

"Booster Collimation Update"

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PIP General Meeting, Wed, Aug 12, 2015

Optimal thickness of primary collimators

- **MADX code** has been modified to include **proton interactions with thin primary collimators** (Prim-Colls), while out-scattering from secondary collimators is neglected
- **Dependence of collimation efficiency on thickness** of **Cu** Prim-Colls at injection energy (**400MeV**) within thickness range {0; 381mkm} has been simulated. It is quite smooth.
- Collimation efficiency grows up **with the number of turns** (simulated up to 100) under simulation approach that all accelerator parameters are constant (*is it a case of booster ?*)
- **Optimal thickness** of Prim-Colls for Cu is **~50mkm (or thinner)** to reduce losses of scattered protons in magnet apertures and pipes between primary and secondary collimators.
- ~50 mkm is much less of **existing 381 mkm (0.015") Cu foil** for both hor. and vert. primaries
- Original STRUCT's calculations at 400 MeV corresponds to **equivalent Cu foils of ~12mkm**

A pair of new aluminium Prim-Colls are already fabricated and is ready for installation



- All sizes are the same as for existing Cu heat sink (complicated shape) to keep similar manufacturing technology; (heat transfer calculations for Al might be necessary "?")
- Al foil part has the thickness ~ **381mkm** which is equivalent to ~**60mkm of Cu** foil (left figure)
- A thinner foils ~300mkm **is difficult to fabricate** (one was broken during manufacturing – see right figure)
- Another possible materials are *carbon and berillium* (require special investigations)

Tests for collimators motions

- **Primary** collimators moves **reliably** (tested by Salah & myself)
- **Secondary collimators** (Sec-Colls) tests on 23-Jul & 11-Aug have showed **some problems** for all 3 collimators: vertical motion for all 3 collimators and horizontal motion for 2nd collimator.
- Several **meetings and discussions** (see Beam-Doc DB); team including Mike Coburn (controls), Matt Slabaugh (mechanics) and Rick Tesarek; support from Salah and Todd at all studies.

Conclusion:

hopefully, the new tests of two-stage collimation system with new Al foil will be done in this autumn.

Question:

if two-stage collimation can be more effective for FNAL booster (with fast-variable parameters, not as storage ring) than one-stage (primaries off) used now.

Simulations

- A new simulation approach including **out-scattering in Sec-Colls** is under development for a correct **comparison of two-stage and one-stage collimation** in the booster. The proton interactions with Sec-Colls are simulated by MARS (Mokhov's group) and will be used by MADX tracker as black-boxes.
- Review of collimation systems on similar proton synchrotrons (J-PARC, SNS, ISIS, ?) to work out **possible alternative solutions**, if present booster two-stage collimations is failing.