

# Development of operator interface using Angular at the KEK e-/e+ injector linac

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## Introduction

The KEK electron/positron injector linac provides the beams of different energies to five independent storage rings. The first electronic operation logbook system was developed using a relational database in 1995. This logbook system has the capability to automatically record detailed operational status changes. In addition, operators can manually input de-tailed information about operational problems, which is helpful for future troubleshooting. In 2010, the logbook system was improved with the implementation of a redundant database, an Adobe Flash based frontend, and an image file handling feature. In 2011, the CSS archiver system with PostgreSQL and a new web-based archiver viewer utilizing Adobe Flash. However, with the discontinuation of Adobe Flash support at the end of 2020, it became necessary to develop a new frontend without Flash for both the operation logbook and archiver viewer systems. For this purpose, the authors adopted the Angular framework, which is widely used for building web applications using JavaScript. In this paper, we report the development of operator interfaces using Angular for the injector linac.

## Transition from Adobe Flash to Angular

Many web applications developed with Adobe Flash in KEK e-/e+ injector linac

### Pros.

- Good operability and expressive power
  - Available on multiple OS
  - Easy redistribution because of Web application
- ⇒ No installation is required. Simplicity of management is improved.

### Cons.

- Security issue
- ⇒ End of life in 2020

Angular is suitable for our purpose

### Angular?

Angular is an open-source Web application framework led by the Angular Team at Google and by a community of individuals and corporations.

### Features

- Helpful to develop Single Page Web Application (SPA)
- Performance speed of SPA is comparable to native applications

## Archiver viewer Web application

### Archiver

CSS Archiver, Archiver Appliance

### User interface

#### Multiple PV plot



#### Pan and zoom control with mouse



#### Scattering plot



#### Relative and absolute time range setting



Together with auto update functionality, latest values can be easily monitored.

#### Up to 10 vertical axis



#### PV, axis setting value saving feature



Helpful for streamlining operations

## Magnet information management Web application

### Background

In KEK e-/e+ injector linac, around 600 magnets are in operation. So far, the detailed information of magnets and power supplies has been managed by using the database with the simple ascii files.

To improve the management efficiency, we developed a new Web application with relational database in 2022.

### System configuration

Database: PostgreSQL

User interface: Angular

### User interface functionality

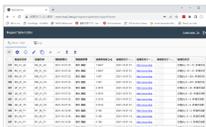
#### Access control



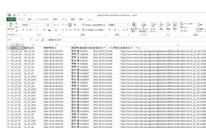
Access control can be set for each user like read only permission, read/write permission.

User management can be managed with LDAP.

#### Filtering

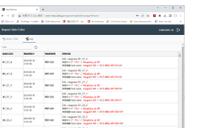


#### Import and Export



Batch update of large amounts of data.

#### Change log



The update date, updater, and contents can be automatically recorded.

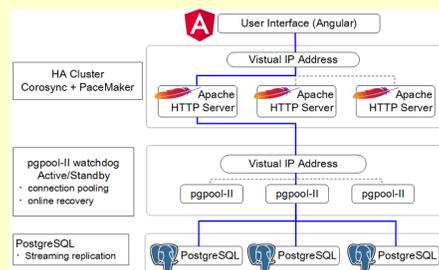
## Electric operational logbook system

### System configuration

User interface : Angular

Web server: Apache  
Three server redundancy  
Corosync + PaceMaker

Database: PostgreSQL  
Three server redundancy  
PostgreSQL replication functionality  
PostgreSQL middleware (pgpool-II)



### User interface functionality

#### Nine tabs in one page



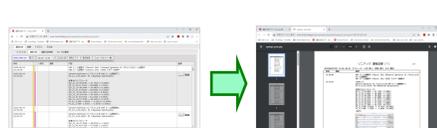
Each tab shows shift member, trouble, operation outline, and so on.  
With Single Page Application

#### Popup edit form



Image file, movie file, and URL can be embedded for the detailed descriptions of troubles or other events.

#### PDF export



PDF style file is created by using tFPDF.

#### Trouble report



Trouble can be grouped into some categories. (RF, Timing system, ...)  
Machine downtime, beam lost time can be automatically calculated.  
PDF style file is created by using tFPDF.

## Summary

At the KEK Injector, the web applications with Adobe Flash were developed for the operator interface including the electron operational logbook system and archiver viewer system. However, because of the end of life of Adobe Flash Player, the transition to a new framework became urgent. Therefore, we replaced and developed web applications using Angular, a web application framework developed by a community led by Google. These applications are strongly helpful for the stable linac machine operation.