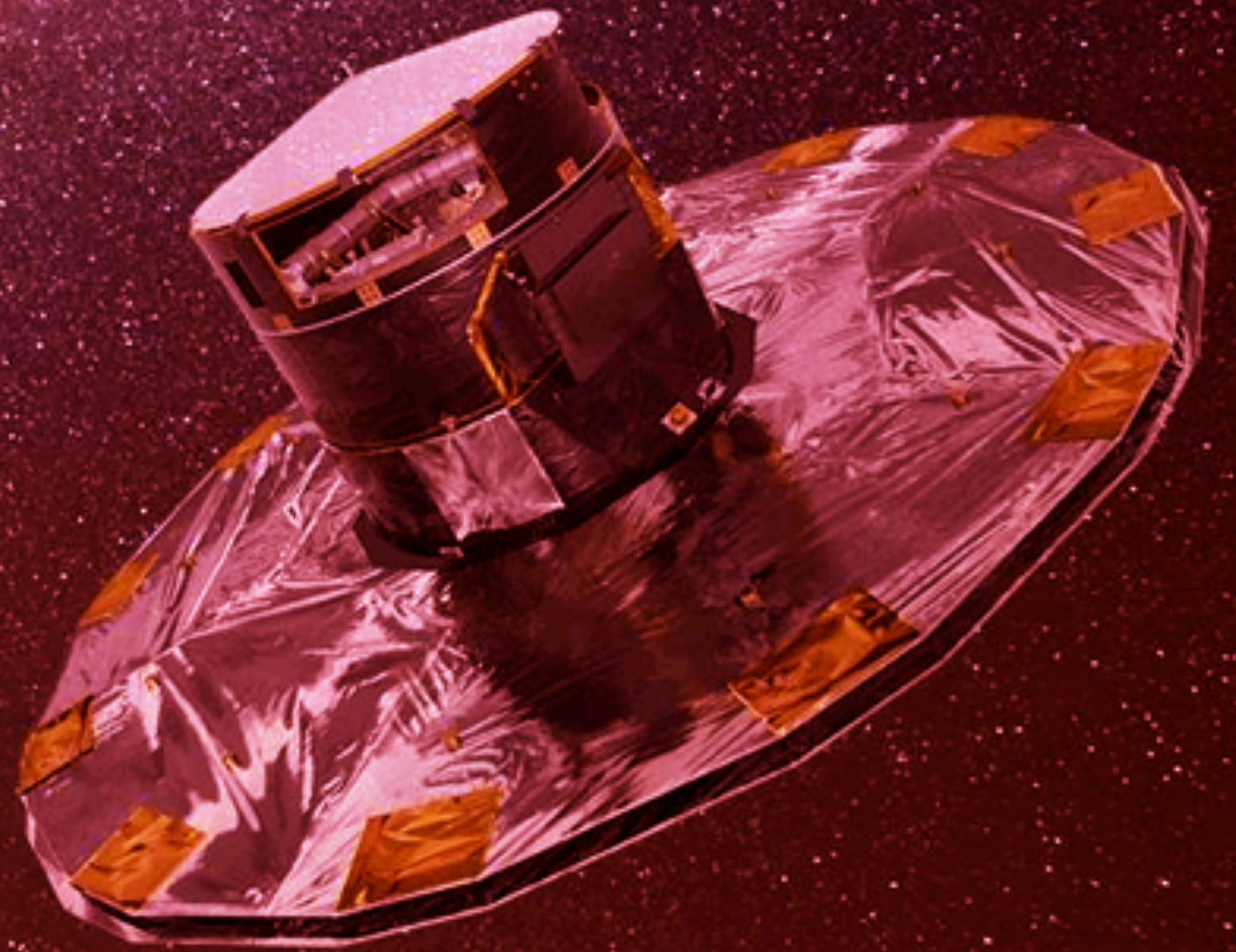




# The Hidden Regions

## Astrometry in the Near Infrared

David Hobbs  
Lund Observatory  
Sweden



# What to do first?

- ◆ Photometric filter bands need to be studied - dispersion or filter photometry or both?
- ◆ An RV spectrograph - which wavebands in NIR - the need for high resolution spectra?
- ◆ Periods of slow scanning law need to be studied - for spectra only!
- ◆ Crowding in GC needs to be studied - limiting depth as function of sky position!
- ◆ Onboard processing to reduce data rate!
- ◆ Larger primary mirrors collect more photons!
- ◆ Combining GaiaNIR with other missions needs to be studied!
- ◆ A GaiaNIR Consortium
- ◆ Other ideas?

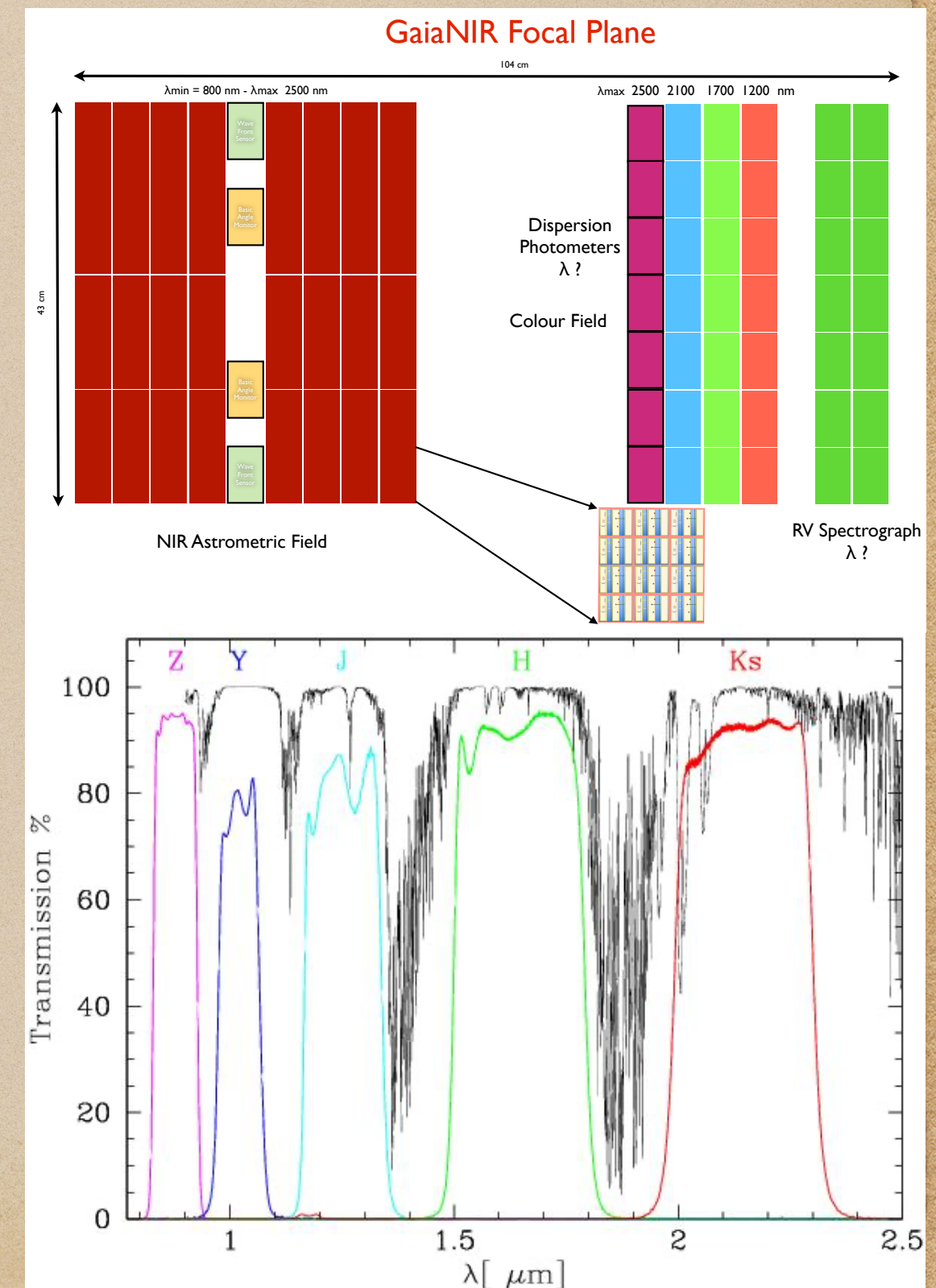
Science focus but who will do this work?

The results will be used for a proposal in ~3 years

# Photometric filter bands

- ◆ We require one broad filter for all wavelengths to act as a SM
- ◆ The other filter bands can be changed
- ◆ Broad bands enhance the astrometry!
- ◆ Superimpose filters or use dispersion prisms or both
- ◆ Science cases for spectra-photometry?
- ◆ People are needed to define a good set of filter bands for astrometry and photometry

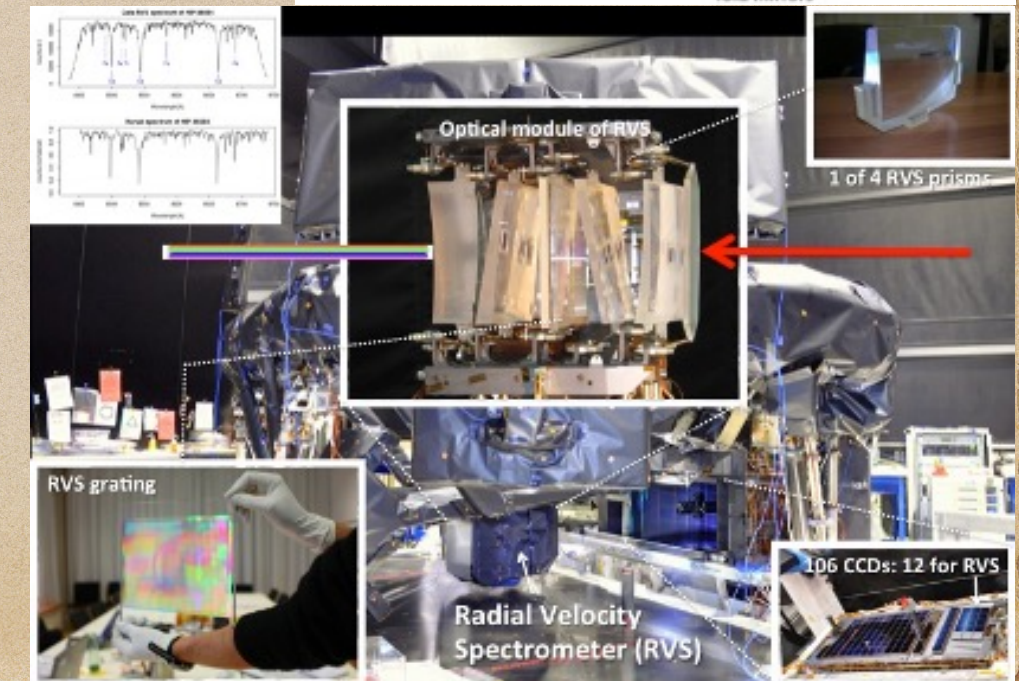
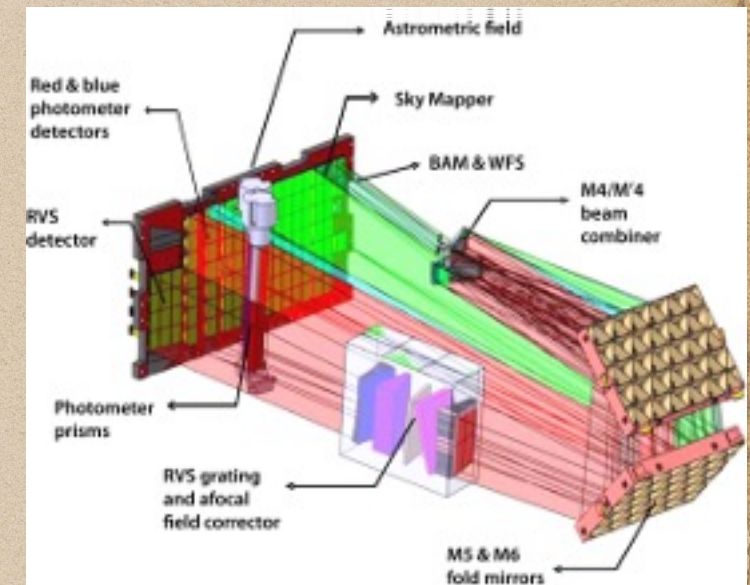
Driving science cases needed!



# Can we get billions of RV's?

- ◆ The RV spectrograph was avoided to fit in an M-class mission but now we are L-class
- ◆ RV would give an outstanding extra science return potentially for billions of objects
- ◆ We need RVS experts to consider what we could do from 800-2500nm
- ◆ How useful are high resolution spectra in NIR?
- ◆ Which spectral line can be used in NIR for RV?
- ◆ What studies are needed?
- ◆ How deep can we go?
- ◆ How much would it increase the costs?
- ◆ How much would it increase the telemetry data rate?

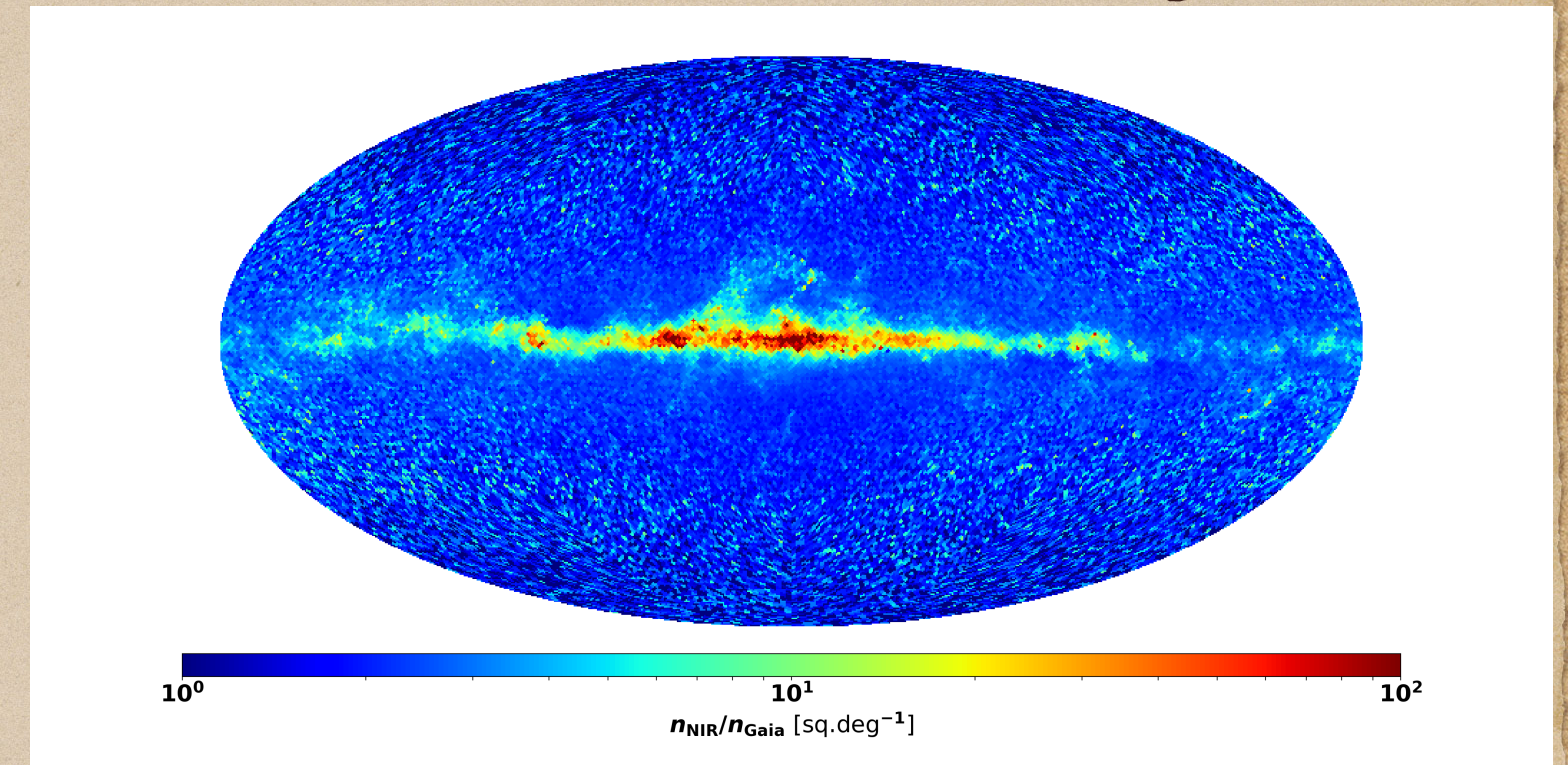
How to do it!  
RVs only?  
Chemistry -  $\lambda$  range?



# Crowding in Galactic centre

(H-band limit of 20th mag)

- ◆ To estimate number counts we can use Galaxy models with N-body sampling to give approximate numbers
- ◆ These can be used to estimate telemetry needs
- ◆ Also used for EoM accuracy estimates
- ◆ We can assess how deep we can go
- ◆ Depth of survey may need to be reduced in GC



Use Besançon model or Galaxia models?

How to do this  
Input  
contributions!

# Onboard processing

- ◆ Gaia has 2 billion sources but the new mission will have at least 12 billion
- ◆ Antenna with higher data rates are being developed
- ◆ We have to do as much processing onboard as possible to reduce telemetry
- ◆ RVs and spectral photometry would add lots of extra telemetry also

What needs to  
be done?

# Combining with other missions

Euclid, Roman,  
and JASMINE  
provide NIR stars

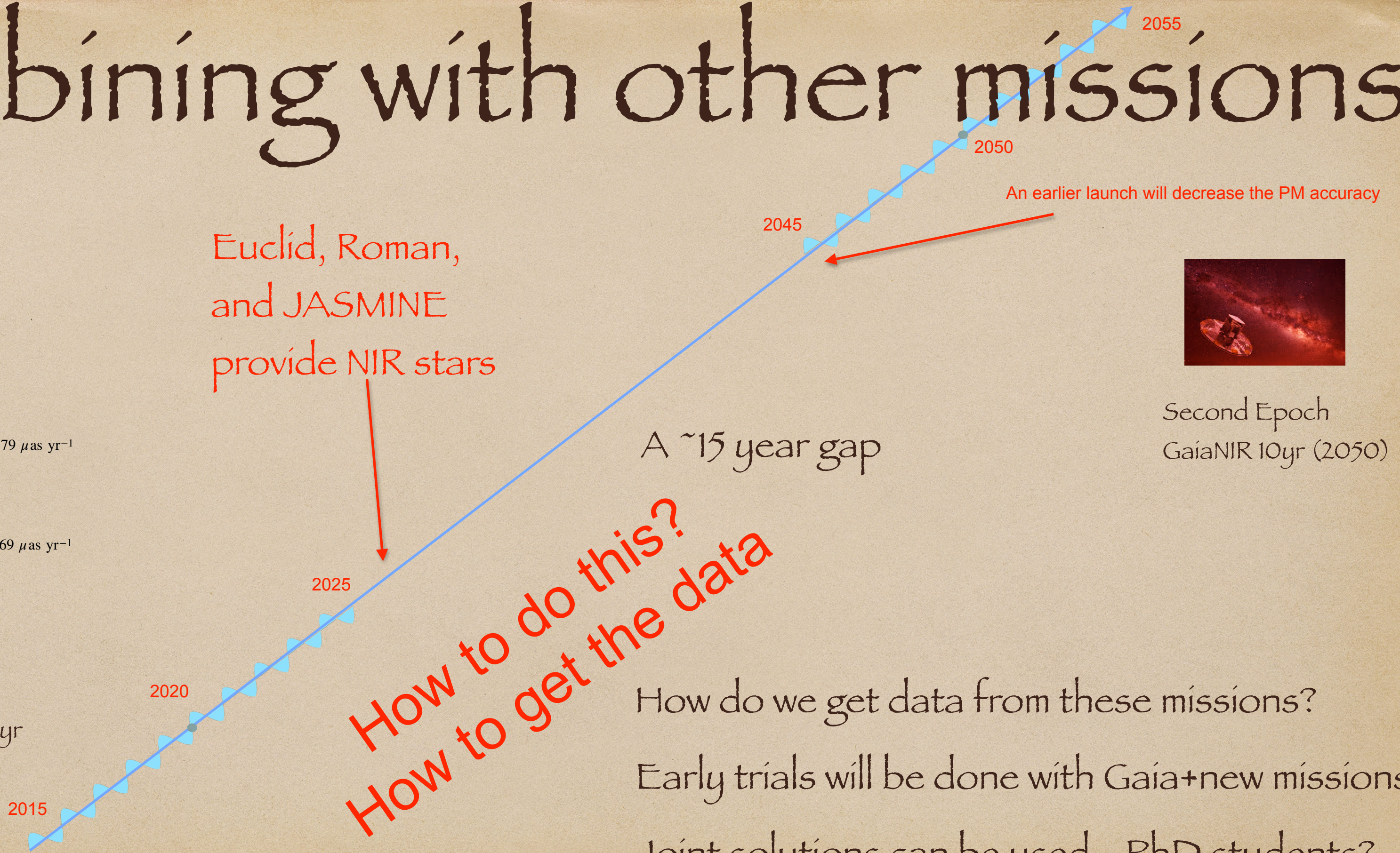
$$\sigma_{\mu_{\alpha^*}} = \frac{\sqrt{\left(\frac{23.6}{\sqrt{2}}\right)^2 + \left(\frac{23.6}{\sqrt{2}}\right)^2}}{20 + 10} = 0.79 \mu\text{as yr}^{-1}$$

$$\sigma_{\mu_{\delta}} = \frac{\sqrt{\left(\frac{20.6}{\sqrt{2}}\right)^2 + \left(\frac{20.6}{\sqrt{2}}\right)^2}}{20 + 10} = 0.69 \mu\text{as yr}^{-1}$$

First Epoch Gaia 10yr  
(2020)



$\sigma_{\mu} = \sim 16 \mu\text{as yr}^{-1}$  is estimated at  $G = 15$  for Gaia DR4



Second Epoch  
GaiaNIR 10yr (2050)

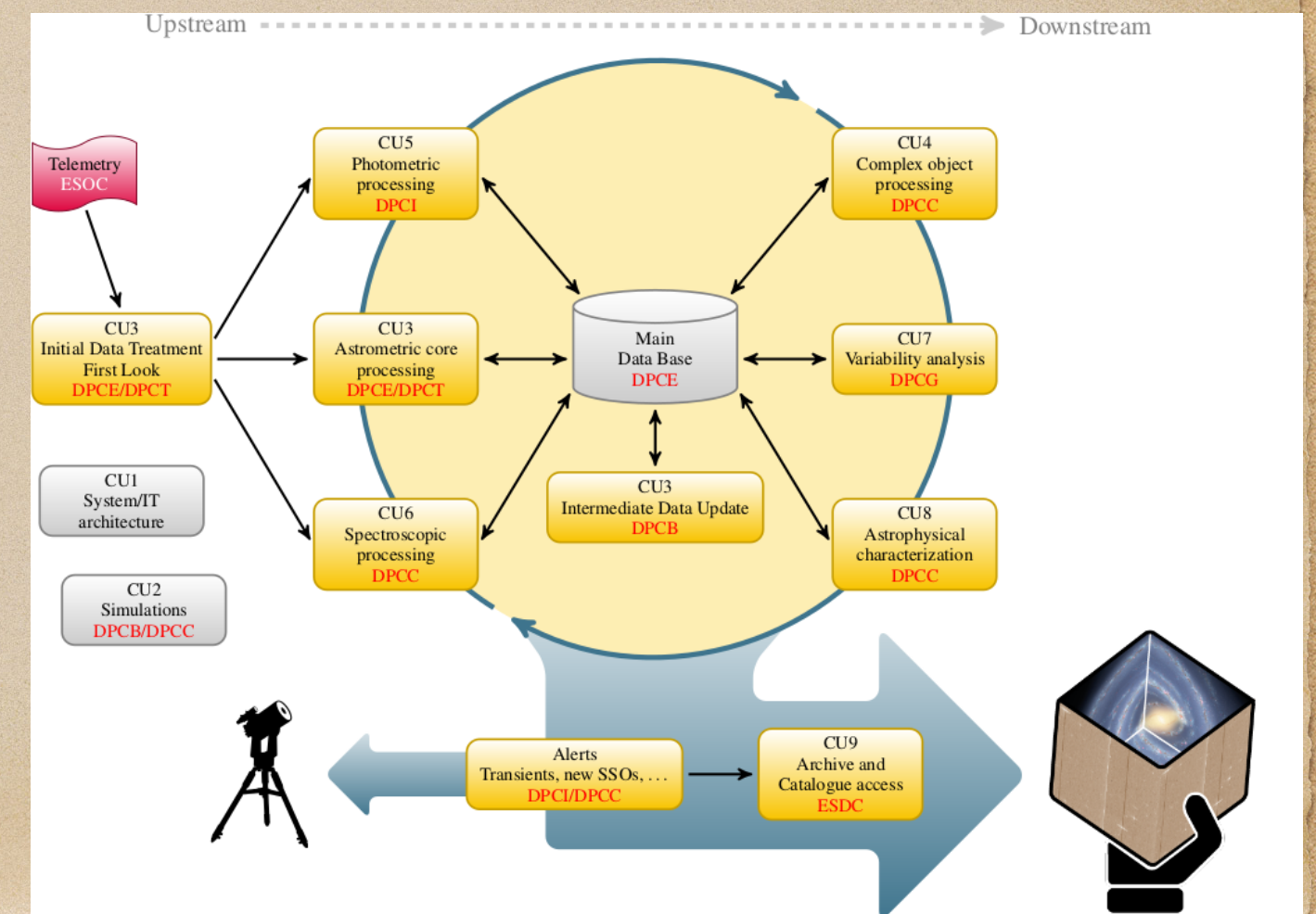
How do we get data from these missions?

Early trials will be done with Gaia+new missions

Joint solutions can be used - PhD students?

# A GaiaNIR Consortium?

- ◆ It is probably too early to form a consortium
- ◆ A consortium similar to DPAC will be needed - maybe NIRPAC?
- ◆ Countries should start to discuss this with their funding agencies to ensure long term support
- ◆ Should we do more processing in the community?
- ◆ What will ESA's role be - it costs money?
- ◆ What works well in Gaia?
- ◆ What does not work well in Gaia?





# Other ideas?

- ◆ Relativity Models?
- ◆ All groups should be considering science cases for GaiaNIR!
- ◆ Add more ideas here!
- ◆ Will set up web page to ask who will do what?

## MAIN IDEAS TO RESOLVE SOON

- ◆ Need for blue stars- any science cases?
- ◆ Survey depth - may need to vary?
- ◆ Photometry and RVS?