INDIANA COOLER (1981 – 2002) – ARCHIVE

The 'Indiana Cooler' was a storage ring for light ions consisting of a circular magnet lattice of about 100 m in circumference. It was part of the Indiana University Cyclotron Facility (IUCF). Initially, the IU Cyclotron delivered the ion beam for the ring; eventually a dedicated Injector Cyclotron was added. The Cooler ring was built specifically for the purpose of exploiting the novel technology of electron cooling which made the use of an internal target possible. For more, see: H.O. Meyer, *The Indiana Cooler: a Retrospective*, Annu. Rev. Nucl. Part. Sci. 2007. 57:1-31

During my involvement with the Cooler, many documents concerning the construction and commissioning of the machine and covering much of the conducted research have accumulated in my files. After some culling and ordering, I have submitted these documents to the **Indiana University Archives**. The material is contained in five boxes. Each box comes with a detailed table of content.
Hans-Otto Meyer, April 2018

Box 1 (series 1): Construction, operation and end of the Cooler

This series covers the conception, planning, construction and operation of the Cooler storage ring. In particular, it illustrates the start-up phase and first attempts to learn about the novel experimental environment and its usefulness in the study of nuclear physics.

3.3 Cooler Dedication, June 1, 1988, official invitation

4 Development

4.1 Electron cooling

4.1.1 Electron cooling, theoretical issues

Derivation of cooling force for a flattened distribution
Mills circle
Ionization by electron collision
Heating of ions in an electron beam
Space charge effects in a cylindrical electron beam

4.1.2 IUCF electron cooling system

Design drawings
Reports by Friesel, Ellison, Dermois

4.2 Polarization and Siberian snakes

4.2.1 Use of the CE01 detector as a polarimeter

4.3 Monte-Carlo simulation of the stored, cooled beam (HOM)

4.3.1 Monte Carlo simulation, part 1

Cooling force, longitudinal cooling, target heating, longitudinal heating, Monte-Carlo without RF, treatment of RF cavity, FULLEQ: MC calculation that includes transverse phase space, transverse cooling, heating and betatron motion

4.3.2 Monte Carlo simulation, part 2

Dispersion-coupled losses, fiber targets, vacuum limitations, analytical expressions for transverse Cooler beam properties.

4.3.3 Beam-Target interaction

4.3.4 Longitudinal phase space

4.4 Internal targets for the Indiana Cooler

4.4.1 General studies

Memos by Pollock, Meyer, Pancella, Sperisen (1985)
Gas dynamics, tubes, nozzles
Memo by Pancella (1992)

4.4.2 Micro-ribbon targets, part I

How to make micro ribbons, electron microscope pictures, resistance, sublimation
Interaction between fibers and stored beam, P. Schwandt's report on heating

4.4.3 Micro-ribbon targets, part II

Experimental studies 1988 - 1991

4.4.4 Micro-particle targets, part I

Interaction between micro-particle targets and the stored beam
Design and construction of a laser diagnostic device
Contact charging and electrostatic manipulation (a lot of work, but did not work)

4.4.5 Micro-particle targets, part II

Gas jet, seeded with micro-particles (idea that worked)
Heiko Rohdjess, Microparticle beam target test in the Indiana Cooler, Diplomarbeit
"Dust target user guide", H. Rohdjess

4.4.6 Skimmer targets, Report on linear motor system (FLIM), Pancella, 1990, Rate stabilization hardware and electronics, Flimlet

4.5 Background and scraper slits

4.6 Miscellaneous

Cooler circumference measured using pd $\rightarrow {}^{3}\mathrm{He}\pi^{0}$, Pancella, 2001
Cooler beam profile measurement, Pancella, 1989
Floor plans
'combos' (local beam shift and tilt)
Ring magnets, details, early documents

5 Startup of experimental program

5.1 Planning for experiments

Pollock, Meyer memos 1983

The “Cooler User Guide”, 1st ed., March 1984

The “Cooler User Guide”, 2nd ed. March 1988, contains everything one needs to know about the ring in order to design an experiment

5.2 Towards the first Cooler experiment

Note: see also the separate file ‘CE01’ dedicated to the first experiment

Design and equipment procurement of parts

CE01 working group (19 people)

Attempts to get adequate resources, 1989

CE01 run, Aug. 1989, planning for remainder of year

IUCF Organigram April, 1990

6 Final decade of Cooler operation

6.1 1992 – 1999

NSAC/NSF review, Dec. 10-11, 1992

Visiting committee to IUCF, Apr. 27-29, 1994 (ordered by Gearge Walker) and report of that committee (recommends keeping up Cooler research)

Status of Cooler research, Feb. 1996 (list of experiments at that time)

Various emails concerning end of cyclotron funding by NSF

1998 annual report to NSF

1999 annual report to NSF

6.2 1999 - 2002

NSF site visit and facility review Jan. 14, 1999

Report of the NSF review panel (recommend 3 more years funding for Cooler research)

2000 IUCF status report (including separate reports on Pintex, pion production near threshold and the 3-nucleon force

Cooler shutdown scenarios. Pintex plans. Cameron’s objection. Home stretch scenario. Last beam: June 2002.