The EMIT4D technical challenge

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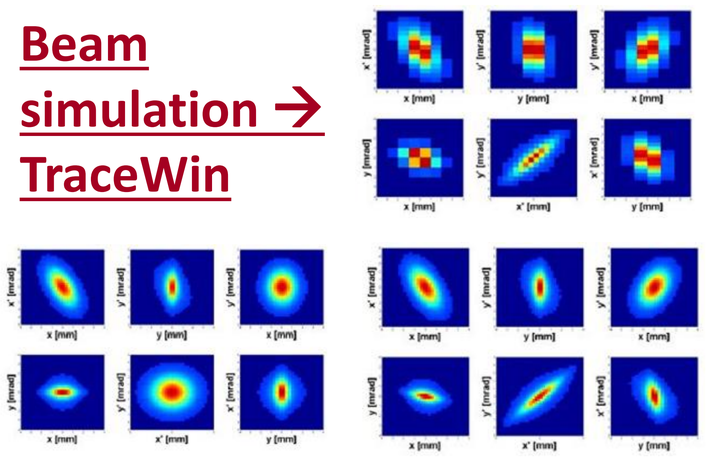
Requirements specification

- **Measure 4D emittance for a beam of :**
- Protons $Ø_{max}$ = 100mm
- 1kW average (or 10kW 10%pulse)
- I_{max} = 100mA
- Gaussian power density
- Angular acceptance : 100mrad
- 100KeV to 3MeV
- Single tank CF250
- Shortest time of measurement
- Without hole distortion

Beam simulation → TraceWin

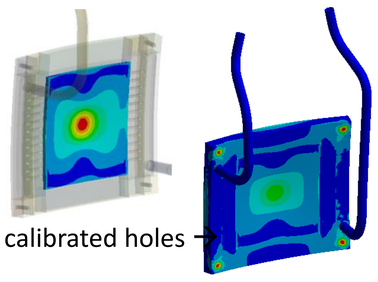


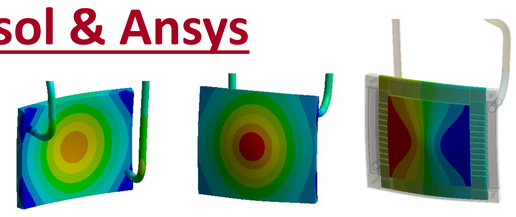
Thermomechanic simulations → Comsol & Ansys

Dimensions :
- 164*140*13mm
- 121 holes – spacing 7mm

Cooling system :
- 12 parallel tubes $Ø_{int}$=2mm

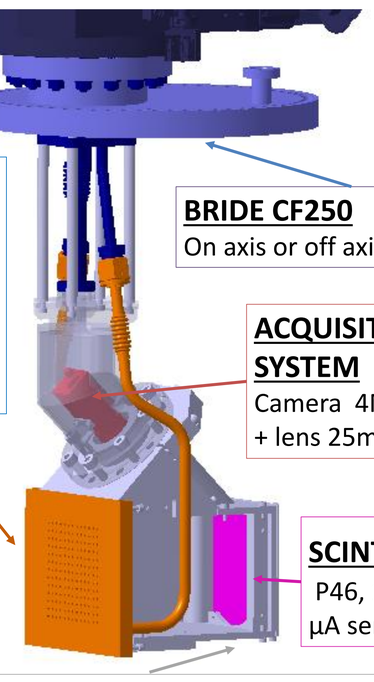
Materials :
- maximum power absorbed before calibrated holes → 10mm of **Cu**
- Rigid to avoid holes dimension modification and the heat influence → 3mm of **W**





	Stress max. (MPa)	Tempeature max. (°C)	Distortion max. (µm)
Cu	135	232	11
W	47	71	4,5
tubes	117	2,5 (ΔT fluid)	90 (inflexion tot.)

GENERAL DESIGN AND COMPACTNESS



MOVING SYTEM
→ Neyco et Thermionics
Microstep motorization
step 50µm
XY table
X : stroke 10mm
Y : stroke 10mm (+ HOME 180mm)

BRIDE CF250
On axis or off axis

ACQUISITION SYSTEM
Camera 4MPixels
+ lens 25mm

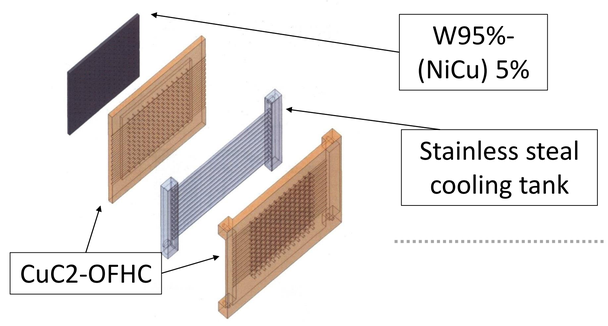
PEPPER POT
Cu-W cooled assembly
121 holes – Ø70µm
1KW average – 100mrad

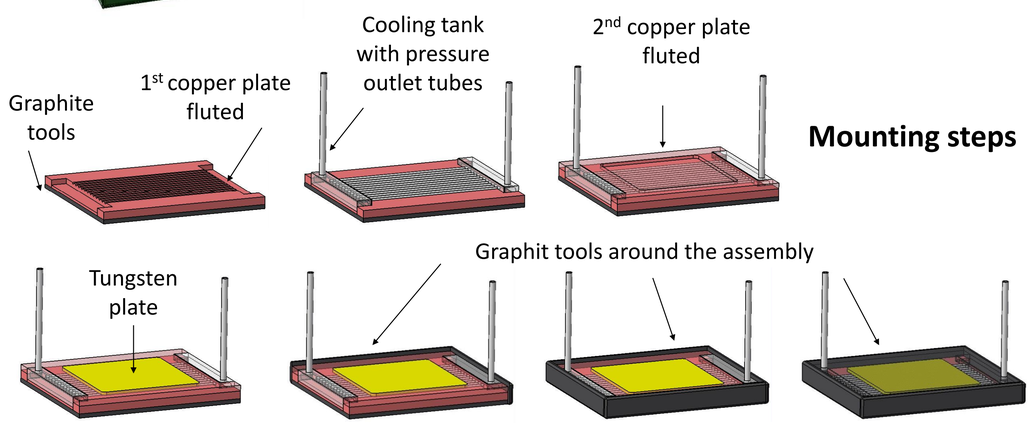
SCINTILLAToR
P46, 100*100*5
µA sensitive

MECHANICAL PART
Integral with the movement and vaccum tight support

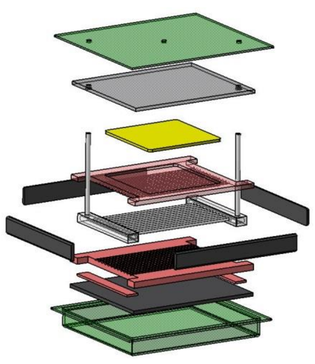
High Isostatic Pressure assembly of the Pepper pot → Liten (CEA Grenoble)

Container placed 2h in 1400bar 950°C

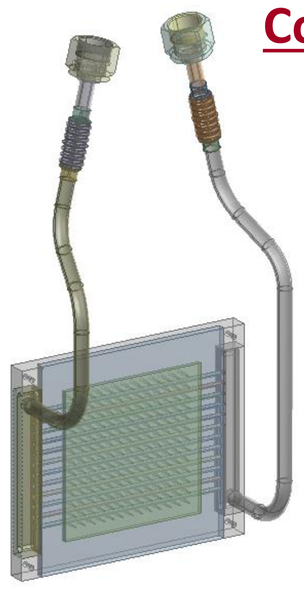




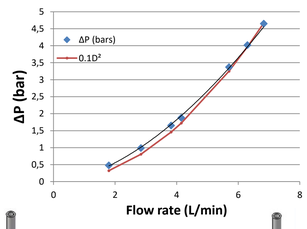
Exploded view

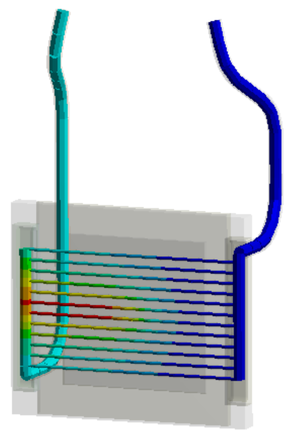


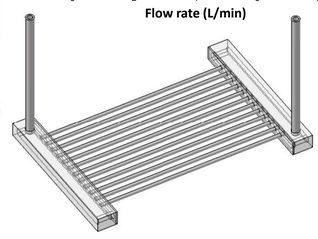
Cooling of the Pepper pot



Flow rate $_{total}$ = 6L/min
Pressure $_{max}$= 10bars
Pressure loss :







Small powerfull camera → Stemmer Imaging

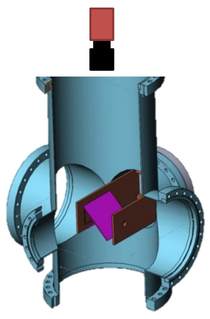
Camera AVT MAKO
G-419B POE
4MPixels
29*29*60,5mm

Scintillator study → Betsi et Jannus

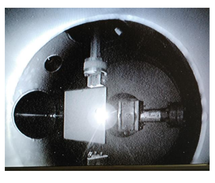
Material emitting light when it absorbs a ion beam

Type	Powder on metallic support				Translucid cristal			Dielectric opaque
Name	P47	P22	P46	P31	35BGO	SKB10B	35LYS	GSI
Composition	Y_2SiO_5: Ce	Y_2O_2S: Eu	Y_3AlO_{12} : Ce^{3+}	ZnS: Cu	BGO	YAG	$Lu_{1.8}Y_2SiO_5$:Ce	BaF_2 doped AL_2O_3:Cr

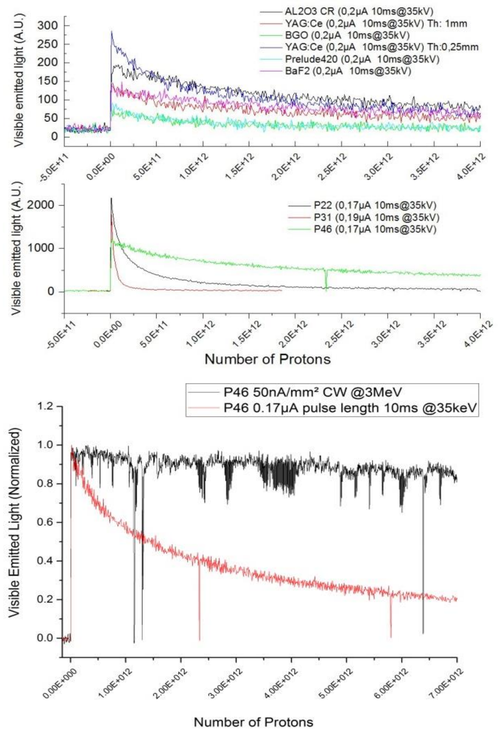
Camera + viewport



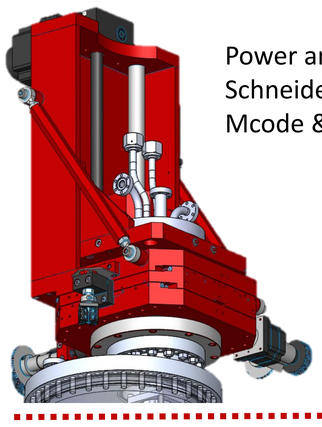
Experiment principle schema



Camera view during measurement



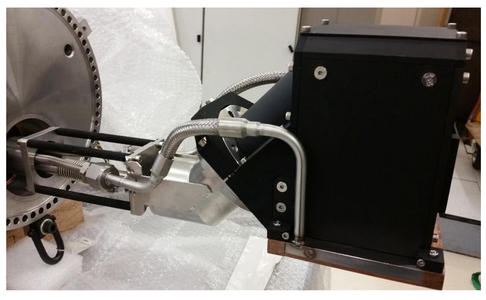
XYZ moving system → Neyco et Thermionics



Power and control
Schneider Electric
Mcode & Labview

Microstep motor
Step 50µm
XY table
X : stroke 10mm
Y : stroke 10mm
(+ HOME 180mm)

Support blackening with Black Meudon → Protection des métaux



Pepperpot drilling by Laser Jet → AcalBFI

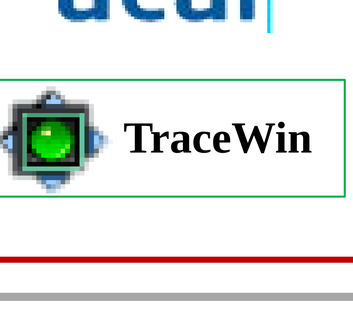
121 trous - 5 étages - entraxe 7mm

Stepped holes:
→ Maximal power absorbance before selection holes

→ Standard drilling– 4 forets

Calibrated holes (Ø70µm)

→ Waterjet laser guided drilling



PARTNERS