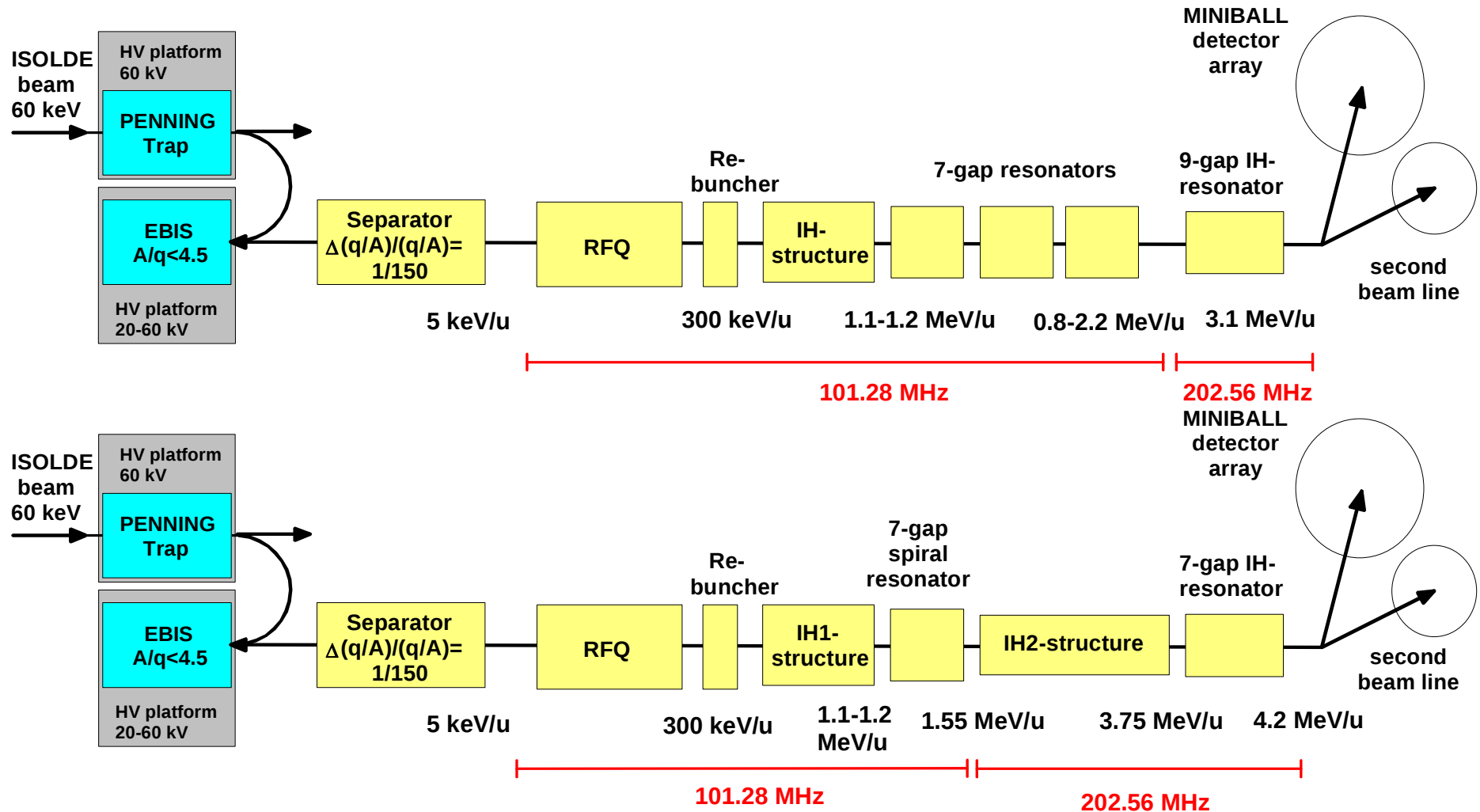
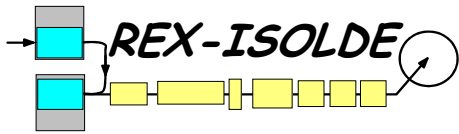
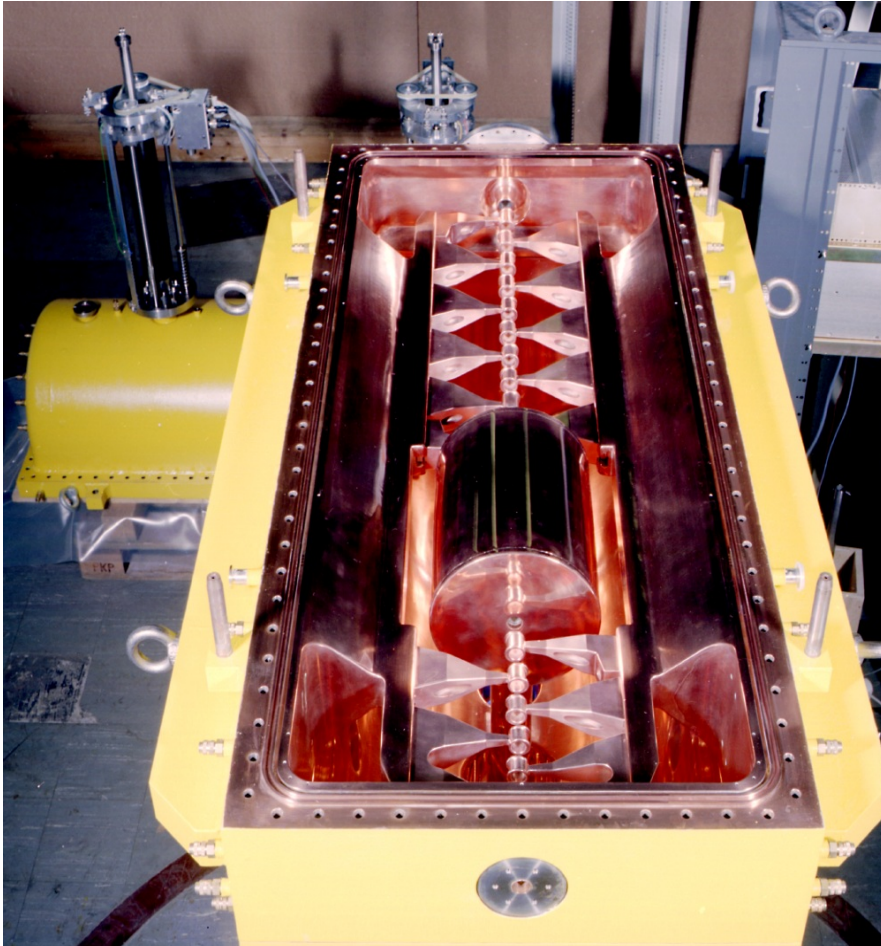


REX-ISOLDE energy upgrade

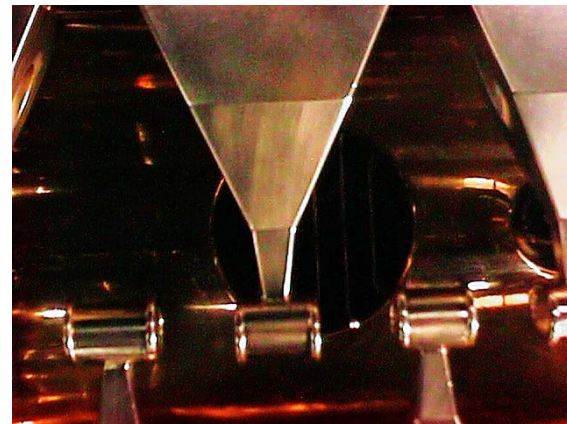


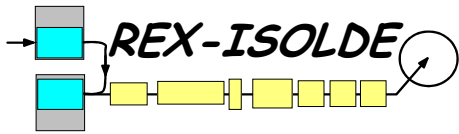


REX IH-type structure



Design resonator voltage: $V_{\text{eff}} = 4.6\text{-}5.1$ MV
achievable with 100 kW rf power: 7 MV
shunt impedance: $Z = 330$ M Ω /m
Quality factor: $Q = 16000$
frequency: 101.28 MHz





7-gap resonators



7-gap spiral resonator (REX)



Fixed structure!

$f = 101.28 \text{ MHz}$

$Z_{\text{eff}} = 53 \text{ M}\Omega/\text{m}$

$Q = 5400 - 5600$

$1,8 \text{ MV @ } 90 \text{ kW}$

Drift tube structure can be exchanged!

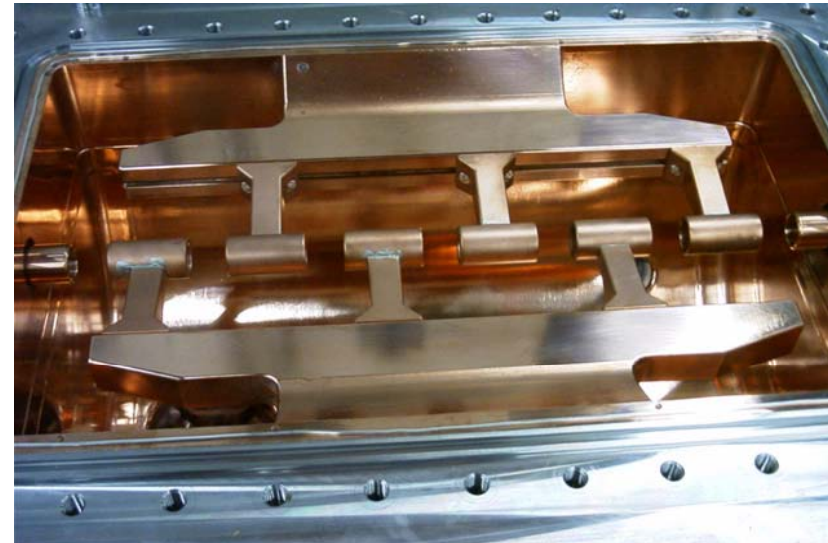
$f = 202.56 \text{ MHz}$

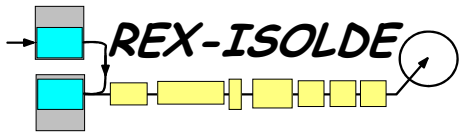
$Z_{\text{eff}} = 110 \text{ M}\Omega/\text{m}$

$Q = 9800$

$2,4 \text{ MV @ } 95 \text{ kW}$

7-gap IH-resonator (MAFF)





small 202.56 MHz IH-resonator

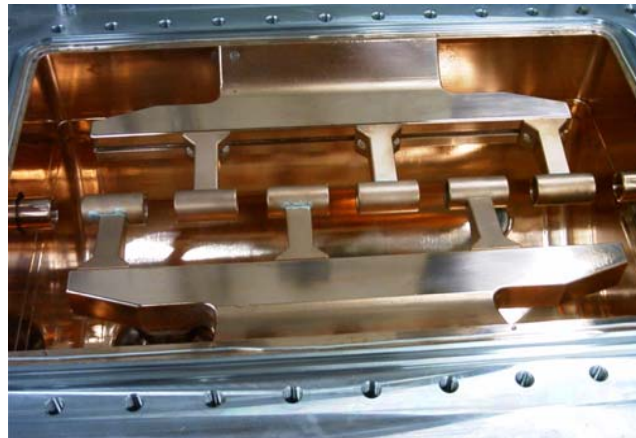


Drift tube structure can
be exchanged!

$f = 202.56 \text{ MHz}$

2,4 MV @ 95 kW

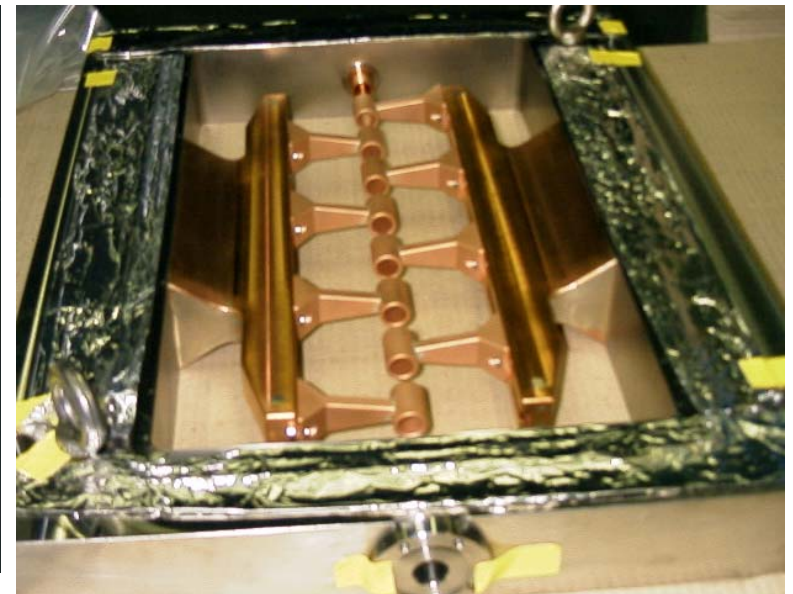
7-gap IH-resonator (MAFF)



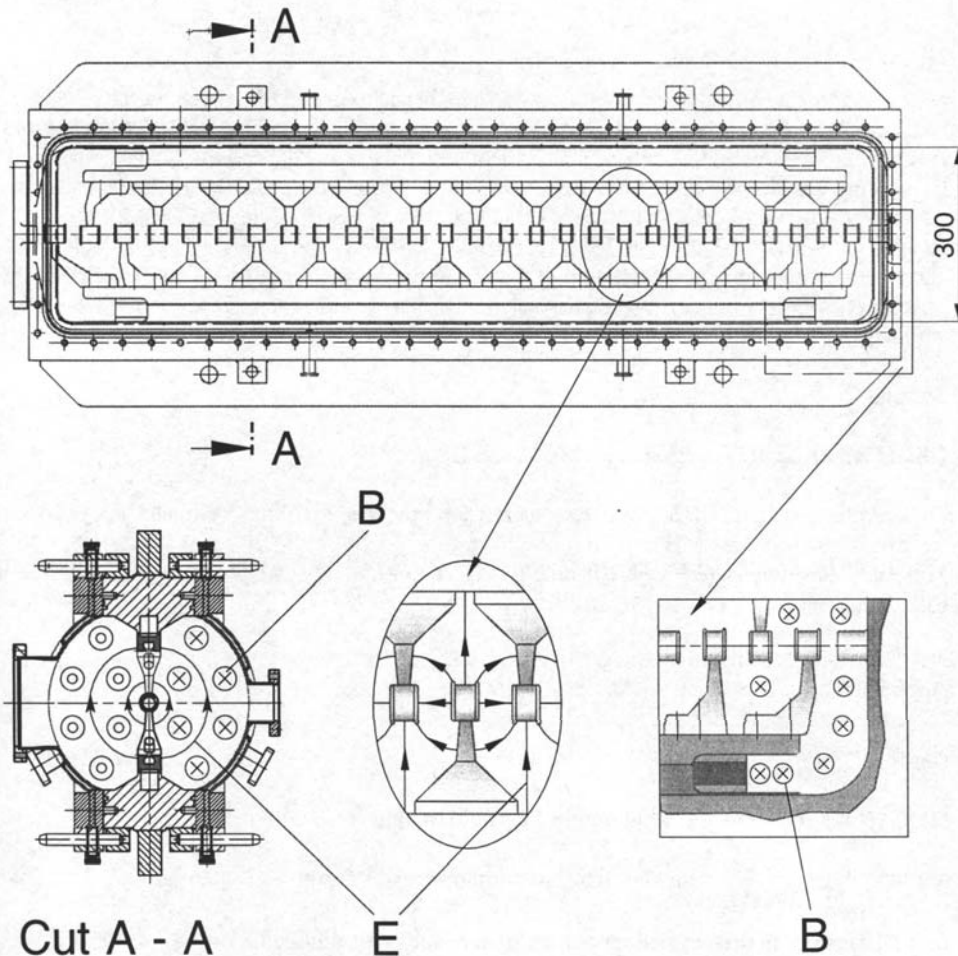
7-gap resonators →
9-gap resonator

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

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



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



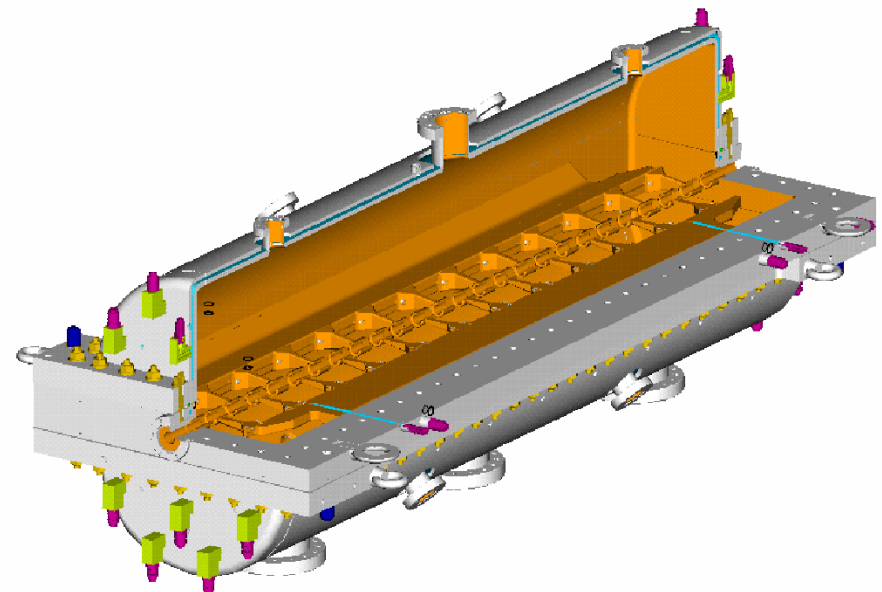
example: CERN LINAC III

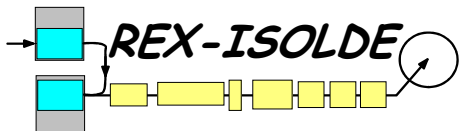
$f = 202.56$ MHz

8.3 MV @ 300 kW

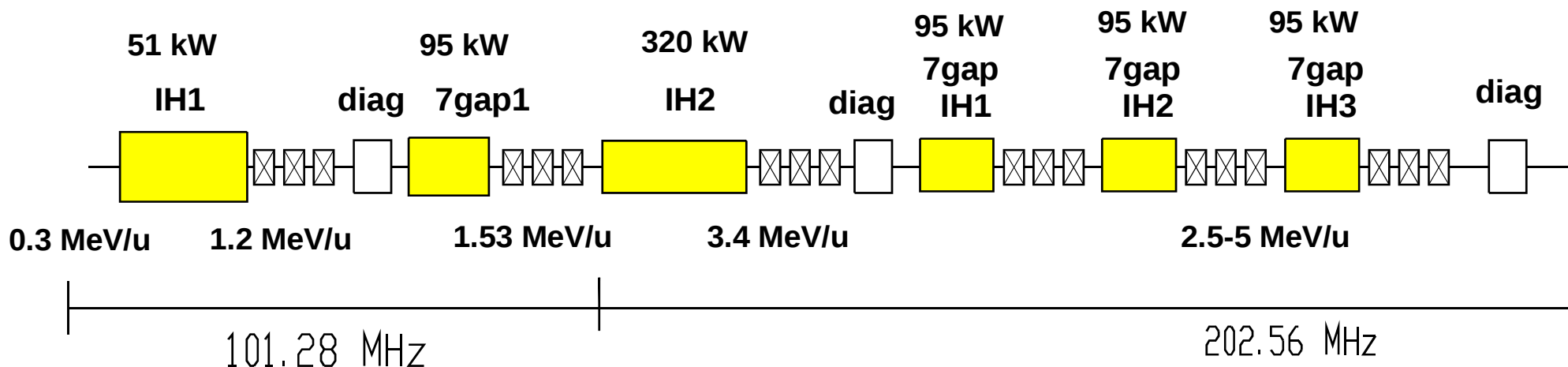
effective shunt impedance:

120 – 160 M Ω /m



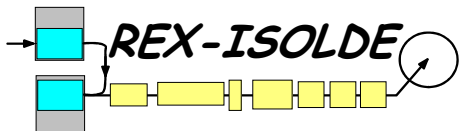


Above 4.2 MeV/u, option 1

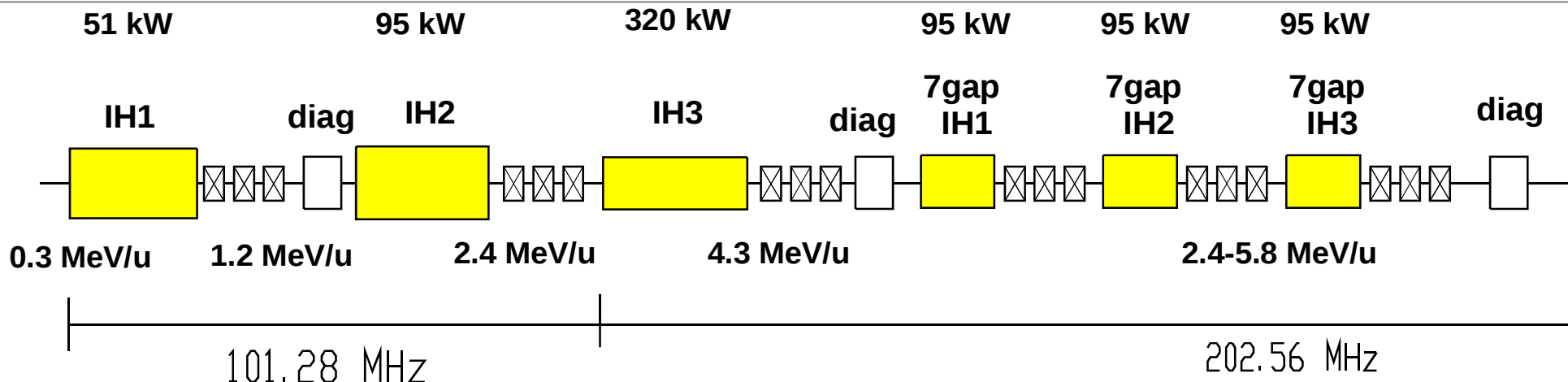


Price of the LINAC modification (in k€)

	IH3	IH 7gap 1	IH-7gap2	IH-7gap3	price of components
rf-Amplifier	230	200	200	0	630
Low level rf-modules + SIMATIC, crates	20	20	20	0	60
electronics (vacuum, control, SIMATIC, PCs, ADCs, DACs, Profibus)	20	20	20	0	60
vacuumsystem (valves, gauges, pumps)	40	20	20	10	80
tuning plungers, structure	15	10	10	5	35
resonator tank (material and production)	150	90	90	0	330
cooper plating (tank, structure)	20	15	15	0	50
support stands	5	5	5	5	15
magnetic lenses+power supply	50	50	50	0	150
price of the structures	550	430	430	20	1410

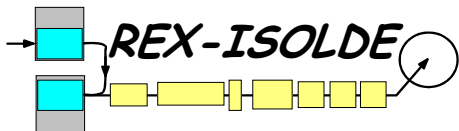


Above 4.2 MeV/u, option 2

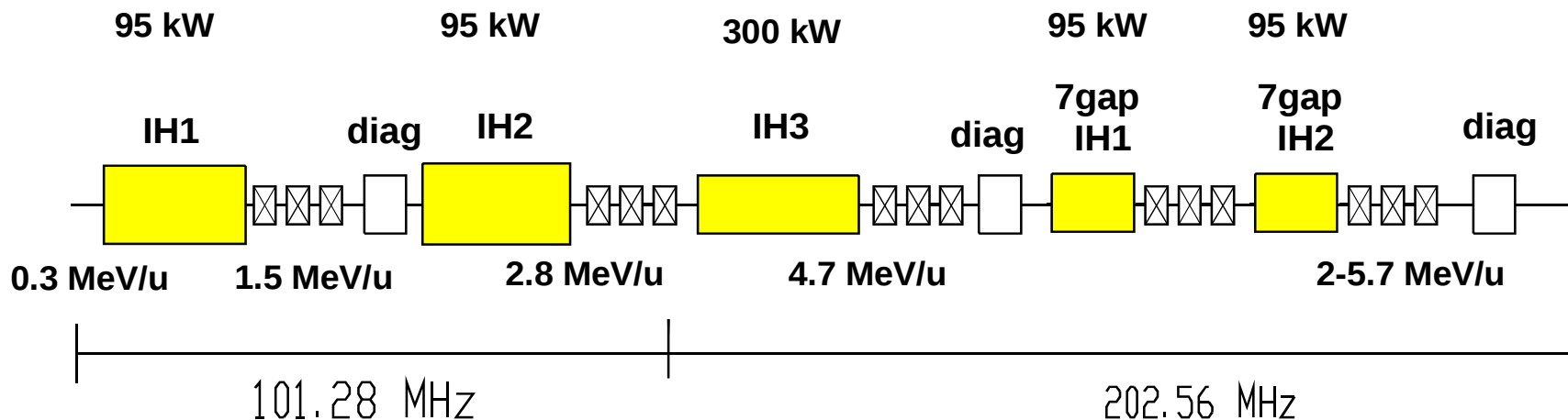


Price of the LINAC modification (in k€)

	IH2	IH3	IH 7gap 1	IH-7gap2	IH-7gap3	price of components
rf-Amplifier	0	230	200	200	0	630
Low level rf-modules + SIMATIC, crates	0	20	20	20	0	60
electronics (vacuum, control, SIMATIC, PCs, ADCs, DACs, Profibus)	0	20	20	20	0	60
vacuumsystem (valves, gauges, pumps)	40	40	20	20	10	120
tuning plungers, structure	10	15	10	10	5	45
resonator tank (material and production)	150	150	90	90	0	480
cooper plating (tank, structure)	15	20	15	15	0	65
support stands	5	5	5	5	5	20
magnetic lenses+power supply	50	50	50	50	0	200
price of the structures	270	550	430	430	20	1680



Above 4.2 MeV/u, option 3



Price of the LINAC modification (in k€)

	IH1	IH2	IH3	IH 7gap 1	IH-7gap2	price of components
rf-Amplifier	0	0	230	200	200	630
Low level rf-modules + SIMATIC, crates	0	0	20	20	20	60
electronics (vacuum, control, SIMATIC, PCs, ADCs, DACs, Profibus)	0	0	20	20	20	60
vacuumsystem (valves, gauges, pumps)	0	40	40	20	20	120
tuning plungers, structure	10	10	15	10	10	55
resonator tank (material and production)	0	150	150	90	90	480
cooper plating (tank, structure)	0	15	20	15	15	65
support stands	0	5	5	5	5	20
magnetic lenses+power supply	0	50	50	50	0	150
price of the structures	10	270	550	430	380	1640