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 2): CE01: the first experiment

Documents the build-up of experimental equipment and how the first nuclear data were obtained with the Cooler. The first experiment was a measurement of the cross section of neutral pion production close to the energy where this process becomes possible.

1 Conception of the experiment

1.1 Proposals, early preparation

- Pollock's memo proposing $pp \rightarrow pp\pi^0$ for the first experiment (7/83)
- CE01 proposal (84-C112)
- CE23 proposal (90-105) energy dependence, PAC defense
- Reaction kinematics, beam energies needed
- Existing data on near-threshold pion production in NN

1.2 Theory

- expected energy dependence of $pp \rightarrow pp\pi^0$ near threshold
- phase space calculations
- quantum numbers, partial waves

1.3 Theory

- final-state interaction

2 Apparatus

2.1 Administrative

Note: see also the subdirectory 'CE01' (5.2) in Box 1, series 1.

- Flow sequence for assembly and testing (Pancella)
- Cost estimates
- Man power estimates

2.2 Target and target region (G)

- Surveying of target region
- Target box drawings
- Alignment procedure
- Thin exit foil (design, brazing, etc.)
- Report on CE01 installation 3/88 (Pancella)
- Angular acceptance of detector stack

2.3 Gas jet target

- Scale drawings
- Gas dynamics
- CE01 vacuum and target instructions (Pancella, Sperisen)
- CE23 target thickness data
- Density profile, measurement with electron beam

2.4 Wire chambers
- Design and construction of wire chambers with a hole in the middle
- Test run 1/88
- WC efficiency near edges (Bilodeau)

2.5 Scintillator detectors (E, F, V)
- Scale drawings
- Manufacturing and purchasing of materials
- Procuring of photomultipliers and bases
- Position-dependent light collection efficiency, tests

2.6 Position-sensitive recoil detectors

2.7 Electronics
- Design ideas (first use of ECL at the lab)
- Full electronics diagram

2.8 Monte-Carlo simulation of the measurement

3 Data acquisition

3.1 General
- Strategy for production runs (Meyer. 11/89)
- 'Data run' checklist (Pancella)
- CE01 tape index (Pancella)

3.2 Production runs
- 10/89 OCTK: first $pp \rightarrow pp\pi^0$ cross section
- 12/89 DECM: production running at 287.0 MeV
- 01/90 JANN: 289.0 and 286.5 MeV
- 02/90 FEBO; 03/90 MARP

4 Analysis

4.1 Strategy
- Zeroth order CE01 analysis
- Analysis software and formulae
- planning for CE23analysis (12/90)

4.2 Corrections
- Scintillator and wire chamber efficiency
- Wire chamber multiplicities
- E-detector position dependent gain correction
- Correction for loss in crack between the F segments

4.3 Loss in central hole

4.4 Cuts and conditions

4.5 Beam energy calibration and energy spread

5 Results

5.1 Integrated luminosity

5.2 Final results

6 CE23: Energy Dependence of $pp \rightarrow pp\pi^0$ near Threshold (Meyer, IUCF)
- continuation of CE01, proposal 90-105, beam time requests, talk by Kam Seth on pion production (Adelaide 1992)