

Tracker status

WEIZMANN
INSTITUTE
OF SCIENCE



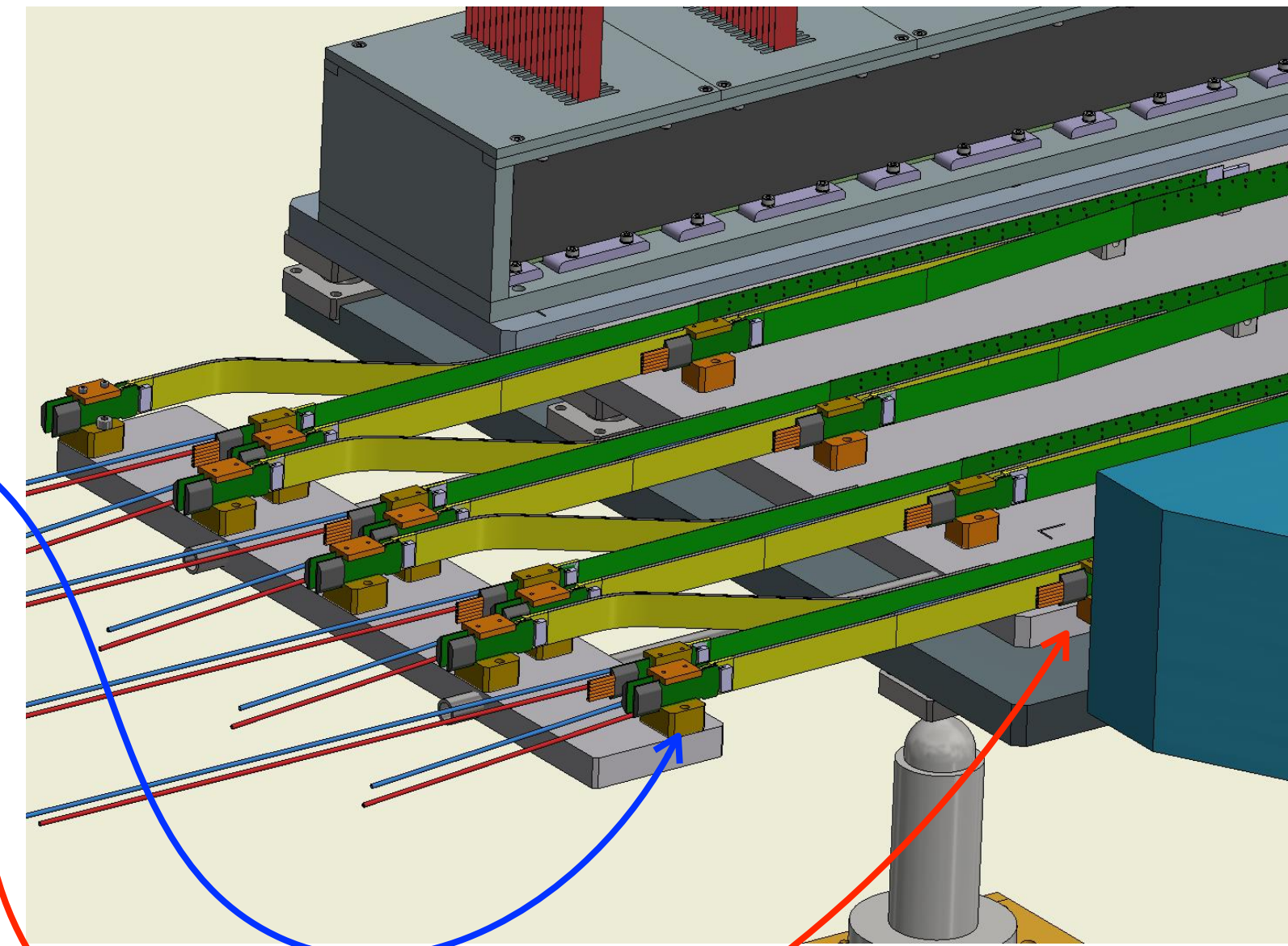
Aug 25 2021

Intro

- ◉ Equipment news
- ◉ Reconstruction software
- ◉ Insitu calibration

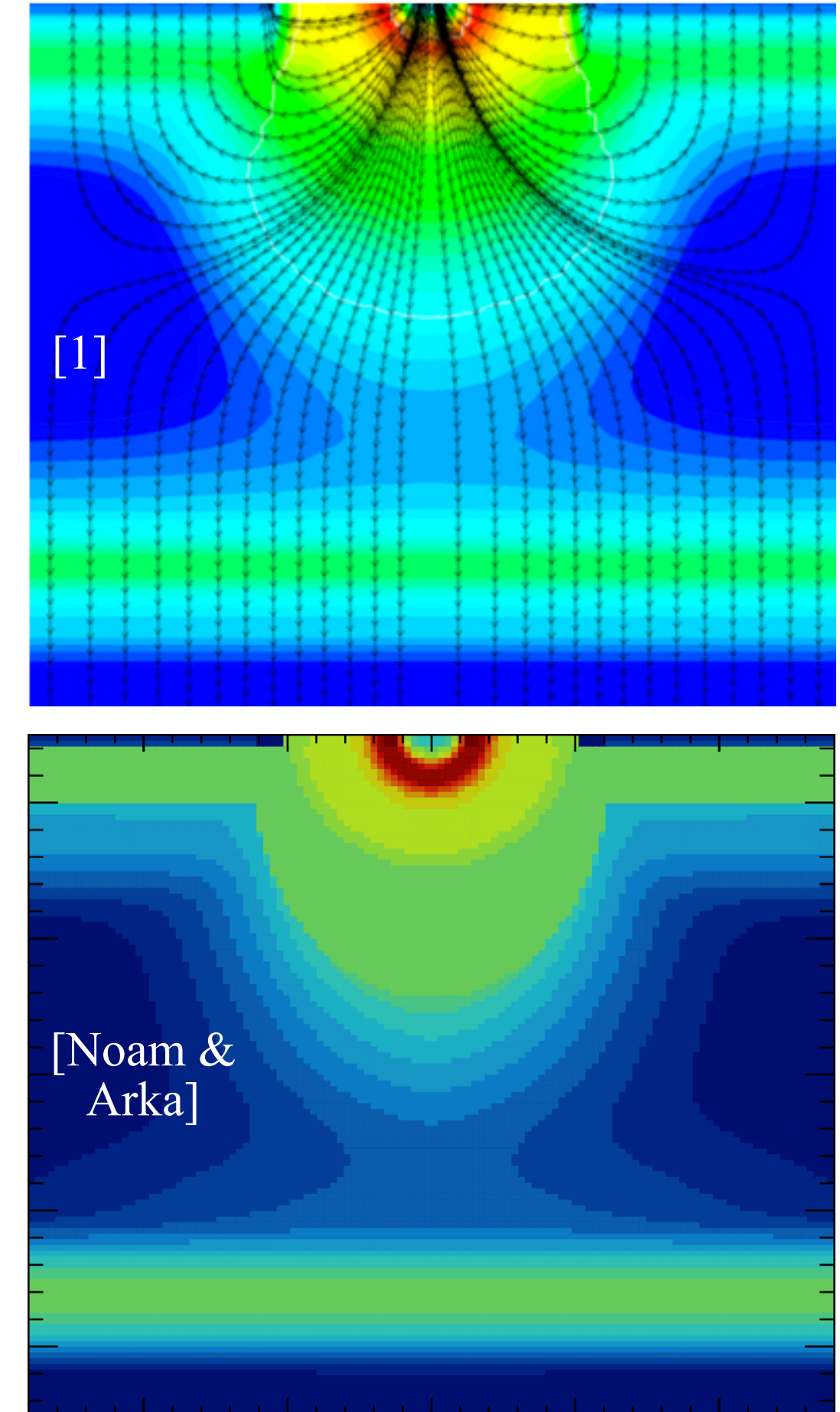
Equipment news

- License was prepared by CERN+TJ and is officially signed and stamped now by WIS and DESY (thanks to Beate and Ties)
 - hope it'd get approved by TJ before Sep since Sep is nearly a dead-month in IL
 - this will be good for both the WIS equipment and the LUXE equipment (i.e. the license is very strictly linked to 2 projects)
- What I'm getting for WIS:
 - one silver category stave: each chip has more than 50 but up to 1500 dead pixels out of the 512x1024 pixels, so up to 0.3% dead pixels
 - individual chips are ready but waiting for license approval by TJ to start the bonding on the individual carriers
 - bonding lab at CERN is anyhow closed until Sep 2
- For the LUXE production:
 - The sPHENIX production is done - during the ITS installation the CERN techs were not available so other techs came in for the sPHENIX production
 - The ITS installation is nearly done and the CERN techs can devote some time (still <50% FTE) for our production after a short re-training
 - Good news: the rate they can achieve is ~1-2 modules per week (1+1 techs for assembly+testing)
 - for sPHENIX there were weeks where they managed to complete even 5 modules
 - we will need to extend the FPC flex cables by ~25 cm - just the **analog and digital power** (not a problem and it just implies some re-ordering parts (we will not extend the **readout** line))
 - overall, to produce ~18-20 staves (16 + 2 or 4 spares) we would need
 - at most 20 weeks so <4.5 months assuming 1 staves per week
 - at most 10 weeks so <2.5 months assuming 2 staves per week
- Readout units: there should have been a new big production for JINR this year. It will not happen since they didn't get the license for the ALPIDEs from TJ. We will need to explore other directions but that should not be a showstopper.



Reconstruction software #1

- In the last few months we have been focusing on the simulation of the ALPIDE sensor response itself with AllPix² [1]. There's also fast-sim [2] on which we will collaborate as well
- The key point here is the knowledge of the electric field which usually comes from TCAD simulation - linked to the fabrication process (doping profiles, etc.)
- The TCAD simulation is proprietary of TJ and so far we don't have the permission to get it (maybe this will change after having the ALPIDEs license)
- Since we could not wait for that, we decided to try and replicate the field empirically based on [1] and it was/is not trivial (!!!) since:
$$E(\vec{r}, V) = \sqrt{\Sigma E_i^2(\vec{r}, V)}$$
- Arka has shown this study in the AllPix² workshop last week and it was very well accepted. He will show the results in the next simulation meeting (Aug 31)



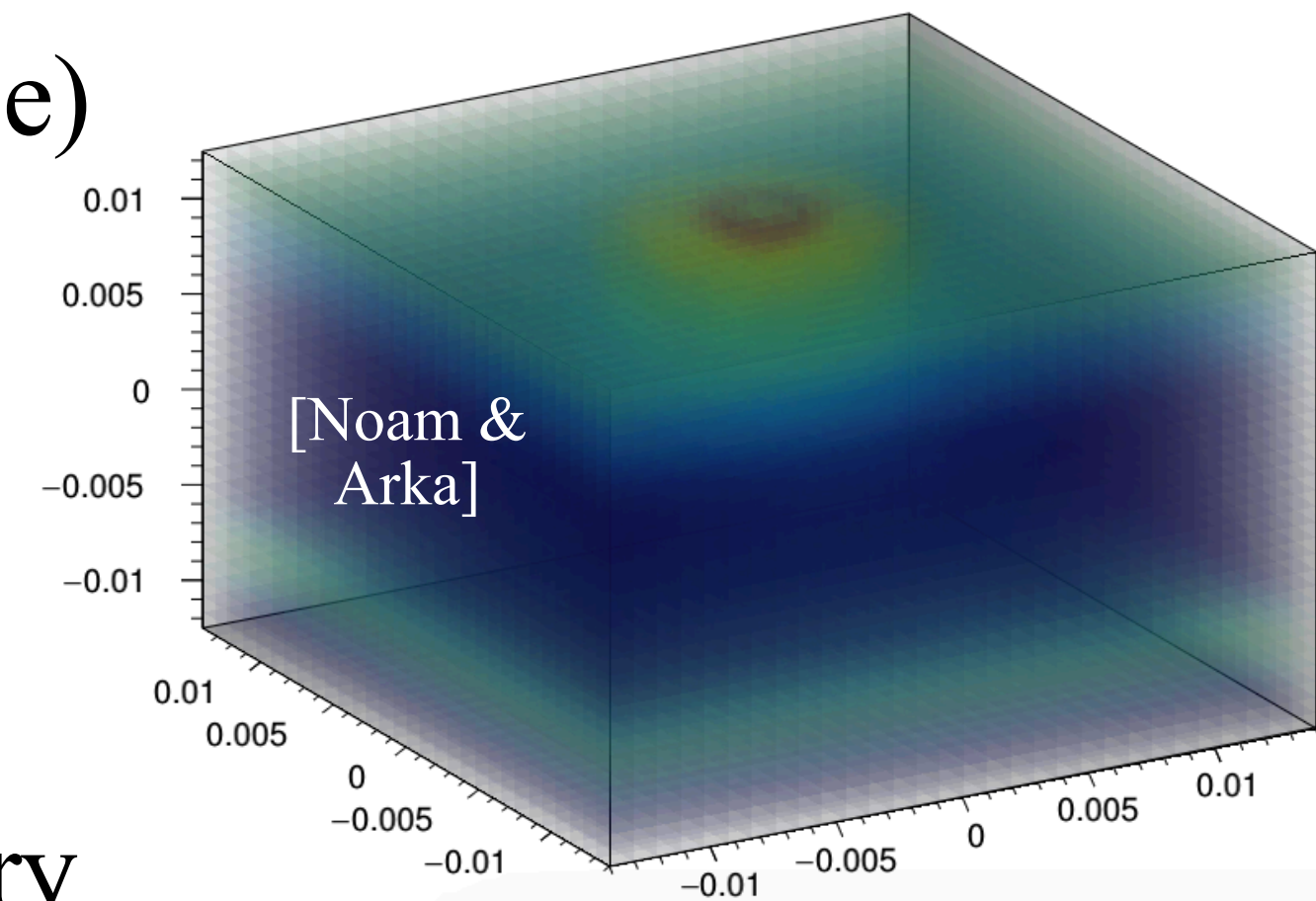
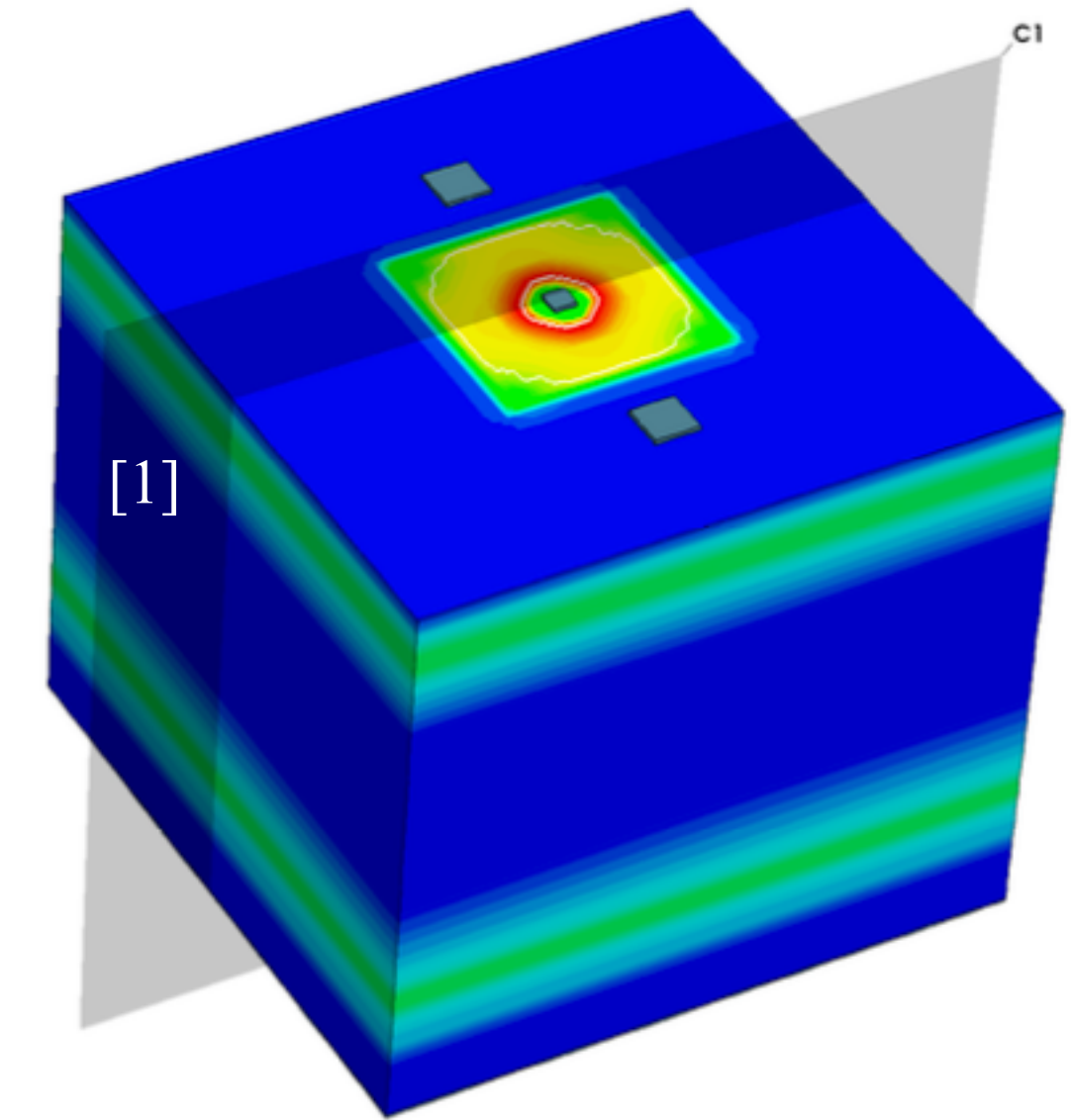
[1] NIM A 964 (2020) 163784
[2] NIM A 950 (2020) 162882

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Reconstruction software #2

- ◉ Theia development is ongoing: <https://github.com/asantra/Theia>
- ◉ Migration of the fastsim code to CMake is done
 - ◉ tested on macOS and CentOS
 - ◉ validating now that the fastsim code does what it used to do earlier
- ◉ To do:
 - ◉ validate the transition from standalone geometry to the GEANT4 one
 - ◉ once this is fine, use all “hits” as clusters when doing reconstruction
 - ◉ integration with AllPix² (or the fastsim equivalent)
 - ◉ this is already progressive based on a side project we’ve done a few months ago
 - ◉ clustering based on the AllPix² output
 - ◉ can use AllPix² alg or our own alg which was discussed in Feb
 - ◉ track reconstruction starting from clusters

Insitu calibration

- ◉ We didn't do anything special yet since we're focusing on the reconstruction itself (i.e. digitisation + track fitting)
- ◉ Cannot say much now beyond that: use the Bremsstrahlung from the IP-chamber's needle in calibration runs: “**e+needle**” and “ **γ +needle**”
 - ◉ e⁻ tracker cannot be used in e⁺needle mode due to the e-beam
 - ◉ either way, the positron (and electron) spectra will be well known
 - ◉ e⁺ tracker can be used to calibrate our magnetic field knowledge
 - ◉ residual misalignment can be resolved from the e⁺ and e⁻ trackers in γ +needle mode (and e⁺ tracker only in e⁺needle mode)