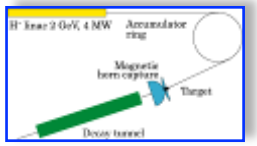
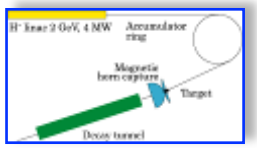


The 4 Horn System

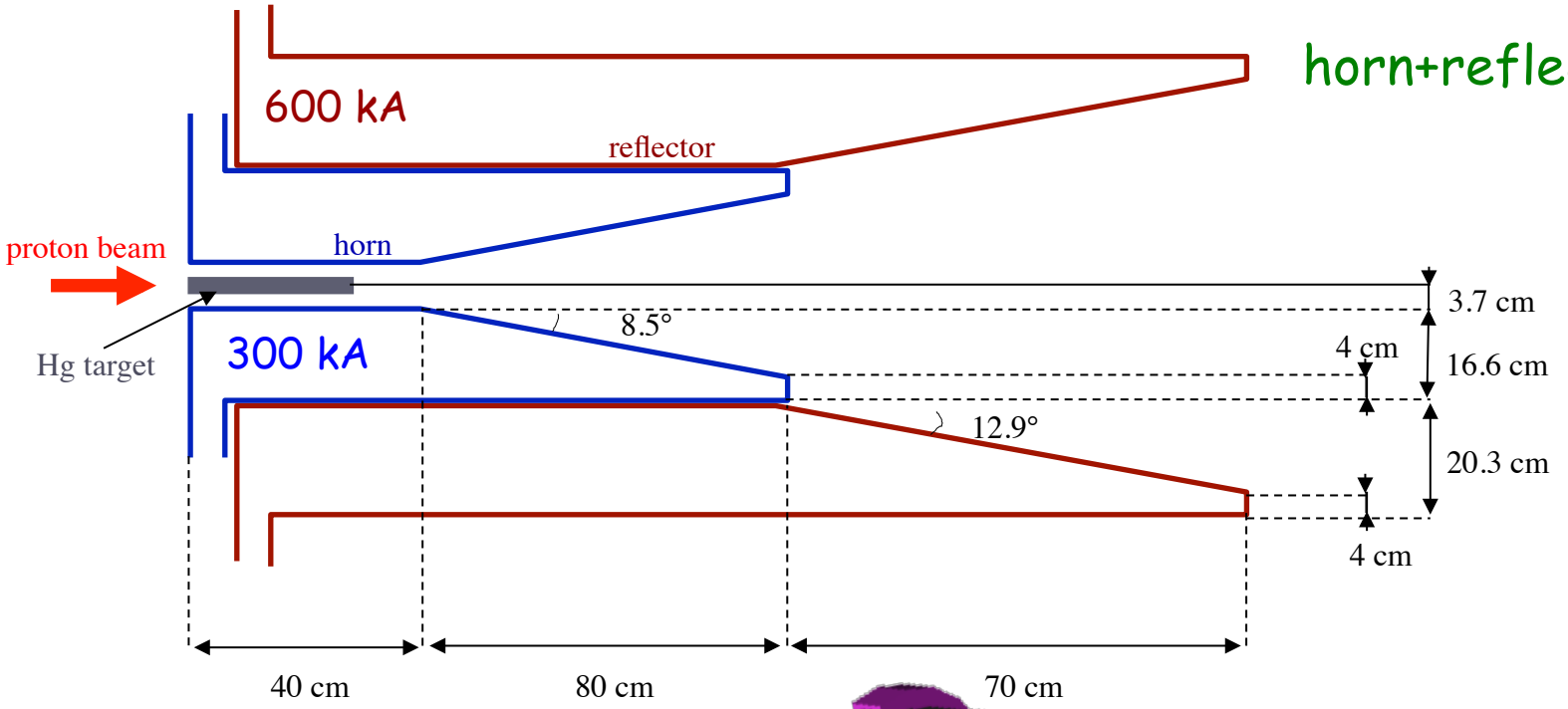
Marcos Dracos

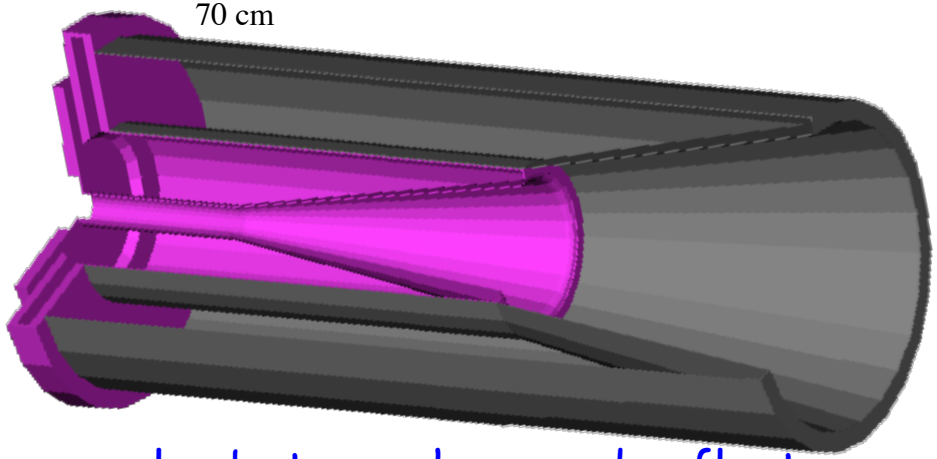
IPHC-IN2P3/CNRS Strasbourg

Proposed design for SPL



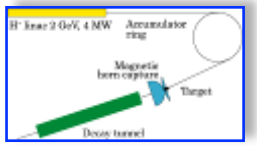
horn+reflector



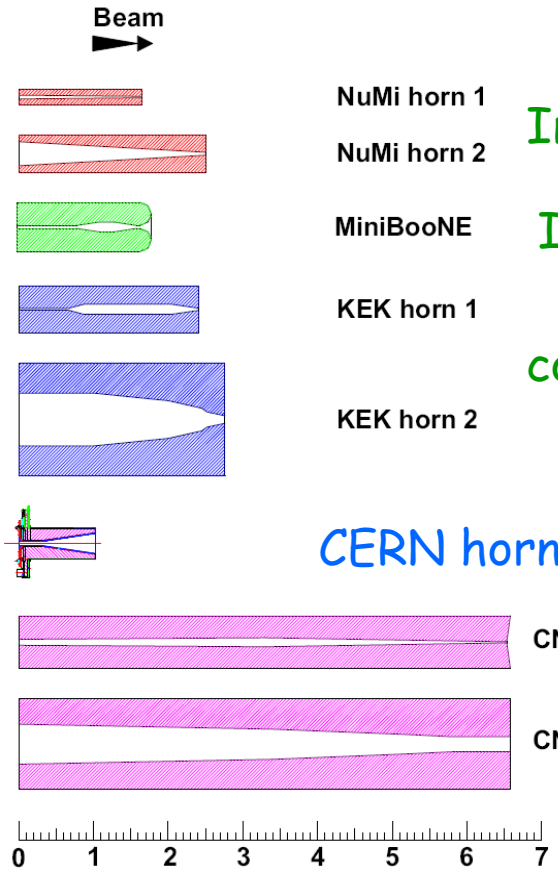


for the first time overlap between horn and reflector

Present Collectors



Experiment	Current	Rep. Rate	Pulses per time period
Numi (120 GeV)	200 kA	0.5 Hz	6 Mpulses 1 year
MiniBoone (8 GeV)	170 kA	5 Hz	11 Mpulses 1 year
K2K (12 GeV)	250 kA	0.5 Hz	11 Mpulses 1 year
Super-Beam (3.5 GeV)	300 kA	50 Hz	200 Mpulses 6 weeks
CNGS (400 GeV)	150 kA	2 pulses/ 6 sec	42 Mpulses 4 year



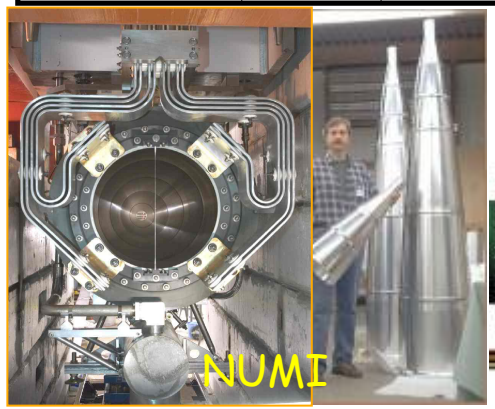
In operation

In operation

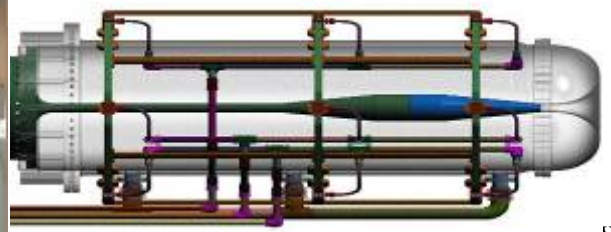
completed

CERN horn prototype for SPL

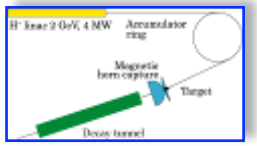
In operation



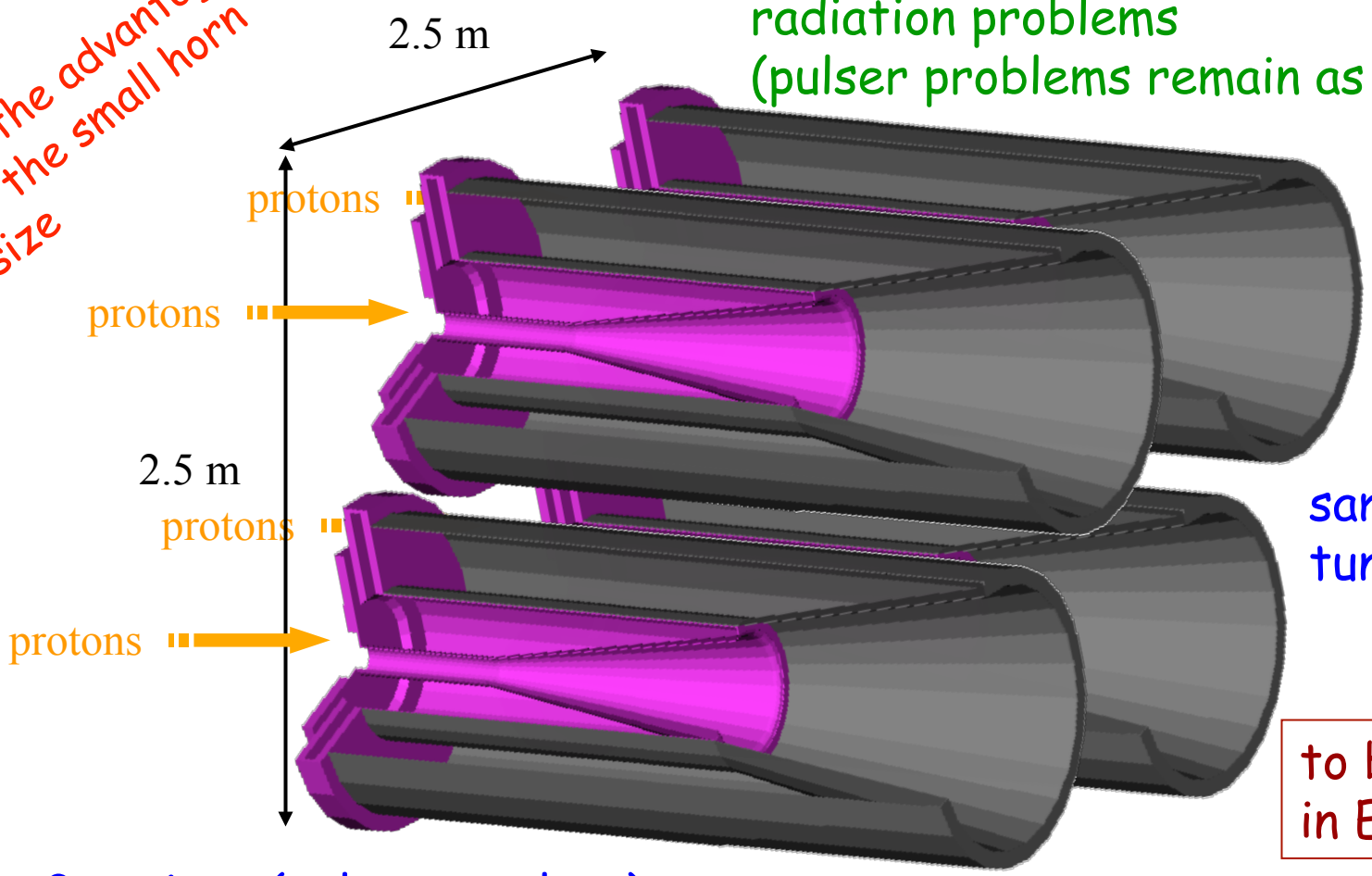
MiniBooNE



New ideas



use the advantage of the small horn size



minimize power dissipation and radiation problems
(pulser problems remain as before)

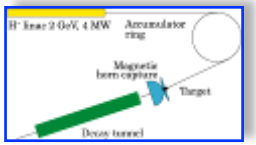
same decay tunnel Ø 3 m

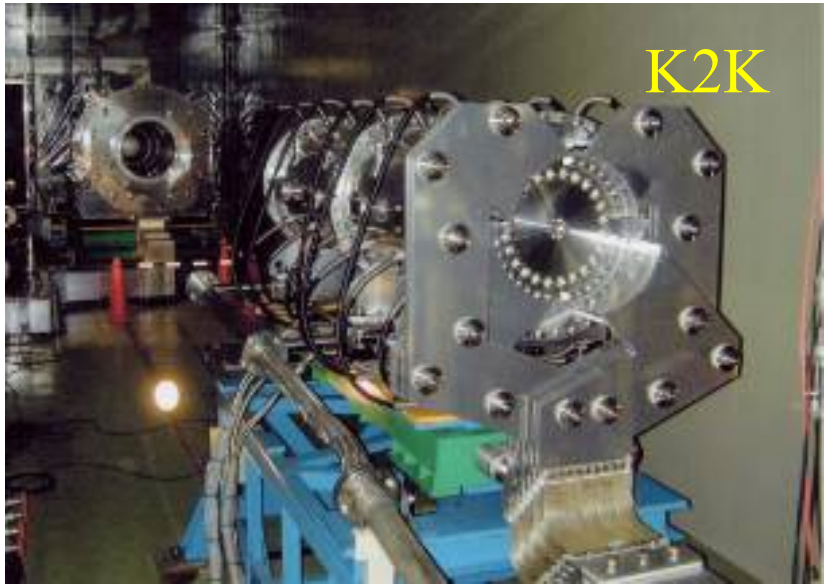
to be studied in EUROν

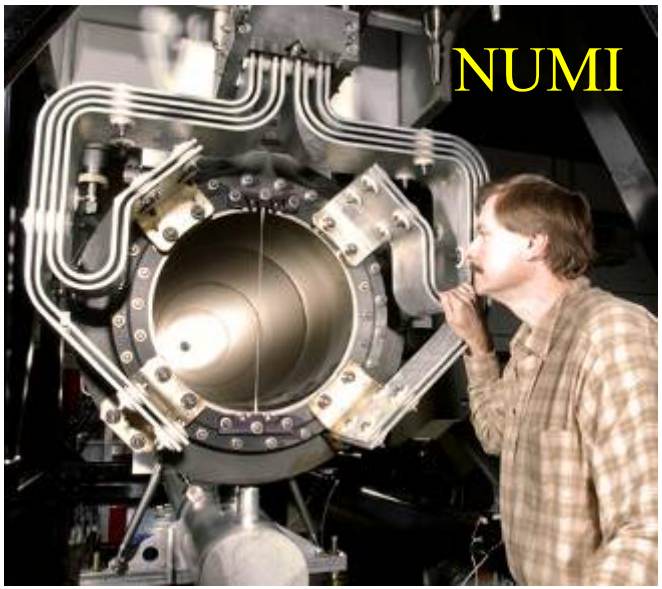
2 options (only one pulser):
- send at the same time 1 MW per target/horn system
- send 4 MW/system every 50/4 Hz

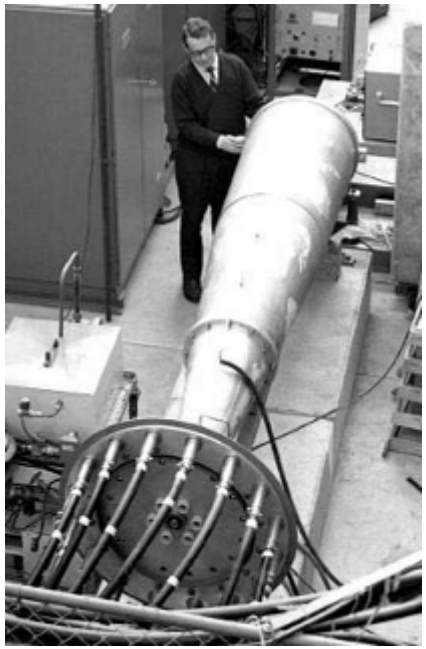
→ possibility to use solid target?

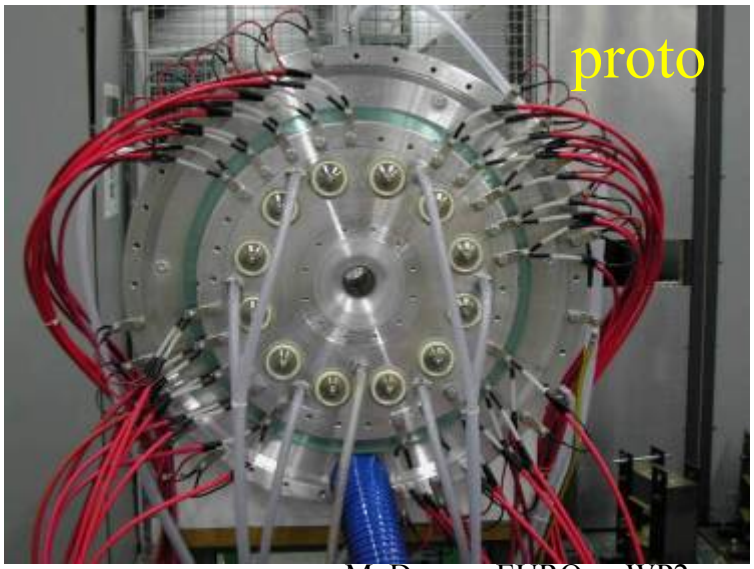
4 target/horn system

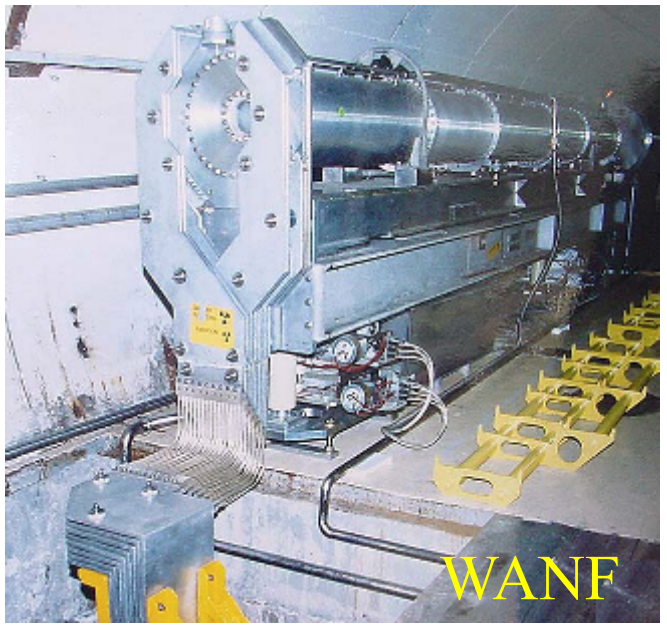




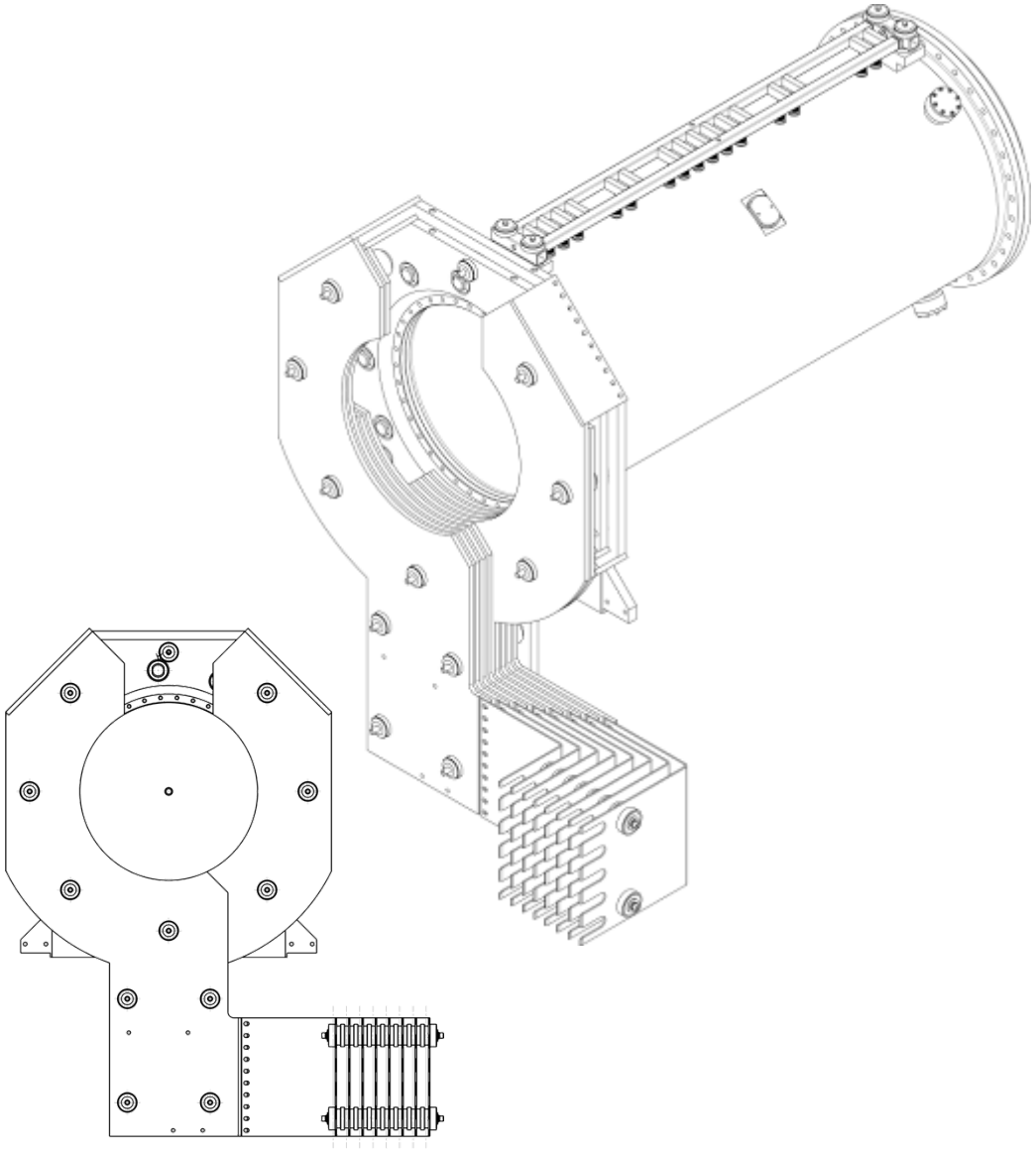


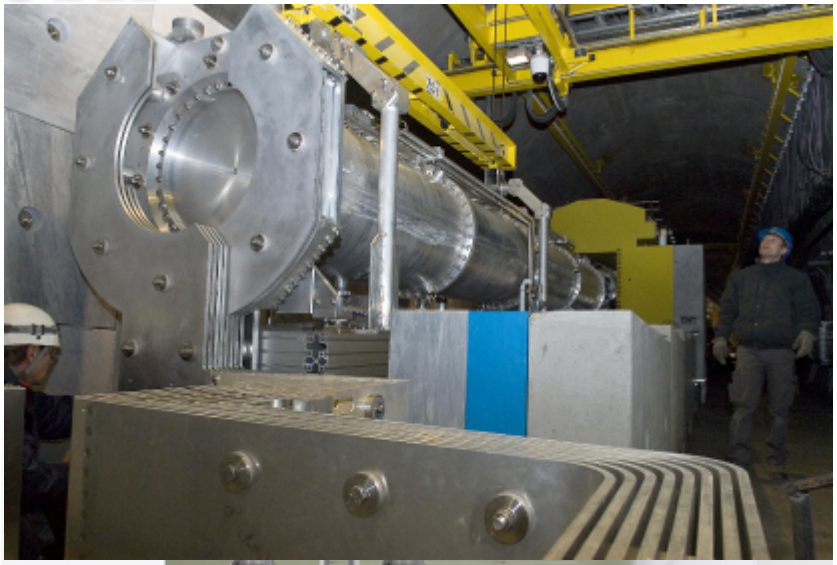


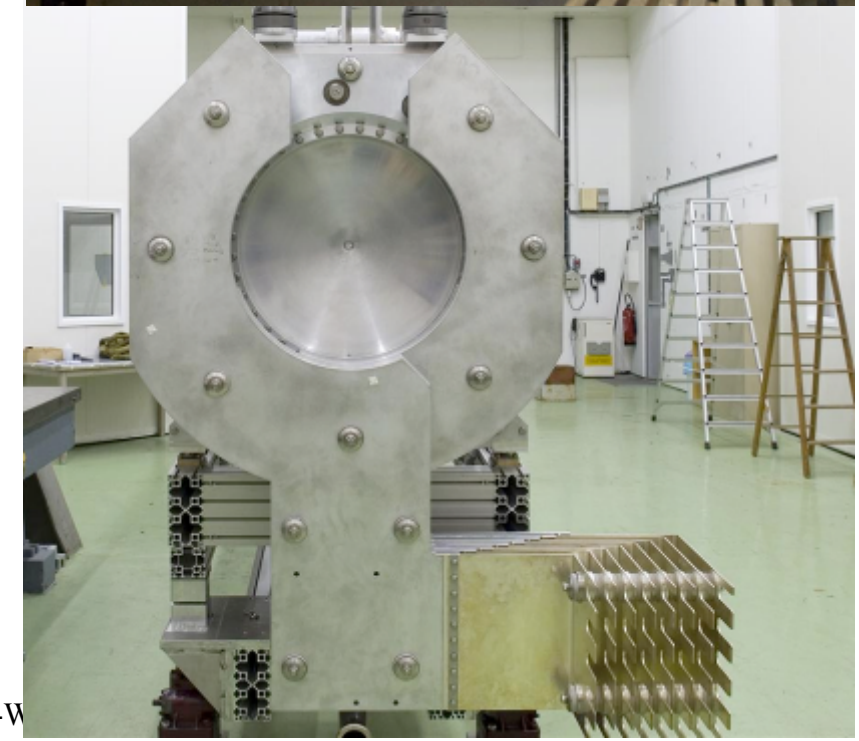


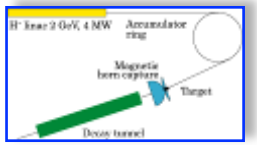


CNGS Horn

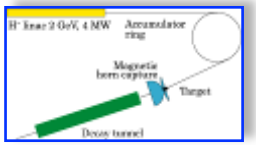


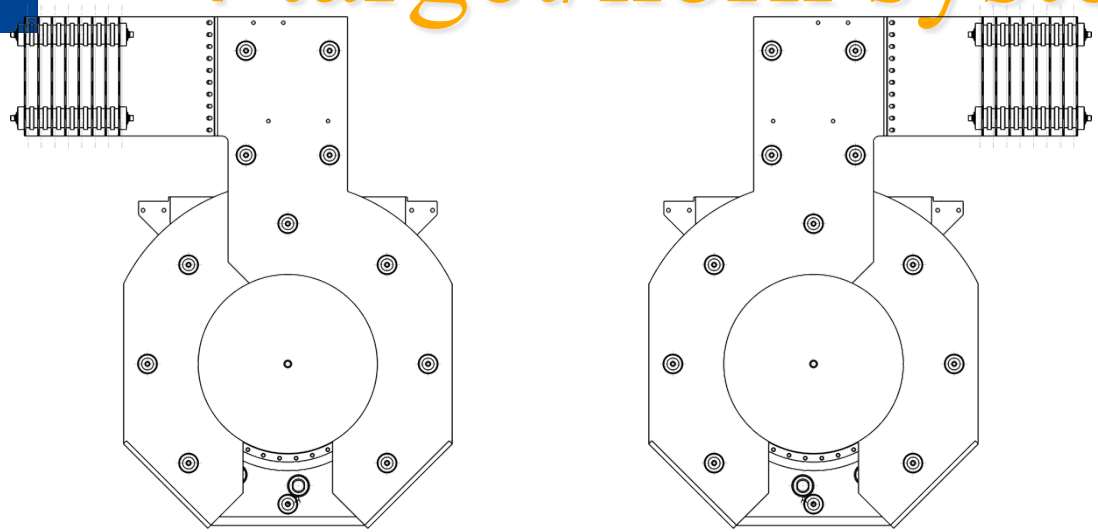


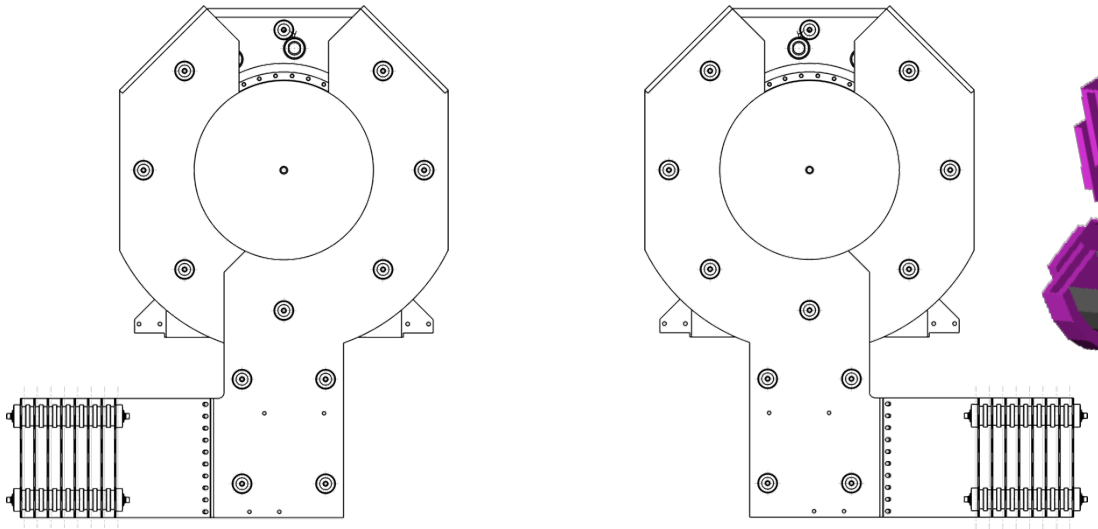




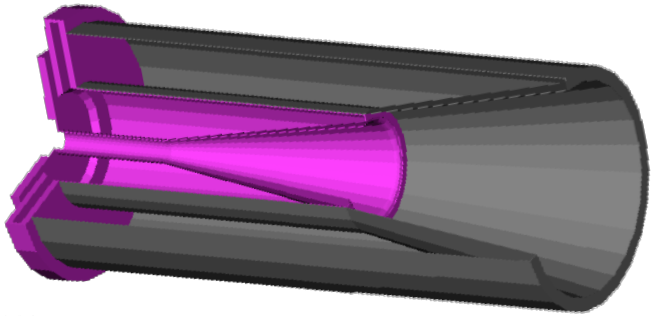
4 target/horn system



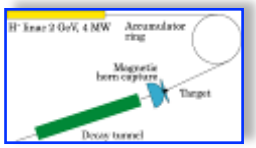


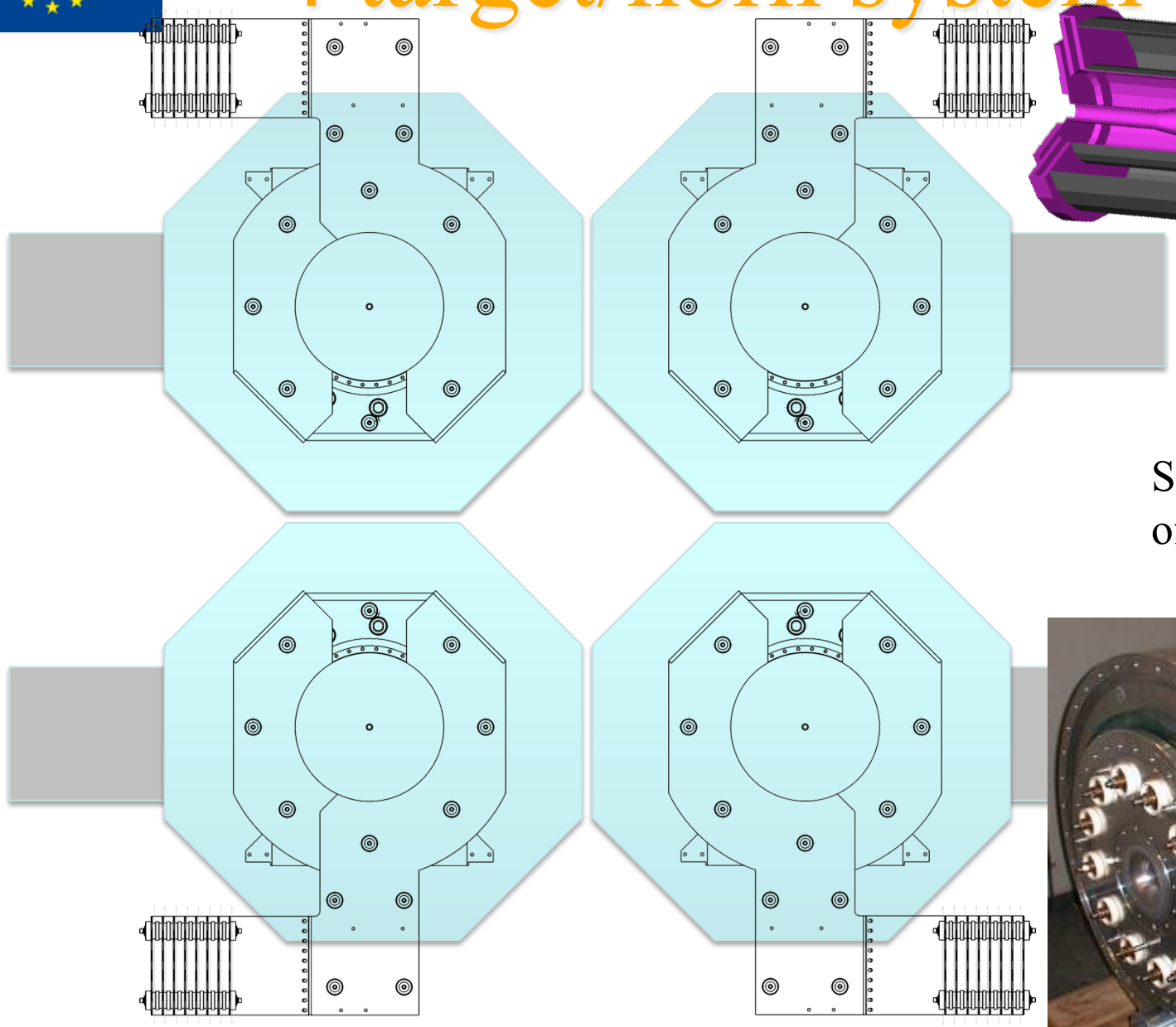


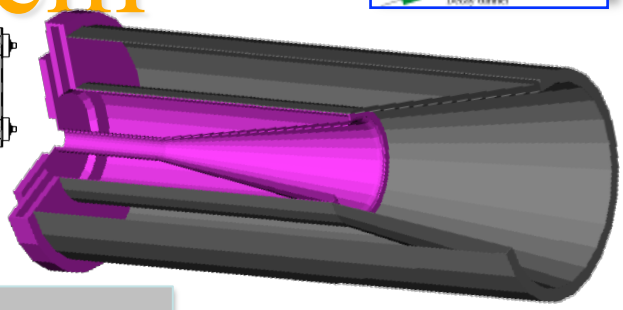
Strip lines instead of cables



4 target/horn system

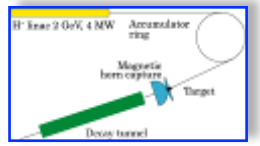


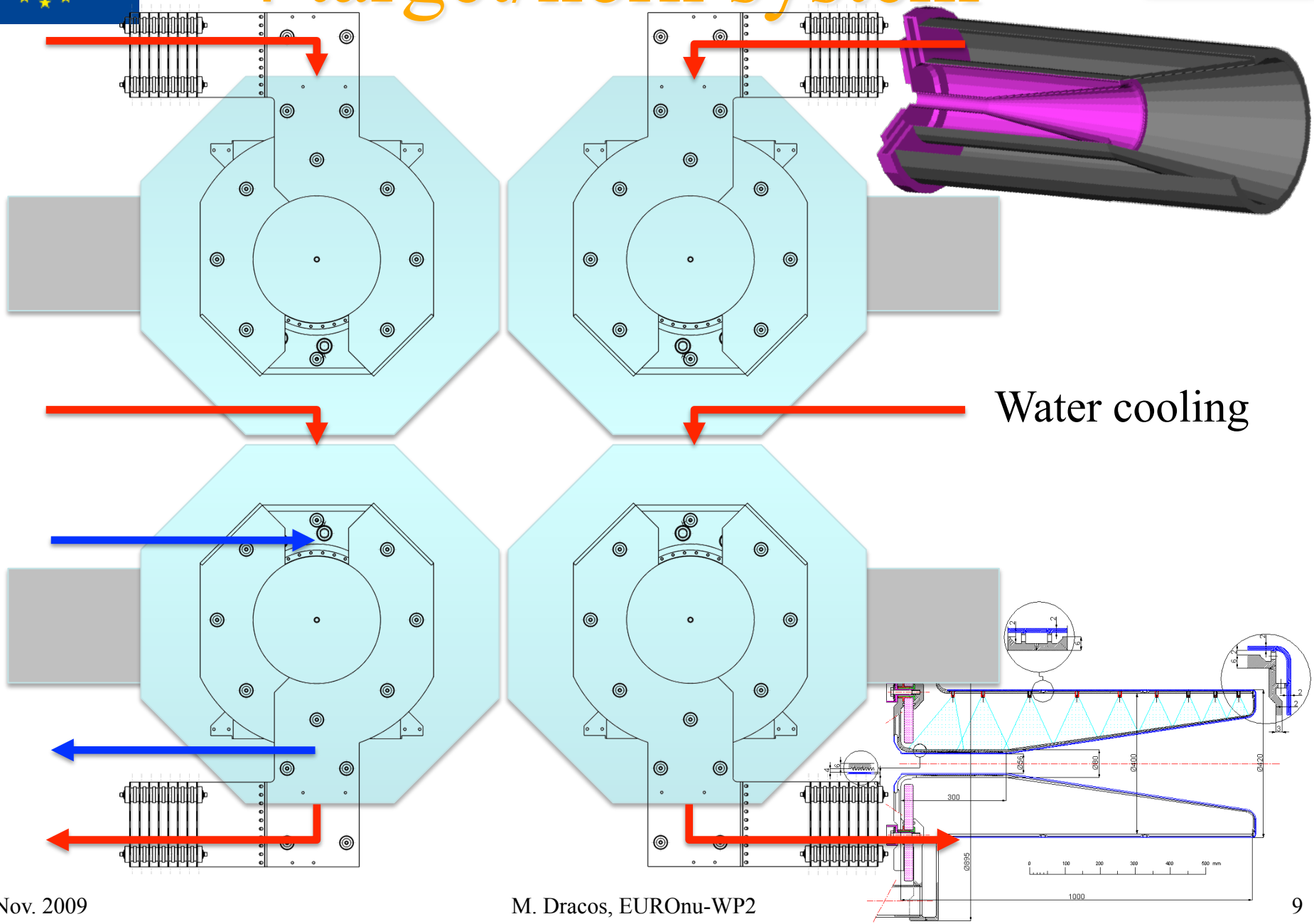




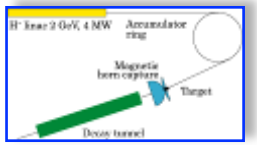
Strip lines instead of cables

4 target/horn system



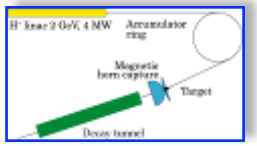


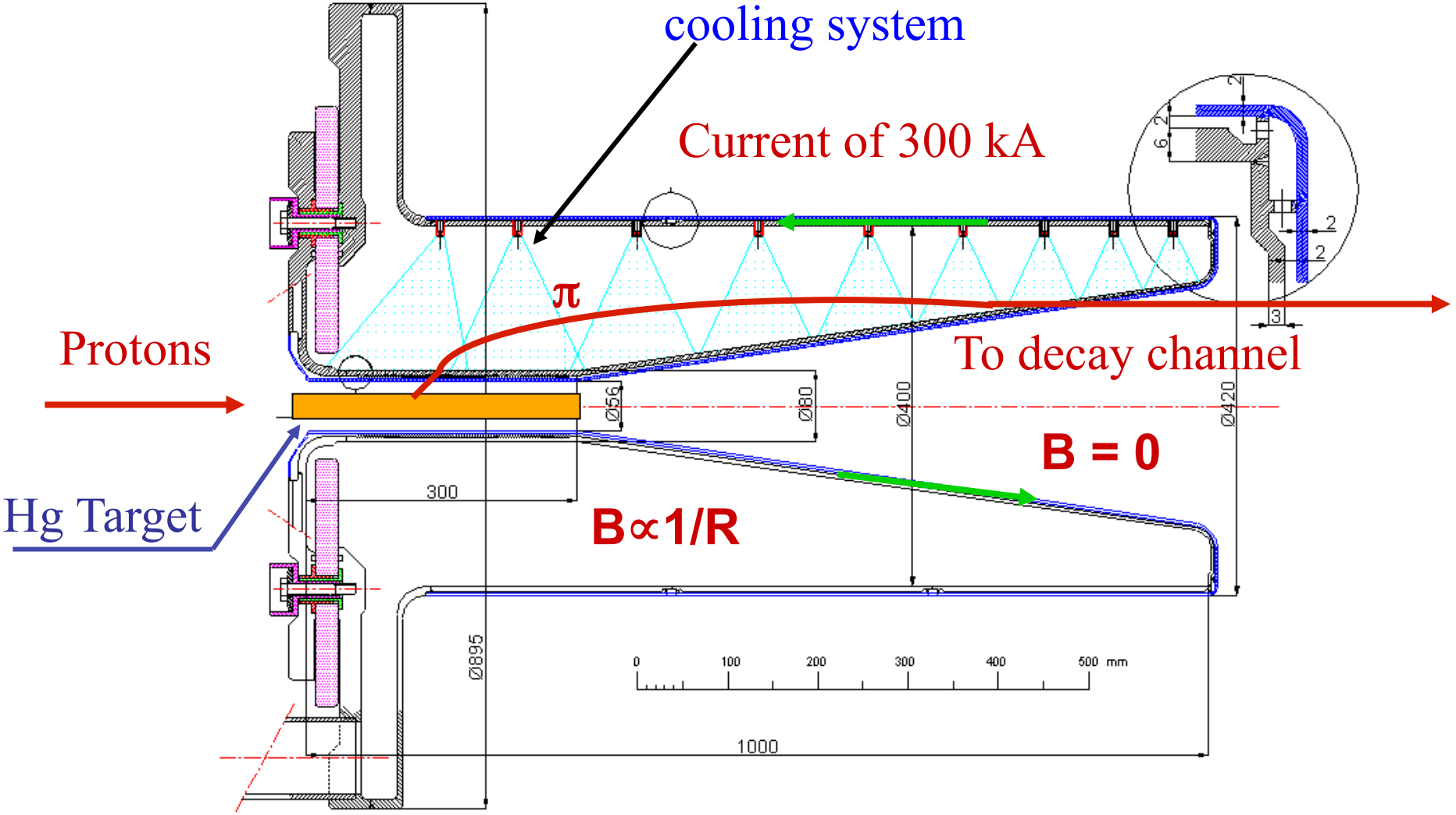
Water cooling


Accumulator ring
Magnetic horn capture
Target
Decay tunnel

End

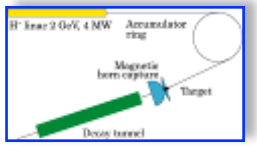
CERN horn prototype

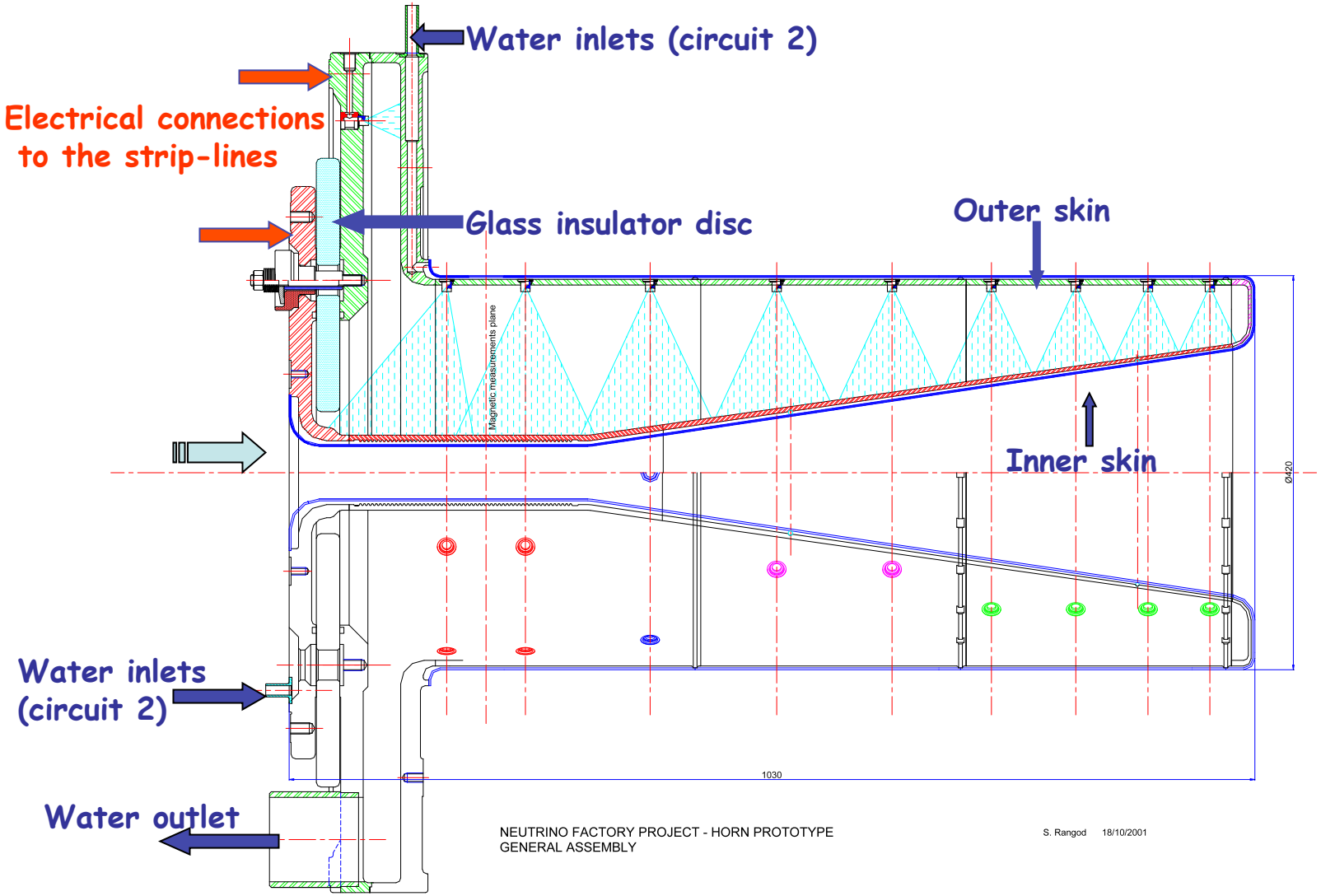




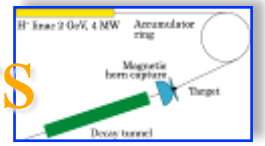
initial design satisfying both, neutrino factory and super-beam

CERN horn prototype

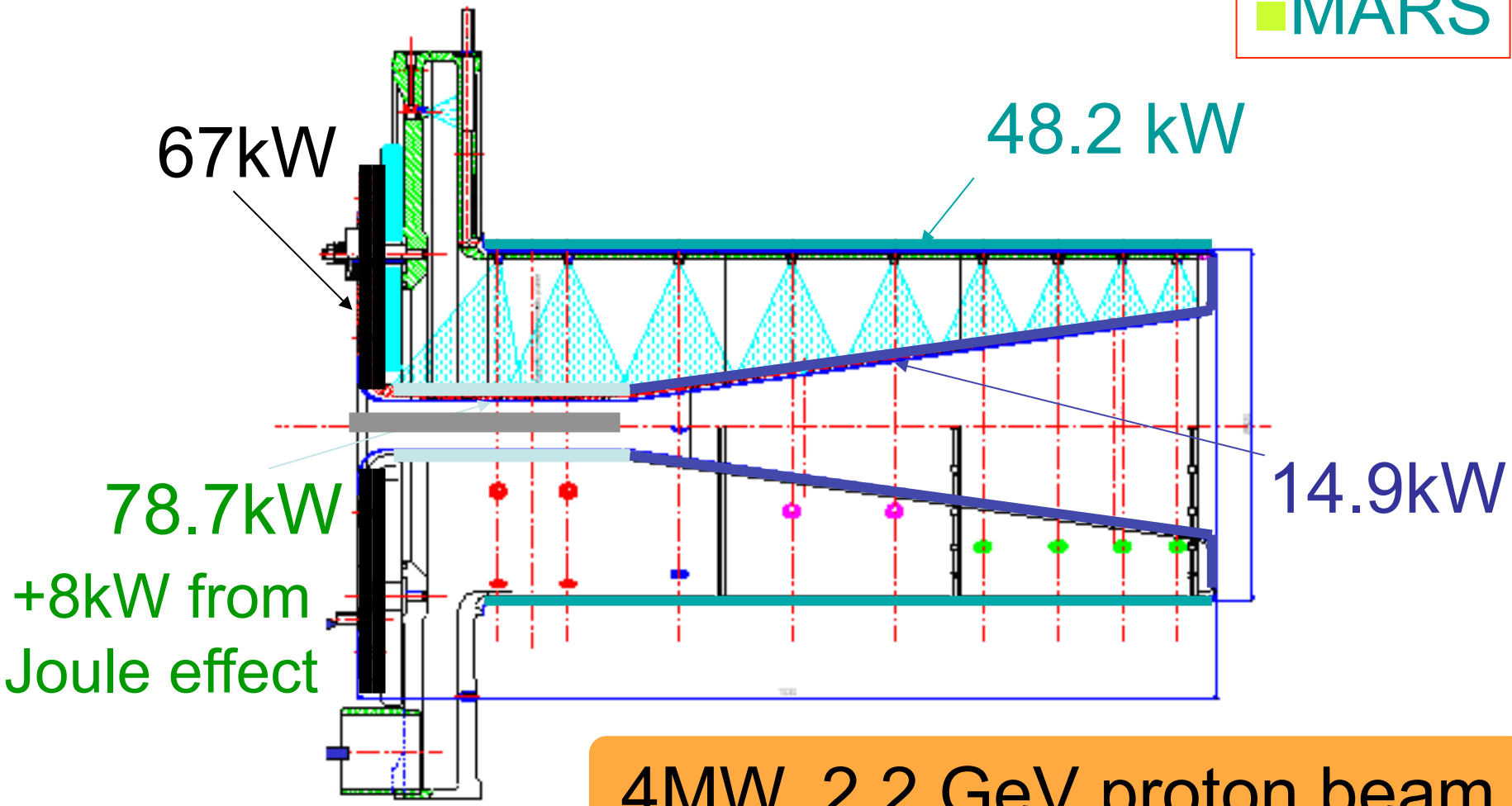




Energy deposition in the conductors



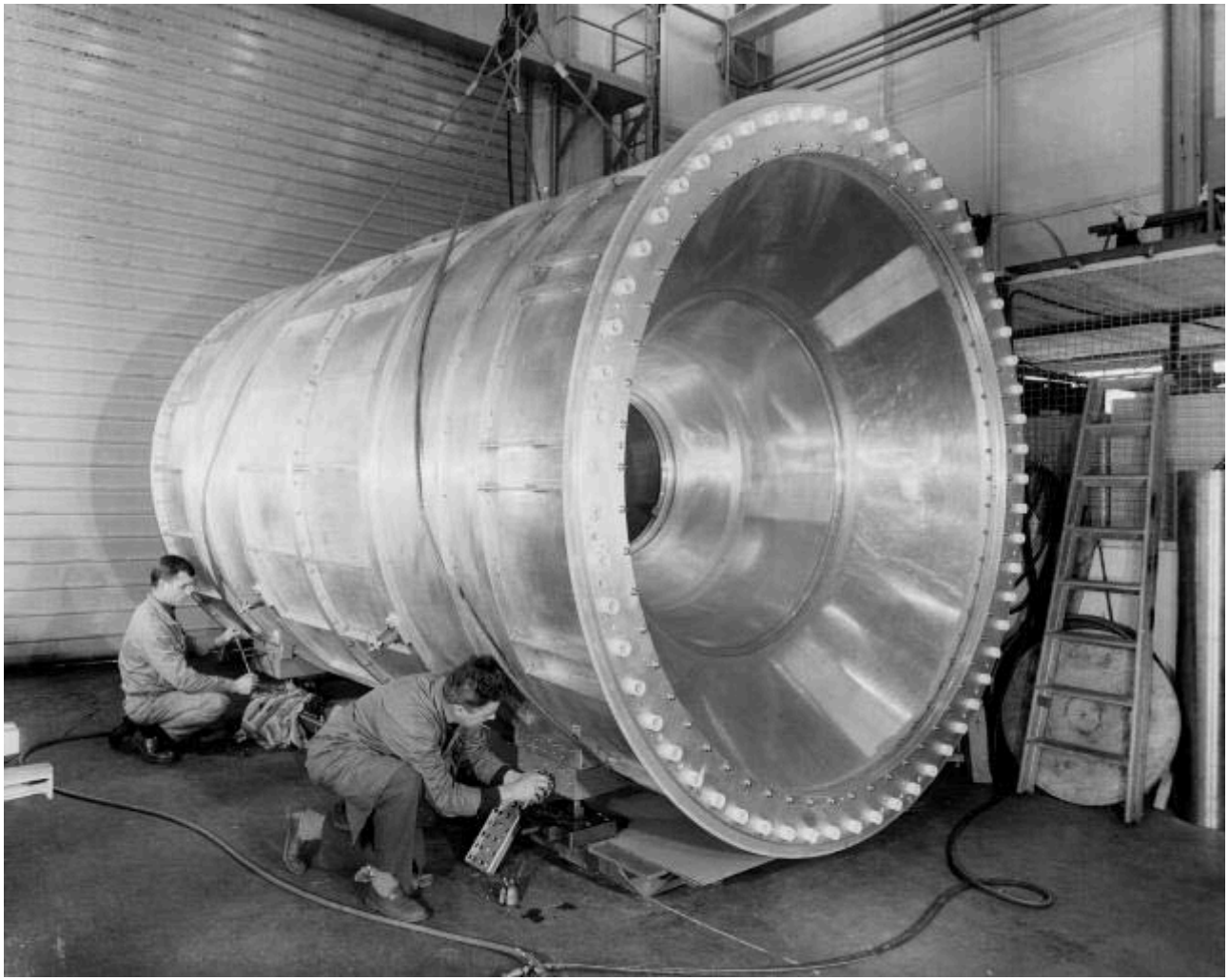
MARS



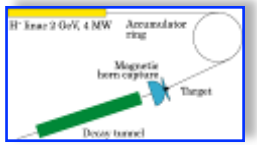
4MW, 2.2 GeV proton beam

(1MeV = 1.82 kW)

Big Horns



Prototype Horn

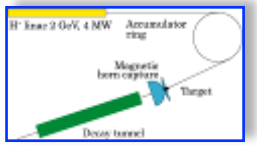


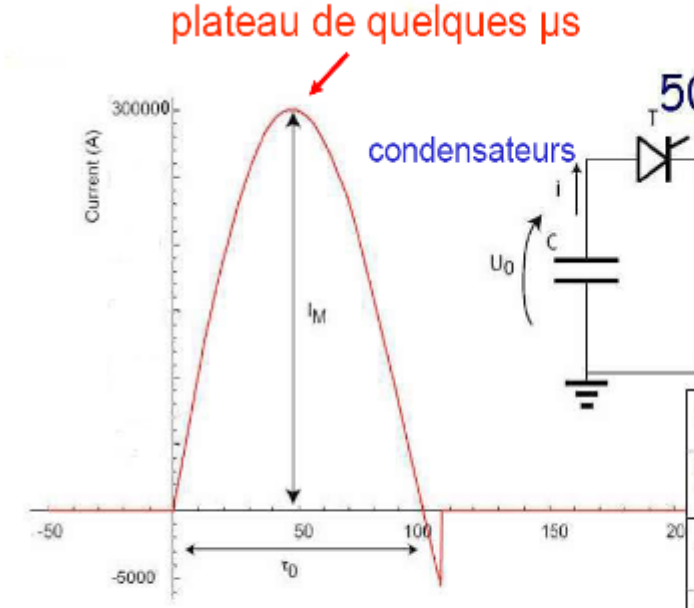
3.5 Neutrino Factory studies for future

Prototype developed at CERN in 2001

Maximum current	:	300 kA
Pulse repetition rate:		50 Hz
Waist diameter	:	80 mm
Length	:	1030 mm
Life time	:	6 weeks or 2 x 10^8 pulses for the prototype (six months or 8 x 10^8 pulses for a final horn)
Pulse length	:	≤ 100 μs
r.m.s current	:	15 kA (CMS – 20 kA)
Voltage on horn	:	~ 4000 V
Skin depth	:	1.25 mm
Joule losses	:	40 kW

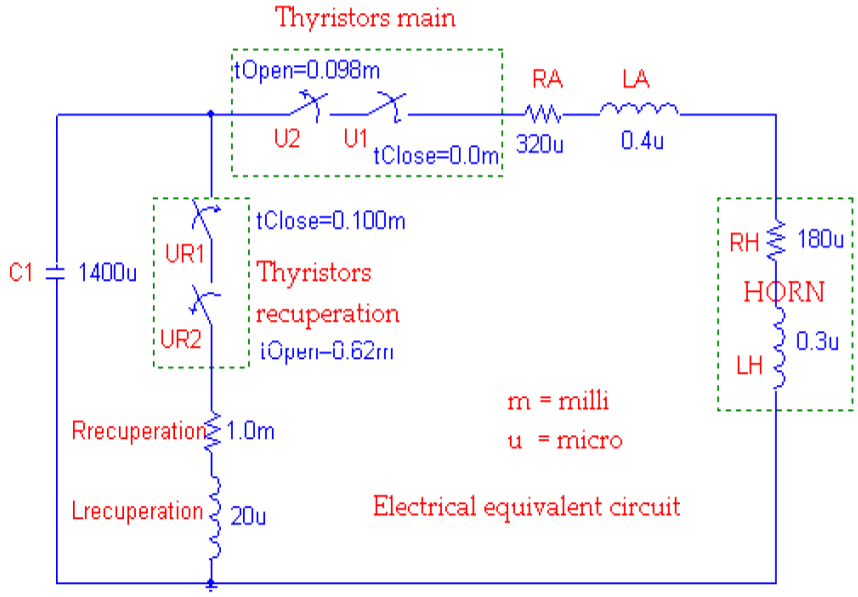
Power Supply for horn pulsing (major issue)





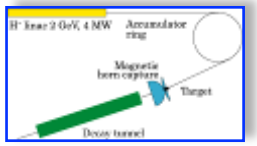
values considered by CERN

U_o	7kV
I_M	300kA (14,5 rms)
τ_o	100µs
L	0.6 (0.4 Horn)µH
R	500 (180 Horn) µΩ
C	1500µF

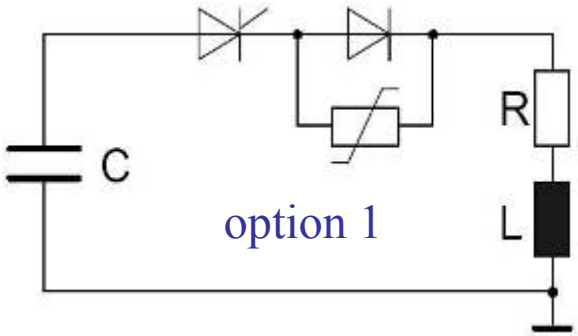


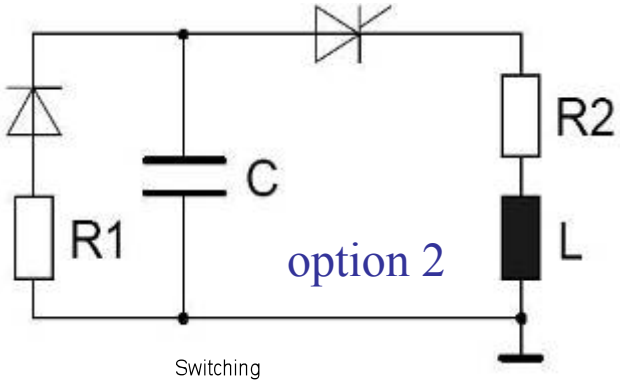
Restart the studies by beginning of next year

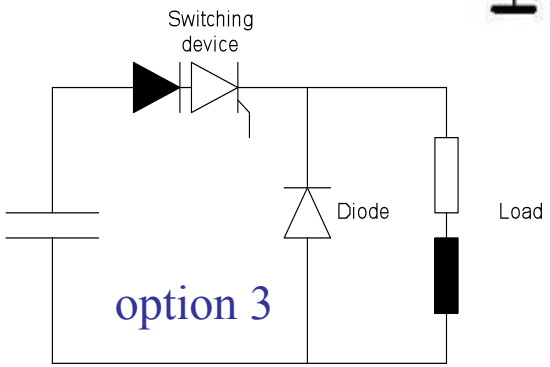
3 Solutions proposed by ABB

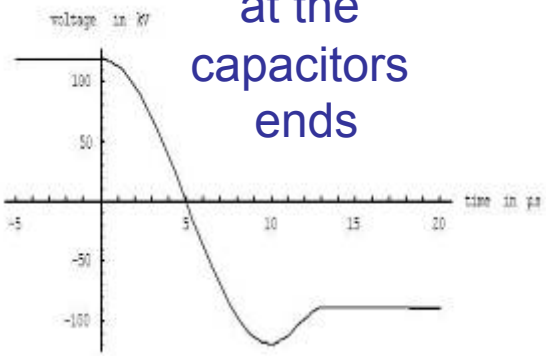


schematic versions

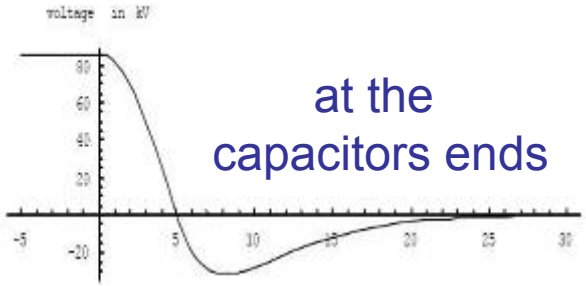




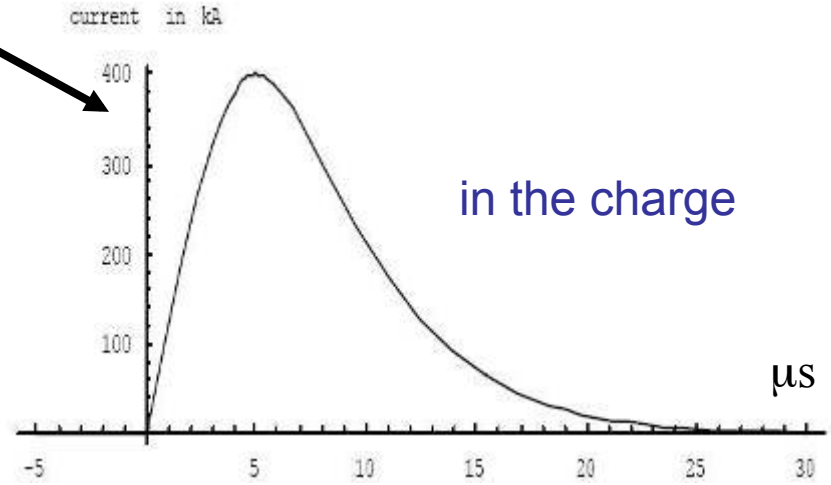




at the capacitors ends



at the capacitors ends



in the charge