

# Probing the robustness of a TCDI-like collimator in case of high-brightness beam impact

LIU and HL-LHC WP14

CoIUSM

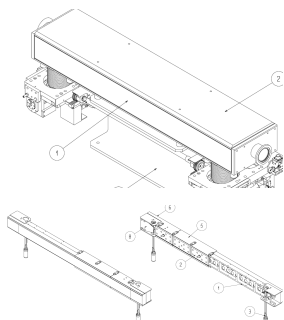
July 3<sup>rd</sup>, 2014

## TCDI test in HiRadMat

Upgrade of SPS-to-LHC transfer line (TCDI) and LHC injection protection devices (TDI etc.) for the HL era

- Installation foreseen in LS2 as a part of the LIU and HL-LHC (WP14) project
- **Very challenging beam impact conditions**
  - $I = 288 \times 2 \cdot 10^{11}$ ,  $\epsilon_n = 1.37 \mu\text{m} \rightarrow \sigma^2 = 0.18 \text{ mm}^2$
- Devices must not lose their ability to protect downstream superconducting magnets
- Materials must retain their structural integrity under all load conditions
  - Thermo-mechanical+shock-wave sim. indicate that stresses for small impact parameters could be beyond strength of currently used materials (like GR4550)

*Proposal submitted, will be presented at the next HiRadMat Scientific Board (13<sup>th</sup>/14<sup>th</sup> Oct.)*



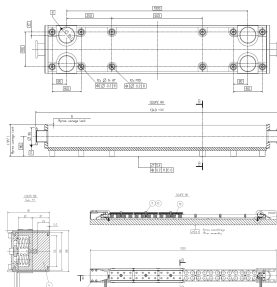
### HiRadMat test proposal

- The purpose of the proposed HiRadMat experiment is to realistically probe the robustness of a TCDI/TDI-like beam-intercepting device in case of such high-brightness beam impact

# TCDI test in HiRadMad

## Impact conditions

- In order to achieve similar beam impact conditions as in the HL-LHC era, a customized HiRadMat optics setup is proposed
  - The lower pre-LIU intensity delivered by the SPS is compensated by a sufficiently small beam size at the target station ( $\sigma=100\text{--}300\mu\text{m}$ )
- The experiment distinguishes itself from previous tests by a significantly higher energy density achieved in jaws with low-Z blocks
- The experiment further aims at a small impact parameter ( $\sim 1\sigma$ ) which is expected to yield the highest stresses.
  - High-precision alignment with jaws
  - Online beam position monitoring during high-intensity extractions with a monitor (likely BPKG) integrated in tank



### Setup:

- *TCDI-jaws in custom-made tank (similar to standard TCDI tank)*
- *Online monitoring (e.g. temperature, vibration) and post-irradiation analysis (e.g. detection of defects) under investigation*