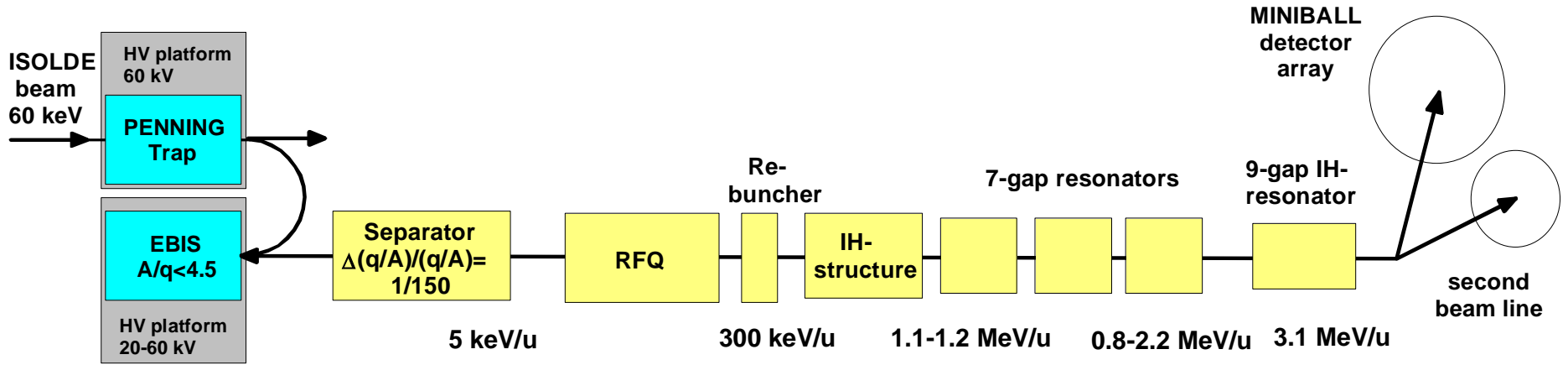
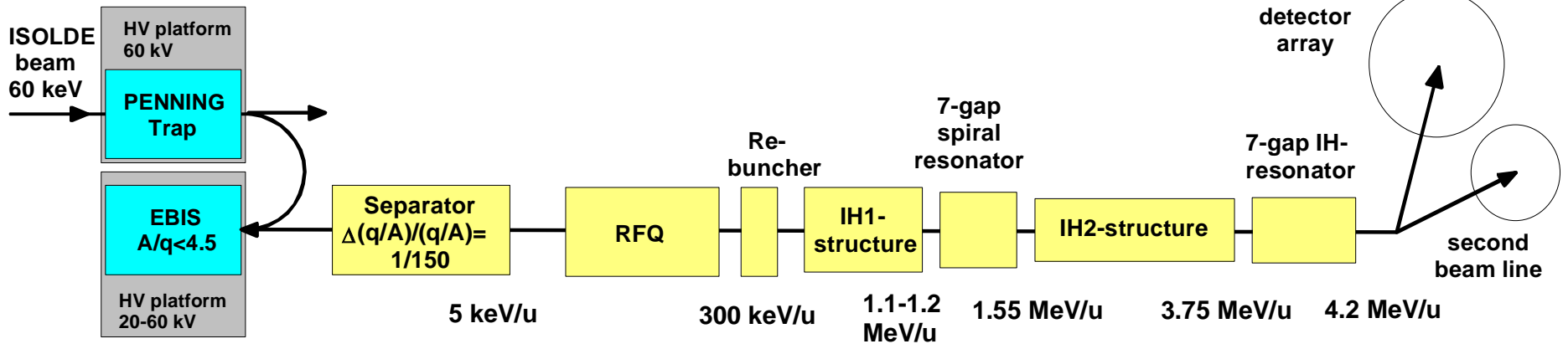


REX-ISOLDE energy upgrade



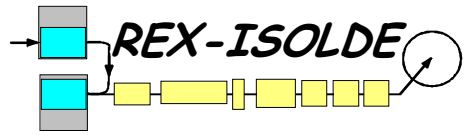
101.28 MHz

202.56 MHz



101.28 MHz

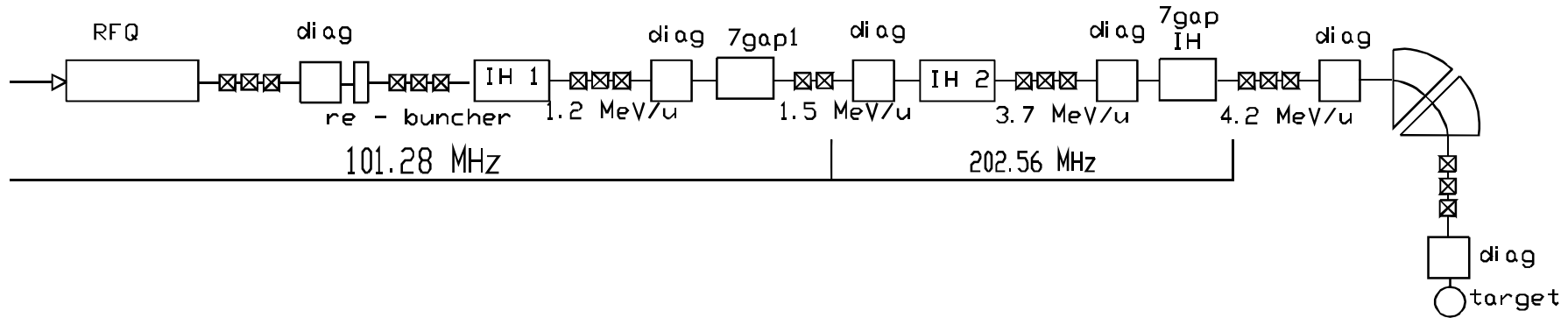
202.56 MHz



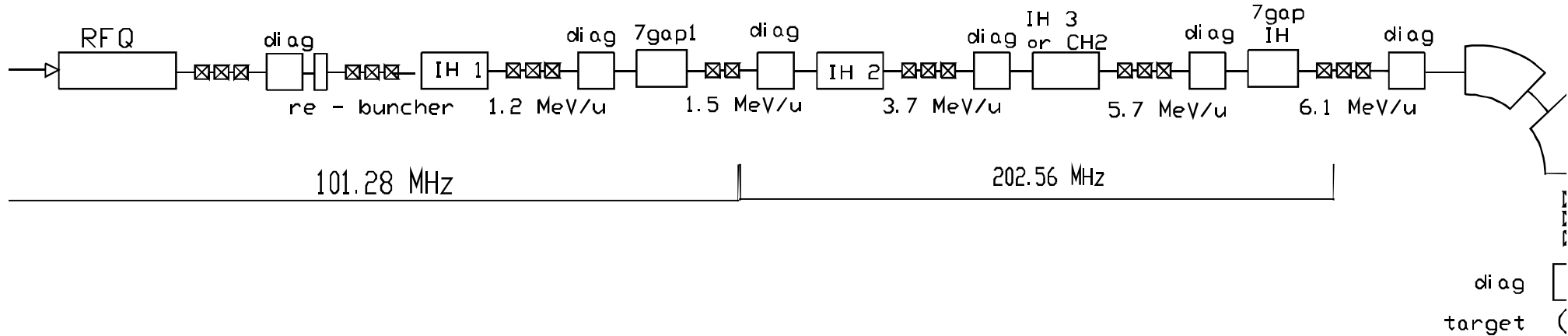
REX-ISOLDE energy upgrade above 4 MeV/u

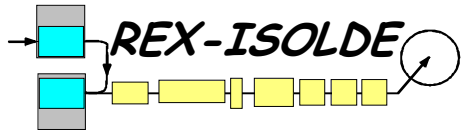


bove 4 MeV/u



bove 5.5 MeV/u

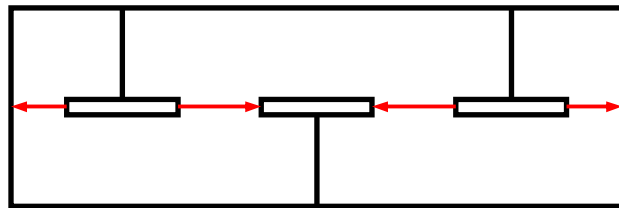
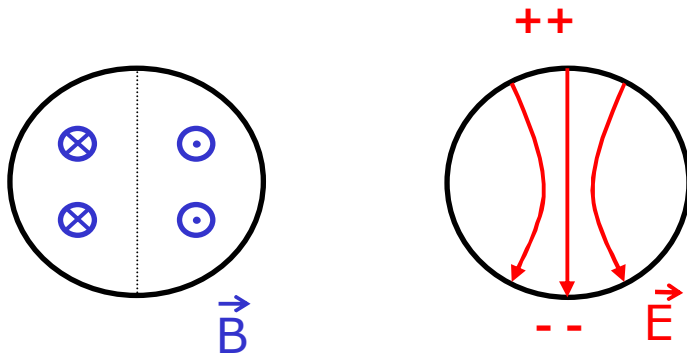




H-Mode structures

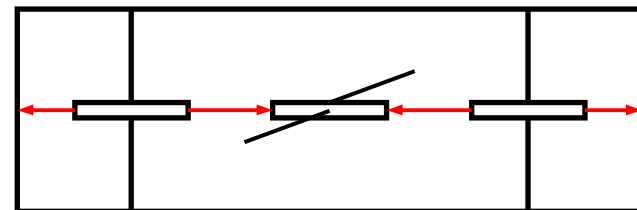
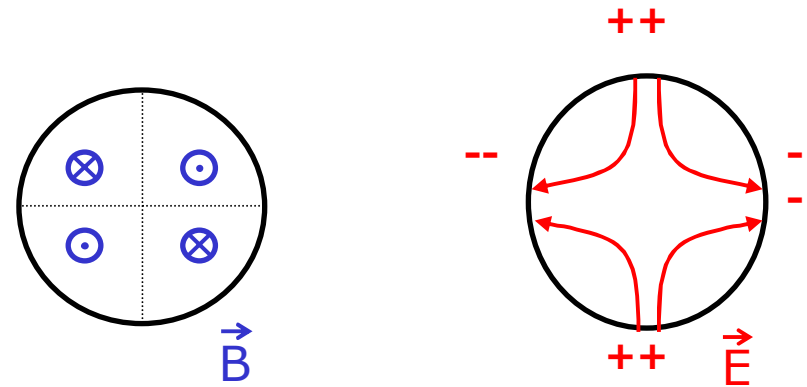


H_{111} -mode



interdigital H-mode (IH)

H_{211} -mode



crossbar H-mode (CH)

IH-RFQ

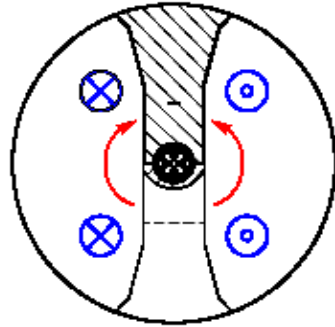
Low and Medium - β Structures in H-Mode Operation

4-vane RFQ

R
F
Q

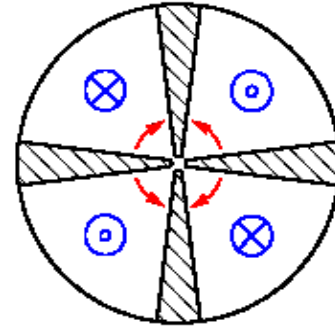
H_{110}

$f \lesssim 100$ MHz
 $\beta \lesssim 0.03$



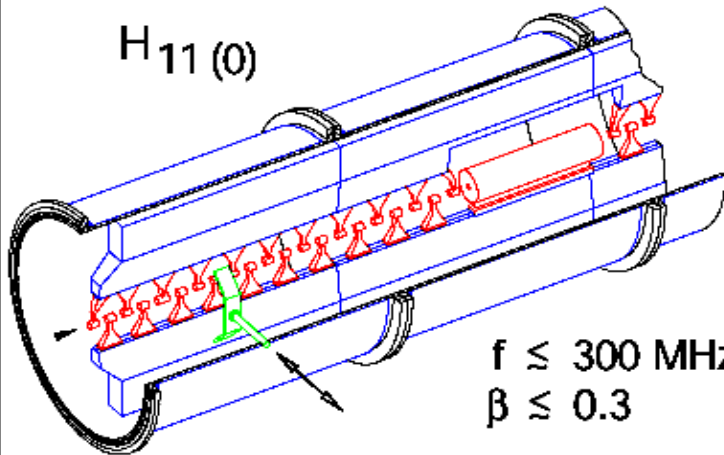
H_{210}

100 - 400 MHz
 $\beta \lesssim 0.12$



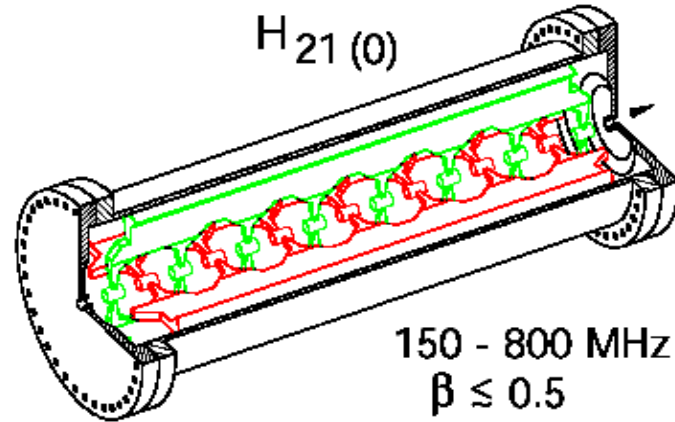
D
T
L

$H_{11}(0)$



$f \lesssim 300$ MHz
 $\beta \lesssim 0.3$

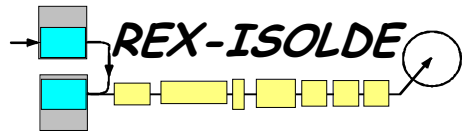
$H_{21}(0)$



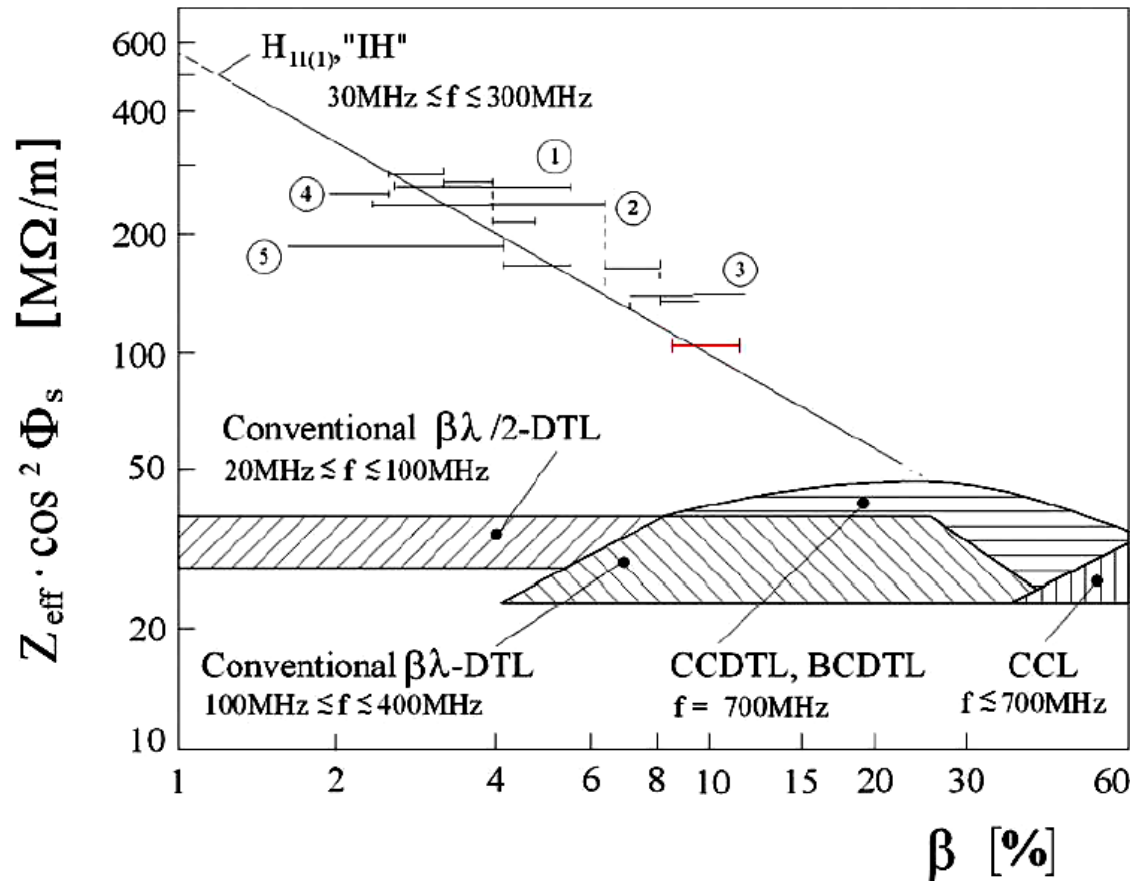
150 - 800 MHz
 $\beta \lesssim 0.5$

IH-Struktur

CH-Struktur

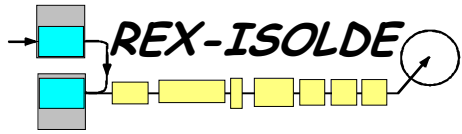


shunt impedance of IH cavities



- 1) HLI-GSI, 108 MHz , 2) LINAC III-CERN 101.28/202.56 MHz
 3) SchweIN 78.5/157 MHz, 4) ISOL, INS, 51 MHz
 5) HSI-GSI, 36 MHz

$$T^2 \cdot Z_0 \propto f^{-1/2}$$



small 202.56 MHz IH-resonator



Drift tube structure can be exchanged!

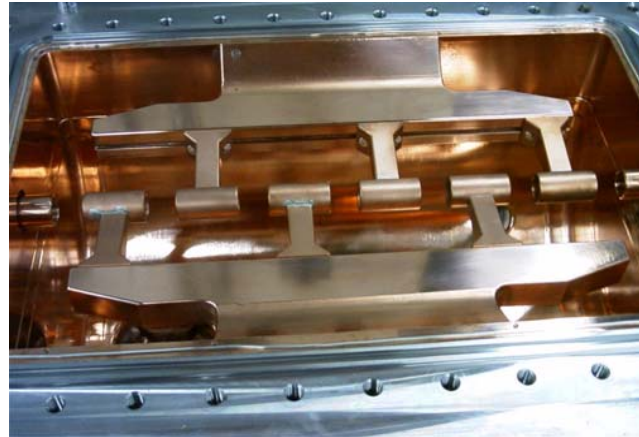
$f = 202.56 \text{ MHz}$

$Z = 130 \text{ M}\Omega/\text{m}$

$Q = 9800$

2,4 MV @ 90 kW

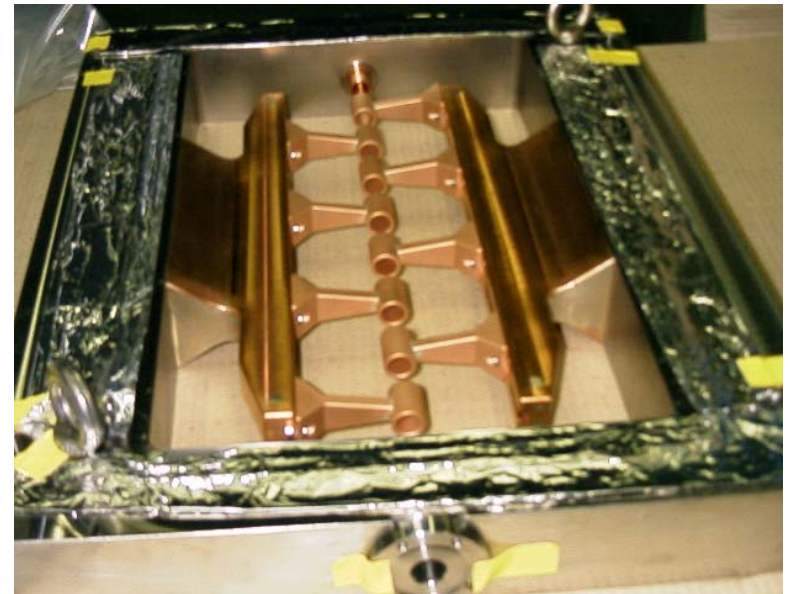
7-gap IH-resonator (MAFF)

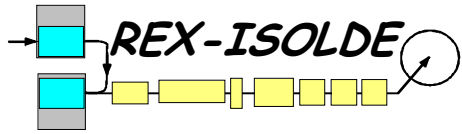


7-gap resonators \rightarrow
9-gap resonator

$E_{\text{synchron}} \text{ 7-gap} = 4.6 \text{ MeV/u}$
 \rightarrow cell length = 74 mm

$E_{\text{synchron}} \text{ 9-gap} = 2.5 \text{ MeV/u}$
 \rightarrow cell length 55 mm

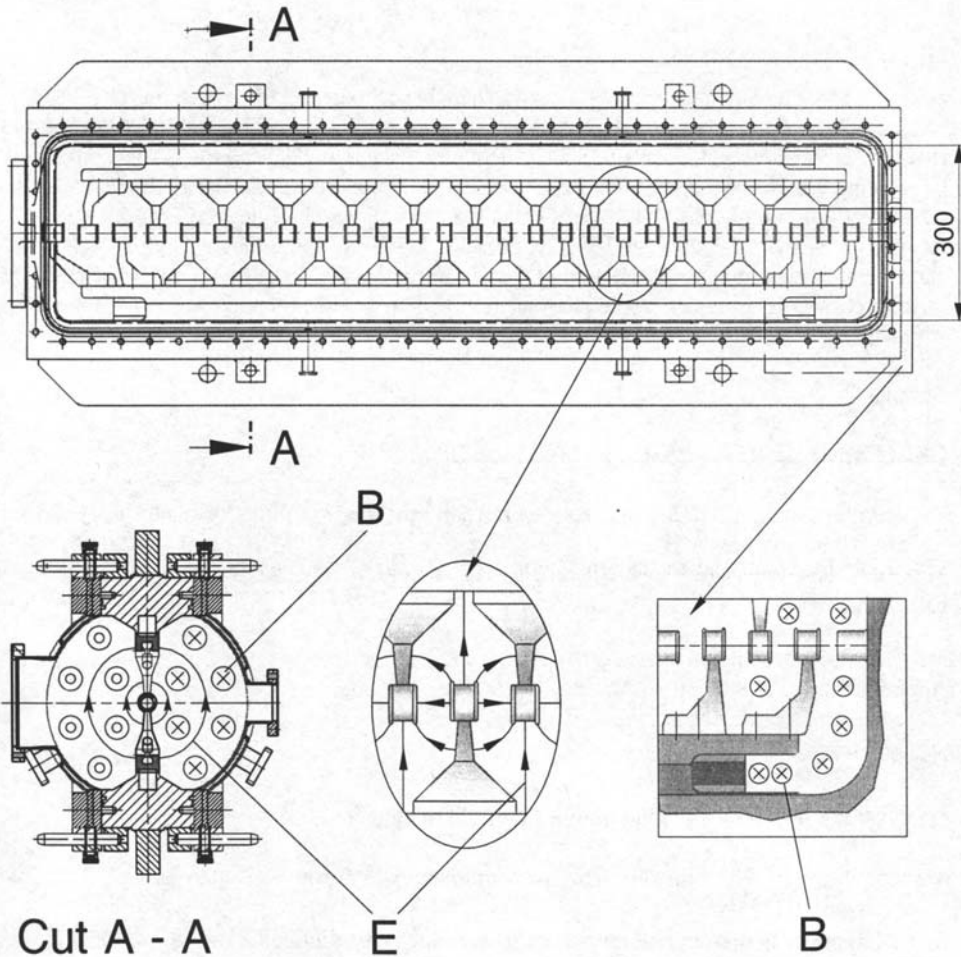




202.56 MHz IH-resonators



IH - Cavity, $H_{11(0)}$, 202 MHz



**example:
CERN LINAC III**

typical parameter for REX-ISOLDE:

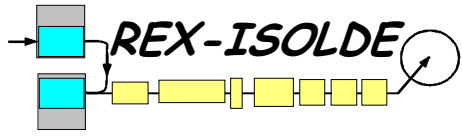
$E \sim 1.5 - 7 \text{ MeV/u}$

**effective shunt impedance:
 $120 - 160 \text{ M}\Omega/\text{m}$**

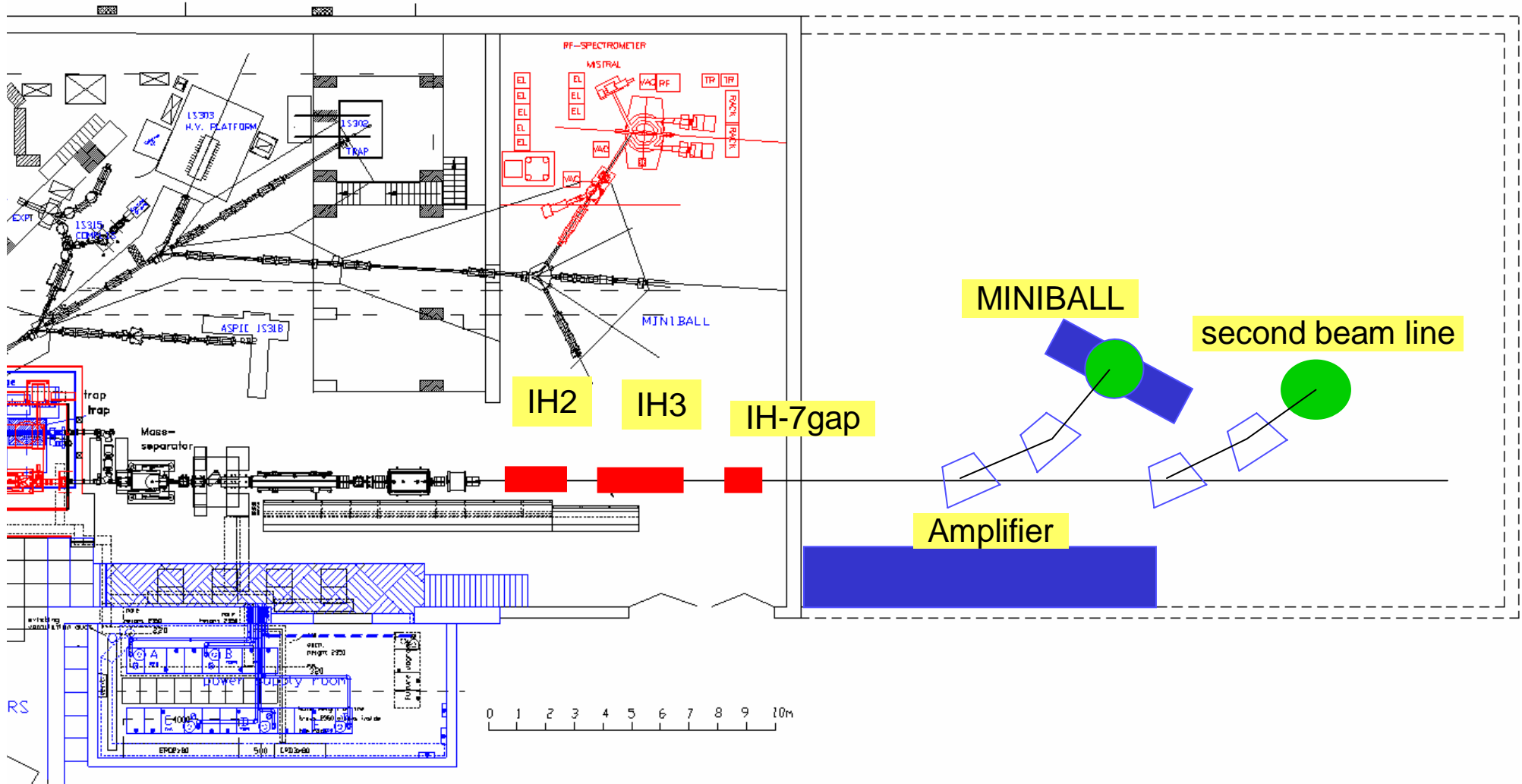
**for energy gain of 2.2 MeV/u
 10 MV effective voltage**

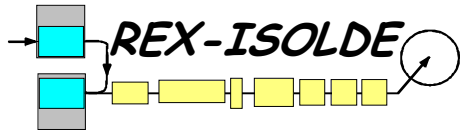
$\rightarrow 400 \text{ kW}$ rf-power

3 stage amplifier, 6 m long



Extension of the LINAC





Costs of accelerator components



price of the structure components in k€

	IH-Tank 200 MHz	CH-Tank 200 MHz	de/re-buncher
rf-Amplifier, 400 kW, 10% duty cycle	1000	1000	150
Low level rf-modules + SIMATIC, crates	30	30	20
resonator tank and plungers (material and production)	220	300	40
copper plating (tank, structure)	25	35	10
vacuum system (valves, gauges, pumps)	50	50	25
electronics (vacuum, control, SIMATIC, PCs, ADCs, DACs, Profibus)	20	20	20
diagnostics	20	20	20
support stands	10	10	5
lead shield	10	10	5
quadrupole triplet lens (one per cavity)	35	35	35
lens power supplies	30	30	30
price of the structures	1450	1540	360
	per magnet	4 magnets	
bending magnets (4 x 22.5 deg or 30 deg)	45	180	
power supplies (65 V, 400A)	40	160	
		340	

