Far-Forward Detectors overview

- Yulia Furletova (JLAB) is the CAM for the FF (ancillary) detectors.
- In ePIC, I am the DSL for FF, and DSTC for the RP and OMD.
  - Zvi Citron (Ben Gurien - Israel) is DSTC for the B0.
- Roman Pots, Off-Momentum, B0 tracking
  - All pixilated AC-LGAD sensors.
  - **Sensors:**
    - Can be purchased from HBK, or made here in IO – for FF and FB (and potentially for polarimetry) subsystems perhaps IO can do all of it (comparatively small subsystems). → 4x4 channel sensors already exist and have been shown (by themselves) to meet physics requirements in test beams for our purposes.
      - No irradiation tests have been carried out with the AC-LGADs, to my knowledge.
    - Any further sensor development makes the most sense within IO, with feedback from scientist on project or in PO (for performance).
  - **ASIC:**
    - IJCLab + OMEGA for production; testing at BNL and other places.
    - Testing has involved EIC project (me), BNL PO (e.g. Prithwish, Alessandro, Prashanth, several students), and IO (e.g. Gabriele Giacomini).
  - Present “engineering” (e.g. bonding, laser tests) carried out by personnel in IO (interfaced via Alessandro).

Far-Forward Detectors Needs

- **ASIC**
  - Currently have 4x4 channel EICROC0 → needs revisions to address some issues → this is really only doable by IJCLab and OMEGA, they have the expertise.
- **Testing**
  - Bench testing of AC-LGAD + ASIC setup (analog signal testing, ADC/TDC measurements, etc.) → Can be done in IO with personnel from EIC project and PO (not majorly labor-intensive).
  - Beam tests → can align efforts with needs for TOF, but requirements are ultimately different as things evolve in the next few years.
    - For initial tests with sensor + ASIC for basic performance requirements, all fine.
    - Final system design for FF and Forward TOF will have different needs w.r.t. radiation (e.g. B0 packages), spatial resolution performance needs (RP/OMD ~ 140um, FTOF ~ 30um, B0 ~20um), full module solution (sensor + readout, cooling, cabling, etc.).
    - 500um pixels (aim for these AC-LGADs) also needed to separate hits from nearby particles.
    - → at some point these efforts will have to diverge to their respective work packages for their subsystems.
      - Some of these work packages could potentially be aided in PO using lab space + partial FTE person.
- **Integration**
  - Requirements for FF very stringent in-terms of integration with machine.
  - ES&H and safety requirements will be different, and installation schedule will be different than for central detector.
  - This part really can only be under the project since it follow so closely with the machine (in my view).

My two cents on BNL PO + Far-Forward

- Small subsystems – much of the engineering done on the project.
- **BUT:**
  - PO person can be partial FTE in combo with project – *this is how I function now, kind of* → direct work on the detector development charged to the project, simulations and software charged to R&D funds or PO (ColdQCD group).
  - Any ”physics” work for the TDR or through DD4HEP similarly cannot be charged to the project, but that work is obviously important to advance the design.
    - Finding a way to fund this explicitly would make life a lot easier.
  - IO is an instrumental (pun intended) part of the equation here → all of our testing up to now has used their lab space, some of their personnel, etc.
    - Whatever we decide to do, they need to be in the loop.
  - **Kinds of work which could potentially be done in PO (with partial FTE(s)).**
    - Bench testing of sensors and ASICs.
    - Construction of components for support system and cooling (not fabrication of custom parts).
    - Participation in test beams, both in setting up apparatus and analyzing data.
    - ”physics” simulations to test performance as design evolves.
    - Software development for operating the detectors (e.g. reconstruction code - much exists, but it will need to be maintained and updated).
    - DAQ/readout → requires more dedicated knowledge for the design aspects.