

FLASH Seminar at January 26<sup>th</sup> 2010

## Status of the 3<sup>rd</sup> Harmonic Module ACC39

- purpose of the system
- the subsystems and the work distribution
- survey on all the work done
- test results
- actual status
- what comes next

Elmar Vogel for everyone involved in the FLASH 3<sup>rd</sup> harmonic system

## Bunch-Compression at FLASH

## Linearization by 3<sup>rd</sup> harmonic

Additional effects: space charge, longitudinal wake fields, ...

**Sum voltage** required: ~19 MV

Using nine-cell superconducting cavities

## The geometry of 3.9 GHz cavities follows the one of 1.3 GHz cavities

With 14 MV/m we need four cavities ...

## FNAL build 3.9 GHz module ACC39

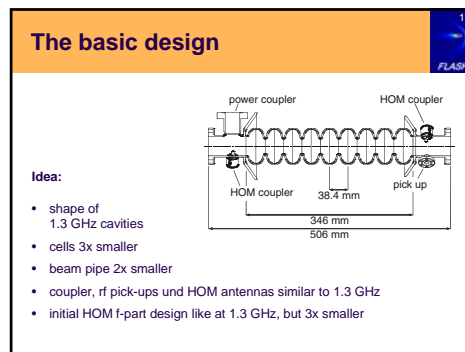
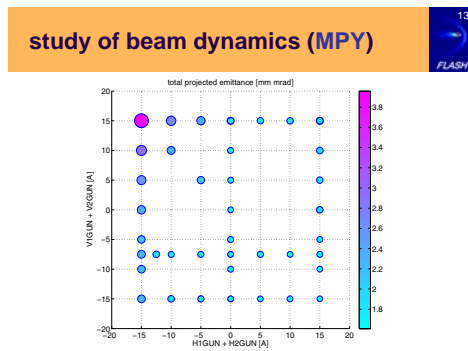
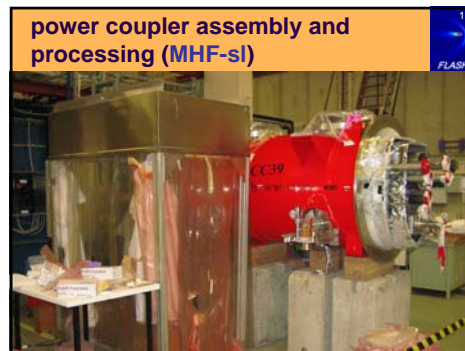
**ACC39 contains four! 3.9 GHz cavities.**

## DESY colleagues are taking care of the power rf (MIN)

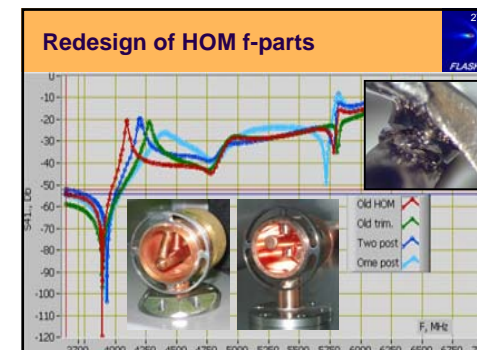
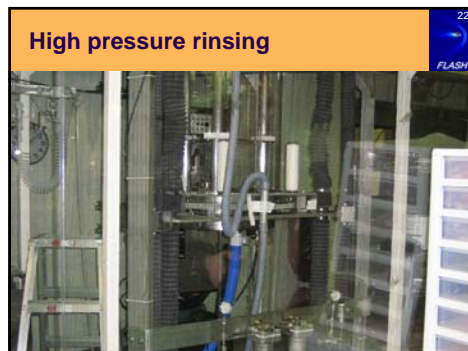
## cavity tuner motor drivers (MCS2)

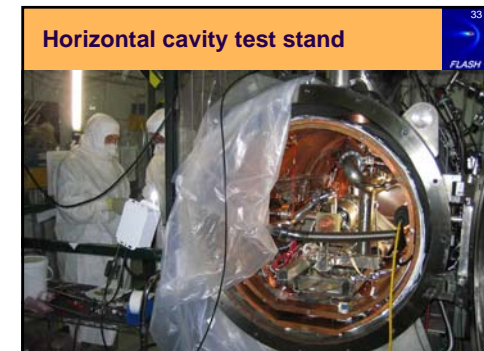
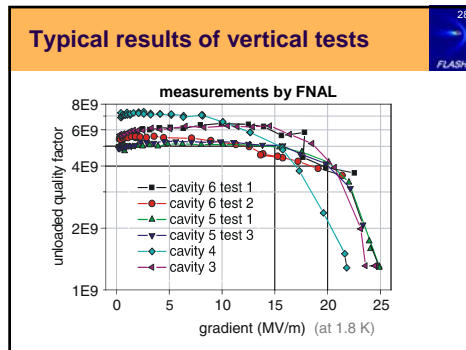
## rf-control (MSK)

## cryogenic integration (MKS1)







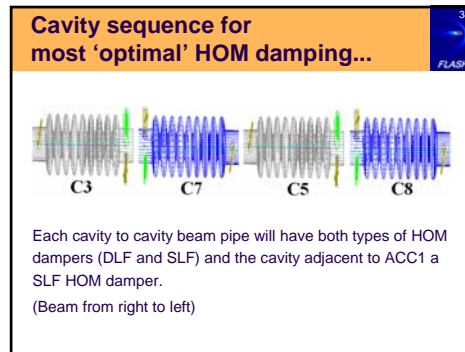
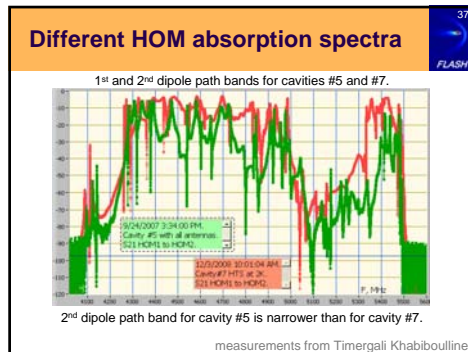


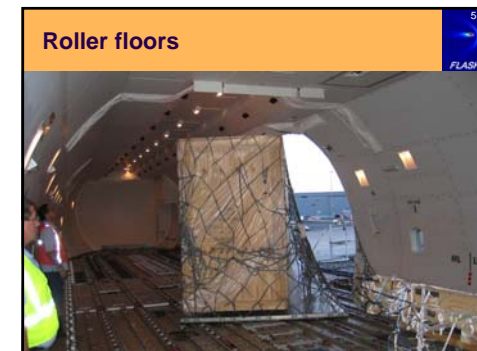
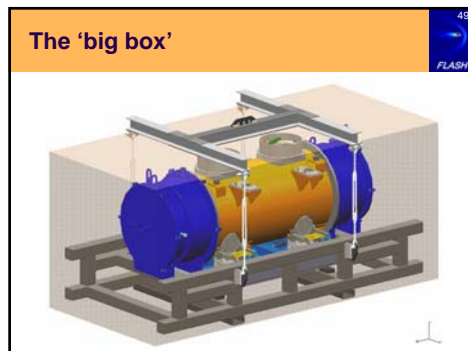
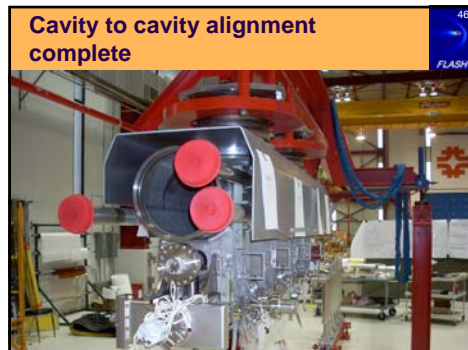
### Performance of the four cavities

cavity	maximum <u>horizontal</u> gradient achieved	no field emission measured below a gradient of
F3A5	22 MV/m	18 MV/m
F3A3	22 MV/m	18 MV/m
F3A7	26 MV/m	21.7 MV/m
F3A8	24 MV/m	18.3 MV/m

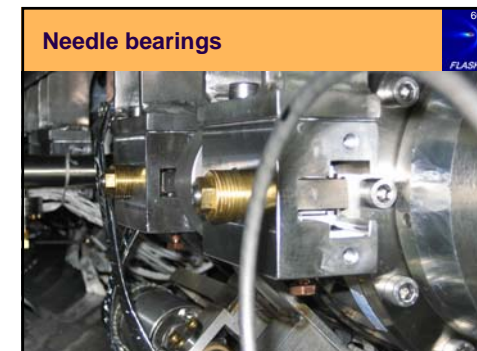


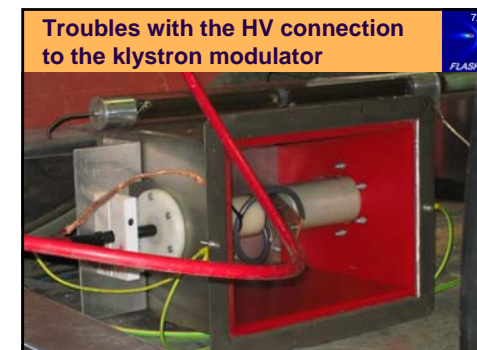
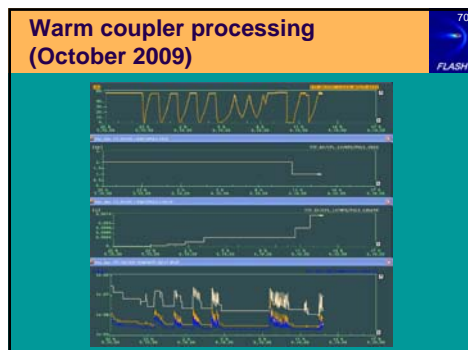
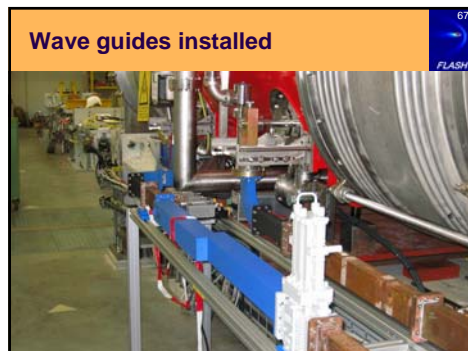




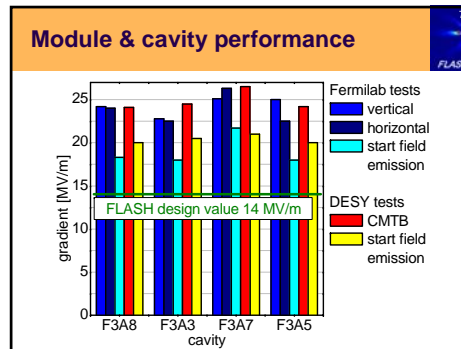
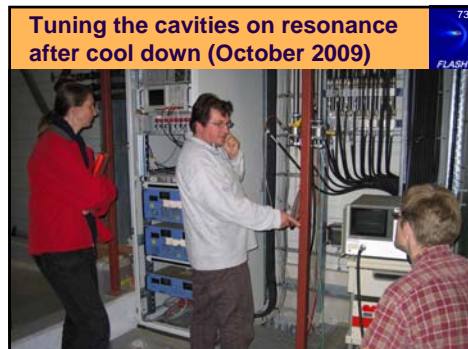










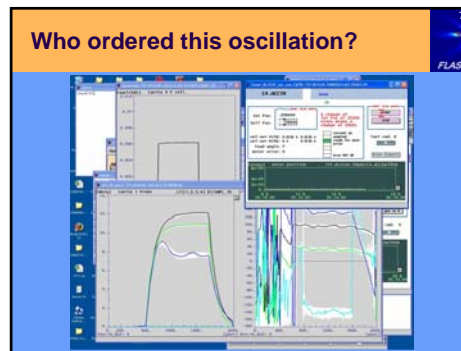


**Cross talk between the cavities**

Coupling matrix:

$$\begin{pmatrix} 1 & 0.051 & 0.005 & 0.002 \\ 0.546 & 1 & 0.016 & 0.022 \\ 0.008 & 0.035 & 1 & 0.123 \\ 0.003 & 0.002 & 0.107 & 1 \end{pmatrix}$$

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**RF control stability finally achieved**

ACC39	required	measured
$\frac{\Delta A}{A} =$	$1 \cdot 10^{-4}$	$1.3 \cdot 10^{-5}$
$\Delta \phi =$	$0.03^\circ$	$0.003^\circ$

See FLASH Seminar Talk 'Status of 3.9 GHz LLRF' from Markus Hoffmann given at January 12<sup>th</sup> 2010

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