PETRA-III 500 MHz Cavity

Status Report

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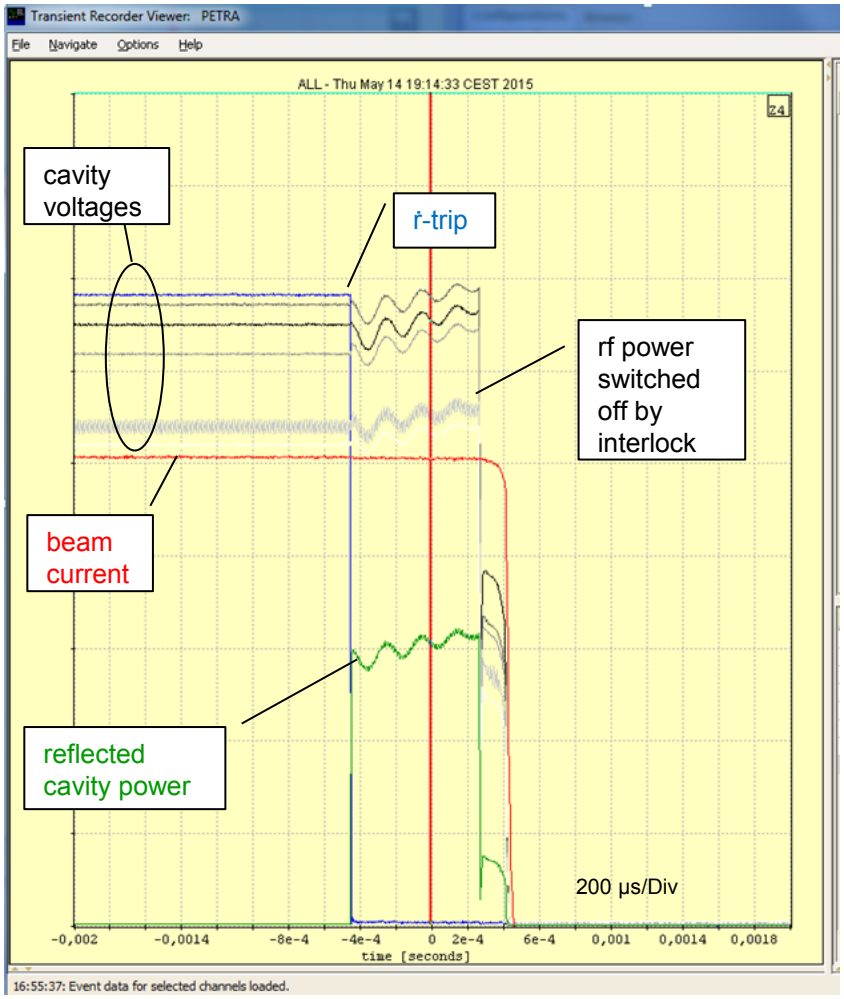
DESY-TEMF-Meeting
Hamburg, 23.01.2017

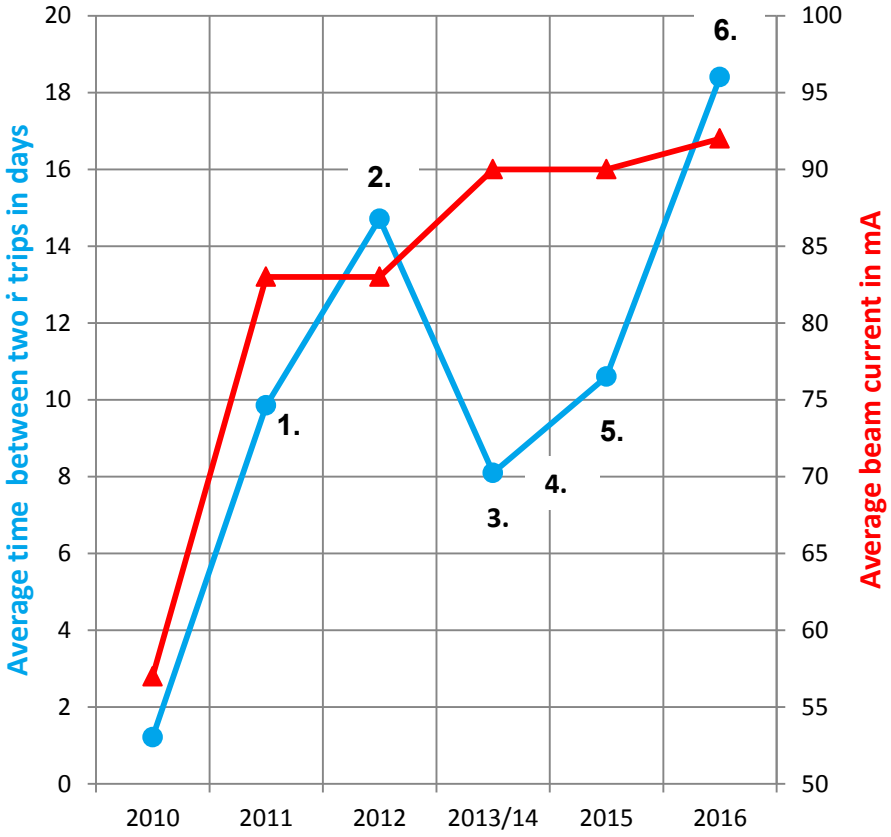
HELMHOLTZ GEMEINSCHAFT

DESY

Unsolved Reflected Power Trips „ṙ events“

Development of the ṙ event rate over the last years





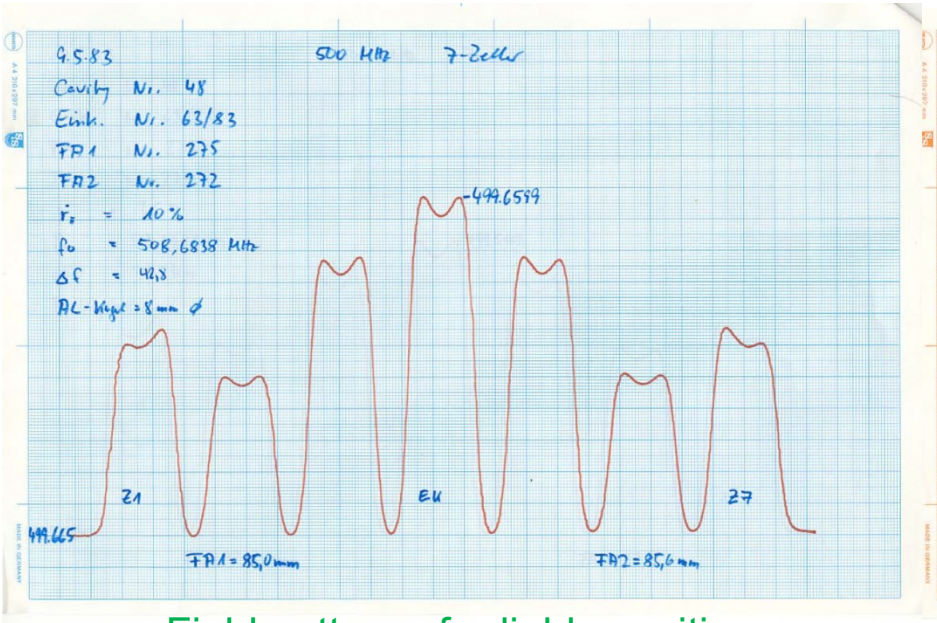
1. Cavity temperature controller installed to detune harmful HOMs
2. Temperature tuning seemed to be successful
3. Increased beam current destroyed our confidence
4. A new finding led to new hope
5. Measures taken seemed to help, but a different problem occurred
6. Measures have finally been successful

We now have a medicine, but we still do not know the cause of the problem

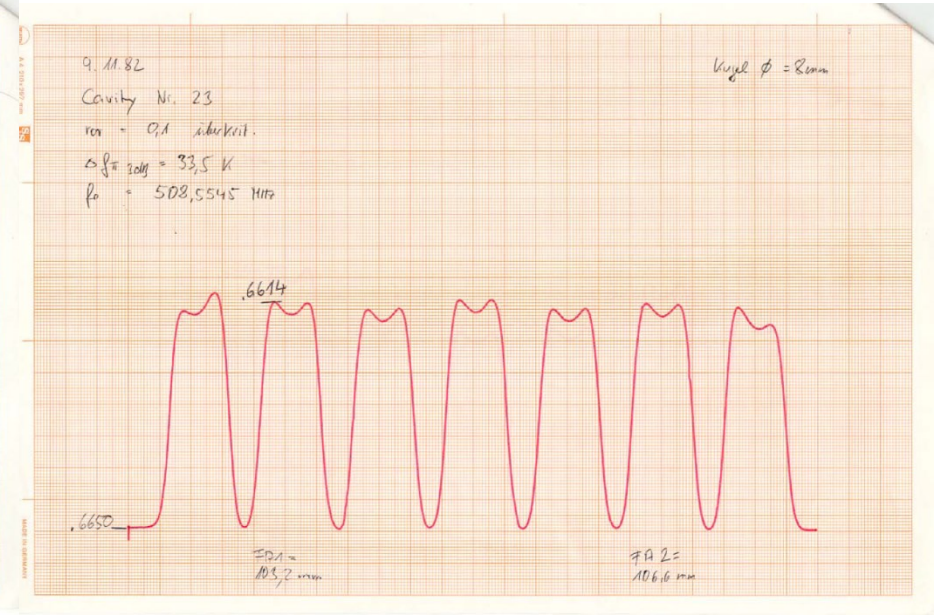
Mich

In 2014 A New Finding Led To New Hope

Old bead-pull-measurements show differences between reliable and unreliable cavities



Field pattern of reliable cavities



Field pattern of unreliable cavities

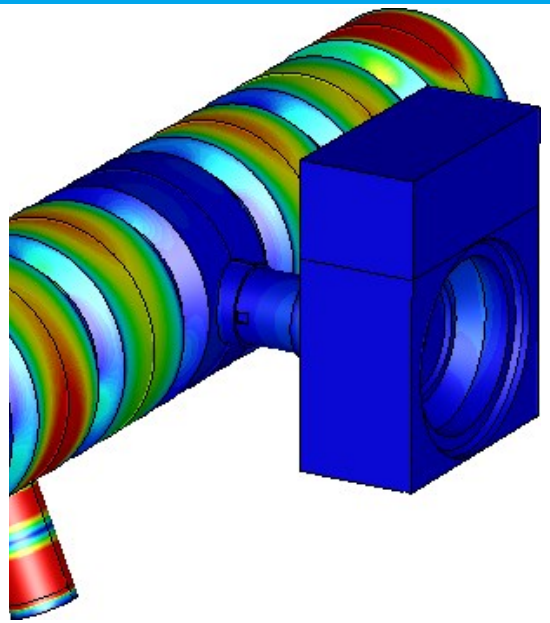
By heating the unreliable cavities up to 70 °C we could change the field pattern and turned unreliable into reliable

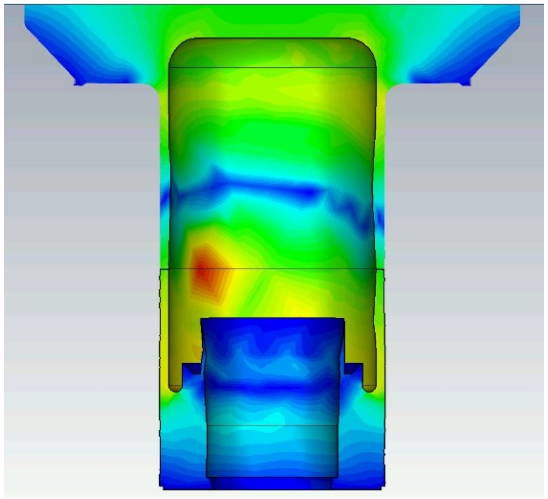
The medicine

Support by TEMF Should Help to Find the Cause

With support of the TU Darmstadt the cause of the ṙ-problem should be found

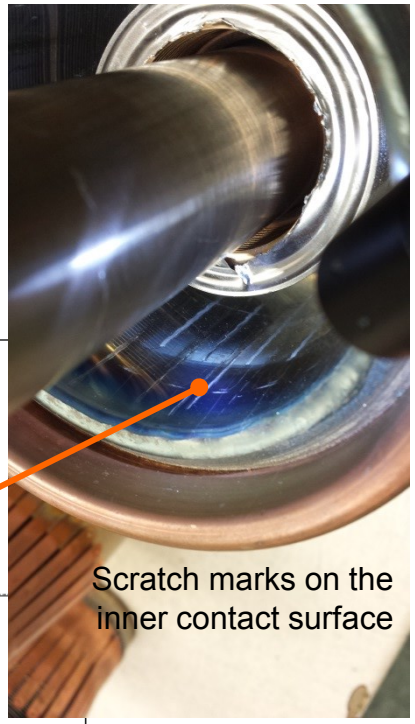
- W. Ackermann et al. built a very detailed computational model and presented first results on status meeting at DESY in January 2016
- In a next step the model was split into two different models. One representing a reliable and the other representing an unreliable cavity. The models were named „Reliable“ and „Spark“
- Expectation: conspicuous differences of the maximum field values in the range of the machine lines should lead to the cause of our ṙ-problem. W. Ackermann presented the results on March 2016
- The expectation has not been fulfilled. Found differences between the models “Reliable“ and „Spark“ did not lead to the cause of our problem
- Measurements carried out in parallel to the simulations and calculations gave some findings – but not the solution of our problem

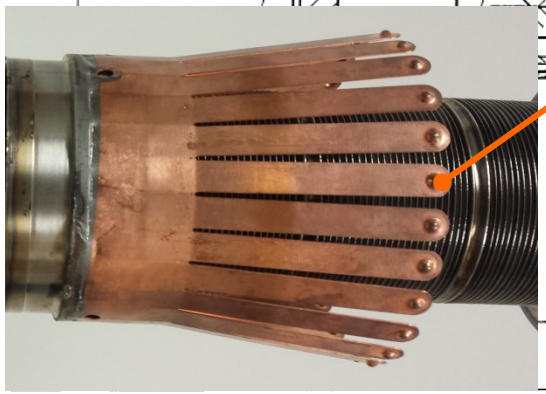


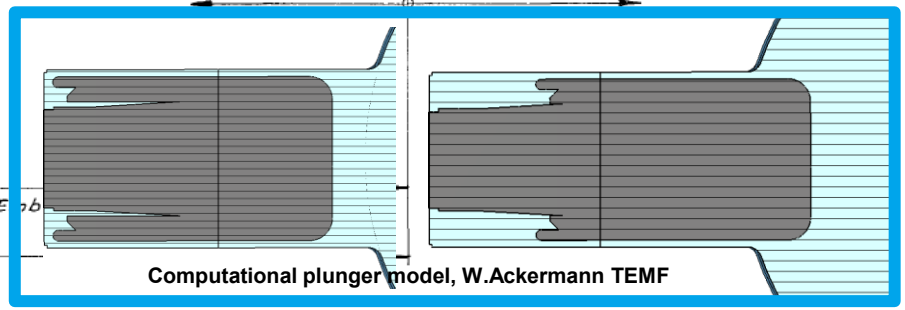


Suspect RF Springs

For decades, in the case of unexplained cavity problems, the plungers with their contact springs were always suspected

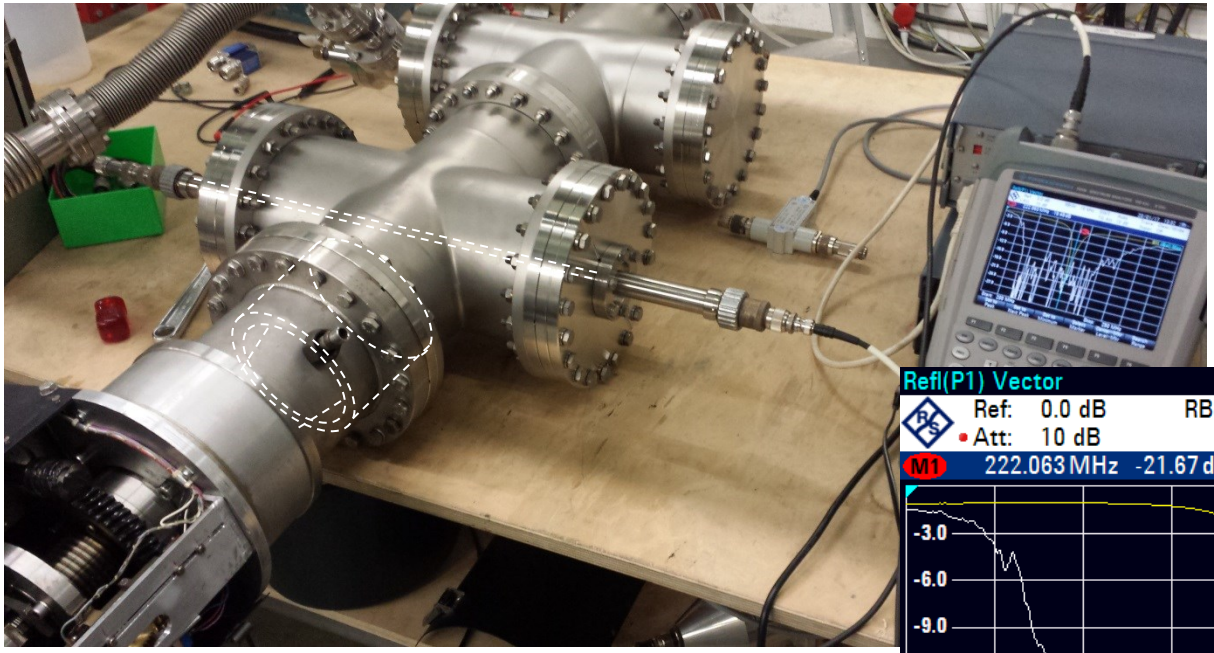


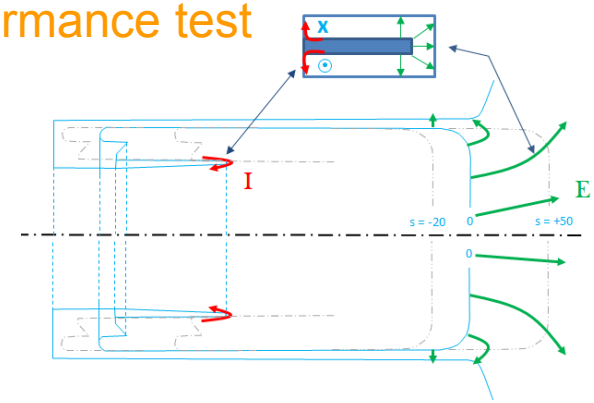


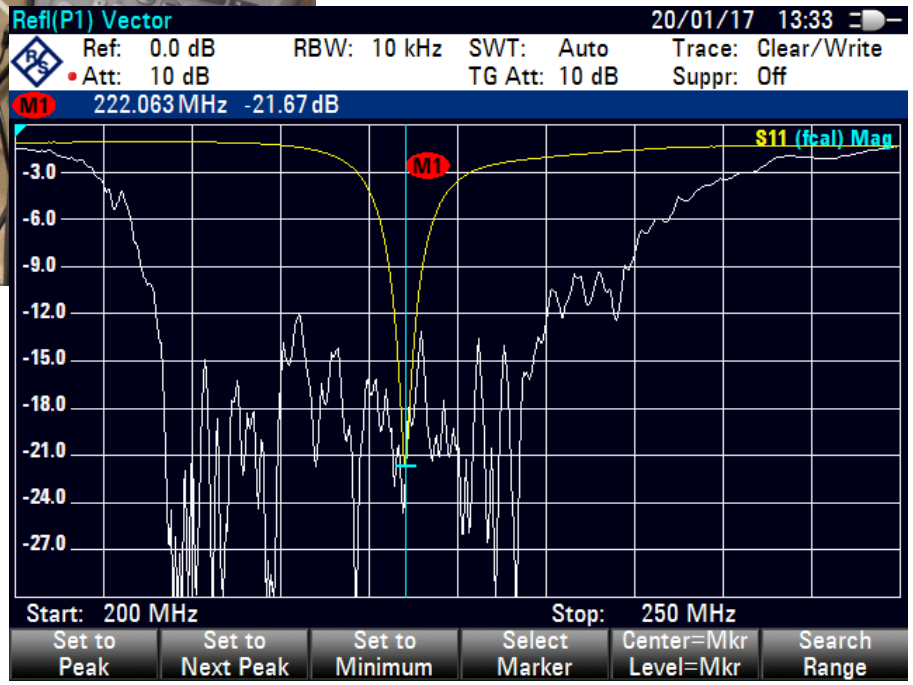


Latest Finding

New invented plunger test-apparatus for survey and performance test



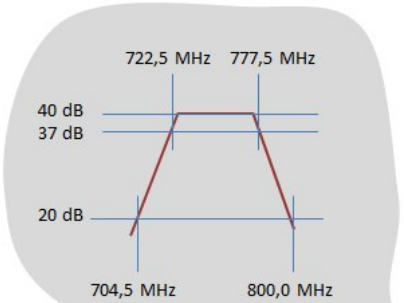


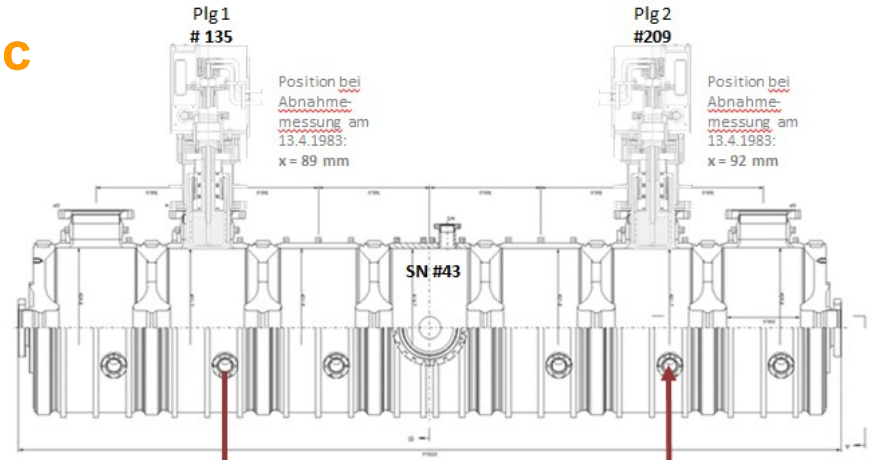


- Plunger exited as coaxial λ/4- resonator
- Observation: Resonance is jumping up/down and back/forth during the plunger runs
- This finding could be well explained by contact problems
- **Question: How could we measure this with the plunger mounted on the cavity?**

Promising Idea

In-situ plunger diagnostic





guitar amplifier

radio scanner

rf millivoltmeter

WBK 750-45-3SS

MCL
TIA-1000-1R8-2
071006B

WBK 750-45-3SS

790-1000 MHz

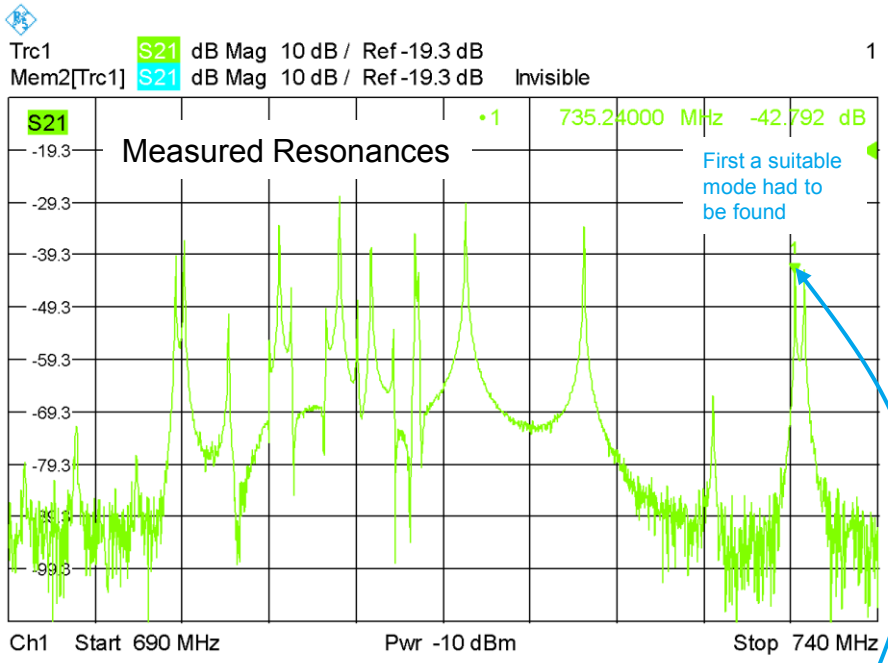
Philips
2722 162 03261

50 dB

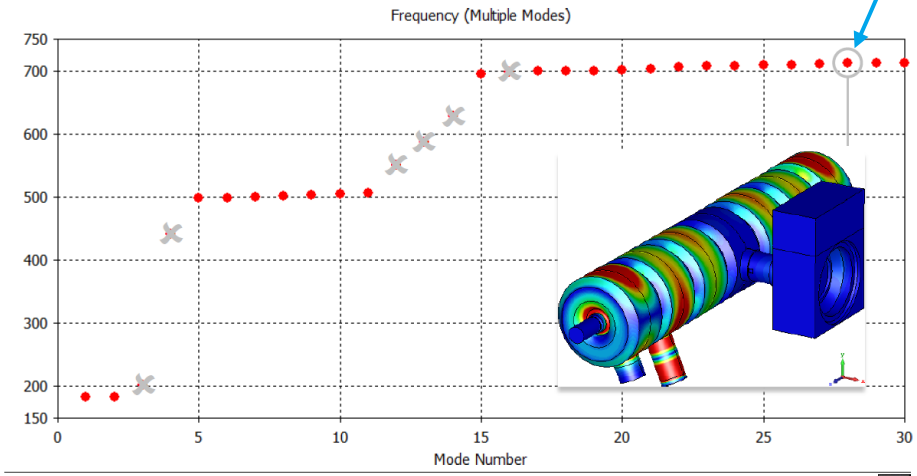
MCL
ZHL-20W -13

rf generator

Crucial Test



▪ Calculated Resonances



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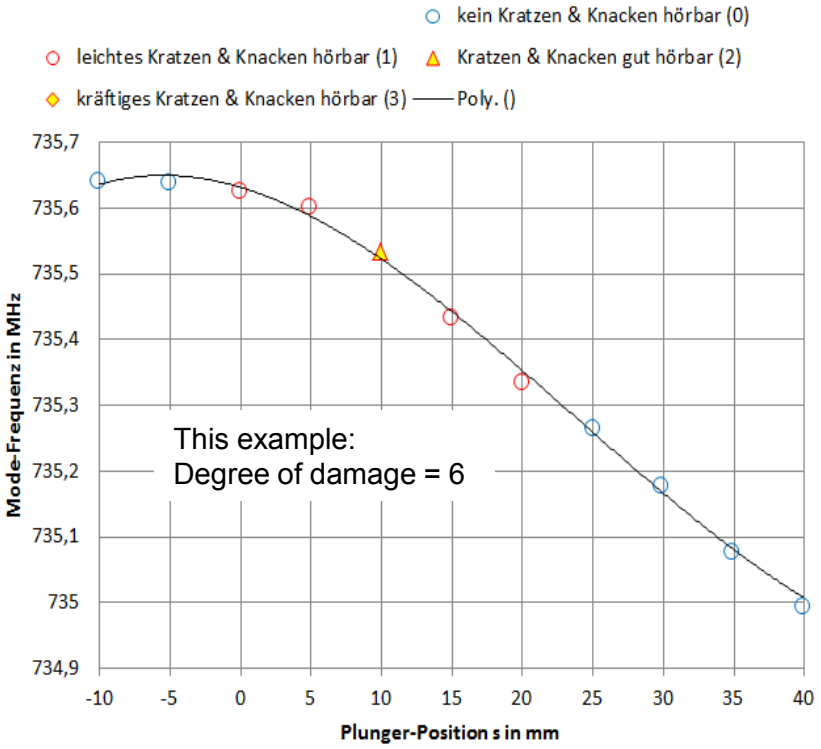
Measuring the degree of damage

We defined:
degree of damage = sum of classification numbers

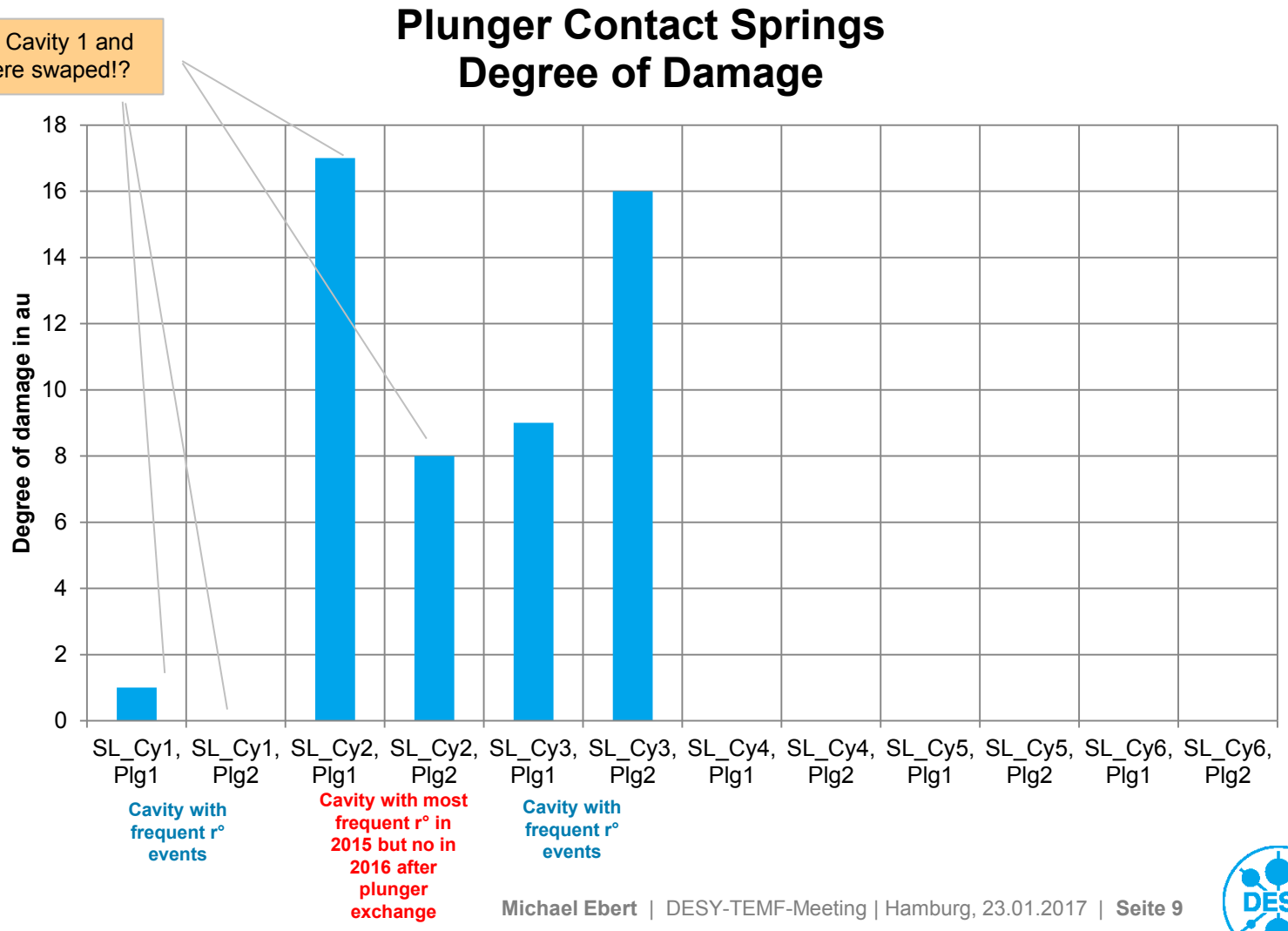


Plunger-SN 135 measured in Cavity-SN 48

Result of the In-Situ Plunger Diagnostic @ PETRA-III

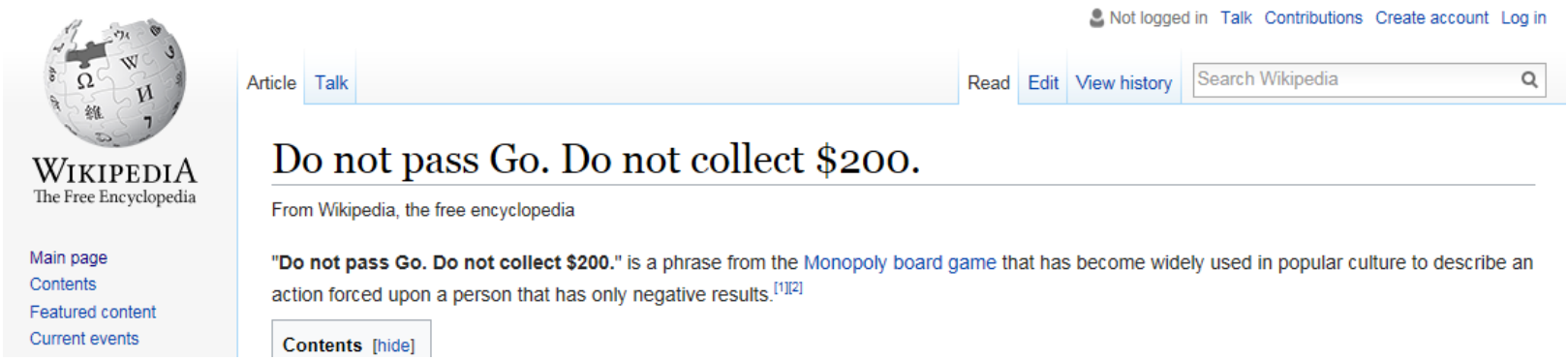
The result is completely unexpected and has potential for demotivation

It looks like Cavity 1 and Cavity 2 were swaped!?



Outlook

Gehe zurück auf Los!



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Thank you for your attention!

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DESY