TESLA Technology Collaboration Meeting

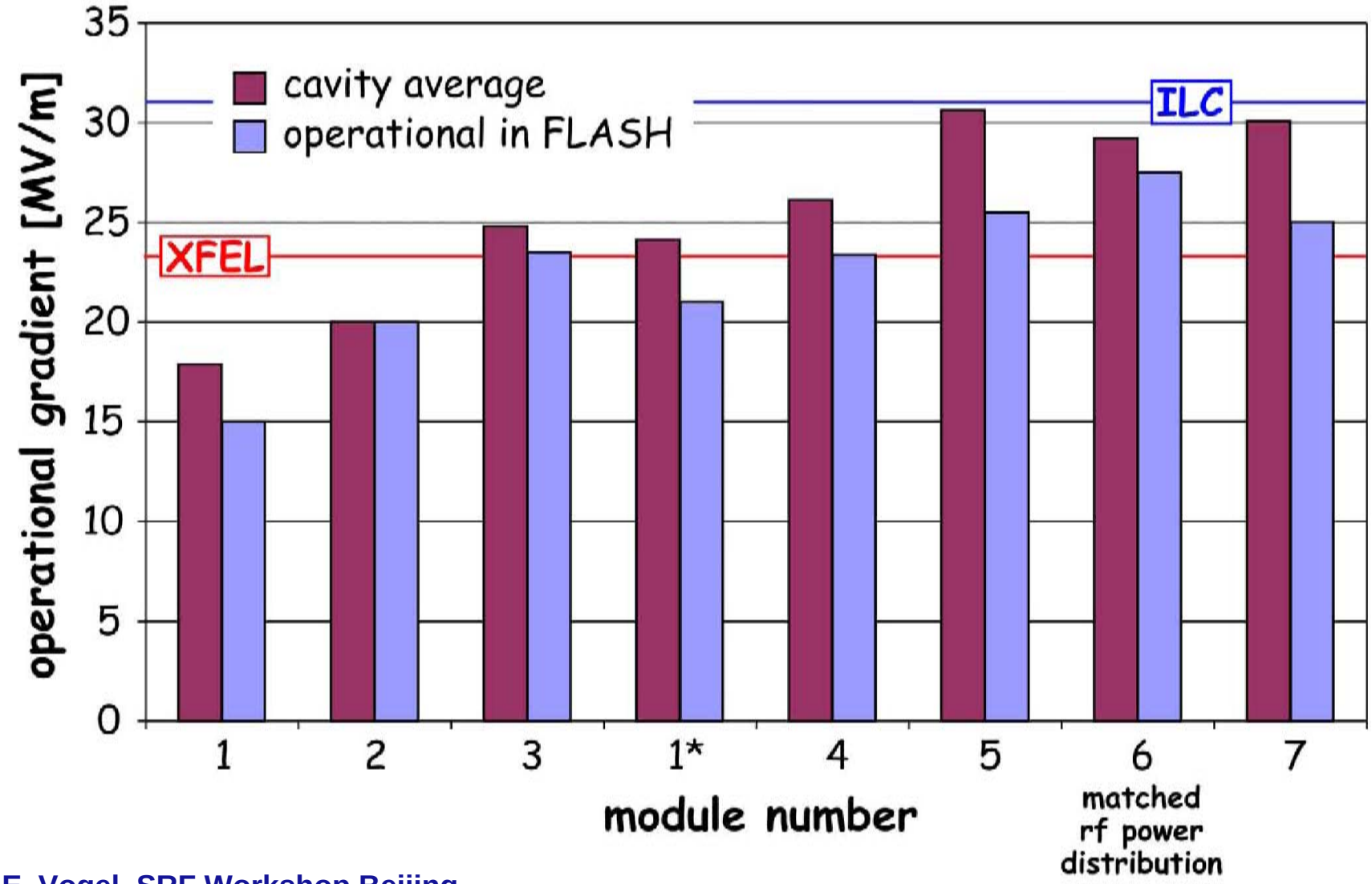
DESY, January 14-17, 2008

Highlight of SRF Activities in Europe

Carlo Pagani

University of Milano and INFN Milano

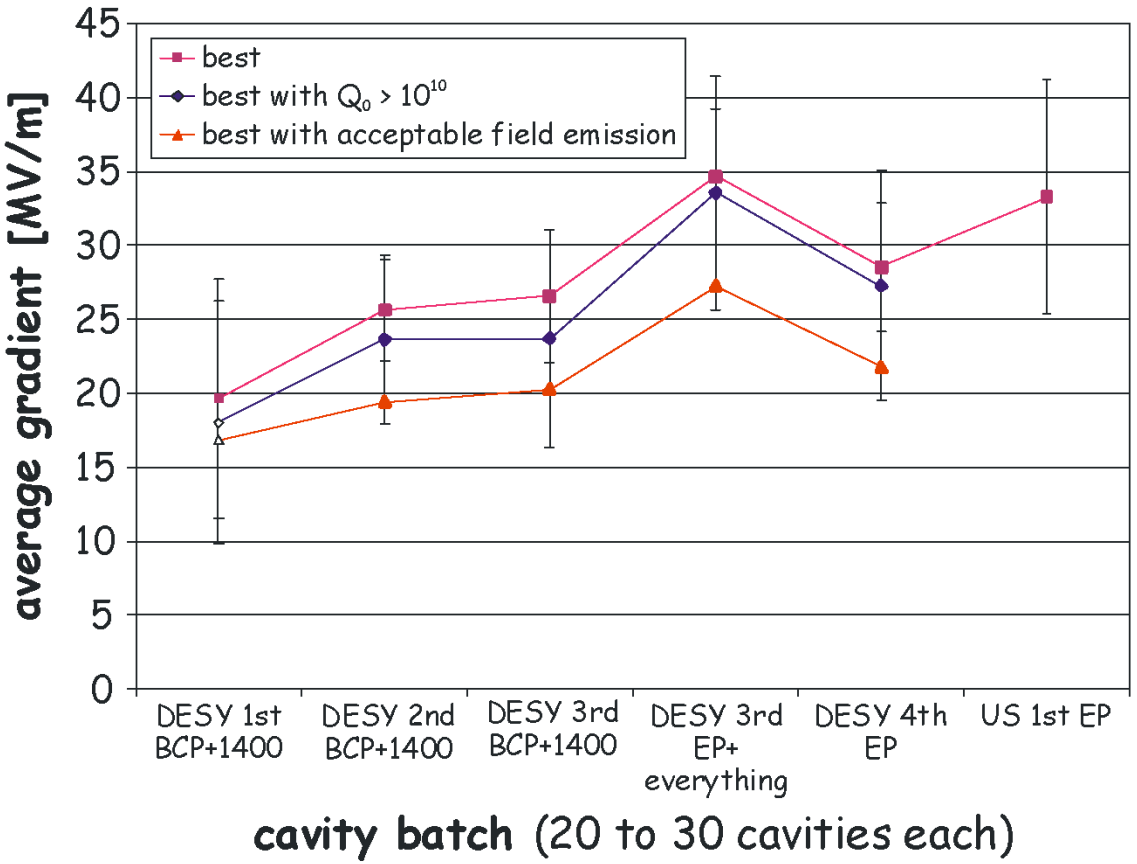
TTF/FLASH Modules



E. Vogel, SRF Workshop Beijing

TTF/FLASH Cavity batches

'Qualified' vendor productions: best test results

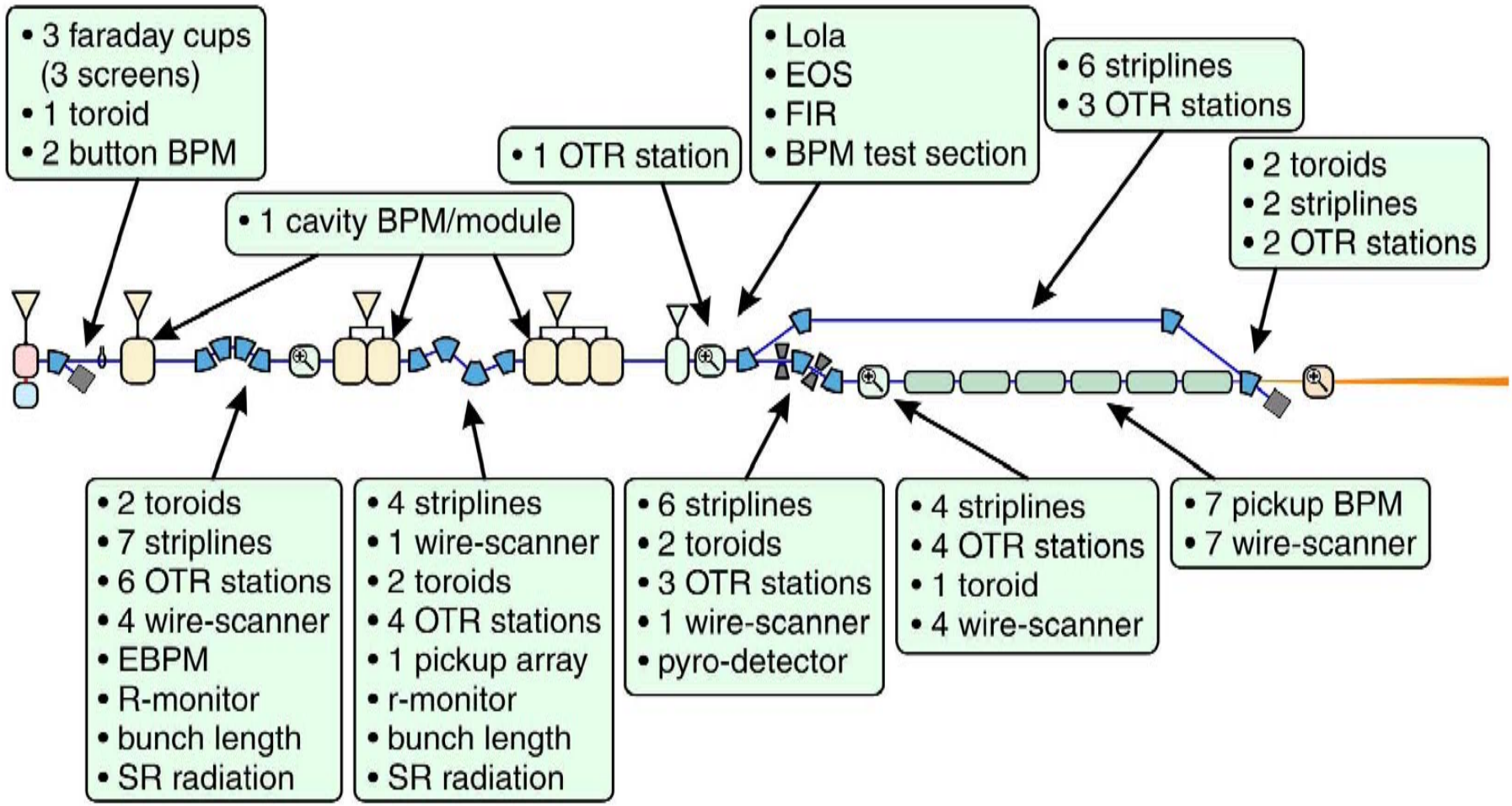


E. Vogel, SRF Workshop Beijing

Status

- typical gradients obtained in pre-series production > 25 MV/m
- at September 25th new record at horizontal cavity test stand CHECHIA: 40 MV/m (stable for ½h)

TTF/FLASH: Wealth of beam diagnostics



E. Vogel, SRF Workshop Beijing

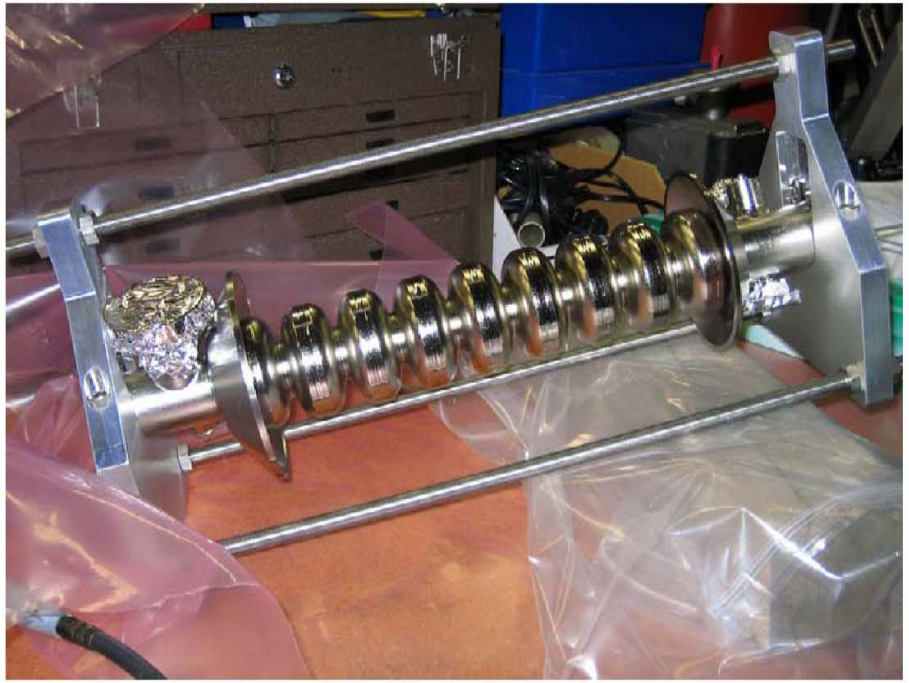
TTF/FLASH will provide more in a few years

potential installation of 7th module

- for 1.2 GeV (or perhaps 1.3 GeV)
- lasing at 4.4 (3.7) nm

installation of 3rd harmonic rf

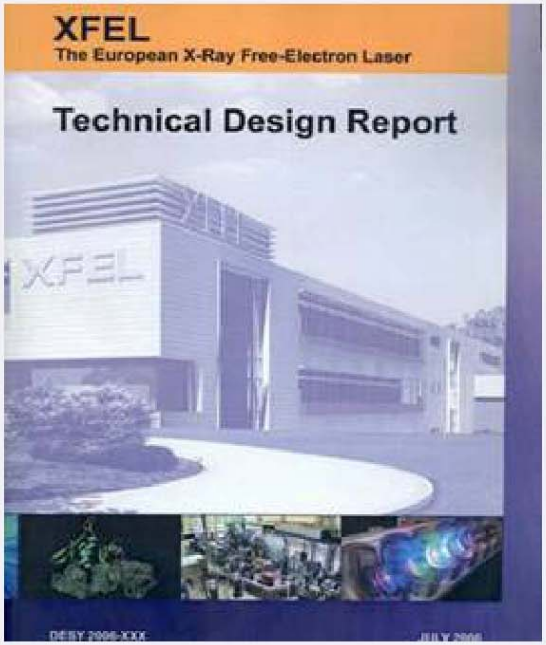
- to flatten E-z phase space before bunch compression



E. Vogel, SRF Workshop Beijing

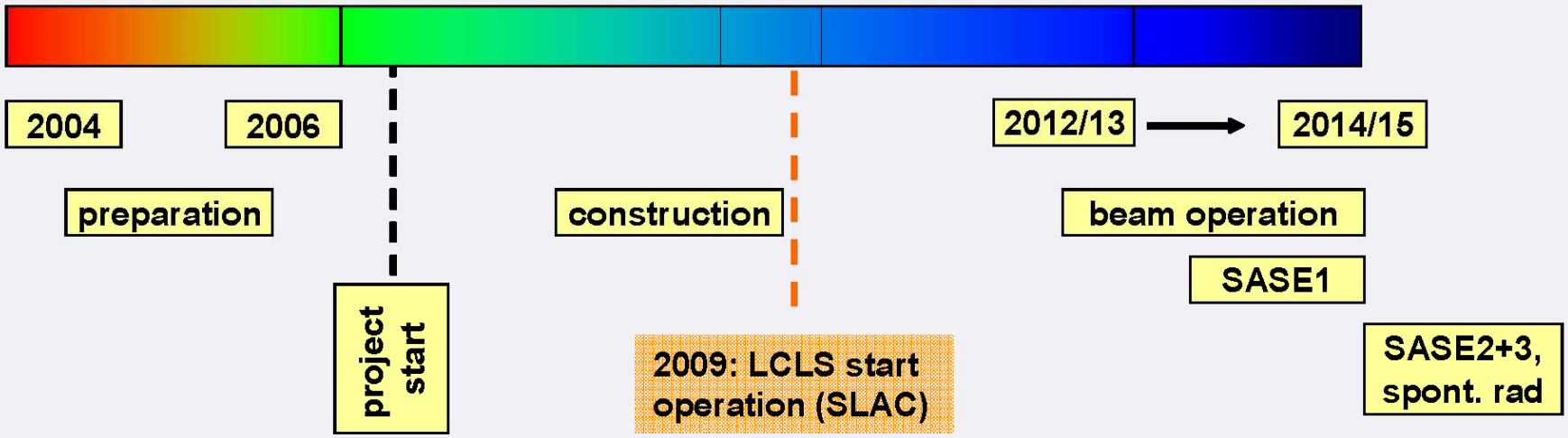
beyond FLASH…

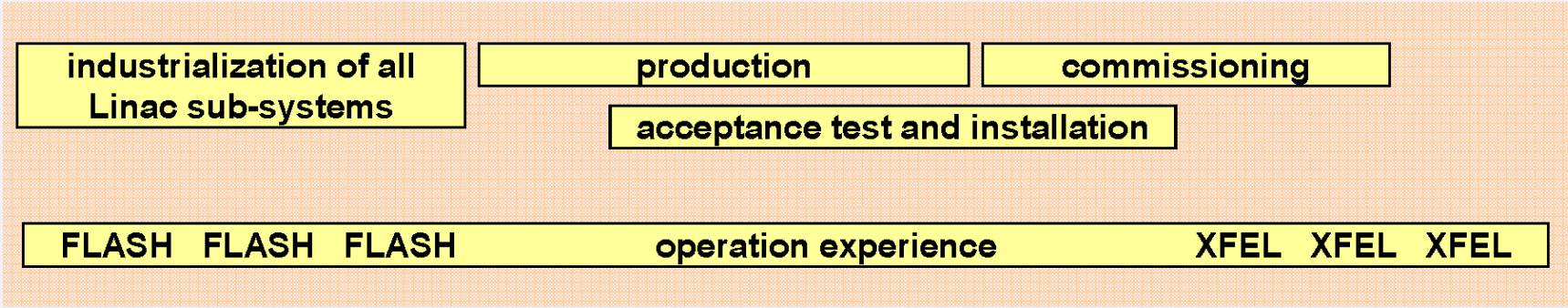
- Technical Design Report
  - Report by over 300 Authors from 17 countries and 71 institutions
  - Has been reviewed internationally
  - Is available at:
  - http://xfel.desy.de/tdr/tdr/index_eng.html
  - Completed July 2006
    - Minor edits: Final version available now
- In parallel finished the 'Planfeststellungsverfahren'
  - Legal procedure to get plan approval
  - Includes ecological impact studies etc.
  - July 2006: Plan approval announced by authority in charge



L. Liljie, SRF Workshop Beijing

XFEL timescale





L. Liljie, SRF Workshop Beijing

Common EU effort for the XFEL Linac

From the document presented by the Chairman at the XFEL In-Kind Contribution Review Committee at the Meeting of the XFEL International Steering Committee on September 2007

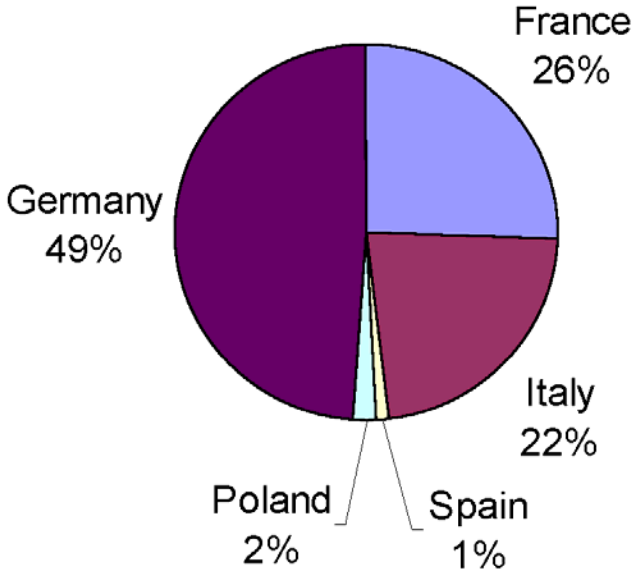
The following laboratories were involved in the discussion of the cold linac and agreed on the delivery of a common proposal for the in-kind contributions. Besides clarification of a few still open questions, the final official in-kind proposal will also require approval of the individual funding agencies.

Laboratory	**Country**	**Fields of interest**
CIEMAT	Spain	cold magnets, power supplies
LAL Orsay	France	main RF input coupler
DAPNIA Saclay	France	accelerator modules, cavities, cold beam position monitors (BPM), cold frequency tuners, 3.9 GHz harmonic accelerator section
INFN Milano	Italy	accelerator modules, cavities
DESY	Germany	accelerator modules, cavities, cold beam position monitors (BPM), cold frequency tuners, cold vacuum system
IPJ Swierk	Poland	HOM

Details presented at the XFEL-ISC - 2

	Laboratory	Country	Invest / M€		FTE / M€	
WP – 3	CEA Saclay	France		60%		43%
	INFN	Italy		19%		29%
	DESY	Germany		21%		29%
sum				*100%*		*100%*
WP – 4	INFN	Italy		50%		34%
	DESY	Germany		50%		66%
sum				*100%*		*100%*
	Received from WP -9					
WP – 5	LAL Orsay	France		73%		52%
	DESY	Germany		27%		48%
	or					
	LAL Orsay	France		99%		100%
	DESY	Germany		1%		0%
sum				*100%*		*100%*
WP – 6	IPJ Swierk	Poland		100%		100%
sum				*100%*		*100%*
WP – 7	DESY	Germany		100%		100%
sum				*100%*		*100%*
WP – 8	DESY	Germany		100%		100%
sum				*100%*		*100%*
WP – 9	CEA Saclay	France		90%		51%
	DESY	Germany		10%		49%
	Transferred to WP -4					
sum				*100%*		*100%*
WP - 11	CIEMAT	Spain		56%		10%
	DESY	Germany		44%		90%
sum				*100%*		*100%*

WP – 3	Accelerator Modules
WP – 4	Superconducting Cavities
WP – 5	Power Couplers
WP – 6	HOM Coupler / Pick-up
WP – 7	Frequency Tuners
WP – 8	Cold Vacuum
WP – 9	Cavity String Assembly / Clea
WP – 11	Cold magnets



dapnia

cea

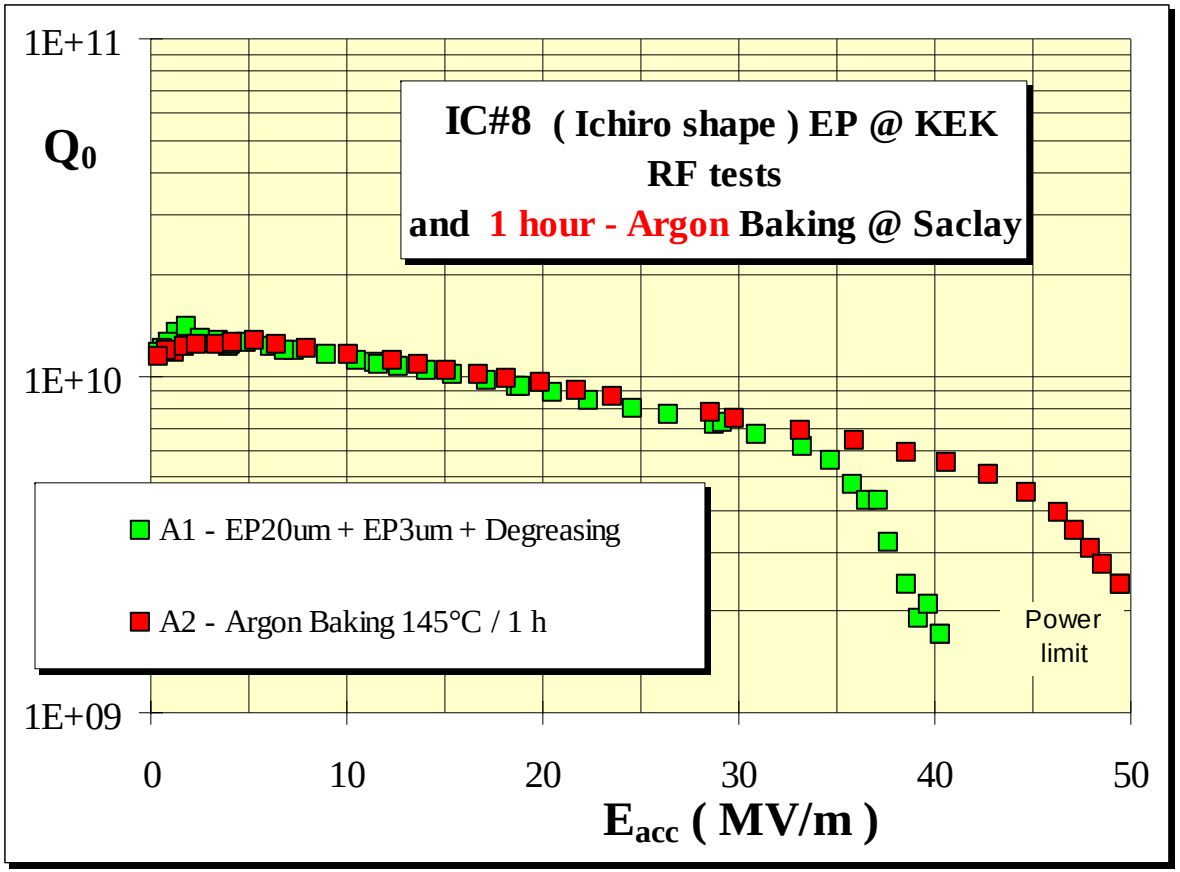
saclay

Fast Baking (145°C vs. time)

Electropolishing at KEK

Argon baking "1 hour " and RF tests at Saclay

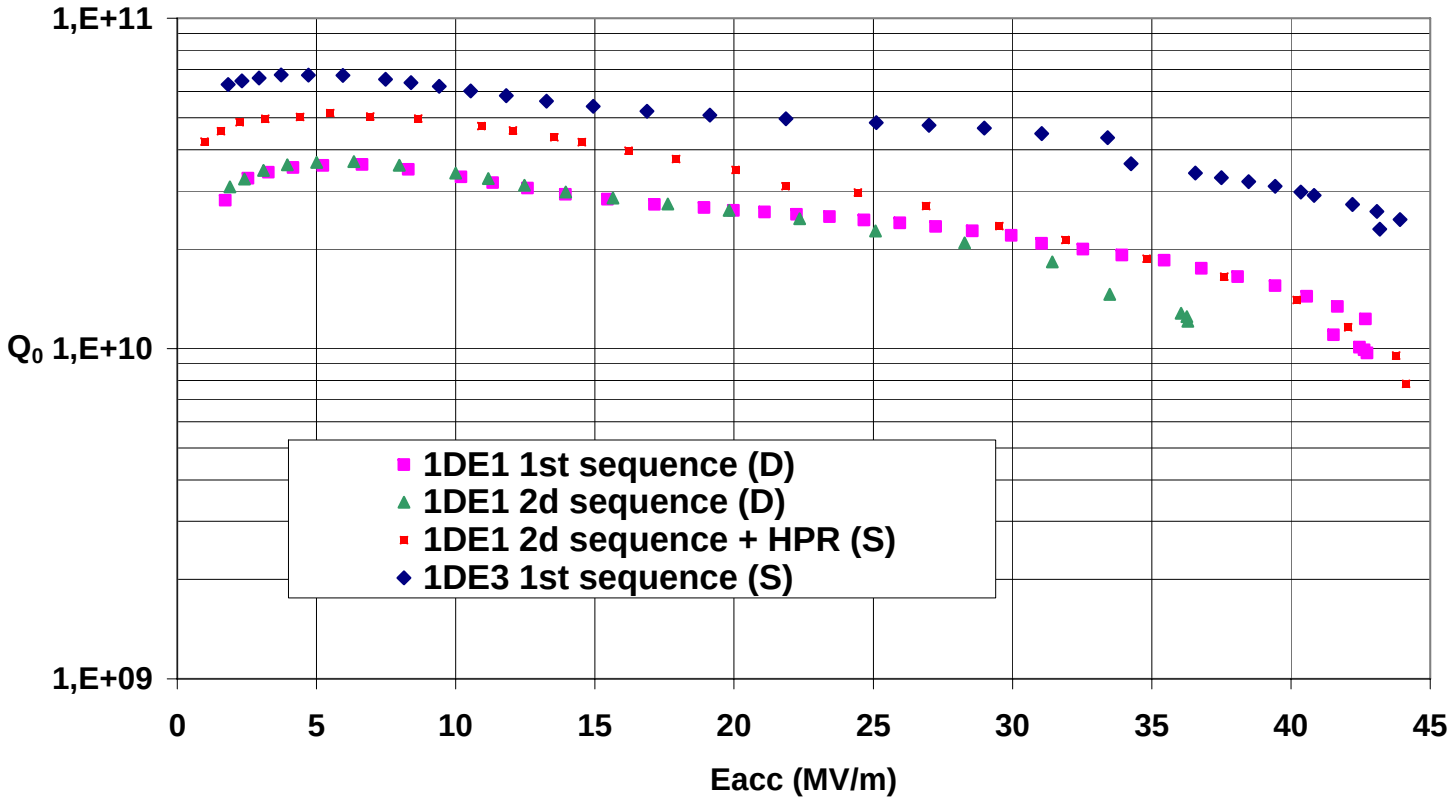
ICHIRO IS#8 Cavity



EP S0 Program (Alcohol Rinsing)

Results for 1DE1 and 1DE3 Cavities

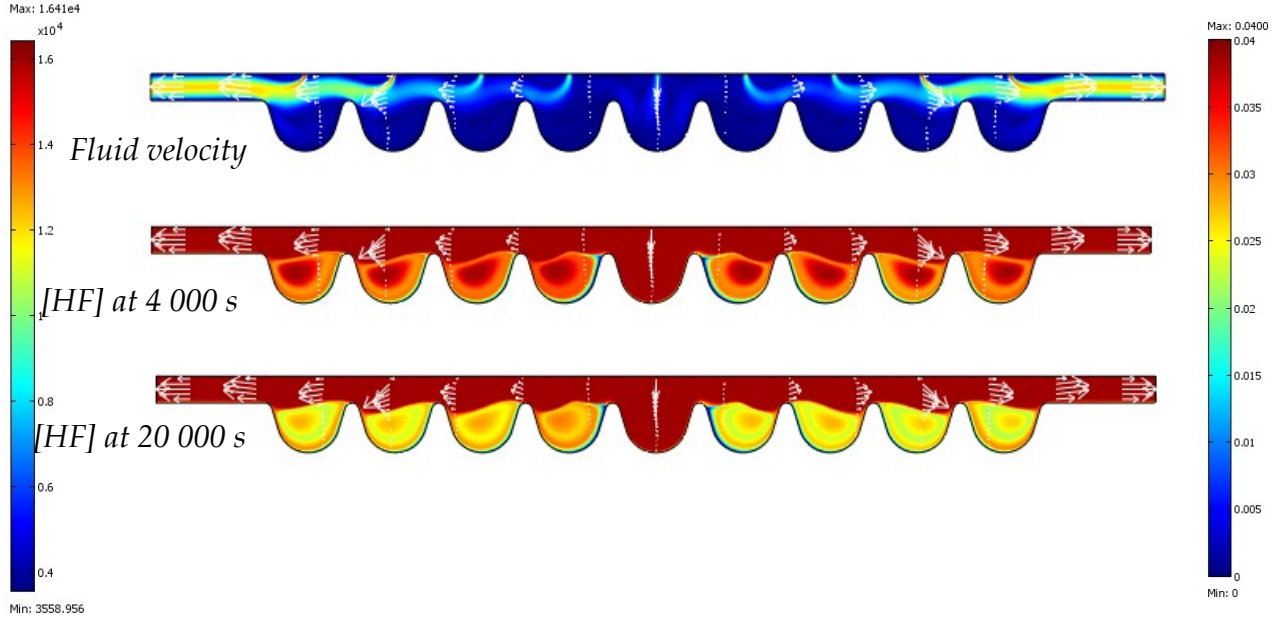
Q_0=f(Eacc) after baking. 1DE1and 1DE3 Cavities.
Recipe: 30 µm EP + Ethanol Rinsing + HPR



dapnia
cea
saclay

EP Modelling with COMSOL

TESLA Cavities



HF

Velocity

Very promising results from simulations

- **EP standard set up gives non uniform removal: center cell gets more**
- **Field Flatness degradation detected at KEK could be explained**
- **EP set up improvements are required to cure this intrinsic effect**

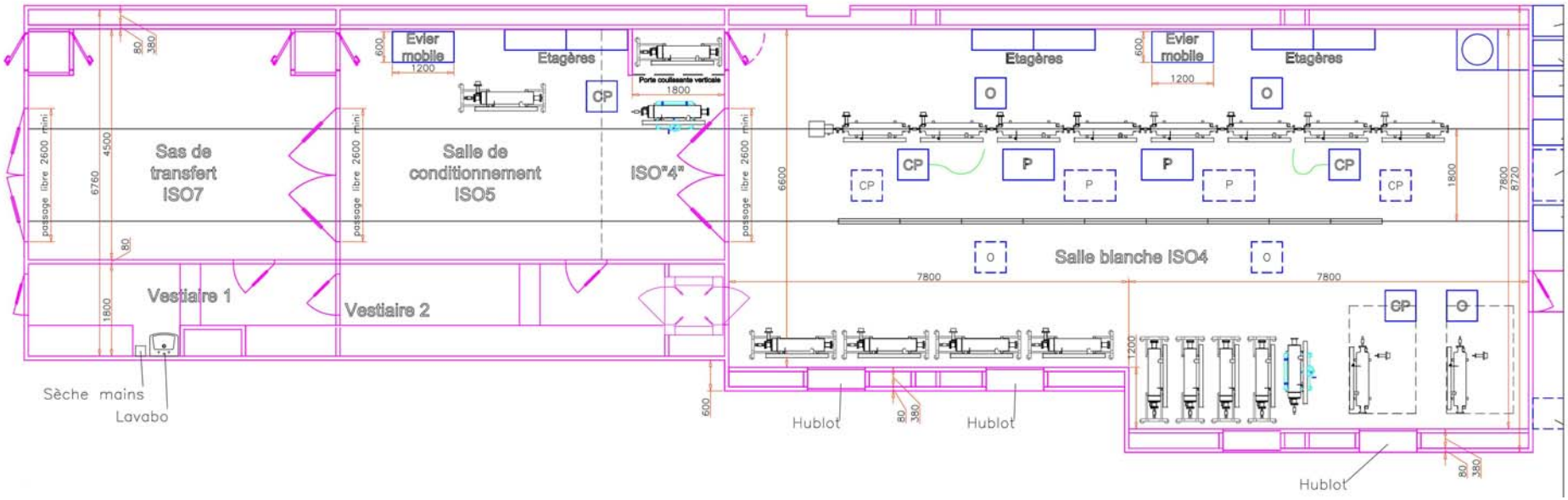
dapnia

cea

saclay

XFEL Clean Room & CEA Saclay

- **Design finished**
- **Installation June 2008**
- **In operation beginning 2009**

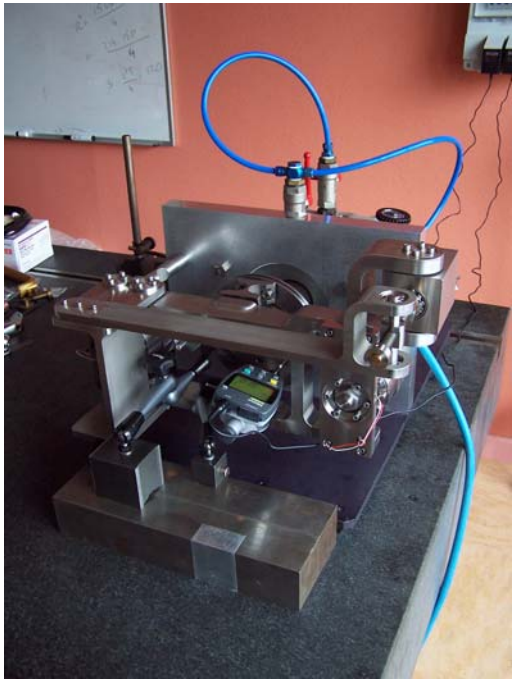


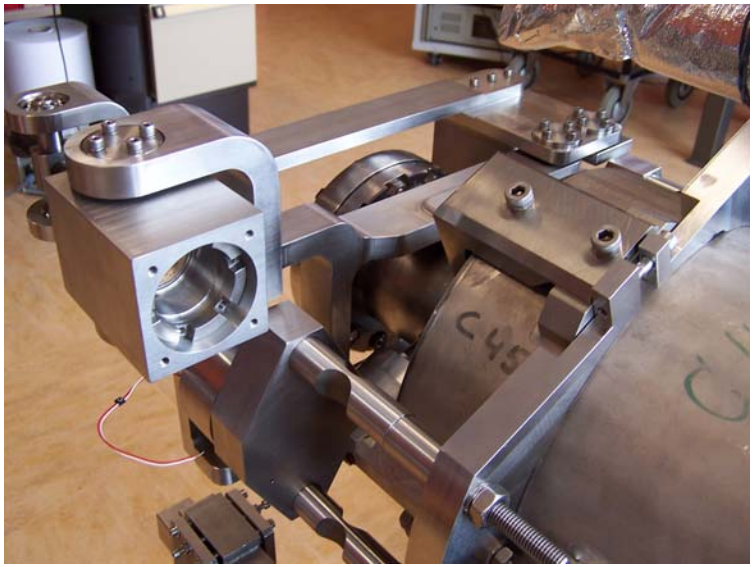
dapnia

cea

saclay

XFEL SACLAY-IV Tuner



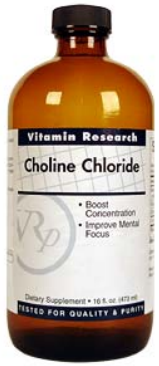


Test planned in CHECHIA (DESY) this week

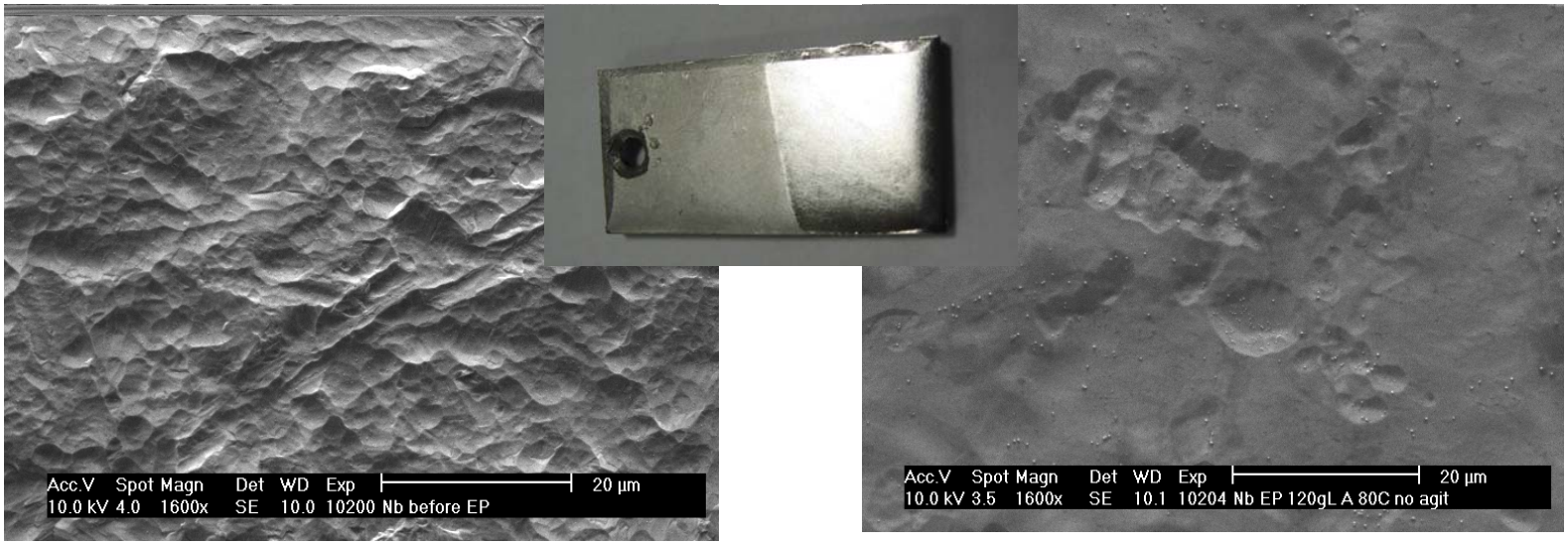
Fluoride-free Nb Electropolishing

First success on Nb using a mixture of:
Choline Cloride, Urea, NH_4F at 80°C

Then a totally Fluoride-free solution was developed by substituting NH_4F with NH_4Cl

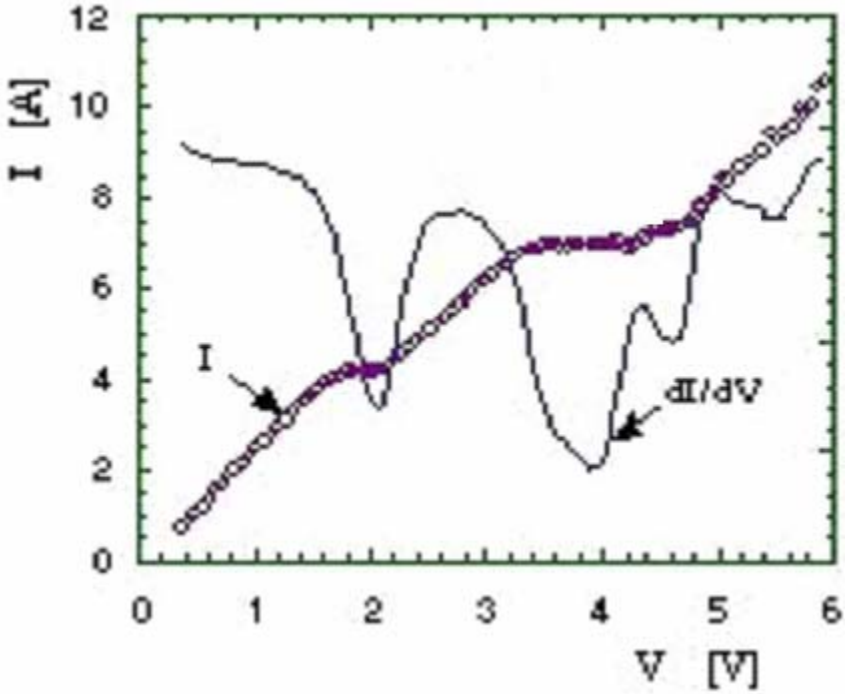


Choline Chloride Drink



Support of the European Community-Research Infrastructure Activity under the FP6 "Structuring the European Research Area" program (CARE, contract number RII3-CT-2003-506395

EP Process Atomatization



The working point (I , V) is being set locking the minimum of dI/dV (thickest viscous layer).

The surface morphology changes, but the program tunes the voltage around the best working parameters.

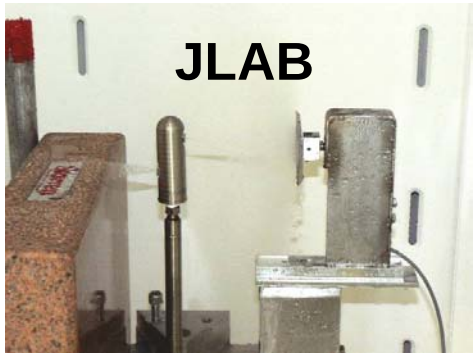
Tested for continuously for more than 12 hr, resulting in a mirror-like surface

Support of the European Community-Research Infrastructure Activity under the FP6 "Structuring the European Research Area" program (CARE, contract number RII3-CT-2003-506395

HPR system qualification 1/2

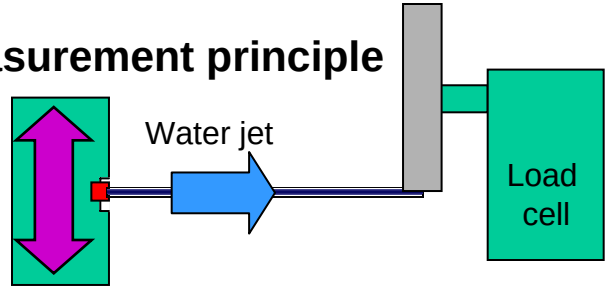
Qualified HPR systems:

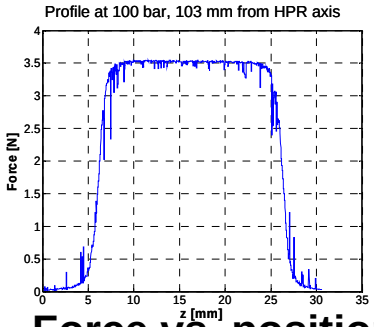
- KEK Tsukuba
- KEK Nomura Plating
- JLAB Production and R&D Lab
- DESY



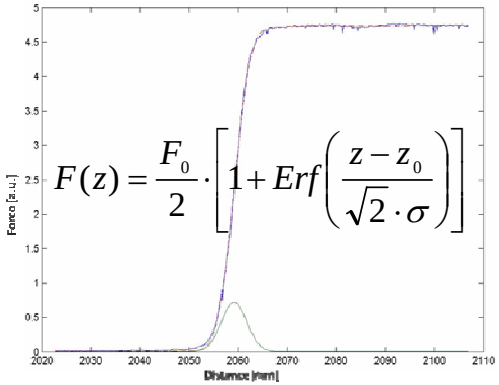
Data analysis in progress

Measurement principle





Force vs. position



Water Jet σ interpolation

HPR system qualification 2/2

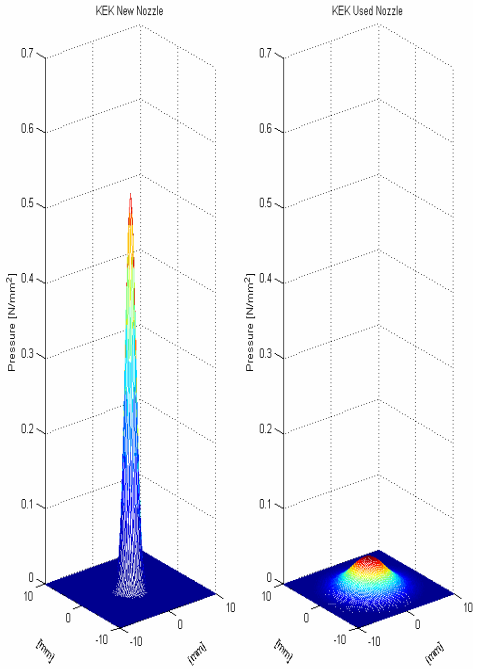
Measured parameters:

- Force vs. nozzle to target Distance
- Water velocity (at the nozzle exit)
- Water jet Power
- Jet dimension (sigma) vs. distance
- Peak pressure on the cavity surface

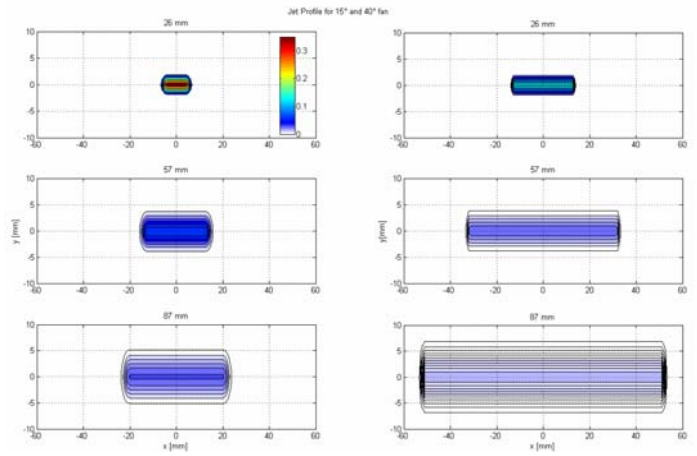
KEK

DESY

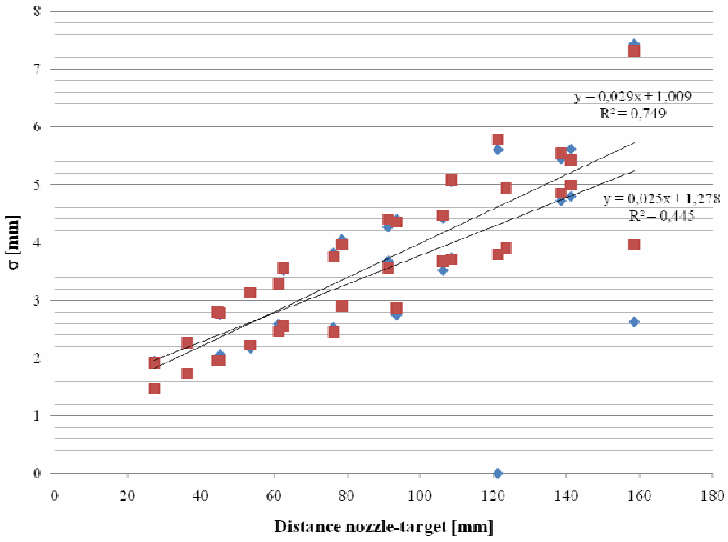
JLAB



KEK HPR: pressure on surface by new and long time used nozzles

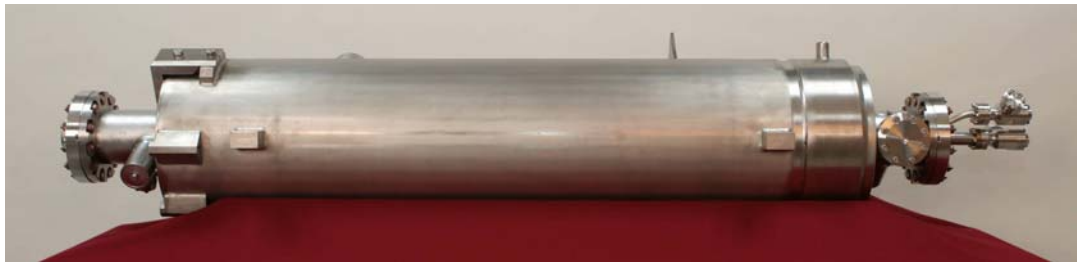


JLAB Fan jet (15° and 40°) vs. distance

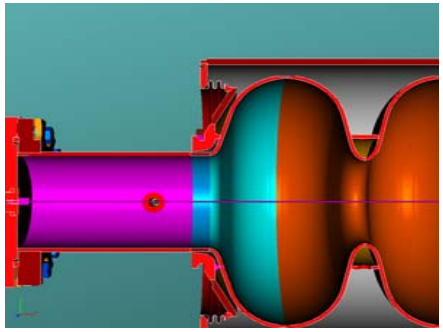


DESY HPR: jet sigma vs. distance

New end groups and simplified tank

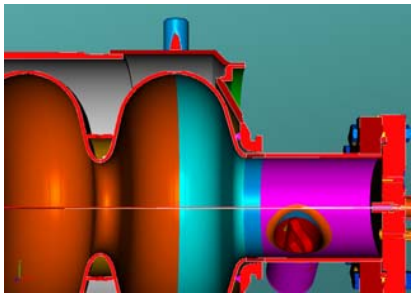


Present TTF dressed cavity

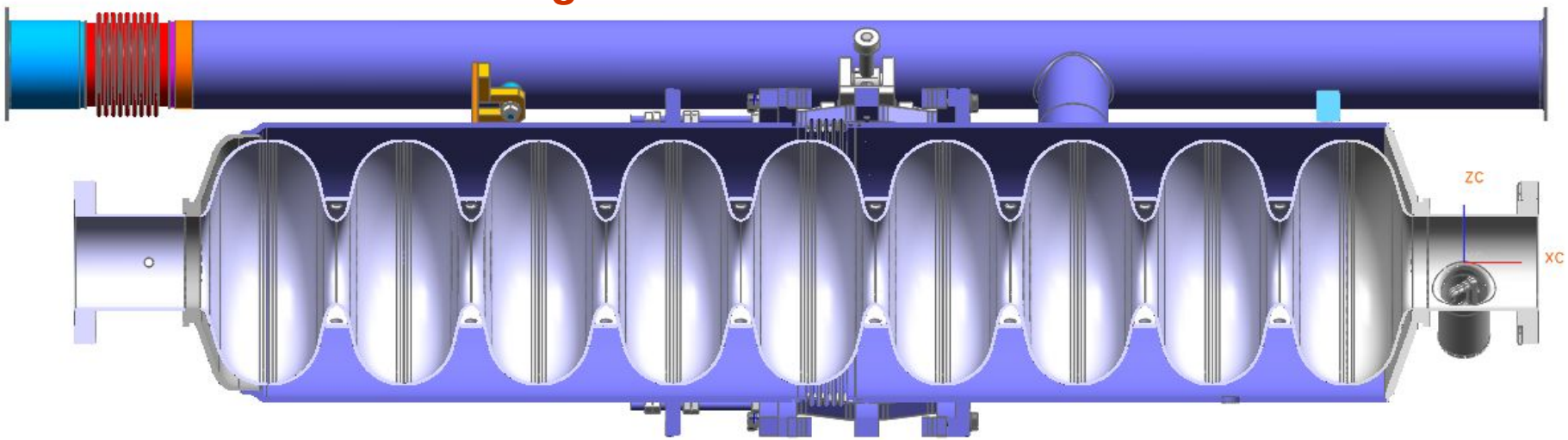


X Lateral tuner

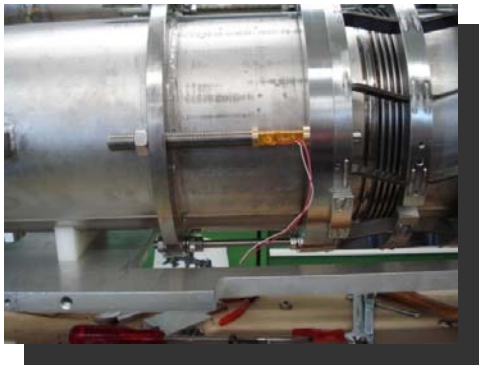
X Coaxial tuner

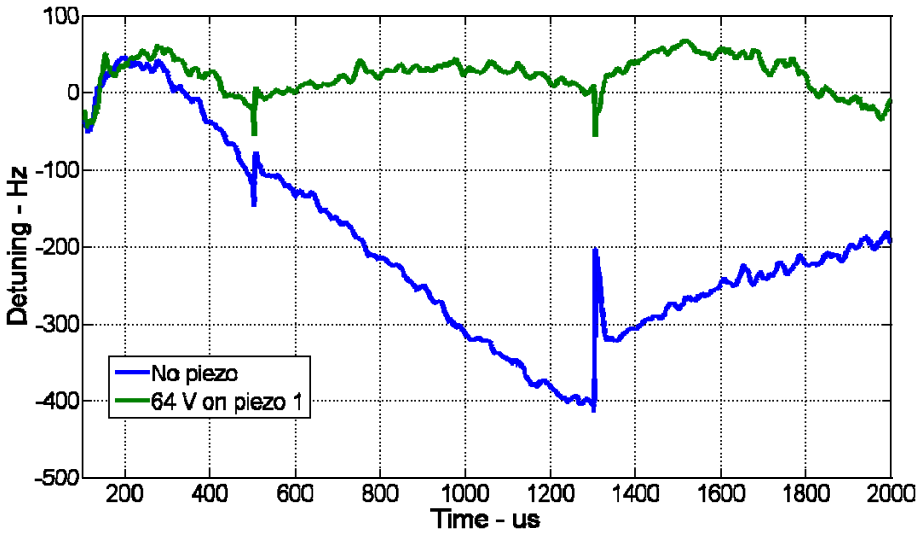


Design reviewed for Blade Tuner

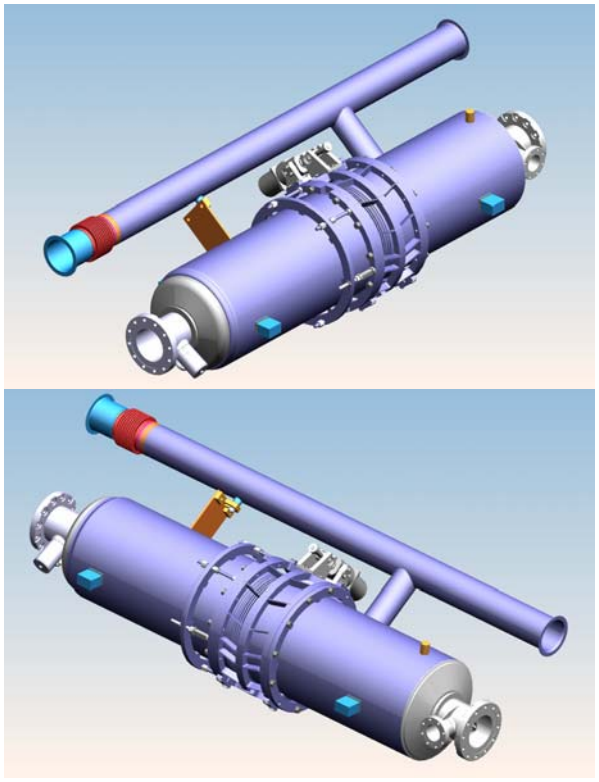


Slim Blade tuner tested in CHECHIA





Final version with revised He tank and end groups, proposed for ILC-HiGrade and FNAL 2° ILCTA module



300 Hz of LFD, during the RF pulse flat top, have been compensated at Eacc = 23 MV/m, driving only one of two installed piezo actuators with 64 V, less than 1/3 of the nominal maximum driving voltage (200 V @ RT).

Coaxial Blade tuner used in many applications

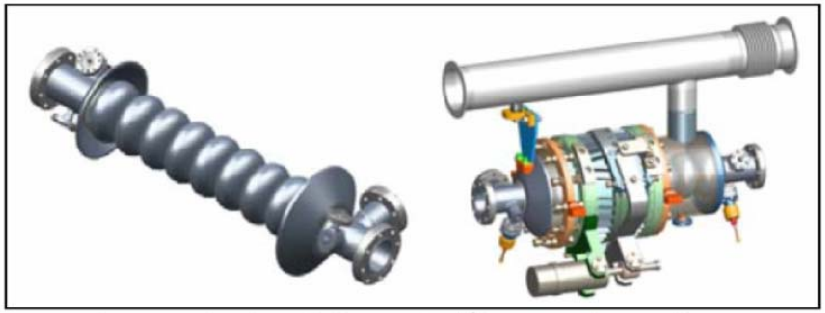
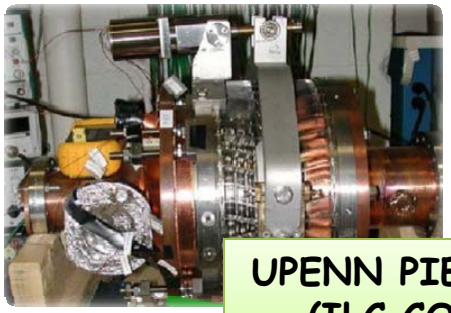
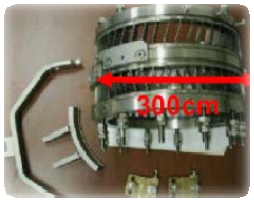


Fig.2. Naked and dressed 3rd harmonic cavity.

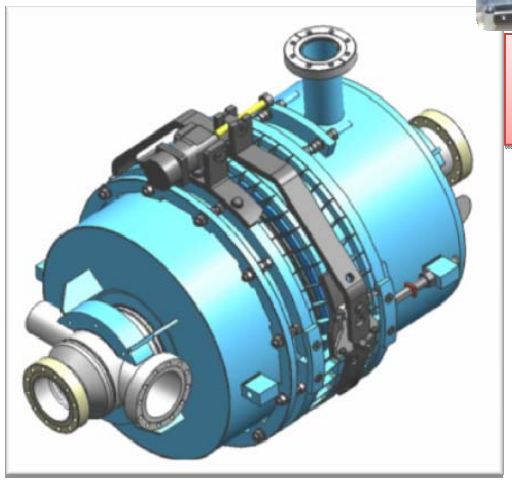


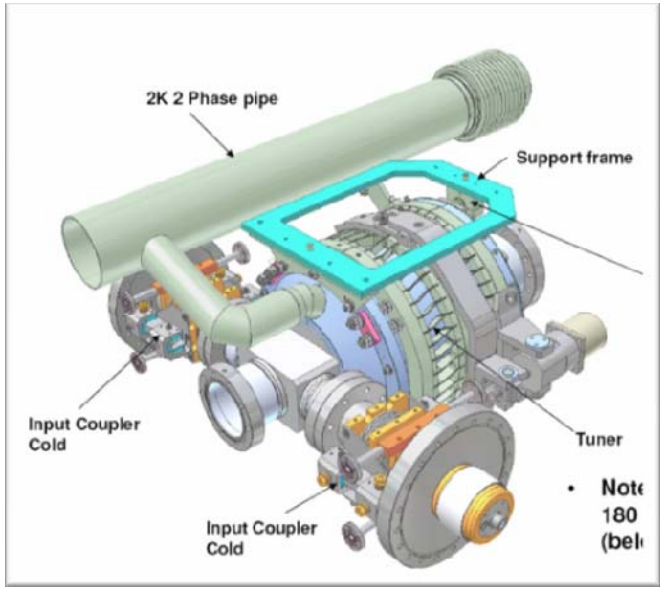


UPENN PIEZO BLADE TUNER (ILC COLLABORATION)

FERMILAB THIRD HARMONIC ACCELERATING (3.9GHZ) SC CAVITY FOR NEW GENERATION HIGH BRIGHTNESS PHOTO-INJECTOR

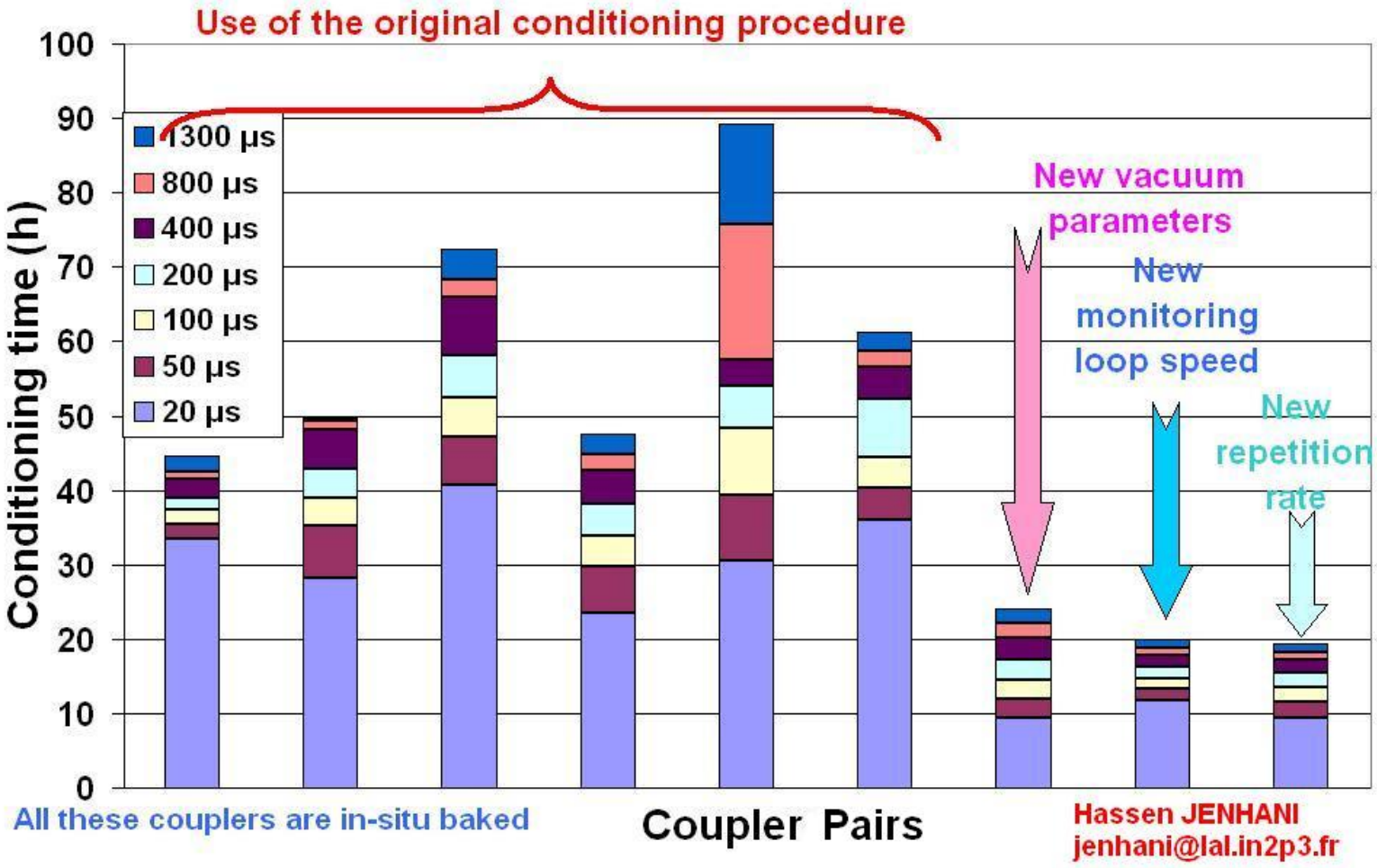
LOW β CAVITY FOR PROTONS





THE CORNELL ERL SUPERCONDUCTING 2-CELL INJECTOR CAVITY

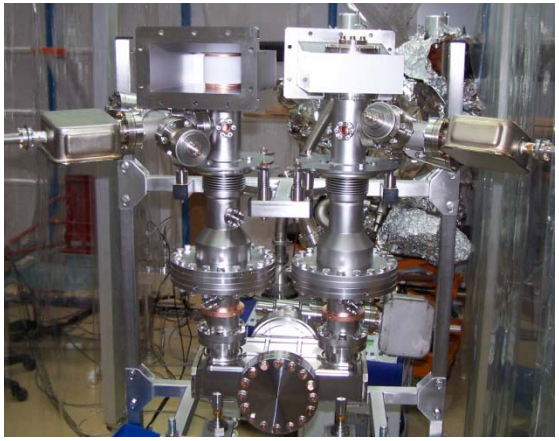
R&D on conditioning of TTF-III couplers



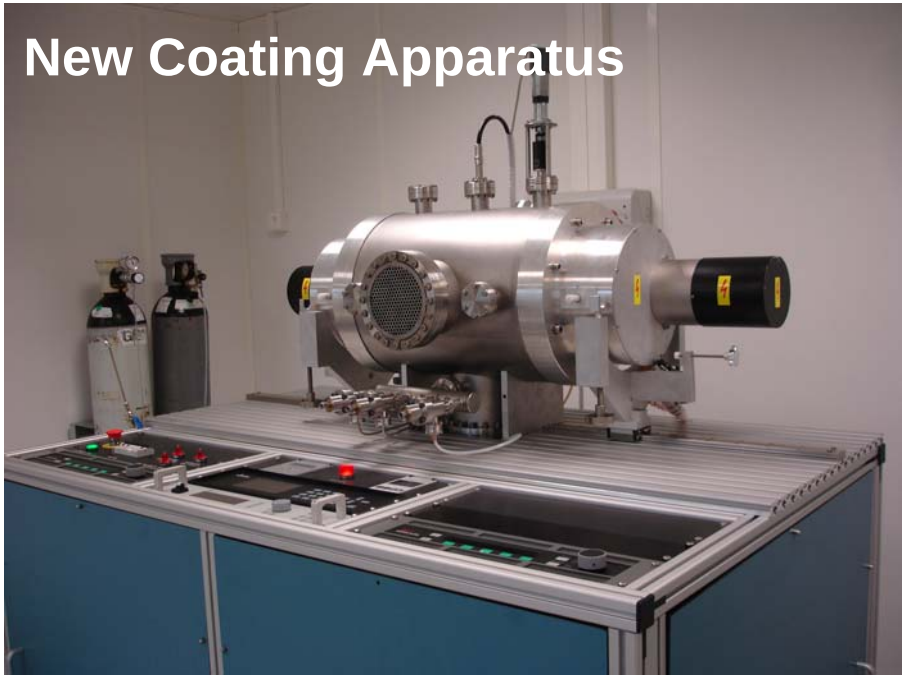
Coupler Infrastructure Improvements

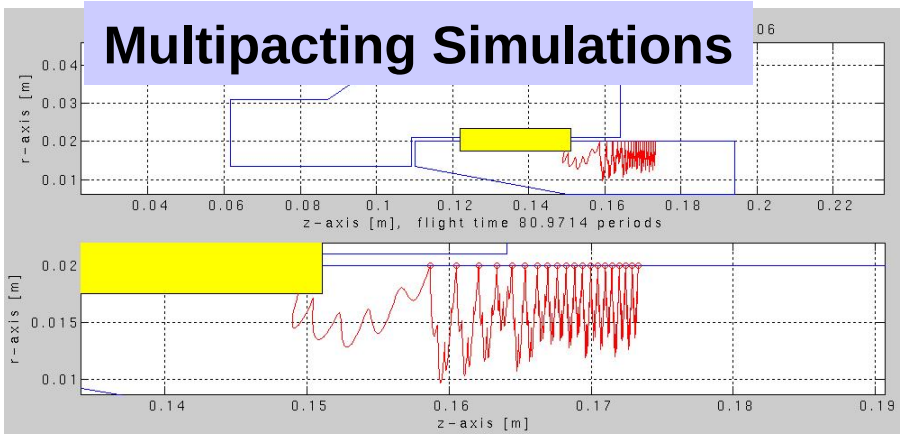
Couplers under test

TW60

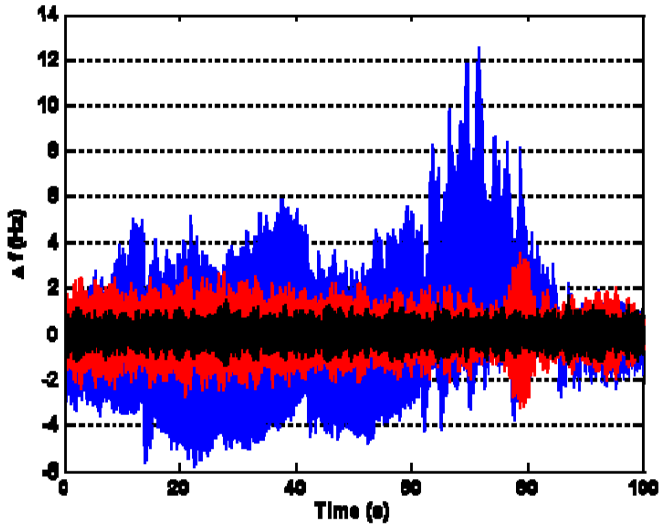


TTF-III





BESSY: Microphonics compensation tests

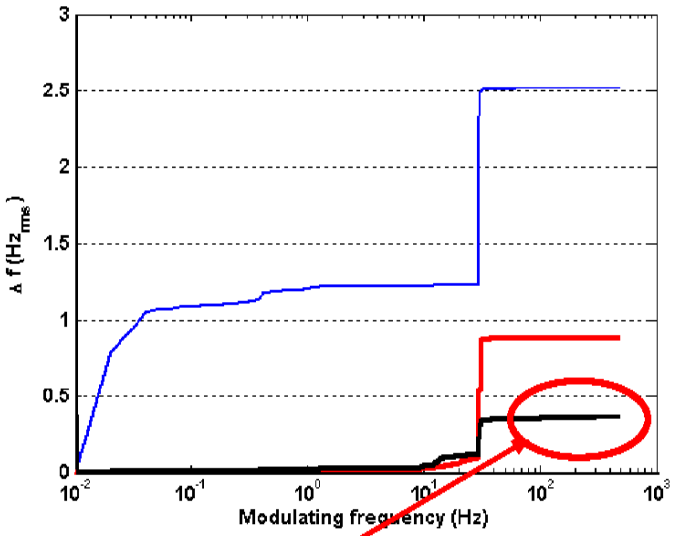


ΣFFT

Open loop

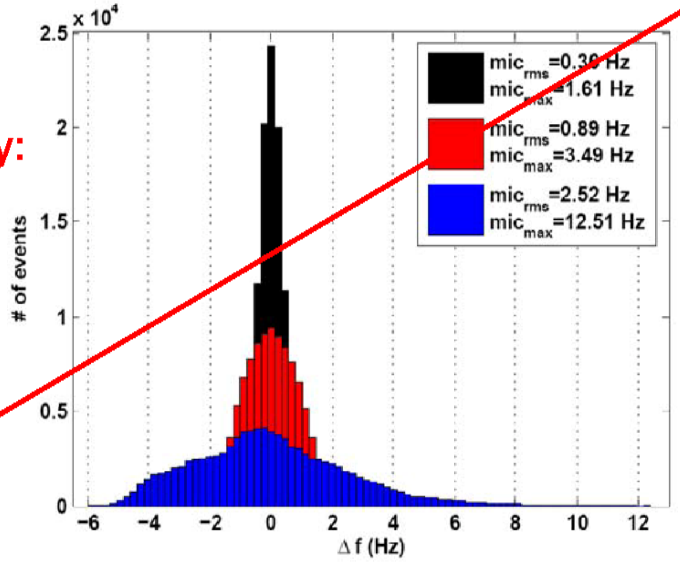
Feedback

FB+Feed forward



Factor 7.6 of compensation

Improved open loop phase stability:
13.2→ 2.0°

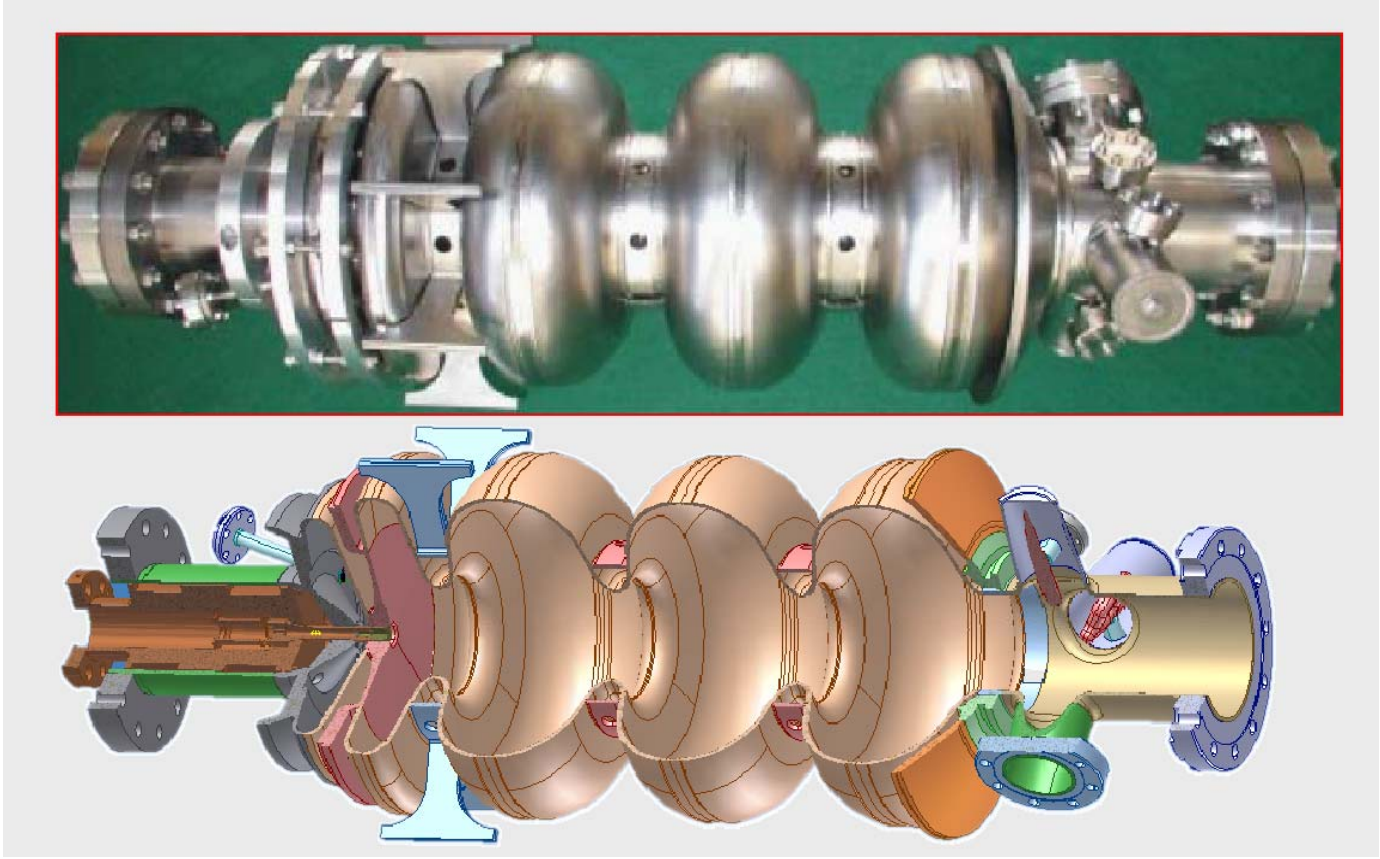


Limit by piezo-tuner resolution

A. Neumann, SRF Workshop Beijing

FZR: First e-beam from RF Gun

…
on Monday 12th November 2007 at about 5 pm, the first electron beam was generated from the superconducting rf photo injector at the Forschungszentrum Dresden-Rossendorf.



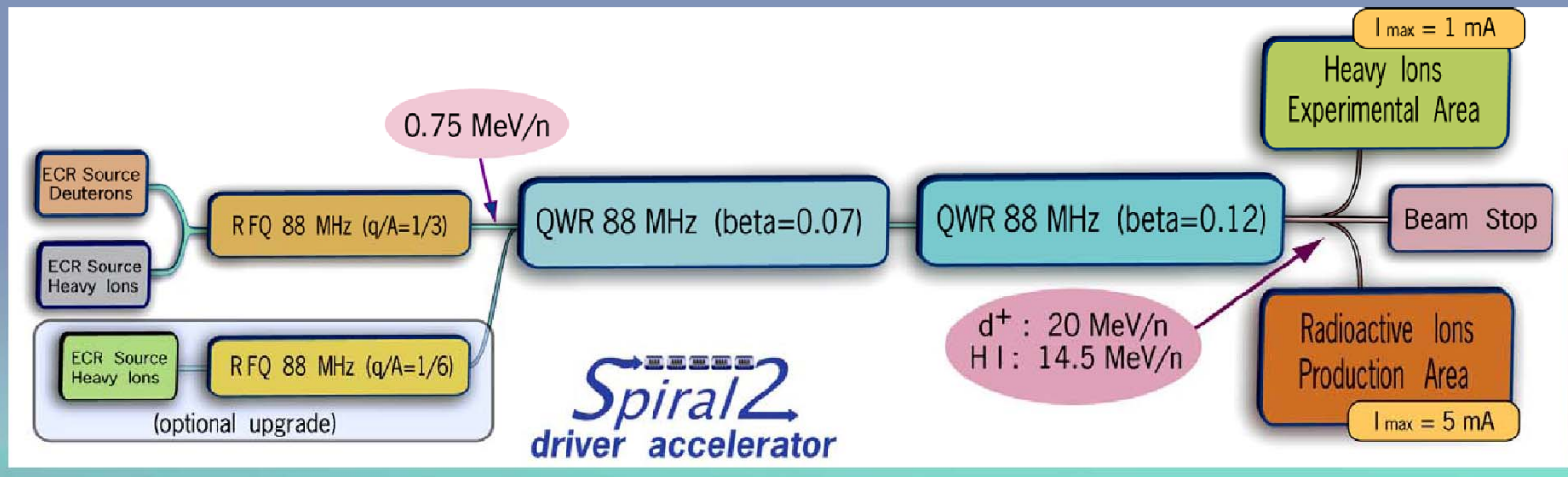
Spiral 2 in France (CEA & IN2P3)

beam	p+	D+	ions	ions
Q/A	1	1/2	1/3	1/6
I (mA) max.	5	5	1	1
W_o min. (Mev/A)	2	2	2	2
W_o max. (Mev/A)	33	20	14.5	8.5
CW max. beam power (KW)	165	200	44	48

Total length: 65 m (without HE lines)

D^+ : ECR ion source
Heavy Ions: ECR Ion Source
Slow and Fast Chopper
RFQ (1/1, 1/2, 1/3) & 3 re-bunchers

12 QWR beta 0.07 (12 cryomodules)
14 QWR beta 0.12 (7 cryomodules)
1 KW Helium Liquifier (4.2 K)
Room Temperature Q-poles
30 Solid State RF amplifiers (10 & 20 KW)



T Junquera, SRF Workshop Beijing

dapnia

cea

saclay

Saclay: β 0.07 Cryomodule

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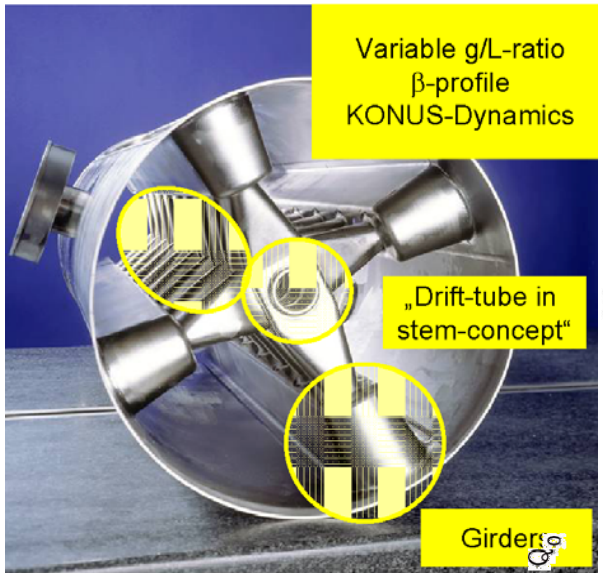
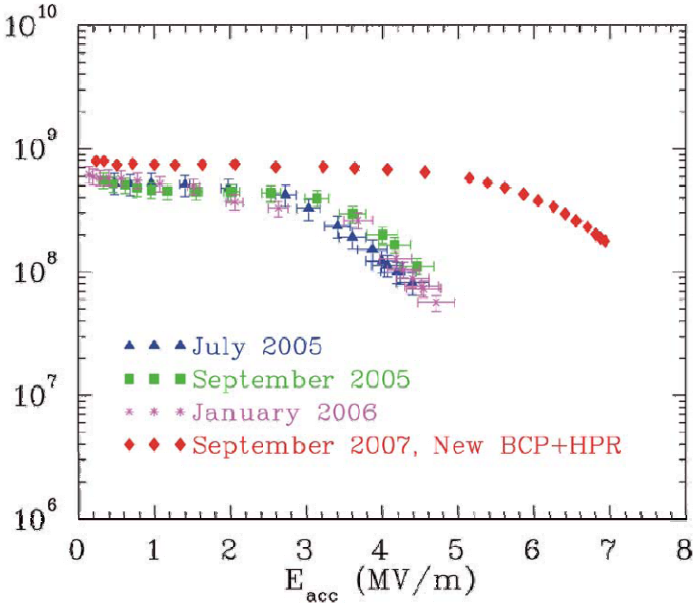
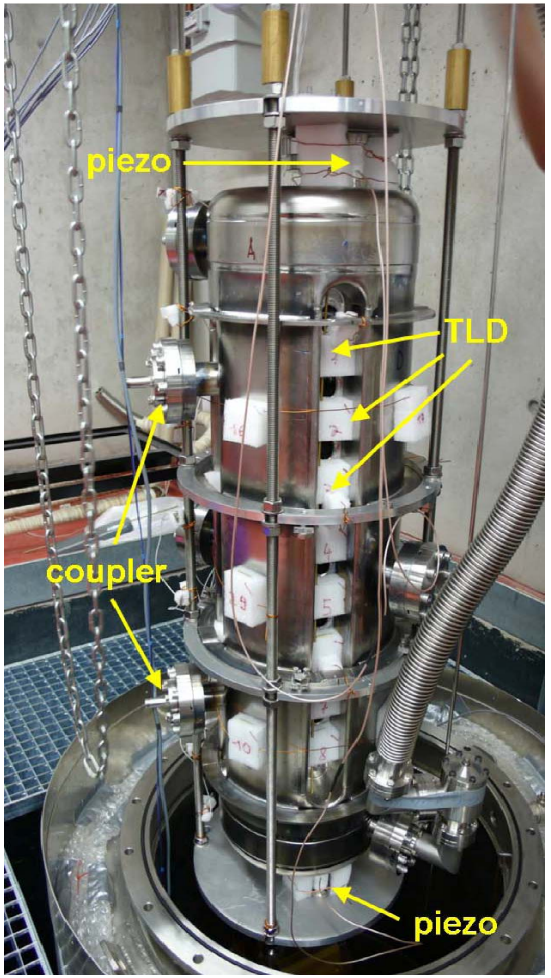
IPN Orsay: β 0.12 Cryomodule

T Junquera, SRF Workshop Beijing

IAP Frankfurt: Tests of CH structure

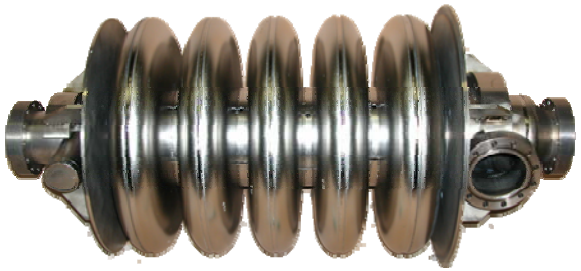


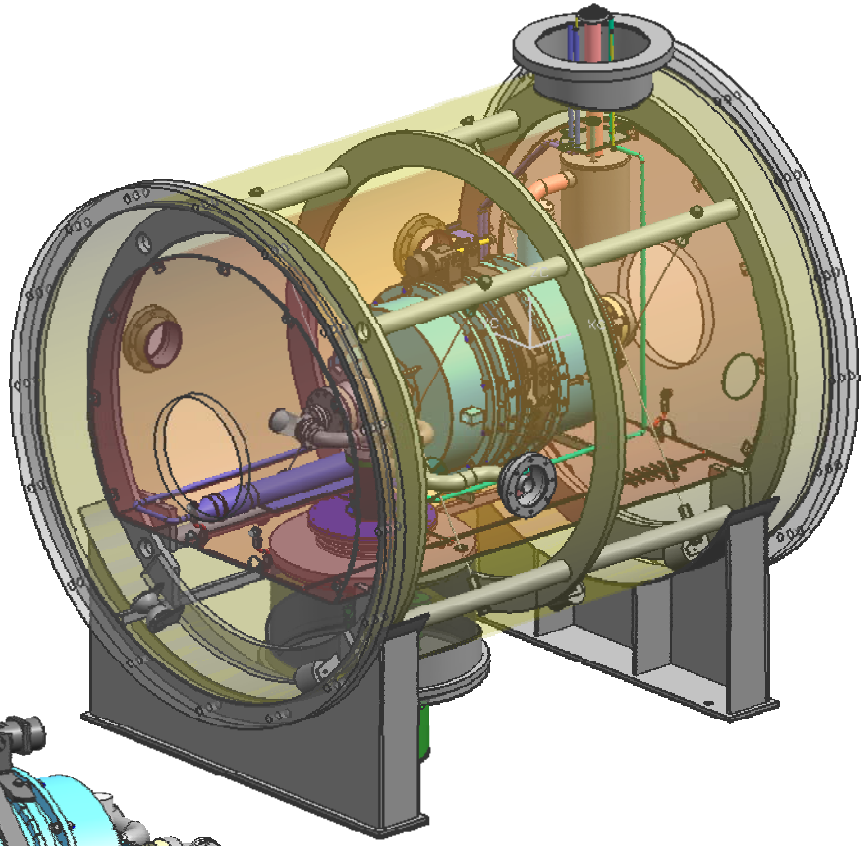




E_a=7 MV/m
U_a=5.6 MV
E_p=36 MV/m
B_p=40 mT

INFN-MI: Eurotrans short module





Mag shield internal to HT