# Design of an Integrated Crotch Absorber for ALBA Synchrotron Light Source

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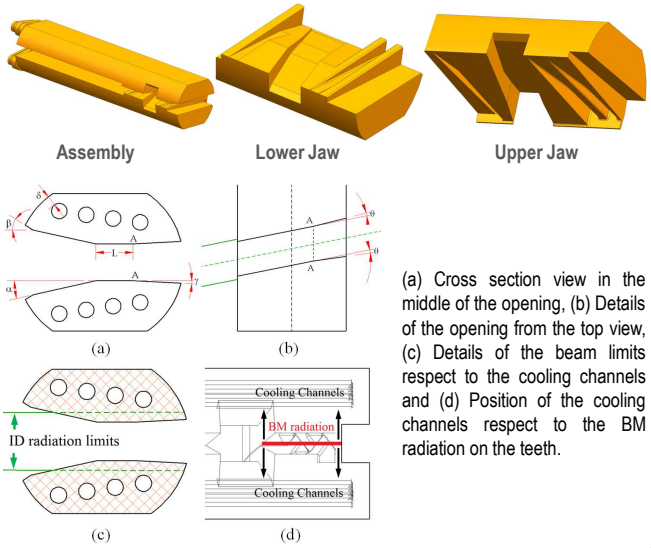
## Abstract

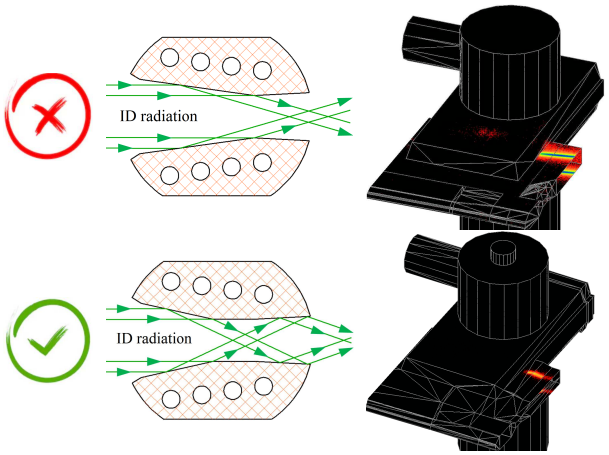
This paper presents the design of an Integrated Crotch Absorber for the new beamline LOREA (Low-Energy Ultra-High-Resolution Angular Photoemission for Complex Materials at ALBA). The LOREA Insertion Device (ID) consists of an Apple II undulator with a period of 125 mm.
For the current ALBA dipole chamber the ID vertical polarized light hits the upper and lower walls because of the very narrow vertical aperture between the cooling channels. To solve this problem some modifications must be implemented both in the dipole chamber and in the crotch absorber located inside of the dipole.
The new crotch absorber, named Integrated Crotch Absorber, must absorb a significant part of the ID vertical polarized light in order to avoid radiation impinging at the post dipole chamber.
The geometry of the Integrated Crotch Absorber is a combination of the conventional crotch and the distributed absorber done at PSI for ANKA. The design has been optimized taking into account the standard thermo-mechanical design criteria as well as the reflective effects of the ID radiation from the opening towards the walls of the dipole chamber.

## The Integrated Crotch Absorber



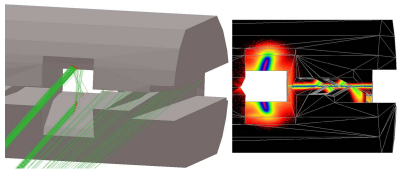

(a) Cross section view in the middle of the opening, (b) Details of the opening from the top view, (c) Details of the beam limits respect to the cooling channels and (d) Position of the cooling channels respect to the BM radiation on the teeth.

## Photon Reflection as Design Parameter



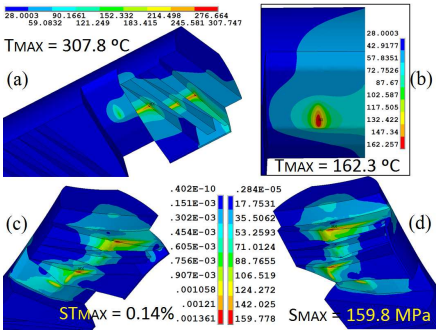

Collision and reflection of the ID radiation vertical mode in a cross section view of the opening. **Upper figure:** The radiation hits the absorber and is reflected directly to the walls of the dipole vacuum chamber. **Lower figure:** After the collision on the absorber the reflected ID radiation hits the internal walls of the Integrated Crotch Absorber.

## Absorber Simulated by Using SynRad+



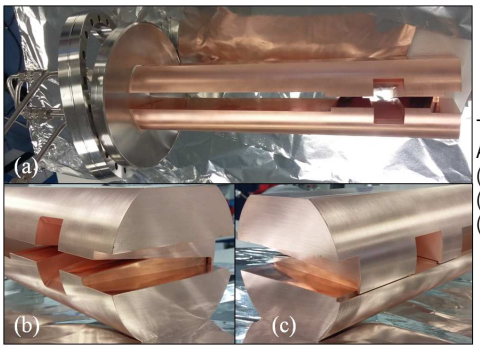
Absorber simulated by using SynRad+. Details of the photon beam trajectory and the footprint of the ID and BM radiation.

## Absorber FEA Results




The temperature, stress and strain distribution have been calculated based on linear elastic analysis. The thermal mechanical simulations show good results, the new absorber is in a safe range according to the design criteria. The maximum temperature, stress and strain are 307.8 ºC, 159.8 MPa and 0.14%, respectively.

## Manufactured Model




The Integrated Crotch Absorber for LOREA.
(a) The complete absorber.
(b) Opening inlet reference.
(c) Opening back reference.

## Conclusions

Details of a non-conventional absorber at ALBA are presented. This new Glidcop Al-15 absorber is named Integrated Crotch Absorber because we combine two types of geometries: the conventional crotch absorber and the distributed type. Its optimization is based on geometrical aspects in order to have an optimal thermal mechanical behavior and also with the aim to capture the ID radiation reflected inside of the same absorber. The final design meets the thermal mechanical design criteria for the absorbers and reduces the effects of the ID photon reflection on the dipole vacuum chamber.