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Volunteer
computing
for the LHC



LHC@home and the Impact of BOINC on Science

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BOINC Workshop, CERN IdeaSquare, 29 May 2024

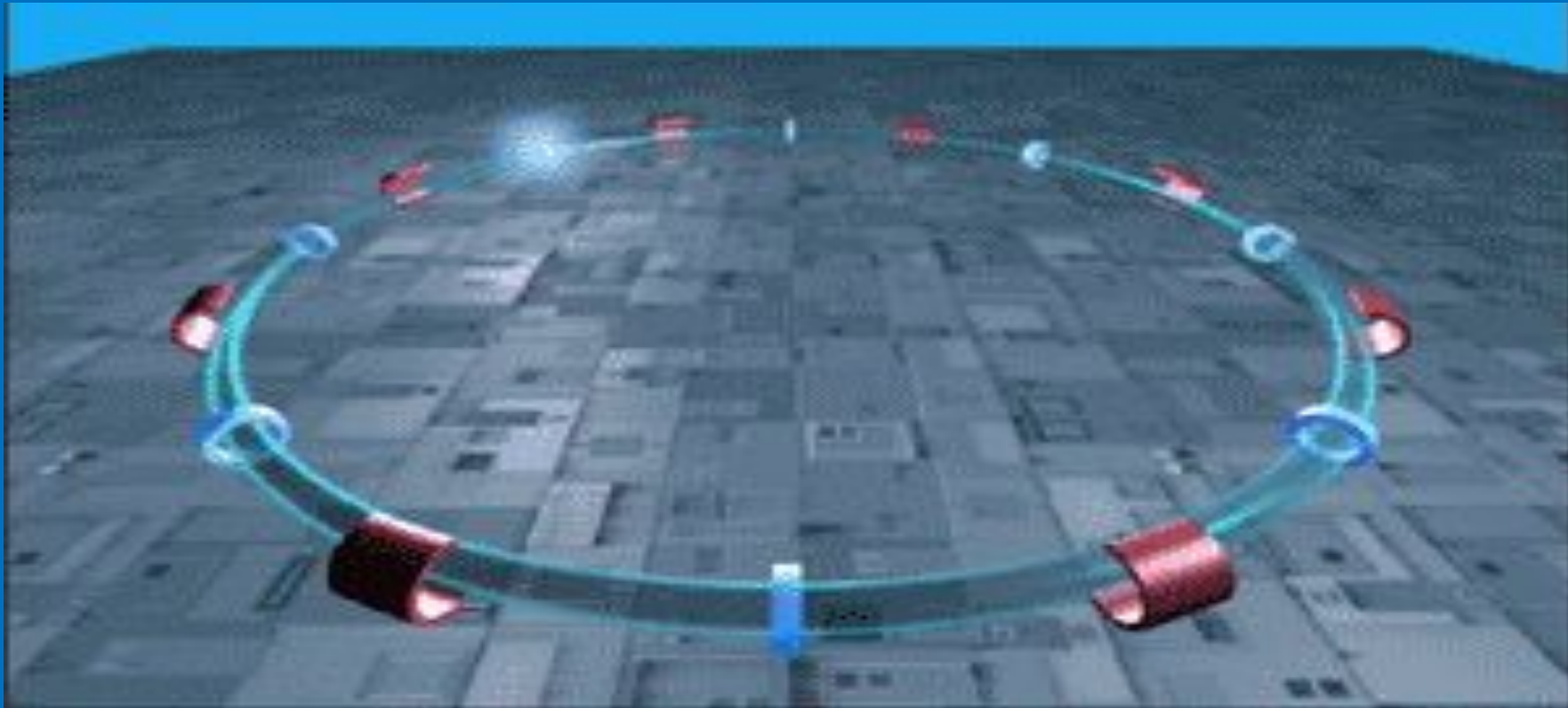


Overview

1. How LHC@home started - and what it inspired (Francois)
2. Status of LHC@home today - still going strong (Laurence)
3. Impact of BOINC on Science - publication metrics (Alex)
4. Impact of the BOINC workshop at ITU this week (Polina)
5. What to expect this afternoon (Francois)

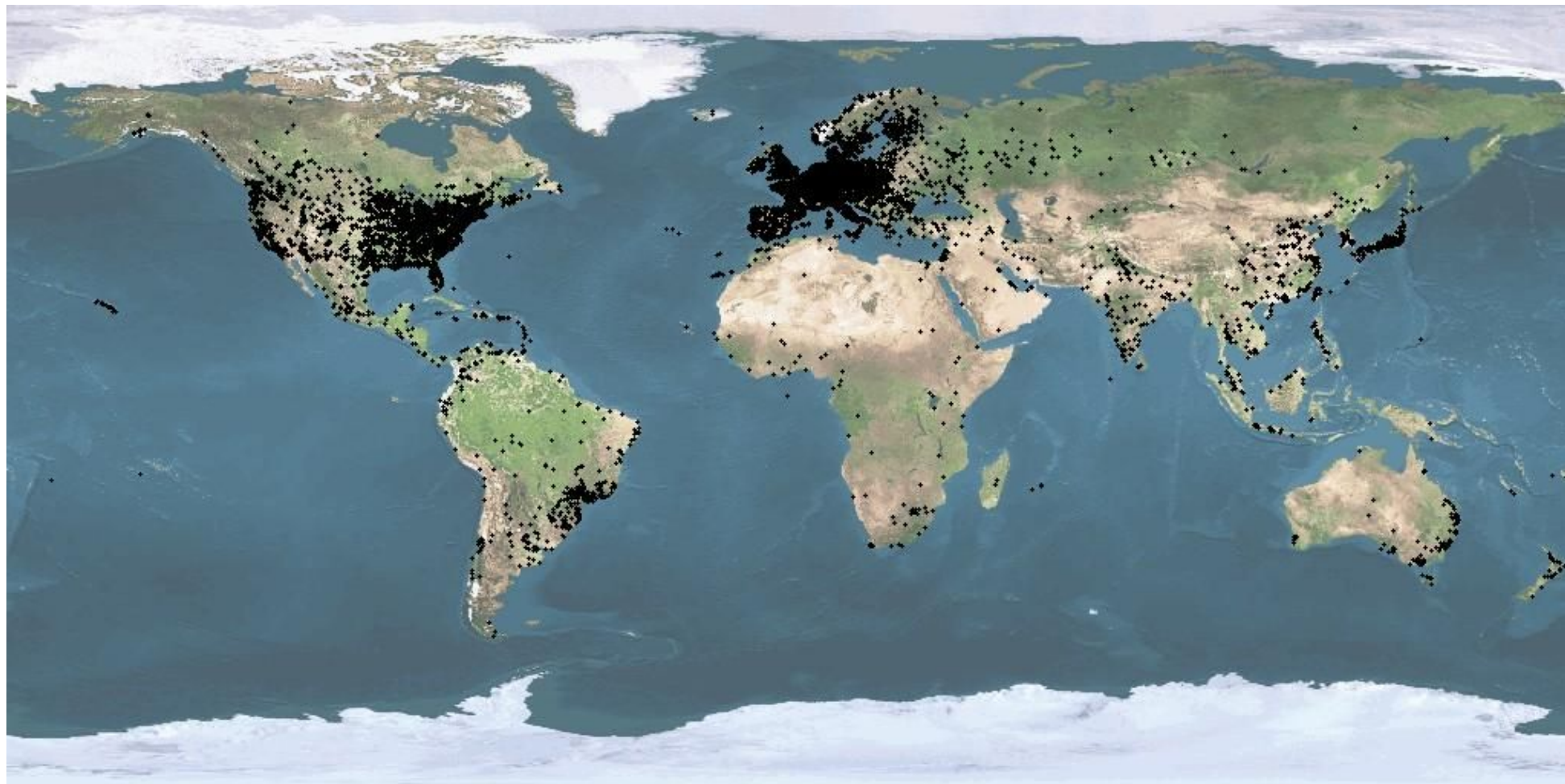
2003: LHC@home project initiated

Volunteer computing project launched 2004





2005-2015 : MalariaControl.net



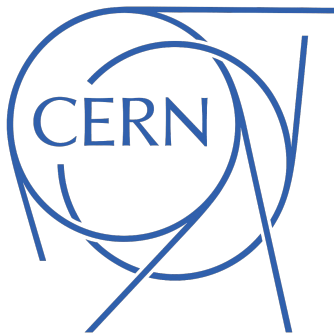


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unitar

United Nations Institute for Training and Research



For crowdsourcing to achieve its full potential, governments will need to support projects that promote public participation in measuring progress towards the SDGs. National statistics offices must develop best practices for integrating crowdsourced data.

“SDG indicators need crowdsourcing”
N. Seth and Y. Flückiger, Nature, 23 March 2016
(<https://www.nature.com/articles/531448c>)

Institutional Outreach

- Africa@home
- Asia@home
- Brazil@home
- India@home

Examples of Spin-Off

- Asia@home
 - ◆ Quake-Catcher Taiwan (2009)
 - ◆ CAS@home (2010-15)
 - ◆ Computing for Clean Water (2010-15)
 - ◆ Mozilla Hackfest (2011)

Youth Outreach

- CERN Webfest (2012-23)
- Science Hack Day (2013-14)
- Open17 Challenge (2015-23)
- Open Geneva Festival (2017-24)
- SDG Summer School (2016-24)
- Geneva Trialogue (2016-24)
- SDG Olympiad (2024)

- Citizen Cyberlab (2009-19)
 - ◆ Partnership with UNITAR
 - ◆ EU Citizen Cyberlab Project (2012-2015)
- Citizen Cyberscience Summit (2010-14)
 - ◆ ECSA Conferences (2016-24)
 - ◆ EU Crowd4SDG Project (2020-2023)

- Geneva Tsinghua Initiative (2016-23)
 - ◆ Geneva Trialogue (2016-24)
 - ◆ SDG Internship Program (2018-24)
- Citizen Science Global Partnership (2022-24)
 - ◆ CSGP Geneva Hub with Citizen Science Zurich
 - ◆ EU Albatross Project (2024-27)

A Student Innovation Hub in the Heart of International Geneva

Palace of Nations (UN)

International Telecom. Union (ITU)

UN High Commission For Refugees (UNHCR)

SDG Solution Space

World Trade Organization (WTO)

World Meteorological Organization (WMO)

Campus Biotech





20 Years of LHC@home



<https://cern70.cern>

- Innovation to stable solution
 - Impact of ideas
- Continuous improvement
 - Further innovation
- Sustainability
 - Self-driven continuity

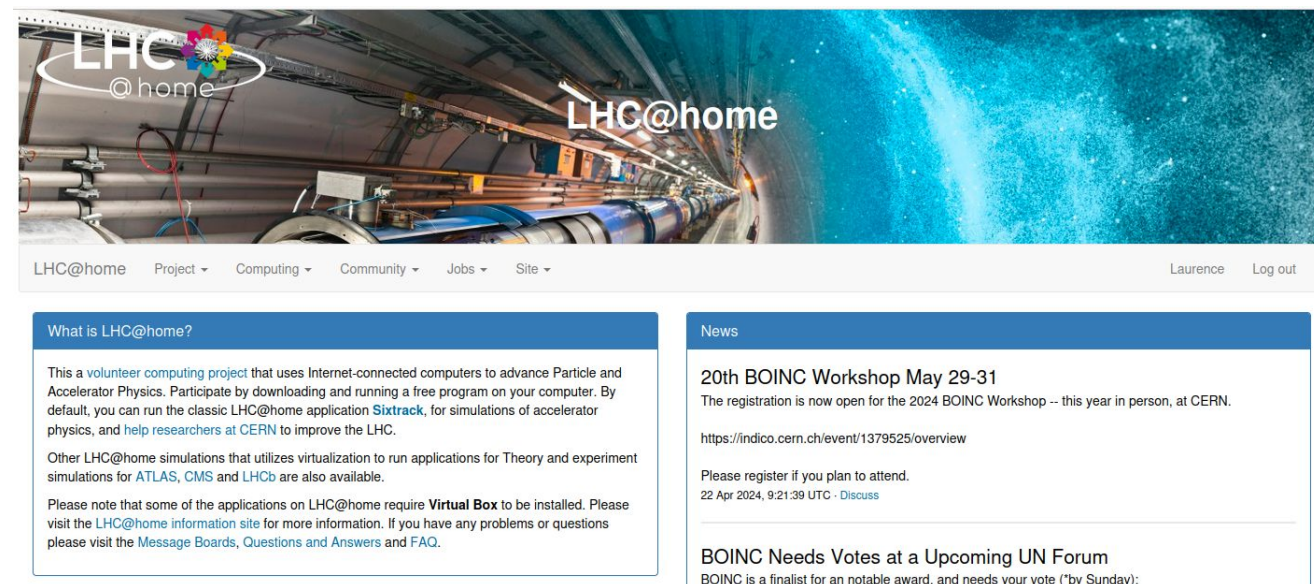
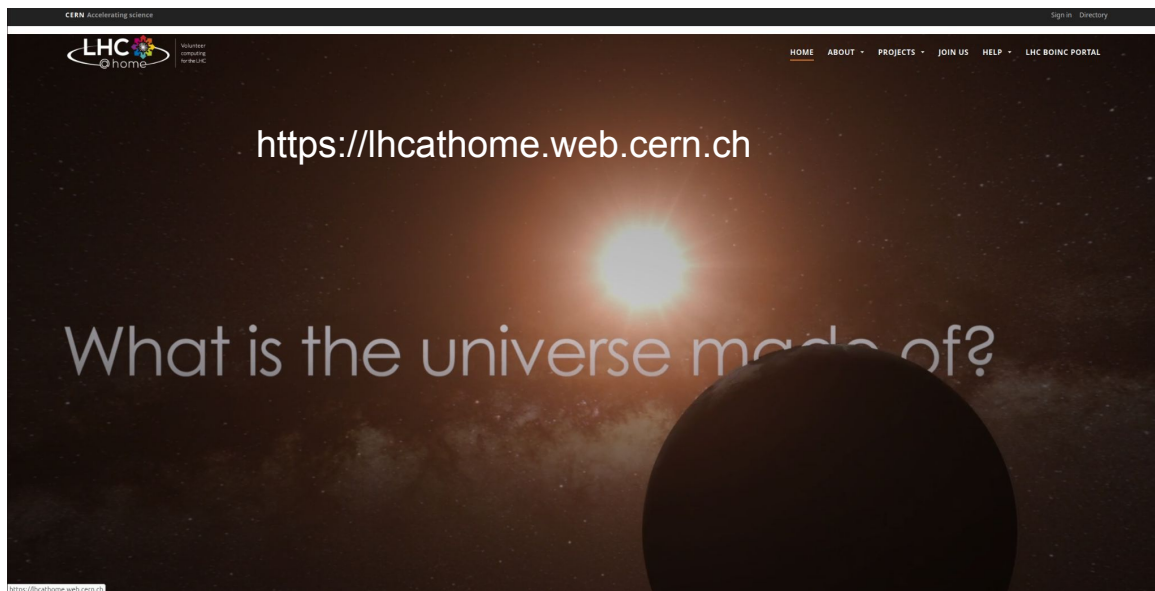


Some History

- 2003: CERN Physics Screensaver (CPSS)
 - Running SixTrack on Windows Desktops
- 2004: LHC@home on BOINC started
 - 50th anniversary of CERN
 - Sixtrack application
- 2011: Test4Theory as a new BOINC project
 - Pioneered the use of virtualization
 - CernVM on volunteer desktops
- 2014/15: ATLAS@home and CMS@home
 - CernVM and CernVMFS, in-house innovations
- 2016: Consolidation of LHC@home to a single project
 - Outreach and improved website
- 2018: Record CPU capacity due to BOINC Pentathlon



LHC@home Today



What is LHC@home?

This is a [volunteer computing project](#) that uses Internet-connected computers to advance Particle and Accelerator Physics. Participate by downloading and running a free program on your computer. By default, you can run the classic LHC@home application **Sixtrack**, for simulations of accelerator physics, and [help researchers at CERN](#) to improve the LHC.

Other LHC@home simulations that utilizes virtualization to run applications for Theory and experiment simulations for **ATLAS**, **CMS** and **LHCb** are also available.

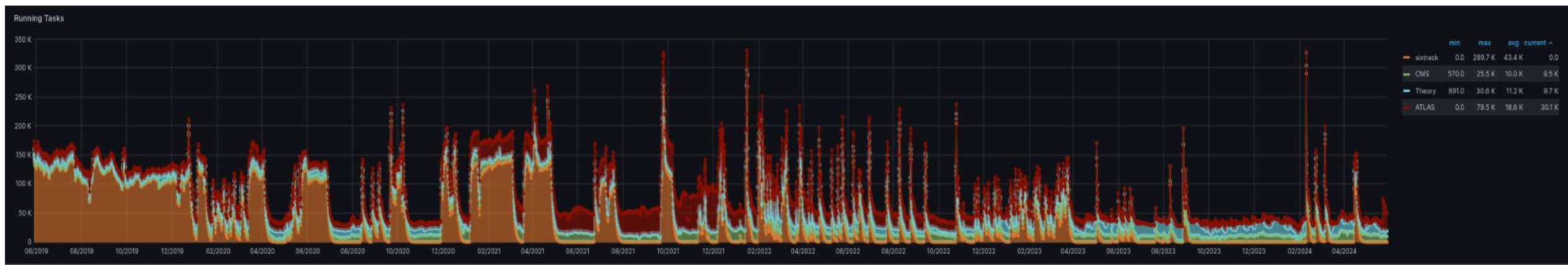
Please note that some of the applications on LHC@home require **Virtual Box** to be installed. Please visit the [LHC@home information site](#) for more information. If you have any problems or questions please visit the [Message Boards](#), [Questions and Answers](#) and [FAQ](#).

News

20th BOINC Workshop May 29-31
The registration is now open for the 2024 BOINC Workshop -- this year in person, at CERN.
<https://indico.cern.ch/event/1379525/overview>

Please register if you plan to attend.
22 Apr 2024, 9:21:39 UTC - [Discuss](#)

BOINC Needs Votes at a Upcoming UN Forum
BOINC is a finalist for an notable award, and needs your vote (*by Sunday):





The Service

- BOINC Server version 1.4.2
- Redhat Enterprise Linux 9
 - Just upgraded from CentOS 7
- ~20 large VMs running in OpenStack
 - Data Centre Infrastructure/Hardware
- Production and QA environment
 - lhathomedev
- Dedicated services
- Custom services
 - Volunteer Computing Credential Service (VCCS)
 - DataBridge
- Application Infrastructure
 - CVMFS servers, MCPlots, ...



Ongoing Activities

- Keeping the service running
- Community Participation
 - Transition BOINC to Open Source
 - BOINC Software
 - Server Releases (and testing)
 - GDPR
 - Further Innovations
 - Prototype Web-based Manager
 - Containers
 - Projects Calls
 - Sharing experiences
 - BOINC Workshops
- Volunteer engagement



The Future: XTrack

- SixTrack
 - Beam simulations of the stability of proton orbits in the LHC accelerator (and FCC)
- Xtrack
 - Workloads already moved
 - Less Sixtrack jobs for BOINC
 - Native pre-compiled, stand-alone executable
 - CPU and GPU
 - LHC and FCC studies
- More details in a dedicated [presentation](#)
 - 2023 BOINC Workshop - Day 02

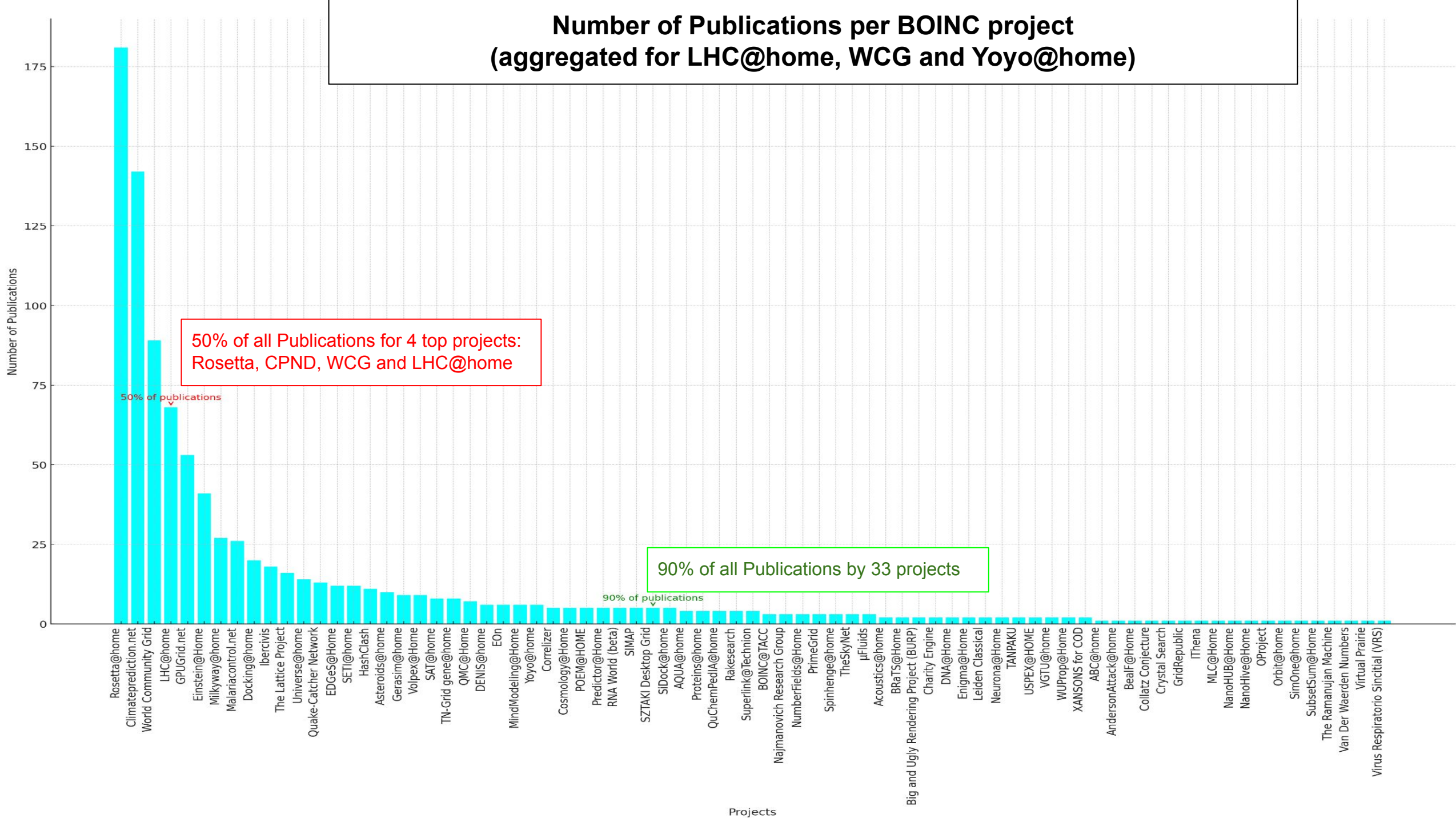
<https://www.youtube.com/watch?v=3QLk6y2WNGs>



BOINC publication methodology

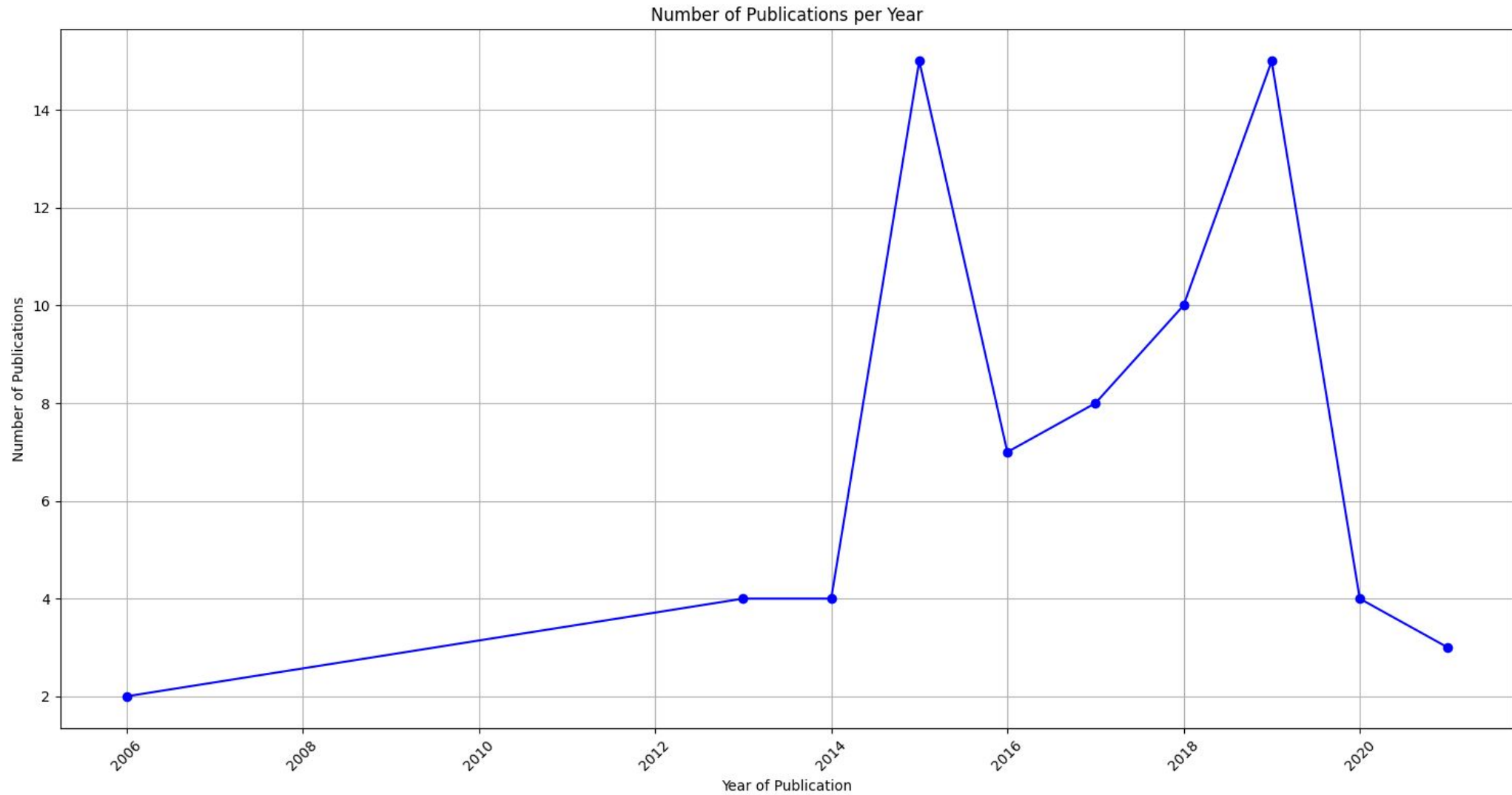
- began updating BOINC's own MediaWiki page by gathering publications from project websites, internet searches and other existing lists (Boinc.Italy, Rechenkraft.net etc.)
- the list became impressive enough to warrant its own php page - boinc.berkeley.edu/pubs.php
- Zotero research assistant software is used to organize publications and export files that are uploaded to BOINC GitHub and then used to generate pubs.php
- criteria to be included on the pubs page solidified to list papers containing scientific results arising, directly or indirectly, from BOINC-based computing.
- publications are confirmed manually by myself and by the projects where possible.

Number of Publications per BOINC project (aggregated for LHC@home, WCG and Yoyo@home)





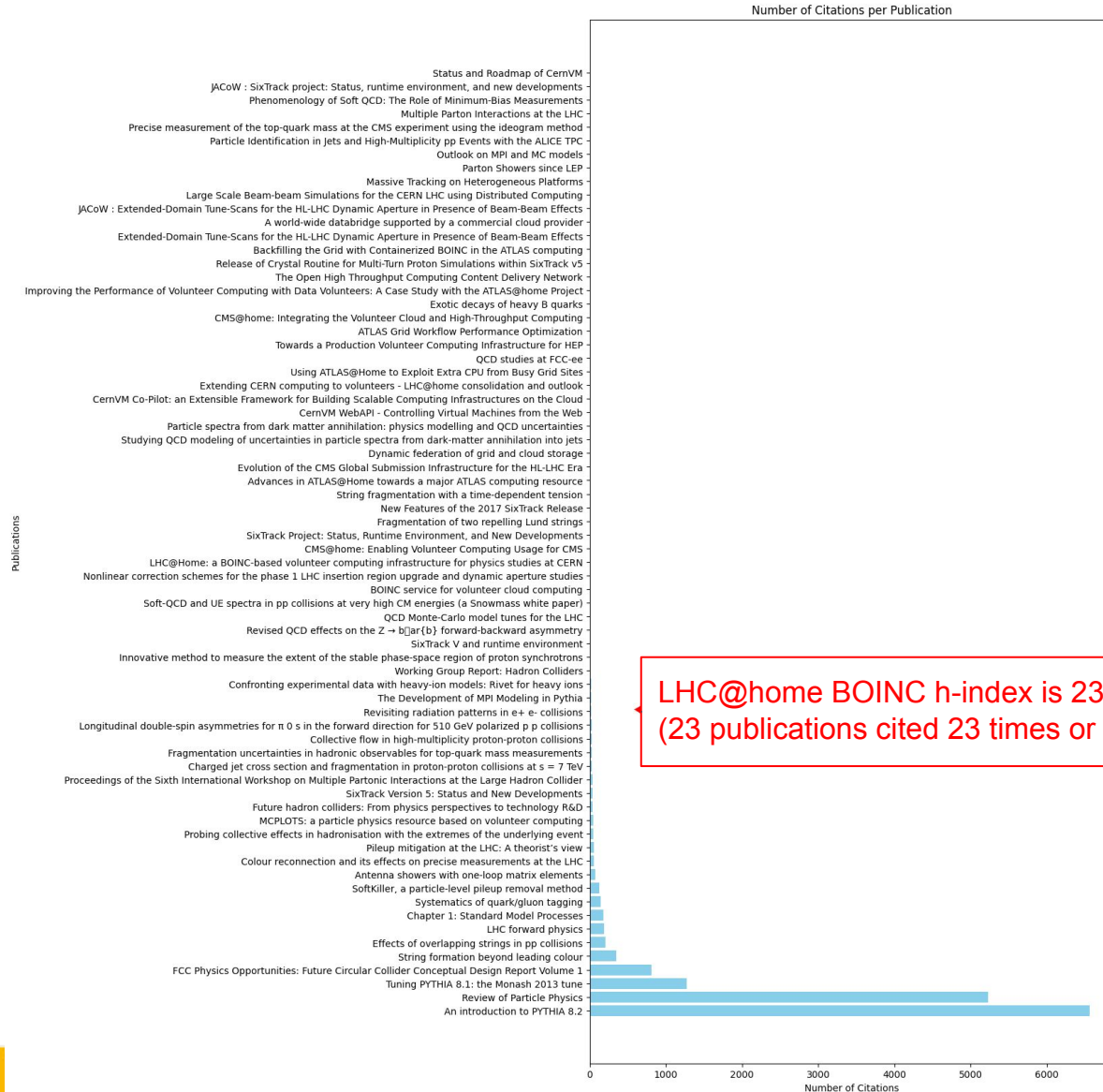
LHC@home publications per year





LHC@home citations per publication

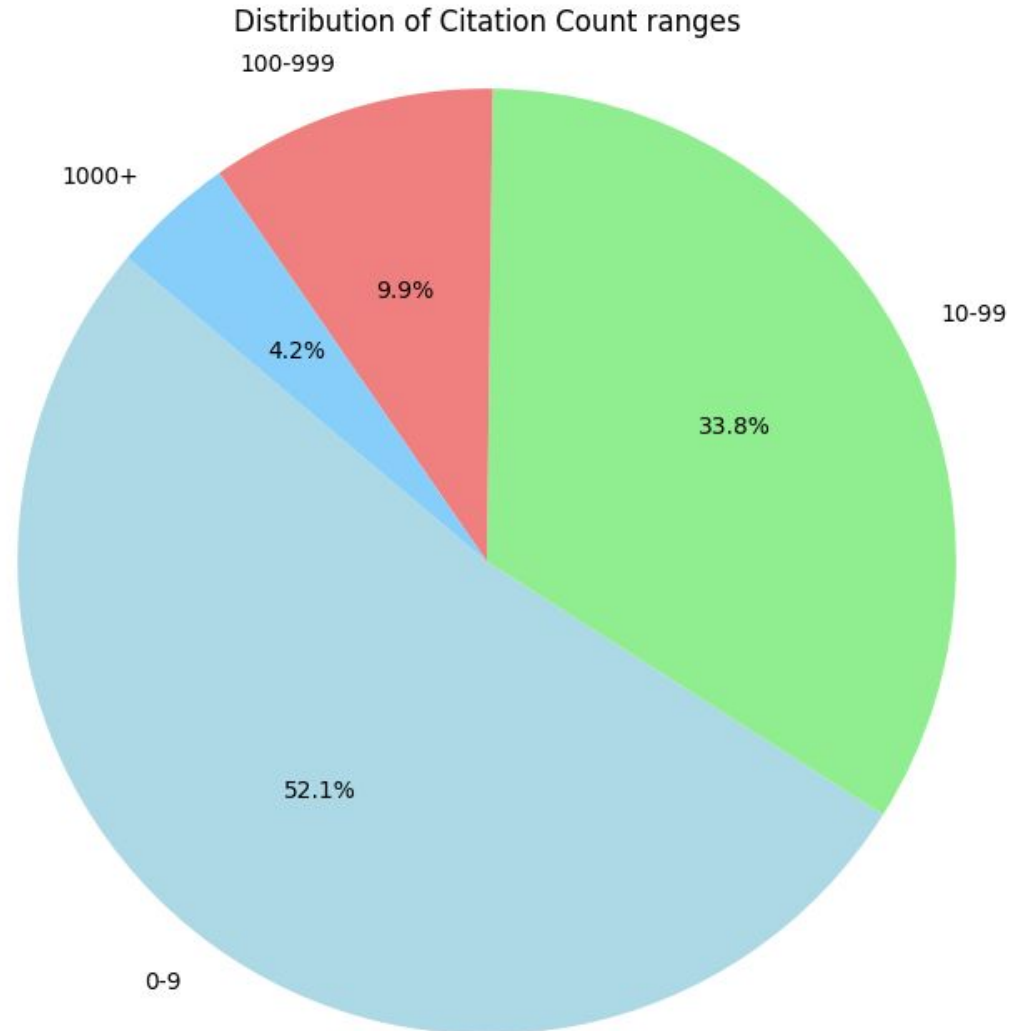
Total Publications: 70
Total Citations: 15,592



LHC@home BOINC h-index is 23.
(23 publications cited 23 times or more)



LHC@home citation count distribution



- What other metrics should we extract from the broader data set?
 - ◆ e.g. national, regional distribution of author institutions (per project and global)

BOINC workshop events at ITU

- **WSIS Prizes:** submission within Action Line 7 - E-science
- **Open Panel:** Volunteer computing for climate science, sustainable development and human health
- **Geneva Trialogue:** table on volunteer computing for AI

Related activities:

- Space and Global Health Hackathon
- Preparation of the report on the results of the Panel



WSIS+20 FORUM
HIGH-LEVEL EVENT

27-31 May 2024
Geneva, Switzerland

WSIS Prize


→ WSIS Prizes: Champions Prize for Action Line 7 - E-science



Session 478

 Thursday, 30 May 2024

 14:00–15:30 (UTC+02:00)

 Physical (on-site) participation only

 ICT Discovery, ITU Montbrillant Building

 WSIS Prizes

A prize-winner from last year



NEWS

Seed Studio Wins “WSIS Prize 2023 Champion” Certificate for Using AIoT for Environment at UN ITU: Global Recognition of IoT2Wild Contest!

By Ye Seong SHIN 1 year ago

On March 15th, Seed Studio was awarded “WSIS Prize 2023 Champion” prize certificate at the UN ITU, in Geneva, Switzerland. It’s a UN-level of recognition for the success of IoT2Wild Contest 2022 and the usage of ICTs for environment, which was awarded at ITU’s 14th World Summit on the Information Society (WSIS) Forum 2023.

ITU WSIS Panel on BOINC

- “Volunteer computing for climate science, sustainable development and human health”
- Summarize main outcomes of the Workshop

Panelists:



Prof. David Wallom
Associate Director
Oxford e-Research Centre



Prof. Ana-Lucia Varbanescu
Associate Professor
The University of Twente



Dr. Ben Segal
CERN Alumnus and Internet
Hall of Fame, Switzerland

Session 215

📅 Friday, 31 May 2024

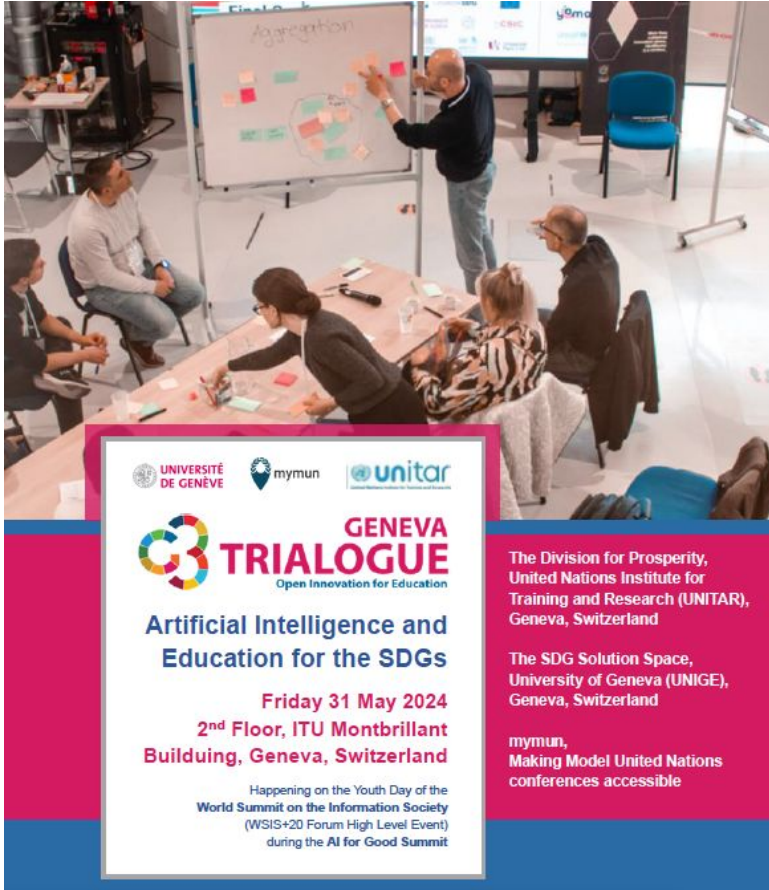
🕒 11:00–11:45 (UTC+02:00)

📍 Physical (on-site) participation only

📍 SDG Stage, ITU Montbrillant Building

⚙️ Interactive Session

Geneva Trialogue



CO-CREATION TABLES

1) **Creating a youth-powered global computing resource for sustainable AI**

Sharada Mohanty, AICrowd

2) **Accelerating Serendipitous Collaborations for Youth Conferences using AI**

Lee Howell, Villars Institute

3) **Healing the Post-MUN Syndrome at Scale with AI and Online Learning**

Prajeeth Sitherasanen, Swiss Learning Exchange (SLX)

4) **Enabling the Use of Open Humanitarian Data for MUNs thanks to AI**

Javier Teran Castro, Humanitarian Data Exchange (HDX)

....(8 more Co-creation tables)



What to expect this afternoon

Ana Varbanescu	Energy consumption and carbon footprint of volunteer vs data center computing
Bastien Chopard	New opportunities for BOINC in the field of scientific simulations
Sharada Mohanty	New strategies for combining volunteer computing and BOINC
Clemens Gregor	Open source software projects in high-energy physics: some lessons learned
Levi Rybalov	Incentives for distributed computing: new concepts and methodologies
Violet Su	Beyond Computing: new trends in networked sensors



What to expect this afternoon

Breakout Sessions:

1. BOINC and new science applications
2. BOINC for reducing carbon footprint of distributed computing
3. BOINC and new open-source management methods
4. BOINC and large-scale computing for AI
5. Promoting BOINC on new platforms
6. Promoting BOINC as national Cyber Infrastructure