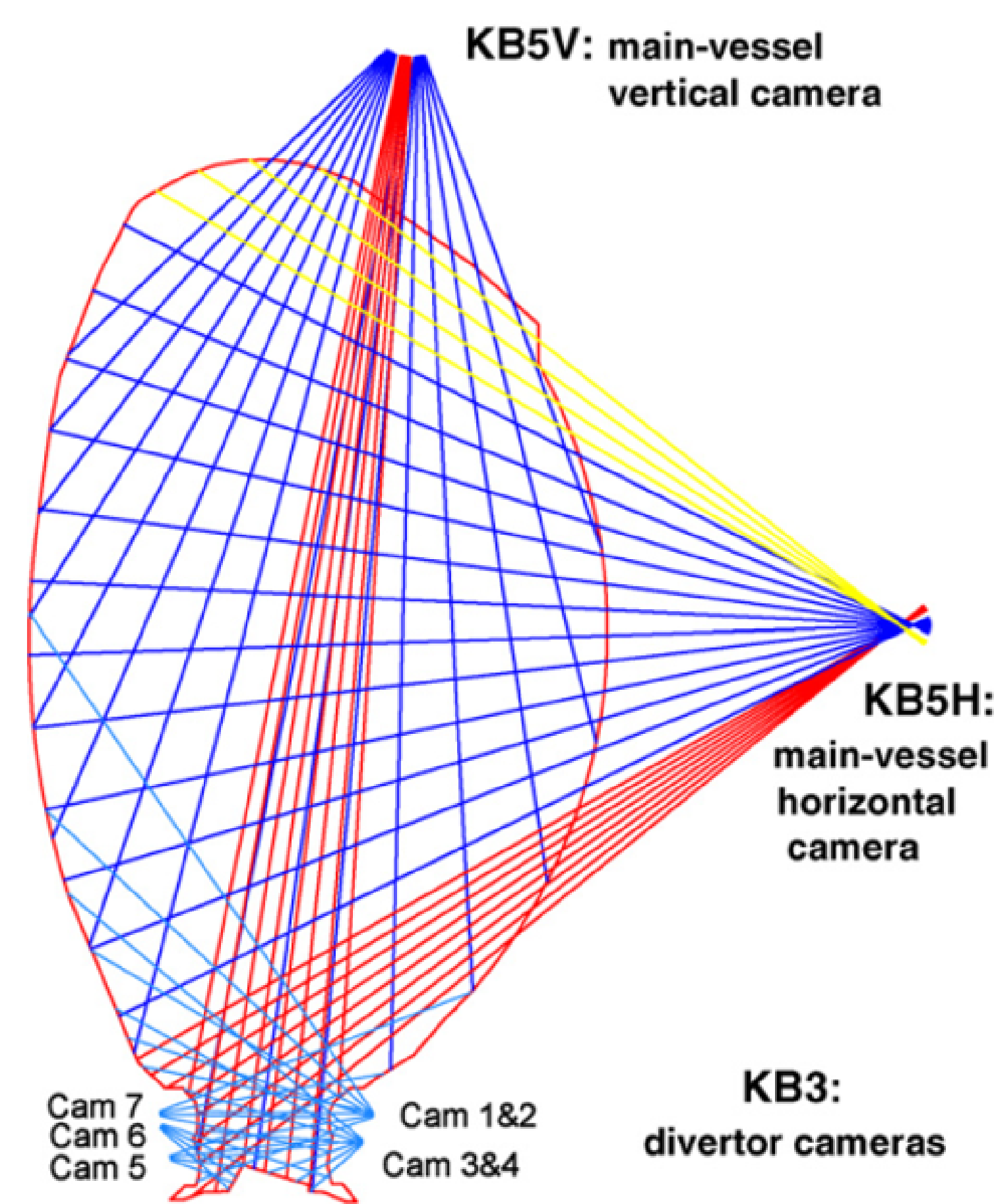# EUROfusion

Determination of radiated power density profile using bolometer data for DT Baseline scenario at JET

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KB5V: main-vessel vertical camera

KB5H: main-vessel horizontal camera

**KB3:** divertor cameras

Cam 7, Cam 6, Cam 5, Cam 1&2, Cam 3&4

Two main-vessel bolometric cameras with horizontal (KB5H) and vertical (KB5V) views of the plasma cross-section have been installed, providing a substantial upgrade in capabilities: more viewing chords, higher energy range, higher sensitivity, lower noise and therefore, lower detectable signals at JET.

Each camera collects radiation along 24 chords. The spacing of the lines-of-sight has been chosen to give an increased spatial resolution of the divertor region in addition to covering the whole plasma: two fans of eight chords, each span the divertor region with 8 cm separation, while the other 16 channels cover the whole plasma with a coarser resolution.

The lines-of-sight for KB5V are determined by the individual bolometer apertures in connection with a collimator block. In the case of the horizontal camera (KB5H), pinhole structure is used to define the lines-of-sight.

In addition to the main chamber system, three new dedicated divertor bolometers (KB3) with 12 lines-of-sight in total.

The combination of the divertor systems with the KB5 overview cameras provides radiation pattern reconstructions, particularly in the divertor region

(a) Four channel bolometer head and (b) schematic representation of the detector head cross-section
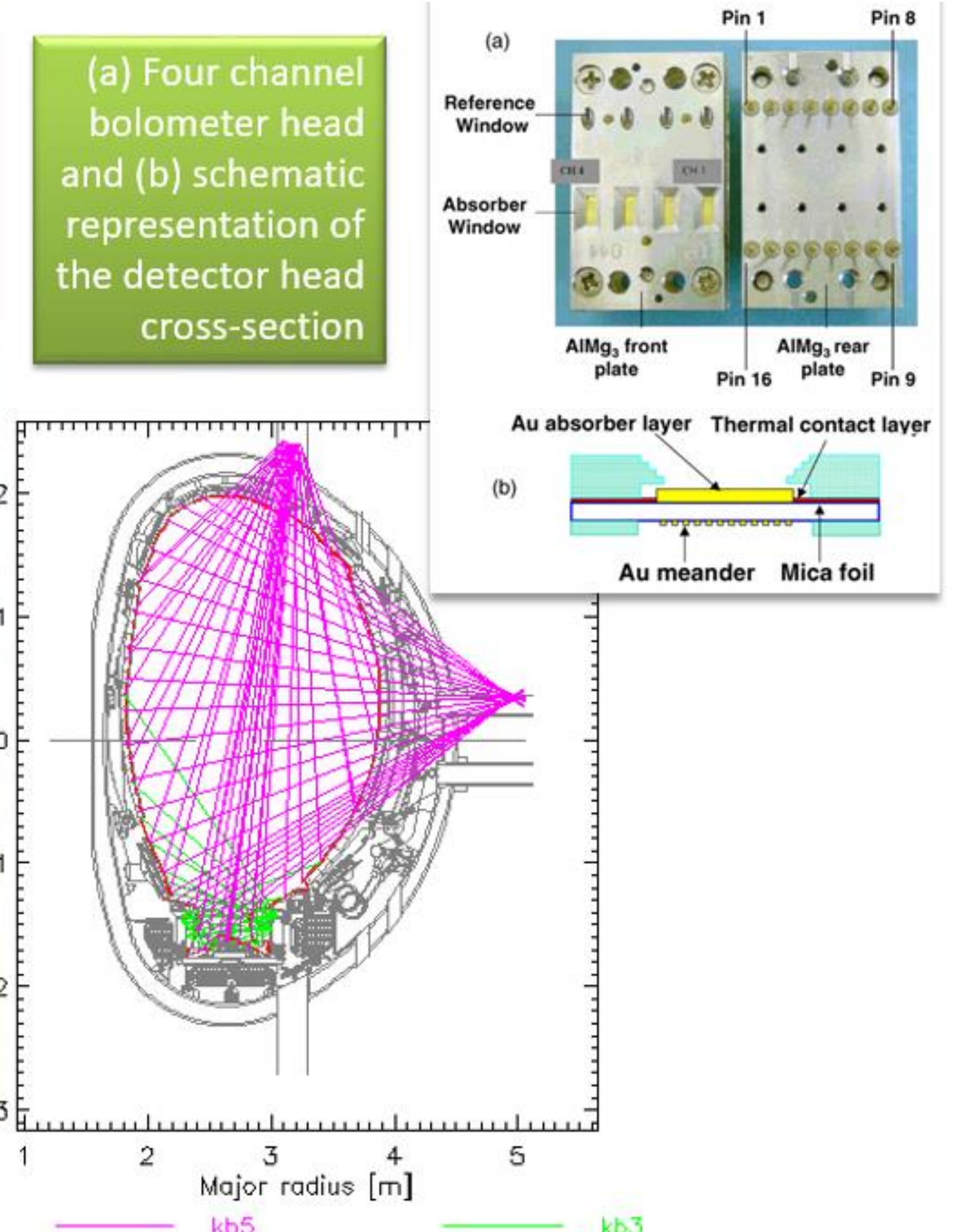
Bolometer analysis is essential to provide results for the further analysis/modeling, therefore the required pulse data will be analyzed by reproducing and creating tomographic reconstructions using KB5 (and KB3) bolometer data.
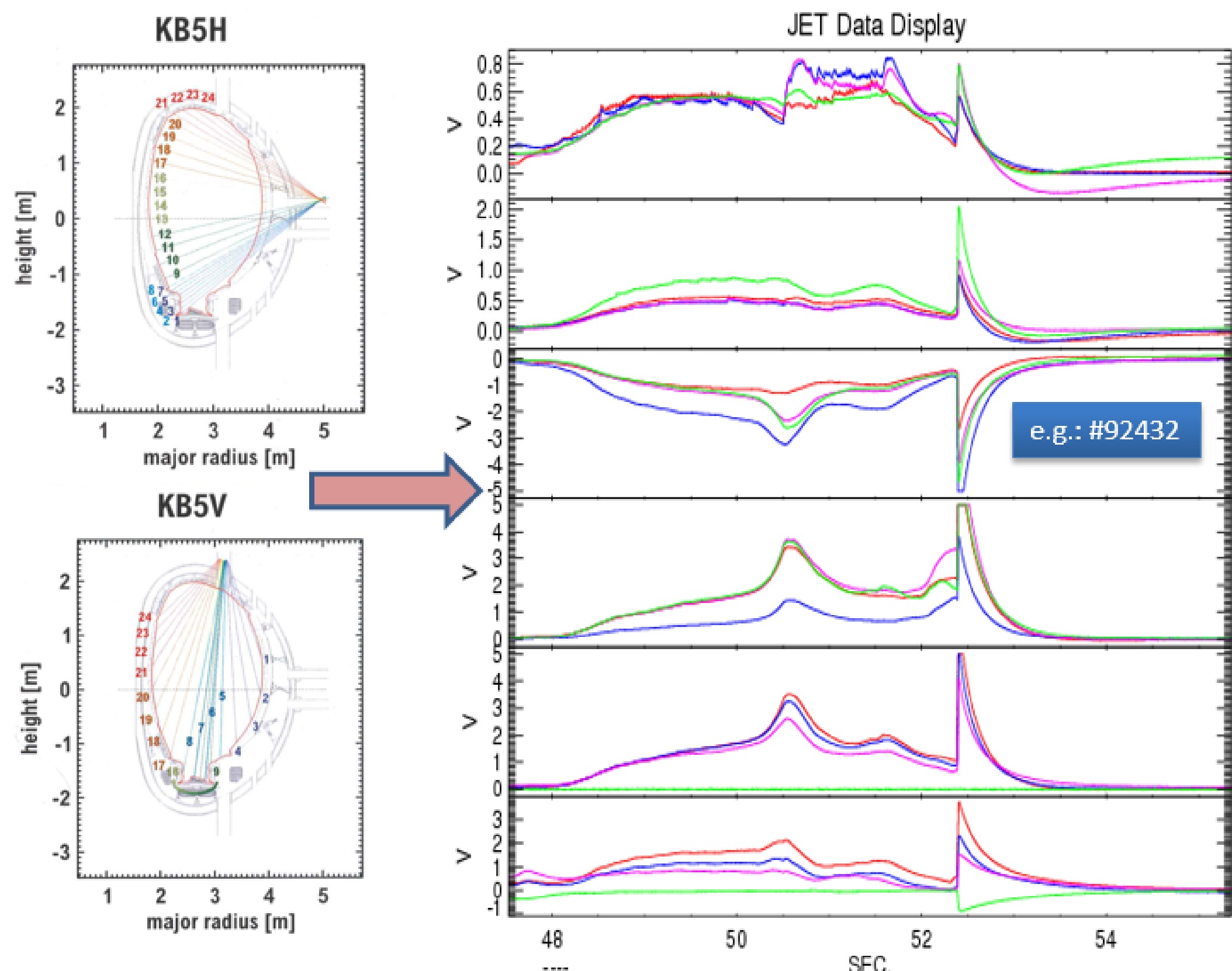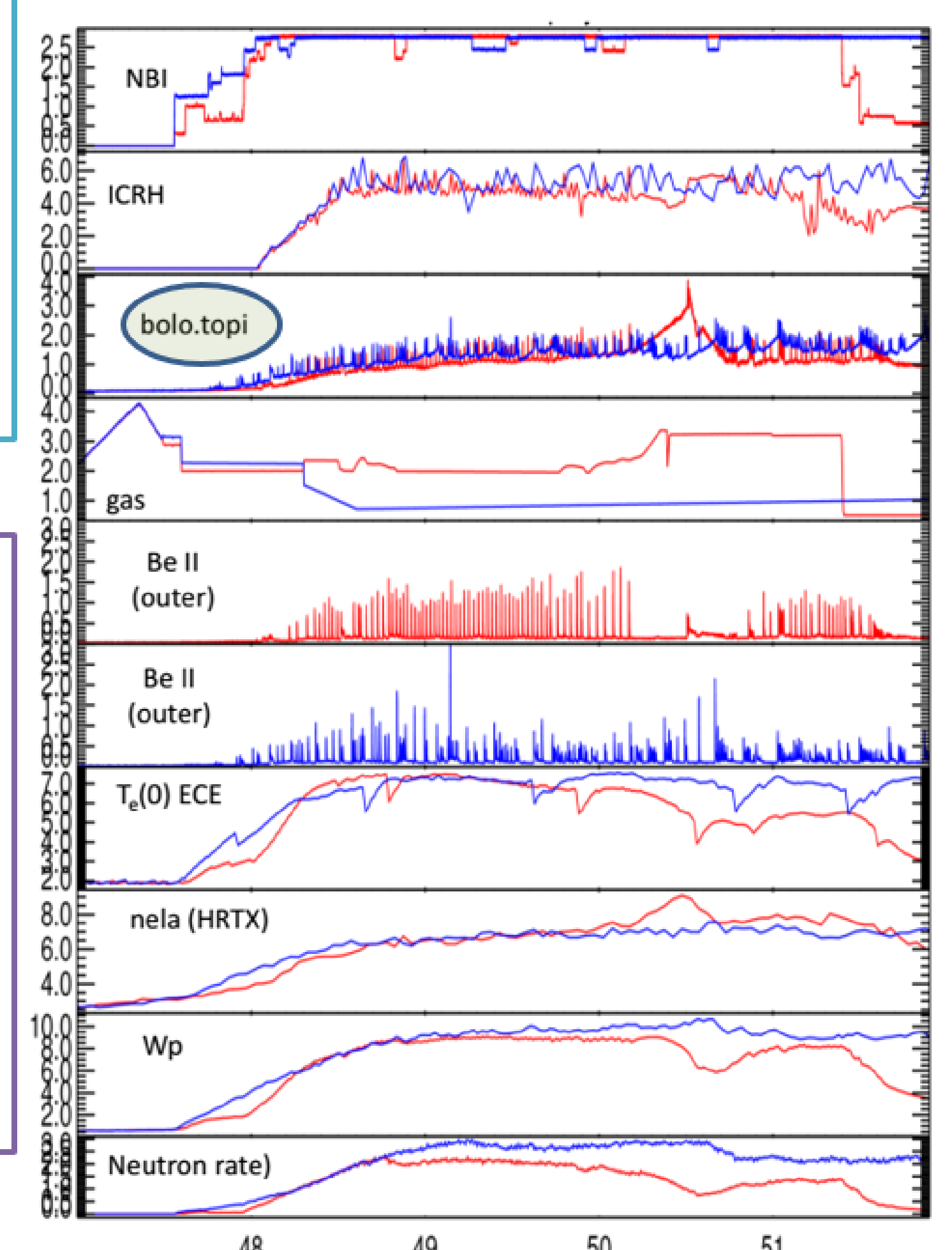

Analysis steps:
- Usage of bolometer available data.
- Starting data: raw voltages and/or calibrated radiation flux.
- analysis specific to the goals of the deliverable will be performed by extracting the required information
- This analysis provides information to achieve the goals of the deliverable.

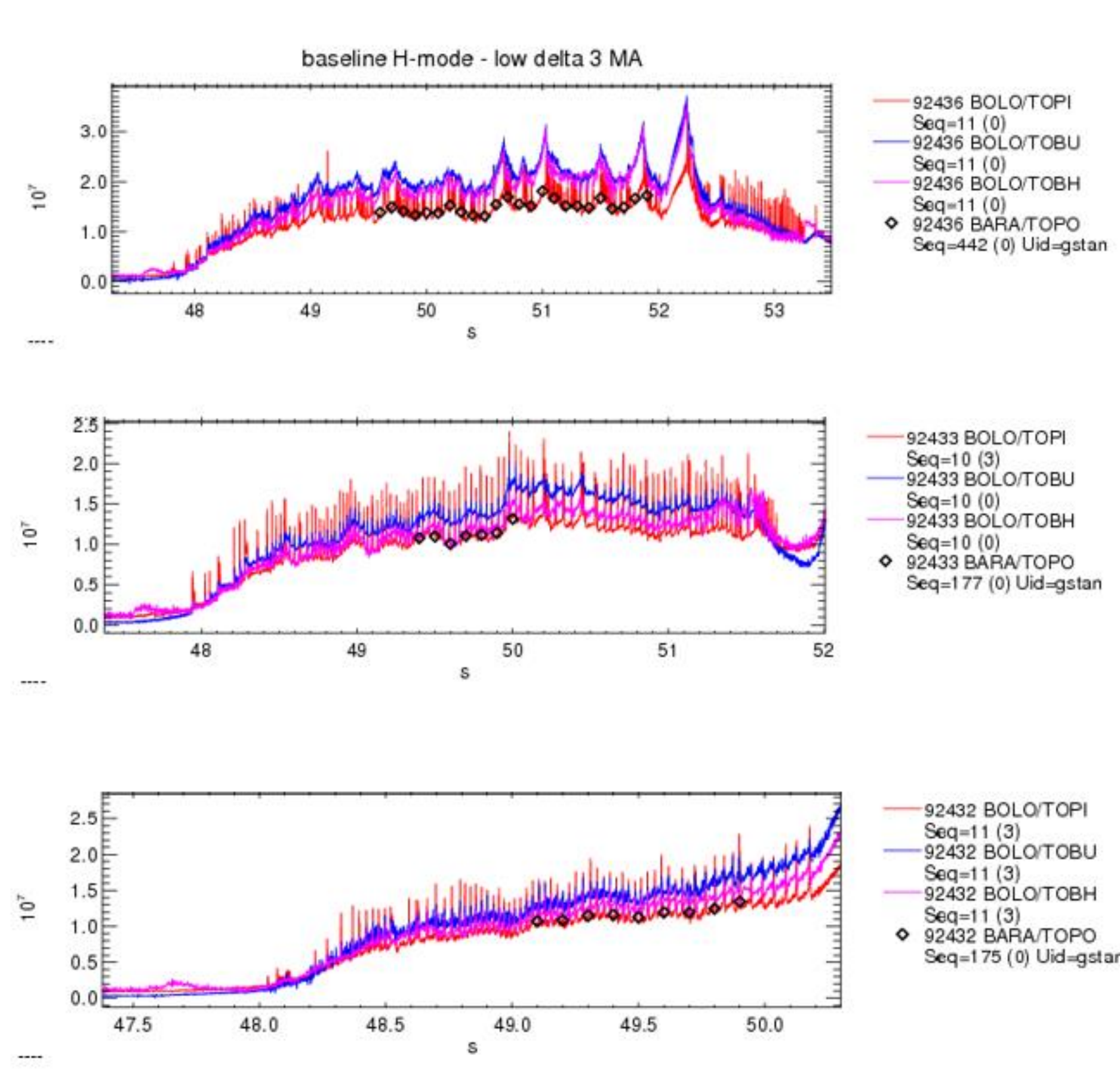e.g.: #92432

Red : #92432   blue : #92436
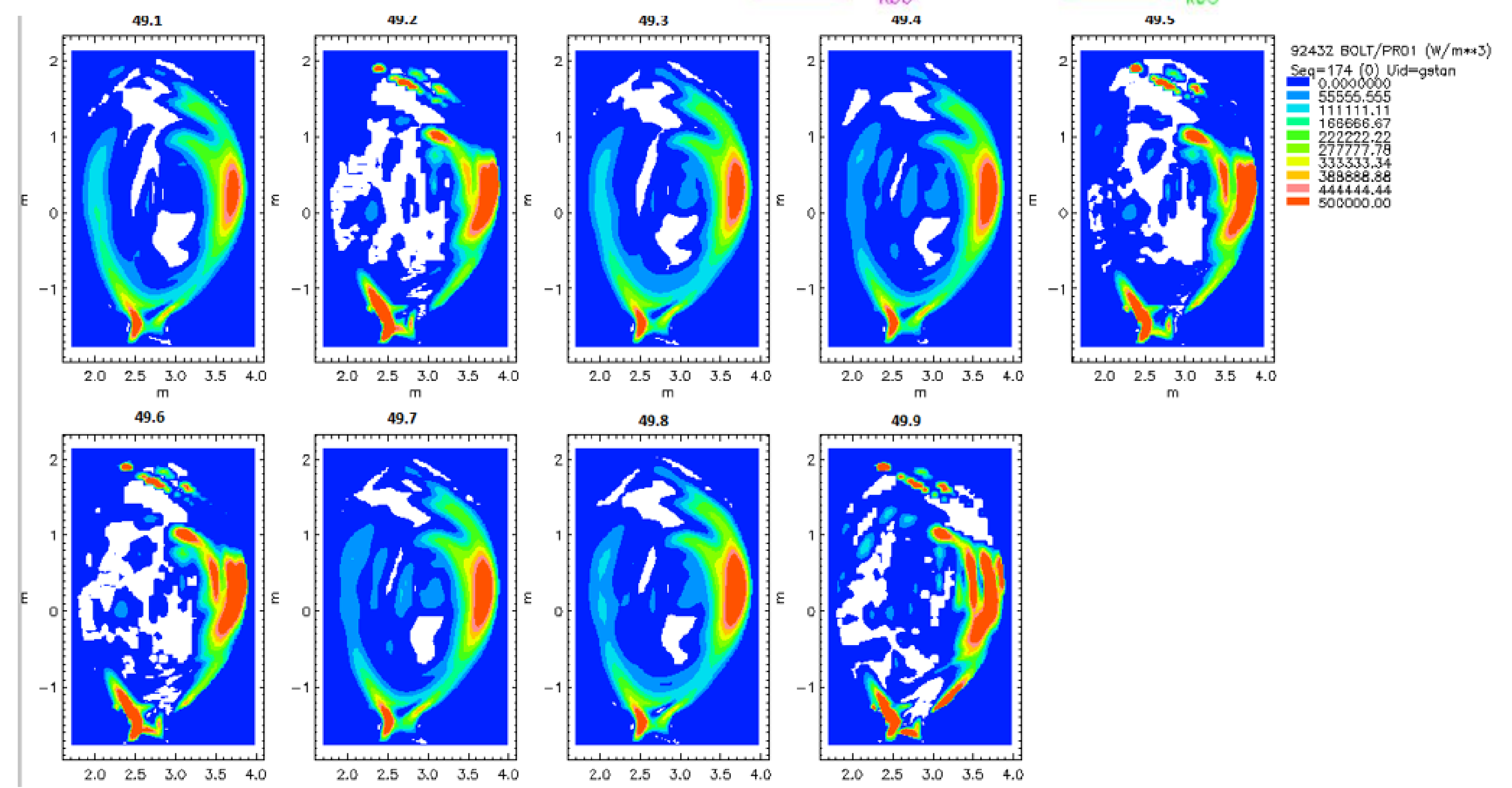
As for the future research, a strong possibility is the use of pacing pellets + low gas dosing, rather than pure gas dosing. Although a detailed analysis of the pacing effect indicates that the pacing efficiency is only ~50%, it is not possible to exclude other fuelling effects from the pellets.

BOLO/TOBU uses outer channels of the vertical bolometer avoiding the divertor and assumes in/out symmetry which is reasonable for the carbon wall pulses on which it was originally derived. It was assumed that TOBH, which uses the horizontal camera, should be more reliable in these cases due to the up/down symmetry.

Based on the bolometry data, the research raised thought-provoking problem concerning the fact that at high input power there was a strong centrifugal effect on the tungsten radiation making it highly in/out asymmetric. #92432

Courtesy: F.Rimini

For example, it would be useful to have some analysis of the pacing pellets vs. gas particle deposition in the pedestal region and in the near SOL (Scrape-Off Layer). The high NBI+ICRH (Ion Cyclotron Resonance Heating) power by itself is not the answer to the question. In fact, we have a pulse earlier in the same JET Baseline scenario session, at almost exactly the same power and not achieving the same performance.

- In EUROfusion project LEI is involved in JET1 – JET campaigns (since 2014). Participation in JET Campaigns C35, C36 ... up to now (bolometer data analysis and reconstruction).
- Two main-vessel bolometric cameras with horizontal (KB5H) and vertical (KB5V) views of the plasma cross-section provid a substantial capabilities at JET.
- BOLT – 2D radiation distribution, measured and back/calculated channel data, parameter of reconstruction.
- BARA – different integrals of radiated power from reconstruction (e.g. total power TOPO, total radiation within flux surfaces TOIF, etc..).
- The total radiation as computed via tomography does agree quite well with the total radiation.