Considerations on the module vacuum

P. Costa Pinto N. Hilleret

•Summary

–Specifications: P

–Key points: Gasloads

–A scheme for the vacuum system

GAS LOAD

- Baked
  - Expensive
  - Mechanical constraints (thermal elongation)
  - Extra space needed for bellows
  - Space in quadrupoles?
  - Lower pressure in shorter time
- Unbaked
  - More demanding in terms of materials/cleanliness (ferrite excluded)
  - Longer time to achieve "good" pressure
  - Reduced thermal elongation=> less constraints on bellows=> more space
  - Cheaper operation
  - Less constraints on Quad aperture

Possible quad chamber design

- Produced in 2 halves
- Machined (accurate parts)
- Longitudinal weld between 2 profiles
- NEG strips in the appendixes (Pumping and heating elements)
- To be adapted to actual quad design
- Integrated pump~ 10l/s/m
- To be checked for feasibility, cost and performance

CONCLUSIONS

- Most important question: design pressure?
- =>Choice between baked/unbaked system
- Achievable pressure in cells determined only by geometric constraints
- Connexion between module/BPM/quadrupoles must be studied: space, technique…

THE CLIC ALIGNMENT STUDIES

Hélène MAINAUD DURAND

STEPS OF CLIC ALIGNMENT (1)

1. INTRODUCTION

Installation and determination of a geodetic tunnel network

Installation and alignment of the CLIC components w.r.t. the geodetic network

Implementation of active prealignment → Components within ± 10 µm (3σ)

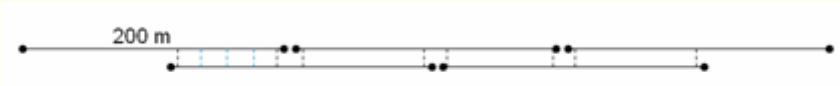
Implementation of beam based alignment → Active positioning to the micron level

Implementation of beam based feedbacks → Stability to the nanometer level

CONCEPT

2. ALIGNEMENT SOLUTIONS

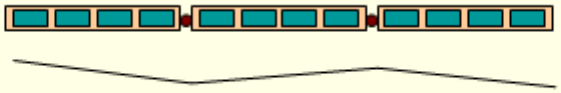
The straight reference line between the two ends of the linac is obtained through overlapping reference lines.



Zoom

a. Simplification of the problem by pre-aligning components on girders

b. Simplification of the alignment by linking adjacent girders by a common articulation point

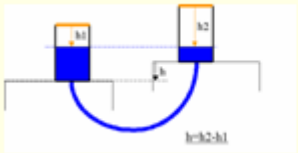


ALIGNMENT SYSTEMS PROPOSED

2. ALIGNEMENT SOLUTIONS

For the propagation network...

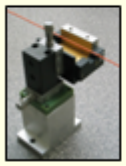
Hydrostatic Leveling System (HLS)



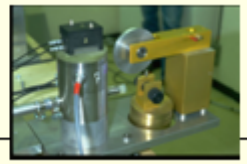
- ✓ Based on the communicating vessels
- ✓ Water network = reference surface
- ✓ Each vessel surrounded by a capacitive sensor which measure the distance to the water surface

Wire Positioning System (WPS)

- o Also based on capacitive technology
- o Sub-micrometric resolution



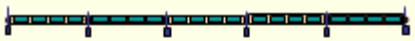
- ✓ In the horizontal plane : wire = straight line
- ✓ In the vertical plane : wire = catenary



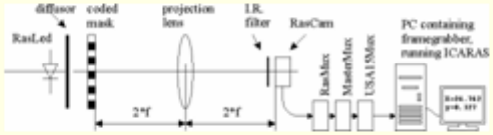
2. ALIGNEMENT SOLUTIONS

ALIGNMENT SYSTEMS PROPOSED

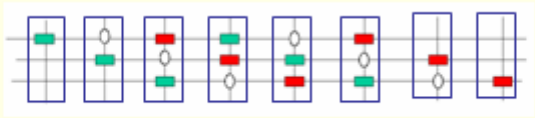
For the proximity network...



Red Alignment System from NIKHEF (RASNIK)



- ✓ Resolution: 0.01µm
- ✓ Range: 5mm
- ✓ Uncertainty of measurement 2.f = 2.5 m : 1 µm
- ✓ Developed by NIKHEF
- ✓ Only on short distances



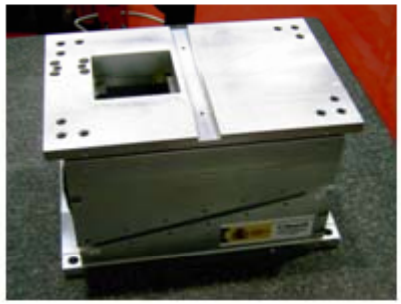
CONCLUSION

Conclusion

The different test facilities and studies carried out have shown that it was not illusory to align components with tolerances of 10 microns over 200m.

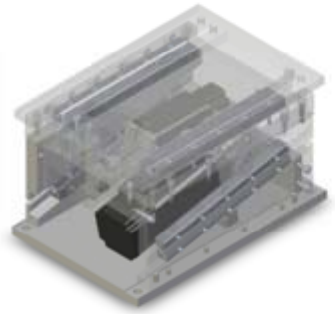
Some questions however still subsist (micrometric absolute measurements, determination of the geoid within a few microns, gravitational effects on alignment systems,...) that need to be answered as soon as possible, with the adequate means.

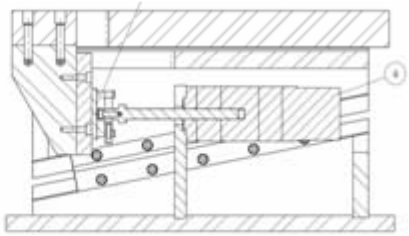
TBL quadrupole mover prototype development



J. Calero, J.L. Gutiérrez, E. Rodríguez, F. Toral
CERN, 18/10/2007

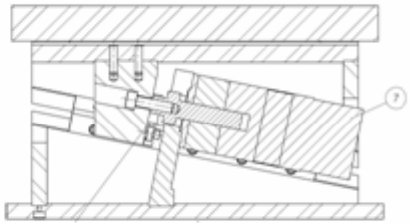
Layout (I)





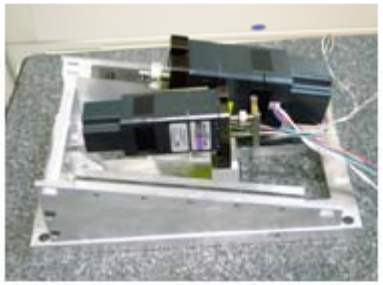
Horizontal actuator

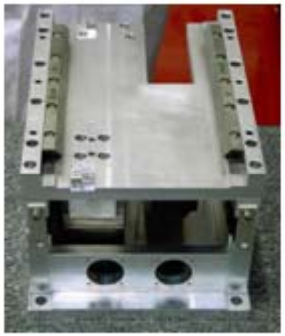
- Actuators based on 5-phase step motors with integrated screws and electromagnetic brakes.
- Pairs of precision linear guides.
- Mechanical micro-switches: home position and end-of-movement detectors.



Vertical actuator

Fabrication and assembly





Conclusions

✓ TBL quadrupole mover has been successfully designed, fabricated and tested at CIEMAT.

✓ It has just arrived at CERN for acceptance. Control will be done by means of a PLC.

✓ The design must be updated to start with the series production, which should be delivered by the end of 2008.

✓ Hopefully, this development will be transferred to CLIC quadrupole movers.

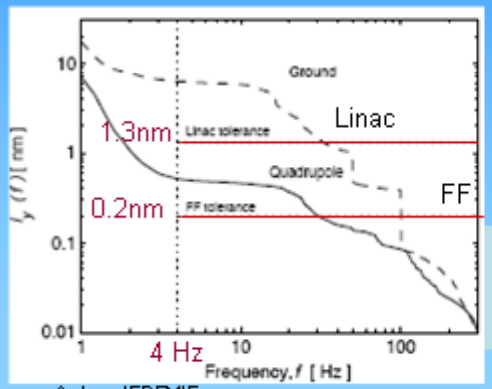
Specs to be checked for 3D rotation issues!

CTF3 module and CLIC Final Doublet stabilization

Key issue for luminosity!

CERN, JAI, PSI, LAPP

The CLIC luminosity performance critically depends on the vertical linac quadrupole vertical stability (<1nm @ 1Hz) and the final doublet stability (<0.1nm @ 4 Hz) in noisy site

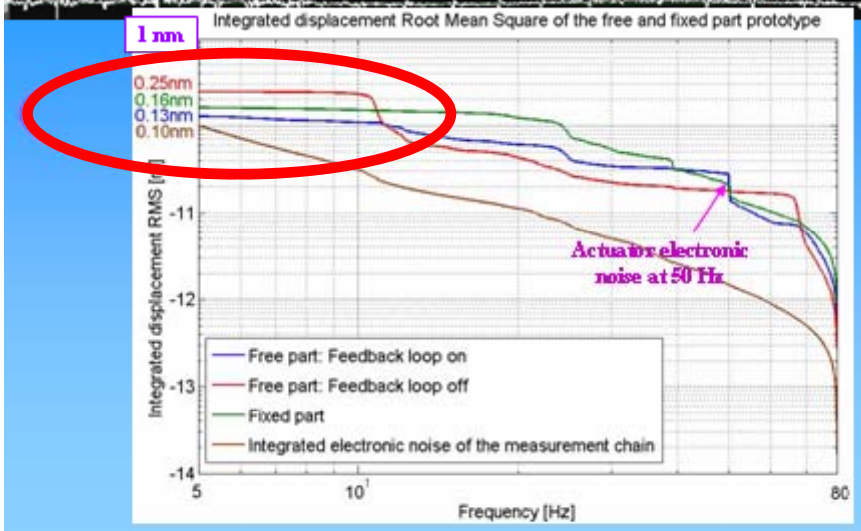


S.Redaelli's PhD 2003

Measurement of the quadrupole vibrations on active table in vertical direction compared to linac and Final Focus (FF) tolerances at 4Hz (in 2003)

Tests with the large prototype: quiet room

integrated displacement RMS (with active table ON)



Ending comments

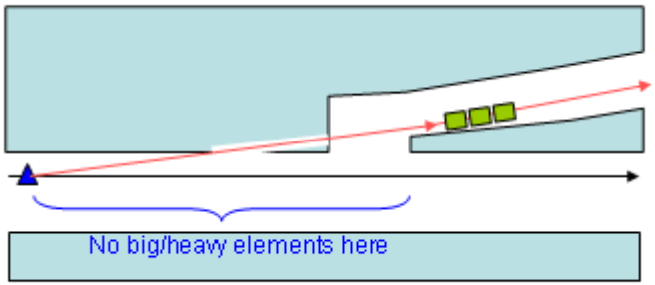
- Financing? Within FP7 framework? And local institutions
- Personnel issues
- See how it interferes with the alignment system (close discussion with Hélène).
- Follow CTF3 module development

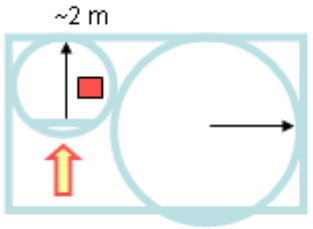
Searching test location in real accelerator environment!

Drive Beam transfer lines in the main tunnel

B.Jeanneret CERN/AB/ABP

CLIC Workshop , 16 Oct 2007

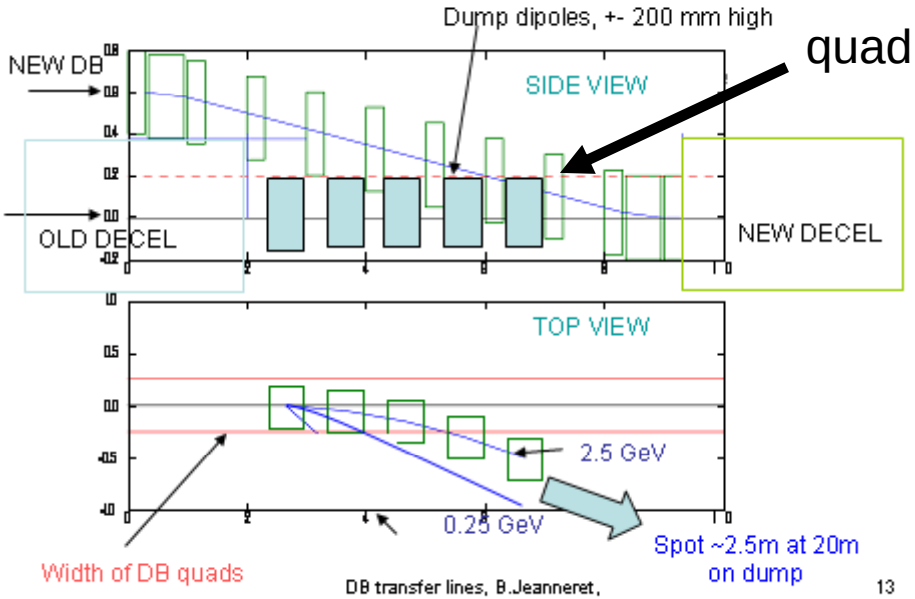




- Minimize disruptive impact on
- main tunnel continuity
- ensure turnaround stability
- more easy installation ?

Much work ahead

A way to avoid alternating low and high Decelerators – now baseline



Summary

- Long transfer line
  - Small compact combined magnet can be considered
  - Conflict services / beam line / survey must be resolved
- DB Turnarounds
  - Optics exists
  - Integration requires more attention and coordinated approach
  - Civil engineering not trivial
- DB Dump line
  - Single height decelerator is an overall simplification
  - But short 10m section with two lines must be studied
  - Dump line and dump tunnel still to be designed

CLIC Main Beam Transfer Lines

A. Latina, L. Rinolfi

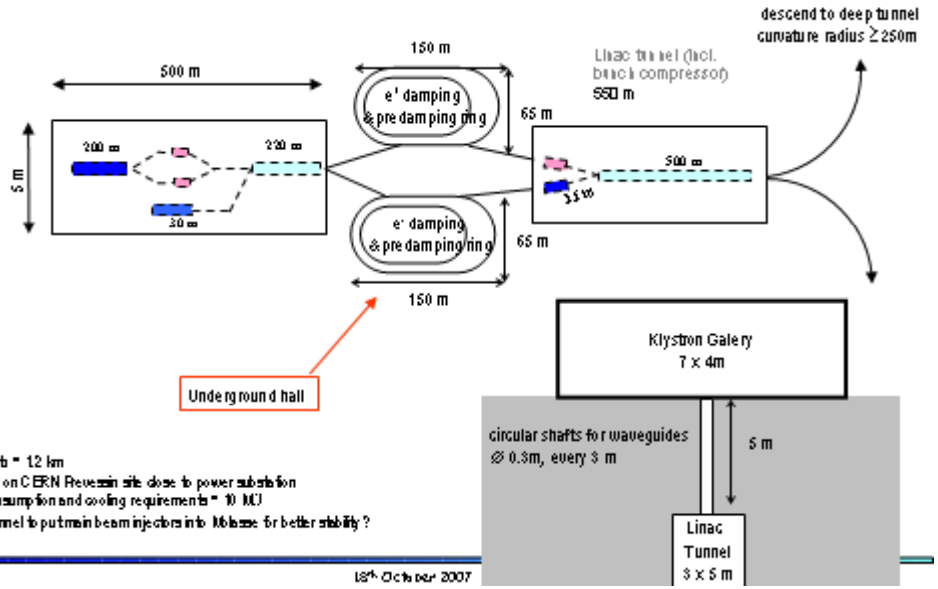
Components to be aligned for e⁻ and e⁺

(without PDR and DR)

	RF Cavities	Magnets	BPM and other BI
For e⁻ beam (including both common linacs)	180	2638	1000
For e⁺ beam (without the Injector and the Booster Linacs)	103	2300	900
GRAND TOTAL	**283**	**4938**	**1900**

Alignment precision : **0.1 mm**

Civil engineering layout



For the RF cavities => stabilized water at 30 °C

For the magnets => demineralized water

Main Linac Quadrupoles

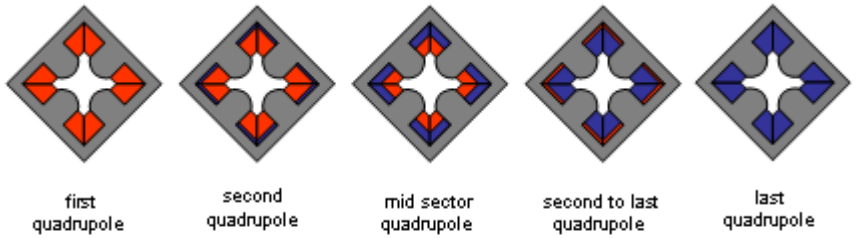
Th. Zickler

CERN

'Two-Current' Proposal

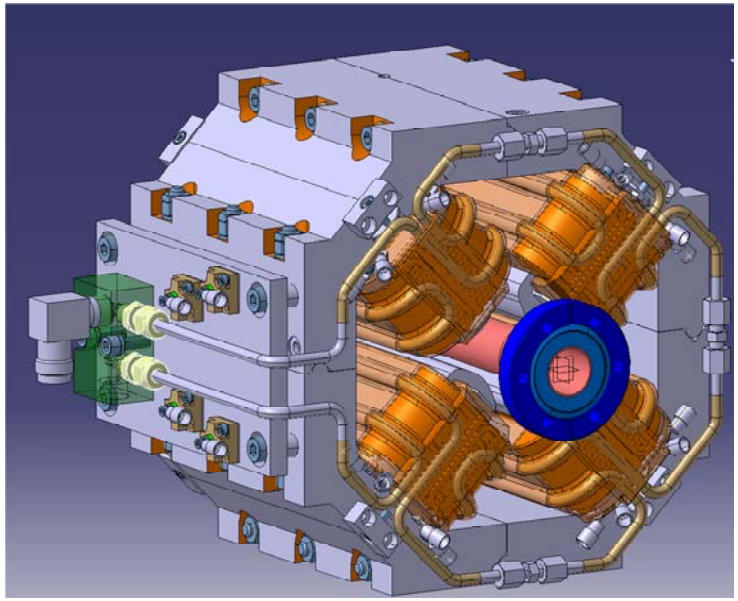
'Two-current' proposal by H. Braun:

- Splitting the coils in two sub-coils (red & blue)
- Connect all sub-coils of the same type in series (string)
- Power the strings with different current (I_{red} & I_{blue})
- Linear gradient decrease along the string



Picture by courtesy of H. Braun

TBL Quadrupole



Open Issues

Detailed cooling circuit study
- Long term reliability
- Heat dissipation into tunnel
- Cooling efficiency
- New insulation materials

Mechanical and thermal stability
- Thermal expansion
- Cooling flow induced vibrations

Manufacturing and assembly tolerances
- Small aperture
- Long and slim structure
- Large series prodution
- New technologies required

Magnetic measurements, vacuum chamber integration, corrector optimization

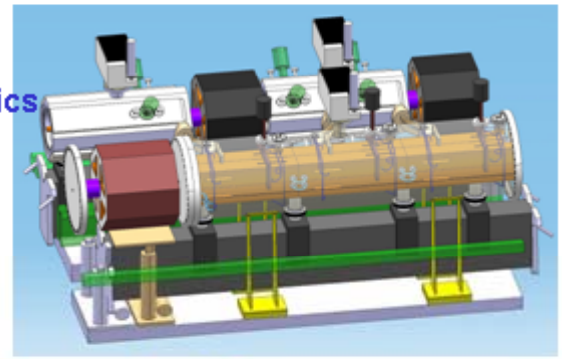
resources req. for prototype MB quad

CLIC Module BPM integration

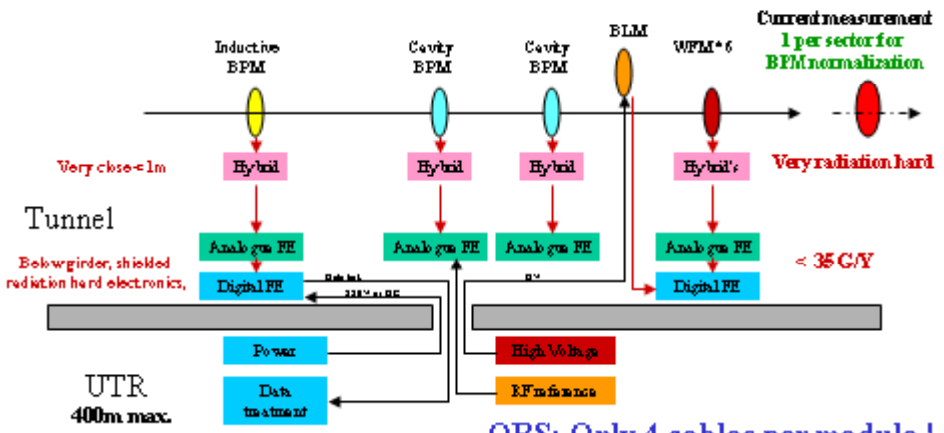
Outlook:

- BPM specifications
- Possible BPM types
- Wake Field Monitor
- Acquisition system
- Integration of electronics
- Summery

3 Quad BPM's
6 (3) Structure BPM's (WFM)
1 (+) BLM



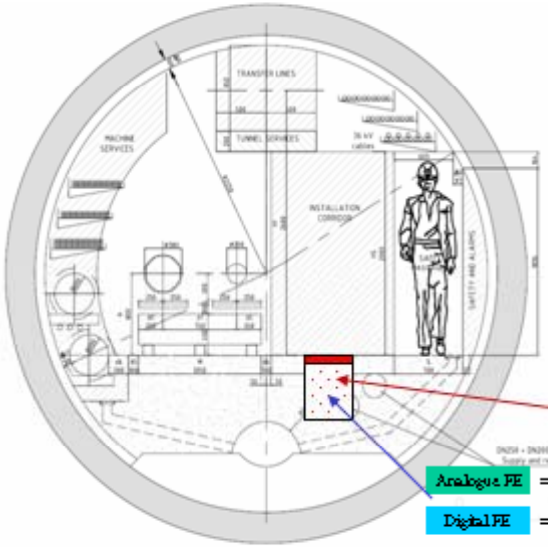
Module instrumentation



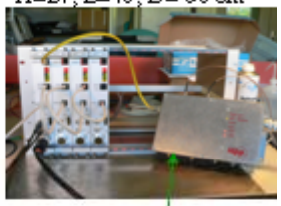
OBS: Only 4 cables per module !
Normally 2-3 cables per BPM of ~ 2kCHF = 40kCHF
So a reduction of 30kCHF per module using FE digitizers.

Analogue FE = Down converters, Signal conditioning, Calibration units
Digital FE = Digitizers and control

Electronics in the tunnel



LAPP digital FE
Designed to Resist up to 350GY
H=27, L=45, D= 30 cm



Summery

- Space must be foreseen for electronics on the module and in a radiation shielded location within a few meters, i.e. in the floor.
- A digital front-end reduces significantly the cable costs
- A dedicated study and design of CLIC BPM's and WFM is needed.

BPM for TBL: status of the amplifier

Gabriel Montoro*, Antoni Gelonch, Yuri Kubyshin
Universitat Politècnica de Catalunya (UPC)
*E-mail: montoro@tsc.upc.edu

This work has been supported by the Spanish Government (MEC) under project FPA2005-25366-E

Tentative parameters of the BPMs for the TBL	
BPM analog bandwidth (BPM with associated electronics)	10 kHz -100 MHz (**200 MHz is highly desirable**)
Beam position range of interest	+/-5 mm horizontal and vertical
Beam aperture diameter	22.5 mm
Overall mechanical length	< 100 mm
Number of BPM's in TBL	18
Resolution at maximum current	<5 μm
Overall precision	<50 μm
Typical radiation levels	<1000 Gray/year

The BPM design for the DBL by M. Gasior cannot be applied directly. Modifications are required:

a) The dimensions of the IPU should be reduced (by a factor of 0.6 approximately)

b) The amplifier bandwidth should be increased (desired up to 200 MHz)

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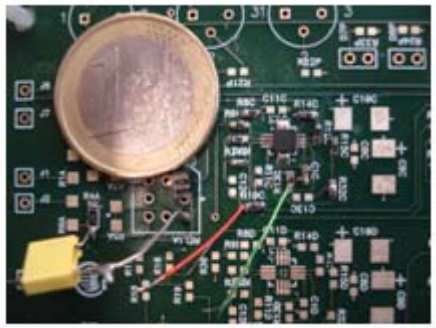
Testing one channel



Future work to be done

1. To finish the board assembly
2. To test the amplifier in the UPC lab.
3. To start testing it at CERN (together with the mechanical part - IPU)

After this: It is possible that after tests at the UPC and CERN some rework or further adjustments of the amplifier can be necessary

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