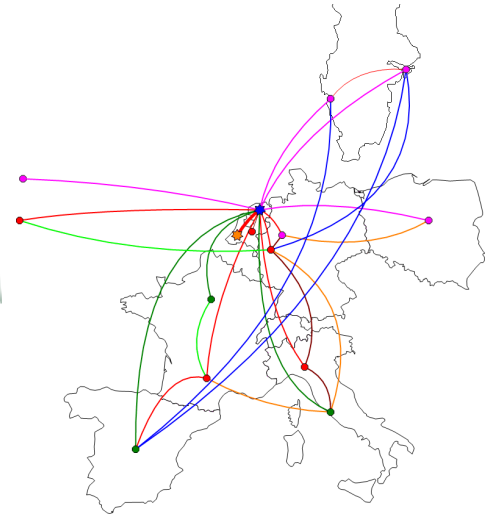


# Conclusions splinter Mars & Giant Planets

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HiFi ICC



- Models of Mars and Giant Planets are needed for Herschel:
  - better than 5% in order to be better than 10% in *overall* calibration
  - HI FI has an ambitious 3% goal
- Models of Mars and Giant Planets are available!
  - Accuracy estimates are still above 5%
  - Mainly due to temperature profile and VMRs for Giant planets
  - For Mars most important is thermal inertia and lateral heat-transfer
- Measurements in the Far-IR/submm are scarce
  - And maybe calibrated by themselves (partially or complete)
- Model improvement
  - To improve the models any new data is useful (even a posteriori)
  - Herschel data itself is also useful to improve models
  - BUT: this should be quantified before we can write any proposal!

# Role of Mars and Giant Planets as calibrators

Photometric Calibration	Aperture efficiency	PSF
Mars	HIFI	HIFI
Uranus	HIFI	---
Neptune	SPIRE/PACS	SPIRE
Large asteroids	SPIRE/PACS/HIFI	---
Small asteroids	SPIRE/PACS	---

- How do we want to use the calibrators? See table
- Use the continuum of Uranus, Neptune, Mars or Jupiter!
- New idea: Use the optically thick Mars atmospheric lines coupled to the global circulation model? Very uncertain T-profile

- Global sand storms have an effect on the surface temperature
- Predict line strengths and widths and do calibration in the windows
- Consider dust solid-state features in the PACS range for Mars, Callisto (see data bases)
- Surface roughness of Mars not too important at submm wavelengths
- Surface temperature and thermal inertia maps available from TES (Mellou ea 02)
- Subsurface scattering, lateral heat transport not taken into account in Rudy's model
- Pointing is very important
- Saturn rings contribute significantly in the submm
- Uranus is variable! 5% over 10 yr wrt Neptune
- Cross-calibration of Mars & Uranus is potentially very useful



# The role of Mars and the big picture

- Mars seem to be key in coupling to the general astronomical frame work.
- Proposal for cross-calibration:
  - Use HIFI as stable transfer mechanism from Mars to weaker objects: Mars-Uranus-Neptune-Ceres-...-Stars
  - HIFI observations of Mars and e.g. Ceres
  - PACS and SPIRE measurements of Ceres at the same wavelengths
  - Optical model to transfer the HIFI beams to the PACS and SPIRE Point Spread Functions
  - This is possible, but relies extremely on HIFI's most difficult band (Band 6)/pointing and on a correct optical model which may not be of high priority just after launch.
    - quasi-optical calculation of HIFI beams (include M3, M2, M1)
    - optical properties of fabricated M1

# Need for comparison

- At the moment it is unclear if the internal errors of the different models are less than systematic errors/offsets between the models
- In Lorentz Centre fashion this can be investigated by a detailed comparison. Needed:
  - A specialized input set: Observing date (July 1, 2007, object, ...)
  - A dedicated output set: Model output spectra at Herschel wavelengths at 100MHz(?) resolution. Extra I RAM/JCMT/APEX filters?
  - Input from:
    - Mars: R.Moreno (LMD), P.Hartogh (MAOAM), B.Butler (Rudy's model)
    - Uranus: R.Moreno, M.Hofstadter, G. Orton
  - Present state-of-the-art now. Improve and revise later
- There are databases containing very useful data: JCMT archive (open), I RAM 30m archive (proprietary, ...)
  - Manpower/guidance needed to make full use of these data

- ? Establish contacts
- ? Web page of all the talks given here:  
[http://www.sron.rug.nl//hifi\\_icc/public/HerschelCalibrationWorkshop/Presentations](http://www.sron.rug.nl//hifi_icc/public/HerschelCalibrationWorkshop/Presentations)
- ? Full spectra of Mars and Uranus between 57 and 600mm for one date (July, 1st, 2007) at 100 MHz resolution  
New workshop!
- ? Coordinated ground-based observations (cm, mm, submm):
  - Which observations are best suited to restrict the models ? ..., LaBoca/APEX, VISIR/VLT, ...
  - Space: CASSINI /CIRS (now!), ASTRO-F, Planck
- ? Simulation of observations
  - Study of various effects (models, pointing, mirror accuracy, error beam) with output from e.g Mars LMD-Model (R.Moreno)