# DESY beam test preparations

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Two main goals for beam test

- MIP paper
    - Find efficiency for other sensor variants which were not covered in enough detail at CERN
    - Requires that enough sensor variants are available and trimmed
    - Aim for two each of $12\mu m$ non-deep P-well, $12\mu m$ hi-res and $18\mu m$ hi-res, plus as many as possible (at least five) of standard sensors
    - All need to be trimmed, potted and checked beforehand
- Shower density paper
    - Measure electron shower response and core density
    - Requires accurate knowledge of shower centre
    - Need external tracking to find projected impact point
    - Use EUDET telescope and combine with TPAC DAQ data

Telescope interface

- EUDET trigger handed by TLU
    - Designed by Dave Cussans, Bristol
    - Can send (lowest 15 bits of) trigger number for each trigger via hardware interface; need RJ45 cable to connect to TLU
- Add interface to master USB_DAQ firmware
    - Rui Gao, Oxford, has started working on this
    - Will make a custom RJ45-IDC short cable to plug into USB_DAQ
    - Record trigger arrival timestamps and trigger numbers in FPGA
    - Also need run number; accessible through EUDET socket software
    - Read out run/trigger data along with other data following bunch train
- Associate systems offline
    - Use standard EUDET software to internally align telescope and form tracks (as being done by Alessandro Calderone at Bristol)
    - Use run/trigger data and timestamps to associate tracks with one (or a few) BX in TPAC data
    - Do alignment by comparing TPAC hits to tracks; new code needed

Suggested stack geometry
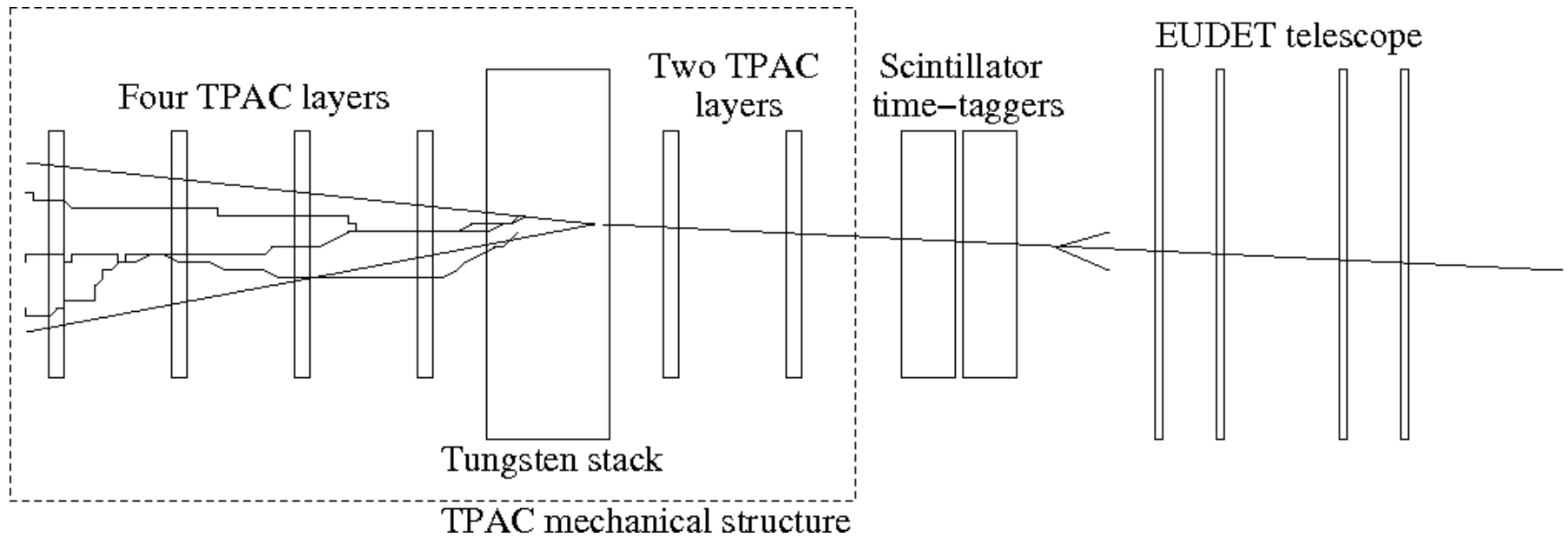
- Put tungsten slabs within sensor array, not in front
  - Still allows several layers behind tungsten
  - Could be three before/three behind rather than two/four
- Initial layers give direct cross-check of telescope and make alignment easier
  - Also give backup in case telescope data cannot be interpreted
- Initial layers allow "MIP" measurements to continue even while doing shower measurements

Triggering

- What does EUDET telescope trigger use for triggering?
  - TPAC $1\times1\text{cm}^2$ scintillators or some other, larger ones?
- Do we need to know about showers just outside the scintillators?
  - These would give tails which would look like random noise
  - Makes comparison with out-of-time BXs more complicated
  - Larger scintillators, e.g. $5\times5\text{cm}^2$, would catch these tails
- Downsides to using larger scintillators
  - Higher rate of telescope triggers so more deadtime; probably not a big issue
  - Need to buy/borrow and commission them!

Plan

- Reassemble system as used at CERN
    - Start running with any/all sensors which are trimmed as they become available
    - System should be assembled asap – Marcel, Jan
    - Sensor gluing, potting and trimming – Jamie, Paul
- Try out stack geometries with sensors both sides of tungsten
    - Find out what is feasible/easy
    - Do as soon as system is stable – Marcel, Jan
- Add in new TPAC master firmware and TLU when Rui is ready
    - Get EUDET online software interface running also
    - Check run/trigger data look sensible offline
    - Aim for ~two weeks – Rui, Paul
- Get larger scintillators for telescope trigger
    - Need HV and logic also
    - Ideally ready when interface is ready – John, Nigel?