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Fabrication of photo-injectors for CTF3 and for the NEPAL test stand

Raphaël Roux

1. Status of the construction of the photo-injector for the drive beam linac
   Funded by CARE
2. Status of the construction of the NEPAL beamline
   Funded by CARE
3. Project of the photo-injector for the probe beam linac

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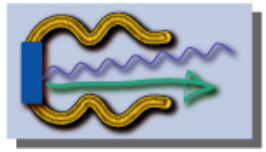
1. Status of the construction of the CTF3 photo-injector



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•Modification of the technical drawings of the gun upon a CERN request due to the insertion of photo-cathode transfer chamber (August)

⇒All the cooling channels in the gun had to be re-designed

⇒Makes difficult to support the gun

•Finalization of the technical drawings of the NEG envelop around the gun

Strong collaboration with CERN is mandatory since the NEG coating is done there

=>drawings are finished

1. Status of the construction of the CTF3 photo-injector

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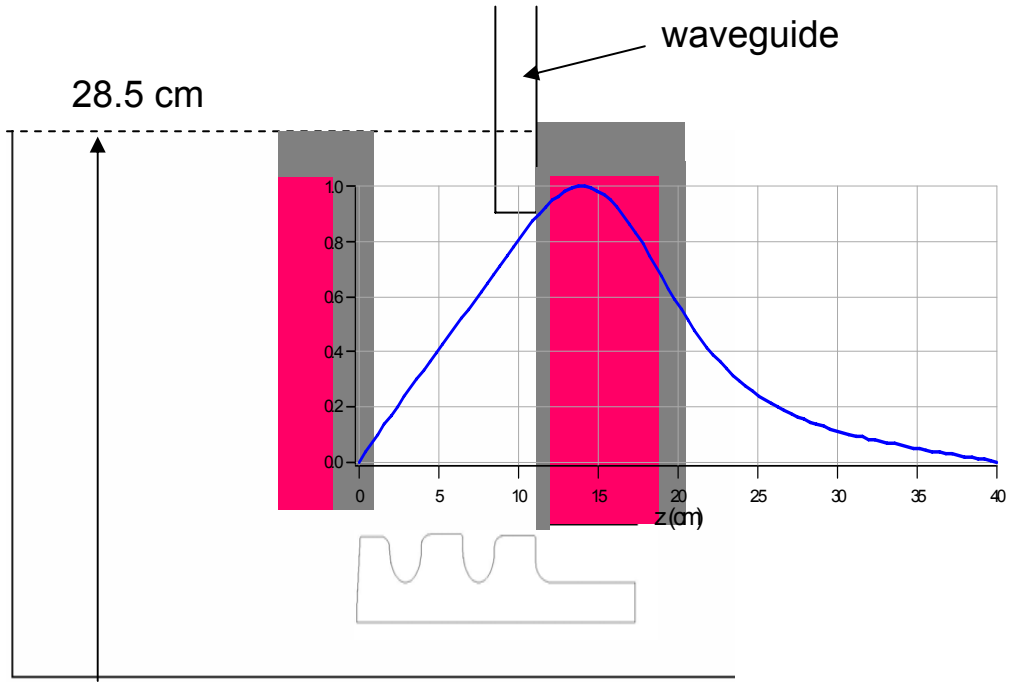
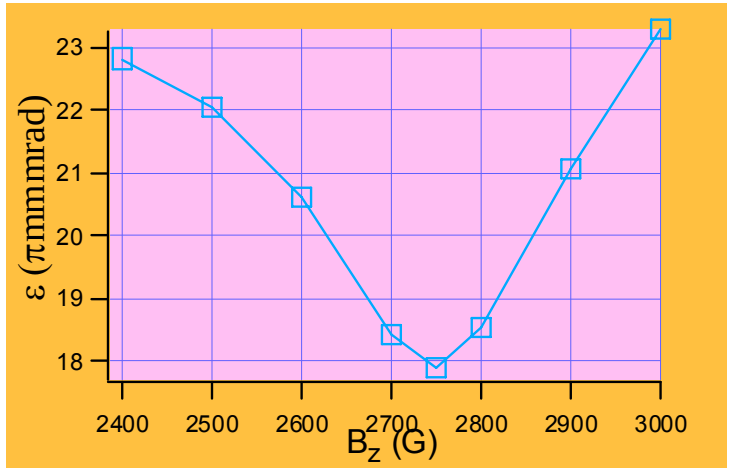
- Modification of the magnetic design: 2 coils instead of 3

No enough space for pumping with 3 coils

Solenoids ordered in June, one was modified in September taking into account the data of the CERN cooling system





With a gaussian laser

=>delivery of solenoids in December

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1. Status of the construction of the CTF3 photo-injector

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Construction of a prototype to valid HF simulations

Ordered in March . . . . . last piece received in November, 4th !!

History:

- ordered in March to the French company DURUAL
- test cavity received in April not satisfying
- several tries later, order in beginning of June, foreseen delay: 2 months
- the firm begins (we suspect) the work only in October

Set up of the HF measurement apparatus begun the 10th

Duration: 2 months but we hope to order the final gun before the end of the year

1. Status of the construction of the CTF3 photo-injector

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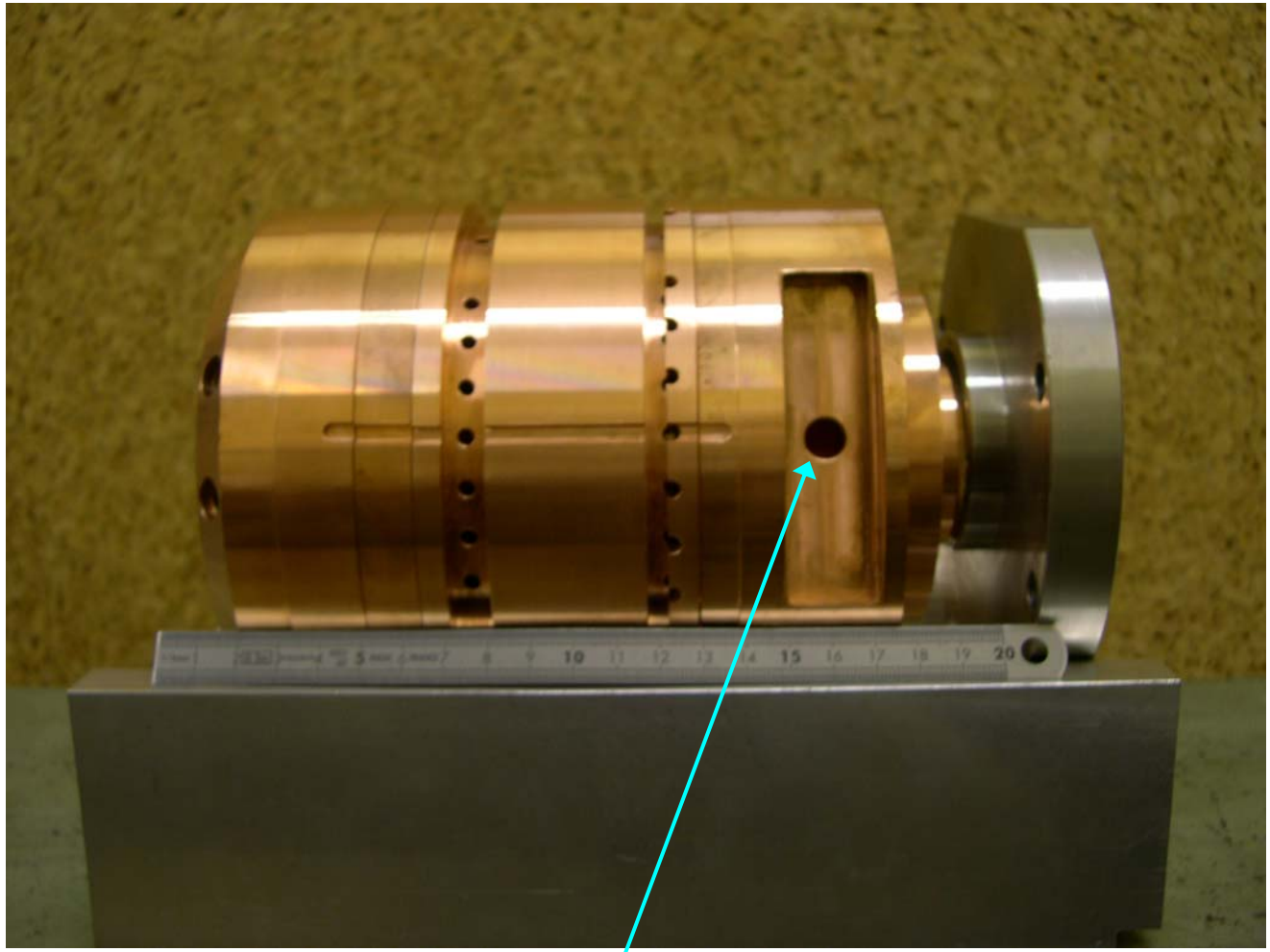

1. Status of the construction of the CTF3 photo-injector

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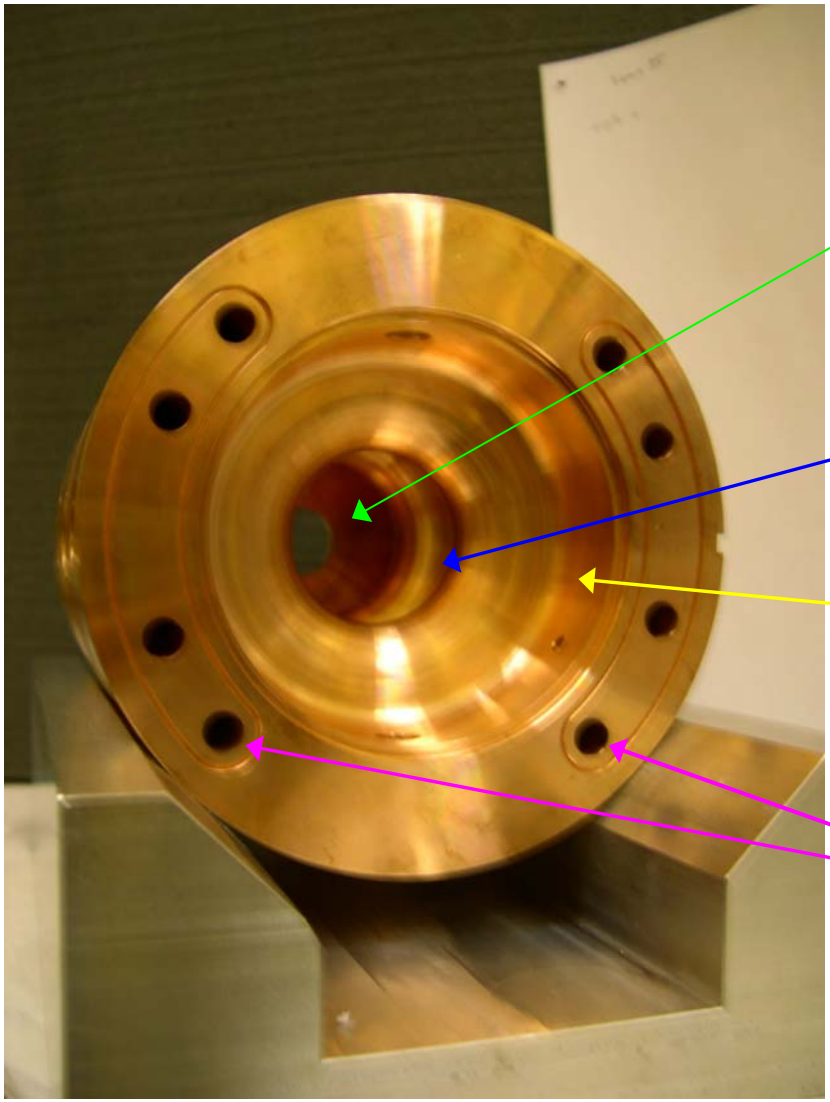

First half cavity with the hole for the photo-cathode

Central cavity

Last cavity with coupling holes

Cooling channels

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1. Status of the construction of the CTF3 photo-injector

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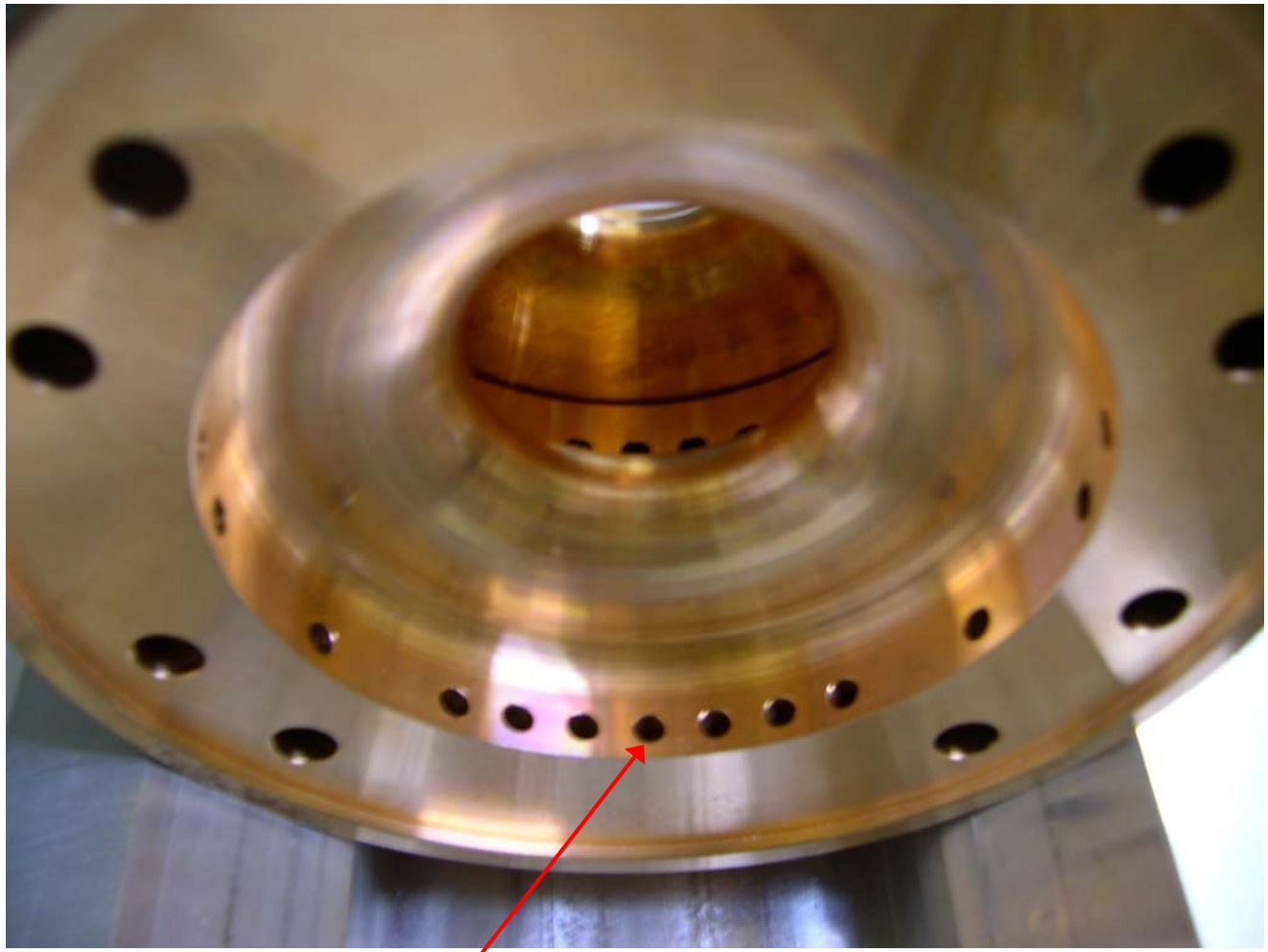

Ducts for NEG pumping

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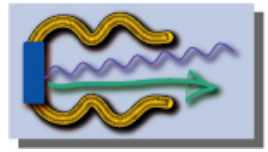
2. Status of the construction of the NEPAL beamline



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- RF gun will be built almost in same time with the one for CTF3
- photo-cathode preparation chamber under construction in our workshop
- laser from HighQ should be delivered next month as all the optical stuff
- drawings of magnetic elements are available
- modulator is under construction

But :

New shielding to radiations is mandatory due to more severe legal threshold

=>first study implied a cost too high

=>second study under way reducing the area of the NEPAL room

civil engineering is foreseen

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3. Project of a photo-injector for the probe beam linac

Probe Beam linac

Probe Beam Photo-Injector (PBPI):

Energy	200 MeV
Normalised r.m.s. emittance	20 π mm mrad
Energy spread	± 2%
bunch charge	0.5 nC
Number of bunches	Variable from 1 - 64
Bunch spacing	0.333 ns
r.m.s. bunchlength	0.75 ps

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Energy	~ 4 - 5 MeV
Normalised r.m.s. emittance	20 π mm mrad <
Energy spread	± 2% <
bunch charge	> 0.5 nC

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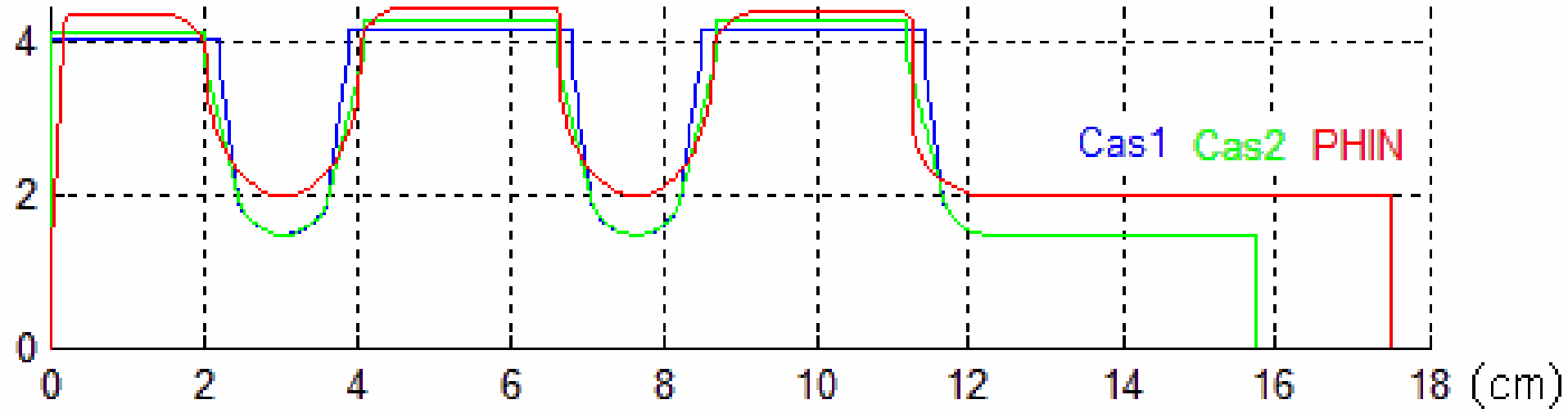
3. Project of a photo-injector for the probe beam linac

Initial PBPI design derives from PHIN photo-injector :



Modifications (because spec. are ≠) :

- smaller Iris aperture (15 mm instead of 20 mm for PHIN).
- Cathode wall angle set to zero.
- Iris profile is circular and connexe walls are obliques.
- « upper part » of each cellule profile is rectangular. (easier to re-machine).

HF Simulations performed by Julien Brossard

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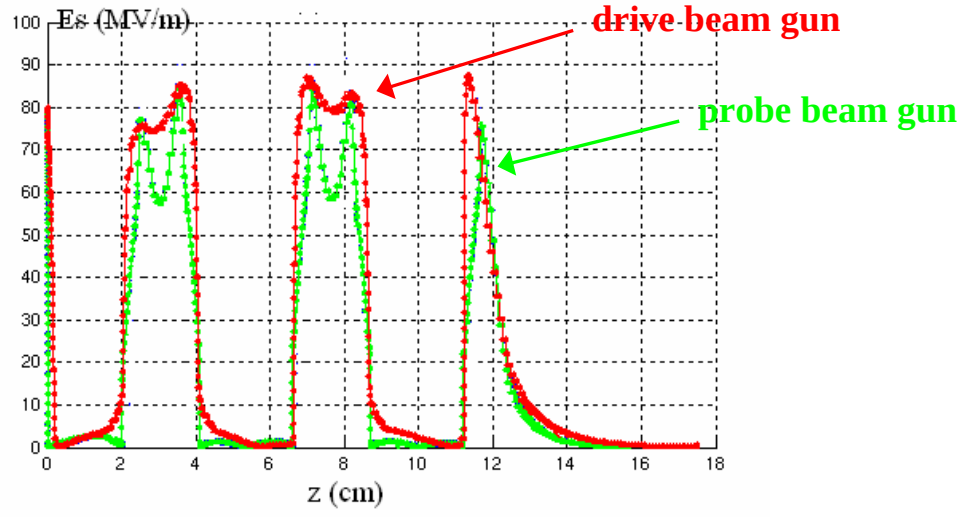
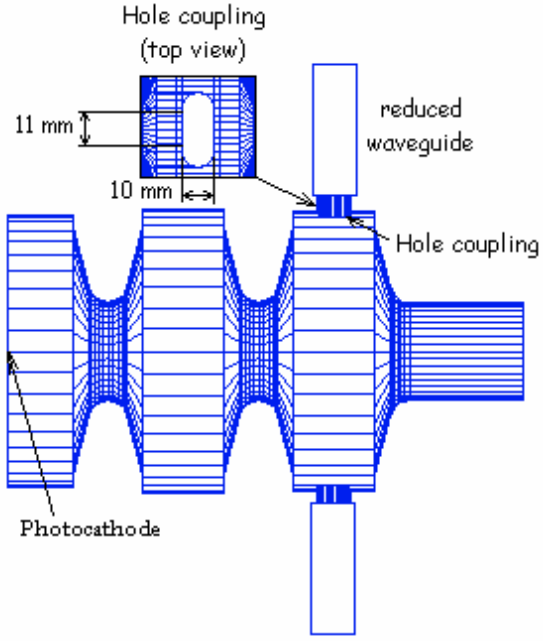
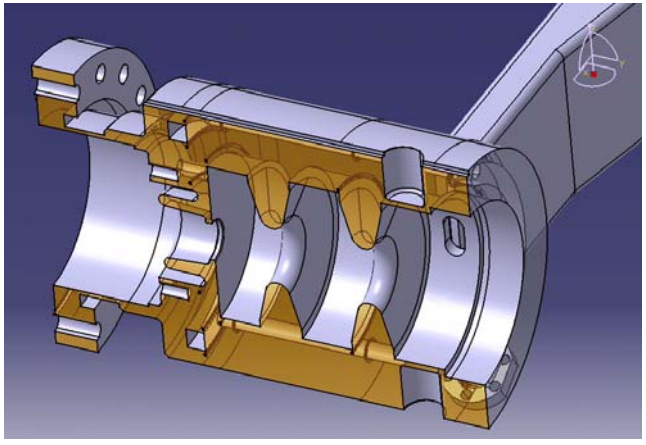
3. Project of a photo-injector for the probe beam linac

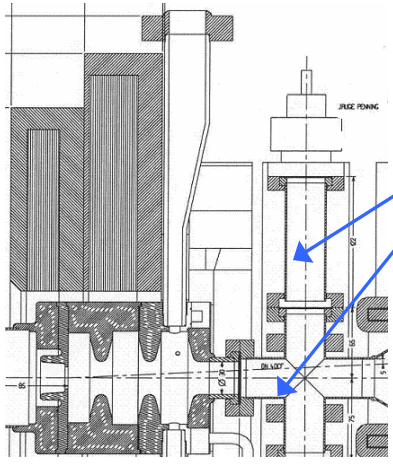


HFSS simulations



Q = 14400, R_s = 7.84 MΩ => P_{HF} = 5.2 MW
for 80 MV/m





E (MeV)	5.35
σ_r (mm)	2.33
$FWHM_z$ (ps)	8
σ_γ/γ rms (%)	0.33
ε (πmmmrad)	6.5

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CONCLUSION

► Photo-injector for the drive beam linac

measurements and re-machining of prototype under way

do our best to catch up for a delivery before summer but no guaranty

► Construction of the NEPAL beamline

Most of components will be available before the end of next year

but incertitude on the delay to get the authorization

► Photo-injector for the probe beam linac

HF design of the gun and coil calculations are completed

detailed technical drawings under way

design simpler => less problems