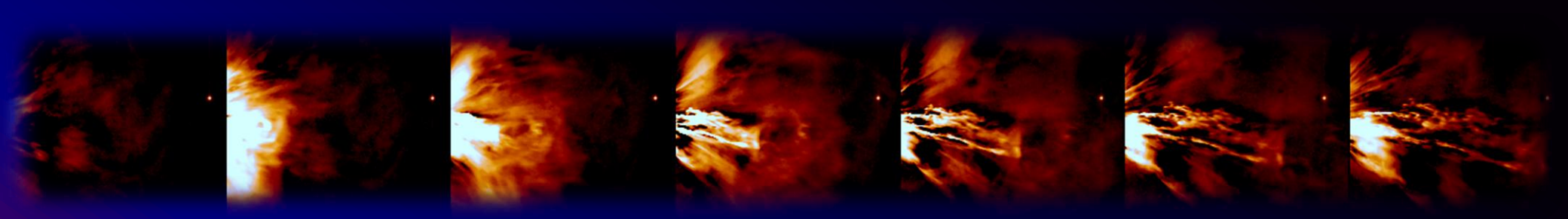

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Work Package 3

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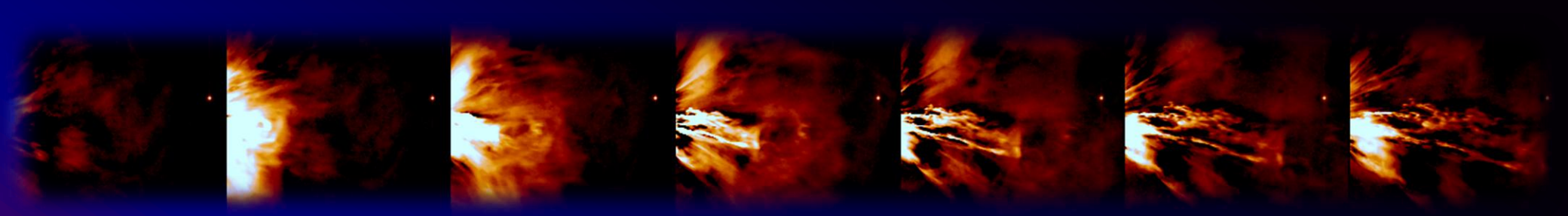

WP3: Deriving/cataloguing the kinetic properties of STEREO/HI CMEs based on geometrical and forward modelling

WP3.1: Geometrical modelling of STEREO/HI CMEs (STFC, UNIGRAZ, UGOE)

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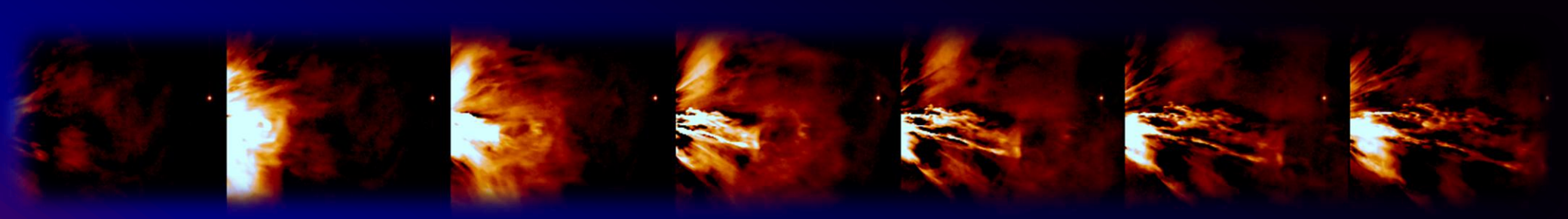

The objective of task 3.1 is to perform geometrical modelling of the STEREO/HI CMEs, identified and catalogued in WP2, to derive their kinematic properties. The STEREO/HI catalogue will be augmented with this information.

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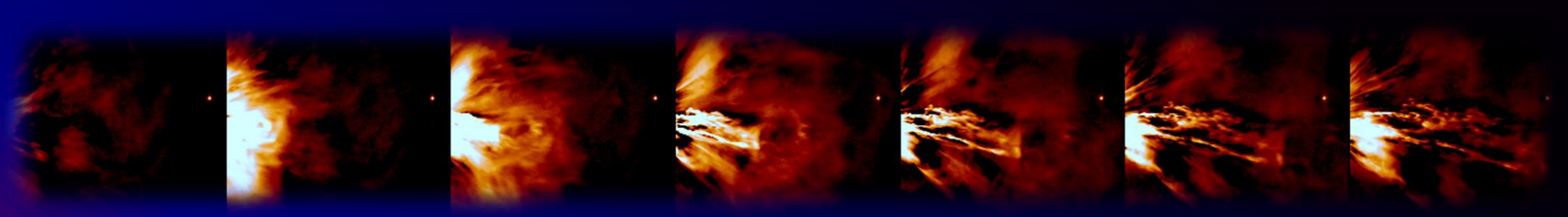

From time-elongation maps (J-maps) generated from the HI data, the time-elongation profile of each CME will (where possible) be extracted and analyzed using a range of single-spacecraft and stereoscopic geometric models to provide estimates of CME propagation speed, direction and potentially size.

UNIGRAZ, UPS and STFC are acknowledged leaders in this field…..

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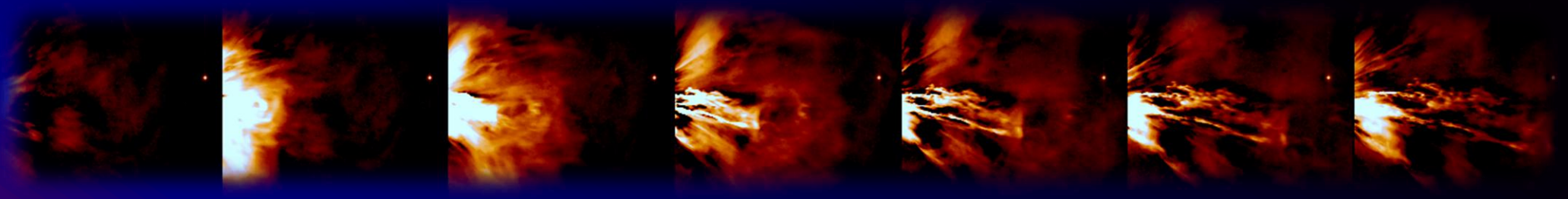

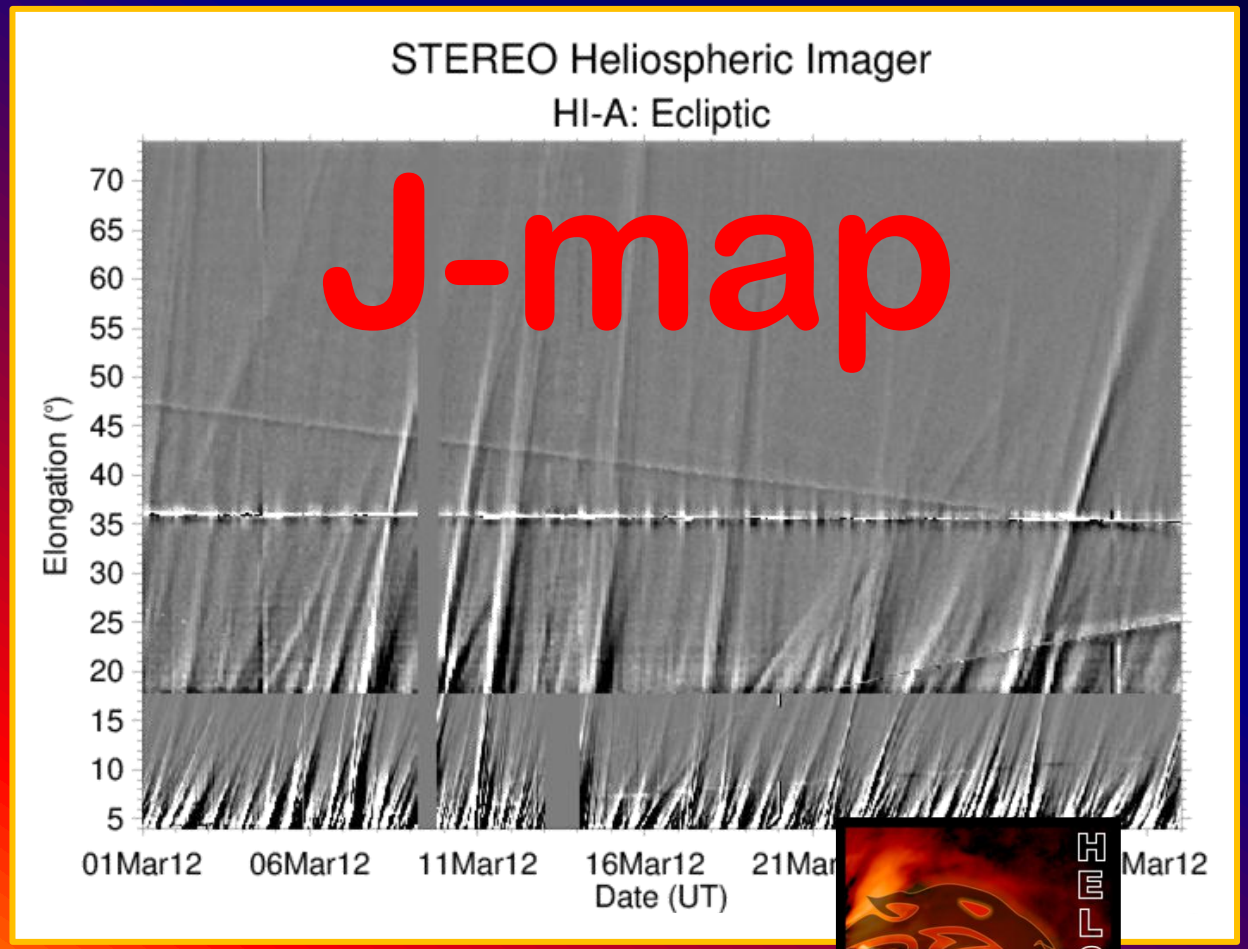

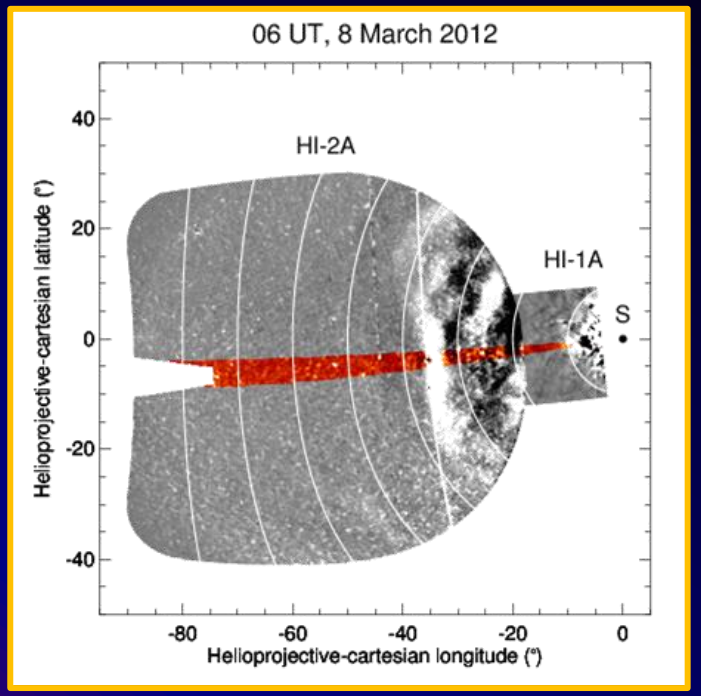

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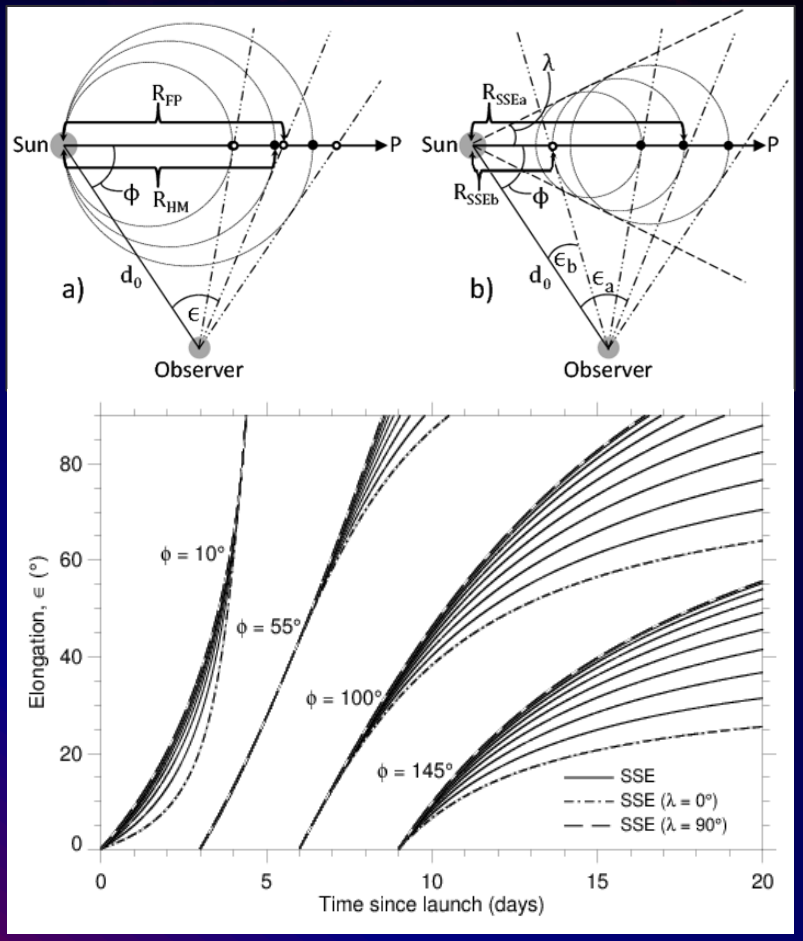
Single-spacecraft fitting techniques

The time-elongation profile of a solar wind transient (e.g. CME), viewed from a single vantage point, can be fitted to estimate radial speed and propagation direction.

This requires a model of the transient's cross-sectional geometry:

- **Fixed-Phi Fitting (FPF):**
point-like transient; Rouillard.
- **Harmonic Mean Fitting (HMF):**
circular transient fixed to Sun-centre; Möstl.
- **Self-Similar Expansion Fitting (SSE):**
Generalisation of above into a Single geometry, Davies.



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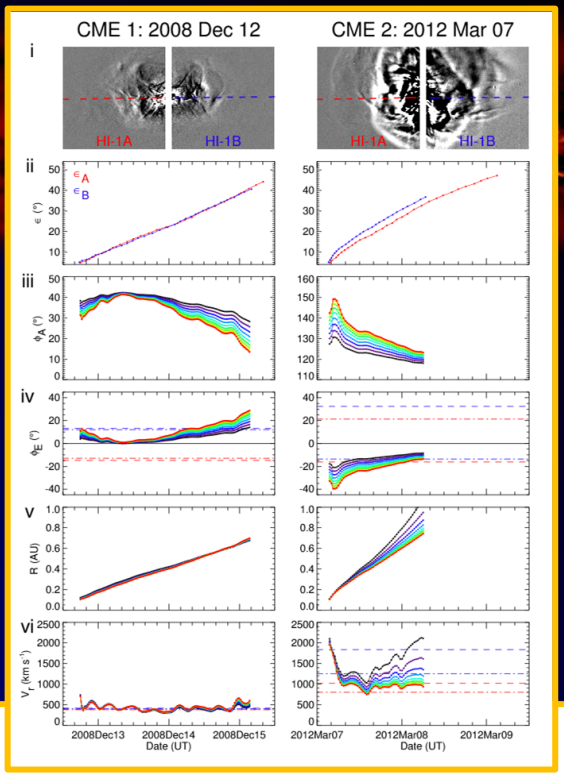
Stereoscopic analysis techniques

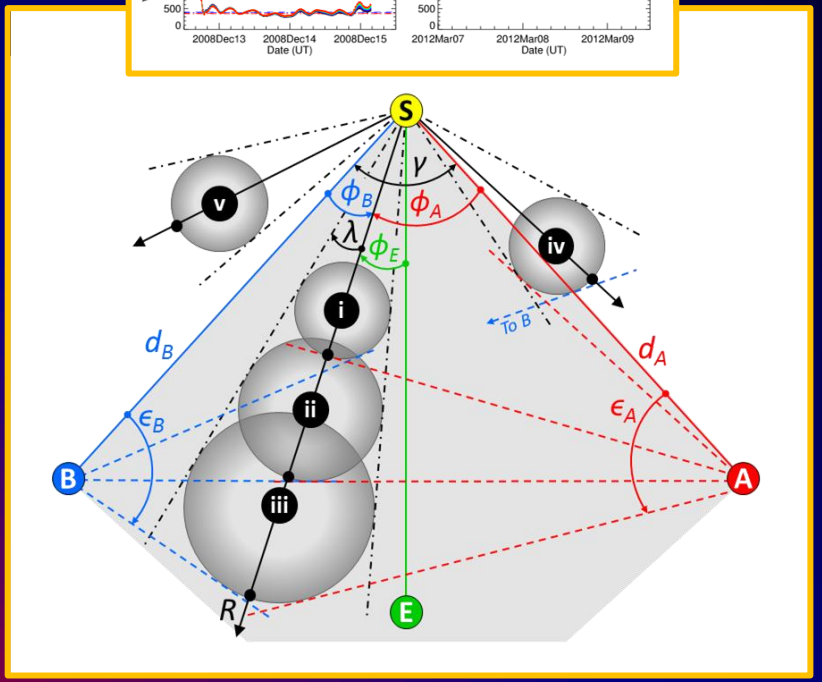
Each single-spacecraft fitting technique has a stereoscopic analogue that enables the time profiles of radial speed and propagation direction to be estimated based on the time-elongation profiles from two vantage points:

FPF → Geometric Triangulation (GT)

HMF → Tangent-To-A-Sphere (TAS)

SSEF → Stereoscopic Self-Similar Expansion (SSSE)





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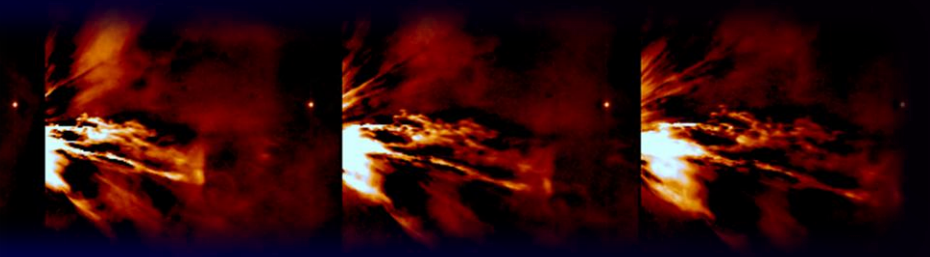
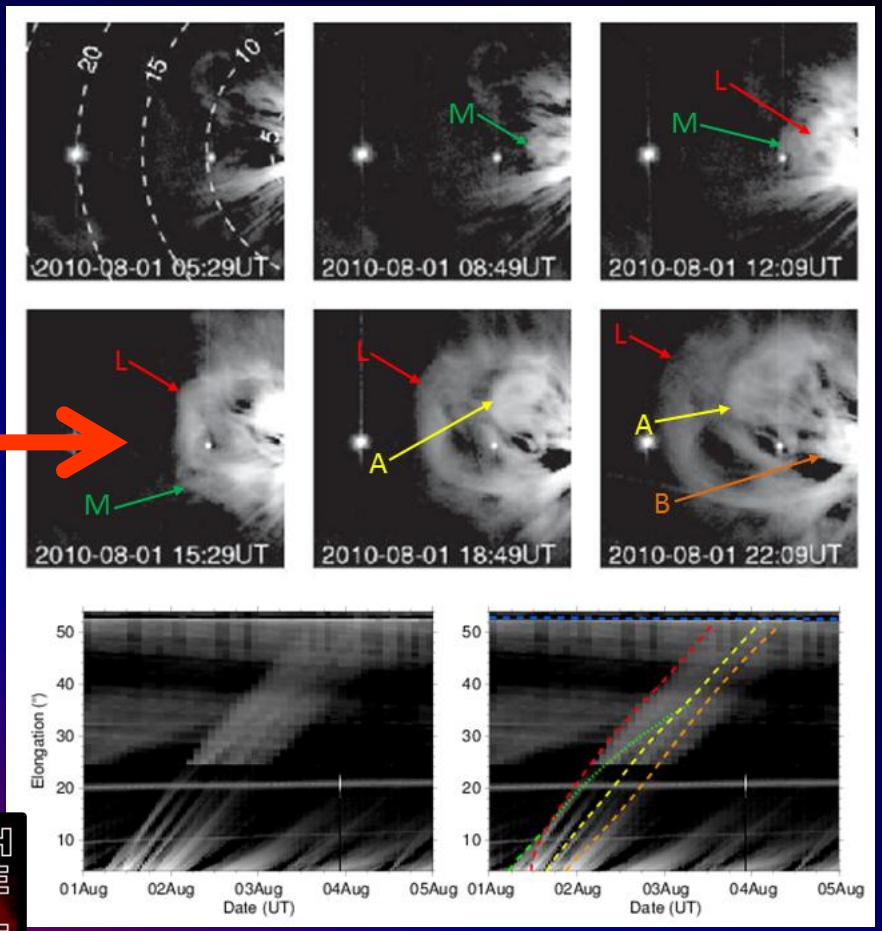
Geometrical modelling techniques



These techniques have been extensively applied, but only to a very limited set of CMEs.

e.g. Harrison et al. (2012)



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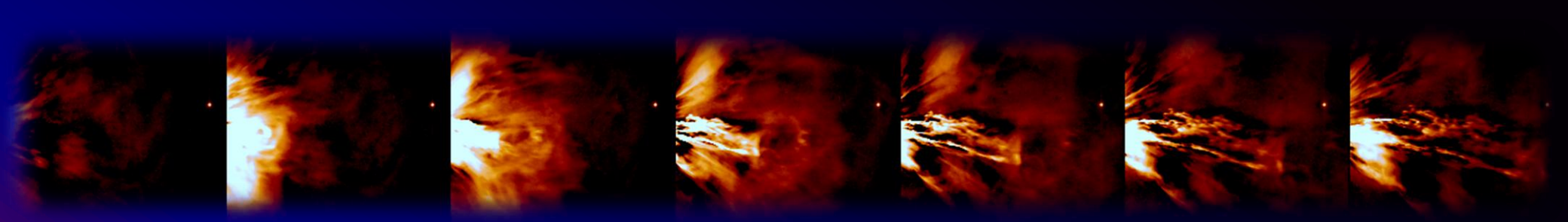

Geometrical modelling techniques

As well as kinematic properties, back-projected CME launch time/location, derived from the geometrical modelling, will be incorporated into the catalogue.

- This enables potential source signatures associated with CME onset to be identified (WP4.1).
- The in-situ observations of CMEs will be compared to their white-light counterparts (WP4.2).

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