

# **MULTISPECTRAL IMAGING**

**THE HIDDEN INFORMATION IN  
THE BOOK OF SAGAS**

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MA degree in Electrical Engineering from DTU Copenhagen.

PhD degree in Icelandic linguistics from University of Iceland

Work in standardisation and in Radiation Protection (industrial)

My thesis from two years ago:

***The unreadable poem of Arinbjorn, preservation, meter, and a restored text.***

**I am currently an ERCIM post-doc fellow at NTNU**

# MY EQUIPMENT





# THE BOOK OF SAGAS

*Möðruvallabók* 'book from *Möðruvellir*' **M** is the main source of the Sagas of Icelanders, for some it is the only source (written in 1320-1370). Multispectral imaging reveals information that the naked eye cannot see. The following images demonstrate this.





**SOME PAGES ARE PARTLY OR FULLY  
ILLEGIBLE**

**MULTISPECTRAL IMAGING CAN SOMETIMES  
HELP**



**PAGE 69V IN MÖÐRUVALLABÓK**













# A DIFFERENT WAY TO VIEW THE PAGE

Remove the IR blocker, and add an IR 950 nm bandpass filter



# THE TEXT IS MOSTLY VISIBLE IN IR





# WHY DOES THIS WORK?

- This works for red and „brownish“ inks (most old inks) and pages that are unreadable because they are covered with dirt (pages on the outside of books and outside of quires of books). The ink is not white. It is, however, lighter than the soot and the dirt around it. The ink has saved the parchment underneath it, making the text readable, even if the ink is no more present.
- We will test and verify this at NTNU using mock-ups!
- Does not work for museum pieces that have always been handled with care and stored in libraries!

# HAPPY ENDING

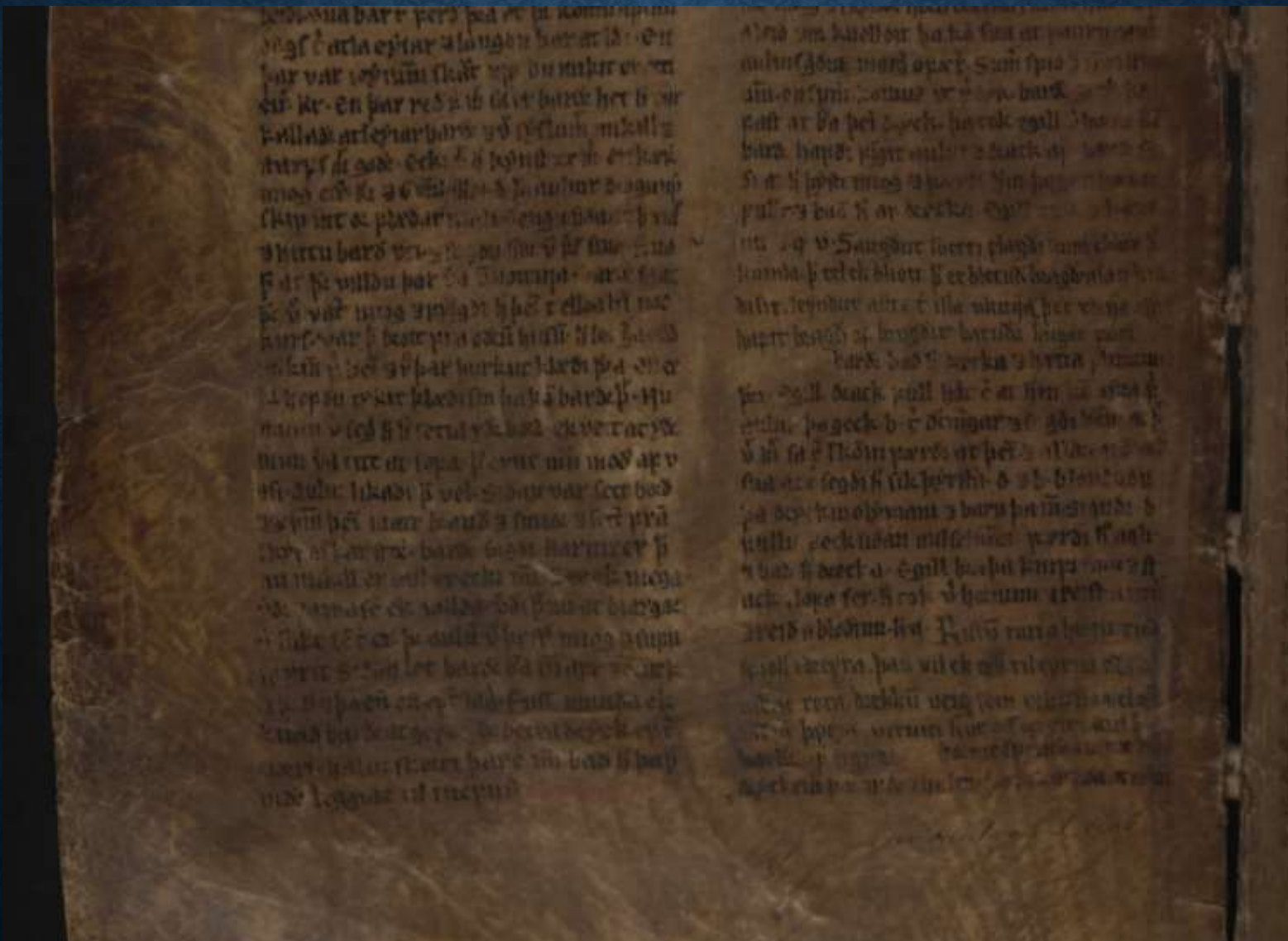
- I wrote an article in *Gripla* with IR pictures of the text and my reading of it.
- **2013.** Þorgeir Sigurðsson et al. Ofan í sortann, Egils saga í Möðruvallabók. *Gripla* 24, pages 93–120.
- The text that was read by Finnur Jónsson in 1886 **can be confirmed** and some words can be added or corrected. Future editions will use Finnur's readings with a good conscience and use these corrections.



# ANOTHER INTERESTING PAGE

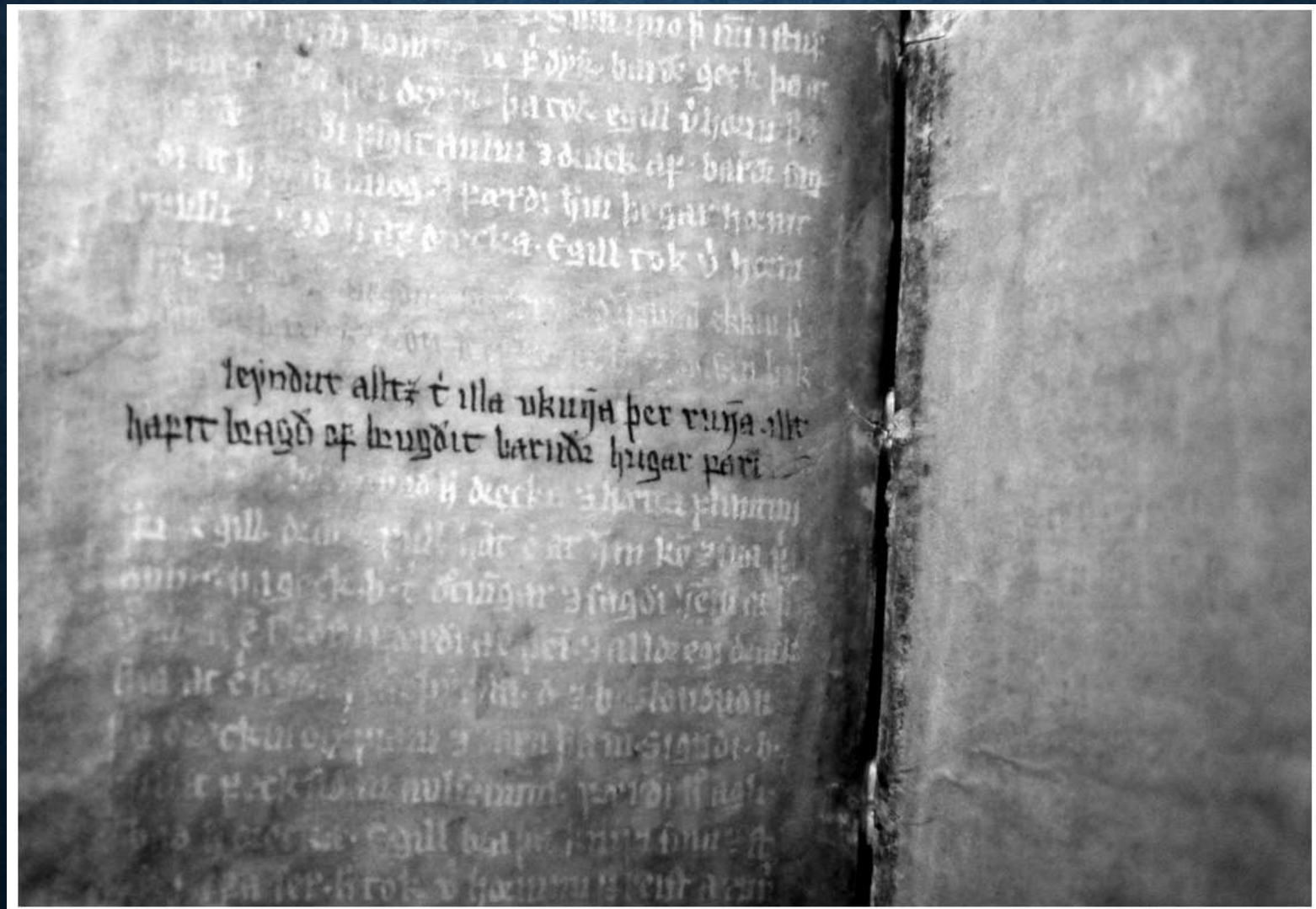
- This page is also an outer page that has accumulated dirt, even if it is not unreadable. It contains stanzas with a different hand that have been inserted into the Saga of Egill.
- An IR picture shows that they are not written with the same ink as the main text and are therefore not likely to be written concurrently.

# PAGE 77V IN NORMAL LIGHT





# PAGE 77V IN IR



# **WE HAVE DIFFERENT TYPES OF INK**

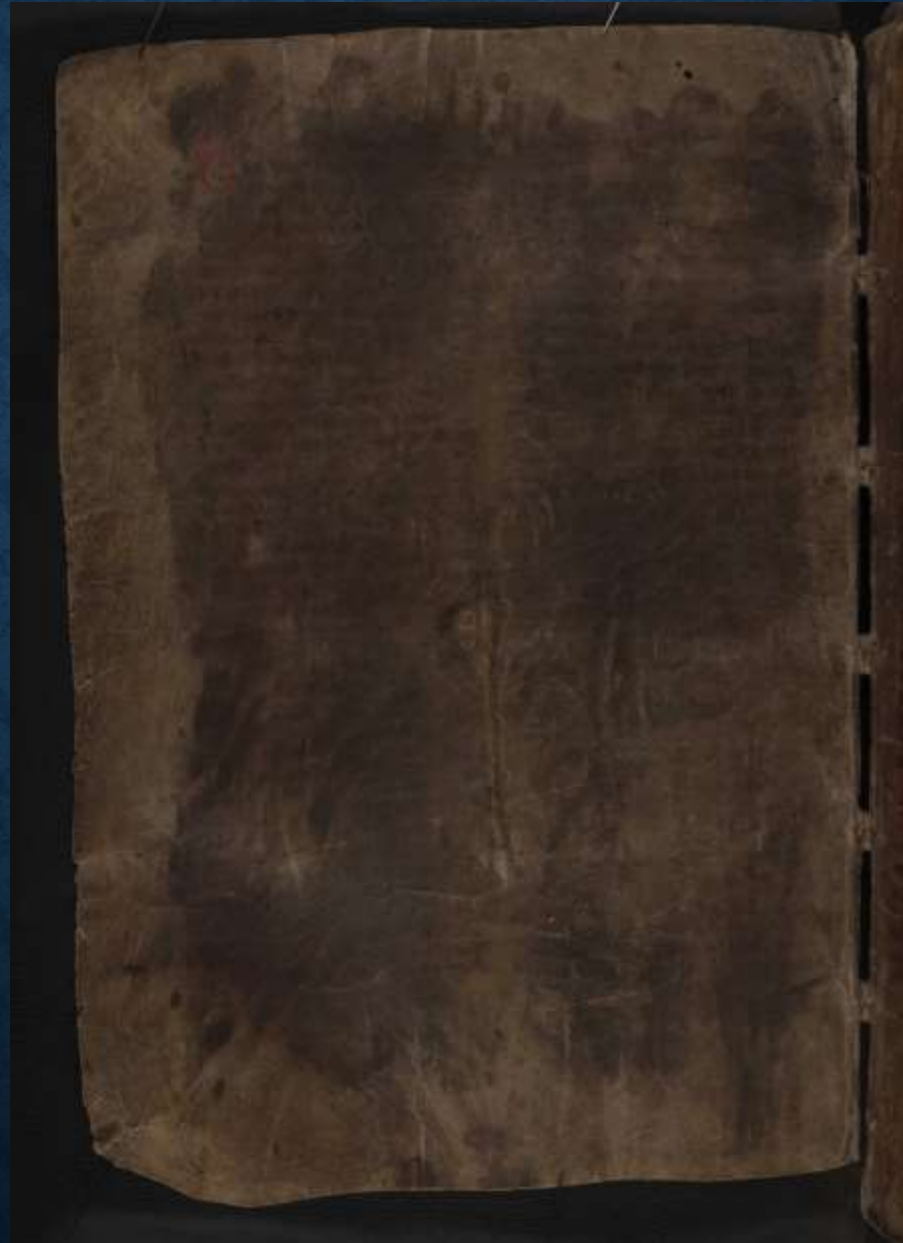
- Obviously the page was written with different types of ink, either two or three.
- 
- We will look for inks with the same type of spectral signature at NTNU



# MORE HAPPINESS

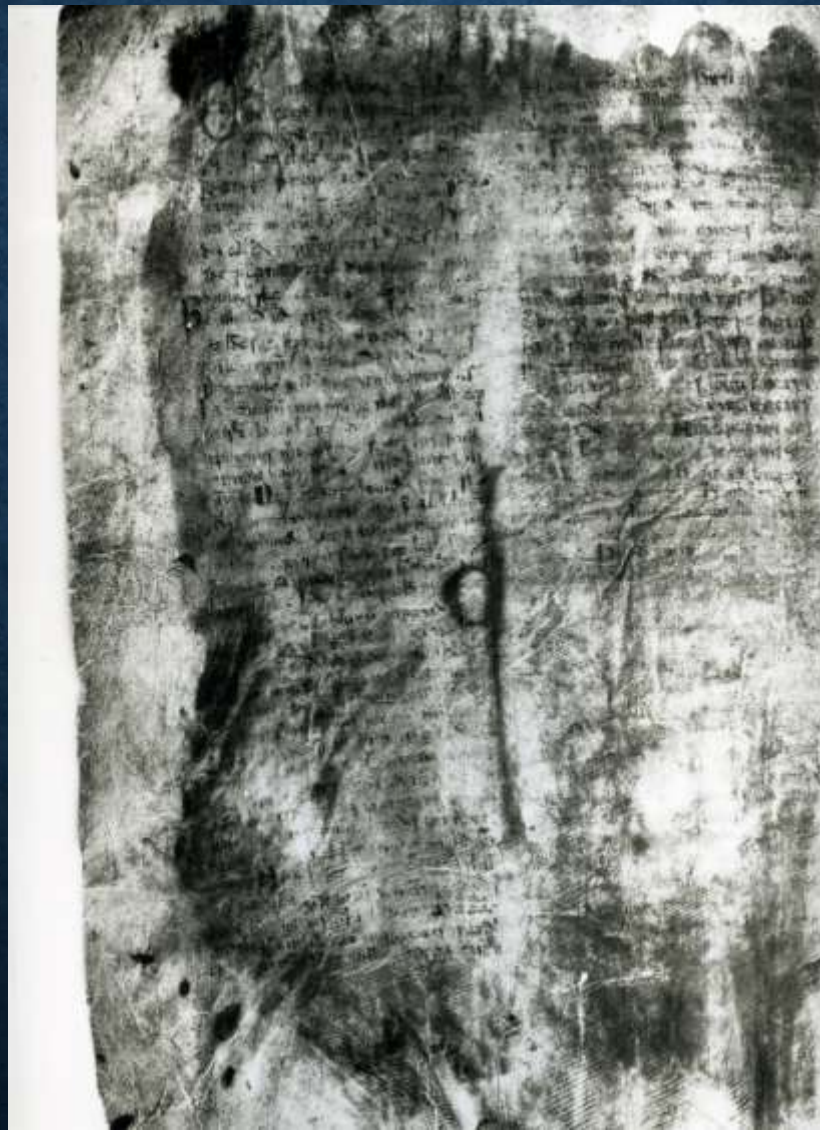
- I wrote an article in *Són* with IR pictures and a discussion on the inserted stanzas.
- 2018. Þorgeir Sigurðsson. Hví skal eigi drepa Egil? *Són* 16, pages 13–33.
- The main point of my article was not the IR pictures themselves, but they supported my story.

# PAGE 99V IN MÖÐRUVALLABÓK





# FINNUR DID NOT HAVE UV



**LAST QUARTER HAS NO TEXT**



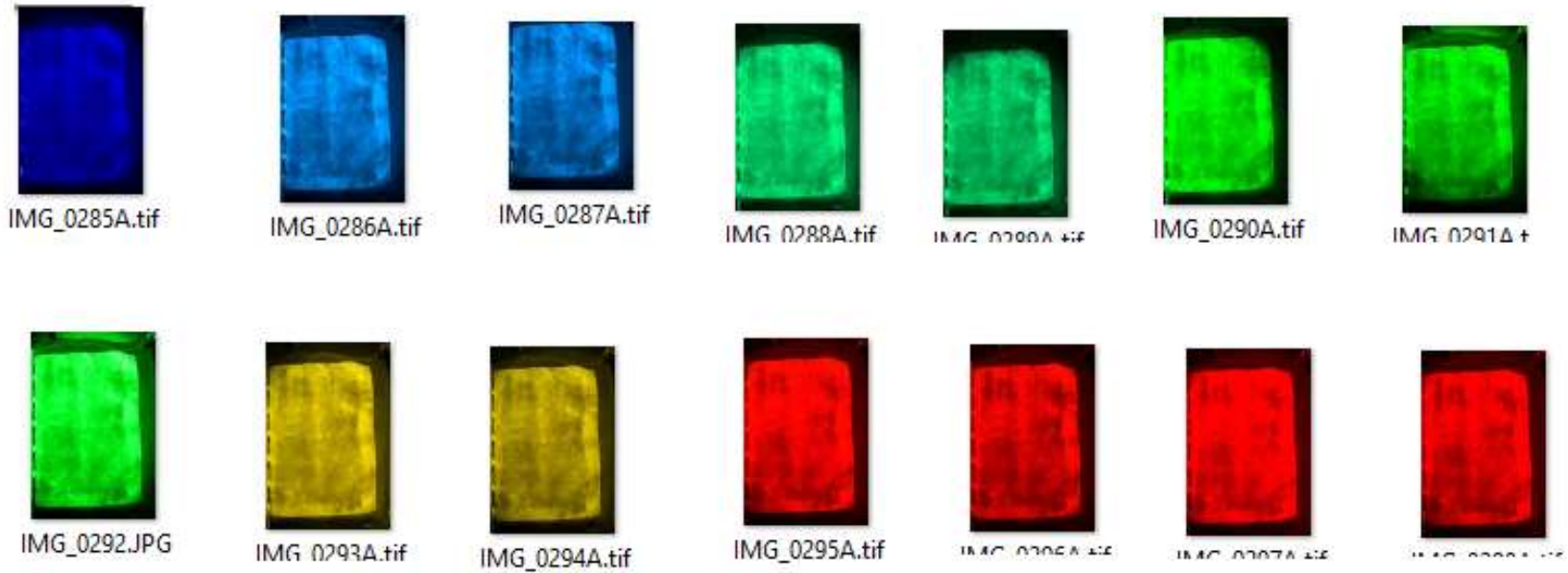


**THE PAGE IS AN OUTER PAGE OF A QUIRE  
- AN IR PICTURE SHOWS SOME TEXT**



# **THE LAST QUARTER IN IR**





# LED LASERS IN DIFFERENT COLOR PRODUCED THESE IMAGES

They did, however, not help produce a more readable text (using PCA or ICA)

**REMOVING THE UV BLOCKER AND  
POINTING AT THE TEXT WITH BLUE OR UV  
LIGHT DOES NOT SEEM TO PRODUCE GOOD  
RESULT EITHER**









# THE RESULT OF PCA





**HERE I ADDED THE IR PIC  
INTO ONE CHANNEL**





**THE BEST  
WE HAD  
BEFORE**







# CONCLUSIONS ON 99V FROM MY PH-D THESIS: THE POEM IS NOT LOST!

- Finnur Jónsson's text could NOT be verified
- All current editions are based on a single reading from the 17th century
- With this reading and the new pictures we have most of the poem
- We can now see the hand and identify Einar Hafliðason as a likely scribe.
- Einar was a church official in the 14th century and he is the author of a saga on Bishop Laurentius .



# THE WAY FORWARD: A HYPERSPECTRAL EDITION ?

- Future work will, hopefully, lead to all the pages of M and other important manuscript becoming available in high quality hyperspectral editions, for scientist to test their processing theories and for scholars to verify old readings and produce new ones. For M, such an edition will provide and secure for the future more information that can be gained from reading the manuscript itself.
- NTNU has already produced viewers for such editions (as an add-on to browsers) and is in an ideal partner for producing them.
- We do, however, need to **understand better why UV and IR are of such great help so that all the necessary information may be included in a such an edition.**