AG DI2I
24-26 June 2024, IJClab
https://indico.in2p3.fr/event/32549

Summary of first DRD3 week (17-21 June)

excluding interconnection (see Giovanni's talk)

https://indico.cern.ch/event/1402825

Jerome Baudot
(WP1 co-convenor)

- Collaboration structure
- Summary by Working Groups

The DRD3 collaboration

- Approved by DRDc on 5th June 2024
- **143 institution, 600+ collaborators**
- Common funds mechanism

- **2 Workshops per year**
  - 2024: June @ CERN, ~November (Athens/CERN?)
  - 2025: June @ Amsterdam?, Fall @ CERN?

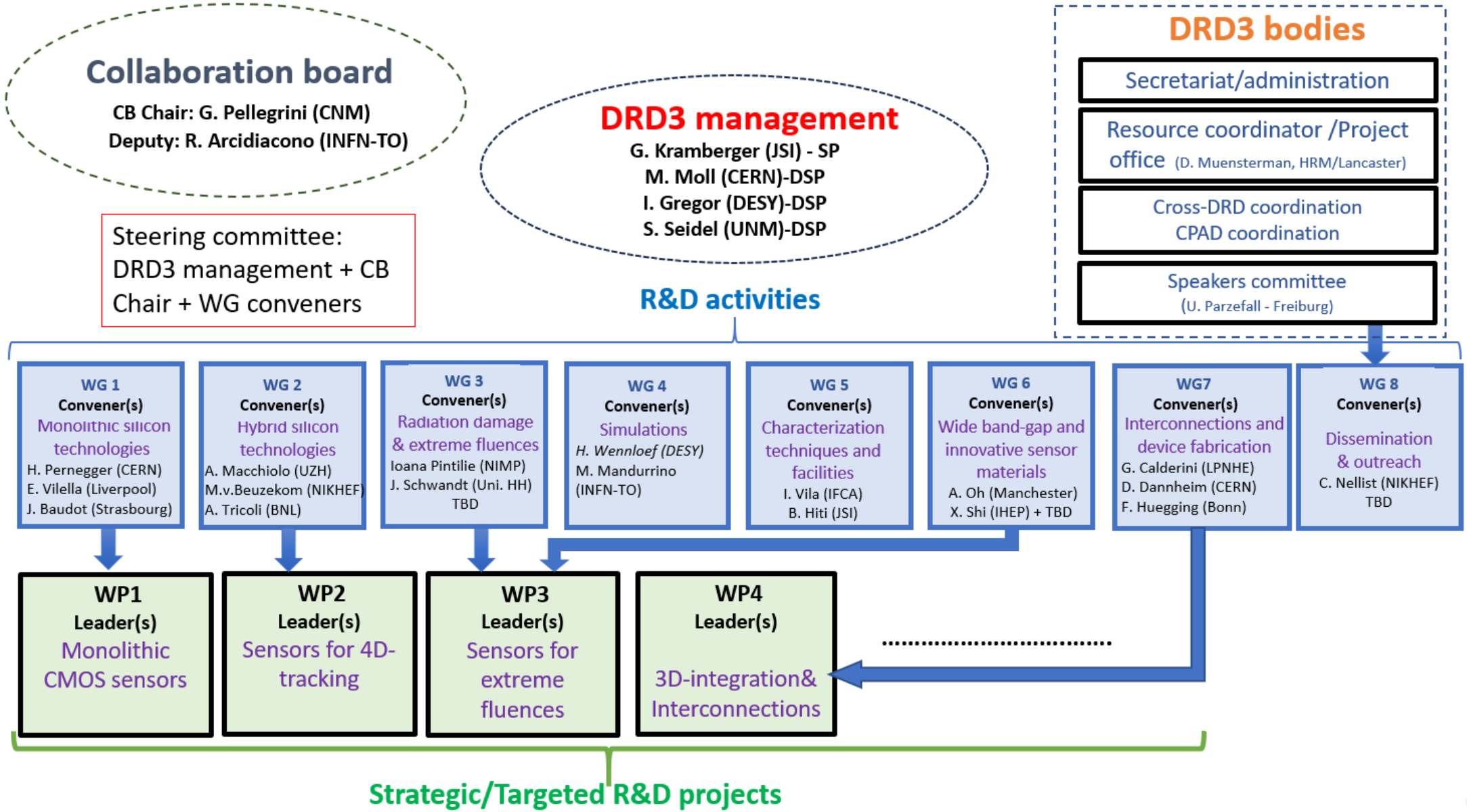
Working Groups (WG) vs Working Packages (WP)

- **WG: activities without review from DRD3 management & DRDc**
  - No constraint
  - Report to DRD3 workshops whenever they like
  - Can apply to common funds

- **WP: strategic activities reviewed by DRD3 management & DRDc**
  - Match recognised ECFA R&D goals associated with a timeline
  - International-size team with resources matching goals
  - Milestones and resources written in MOU to be signed by funding agencies

- **1st DRD week: 17-21 June**
  - 79 talks
  - 268 registrants
  - About 100 in person
  - Sessions by WGs

Structure of the activities



WG1/WP1: CMOS-MAPS

Reports on scientific results <= WG1

- **Experiments**:
  - (ALICE), Belle II, CBM, Super Tau-Charm Facility, Space-radiations
- **R&D**:
  - radiation tolerance (2 ranges: </>10^{16} n_{eq}/cm^2), intrinsic amplification (LGAD), timing (few 10s ps)
  - module concepts (FCCee, BelleII)
- **Technologies**: Tower 180 nm, LF 150 nm, TPSCo 65 nm, SMIC 55 nm(China)
  - Absent: LF 110 nm (INFN), IHP 130 nm (Genève)
- **Groups**: IPHC, PSI, CERN (for DRD7 & techno access)
  - Present but not speaking: US & Japanese partners

Projects <= WP1

- **TPSCo 65 nm**: vertexing FCCee, versatile tracking (HL-LHC/EIC/FCCee) => *2 consortiums by strong synergies*
  - Only projects really addressing sensor architectures
- **Intrinsic amplification / Timing**: LF 150 nm, Tower 180/65 nm => *2 approaches, might merge later*
- **Radiation tolerance LF 150 nm**: MAPS, CMOS-based strip sensors

- Timeline: established proposals by September

Detailed of MAPS project in France

- Access to Tower 180 nm / TPSCo 65 nm techno => Frederic Morel (IPHC-C4i)

- ALICE => Antonin Maire (IPHC)
- Belle II => Marlon Barbero (CPPM), Jerome Baudot (IPHC)
- CBM => Auguste Besson (IPHC)
- FCCee => Ziad El Bitar (IPHC), Didier Contardo (IP2I)), Marlon Barbero (CPPM), Giovanni Calderini (LPNHE), Philippe Schwenling (IRFU)

- Vertexing for FCCee => Auguste Besson, Ziad El Bitar (IPHC), Marco Bomben (APC)
- Tracking => Jerome Baudot (IPHC), Marlon Barbero (CPPM), Didier Contardo (IP2I), Giovanni Calderini (LPNHE), Stefano Panebianco (IRFU)
- Timing => Philippe Schwenling (IRFU), Didier Contardo (IP2I)
- Intrinsic Amplification => Andrei Dorokhov (IPHC), Marlon Barbero (CPPM), Dicier Contardo (IP2I), Philippe Schwenling (IRFU)

WG2/WP2: hybrid silicon sensors

- Main focus: **3D & LGAD sensors for**
  - Replacement of pixel layers for ATLAS/CMS with pitch 50x50 or 25x100 μm^2
  - LHCb(Velo)/CMS/ATLAS timing layers 30-50 ps, sometimes with $5x10^{15}$ n_{eq}/cm^2
  - ToF for ALICE 3/BelleII/EIC/FCCee: large area <30 ps

- 14 scientific reports / 10 projects
  - All focus on 3D or LGAD (various flavours)
  - Proponents from: Austria, CERN, Germany, Italy, Montenegro, Netherlands, Poland, Switzerland, UK, China, Japan, USA

- ASIC for timing sensors are critical
  - Existing: ALTIROC, ETROC
  - In preparation:
    - Ignite and PicoPix, focused on LHCb VELO upgrade in 28 nm CMOS
    - EICROC for ePIC detector at EIC in 130 nm CMOS
    - Fermilab's FCFD for 4D trackers in 65 nm CMOS

- Not strongly structured
  - Not yet WP oriented

WG3/WP3: Extreme fluence and rad damage

- Research goals
  - Improve model & characterization for radiation damages: silicon & wide band-gap materials
  - Target the range: 10^{16} to 10^{18} n^{eq}/cm^2
- Single project-WP (my understanding)
  - Deliverables and milestones include: enriched Si-sensors, (enriched) Si-LGAD, GaN devices (timing)
- Scientific reports
  - Microscopic studies on defects in Si and wide band-gap materials
  - Detailed studies on irradiation of CMS-HGCAL Si sensor
  - Studies of enriched Si and enriched SiC
  - Studies with TCAD

WG6/WP3: non-silicon materials

- **3 materials:** Diamond, SiC, GaN
  - Goal: **higher radiation tolerance & timing**

Other "stuff": amorphous Si (Italy, Swiz) , CiGS (Japan)

Scientific reports

- LGAD made out of SiC, 3 consortia: Austria, CERN, Italy, Netherlands, Spain / USA / CERN, China, Netherlands, UK
  - Developments & simulations
- Diamonds from consortium around LPSC, Marie-Laure Gallin-Martel and for 3D sensor (Italy, UK, USA)
  - Techno R&D + applications (LPSC)
- GaN devices in Canada
  - Low TRL R&D

No new project building up ?

- In Fall

=> Plan 2-3 meetings between DRD3 workshops

WG4: Simulations

- *Not a work-package group but strong-coupling with other WGs*

- TOOLS
  - TCAD: discussed for non-silicon material and MAPS
  - New Chinese sw RASER focused on SiC
  - Allpix^2 : generic presentation
  - Garfield++: generic presentation
  - Light-tools for radiation effect useful at experiment level (LHC)
  - Toward front-end simulation (Timepix)
    - Potential connection with DRD7

Marco Bomben

=> Intend to have a 1st WG4 General Meeting on mid to late July

WG5: Characterization techniques & Facilities

- *Not a work-package group but strong-coupling with other WGs*

Techniques

- CARIBOU: "universal" or common board strongly promoted => only for MAPS??
- Laser based characterization: Two Photon Analysis developments (UK, Spain)
- Introduction of timing layer (LGAD-based) in AIDA-type telescope (FNAL, Spain)

Facilities

- Recent test-beam facility at KEK, Japan: electron few GeV
- Review of many facilities with various beams over the world: https://indi.to/6ZD8q 🇫🇷 Ziad El Bitar
  - List of contacts

Topical schools/workshops

- Pilot one: TCT (transient Current Technique)

Conclusion

- **Intense week: talks & networking**
- **Different working style over WGs**
- **An excellent forum & project opportunities**
- **Clear expertise identified in France** (MAPS, simulation, Diamon, Interconnection)