



Beam Telescope 2025 – Repetition of a success story?

Jan Dreyling-Eschweiler, Ingrid Gregor, Hendrik Jansen, Marcel Stanitzki, Yi Liu

11/07/2018, Hamburg, DESY

Contents

01 History and Status of EUDET-type telescopes

- Evolution
- Performance
- Reviews & User needs

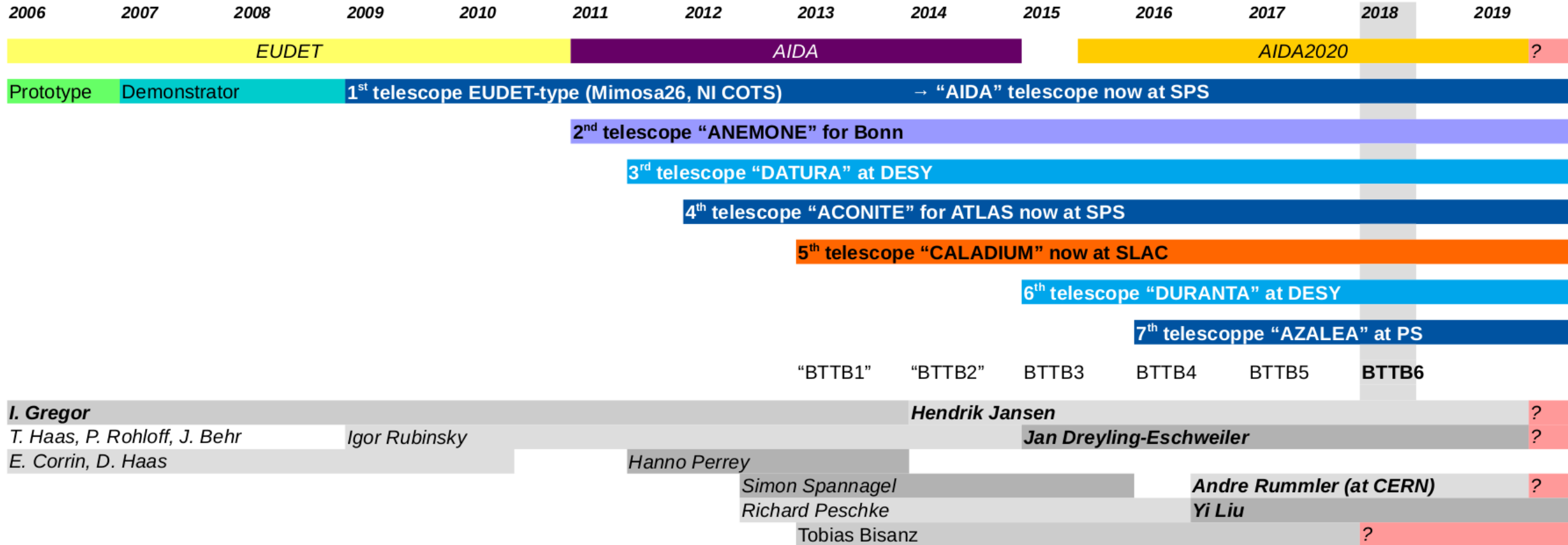
02 Scope of a upgrade / new project

1. Based on Mimosa26 (short-term)
2. Based on existing sensor (mid-term)
3. Based on sensor development (long-term)

03 For discussion: Possible strategies for possible projects

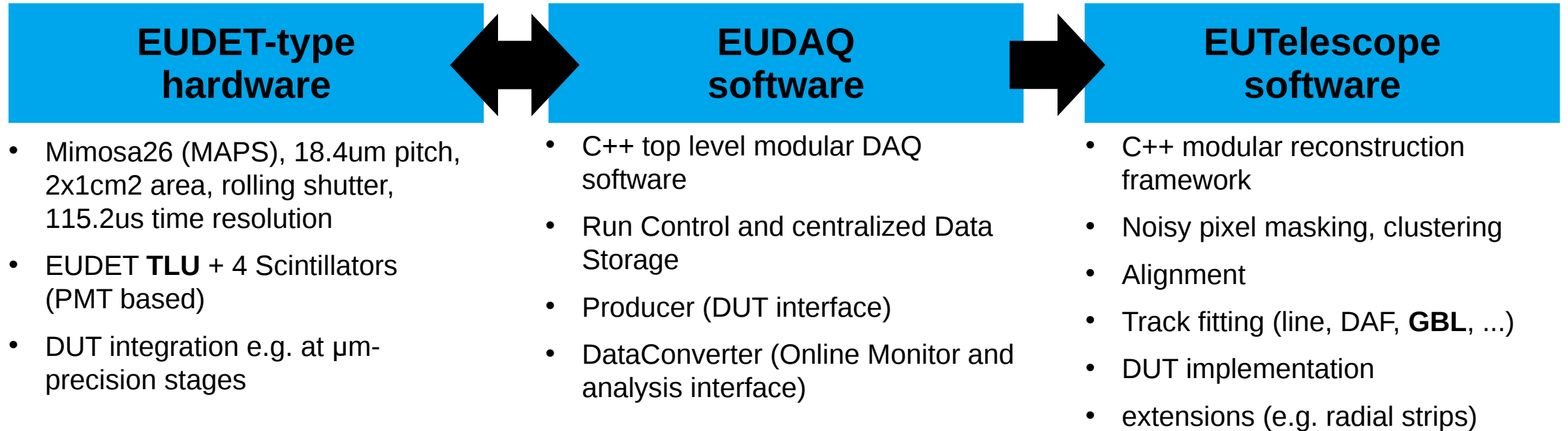
01 Evolution of EUDET-type telescopes

People and devices



01 The common infrastructure package

Hardware – DAQ – Reconstruction



Many and various **user-driven developments and results** over the last decades!

01 Reviews & Limits

Review results

- DESY TB is (nearly) perfect environment
→ but, **higher rates** → multi bunch, R-Weg
- EUDET-type telescopes: “one of very few examples of beam telescopes that are used by many different users from various experiments”
→ **management and support is crucial**
- Mimosa26 telescopes: high spatial resolution (>3.24 μm) and low material budget (50 μm thickness)
→ **Limit:** capability of high track rate and **time resolution** (115.2 μs)
- Sorted out short-term and possible mid- to long-term **actions, see following slides**

Mimosa26

- **11 years running**
- **Life-time and availability** of Mimosa26
→ 10 spares for (5+2) telescopes

**Successful common tool
→ but old technology**

02 Ongoing Upgrades (“based on Mimosa”)

Development & Work Packages

- EUDAQ2 decentralized data taking → done
- EUDAQ reference paper and documentation
→ together with AIDA2020 and WP5
- EUTelescope reference paper and documentation
→ together with Bisanz/Weingarten
- AIDA TLU and EUDAQ2 integration and
EUTelescope upgrades → until end of the year
- Fixed reference timing plane for all telescopes
→ one flexible system (FEI4) available at DESY
- New DAQ board for continuous read out (MMC3)
→ ongoing effort of Bonn
- HW/EUDAQ/EUTelescope maintenance and user

**Ongoing short-term actions
→ no decision needed here**

02 New telescope based on existing sensor

Possible mid-term actions
→ decision needed

Candidates

- **ALPIDE** → ready (for ALICE upgrade)
 - Noiseless, global shutter
 - Faster/full frame RO time 5-10us (factor 10-20 better)
 - Larger area: 3cm x 1.38cm
 - **Less resolution** (5um instead of 3.24um)
 - **Availability: > 2000** sensors not for ALICE detector)
- Clic sensor: faster RO less occupancy → first prototype end of this year
- Other...

Possible Scenario

- No time constraint from sensor development
→ 1-3 year project
- Use existing infrastructure (e.g. AIDA TLU EUDAQ)
- ***Build one telescope plus testing (all) other ideas on improvements***
 - *Compact sensor plane: Reducing material, cooling, and cabling*
 - *New Trigger devices (SiPM)*
 - *Motor-displacable plane configuration along Z*
 - *Mechanics: Robot arm for downstream planes*
 - *Online Tracking: SW or even HW based*
 - *Track Reconstruction by Machine Learning*
 - *More... ?*

02 Based on new sensor development

Wishes: faster, but same granularity

- Low Material Budget (50 um)
- Low noise, high efficiency (>99 %)
- Global Shutter and data-driven read out
- Fine time resolution for hits
- High rate capability
- High resolution (<3.2 um)
- Active area?
- New thin, high-res technologies: ELAD, ... ?
- All user needs accomplishable in one device?
Tracking, Calo, Timing, ...

Possible scenarios

- Stand-alone development of dedicated chip
→ Time scale 3-6 years?
- + improvements from previous slide

**Possible long-term action
→ decision needed**

03 For discussion: Motivations and strategies

Compliance with DESY strategy:

- Coverage: Education, Development & Integration, User Support
- Hub for community: BTTB and AIDA2020
- “One Lab strategy”:
Tool for Plasma Acc. Test Beam? ...

Possible strategies

- only FH orientated / wo FS, ZE, ... expertise
- All DESY involved, complete in-house
- (international) JRA collaboration

Funding

- Base budget from DESY
- Additional resources
 - ITT support for Tomography → Hendrik
 - (Personal) Grant for this project?
 - other? EU Project ATTRACT, ...

Manpower

- ATLAS provide 1 Postdoc (Yi) and 1 PhD (Surabhi)
- Hamburg University (BC/Master students)?
- ...

What want/can we do at DESY?

Backup

Reviews

Reviews & Future Meetings

- Oct. 2017: Future Opportunities for DESY Test Beam → **DESY TB user community**
- Dec. 2017: DESY Tele/TB Strategy meeting → DESY personal (internal)
- Jan. 2018: BTTB 'JRA Beam Telescope 2025'-Forum → **international community**
- Feb. 2018: POF → Test Beam one of 2 HEP on site experiments → **FH community**
- May 2018: DESY-ATLAS contribution and motivation (internal)
- July 2018: Pre-Kick off (internal)