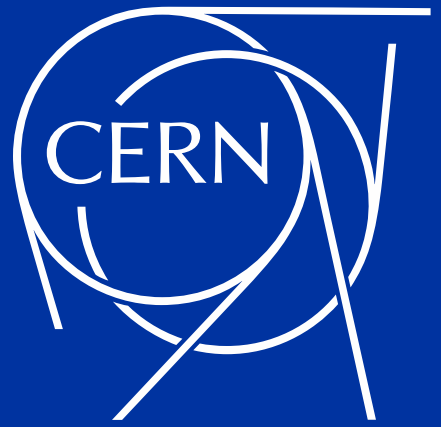


L4 Spare RFQ Project - WP06
Slim RF Window Integration

Suitbert Ramberger

25 November 2020

Introduction

- Big and slim windows
- Available spares
- RFQ integration – the big window
- RFQ integration – the slim window

Detailed mechanical simulations by Jorge

- Principal mechanical deformation
- Potential remedies
- Next steps
- Discussion

Big and slim windows

The big and the slim windows and how it came all about:

- Originally two Thales RF windows have been purchased.
- The prototype structures were all tested with this type of window.
- One window was integrated with the RFQ with the required support structure.
- The window is broadband (like the WR2100 waveguides).
- The window was relatively expensive, so Eric was asked if this could not be done in-house.
- Eric understood that it can be narrowband around the operational frequency of 352.2 MHz.
- And it can be made much slimmer and therefore cheaper!
- He took care of the RF and mechanical design, and of the manufacturing of >25 windows.
- There are 2 spares left but for using it on the RFQ it would make sense to relaunch production.

Available spares

The current situation:

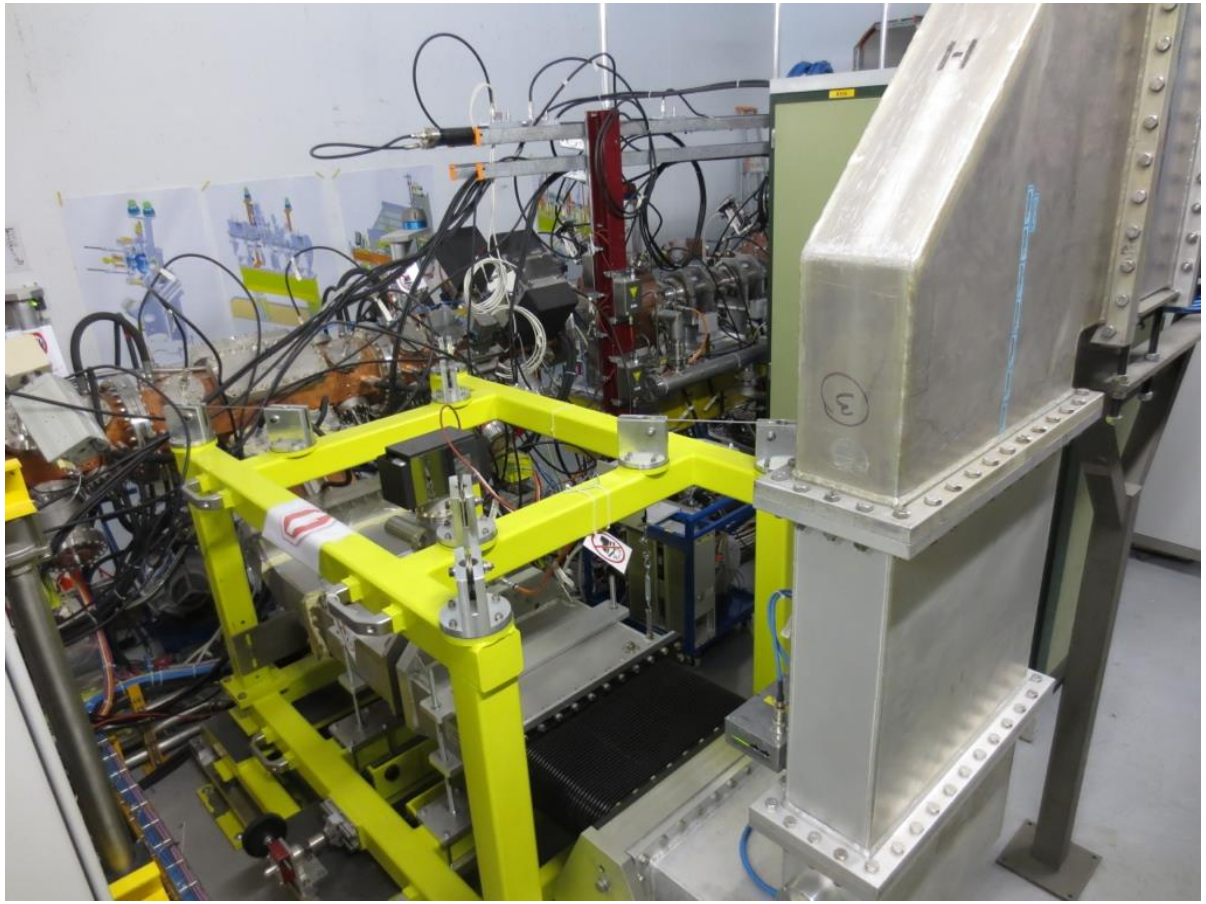
- There are one big and two slim spare windows available.
- For using the slim window on the RFQ, it would make sense to relaunch the production.
  - The two spare windows are convex and require re-machining.
  - We need one on the spare RFQ2 and one on each spare coupler (PIMS and CCDTL types).
  - It would be good to have one for exchange on RFQ1 and RFQ3
- The idea is to produce another 4, – 2 for the spare RFQ project and 2 as Linac4 spares.

RFQ integration – the big window

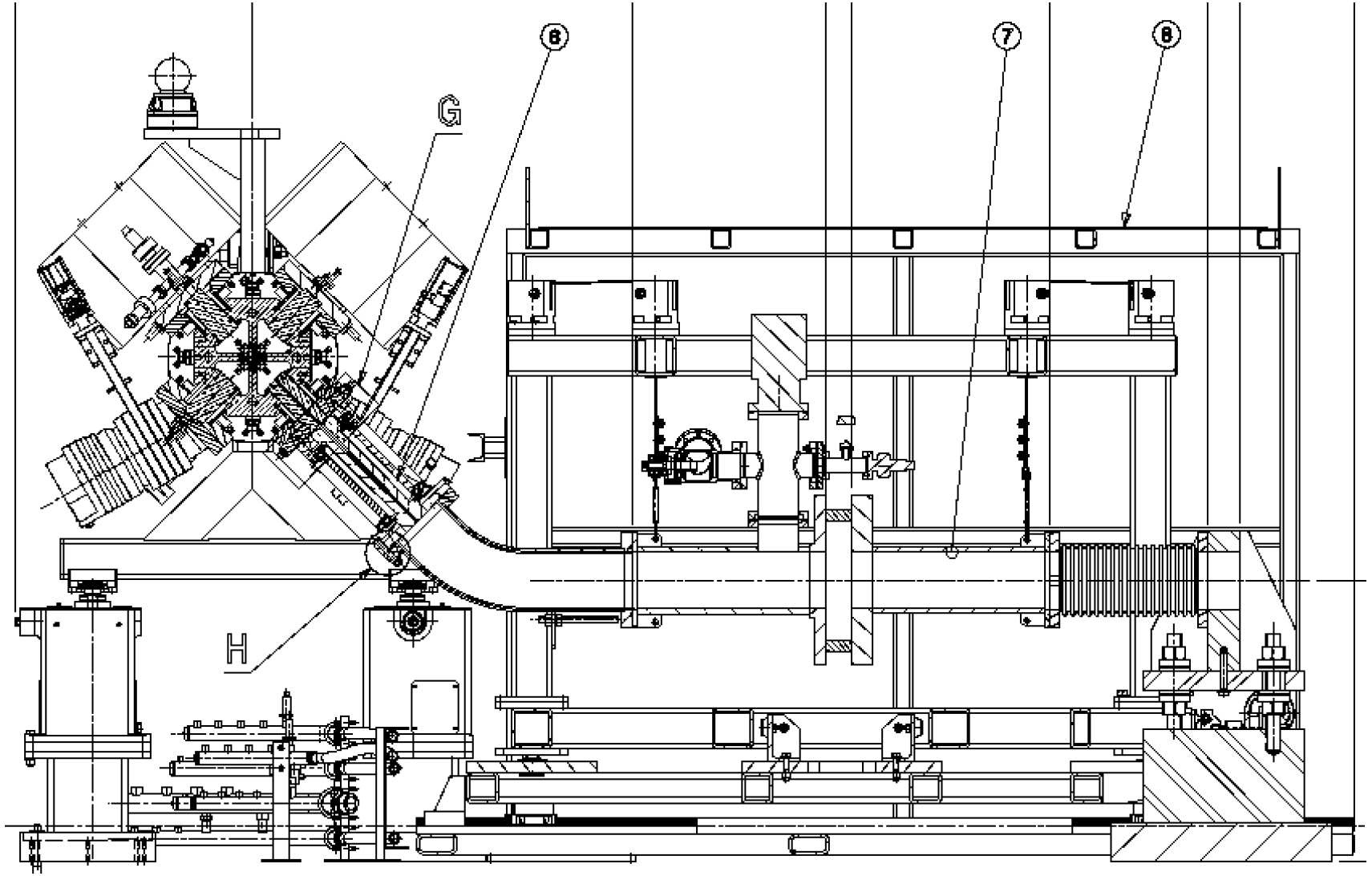
- The big window is suspended on a structure
- The structure reduces forces on the RFQ

But:

- Requires considerable space
- RFQ cannot be moved with the window
- For realignment, vacuum to be broken



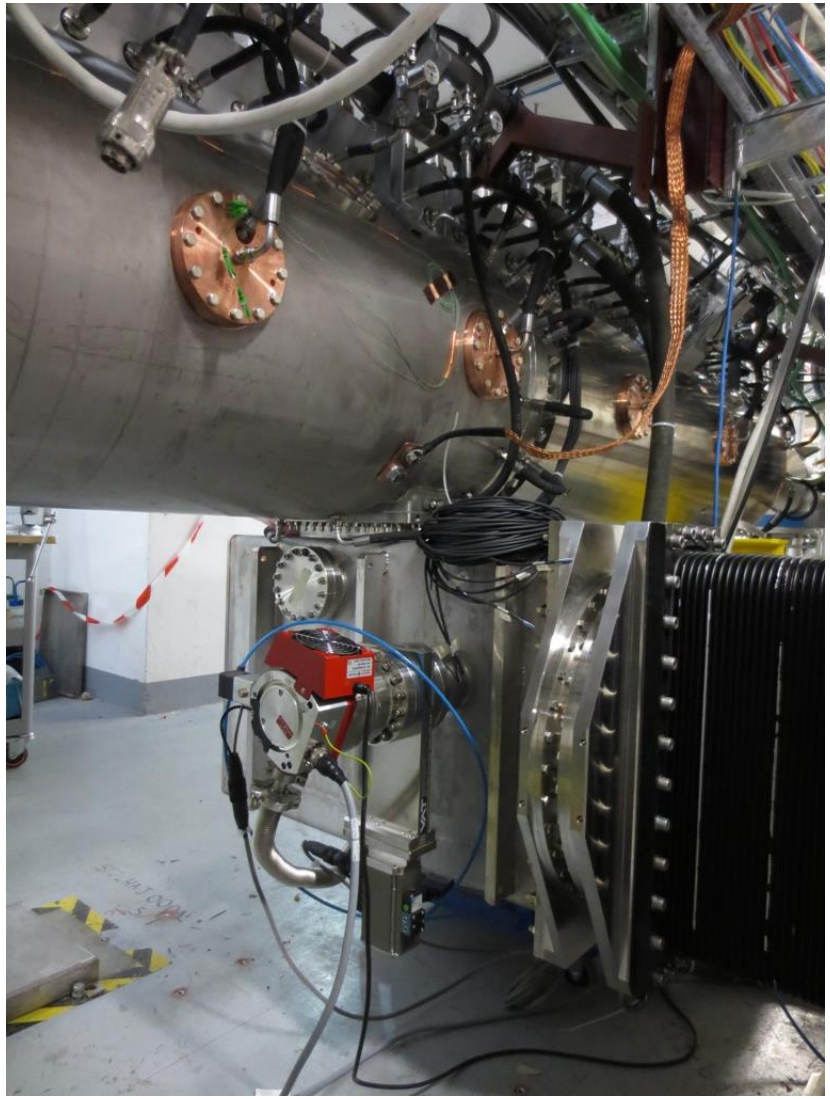
RFQ integration – the big window



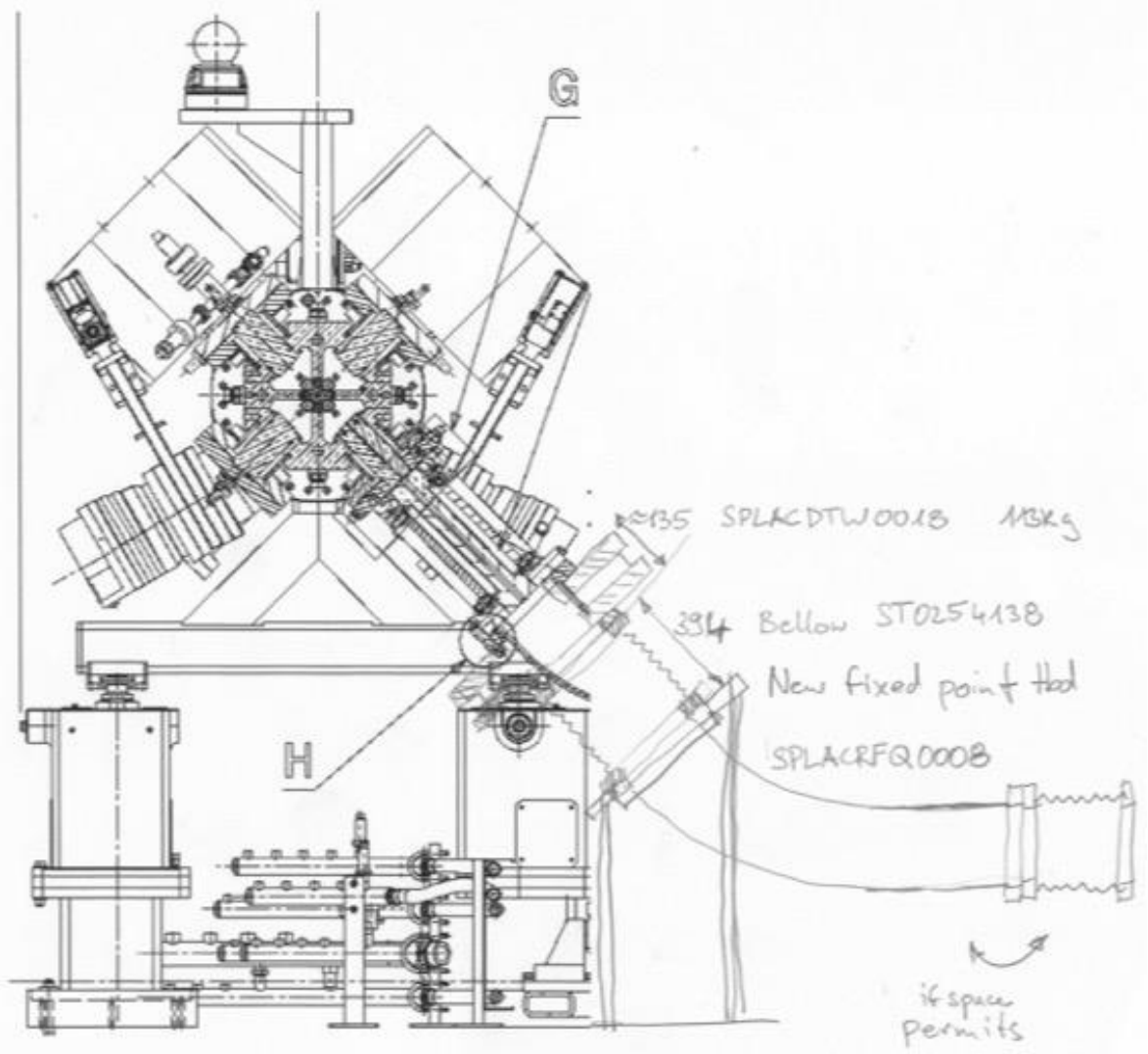
RFQ integration – the slim window

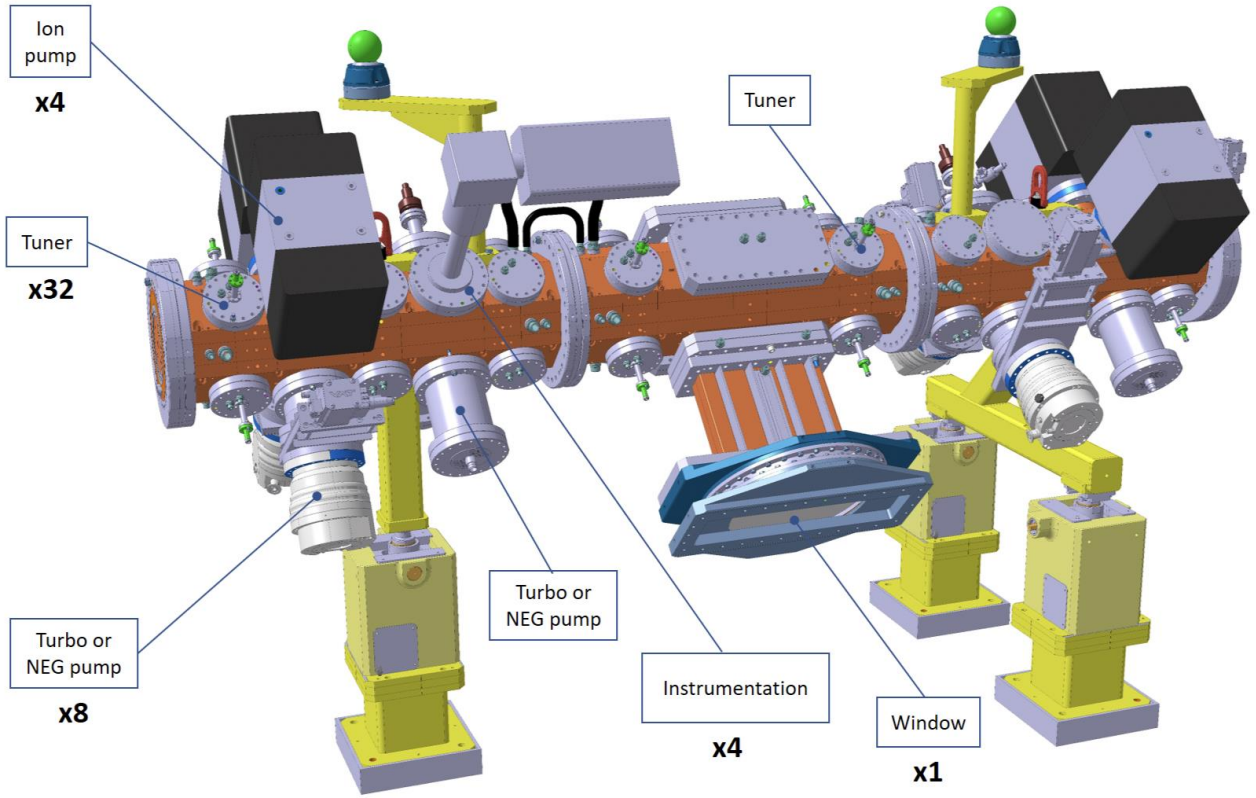
Integration slim RF window improves situation of RFQ:

- No need for a bulky broadband RF window and support.
- Realignment (within tight limits) w/o breaking the vacuum.
- RFQ can be stored and transported with RF window.
- Installation and conditioning will be faster.



RFQ integration – the slim window





Detailed mechanical simulation results
Jorge Guardia Valenzuela

Principal mechanical deformation

The mechanical structure of the RFQ is weakened by the RF openings

After realignment of the deformed RFQ, 3 principal types of deformation remain:

- Deformation of the quadrupolar shape in the center with changes of up to 6µm between vanes
- A sag along the structure with a sharp change from -20µm/m to +20µm/m in the center
- A torsion varying all along the RFQ within 0.3mrad with a variation in the center of 0.6mrad/m

Can this be accepted and maybe partly compensated by:

- RF tuning of the RFQ?
- Beam dynamics design?

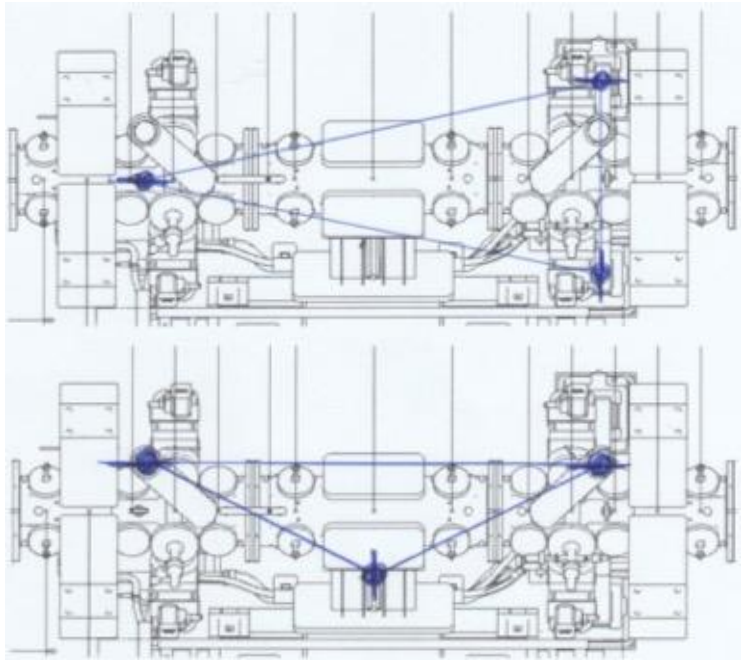
Potential remedies

The preference would be not to apply any mechanical modifications

- To keep the design as is (which is already in production with the RFQ2)
- To be able to apply the same solution also on RFQ1 when required / possible.

Potential remedies:

- A mechanically stiffer redesign – for RFQ3.
- Stiffeners between waveguide flanges
- Weight equilibration (e.g. vacuum pump on other side)
- A different distribution of supports

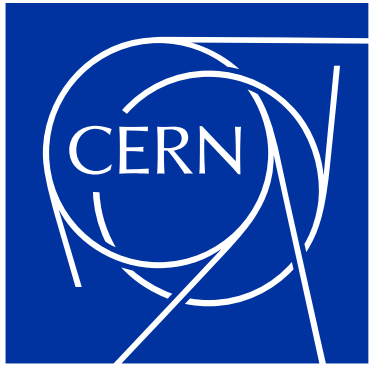


Next steps

The next steps need to follow rapidly as the production of RF windows takes about a year

One window needs to be ready well before the tuning phase 09/2021

- Beam dynamics evaluation – if any
- RF evaluation – if any
- Decision to be taken (end of 12/2020)
- Launch of slim RF window production – if decided
- Mechanical integration and design of new supports
- Supports production
- RF window reception
- RFQ assembly with RF window



home.cern