The Physicists can produce the QGP by

- The Big Bang Theory is the theory of cosmic expansion that describes the evolution of the universe since it started 13.8 billions years ago. Right after the big bang, the universe was full of very energetic particles that eventually “cooled” down to form the structures that we see today in nature.

- Ten million degrees Kelvin (K) is only a hot, dense state of matter called the Quark Gluon Plasma (QGP) was present in the universe. The QGP is a highly energized form of matter that contains particles called quarks and gluons. Under normal conditions, quarks and gluons are bounded within protons, neutrons and other particles. But in the QGP, the quarks and gluons can move freely. Thus, the QGP can be used to study the fundamental particles and interactions present in the early universe.

- Physicists are colliding beams of heavy nuclei that are accelerated to almost the speed of light.

**sPHENIX and the EMCal**

- The sPHENIX detector will measure the products of the particle collisions that create the QGP. It is composed of several layers of subdetectors that use different technologies to measure different particles. The detector has a tracker, a hadronic calorimeter (HCal), an electromagnetic calorimeter (EMCal), and a magnet.

- The electromagnetic calorimeter (EMCal) is the sPHENIX subdetector that will measure the electrons and photons that come out of the particle collisions. The EMCal is made of blocks that consist of scintillating fibers embedded in a mix of tungsten powder and glue.

- There will be more than 6,000 blocks inside the EMCal (with 24 different block designs), all of which will be produced at the UIUC Nuclear Physics Laboratory (NPL).

**Block production:**

- Scintillating fibers (special fibers that emit light when particles go through them) are dropped into a set of brass mesh screens.

- The fibers and screens are placed into a mold.

- Tungsten powder is poured into the mold and compacted for maximum density.

- Epoxy (glue) is poured into the mold and the mix is left to dry for a few hours.

**Block Quality Assurance**

Several tests are carried out to ensure that the produced blocks meet the criteria required for the sPHENIX detector.

- **Dimensions test:** measure all the sides of the block to make sure they match the nominal design and the block can fit in the detector.

- **Density test:** To ensure that the block density is high enough to stop the particles from the collisions.

- **Light transmission test:** To see if the scintillating fibers in the blocks are transmitting enough light. A light source is used to illuminate one end of the block, and then a photograph of the other end is taken.

**Block Mount Design**

- A new block mount was designed for the scintillation test. As shown below in the Current block mount, the mounting system holds multiple pieces (PMT, block and UV light), which is vulnerable to accidental displacement, leading to inconsistencies in testing. Therefore, a one-piece, integrated design will improve the precision of the scintillation test.