

WP4 Wrap-up

R. Calaga, 21 Nov 2014

Are we on track for crabs ?

What still is required for HL-LHC ?

Do we need a harmonic system ?

Which one ?

Crabs: Since HiLumi Last

Tested 3-prototypes

3 world record results in superconducting deflecting cavities

Down-selected to 2 cavities -May 2014 Review

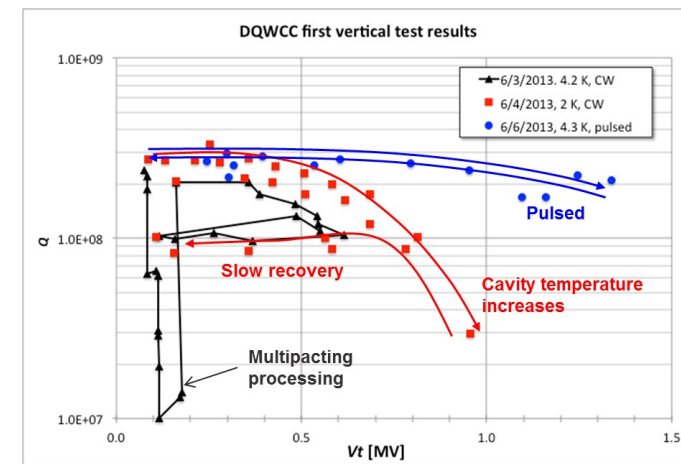
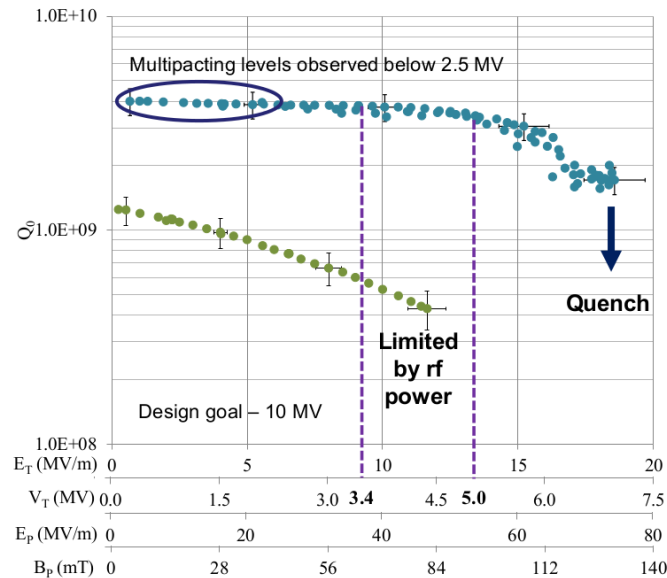
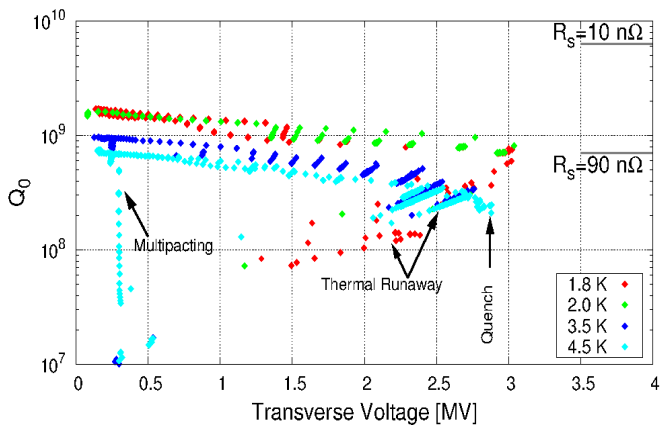
Developed the basic unit 2-Cavity Cryomodule

Several novel concepts -unconventional constraints

Defined SPS/LHC RF architecture, cryo & integration

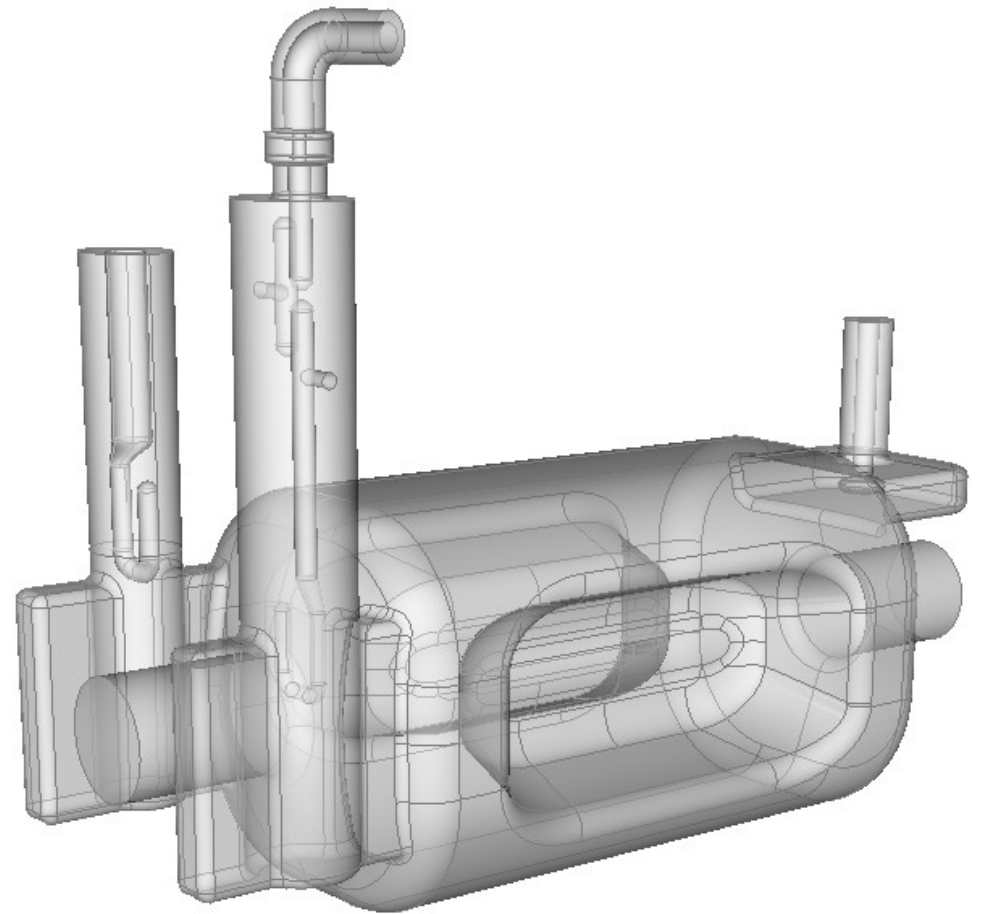
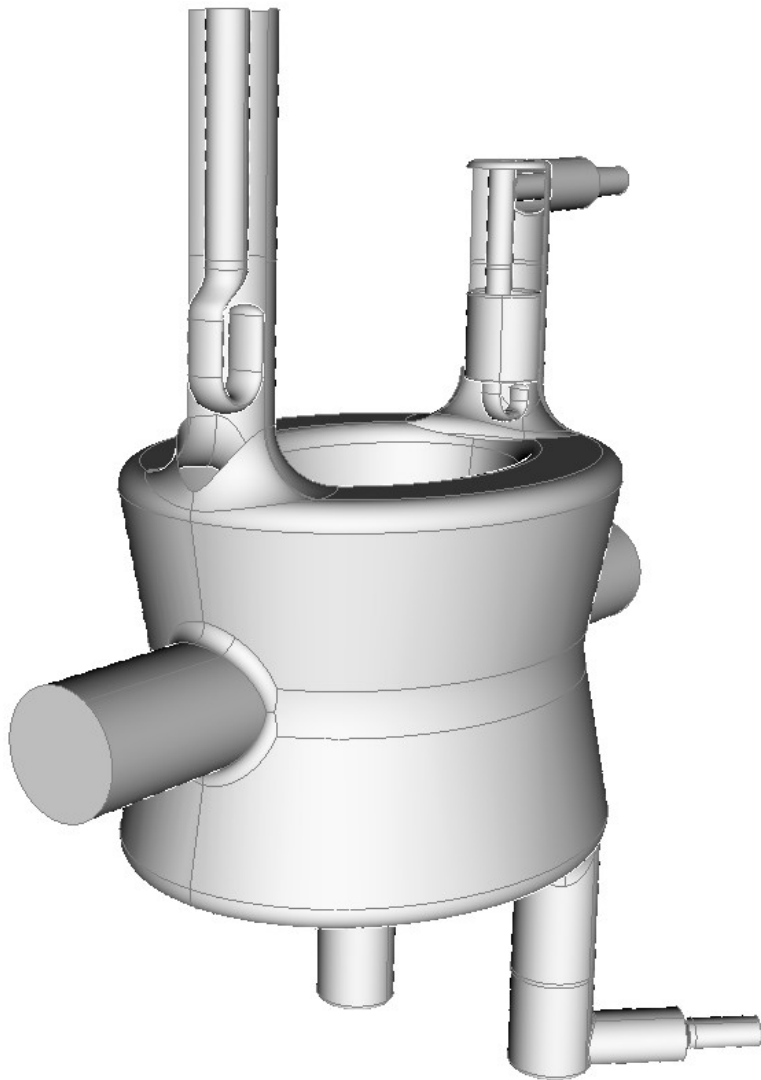
HL-LHC Crab Cavities

Three world record deflecting fields in superconducting LHC crab cavities



RF Design Endorsed by International Expert Panel

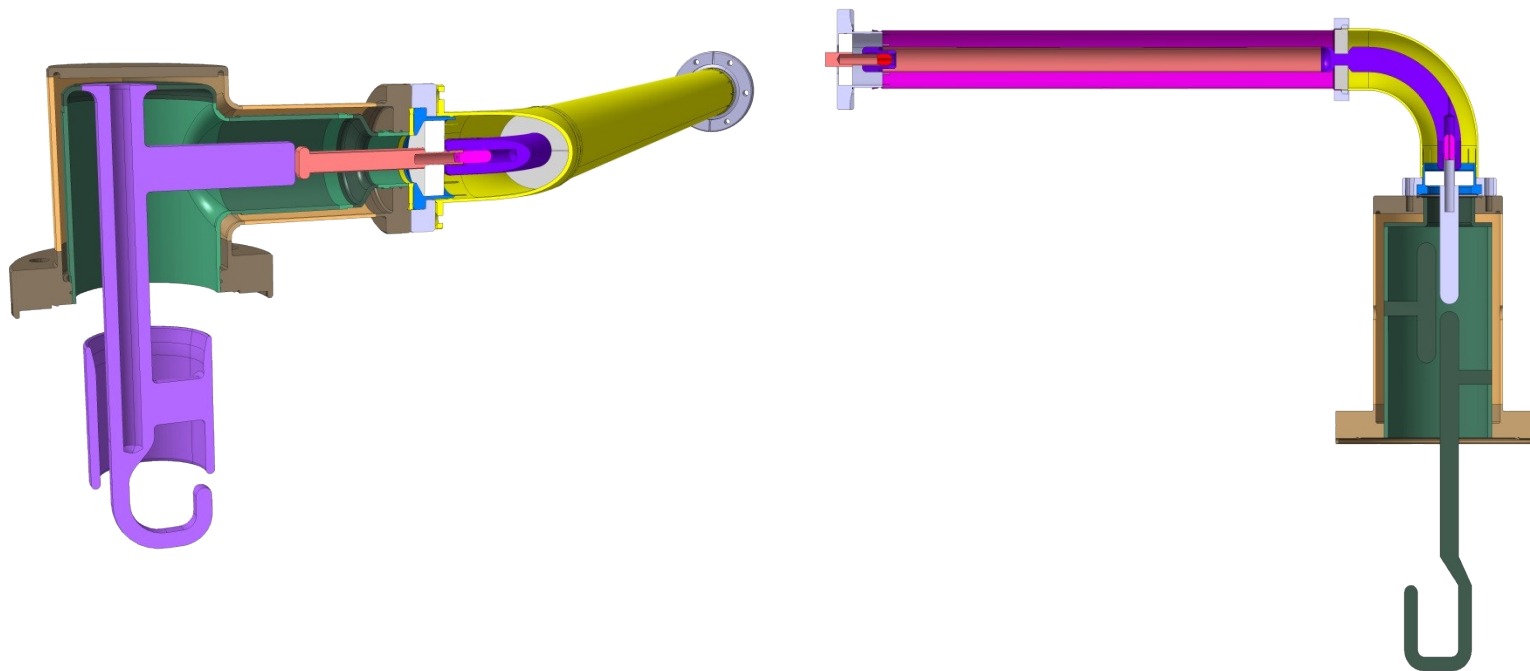
(Thanks to the effort from USLARP, UK & CERN)



HOM Damping

Sophisticated higher order mode damping schemes, but impedances still high according to WP2 (N. Biancacci et al.)

Needs some followup, freq spread helps tremendously
Added impedance effects in the SPS might not be visible



RF Noise & Multipoles

Fresh look at RF noise

Conclusion: cannot ignore amplitude noise (Ohmi/Baudrenghien)

Tetrode/IOT noise is small, but dominant noise source from LLRF demodulator → New low noise designs should satisfy our needs

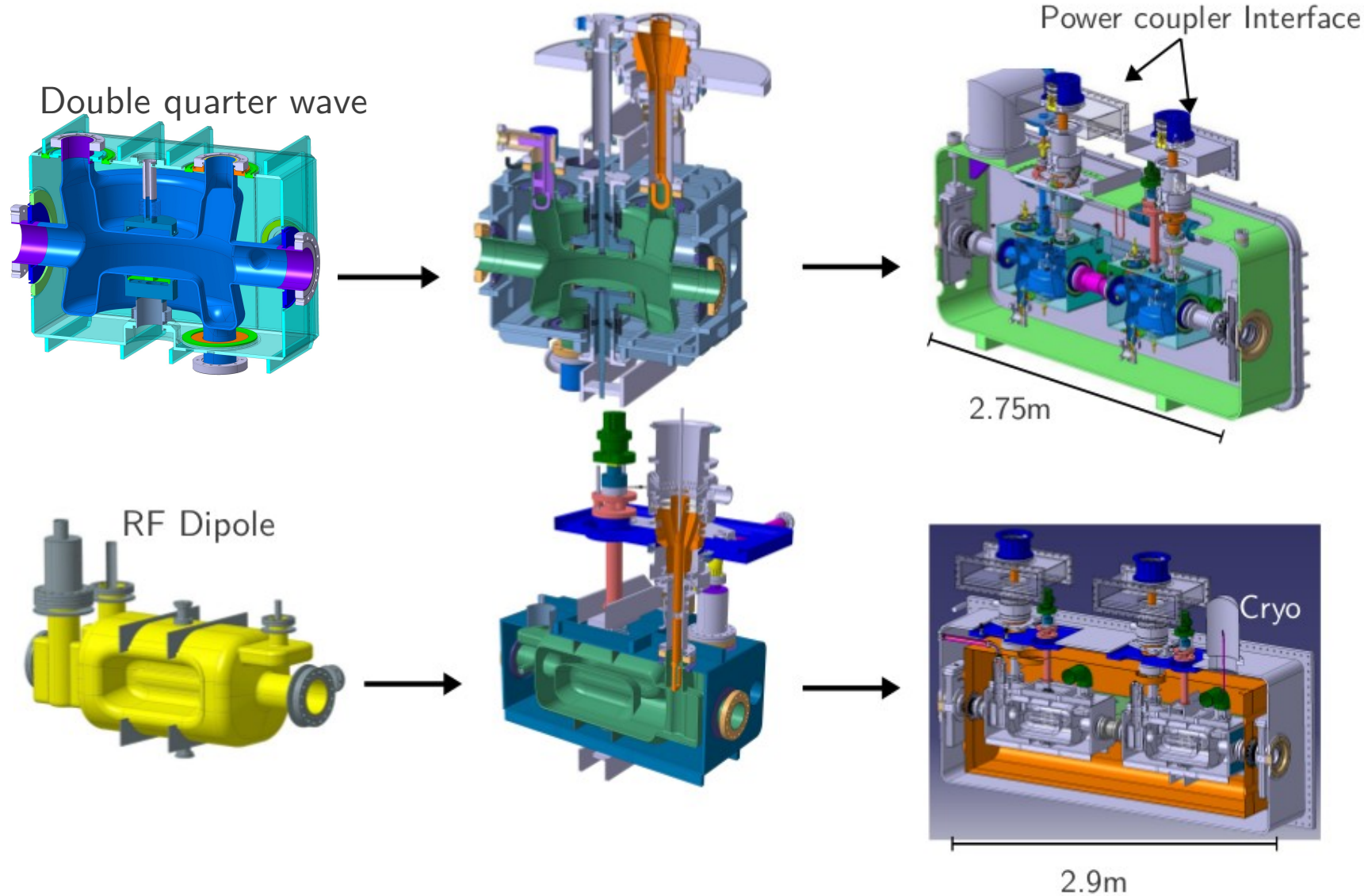
b_2/a_2 fabrication tolerances should not exceed 16/27 units

b_3/a_3 is well within tolerances (J. Barranco et al.)

CM Design on Accelerated Pace

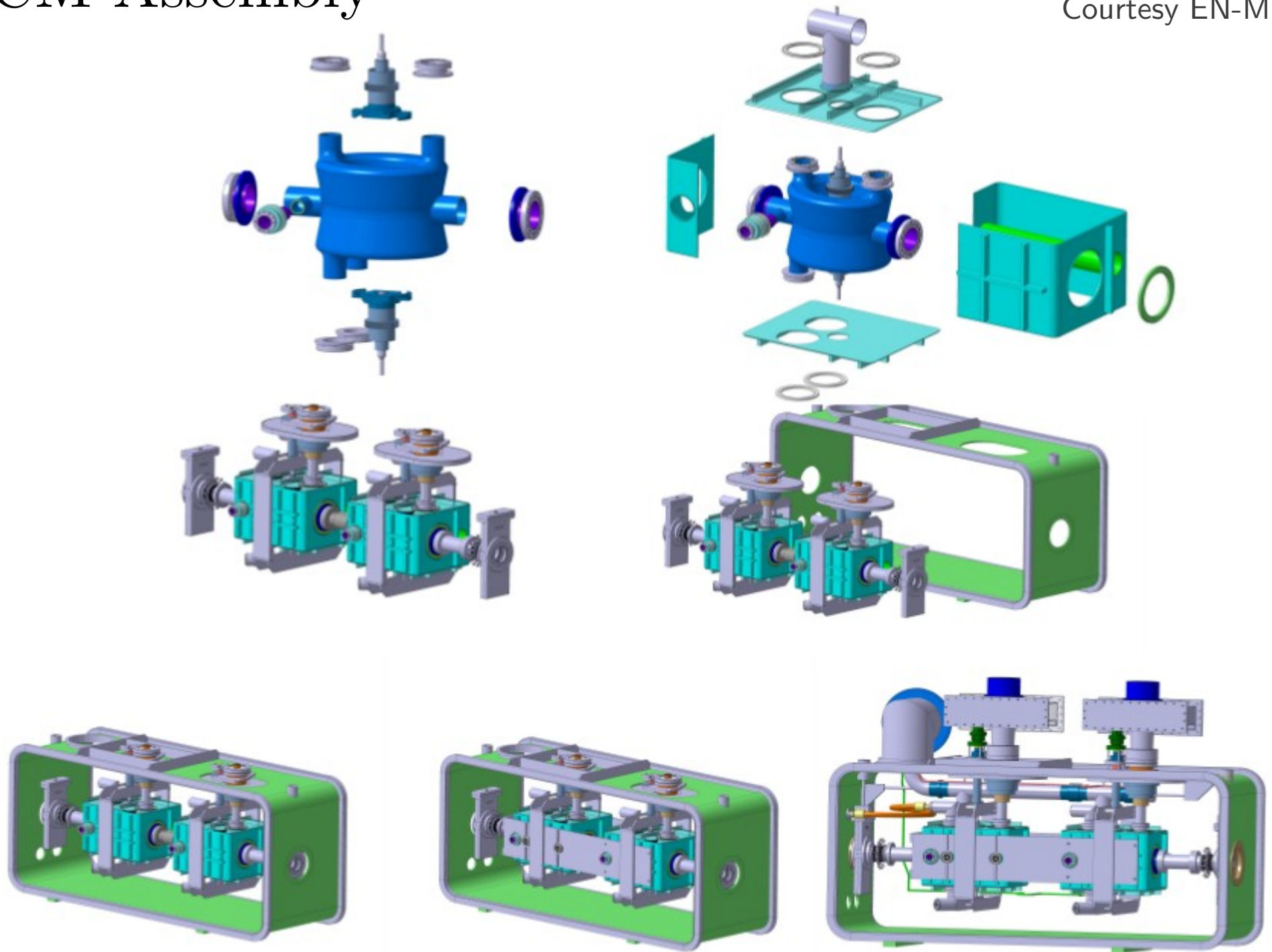
(Chapeau to EN-MME, USLARP & UK)

In approx 1 year



CM Assembly

Courtesy EN-MME



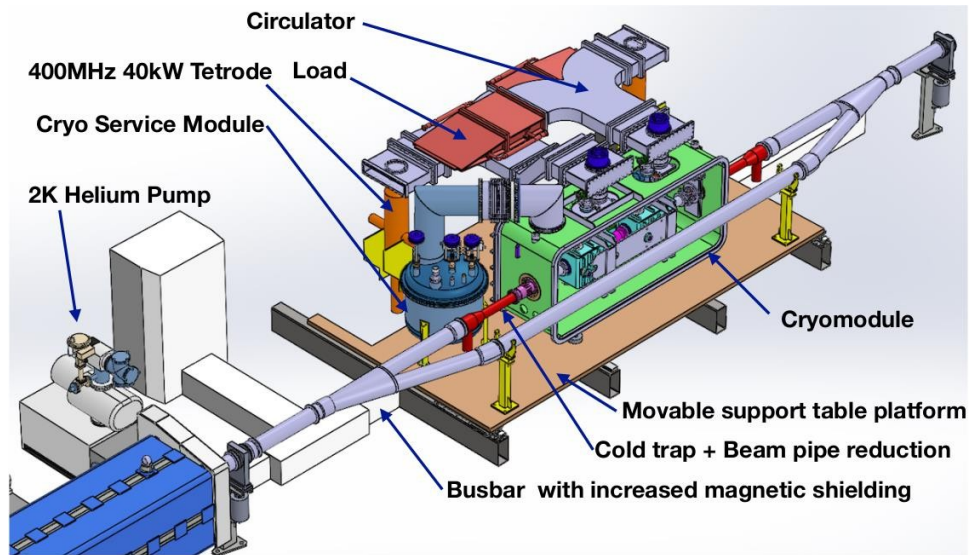
First Life



Test pieces in copper
Courtesy Niowave/USLARP



SPS-BA4 Integration under CCTC is advancing well



Installation in EYETS
very tight

Some 2K infrastructure installed in



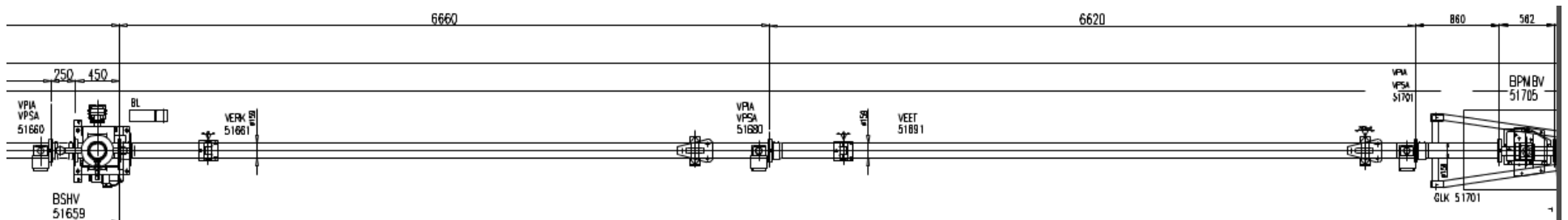
Cryogenics delivered as promised for
& solved the TCF20 bottleneck
(Arigatou !)

But present conclusion:

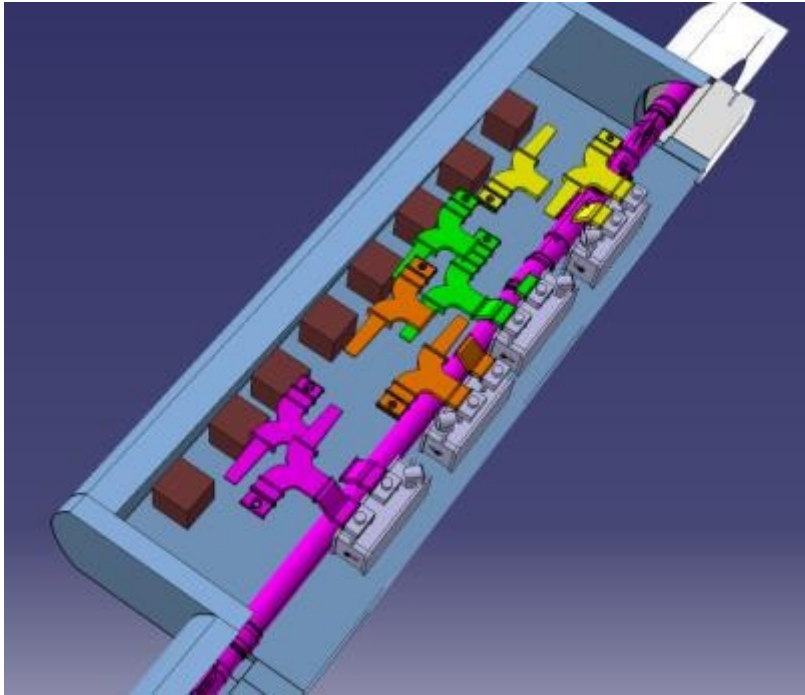
Operation of COLDEX in 2016 for aC-Coating



The option for a 2nd dogleg
at LSS5 (51661 & 51691)
will be revived

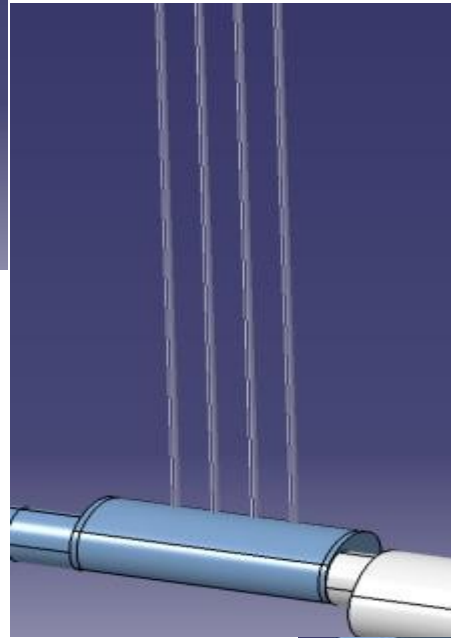


Surface RF Installation

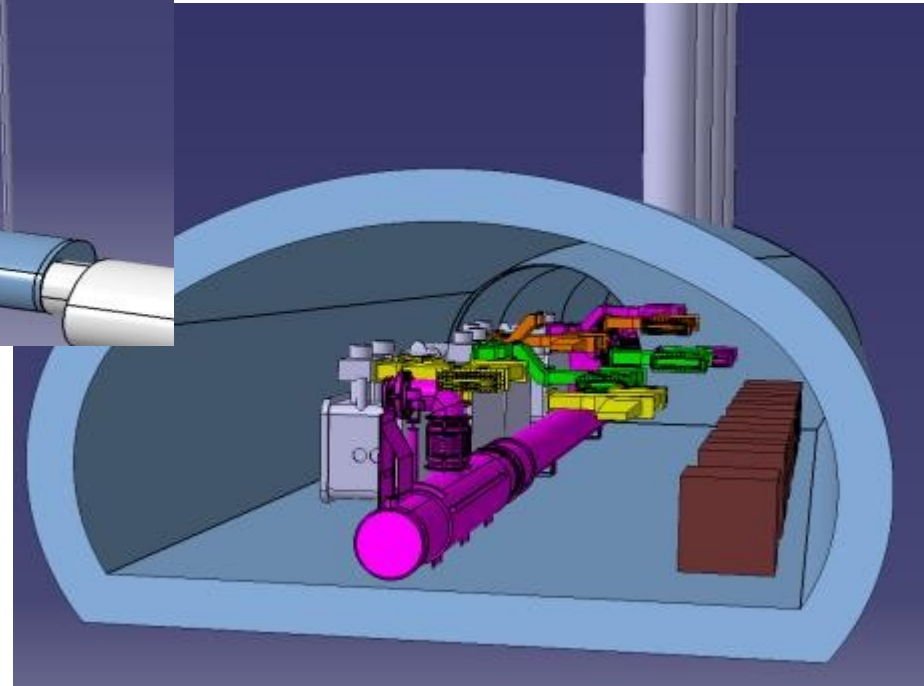


LHC Integration Studies Launched (P. Fessia et al.)

90m cores



Tunnel



Non-trivial civil
engineering.

Harmonic System, Which One ?

E. Shaposhnikova

800 MHz: Beam stability*

200 MHz: Performance, e-cloud, pileup, & beam stability

J. E. Muller

	N_b	Single RF	BSM	BLM
200 + 400 MHz 6 MV, 3 MV	2.4×10^{11}	3.25 eVs (1.8 ns)	2.38 eVs (1.31 ns)	0.70 eVs (1.25 ns)
400 + 800 MHz 16 MV, 8 MV	2.2×10^{11}	2.16 eVs (0.97 ns)	1.72 eVs (0.77 ns)	~0.45 eVs (0.65 ns)

Harmonic system is necessary in the SPS already today

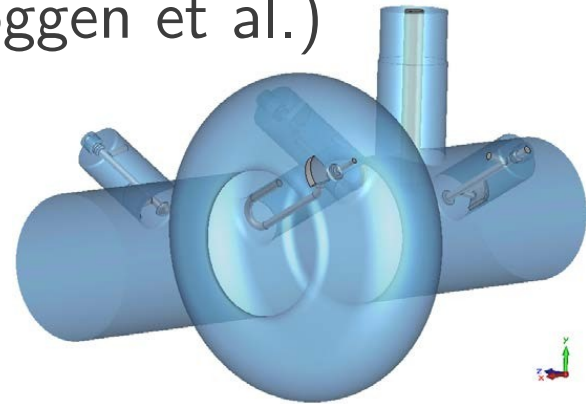
LHC will not wait 5-6 yrs when it needs it !

(* Today we do not question the need for octupoles or transverse damper)

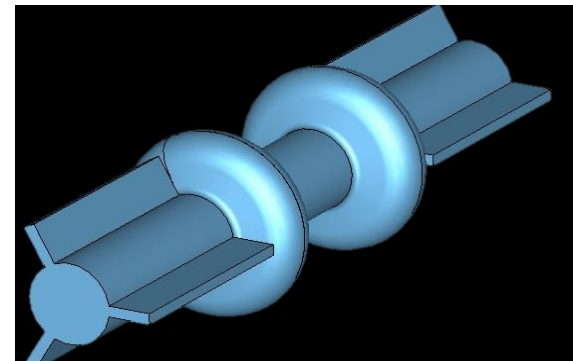
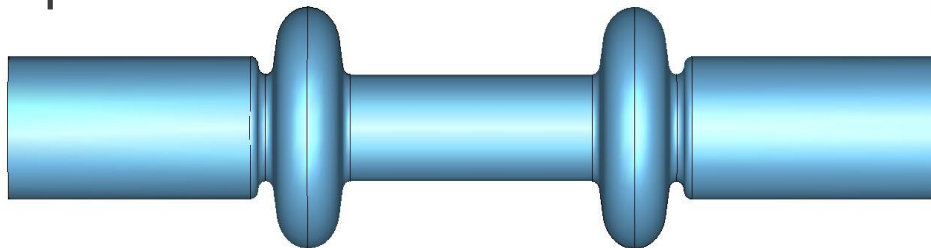
800 MHz

2-Cavity Module could already do the job
(Flattening feasible in BSM mode)

Baseline Design (L. Ficcadenti, T. Roggen et al.)
Scaled 400 MHz design



Alternate Ideas (Y. Shashkov, M. Zobov)
Adapted from KEKB & Cornell



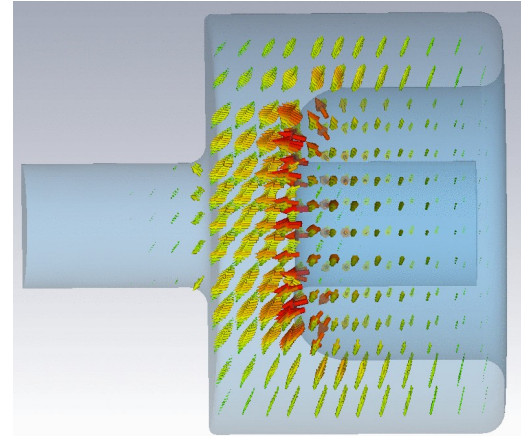
200 MHz

At present only a paper concept

A working design by next HiLumi Meeting

If experiments will not ask for bunch
length < 10 cm, then the obvious choice

If e-cloud cannot be solved,
may become mandatory (see R. Tomas)



Crab Diagnostics

Several diagnostics reviewed in view of SPS crab tests

BQM, Multiband instability monitor, headtail monitor etc.. (T.Mastoridis)

SPS damper upgrade and wide band feedback system,
useful diagnostic tool for crab cavity tests and check interplay
(W. Hofle, J. Fox et al.).

Future SPS measurements to better understand the
natural emittance growth (Y. Papaphilippou)

Many thanks to our KEK colleagues for the wonderful evening



Free alcohol and a summary the day after is brutal!