

The ESS Database for Elliptical Cavities



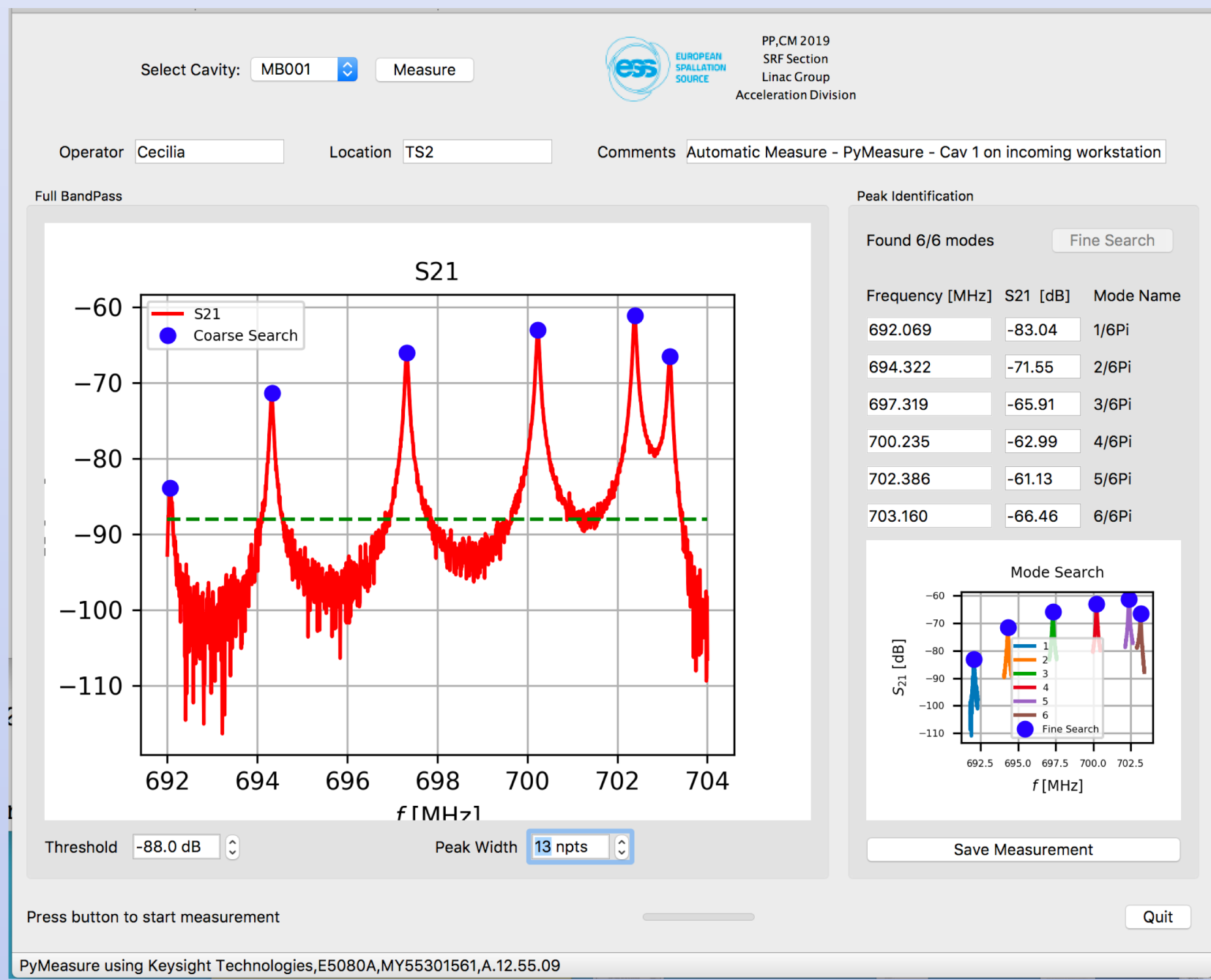
THP099

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The large in kind scope of the elliptical superconducting RF linac of the ESS facility implies the *handling of handover conditions between the cavities fabrication and testing phases performed at INFN and STFC, to the assembly of cryomodules at CEA and later to ESS in Lund.*

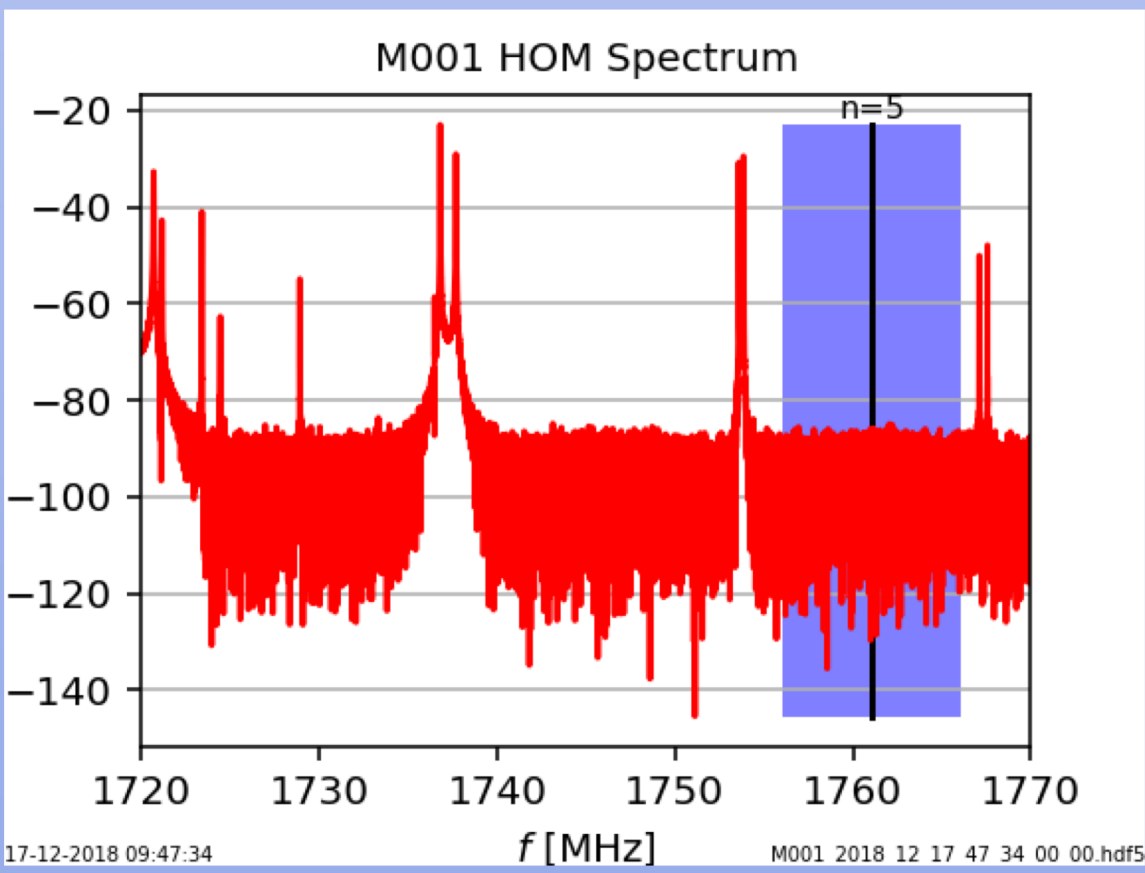
The performance qualification at the test stand, and later the commissioning and operation phases require the availability of the cavity performance and frequency data under all environmental conditions during preparation (e.g. temperature, vacuum in beam line/He vessel/vacuum vessel, tuner state). Availability of the data needs to be guaranteed for the long term maintainability of the accelerator. For these reasons a cavity database has been set up at ESS, integrating the data contained in the handover documentation from the in kind partners and extending it during the activities at ESS after receiving the modules. The database has been used to analyze the preparation steps of the prototype demonstrator cryomodule for the tests at ESS, by benchmarking with the data collected during the tests at CEA, and is currently used during the series cavities handover phases.

Measurement tools



The tool allows to measure cavities **S21 with VNA** and **store data** automatically in the cavity DB

- Bandwidths
- Transmission
- HOM spectrum
- F tracker (e.g. pumpdown)



Architecture of Data Storage

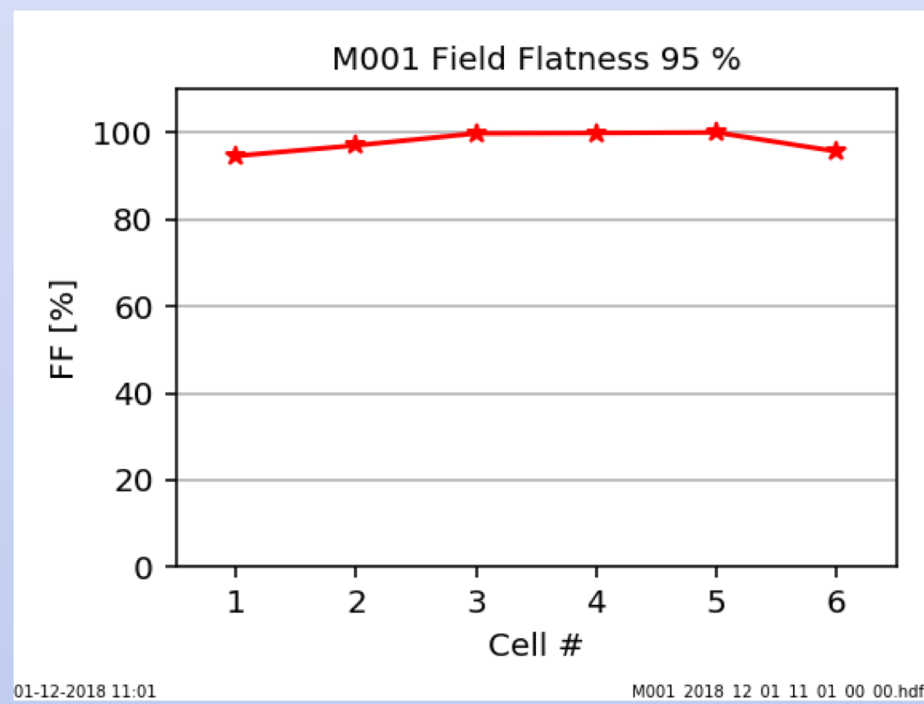
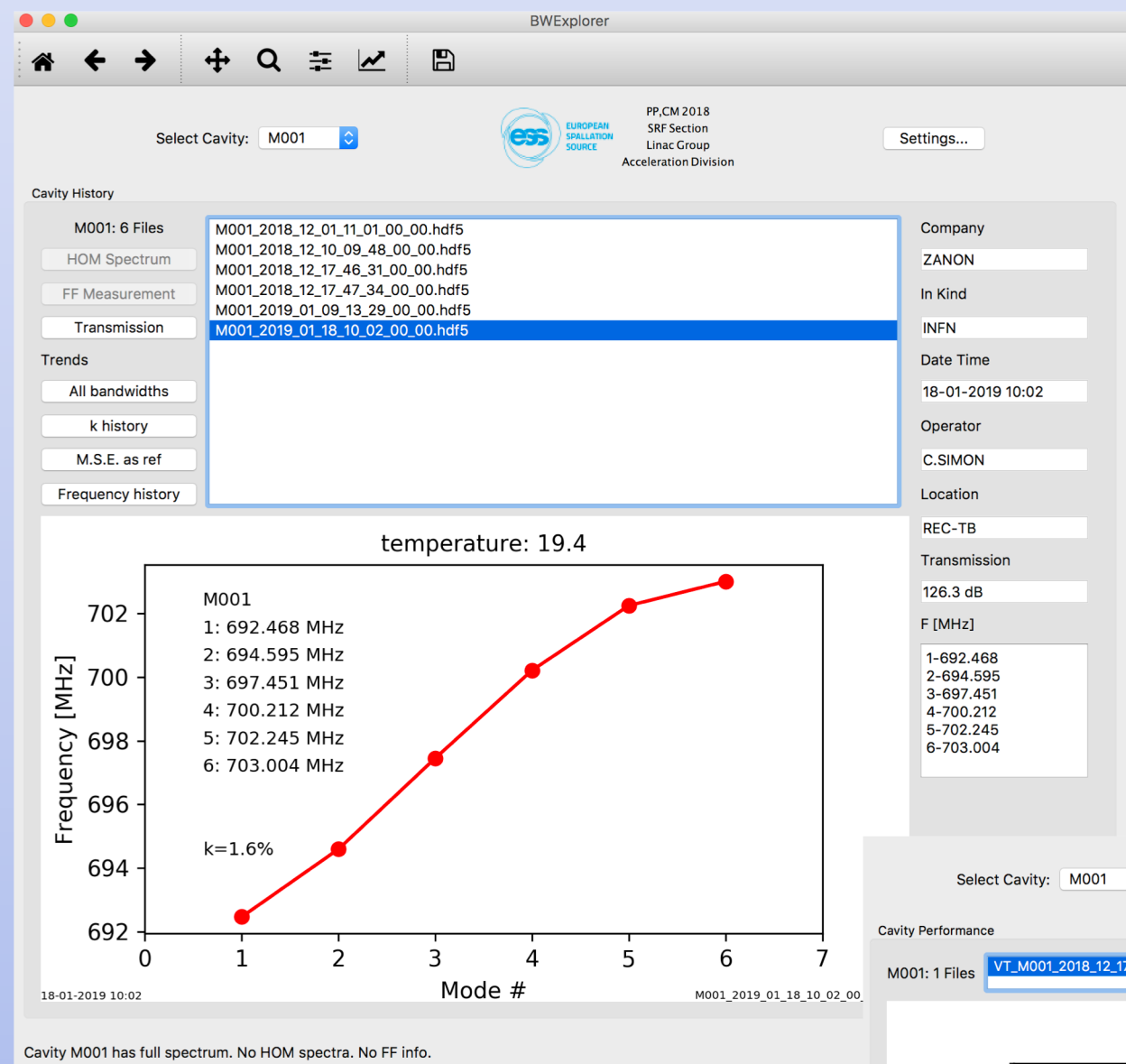
Storage Component	Usage	Comments	Location
Live Staging Area	Area used for the handover of documentation from IR/CA/CEA systems	1. Spontaneous download 2. From Address of the IR/CA and CEA documentation, after notification are received. 3. TSD for STFC 4. Export module in the incoming data. 5. Data is then moved to storage via handovering tools.	ESS Shared network folder Accessible at ESS or via VPN
Normalized Data	Repository of all the datasets, with conversion to the agreed standards and metadata tagging	Access to data via software tools.	https://meas01.ess.lu.se/owncloud/index.php/ Can be accessed from the outside. Convent. tools at the moment not as web services, but may on network access via ownCloud

Existing Tools (ESS Gitlab), all open

Component	Language	Scope	GitLab Project	Branch
Cavity Reception	Python 3.7 with PyGDS	Transfer to the DB the ATRAC data downloaded to the Share folder: IR/CA/CEA data transformation.	https://gitlab.ess.lu.se/ESS/Section/Reception	master
Module Reception	Python 3.7 with PyGDS	Transfer the Cavity data provided from CEA with the module handover: IR/CA/CEA data transformation.	https://gitlab.ess.lu.se/ESS/Section/Reception	master
Browser	Python 3.7 with PyGDS	Browser and analyzes the cavity data in the Measurement DB. Data is taken from the HDF files.	https://gitlab.ess.lu.se/ESS/Section/Reception	master
VT Explorer	Python 3.7 with PyGDS	Browser and analyzes the vertical performance data in the Measurement DB. Data is taken from the HDF files.	https://gitlab.ess.lu.se/ESS/Section/Reception	master
PyMeasure@ESS	Python 3.7 with PyGDS and python-vna module	Measurement of cavity transmission properties. Capabilities to store VNA/TSD measurement data into the Measurement DB.	https://gitlab.ess.lu.se/ESS/Section/Reception	master
Library	Language	Scope	GitLab Project	Branch
bcClasses	Python 3.7	Provides abstract classes for RF, VT, Handover objects, with standard observations to test and test data managers.	https://gitlab.ess.lu.se/ESS/Section/Reception	master

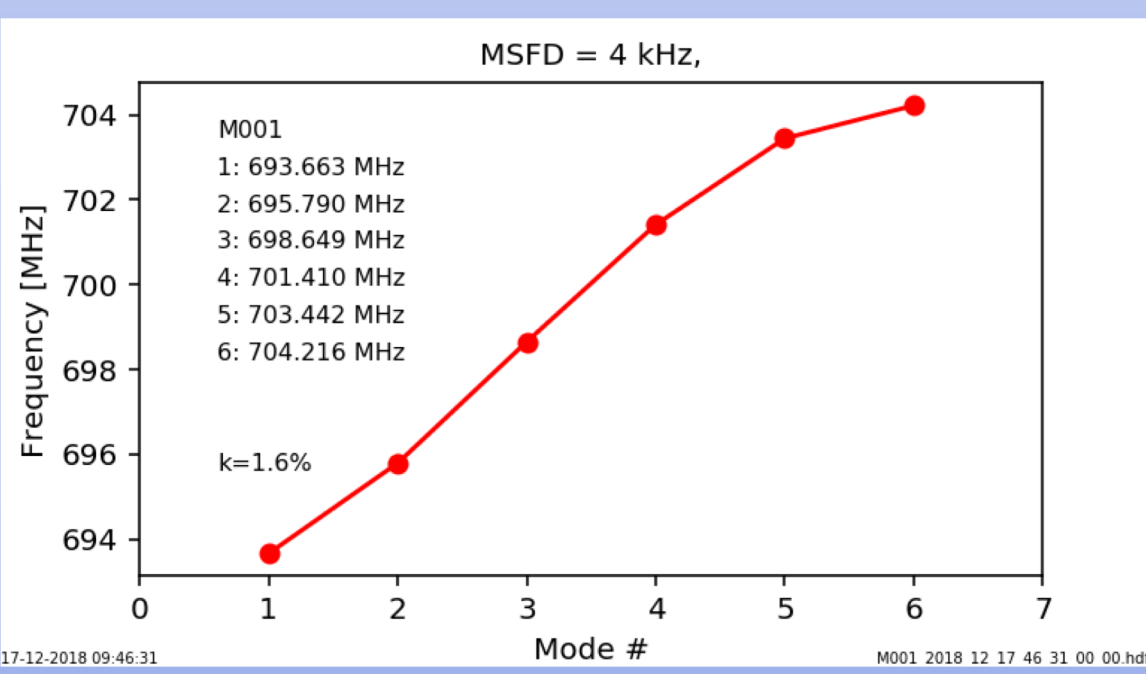
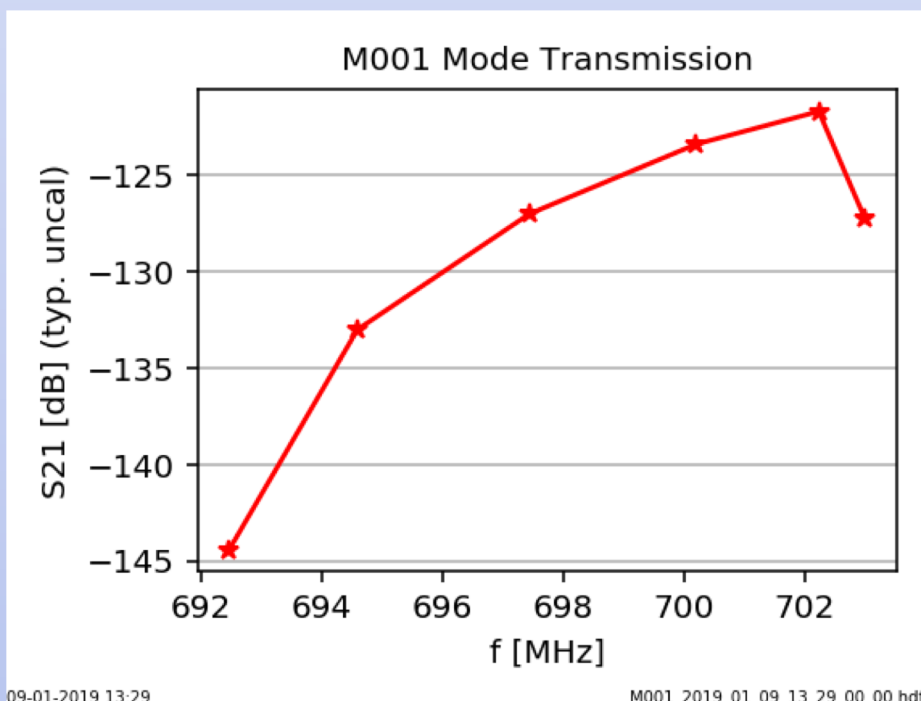
Browsers: Bandwidth & VT Measurements

To check fulfillment of specification or handling the handover conditions. Browse, display & analyze cavities measurements at cold & warm.



Field Flatness measurement

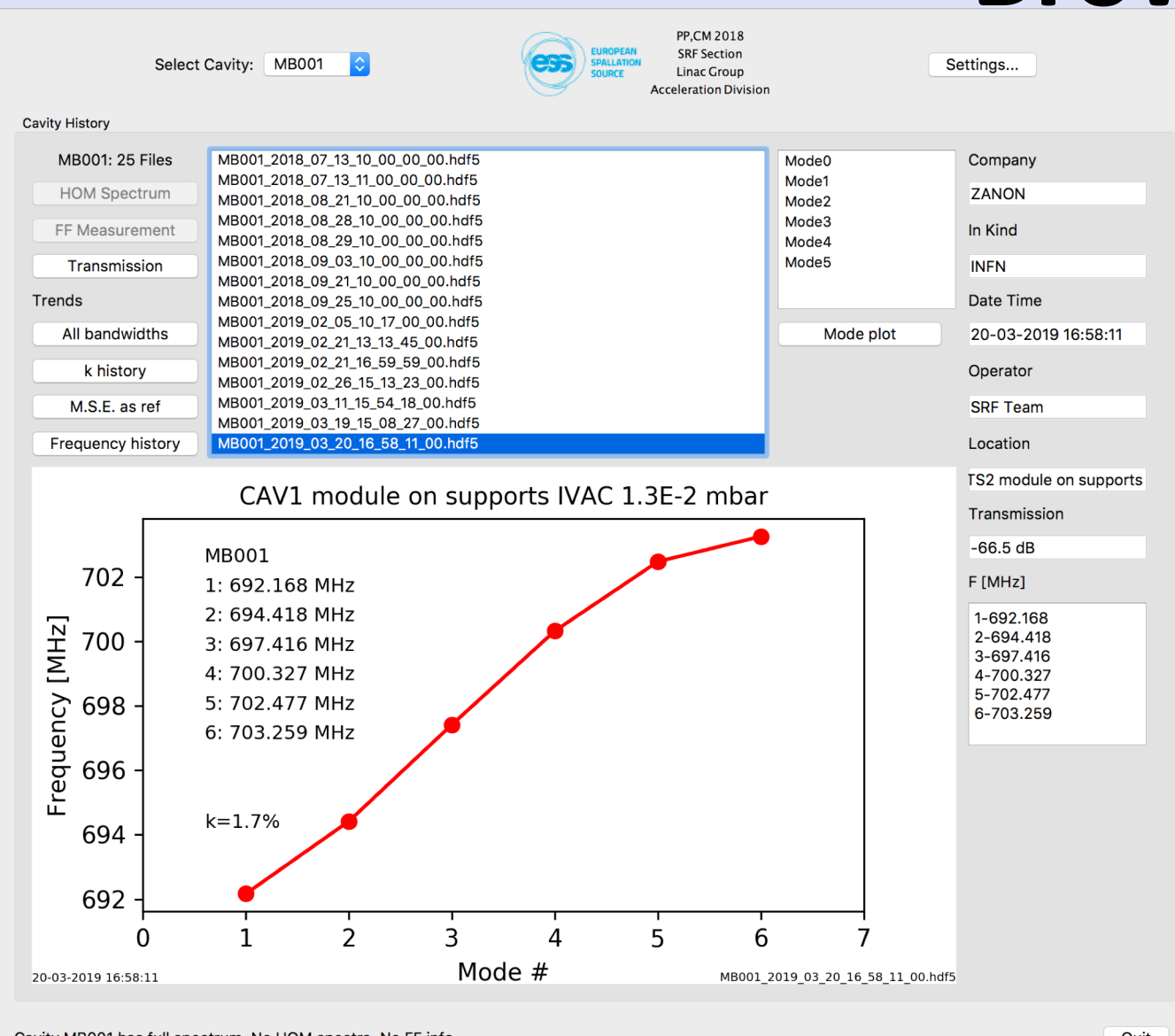
Transmission monitoring



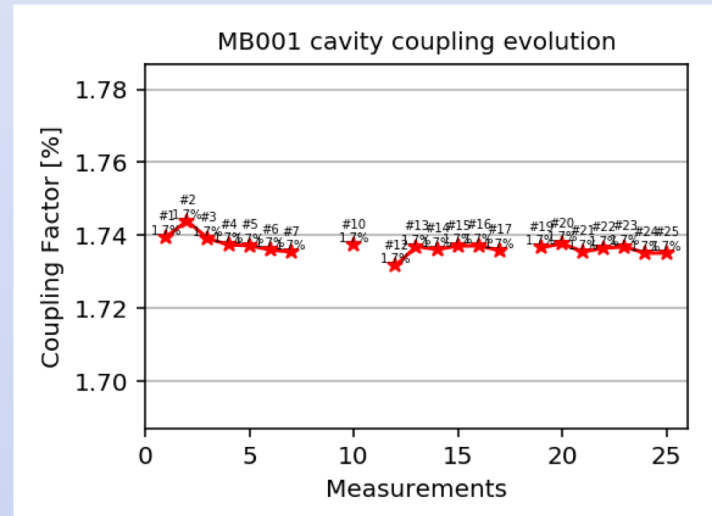
Cold Spectrum

- Cold Test
- RF calibration

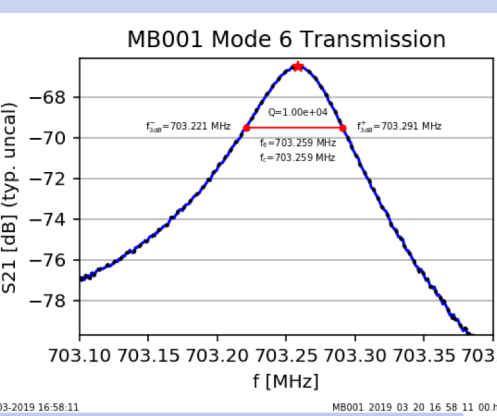
Browsers: data trends



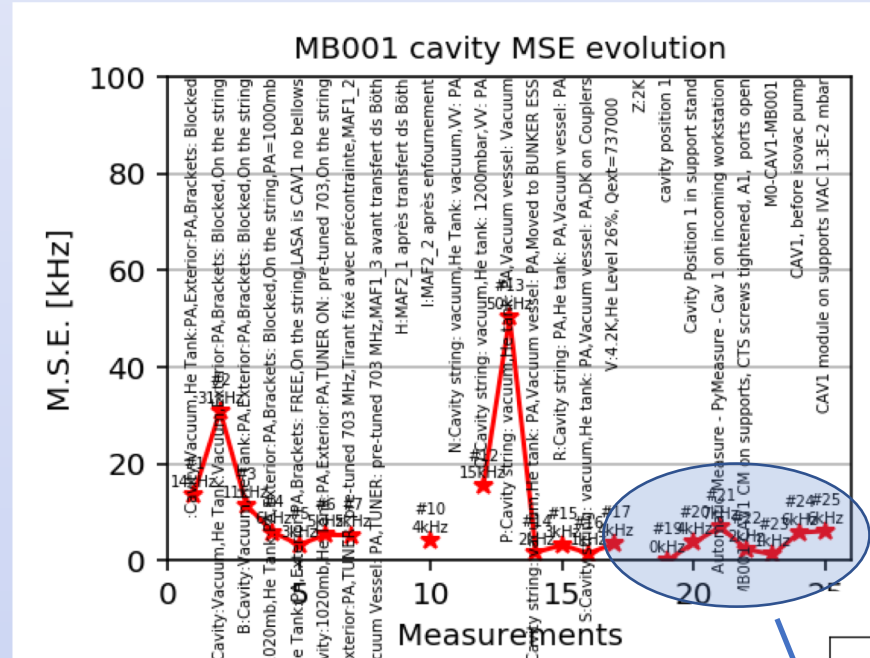
coupling



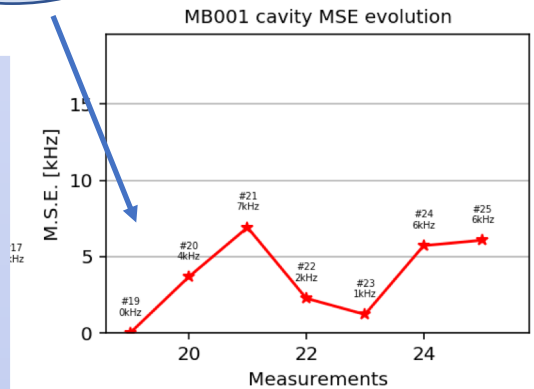
Q-values



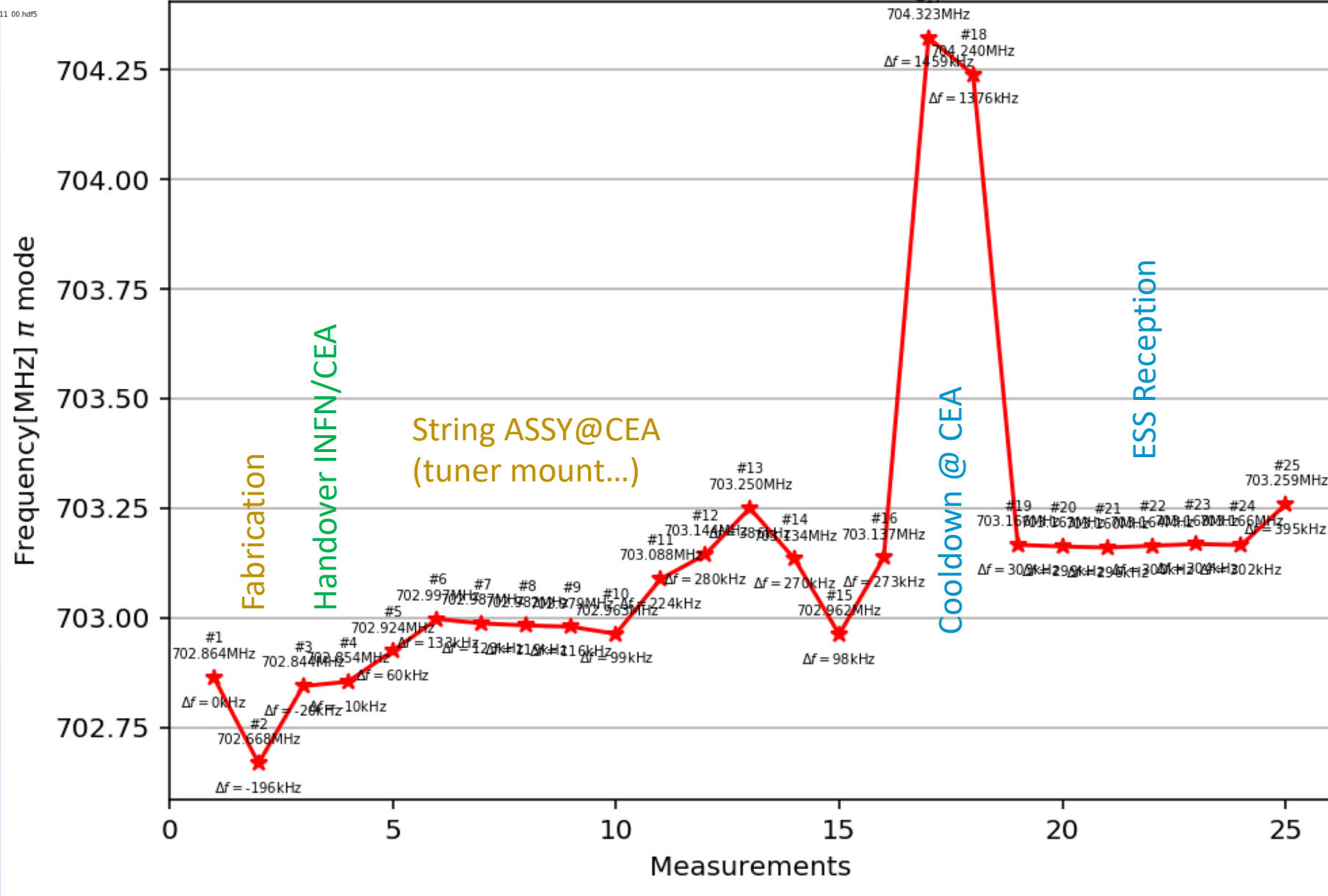
Pi-mode frequency history



MSE, Mean Spectrum Error



MB001 cavity π mode evolution

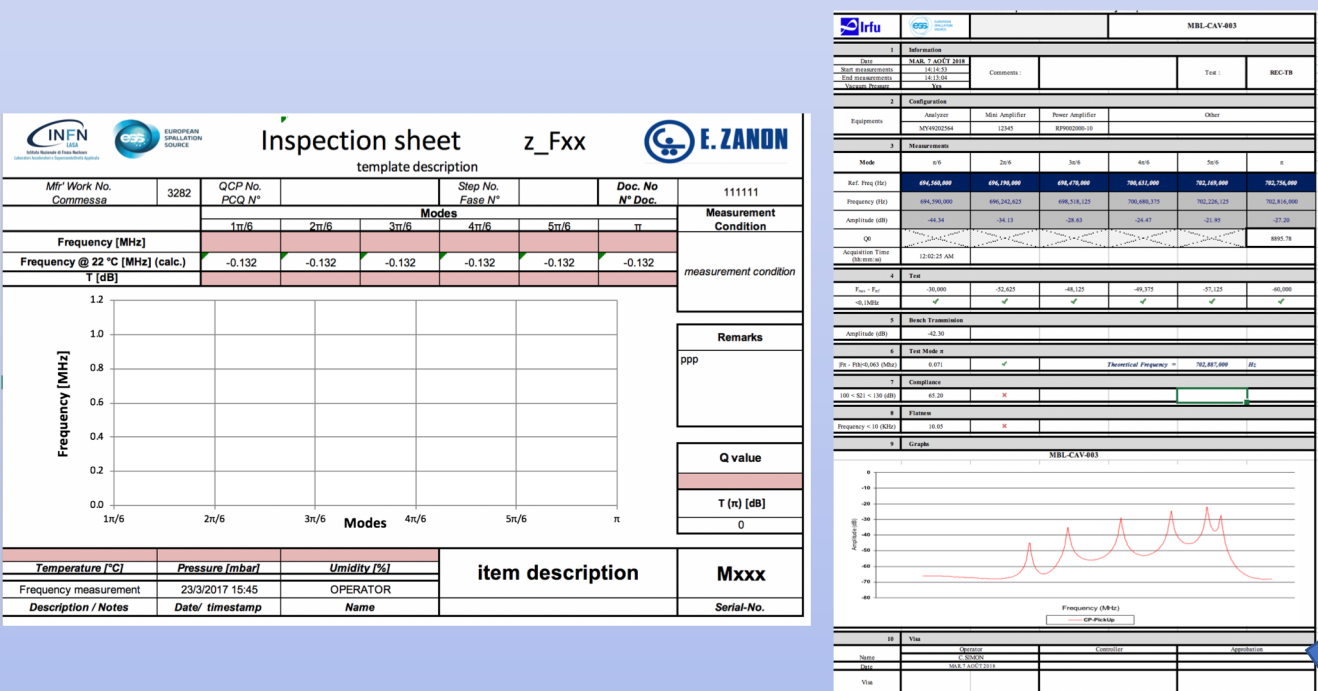


Performances of the first series module cavities

ESS Scope

MEASUREMENTS @ IKC

- After fabrication
- Intermediate handover
- Outgoing



MEASUREMENTS @ ESS

- Incoming
- Preparation TS2/Linac

Measurement&Calibration DB (ownCloud service)

<https://meas01.ess.lu.se/owncloud/index.php/login>

Live Staging Area (typ. text files or xls)

Normalized Data (HDF files, metadata)

ESS Asset Management ID Installation Structure

https://gitlab.ess.lu.se/SRF_Section

MEASUREMENTS @ IKC

- After fabrication
- Intermediate handover
- Outgoing