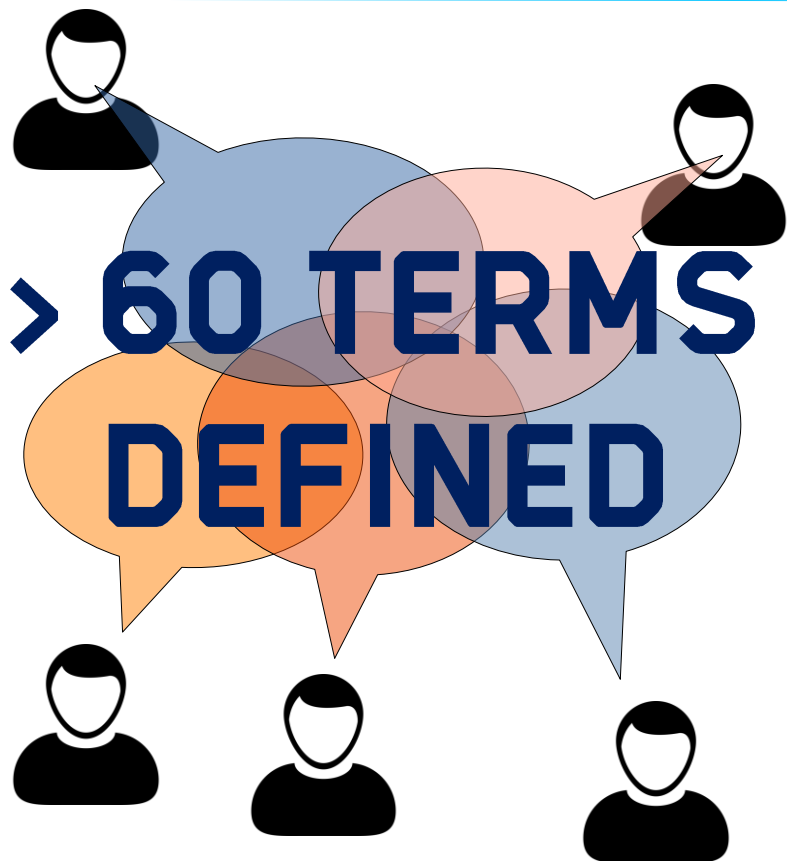
# Scientific Content Development



```
! Term.yml ●
home > v.hofmann > WORKING > EM_Glossary > ! Term.yml > ...
1 ---#Free-text name of definition source
2 labels:
3   - label_en: term
4   singular:
5     - singular_en: terms
6   plural:
7     - plural_en: terms
8   synonyms:
9     - exact_synonym_en:
10       - idiom
11     - broad_synonym_en:
12       - expression
13       - phrase
14       - word
15   iri: https://iris.hmc-services.de/term/00000001
16 definitions:
17   - definition_en: >>
18     - a expression that (1) has a precise meaning, and
19     - (2) is used to describe a thing.
20 sources:
21   - https://www.merriam-webster.com/dictionary/term
22 comments:
23   - comment_en: >>
24     - The meaning of a term might be different in different
25     - contexts i.e. such as e.g. in different scientific
26     - fields. The expression is usually labeled by a specific
27     - string and might have synonyms and antonyms.
28 contributors:
29   - https://orcid.org/0000-0003-0000-4784
30   - https://orcid.org/0000-0002-1008-4530
31   - https://orcid.org/0000-0002-5149-603X
32 ratified: False
33
```

**definitions**  
*in genus-differentia form*  
**A is a B which C**  
**A is a B during which C**

# Scientific Content Development



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! Term.yml ●
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32 ratified: False
33
```



# Semantic Artifact

EM\_Glossary

Subgroups and projects Shared projects Inactive

EM\_Glossary Together towards Interoperable semantics in the electron microscopies ★ 2

EM\_Glossary\_OWL In this repository the OWL representation of the EM Glossary - emg.owl - is assembled and host... ★ 0

EM\_Glossary\_Admin Repository for project planning and administration of the EM Glossary ★ 0

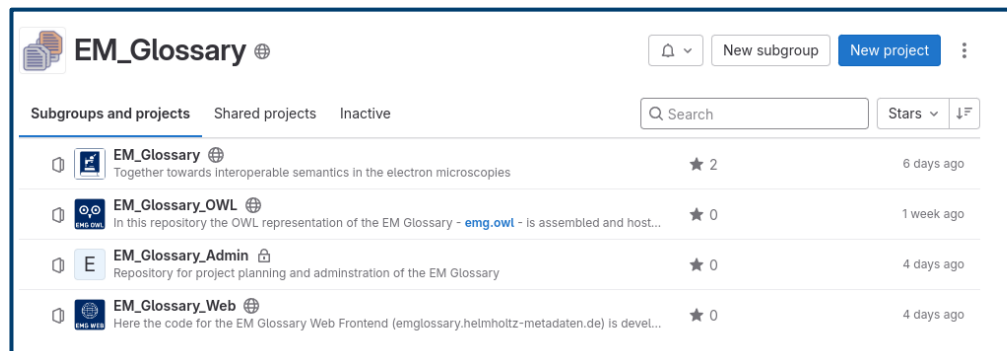
EM\_Glossary\_Web Here the code for the EM Glossary Web Frontend (emglossary.helmholtz-metadaten.de) is devel... ★ 0



<https://purl.helmholtz-metadaten.de/emg>

```
EM_Glossary / EM_Glossary_OWL
243 <rdfs:isDefinedBy rdf:resource="http://www.w3.org/2004/02/skos/core"/>
244 <rdfs:label xml:lang="en">note</rdfs:label>
245 <core:definition xml:lang="en">A general note, for any purpose.</core:definition>
246 <core:scopeNote xml:lang="en">This property may be used directly, or as a super-property for more specific
247 </owl:AnnotationProperty>
248
249 <owl:AnnotationProperty rdf:about="http://www.w3.org/2004/02/skos/core#scopeNote">
250 <rdfs:isDefinedBy rdf:resource="http://www.w3.org/2004/02/skos/core"/>
251 <rdfs:subPropertyOf rdf:resource="http://www.w3.org/2004/02/skos/core#note"/>
252 <rdfs:label xml:lang="en">scope note</rdfs:label>
253 <core:definition xml:lang="en">A note that helps to clarify the meaning and/or the use of a concept.</core:
254 </owl:AnnotationProperty>
255
256 <owl:AnnotationProperty rdf:about="https://schema.org/citation"/>
257
258 <owl:AnnotationProperty rdf:about="https://schema.org/creativeWorkStatus"/>
259
260 <owl:AnnotationProperty rdf:about="https://schema.org/logo"/>
261
262 <owl:Class rdf:about="https://purl.helmholtz-metadaten.de/emg/EMG_00000014">
263 <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
264 <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Disk Of Least Confusion</rdfs:label>
265 <term:contributor rdf:datatype="http://www.w3.org/2001/XMLSchema#string">https://orcid.org/0000-0001-6534-
266 <term:contributor rdf:datatype="http://www.w3.org/2001/XMLSchema#string">https://orcid.org/0000-0002-1278-
267 <term:contributor rdf:datatype="http://www.w3.org/2001/XMLSchema#string">https://orcid.org/0000-0002-5149-
268 <term:contributor rdf:datatype="http://www.w3.org/2001/XMLSchema#string">https://orcid.org/0000-0002-7117-
269 <term:contributor rdf:datatype="http://www.w3.org/2001/XMLSchema#string">https://orcid.org/0000-0003-2285-
270 <term:contributor rdf:datatype="http://www.w3.org/2001/XMLSchema#string">https://orcid.org/0009-0008-6410-
271 <obo:IA0_0000115 rdf:datatype="http://www.w3.org/2001/XMLSchema#string">A cross section of a beam at which
272 </owl:Class>
273
274 <owl:Class rdf:about="https://purl.helmholtz-metadaten.de/emg/EMG_00000041">
275 <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
276 <rdfs:label rdf:datatype="http://www.w3.org/2001/XMLSchema#string">Probe Current</rdfs:label>
277 <term:contributor rdf:datatype="http://www.w3.org/2001/XMLSchema#string">https://orcid.org/0000-0001-5870-
278 <term:contributor rdf:datatype="http://www.w3.org/2001/XMLSchema#string">https://orcid.org/0000-0001-6534-
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291 <term:contributor rdf:datatype="http://www.w3.org/2001/XMLSchema#string">https://orcid.org/0000-0003-2285-
```

# Implementation in OWL for machine readability & technical adoption

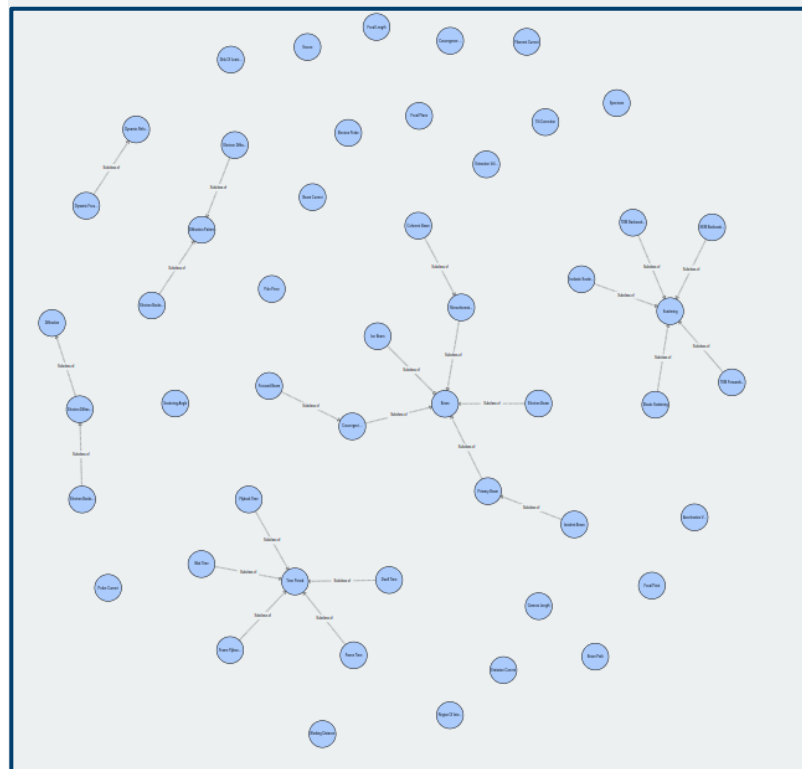


The screenshot shows the GitHub repository for EM\_Glossary. The repository name is "EM\_Glossary" with a globe icon. Below the name, there are buttons for "New subgroup" and "New project". A search bar and a "Stars" dropdown are also visible. The main content area lists four subgroups and projects:

Subgroup/Project	Description	Stars	Last Update
EM_Glossary	Together towards interoperable semantics in the electron microscopies	2	6 days ago
EM_Glossary_OWL	In this repository the OWL representation of the EM Glossary - <a href="#">emg.owl</a> - is assembled and host...	0	1 week ago
EM_Glossary_Admin	Repository for project planning and administration of the EM Glossary	0	4 days ago
EM_Glossary_Web	Here the code for the EM Glossary Web Frontend ( <a href="#">emglossary.helmholtz-metadaten.de</a> ) is devel...	0	4 days ago



<https://purls.helmholtz-metadaten.de/emg>



# EM Glossary Web Explorer

**<HMC>** HELMHOLTZ  
Metadata Collaboration

Home Explore Understand Contributors Adopters About

## Electron Microscopy Glossary

**EM GLOSSARY**

### Welcome to the Electron Microscopy Glossary Explorer

We work together to harmonise terminology in electron microscopy

#### EXPLORE

Explore the glossary terms by alphabetic browsing or keyword search.

[Discover terms 🔍](#)

#### JOIN IN

Learn about who we are, how we collaborate, and how you can join in.

[Learn more 👤](#)

#### IMPLEMENT

Implement EM Glossary terminology in your metadata with our OWL artefact.

[See artefact 📄](#)

### Word of the week

**Beam**

A group of particles which move, on average, in a common direction.

[View the full entry here](#)

83 Views | March 22, 2024



<https://emglossary.helmholtz-metadaten.de/>

# User pathways between Explorer and OWL artifact

POLE PIECE

Previous Monochromatic beam | Next Primary beam

**Definition:** A physical part of an electron or ion microscope which is part of the electromagnetic lens and is used to amplify and shape the magnetic field used to manipulate the [beam](#).

**Comments:** A given electron microscope is likely to have multiple pole pieces. However the term is commonly used to refer to the pole piece of the final optical element between the source and the specimen.

**Internal References:** [Beam](#)

**Sources:**  
[https://en.wikipedia.org/wiki/Pole\\_piece](https://en.wikipedia.org/wiki/Pole_piece)  
[https://www.jeol.co.jp/en/words/emterms/search\\_result.html?keyword=polepiece](https://www.jeol.co.jp/en/words/emterms/search_result.html?keyword=polepiece)

**IRI:** [https://purlis.helmholtz-metadaten.de/emg/EMG\\_00000039](https://purlis.helmholtz-metadaten.de/emg/EMG_00000039)

**Contributors:**

- Markus Wollgarten
- Volker Hofmann
- Oonagh Mannix
- Steffen Brinckmann
- Markus Kühbach
- Reetu Elza Joseph
- Steffen Brinckmann
- Robert Wendt

Please cite as:  
"pole piece" in EM-Glossary, online v1.0.0., 2024, [https://purlis.helmholtz-metadaten.de/emg/EMG\\_00000039](https://purlis.helmholtz-metadaten.de/emg/EMG_00000039)

183 Views | v1.0.0

Copy Citation

Pole Piece<sup>C</sup>

IRI: [https://purlis.helmholtz-metadaten.de/emg/EMG\\_00000039](https://purlis.helmholtz-metadaten.de/emg/EMG_00000039)

A physical part of an electron or ion microscope which is part of the electromagnetic lens and is used to amplify and shape the magnetic field used to manipulate the beam.

**Source**  
[https://en.wikipedia.org/wiki/Pole\\_piece](https://en.wikipedia.org/wiki/Pole_piece)  
[https://www.jeol.co.jp/en/words/emterms/search\\_result.html?keyword=polepiece](https://www.jeol.co.jp/en/words/emterms/search_result.html?keyword=polepiece)

**has super-classes**  
[thing](#)<sup>C</sup>



<https://emglossary.helmholtz-metadaten.de/>

# Adoption happens across projects and communities

- technical support & guidance during adoption
- semantic versioning & release cycle management
- extension of terminology through further scientific development



<https://emglossary.helmholtz-metadaten.de/>



# Adoption identifies missing terms

- feedback from adopters fed back to community
- final direction comes from community
- leads to use-case focused developments which bring benefits which lead to further adoption (and happy scientists)



<https://emglossary.helmholtz-metadaten.de/>

sary / Issues / #143

## List of suggested terms to prioritize

Open Issue created 3 months ago by Rossella Aversa

Follow-up of the discussion had with Volker and Oonagh. Looking at the existing metadata schemas developed for SEM-FIB Tomography and TEM, I report here a list of suggested terms to prioritize:

IN COMMON FOR SEM, SEM-FIB TOMOGRAPHY, TEM:

- Chamber pressure (see #15 )
- Stage (see #42 )
- Program: program or software used for data acquisition
- Pixel size (also 3D) (see #19 )
- Aperture (size/current) (see #63 )
- detector (see #20 )
- Image mode/collection method

IN COMMON FOR SEM, SEM-FIB TOMOGRAPHY:

- Vacuum (of gun/of chamber) mode
- FIB milling (location, material, current)
- Pre-tilt
- FIB Column
- Specimen Current

IN COMMON FOR SEM-FIB TOMOGRAPHY, TEM:

## Activating a community took time & effort

---



**Sept 20**  
1<sup>st</sup> interaction

**Feb 21**  
workshop to  
gather needs

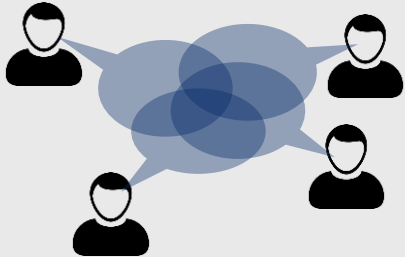
**Aug 21**  
poster at  
microscopy  
conference

**Sept 21**  
attend at  
IGEME 21

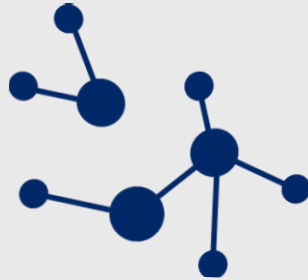
**Oct 21**  
kickoff for EM  
Glossary

And maintaining it takes more.....

Community  
Managers



Knowledge  
Engineer



Web  
Developer



Adoption  
consultants



Resources provided by HMC



# Outlook

- Next EMG.OWL release
- Upgrade Web Explorer with adopter stories
- Upgrade Web Explorer back-end
- Scientific paper on methodology
- More definitions!
- More outreach!
- More adoption!

**JOIN IN!**



<https://emglossary.helmholtz-metadaten.de/about>

# Acknowledgements

## Scientific content

Dr. Markus Wollgarten  
Prof. Dr. Rasmus Schröder  
Dr. Peter Konijnenberg  
Dr. Ing Markus Kühbach  
Prof. Cecile Hebert  
Dr.-Ing. Christoph Pauly  
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Dr. Reetu Elza Joseph  
Dr. Robert Wendt  
Dr. Steffen Brinckmann  
Dr. Rosella Aversa  
Dr. Adrien Teutrie  
Dr. Clemens Mangler  
Ashish Suri

## Community Management & Technical Implementation

Volker Hofmann  
Oonagh Brendike-Mannix  
Özlem Özkan  
Abril Azocar-Guzman  
Mojeeb Rahmann Sedeqi

**THANK  
YOU!**