**Laser-Induced Desorption (LID) for tritium monitoring at JET**

# Minutes of Meeting #1 (12.12.2019)

attending at FZJ: Sebastian Brezinsek, Jannis Oelmann, Gennady Sergienko, Miroslaw Zlobinski  
attending at JET: João Bernardo, Steve Bremner, Andrew Coulson, João Figueiredo, Alexander Huber, Mikhail Maslov, Darren McDonald, Sanjay Mistry, Luke Norman, Daniel Scoon, Shane Scully, Anna Widdowson

1. Presentation by M.Z.”PROPOSAL FOR THE UPGRADE OF THE JET DIAGNOSTICS  
   IN PREPARATION FOR A PROGRAMME UP TO 2024 WITHIN THE WORK PACKAGE JET ENHANCEMENTS, JET4 - PHASE I UP TO 2020   
   Project 2: Installation and test of a Laser-Induced Desorption Spectroscopy (LIDS) system  
   for tritium monitoring”
   * Motivation of the LID project for JET and ITER
   * Past LID activities of FZJ (TEXTOR, lab studies, LID-QMS, laser properties, studied materials, recent desorption of D from Be/D layers in FREDIS)
   * Summary of LID project proposal from FZJ
     + Combined proposal: LID-QMS (use of mass spectrometers for quantification) and LIDS (use of spectroscopy for quantification of desorbed gases)
     + use of JET EDGE LIDAR system (see pre-conceptual study JW13-FT-4.36) or   
       use of KZ3 beam line + new additional windows
     + 2 general project paths possible (presented with advantages/disadvantages)
     + Laser demands deduced from laser-induced surface temperature
     + Installation of an LID target plate as/on tile 0 or 1 for ITER-like surface
     + Hydrogen isotopes detection systems (for LID-QMS and LIDS) and temperature measurement of laser spot
     + Two phase project approach (until end of 2020 and beyond):  
       EUROfusion budget and timeline
     + Proposal of project responsibilities (for FZJ and NJOC)
     + Preliminary estimation of hardware costs
2. Discussion
   * discussion about access to JET for installation of LID components:

next JET shutdown planned for August 2021 for 6 months

* + DT operation shifted probably to later in 2020.
  + S.B.: We need an updated JET timeline for project planning.
  + Test of LID in DTE3 planned for end of 2023. A.H.: This is too late for ITER.
  + test QMS sensitivity for LID in JET with blow-off laser system (KZ3) as an early test
  + do estimation: QMS sensitivity at JET vs. expected desorption amount
  + J.F.: for laser system we first follow both project routes: route 1 (fast, with new ruby laser but old beam path), route 2 (longer, ITER-like design with new beam path and optics). decision point to choose which route to follow?
  + A.W.: will check if spare parts / replacement tile for tile 0 and 1 available.  
    Tile 0 probably easier to replace. Tile 1 with heating will be difficult, but tile 1 with ITER-like castellation but without heating might be possible (if spare part available).  
    After 2024 tile removal much easier than now.
  + to do: (to page 12 of presentation) Each task in responsibilities should be defined in more details/sub-tasks
  + A.H.: For ITER the priority is to test LID-QMS, but we should not exclude LIDS.  
    LIDS could be a solution if there are detection problems with QMS.
  + J.F.: The conceptual phase in the project proposal should end earlier.  
    We have to initiate necessary paperwork for drawing office and CODAS.
  + G.S.: We should work now on the faster ruby laser solution (route 1) and follow both paths in parallel.
  + S.B.: We should invite Philip Andrew from ITER IO to discuss LID plans for ITER.

1. Presentation by M.M. “LIDS/LIBS project at JET – laser infrastructure”
   * Specifications and status of lasers in roof lab (KE11, KE3, KE9, KZ3)
   * Scheme of laser beam lines in roof lab and torus hall
   * Options to use KE9 beam line: only with ruby laser easy, otherwise many replacements
   * Working restrictions in the roof lab due to laser safety and JET operation
   * Possibility to install LID laser in KZ3 enclosure and use a new mirrors in roof lab and torus hall
   * Issue with storage space for KE9 frame
   * Summary:
     + Reviving old KE9 ruby laser: feasible but requires effort (10 years out of operation)
     + Replace KE9 with a new ruby laser: conflict with TS diagnostics, but beam path exists
     + Replace KE9 with YAG laser: complete redesign of beam paths, thus impossible
     + Installing YAG laser next to KZ3 laser: extension of KZ3 enclosure, redesign of KE9 frame, replace few KZ3 optical components and extra mirror on the KE3 tower at Octant 5. No conflict with TS diagnostic operation
2. Discussion
   * M7 mirror only for YAG wavelength (1064 nm)
   * to slide 5: no big work during JET operation possible in roof lab, but minor work OK
   * request to M.M.: Please write your estimation of duration for exchanging one laser in the roof lab with and without JET operation
   * M.M.: rough estimation for time to replace old ruby laser by a new ruby laser: several weeks
   * M.M.: observations windows at TS flange are uncoated, central window for laser is coated for ruby wavelength
   * to slide 8: It is unclear if there are cables and connections at the edge LIDAR window position available.
   * M.M.: Energy of KE9 laser in free lasing mode is unknown.  
     M.Z.: old report of Bernd Schweer says 5 J, 340 µs (without Q-switch, Mode lock off)
   * KE9 frame can be only moved by crane only during JET shutdown
   * Laser scanning for edge LIDAR is installed on frame ex-vessel; needs to be re-installed
   * size of KZ3 laser enclosure unknown, should be measured

next meeting: 9th or 10th of January 2020 at 10 am UK time

minutes by M.Z.