Web Platform for Sharing Modeling Software in the Field of Nonlinear Optics[1]

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[1] The work was supported by RFBR 15-07-09309

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Web platform underlying concept

The main goal is to develop a web platform where researchers with the same area of expertise can share their modeling software between each other (research hub).

Software as a service (SaaS): in contrast to the open source paradigm we focus on sharing of already installed and working programs not the program code.

Web access: for regular operations a platform user should have only web-browser.

Web platform community model

- Developer

  the one who provides a new program, installs it

- Web platform administrator

  the one who checks the provided software and makes the program available to regular users

- Regular user

  the one who wants to use installed program

Web platform

an entity that makes them all cooperate

HUBzero middleware

In our installation of the web platform for nonlinear optics we use HUBzero® middleware.
HUBzero is open source solution for creating dynamic web sites for scientific research and education.

In HUBzero terms every modeling or calculating program to be shared via the platform is called **a tool**.
The concept of a tool also includes:

- some properties (tool name and description, license info, access rights, etc)
- a workflow that determines tool lifecycle

Tool lifecycle

- registration
- testing
- installation
- publishing
- updating
- retirement

HUBzero modules

- tool lifecycle management module
- tools catalog with search engine
- tool launching module

- authentication and authorization module
- logging module
- repository of the software codes
- module for review and blog posting
- module for assigning rating marks

HUBzero key technologies

- Base technologies:
  - Subversion - software versioning and revision control system
  - MySQL - database management system
  - OpenVZ - operating system-level virtualization technology
- Technologies are used to make GUI of a tool work properly in the user's browser:
  - VNC (Virtual Network Computing)
  - WebDAV (Web Distributed Authoring and Versioning)
  - WebSocket
- The Rappture toolkit - quick on-the-fly creation of the GUI for Linux

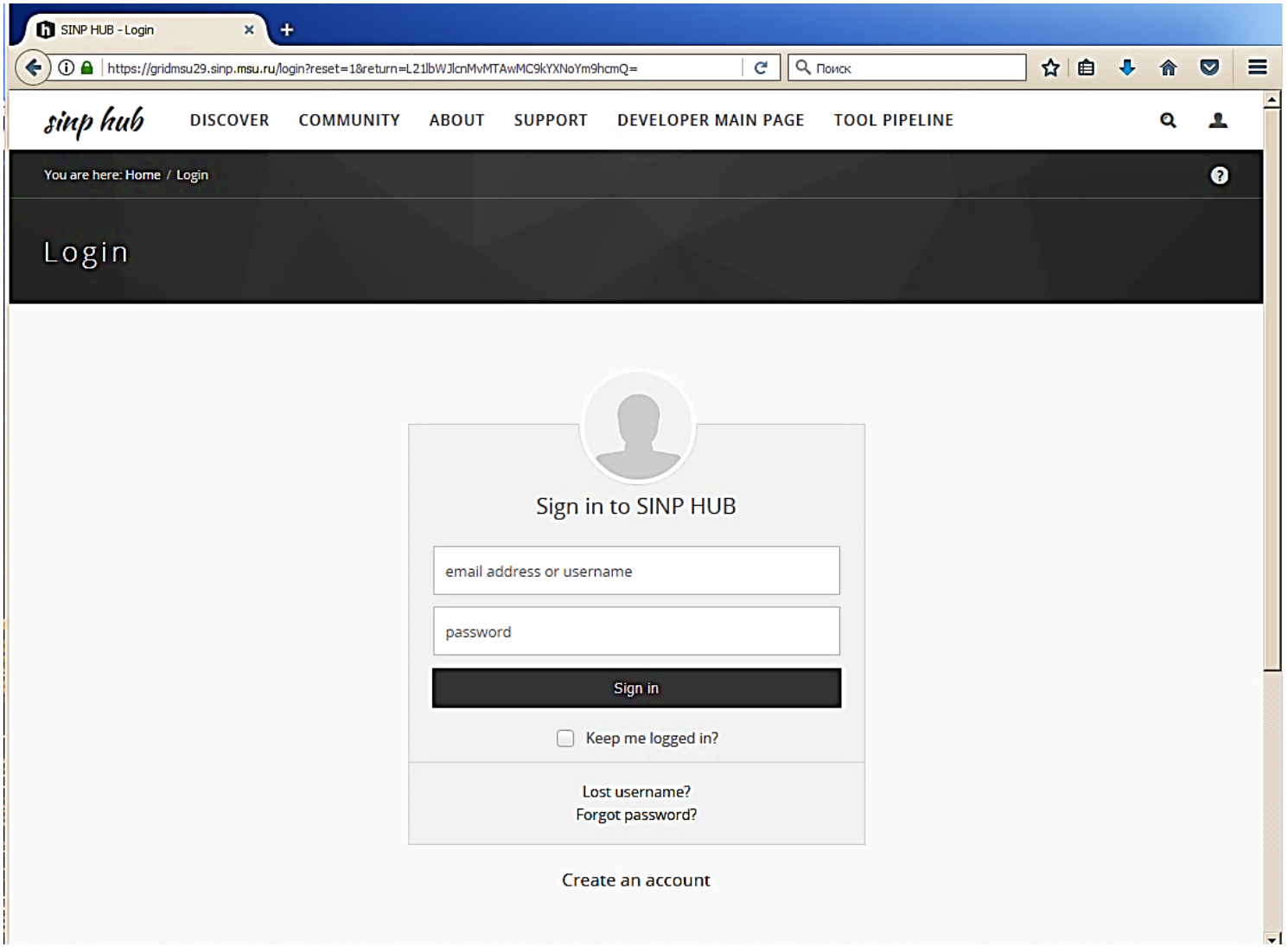
Our prototype of the web platform for nonlinear optics

Nonlinear optics is a rapidly evolving area of modern physical research and engineering with many important applications.

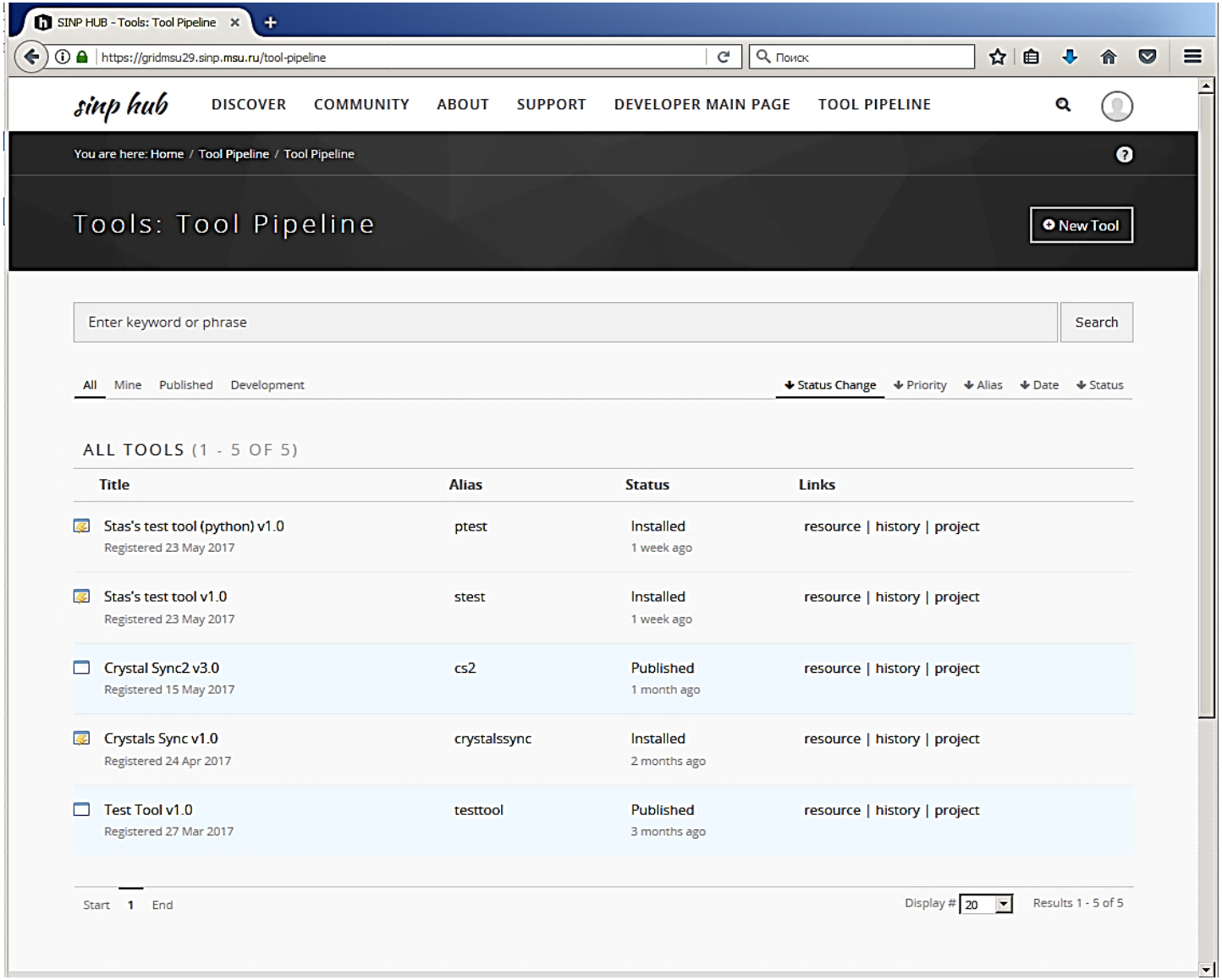
Development of optical devices requires complicated modeling of physical processes that occur in components of devices.

Based on HUBzero middleware we deployed a working prototype of the web platform for the library of programs in nonlinear optics.
The prototype of the platform is now under test.

Web platform prototype: login page



Web platform prototype: tools catalog



Example tool: description

Example tool purpose:

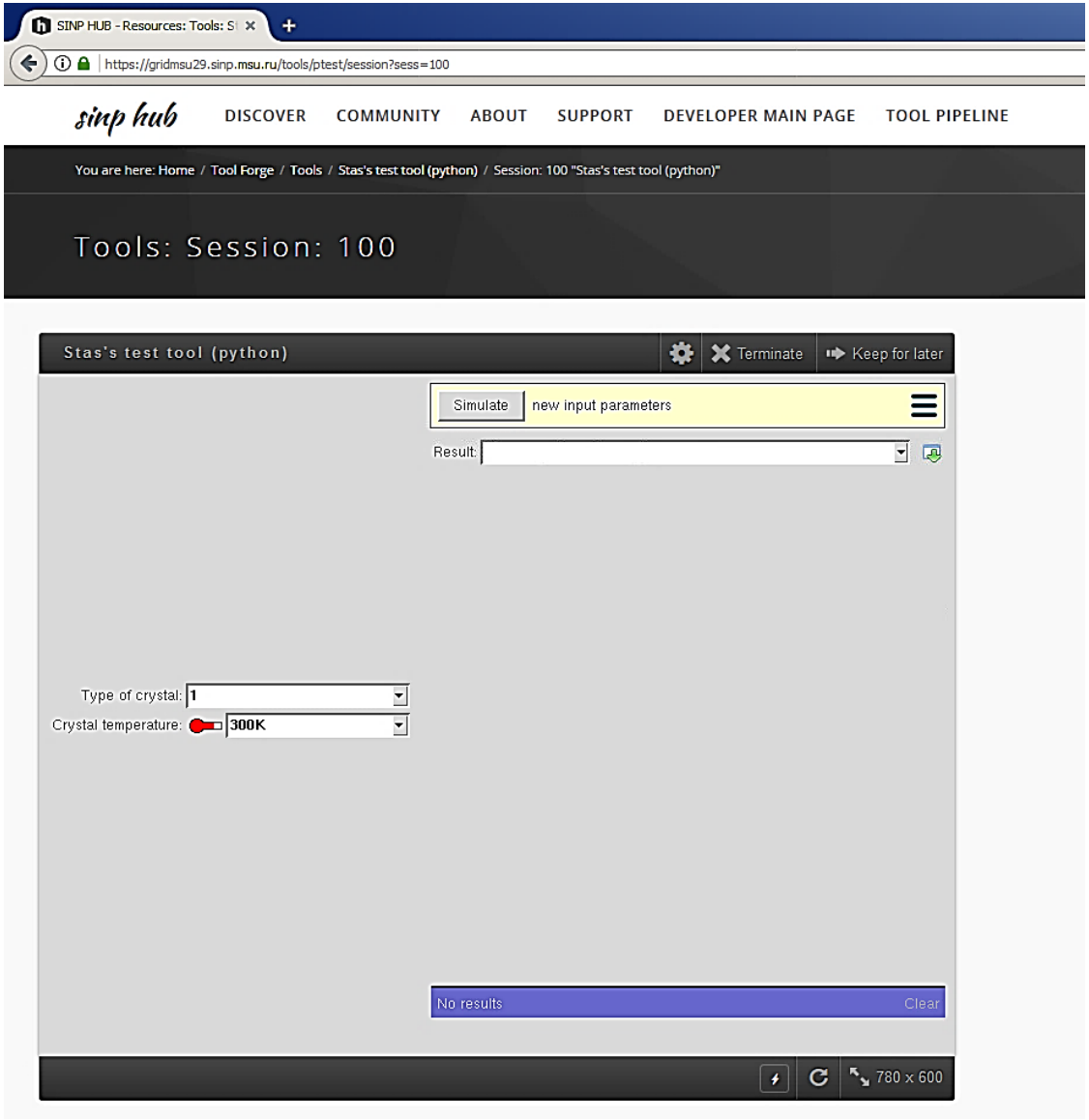
- to calculate angle of synchronism for large number of crystal types stored in a database.

Angle of synchronism is:

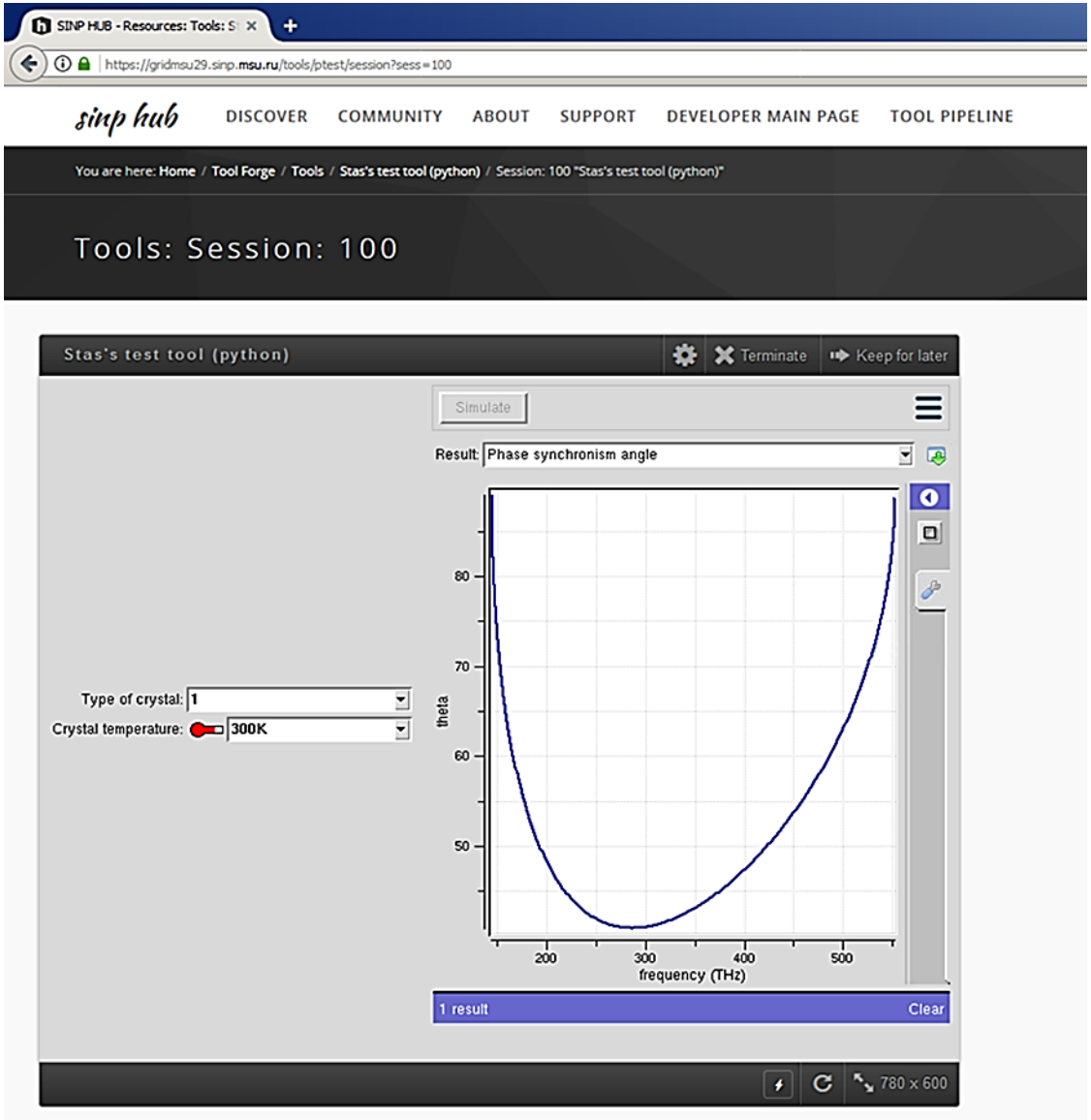
- a geometrical feature which specifies conditions for non-linear optical effects in crystal to become volume effects rather than point effects.

This program calculates angle of synchronism for frequency doubling as a function of temperature, crystal parameters, and frequency of incident radiation.

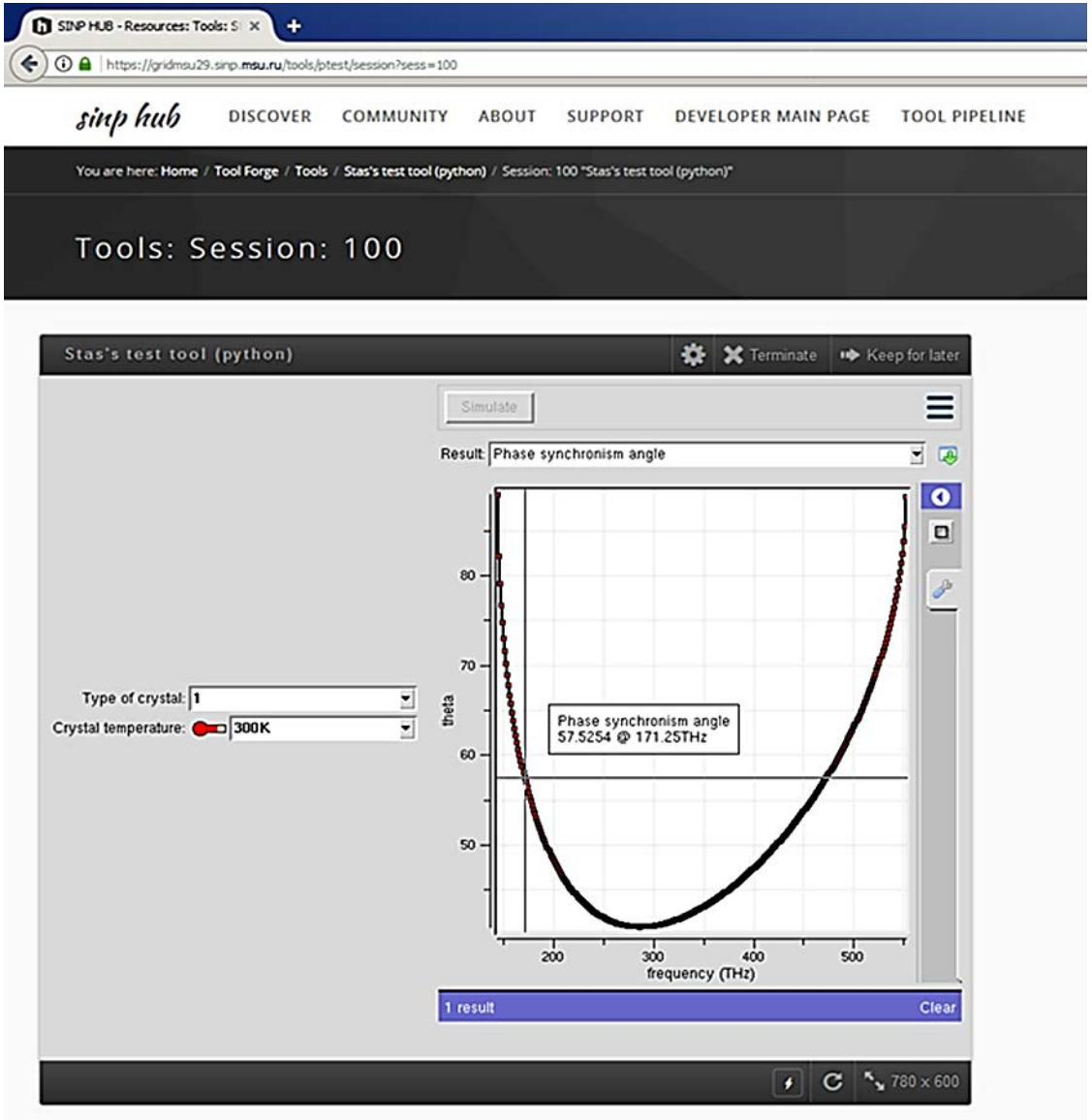
Example tool: initial screen



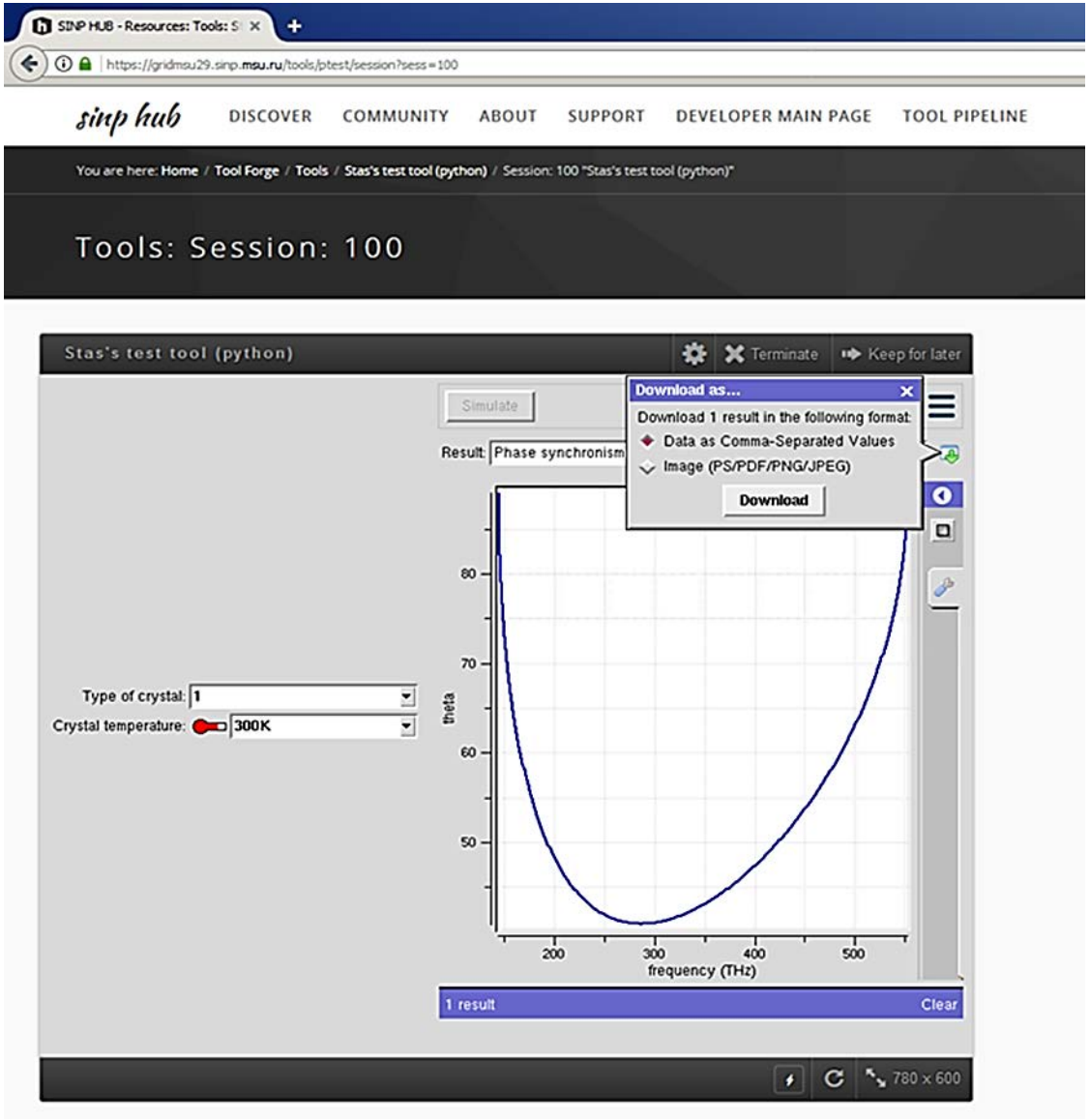
Example tool: general program output



Example tool: program output details



Example tool: program output downloading



Conclusion

- Web platforms for sharing modeling software is a fast-growing and promising area
- HUBzero middleware is a very convenient tool for creating dynamic web sites for scientific research
- We managed to deploy an effective and stable web platform aimed to help solve the arising problem of designing of nonlinear optical devices used for the conversion of laser light
- Prospects – to go broad and deep:
  - Existing installation: move from testing to production
    - Increase computational capacity
    - Add new features upon user's requests
  - New installations: deploy web platform for another scientific areas (e.g. high energy physics, physics of cosmic radiation)

Thank you!