First Results of prototyping for ALBA II BPMs

L. Torino

ltorino@cells.es

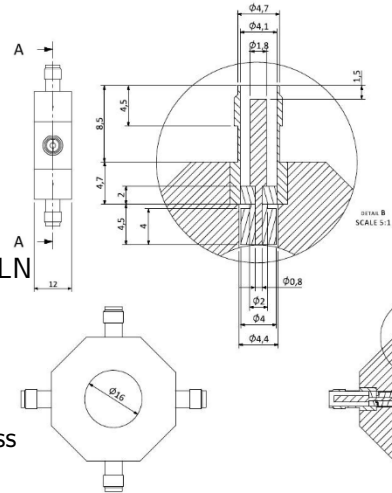
Diagnostics Experts for European Light Sources

Trieste, 12-13/05/2025

ALBA II BPMs

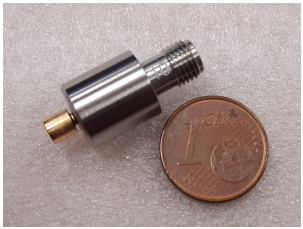
ALBA II BPMs characteristics:

- Chamber diameter: 16 mm
- Button diameter: 4 mm
- Gap: 200 µm
- Insulator diameter: 4.4 mm
- No "skirt"
- Block thickness: 12 mm
- Block Material: Stainless Steel 316LN
- Button Material: Molybdenum
- Housing Material: Stainless Steel 316LN
- Insulator Material: Borosilicate Glass



Company 1

- No modification on tolerances
- Modification on materials:
  - Button: Hasteloy+Au coating
  - Housing: Stainless Steel 316L



Company 2

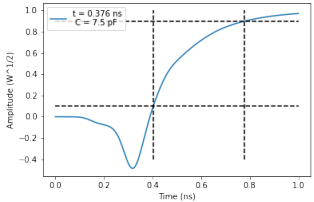
- Modification on tolerances:
  - Housing Diameter: $10.5^{+0}_{-0.04}$ mm (Target = $10.5^{+0}_{-0.015}$)
  - Distance button-housing: $4.5^{+0.05}_{-0.35}$ mm (Target = 4.5 ± 0.05 mm)
  - Concentricity: 0.1 (Target = 0.04)
- Modification on materials:
  - Housing: Stainless Steel 316L

TDR – Setup

We insert the button in the BPM block and we measure the TDR up to 4 GHz.
Each button is inserted/extracted and measured 10 times.
The measurement is repeated in different days

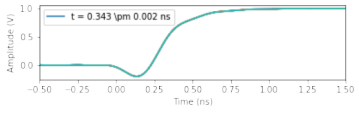
TDR – Data

To estimate the capacitance we use the 10-90 % rise time

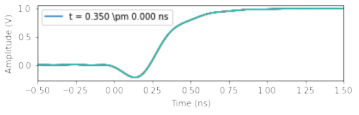


Good agreement with CST simulations

Company 1



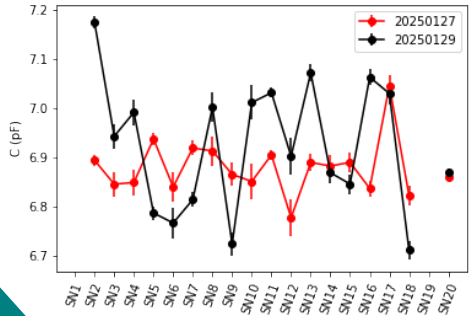
Company 2



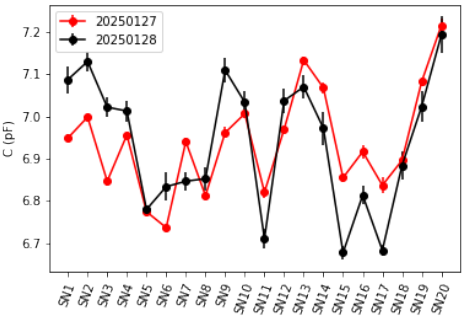
TDR – Repetitiveness

We do the same measurements in different days

Company 1



Company 2



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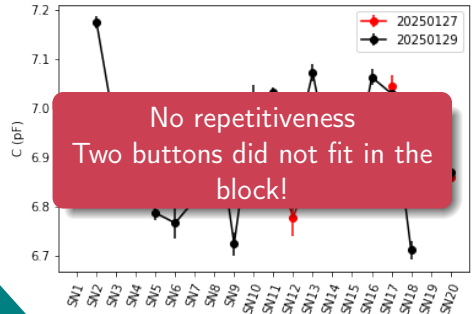
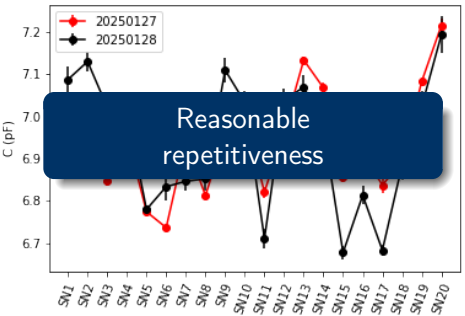
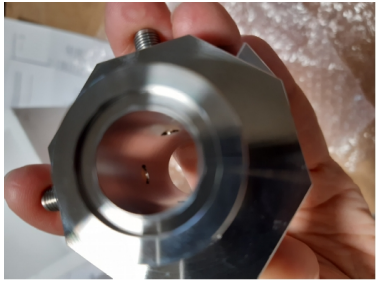


Company 2



Mechanical Characterization

- Non-repetitivity of the capacitance measurements suggest some mechanical inconsistency
- Two of Company1 buttons did not enter in the BPM block
- Visual inspection of buttons inserted in the block shows that Company 1 buttons were retracted with respect to the beam pipe



Mechanical Characterization

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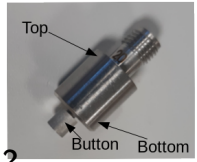
We decided to go for a full mechanical characterization of BPMs and blocks:

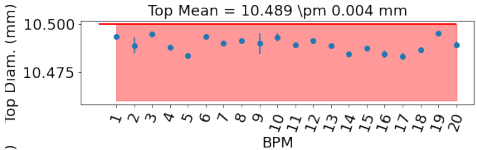
- Button diameter
- Housing diameter
- Distance button-housing

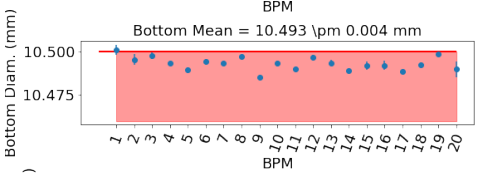
Mechanical Characterization – Button/Housing Diam.

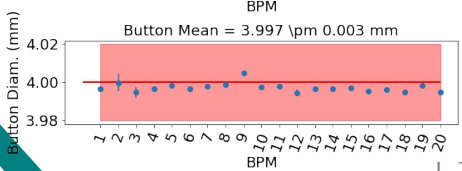


Measured with a standard palmer, 3 measurement per button

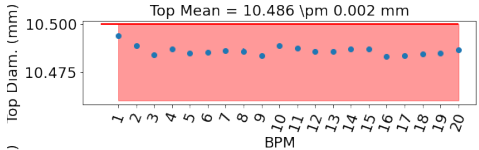
Company 1

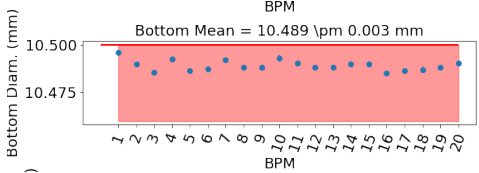


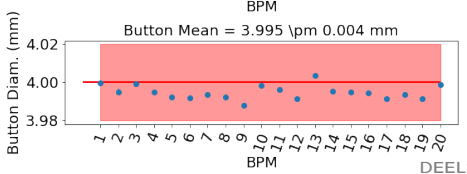




Company 2

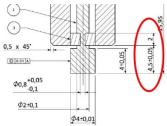




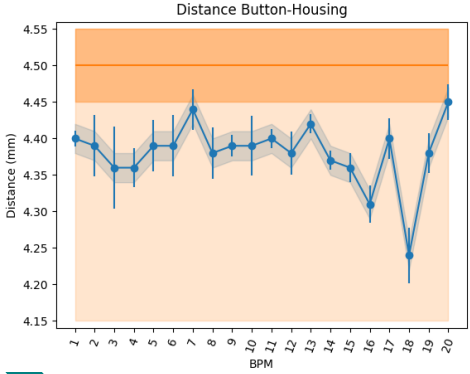


Mechanical Characterization – Button-Housing Dist.

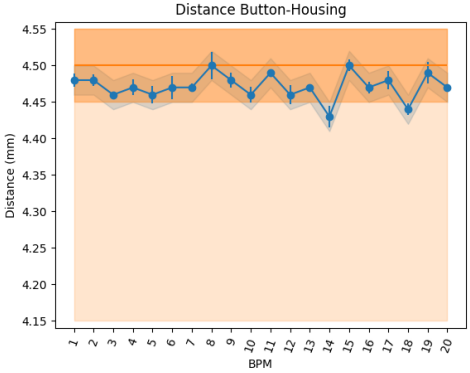
Measured with FARO 3D Arm: $\pm 30\,\mu m$ repetitivity and $\pm 30\,\mu m$ length precision



Company 1

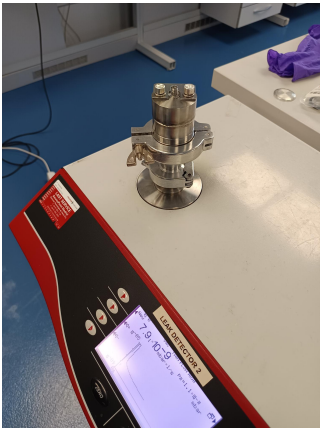


Company 2



Leak Test

Leak test jig has been designed in house: buttons are inserted and kept in position by a clamp. The vacuum is ensured by a rubber o-ring



Leak Test

Leak test jig has been designed in house: buttons are inserted and kept in position by a clamp. The vacuum is ensured by a rubber o-ring

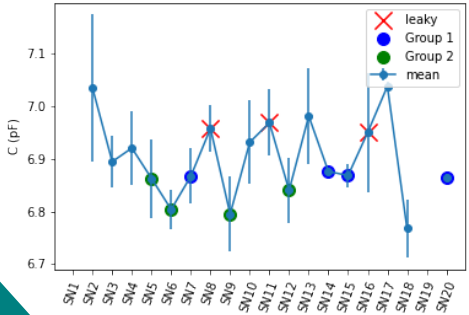
Company 2
All OK

Company 1
3 out of 20 buttons were leaky!

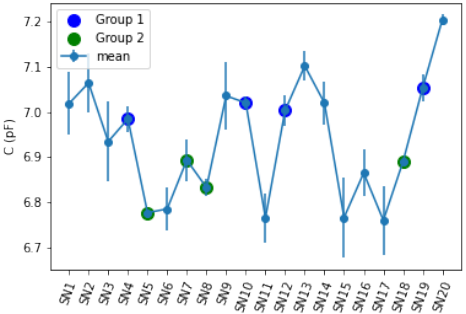
Grouping

In total 4 full BPMs blocks will be assembled ⇒ Tried to group according to capacitance measurement

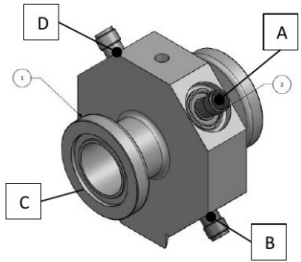
Company 1

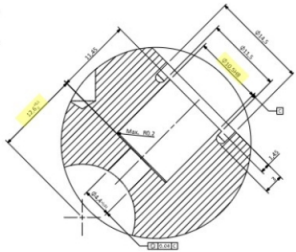


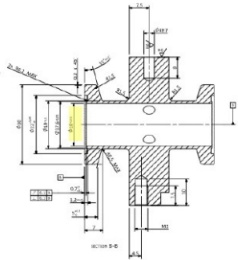
Company 2



BPM-Block



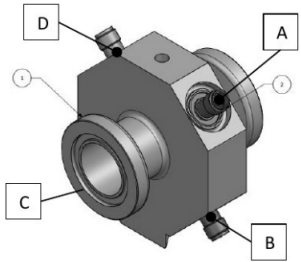


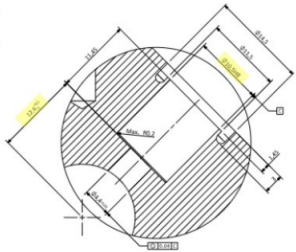


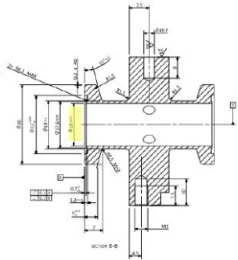
Two companies chosen to produce the block and weld BPMs:

- 2 × Company A
  - Laser welding
- 2 × Compnay B
  - TIG welding
  - NEG coating

BPM-Block







Two companies chosen to produce the block and weld BPMs:

- 2 × Company A
  - Laser welding
- 2 × Compnay B
  - TIG welding
  - NEG coating

BPMs blocks: all in specification

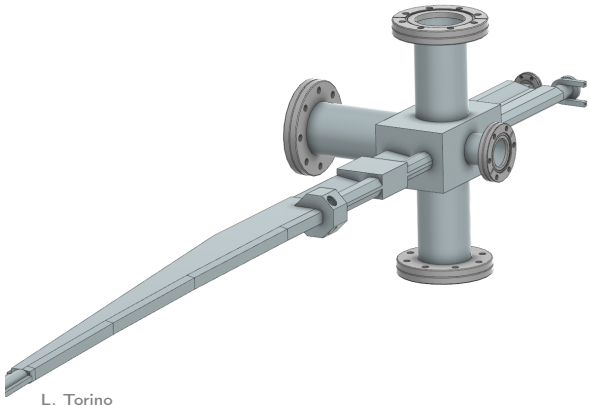
BPM buttons:
for now we prefer **Company 2**,
decision to be taken after welding

Copper BPMs

We need BPMs after each central dipole to guarantee stability and allow bumps in dipole beamlines.

$\Rightarrow$ Due to the complexity of the chamber, the vacuum group would like to avoid splitting the chamber (adding a block) or brazing

Design new button with Cu-housing $\Rightarrow$ TIG weld in the chamber

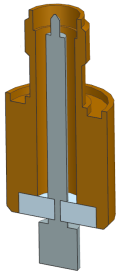


Cu-BPMs

We thought about using ceramic as an insulator to cope with thermal expansion coefficient of copper.
Design similar to the prototyped one, ceramic larger than glass to match 50 Ohm.

We asked two companies (for now)

- **Company 3:**
  $\Rightarrow$ they want to try with glass
- **Company 4:**
  $\Rightarrow$ Proposed a very smart solution that could also be done with glass, but they only do ceramic...



Summary

- We prototyped ALBA II button BPMs with two different companies:
  - **Company 1:** → Tolerances not great
    → 2 Buttons did not fit the block
    → 3 Buttons were leaking
  - **Company 2:** → All OK
- We prototyped BPMs blocks with two companies
  - Waiting for the welding buttons in the blocks
- Starting discussion with companies to prototype button BPMs with Cu housing

Question:

- Are you planning to measure electromagnetic offset also related with cables and electronics? How?